# Virginia Board of Housing and Community Development
# CODES AND STANDARDS COMMITTEE
# 2018 CODE CHANGE CYCLE – BOOK 6
# October 19, 2020

## Opening Statement

## TAB 1 – USBC Proposals Recommended by Workgroups as Consensus for Approval (approve individually or as a block)


| Proposal Number | Description of Proposal | Page No. |
|---|---|---|
| A101.5 | Adds language to include state amendments when international codes and standards are referenced | 1 |
| A101.6 | Order of precedence clarification | 3 |
| A103.1 | Changes reference from IEBC to VEBC | 7 |
| A109.3 | Engineering details where dry flood proofing is proposed | 9 |
| A113.3 | Verification of lowest floor elevation | 11 |
| A117.2 | Moved buildings and structures flood hazard documentation | 13 |
| A119.5 | Aligns with COV language and provides guidance for determining whether to hear certain cases or not. | 15 |
| B101 | Brings forward 2021 tall wood buildings (IBC) | 19 |
| B202(3) | Permit holder definition | 23 |
| B202(4) | Correlates definition of "Building" between VEBC, SPFC and VCC | 25 |
| B310.1 | Residential uses provisions from Residential Uses SWG | 29 |
| B907.3.2 | Corrects section reference | 37 |
| B1709.5.2 | Garage door testing standards | 39 |
| E402.1.4.2 | Clarifies U-factor compliance for roof/ceiling assembly | 41 |
| E402.4.2 | Removes technically infeasible provisions for skylights | 43 |
| E404.5 | Deletes heated water supply piping sections from the VECC | 45 |
| E501.1 | Deletes existing building provisions of the VECC | 49 |
| E502 | Moves VECC existing building provisions to VEBC | 51 |
| E503 | Deletes existing building provisions of the VECC | 55 |
| E504.1 | Moves VECC existing building provisions to VEBC | 59 |
| RE402.1.2(4) | Ceiling r-value increase from R-38 to R-49 | 63 |
| RB200 | Substantial damage and substantial improvement definitions proposal from Resiliency SWG | 71 |
| RB301.2(1) | Component and cladding loads proposal from Resiliency SWG | 73 |


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|---|---|---|
| RB301.2.1 | Wind design criteria to accompany update to the wind map in ASCE 7-16 | 87 |
| RB301.2.1.1 | Wind limitations and wind design proposal from Resiliency SWG | 99 |
| RB302.1 | Removes the 2 feet limit for exterior wall projections | 101 |
| RB302.2 | Townhouses compliance section numbers - 2021 change | 103 |
| RB302.2.2 | Sprinkler piping in common walls allowance | 105 |
| RB302.2.6 | Adds exception for structural independence where protected by a sprinkler system | 107 |
| RB302.3(1) | Adds NFPA 13R and Section P2904 to exception reducing the 1 hour rating to 1/2 hour rating for two-family dwellings | 109 |
| RB302.13 | Adds NFPA 13 and 13R to correlate with proposals RB302.3(1) and RB302.2.6 | 111 |
| RB314.6(1) | Specifies 10-year battery life for smoke alarm power source exception | 113 |
| RB314.6(2) | Removes broken reference | 117 |
| RB322.2.1 | Garage and carport elevation requirements | 119 |
| RB322.3.3 | Foundations in coastal high-hazard areas and A zones | 121 |
| RB403.1.6 | More practical foundation anchorage location | 123 |
| RB609.4 | Garage door labeling proposal from Resiliency SWG | 125 |
| RTE3902.16(2) | Arc-fault protection with GFCI exception | 127 |
| T2701.1.1(2) | Incorporates provisions from 2017 and 2020 NEC for Marinas, Boatyards and docking facilities. | 131 |
| TM403.3.1.1 | Minimum ventilation rates for medical procedure rooms, patent rooms and physical therapy rooms | 135 |
| TM504.10 | Fixes broken reference | 139 |
| TM505.5 | Removes prohibition of dampers in common exhaust systems for domestic kitchens and leaves compliance reference section | 141 |
| RTP608.15 | Backflow preventer access for testing, inspection, service, repair and replacement | 143 |
| RTP2801.6 | Plastic pan prohibition for gas-fired water heaters | 145 |
| TP403.3.3 | Adds and exception to location of toilet facilities in Group S occupancies. Also correlates the building and plumbing code by replicating exceptions. | 147 |
| TP1209.3.1 | Gender-neutral toilet facilities | 149 |
| TP2902.1 | Removes duplicative minimum number of fixtures from the IBC which can be found in the IPC | 161 |
| TP2902.1.1 | Single-user toilet rooms (Withdraw if TP1209.3.1 is approved) | 167 |
| EB102.2.3 | Additions connected with a fire wall | 169 |

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|---|---|---|
| EB307 | Overhaul of reroofing and roof repair sections | 171 |
| EB402.1 | Change of occupancy does not trigger additional accessibility features | 177 |
| EB404.3 | Clarifies accessibility language for alterations affecting an area containing a primary function | 179 |
| EB405.1 | Revises and relocates sections on entrances, toilet rooms and type B units in Historic buildings | 181 |
| EB504.1.6 | Repaired or replacement smoke alarms | 183 |
| EB601.4(3) | Energy conservation for alterations. Proposal supported by Energy SWG | 187 |
| EB1101.18(2) | Relocates address identification for existing buildings into VEBC | 191 |
| EB1401.1 | Evaluation process for existing buildings | 193 |
| PM105.2(2) | Notice to owner when they are not the responsible party | 223 |
| PM604.3.1.1 | Third party electrical inspectors | 225 |
| PM105.2 | Adds tenants to list of possible recipients of NOV | 227 |
| PM105.4 | Aligns NOV language with VRLTA requirements | 229 |

# TAB 2 – USBC Proposals Recommended by Workgroups as Consensus for Approval (approve individually)

| **Proposal Number** | **Description of Proposal** | **Page No.** |
|---|---|---|
| | | |
| TP403.1(1) | Increases the required toilet fixtures for passenger terminals and transportation facilities | 1 |
| TP403.1(2) | Increases the required fixtures for passenger terminals and transportation facilities and specifies locations | 21 |

# TAB 3 – USBC Proposals Recommended by Workgroups as Consensus for Disapproval (approve individually or as a block)

| **Proposal Number** | **Description of Proposal** | **Page No.** |
|---|---|---|
| | | |
| B307.1(1) | Deletes permissible fireworks row | 1 |
| B404.5 | Smoke control exception | 7 |
| B903.2.6 | Group I-3 automatic sprinkler systems for exercise yards | 9 |
| B903.4.2 | Alarm exception where an off-site monitored fire alarm system is supplied | 11 |

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|---|---|---|
| B1010.1.9.6 | Add section that is currently deleted for controlled egress doors in Groups I-1 and I-2 | 13 |
| B1703.1.3 | Concrete inspection and testing personnel credentials | 15 |
| B1703.1.3.1 | Concrete inspection and testing personnel credentials | 23 |
| T2701.1.1(1) | Changes NFPA 70 to not require equipment grounding conductors for private noncommercial docks | 27 |
| TM1101.2 | Addresses the use of A2L refrigerant systems | 287 |
| EB502.1.1 | Addresses repairs to structural concrete and adds a standard – ACI 562. | 289 |

# TAB 4 – USBC Proposals Recommended by Workgroups as Non-Consensus (approve individually)

| **Proposal Number** | **Description of Proposal** | **Page No.** |
|---|---|---|
| | | |
| A113.8(2) | Requirement to energize during final inspection | 1 |
| B713.8 | Coordinates penetrations requirements with current language in shaft enclosures | 3 |
| B713.11 | Enclosure at the bottom of shaft enclosures | 5 |
| B905.5.3 | Removes subject to the approval of the building official | 9 |
| B916 | Emergency responder communication installation and system monitoring | 13 |
| B918.1 | Emergency responder communication required in all new buildings | 19 |
| B1004.3(2) | Adds mercantile to posting of occupant load requirement | 27 |
| B1612.2.1 | Elevation requirements in accordance with ASCE 24 or BFE plus 2 feet | 29 |
| B1612.4 | Flood hazard documentation | 33 |
| B1804.8 | Highest adjacent grade definition | 37 |
| ERB101 | Zero Energy Standards for buildings. Adds Appendix. | 39 |
| E404.2 | Mandatory solar readiness | 43 |
| E405.10 | Requires EV ready spaces in commercial and residential occupancies | 49 |
| E1301.1.1.1 | Removes all energy code state amendments | 57 |
| RE402.1.2(6) | Removes wall and ceiling R-value state amendments | 69 |
| RE402.4.1.2(2) | Limiting air infiltration to 3 air changes per hour | 79 |
| RE403.1.2 | Prohibits electric resistance heat as primary heat source | 85 |
| RE403.1.4 | Prohibits fuel-fired HVAC as primary heat source | 89 |
| RE404.2 | Requires electric readiness | 93 |
| RE407.1.1 | Additional energy requirements | 99 |

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|---|---|---|
| RB302.3(2) | Accessory dwelling units (Supported by Residential Uses SWG) | 103 |
| RB313.1 | Sprinkler system requirement in townhouses | 107 |
| RB325.1 | Habitable attics 2021 change | 141 |
| RB332(2) | Standby power systems | 145 |
| RB703.11.1 | Clarifies soffit installation requirements | 147 |
| EB103.2 | Change of occupancy exception for short-term rentals | 153 |
| EB202(2) | Change of occupancy definition to include electrical | 155 |
| EB701.4 | Moves VECC existing building provisions to VEBC | 157 |
| EB704.1 | Clarification of specific requirements for fire protection | 161 |
| RTE3902.16(1) | Arc-fault protection, similar to RTE3902.16(2), but does not include an exception for GFCI | 165 |
| TM607.6.2.2 | Equipment shutdown to include return duct system | 189 |

# TAB 5 – VADR Proposals Recommended by Workgroups as Consensus for Approval (approve individually or as a block)

| **Proposal Number** | **Description of Proposal** | **Page No.** |
|---|---|---|
| | | |
| AD40(2) | Updating standards | 1 |
| AD75(2) | Recommended changes to fees | 3 |

# TAB 6 – VCS and MHSR Proposals Recommended by Workgroups as Consensus for Approval (approve individually or as a block)

| **Proposal Number** | **Description of Proposal** | **Page No.** |
|---|---|---|
| | | |
| CS10 | Updates to definitions | 1 |
| CS31 | Cleans up qualification and examination requirements | 3 |
| CS41 | Reduces the time training must have been completed prior to certification | 5 |
| CS45 | Grammatical correction | 7 |
| CS61 | Removes noncompliance notices from this section | 9 |
| MH20 | Specifies federal regulations | 11 |
| MH20(2) | Section reference update | 13 |

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## TAB 7 – VADR Proposals Recommended by Workgroups as Non-Consensus (approve individually)

| Proposal Number | Description of Proposal | Page No. |
|---|---|---|
| | | |
| AD20 | Adds provisions and incorporates standards for Aerial Adventure Courses | 1 |

## TAB 8 – VCS Proposals Recommended by Workgroups as Non-Consensus (approve individually)

| Proposal Number | Description of Proposal | Page No. |
|---|---|---|
| | | |
| CS51 | Updates to definitions | 1 |

## TAB 9 – Memos (Energy Subworkgroup, Residential Dock Electrical Safety Subworkgroup, Residential Uses Subworkgroup, Resiliency Subworkgroup)

## TAB 10 – Additional Information (Workgroup Summaries)

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# 2018 Code Update Cycle Overview

**BHCD Meeting October 19, 2020**

The 2018 Code Update Cycle, like all code update cycles, follows the Administrative Process Act (APA) as per Virginia law and the specific provisions applicable to the Virginia Amusement Device Regulations (VADR), Industrial Building Safety Regulations (IBSR), Uniform Statewide Building Code (USBC) and the Statewide Fire Prevention Code (SFPC). This process includes proposed phase regulations and final phase regulations. Both proposed and final phases include multiple full day workgroup meetings in addition to subworkgroups that work on topic specific issues. Below is a breakdown of proposals and meetings for both the proposed and final phase of the code update process.

**Workgroup 1** – Administrative Provisions of all construction codes. Industrialized Building Safety Regulations, Manufactured Home Safety Regulations, Certification Regulations, Amusement Device Regulations.
**Workgroup 2** – Uniform Statewide Building Code and Statewide Fire Prevention Code technical provisions.
**Workgroup 3** – All technical provisions specific to one and two family dwellings.
**Workgroup 4** – All proposals specific to trades (mechanical, electrical, plumbing, fuel gas).

**Subworkgroups** –

- Residential Use Groups
- School Safety
- Energy
- Resiliency
- Residential Dock Safety
- Fire Code Edits

| **Proposed Phase** | |
|---|---|
| **DATE** | **EVENT** |
| 4/10/19 | Combined WGs 1 & 2 |
| 4/12/19 | Residential Use Subworkgroup |
| 4/16/19 | School Safety Subworkgroup |
| 4/24/19 | Energy Subworkgroup |
| 4/26/19 | Amusement Device Technical Advisory Committee |
| 5/7/19 | Resiliency Subworkgroup |
| 5/23/19 | Fire Code Edit Subworkgroup |
| 5/31/19 | Residential Use Subworkgroup |
| 6/5/19 | Combined WGs 3 & 4 |
| 6/12/19 | School Safety Subworkgroup |
| 6/24/19 | ADTAC (Amusement Device Advisory) |
| 7/10/19 | Residential Use Subworkgroup |
| 7/11/19 | School Safety Subworkgroup |
| 7/16/19 | Residential Use Subworkgroup |
| 7/17/19 | Resiliency Subworkgroup |

| | |
|---|---|
| 7/18/19 | Energy Subworkgroup |
| 7/22/19 | Public Hearing |
| 7/24/19 | Combined WGs 1 & 2 |
| 8/7/19 | Fire Code Edit Subworkgroup |
| 8/9/19 | Residential Use Subworkgroup |
| 8/12/19 | School Safety Subworkgroup |
| 8/14/19 | Fire Code Edit Subworkgroup |
| 8/20/19 | Amusement Device Technical Advisory Committee |
| 8/21/19 | Combined WGs 1-4 |
| 9/16/19 | Codes & Standards/SFPCDC and BHCD Meeting |
| 12/16/19 | BHCD/FSB Final approval on proposed regulations |
| **Proposed Phase: Total Proposals Reviewed 121 (103 Consensus – 18 Non-consensus)*** | |

| **Final Phase** | |
|---|---|
| **DATE** | **EVENT** |
| 11/12/19 | Fire Code Edit Subworkgroup |
| 11/25/19 | Residential Dock Safety Subworkgroup |
| 12/10/19 | Resiliency Subworkgroup |
| 1/15/20 | Fire Code Edit Subworkgroup |
| 1/28/20 | Residential Dock Safety Subworkgroup |
| 2/10/20 | Building Code Academy Advisory Committee |
| 3/6/20 | Building Code Academy Advisory Committee |
| 3/10/20 | Resiliency Subworkgroup |
| 3/17/20 | Fire Code Edit Subworkgroup |
| 3/26/20 | Residential Use Subworkgroup |
| 3/31/20 | Energy Subworkgroup |
| 4/06/20 | Residential Use Subworkgroup |
| 5/28/20 | Fire Code Edit Subworkgroup |
| 6/11/20 | Fire Code Edit Subworkgroup |
| 6/23/20 | Workgroup 1 |
| 6/26/20 | Public Hearing |
| 6/29/20 | Residential Use Subworkgroup |
| 6/30/20 | Workgroup 2 |
| 7/1/20 | Workgroup 2 |
| 7/15/20 | Workgroup 3 |
| 7/22/20 | Workgroup 4 |
| 7/30/20 | Fire Code Edit Subworkgroup |
| 8/11/20 | Workgroups 1-4 Combined |
| 8/20/20 | Fire Code Edit Subworkgroup |
| 9/1/20 | Workgroups 1-4 Combined |

**Final Phase: Total Proposals Reviewed 141 (104 Consensus – 37 Non-consensus)***

***NOTE: Total number of Fire Code Edit Sections reviewed totaled 1085.**

**An additional 54 proposals were withdrawn by proponents.**

The summaries and background documents for each of the meetings are found in each book either as informational for each non-consensus item or in aggregate with the board package. Supplemental information also includes testimony from the public hearing on the proposed regulations.

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# A101.5-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Construction Code

**Revise as follows:**

**101.5 Use of terminology and notes.** The provisions of this code shall be used as follows:

1. The term “this code,” or “the code,” where used in the provisions of Chapter 1, in Chapters 2–35 of the IBC or in the state amendments to the IBC, means the USBC, unless the context clearly indicates otherwise.
2. The term “this code” or “the code,” where used in a code or standard referenced in the IBC, means that code or standard, unless the context clearly indicates otherwise.
3. The use of notes in Chapter 1 is to provide information only and shall not be construed as changing the meaning of any code provision.
4. Notes in the IBC, in the codes and standards referenced in the IBC, and in the state amendments to the IBC, may modify the content of a related provision and shall be considered to be a valid part of the provision, unless the context clearly indicates otherwise.

5. References to International Codes and standards, where used in this code, include state amendments made to those International Codes and standards in the VCC.

**Reason Statement:** This language is consistent with the language that was added to VEBC 101.5, Item 6, to clarify that state amendments should be applied/considered when there is any reference to the iCodes or standards.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: A101.5-18

This proposal doesn't have any public comments.

Proposal # 394

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# A101.6-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Construction Code

**101.6 Order of precedence.** The provisions of this code shall be used as follows:

1. The provisions of Chapter 1 of this code supersede any provisions of Chapters 2–35 of the IBC that address the same subject matter and impose differing requirements.
2. The provisions of Chapter 1 of this code supersede any provisions of the codes and standards referenced in the IBC that address the same subject matter and impose differing requirements.
3. The state amendments to the IBC supersede any provisions of Chapters 2–35 of the IBC that address the same subject matter and impose differing requirements.
4. The state amendments to the IBC supersede any provisions of the codes and standards referenced in the IBC that address the same subject matter and impose differing requirements.
5. The provisions of Chapters 2–35 of the IBC supersede any provisions of the codes and standards referenced in the IBC that address the same subject matter and impose differing requirements.

6. The provisions of the NEC, VMC, VPC and VFGC su persede any provisions of the VECC that address the same subject matter and impose differing requirements.

7. The provisions of Chapters 2-10 and 12-44 of the VRC supersede any provisions of Chapter 11 of the VRC that address the same subject matter and impose differing requirements.

**Reason Statement:** Clarification/direction and an order of precedence is needed . . .
When there are VECC (energy code) provisions that address the same subject matter but impose conflicting requirements compared to the other iCodes or standards that typically regulate such components and/or systems - which governs? How does an RDP know which one to use?

If the VECC says one thing about equipment and the IMC says another about the exact same equipment - do we to design to the most stringent? The least costly (as is dictated by VCC 102.1)? The same can be said about electrical systems (e.g., lighting), plumbing systems/fixtures, and fuel gas. Determining "the most stringent" may not always be as clear as one might imagine. If the VECC requires something that potentially affects life safety - is energy conservation "more stringent" than life safety (refer to the kitchen exhaust example below)?

The BHCD has already approved a similar type of proposal where the VECC conflicted with the IMC regarding kitchen exhaust hoods and deleted the provision out of the VECC. Refer below. The BHCD also approved a similar approach in VEBC 101.6, Item 5, where the VEBC supersedes the other iCodes. In this case, we are asking the reverse - that in the event of a conflict, the relevant iCodes should supersede the VECC. With the example of the kitchen exhaust (refer below) - that was a life safety issue.

To be clear - this addresses when it is the SAME subject with CONFLICTING requirements. We are not talking about superseding all energy conservation requirements, the entire IECC, or those subjects that are NOT conflicting.

**Real world example:**

**VECC C404.5 Efficient heated water supply piping** limits the MAXIMUM length of piping (in some cases only 6" and other "usual" cases to 12" or 24") from the plumbing fixtures to heating source(s) and/or recirculation system taps. In order to meet section VECC C404.5, this would require very unusual hot water piping design strategies (looped/ serpentine mains) and lots of recirculation taps and/or lots of instantaneous/tankless water heating strategies. This would certainly cost a lot more money to install **with little or no energy benefit in most applications** (most likely **uses more energy**). This approach would get hot water to fixtures much faster; however that should not be an *energy* code requirement, but a *plumbing* code requirement. If one were able to comply with **VPC 607.2 Hot or Tempered Supply to Fixtures,** you are allowed to go up to 50 feet. That is a HUGE difference - 50 feet compared to 6 inches!

Even the IECC Commentary for C404.5.1 says, "*The **maximum allowable lengths of pipe from a source to a public lavatory system are restrictive**. In most designs, this will certainly require use of a circulating water system or a heat trace system."*

Limited distance requirements impose excessive restrictions to the hot water system layout and design. Added return branches and increased pipe sizes for serpentine-like systems will require INCREASED up-front and maintenance costs as well as require larger recirculation pumps (**using more energy**) to account for the additional flow, head, and heat loss created from the VECC restrictions.

So, in reality, much of VECC C404.5 would not be feasible and would add a lot of cost/ complexity to the design that is not a good idea, whereas the VPC should dictate these maximum distances, not the VECC. Without this code proposal, to avoid compliance with VECC C404.5, one would have

to comply with ASHRAE 90.1-2013 compliance path , which does not require this. However, ASHRAE 90.1 can be more costly in other ways (e.g., ASHRAE requires electrical submetering).

On a recent project, to comply with C404.5 (and limiting the length of piping from lavs to 6") throughout the entire high school would cost over $100,000 (manipulating the piping and adding recirculation taps and/or lots of instantaneous/tankless water heating equipment. Not to mention the INCREASED and ONGOING maintenance of such taps and equipment.

Why so costly?

The proposed solutions are either to route recirculating HW mains near the fixtures – which increases the installed cost and recirculating pump energy – or incorporate heat tracing systems for temperature maintenance – which also add initial and operating costs for the heat tracing, power circuits, and additional controls. Instantaneous/tankless water heaters require space to add them, walls, casework/cabinets and/or brackets to support them, drainage pans, condensate drains, service access, etc.).

**Another real world example**:

Kitchen exhaust hoods (C403.2.8) conflicting not only with the IMC, but with life safety requirements as well. Refer to code proposal **E403.2.8-18 #175** for the revisions proposed and reason statement highlighting the conflicts. This proposal was approved unanimously by the BHCD and is now included in the draft regulations.

**OPTION**: In *the above example*, delete VECC C404.5, its subsections, and Table in their entirety and reduce the "50 feet" in IPC 607.2 to "25 feet" or some distance is more realistic. However, if this is done in lieu of the "order of precedence" proposal, then we would need to find all such conflicts and fix them individually. To avoid such a task, the "order of precedence" seems the most reasonable and supports the purpose of the USBC as described in VCC 102.1.

**Cost Impact:**
Will most often decrease the initial cost of construction if compliance with the VECC is required where conflicts exist. Typically, the VECC has a higher bar - sometimes much higher - than the iCodes that govern such elements and/or systems.

**Resiliency Impact Statement:**
Generally, does not increase resiliency in most cases. However, as indicated in the reason statement, sometimes the VECC actually is LESS resilient than the iCode under which such elements or systems are typically regulated.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: A101.6-18

**Discussion by William Penniman**
Jul 11, 2020 15:46 UTC

Comment on A101.6-18 Proposal 358.1 (presented to Work Group 1 on June 23)

This proposal should be rejected or modified as discussed below. If adopted, this proposal would, in effect, declare that the BHCD and Virginia's builders care less about energy efficiency than any other issue addressed by the building code, notwithstanding statutory recognition of the importance of energy conservation in Virginia's building codes. It makes no policy or practical sense particularly in an era where the Governor and General Assembly have clearly recognized the importance of improving energy efficiency and reducing greenhouse gas emissions, much of which are attributable directly to buildings and the energy supplies they utilize. Further, it will cost residents of Virginia money for decades after construction since building energy conservation reduces their monthly energy bills. That is a particular problem for low-income and moderate-income residents. To make matters worse, the proposal creates the potential for minor code discrepancies to shut down energy efficiency requirements, and it creates perverse incentives for seemingly innocuous provisions in other sections of the code to be written or interpreted to create conflicts with and, therefore, undermine the VECC.

Rather than approve this proposal, the BHCD should require that any conflict identified among sections must be presented in writing to designated senior members of the DHCD and the BHCD to determine (a) whether a real conflict exists, (b) whether an interpretive compromise between the standards can preserve the benefits of each and alert all builders to the appropriate resolution, and (c), if not, how one or both of the conflicting

standards can best be modified to achieve the benefits of each. The party raising the issue may propose a remedy that will achieve the benefits envisioned by each code provision. However, any change that would diminish the benefits of either provision should be published and made subject to public comment. Since any such conflict should be identified in the design phase of a building, there should be no reason not to go through the process outlined above. This conflict-review process will help to advance all the values that building codes are supposed to create and to assure uniformity of implementation as contemplated by the USBC.

Proposal # 358

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# A103.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

**103.1 General.** All administrative provisions of the VCC, including but not limited to, requirements for permits, inspections and approvals by the local building department, provisions for appeals from decisions of the local building department and the issuance of modifications, are applicable to the use of this code, except where this code sets out differing requirements. Where there is a conflict between a general requirement and a specific requirement in the ~~IEBC~~ VEBC, the specific requirement shall govern.

**Reason Statement:** The reference should be to the VEBC not the IEBC. This is intended to be an editorial change only.

**Cost Impact:**
Will not increase or decrease cost of construction. It is intended to be an editorial change only.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency. It is intended to be an editorial change only.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:** Returned to proponent to change strike-through to VEBC

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# Public Comments for: A103.1-18

This proposal doesn't have any public comments.

Proposal # 304

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# A109.3-18

**Proponents:** Resiliency Subworkgroup

## 2015 Virginia Construction Code

**Revise as follows:**

**109.3 Engineering details.** When determined necessary by the building official, *construction* documents shall include adequate detail of the structural, mechanical, plumbing or electrical components. Adequate detail may include computations, stress diagrams or other essential technical data and when proposed buildings are more than two stories in height, adequate detail may specifically be required to include where floor penetrations will be made for pipes, wires, conduits, and other components of the electrical, mechanical and plumbing systems and how such floor penetrations will be protected to maintain the required structural integrity or fire-resistance rating, or both. ~~All~~ When dry floodproofing is provided, the engineering details shall include detail of the walls, floors, and flood shields designed to resist flood-related loads, including the sealing of floor and wall penetrations. All engineered documents, including relevant computations, shall be sealed by the RDP responsible for the design.

**Reason Statement:** This was a consensus item from the Resiliency Subworkgroup. It still needs to be considered by the full workgroup.
Having site plans include flood hazard information improves review efficiency. FEMA post-flood investigations of dry floodproofed buildings identify frequent failures where walls and floors are penetrated by pipes, wires, conduits, etc.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
Having site plans include flood hazard information improves review efficiency. FEMA post-flood investigations of dry floodproofed buildings identify frequent failures where walls and floors are penetrated by pipes, wires, conduits, etc.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Having details on the construction documents improve efficiency for review from flood investigations and aids with compliance with national flood programs and regulations.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: A109.3-18

This proposal doesn't have any public comments.

Proposal # 383

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# A113.3-18

**Proponents:** Resiliency Subworkgroup

## 2015 Virginia Construction Code

**113.3 Minimum inspections.** The following minimum inspections shall be conducted by the building official when applicable to the *construction* or permit:

1. Inspection of footing excavations and reinforcement material for concrete footings prior to the placement of concrete.
2. Inspection of foundation systems during phases of *construction* necessary to assure compliance with this code.
3. Inspection of preparatory work prior to the placement of concrete.
4. Inspection of structural members and fasteners prior to concealment.
5. Inspection of electrical, mechanical and plumbing materials, equipment and systems prior to concealment.
6. Inspection of energy conservation material prior to concealment.
7. Final inspection.

**Add new text as follows:**

**113.3.2 Lowest floor elevation.** In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.5 shall be submitted to the building official.

**113.3.3 Flood hazard documentation.** If located in a flood hazard area, documentation of the elevation of the lowest floor as required in Section 1612.5 shall be submitted to the building official prior to the final inspection.

**Reason Statement:** This proposal adds required inspections to certify the lowest floor elevation at two points in construction. First, before vertical construction begins and then before Final to certify the lowest floor and enclosures meet the elevation certification.

**Cost Impact:** The code change proposal will increase the cost of construction
The inspections called for will increase the cost of construction slightly by calling for additional inspections.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will increase resiliency by allowing for additional clarification to the owner as to the lowest floor elevation and for certification purposes for flood documentation.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:** 08/14/20 Updated to CA from NC. HBAV mistakenly opposed. The language was revised to address their concerns and now they are in support.

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# Public Comments for: A113.3-18

**Discussion by Andrew Clark**
Jun 24, 2020 14:52 UTC

The Home Builders Association of Virginia (HBAV) had concerns with the initial draft proposal but those concerns have been addressed in the latest draft and we now support A113.3. HBAV inadvertently opposed A113.3 during the June 23rd, 2020 Workgroup 1 meeting.

Proposal # 341

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# A117.2-18

**Proponents:** Resiliency Subworkgroup

## 2015 Virginia Construction Code

**Revise as follows:**

**117.2 Moved buildings and structures.** Any *building* or *structure* moved into a *locality* or moved to a new location within a *locality* shall not be occupied or used until ~~a certificate~~ the flood hazard documentation, if required by Section 1612.5, has been approved by the building official and a certificate of occupancy is issued for the new location. Such moved buildings or *structures* shall be required to comply with the requirements of the VEBC.

**Reason Statement:** This proposal alters the CO approval process for buildings in flood hazard areas by requiring flood hazard documentation for moved buildings before a CO is issued.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This will not have any effect on cost.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will increase resiliency by requiring documentation for moved buildings in flood hazard areas before a new CO can be issued.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: A117.2-18

This proposal doesn't have any public comments.

Proposal # 387

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# A119.5-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Construction Code

**119.8 Appeals to the State Review Board.** After final determination by the *LBBCA* in an appeal, any person who was a party to the appeal may further appeal to the *State Review Board*. .In accordance with Section 36-114 of the Code of Virginia, the *State Review Board* shall have the power and duty to hear all appeals from decisions arising under the application of the USBC and to render its decision on any such appeal, which decision shall be final if no appeal is made therefrom. In accordance with Section 36-98.2 of the Code of Virginia for state-owned buildings and *structures*, appeals by an involved state agency from the decision of the building official for state-owned buildings or *structures* shall be made directly to the *State Review Board*. The application for appeal shall be made to the *State Review Board* within 21 calendar days of the receipt of the decision to be appealed. Failure to submit an application within that time limit shall constitute an acceptance of the building official's decision. For appeals from a *LBBCA*, a copy of the building official's decision and the written decision of the *LBBCA* shall be submitted with the application for appeal to the *State Review Board*. Upon request by the office of the State Review Board, the *LBBCA* shall submit a copy of all pertinent information from the record of the appeal. In the case of appeals involving ~~stateowned~~ state-owned *buildings* or *structures*, the involved state agency shall submit a copy of the building official's decision and other relevant information with the application for appeal to the *State Review Board*. Procedures of the *State Review Board* are in accordance with Article 2 (Section 36-108 et seq.) of Chapter 6 of Title 36 of the Code of ~~Virginia. Decisions of the *State Review Board* shall be final if no further appeal is made.~~ Virginia.

**Add new text as follows:**

**1 119.9 New Code Section Hearings and decision.** All hearings before the *State Review Board* shall be open meetings and the chair shall have the power and duty to direct the hearing, rule upon the acceptance of evidence and oversee the record of all proceedings. The *State Review Board* shall have the power to uphold, reverse or modify the decision of the *LBBCA* by a concurring vote of a majority of those present. Proceedings of the Review Board shall be governed by the provisions of the Administrative Process Act (2.2-4000 et seq.), except that an informal conference pursuant to 2.2-4019 shall not be required. Decisions of the *State Review Board* shall be final if no further appeal is made. The decision of the *State Review Board* shall be explained in writing, signed by the chair and retained as part of the record of the appeal. Copies of the written decision shall be sent to all parties by certified mail. In addition, the written decision shall contain the following wording:

"As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty (30) days from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a Notice of Appeal with the Secretary of the Review Board. In the event that this decision is served on you by mail, three (3) days are added to that period."

## 2015 Virginia Maintenance Code

**107.7 Hearings and decision.** All hearings before the LBBCA shall be open meetings and the appellant, the appellant's representative, the locality's representative and any person whose interests are affected by the code official's decision in question shall be given an opportunity to be heard. The chairman shall have the power and duty to direct the hearing, rule upon the acceptance of evidence and oversee ~~therecord of~~ the record of all proceedings. The LBBCA shall have the power to uphold, reverse or modify the decision of the official by a concurring vote of a majority of those present. Decisions of the LBBCA shall be final if no further appeal is made. The decision of the LBBCA shall be explained in writing, signed by the chairman and retained as part of the record of the appeal. Copies of the written decision shall be sent to all parties by certified mail. In addition, the written decision shall contain the following wording:

~~"Any person who was a party to the appeal may appeal to the State Review Board by submitting an application to such Board within 21 calendar days upon receipt by certified mail of this decision. Application forms are available from the Office of the State Review Board, 600 East Main Street, Richmond, Virginia 23219, (804) 371-7150."~~

"Any person who was a party to the appeal may appeal to the State Review Board by submitting an application to such Board within 21 calendar days upon receipt by certified mail of this decision. Application forms are available from the Office of the State Review Board, 600 East Main Street, Richmond, Virginia 23219, (804) 371-7150."

**107.8 Appeals to the State Review Board.** After final determination by the LBBCA in an appeal, any person who was a party to the appeal may further appeal to the State Review ~~Board. In accordance with~~ Board. In accordance with Section 36-114 of the Code of Virginia, the *State Review Board* shall have the power and duty to hear all appeals from decisions arising under the application of the USBC and to render its decision on any such appeal, which decision shall be final if no appeal is made therefrom. In accordance with 36-98.2 of the Code of Virginia for state-owned buildings and structures, appeals by an involved state agency from the decision of the code official for state-owned buildings or structures shall be made directly to the State Review Board. The application for appeal shall be made to the State Review Board within 21 calendar days of the receipt of the decision to be appealed. Failure to submit an application within that time limit shall constitute an acceptance of the code official's decision. For appeals from a LBBCA, a copy of the code official's decision and the written decision of the LBBCA shall be submitted with the application for appeal to the State Review Board. Upon request by the Office of the State Review Board, the LBBCA shall submit a copy of all pertinent information from the record of the appeal. In the case of appeals involving state-owned buildings or structures, the involved state agency shall submit a copy of the code official's decision and other relevant information with the application for appeal to the State Review Board. Procedures of the State Review Board are in accordance with Article 2 ( 36-108 et seq.) of Chapter 6 of Title 36 of the Code of ~~Virginia. Decisions of the State Review Board shall be final if no~~

~~further appeal is made.~~ Virginia.

**Revise as follows:**

**107.9 Hearings and decision.** All hearings before the *State Review Board* shall be open meetings and the chair shall have the power and duty to direct the hearing, rule upon the acceptance of evidence and oversee the record of all proceedings. The *State Review Board* shall have the power to uphold, reverse or modify the decision of the *LBBCA* by a concurring vote of a majority of those present. Proceedings of the Review Board shall be governed by the provisions of the Administrative Process Act (2.2-4000 et seq.), except that an informal conference pursuant to 2.2-4019 shall not be required. Decisions of the *State Review Board* shall be final if no further appeal is made. The decision of the *State Review Board* shall be explained in writing, signed by the chair and retained as part of the record of the appeal. Copies of the written decision shall be sent to all parties by certified mail. In addition, the written decision shall contain the following wording:

"As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty (30) days from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a Notice of Appeal with the Secretary of the Review Board. In the event that this decision is served on you by mail, three (3) days are added to that period."

## 2015 Virginia Statewide Prevention Fire Code

**112.8.1 Resolution.** The *LBFPCA's* decision shall be explained in writing, signed by the chairman, and retained as part of the record by the *LBFPCA*. ~~.~~ Copies of the written decision shall be furnished to all parties. The following wording shall be part of the written decision: "Any person who was a party to the appeal may appeal to the State Building Code Technical Review Board (*State Review Board*) by submitting an application to the *State Review Board* within 21 calendar days upon receipt by certified mail of the written decision. Application forms are available from the Office of the *State Review Board*, 600 East Main Street, Richmond, Virginia 23219, (804) 371-7150." ~~Copies of the written decision shall be furnished to all parties.~~

**112.9 Appeal to the State Review Board.** After final determination by the *LBFPCA*, any person who was a party to the local appeal may appeal to the *State Review Board*~~.~~ .In accordance with Section 36-114 of the Code of Virginia, the *State Review Board* shall have the power and duty to hear all appeals from decisions arising under the application of the USBC and to render its decision on any such appeal, which decision shall be final if no appeal is made therefrom. Application shall be made to the *State Review Board* within 21 calendar days of receipt of the decision to be appealed. Application for appeal to the *State Review Board* arising from the SFMO's enforcement of the code or from any local fire code violation if no local board of appeals exists shall be made to the *State Review Board* within 14 calendar days of receipt of the decision to be appealed and shall be accompanied by copies of the ~~inspection reports and other relevant information.~~ fire official's decision and the written decision of the *LBFPCA* shall be submitted with the application for appeal. Upon request by the office of the *State Review Board* , the *LBFPCA* shall submit a copy of all inspection reports and all pertinent information from the record of the *LBFPCA* . Failure to submit an application for appeal within the time limit established by this section shall constitute an acceptance of the *LBFPCA's* resolution or fire official's decision. Procedures of the *State Review Board* are in accordance with Article 2 ( 36-108 et seq.) of Chapter 6 of Title 36 of the Code of Virginia.

**Delete without substitution:**

~~**112.9.1 Information to be submitted.** Copies of the fire official's decision and the written decision of the *LBFPCA* shall be submitted with the application for appeal. Upon request by the office of the *State Review Board*, the *LBFPCA* shall submit a copy of all inspection reports and all pertinent information from the record of the *LBFPCA*.~~

~~**112.9.2 Decision of State Review Board.** Procedures of the *State Review Board* are in accordance with Article 2 ( 36-108 et seq.) of Chapter 6 of Title 36 of the Code of Virginia. Decisions of the *State Review Board* shall be final if no appeal is made therefrom and the appellant and the code official shall act accordingly.~~

**Revise as follows:**

**112.10 Hearing and decision.** All hearings before the *State Review Board* shall be open meetings and the chair shall have the power and duty to direct the hearing, rule upon the acceptance of evidence and oversee the record of all proceedings. The *State Review Board* shall have the power to uphold, reverse or modify the decision of the *LBFPCA* by a concurring vote of a majority of those present. Proceedings of the Review Board shall be governed by the provisions of the Administrative Process Act (2.2-4000 et seq.), except that an informal conference pursuant to 2.2-4019 shall not be required. Decisions of the *State Review Board* shall be final if no further appeal is made. The decision of the *State Review Board* shall be explained in writing, signed by the chair and retained as part of the record of the appeal. Copies of the written decision shall be sent to all parties by certified mail. In addition, the written decision shall contain the following wording:

"As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty (30) days from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a Notice of Appeal with the Secretary of the Review Board. In the event that this decision is served on you by mail, three (3) days are added to that period."

**Reason Statement: VCC 119.8 / VMC 107.8 / SFPC 112.9**: There are numerous references to Code of Virginia sections in Chapter 1, and this added language is the exact wording from Section 36-114 of the COV. This added language will also help guide the TRB in its efforts to determine whether to hear certain cases or not. If the below new section is approved, then the last sentence of VCC 119.8 / VMC 107.8 is not required. **VCC 119.9 / VMC 107.9 / SFPC 112.10**: There currently is no information on the hearings involving the TRB like there is for the LBBCA/LBFPCA. The language is nearly identical to the LBBCA/LBFPCA language, since the TRB hearings and decisions are almost identical as well. The

"proceedings" language is from COV 36-114. These new sections will provide some guidance for those who may or want to appeal as to how such hearings will be conducted; as well as, help guide the TRB in its efforts to conduct such hearings. The last paragraph is the exact language (absent the secretary's name) from the "Decision of the Review Board" "Certification" statement.

**VMC 107.7**: Somehow, the "Any person" paragraph was inserted into the preceding paragraph. This just moves it to the end where it belongs. This change is editorial and not technical.

**SFPC 112.8.1**: Relocated the last sentence BEFORE the requirement to copy such wording. One might think, even though the "quotes" are clear, that the "Copies" sentence is a part of the required wording. This is also consistent with the formatting of the VCC and VMC.

**SFPC 112.9**: Relocated the language from SFPC 112.9.1 and 112.9.2 into 112.9 to make it consistent with the VCC and VMC formatting, thus allowing the deletion of 112.9.1 and 112.9.2.

**Cost Impact:**
Will not increase or decrease cost of construction.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 1 - Proposed Committee Action:** Consensus Approval

**Workgroup 1 - Proposed Reason:** As amended - Proponent removed a strike-through in 112.9

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# Public Comments for: A119.5-18

This proposal doesn't have any public comments.

Proposal # 183

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# B101-18

**Proponents:** John Catlett (catlettcodeconsulting@gmail.com)

## 2015 Virginia Construction Code

**Add new text as follows:**

**602.1.2 Alternative Provisions.** As an alternative to the construction types defined in 602.2 through 602.5, buildings and structures erected or to be erected, altered or extended in height or area may be classified as construction type IV-A, IV-B or IV-C in accordance with Chapter 6 of the 2021 International Building Code. Buildings and structures classified as IV-A, IV-B or IV-C shall comply with all provisions of the 2021 International Building Code and 2021 International Fire Code specific to mass timber and the construction type of the building or structure, as well as all other applicable provisions of this code, including provisions for buildings of Type IV construction.

**Reason Statement: Reason:**
This proposal brings in the code provisions approved by the IBC General Committee by a 13 to 1 vote for the main body of the 2021 ICC building code and subsequent approvals by all other ICC Code Committees that had Group A and Group B code responsibilities related to Tall Wood buildings, also referred to as Mass Timber. Although there were intense efforts by industries that would potentially be negatively affected by approval of these proposals, Tall Wood building provisions gained approval at the ICC Public Comment Hearings held in Richmond during October of 2018 by nearly a unanimous floor vote. These proposals were approved through online voting in cdpAccess by a nearly the same margin.

Virginia localities have already been approached by designers and building owners regarding the potential use of tall wood materials. This proposal brings in the tall wood code provisions a code cycle earlier (2018) so code officials and designers have guidance as to the requirements developed through over two years of work by the ICC Tall Wood Buildings Ad hoc committee appointed by the ICC Board of Directors in 2015.

**Background:**

The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.

The TWB and it various WGs held meetings, studied issues and sought input from various expert sources around the world. The TWB posted those documents and input on its website for interested parties to follow its progress and to allow those parties to, in turn, provide input to the TWB.

At its first meeting, the TWB discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings:

· No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.

· No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.

· No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.

· No unusual fire department access issues.

· Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.

· Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

The comprehensive package of proposals from the TWB meet these performance objectives. The TWB also determined that fire testing was necessary to validate these concepts. At its first meeting, members discussed the nature and intention of fire testing so as to ensure meaningful results for the TWB and, more specifically, for the fire service. Subsequently a test plan was developed. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of joints, and to evaluate conditions for respondingfire personnel. The Fire WG then refined the test plan, which was implemented with a series of five, full-scale, multiple-story building tests at the Alcohol, Tobacco and Firearms (ATF) laboratories in Beltsville, MD. The results of those tests, as well as testing conducted by others, helped form the basis upon which the Codes WG developed its code change proposals. These code change proposals are the ones developed and approved by the TWB that were approved for the 2021 code.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17

**Additional Background Information:**

The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website

https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on- tall-wood-buildings/

(link active and up to date as of 12/27/17).

As seen in the "Meeting Minutes and Documents" and "Resource Documents" sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

A PDF of additional information is attached to this proposal.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This is a new material method that has been approved by the ICC for the 2021 code. There is no cost impact.

**Resiliency Impact Statement:** This proposal will increase Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:** Carried over to Sept 1 meeting. Approved at that meeting.

**Workgroup 2 - Proposed Committee Action:** Carry over to Final

**Workgroup 2 - Proposed Reason:** Interested parties requested additional time to review.

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# Public Comments for: B101-18

This proposal doesn't have any public comments.

Proposal # 233

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# B202(3)-18

**Proponents:** Michael Redifer (redifermd@nnva.gov)

## 2015 Virginia Construction Code

**Add new text as follows:**

**New Definition** Permit Holder
The person to whom the permit is issued.

**Reason Statement:** A companion to proposed change to 115.2 in order to identify the permit holder. There are 12 references to the permit holder in Chapter 1 of the USBC which may be served by the definition. Current Section 108.3 identifies those who may make application for a permit. This proposal has been edited in response to concerns expressed at previous Workgroup meetings involving the relationship between an agent and the person on who's behalf an application is filed.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This change will have no effect an the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
There will be no impact on resiliency of the building.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

**Workgroup 2 - Proposed Committee Action:** Carry over to Final

**Workgroup 2 - Proposed Reason:**

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# Public Comments for: B202(3)-18

This proposal doesn't have any public comments.

Proposal # 247

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# B202(4)-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr (clementsro@chesterfield.gov)

## 2015 Virginia Existing Building Code

**BUILDING.**
A combination of materials, whether portable or fixed, having a roof to form a *structure* for the use or occupancy by persons, or property. The word "*building*" shall be construed as though followed by the words "or part of parts thereof" unless the context clearly requires a different meaning. "*Building*" shall not include roadway tunnels and bridges owned by the Virginia Department of Transportation, which shall be governed by construction and design standards approved by the Virginia Commonwealth Transportation Board.

~~For application of this code, each portion of a *building* that is completely separated from other portions by fire walls complying with Section 706 of the VCC shall be considered as a separate *building* (see Section 503.1 of the VCC).~~

## 2015 Virginia Statewide Prevention Fire Code

**[A] BUILDING.** ~~Any structure used or intended for supporting or sheltering any use or occupancy.~~
A combination of materials, whether portable or fixed, having a roof to form a *structure* for the use or occupancy by persons, or property. The word "*building*" shall be construed as though followed by the words "or part of parts thereof" unless the context clearly requires a different meaning. "*Building*" shall not include roadway tunnels and bridges owned by the Virginia Department of Transportation, which shall be governed by construction and design standards approved by the Virginia Commonwealth Transportation Board.

## 2015 Virginia Construction Code

**BUILDING.**
A combination of materials, whether portable or fixed, having a roof to form a *structure* for the use or occupancy by persons, or property. The word "*building*" shall be construed as though followed by the words "or part or parts thereof" unless the context clearly requires a different meaning. "*Building*" shall not include roadway tunnels and bridges owned by the Virginia Department of Transportation, which shall be governed by *construction* and design standards approved by the Virginia Commonwealth Transportation Board.

~~For application of this code, each portion of a *building* that is completely separated from other portions by fire walls complying with Section 706 shall be considered as a separate *building* (see Section 503.1).~~

## 2018 International Building Code

**503.1 General.** Unless otherwise specifically modified in Chapter 4 and this chapter, *building height*, number of *stories* and *building area* shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. *Building height*, number of *stories* and *building* area provisions shall be applied independently. For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more *fire walls* complying with Section 706 shall be considered to be a separate building.

**706.1 General.** *Fire walls* shall be constructed in accordance with Sections 706.2 through 706.11. The extent and location of such *fire walls* shall provide a complete separation. Where a *fire wall* separates occupancies that are required to be separated by a *fire barrier* wall, the most restrictive requirements of each separation shall apply.

**Reason Statement:**
This code change is needed to coordinate the USBC and SFPC definition of BUILDING with that of the 2018 IBC provisions as they relate to "separate buildings" (which was achieved by ICC code change G130-15 - attached). Since no code change has been proposed to revise the 2018 IBC in this regard, this proposal is needed. The 2018 IBC commentary summarizes the G130-15 reason statement. Note that though the definition of BUILDING is derived from the Code of Virginia (COV), the portion proposed for deletion is not part of the statutory definition; therefore, this proposal can be done through the regulatory process.

Per the 2018 IBC Commentary . . .

- *"Fire walls serve to create separate buildings for purposes of **allowable area, allowable height and type of construction requirements** (see the definition of 'Area, building' in Section 202). Using these provisions to control other building features or elements such as means of egress, building systems or building utilities **is not intended or implied by the provisions**."*

The definition in the SFPC should match those in the VCC and VEBC and how BUILDING is defined in the Code of Virginia - which this proposal does. Otherwise, the definition in the SFPC would not comport with that in the COV.

By incorporating the 2018 IBC *revised* versions of 503.1 and 706.1 (included for context only - no code changes are being proposed herein) into the

2018 VCC/VEBC/SFPC, the "extended portion" of the BUILDING definition without any changes may create unintended consequences and differing interpretations.

Current 2015 VCC text: (for comparison purposes to the new 2018 IBC text)

**503.1 General.** Unless otherwise specifically modified in Chapter 4 and this chapter, *building height*, number of stories and *building area* shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. *Building height*, number of stories and *building* area provisions shall be applied independently. ~~Each portion of a building separated by one or more *fire walls* complying with Section 706 shall be considered to be a separate building~~. **[<--This sentence was changed in 2018 IBC to clarify it was for those purposes only - area limitations, height limitations and type of construction]**

**706.1 General.** ~~Each portion of a building separated by one or more *fire walls* that comply with the provisions of this section shall be considered a separate building.~~ **[<--This sentence was deleted in 2018 IBC]** The extent and location of such *fire walls* shall provide a complete separation. Where a *fire wall* separates occupancies that are required to be separated by a *fire barrier* wall, the most restrictive requirements of each separation shall apply.

**Cost Impact:**
Decrease cost of construction. If means of egress, building systems, and building utilities can extend from one side of a fire wall to the other and not have to be designed as independent systems/utilities and/or limit the flexibility of extending an otherwise compliant means of egress system through and beyond such fire walls, the cost of construction could potentially decrease.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B202(4)-18

This proposal doesn't have any public comments.

Proposal # 300

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# Code Change No: G130-15

**Original Proposal**

**Section: 503.1, 706.1**

**Proponent:** Edward Kulik, representing Building Code Action Committee (bcac@iccsafe.org)

**Revise as follows:**

**503.1 General.** Unless otherwise specifically modified in Chapter 4 and this chapter, *building height*, number of stories and *building area* shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. *Building height*, number of stories and *building* area provisions shall be applied independently. ~~Each~~ For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more *fire walls* complying with Section 706 shall be considered to be a separate building.

**706.1 General.** ~~Each portion of a building separated by one or more *fire walls* that comply with the provisions of this section~~ Fire walls shall be ~~considered a separate building~~ constructed in accordance with Sections 706.2 through 706.11. The extent and location of such *fire walls* shall provide a complete separation. Where a *fire wall* separates occupancies that are required to be separated by a *fire barrier* wall, the most restrictive requirements of each separation shall apply.

**Reason:** This public proposal is submitted by the ICC Building Code Action Committee (BCAC). The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 13 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes and the public comments. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.
The purpose of this proposal is to clarify the intent of the these sections of the Code that the requirement for a fire wall in Sections 503.1 and 706.1 is predicated on the determination of the maximum allowable height and area calculations under Chapter 5. Using these sections of Code to control other building features or elements such as means of egress, building systems or building utilities is not intended or implied by these sections of the Code. However, by inclusion of the first sentence in Section 706.1 some code officials have incorrectly interpreted that language to mean that the portions of the various elements and systems on each side of a fire wall must be completely self-contained. There are no requirements in the I Codes that mandate that the placement of fire walls to create a separate building such that its building features need to be separated from other like building features in adjacent buildings. The scope of Section 706 is to provide the technical requirements for the construction of a fire wall.

The added language in Section 503.1 along with the strikeout and added language in Section 706.1 will clarify application of these two sections.

**Cost Impact:** Will not increase the cost of construction
The cost of construction will be reduced by eliminating incorrect application of Section 706.1.

**Report of Committee Action Hearings**

**Committee Action:** **Approved as Submitted**

**Committee Reason:** The proposal clearly separates the scoping of fire walls from the design requirements for fire walls. Section 706.1 is the location of the standards for fire walls and is similar other provisions in Chapter 7 which are the 'cook books' for each type of wall and horizontal assemblies. The committee hopes that this will reduce requests for duplication of other systems such as sprinkler systems, electrical systems, etc, in each portion of a structure separated by fire walls. The new text in 503.1 clearly states why fire walls are needed for addressing height and area limitations as well as type of construction.

**Assembly Action** **None**

**Final Hearing Results**

**G130-15** **AS**

# B310.1-18

**Proponents:** Residential Use Subworkgroup

## 2015 Virginia Construction Code

**STATE REGULATED CARE FACILITY (SRCF).**

A *building* ~~with an occupancy in Group R-2, R-3, R-4 or R-5 occupied~~ occupied by persons in the care of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education, the Virginia Department of Health or the Virginia Department of Juvenile Justice.

**302.1 General.** Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in this section. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a *structure* is proposed for a purpose that is not specifically provided for in this code, such *structure* shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
2. Business (see Section 304): Group B.
3. Educational (see Section 305): Group E.
4. Factory and Industrial (see Section 306): Groups F-1 and F-2.
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.
6. Institutional (see Section 308 and Section 313 for SRCFs)
7. Mercantile (see Section 309): Group M.
8. Residential (see Section 310 and Section 313 for SRCFs): Groups R-1, R-2, R-3, R-4 and R-5.
9. Storage (see Section 311): Groups S-1 and S-2.
10. Utility and Miscellaneous (see Section 312): Group U.

**Revise as follows:**

**308.3 Institutional Group I-1** This occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive custodial care. Buildings of Group I-1~~, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 308.3.1. Assisted living facilities licensed by the Virginia Department of Social Services~~ shall be classified as one of the occupancy conditions indicated in Section 308.3.1 or 308.3.2. ~~This group shall include, but not be limited to, the following:~~

~~Alcohol and drug centers~~

~~Assisted living facilities~~

~~Congregate care facilities~~

~~Group homes~~

~~Halfway houses~~

~~Residential board and care facilities~~

~~Social rehabilitation facilities~~

**308.3.1 Condition 1.** This occupancy condition shall include buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete *building* evacuation. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents that may require the physical assistance reside on ~~a single level~~ a level of exit ~~discharge.~~ discharge and the path of egress to the exit does not include steps.

**Delete without substitution:**

~~**308.3.3 Six to 16 persons receiving custodial care.** A facility housing not fewer than six and not more than 16 persons receiving *custodial care* shall be classified as Group R-4.~~

**308.3.4 Five or fewer persons receiving custodial care.** A facility with five or fewer persons receiving *custodial care* shall be classified as Group R-3 or shall comply with the International Residential Code provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.

**Revise as follows:**

**308.4 Institutional Group I-2** This occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation. This group shall include, but not be limited to, the following:

- Convalescent facilities
- Detoxification facilities
- Foster care facilities
- Hospice facilities
- Hospitals
- Nursing homes
- Psychiatric hospitals

Exception: Hospice facilities occupied by 16 or less occupants, excluding staff, are permitted to be classified as Group R-4.

**Delete without substitution:**

**308.4.2 Five or fewer persons receiving medical care.** A facility with five or fewer persons receiving medical care shall be classified as Group R-3 or shall comply with the International Residential Code provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.

**Revise as follows:**

**310.3 Residential Group R-1.** Residential occupancies containing sleeping units or more than two dwelling units, and: where the occupants are primarily transient in nature, including:

Boarding houses (transient) with more than 10 occupants
Congregate living facilities (transient) with more than 10 occupants
Hotels (transient)
Motels (transient)

**Exceptions:**

1. Nonproprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height with a maximum of 10 occupants total are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.
2. Proprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height, that are also occupied as the residence of the proprietor, with a maximum of five guest room sleeping units provided for the transient occupants are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.

1. The occupants are primarily transient, and
2. There are more than 10 occupants.

**310.4 Residential Group R-2.** Residential Group R-2 occupancies containing *sleeping units* or more than two *dwelling units* where the occupants are not primarily permanent transient. in nature, including:

Apartment houses
*Boarding houses* (nontransient) with more than 16 occupants
*Congregate living facilities* (nontransient) with more than 16 occupants
Convents
*Dormitories*
Fraternities and sororities
Hotels (nontransient)
*Live/work units*
Monasteries
Motels (nontransient)
Vacation timeshare properties

**310.5 Residential Group R-3.** Residential Group R-3 occupancies containing no more than two dwelling units and where the occupants are

~~primarily permanent in nature and~~ occupancy is not classified as Group R-1, R-2, R-4 , R-5, or I, ~~including:~~ and:

~~Buildings that do not contain more than two *dwelling units*~~
~~*Boarding houses* (nontransient) with 16 or fewer occupants~~
~~*Boarding houses* (*transient*) with 10 or fewer occupants~~
~~Care facilities that provide accommodations for five or fewer persons receiving care~~
~~*Congregate living facilities* (nontransient) with 16 or fewer occupants~~
~~*Congregate living facilities* (*transient*) with 10 or fewer occupants~~
~~*Lodging houses* with five or fewer *guest rooms*~~

1. The occupants are not primarily transient, or

2. There are no more than 10 transient occupants per dwelling unit.

**310.5.1 ~~Care facilities within a dwelling~~ Radon-resistant construction.** ~~Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the International Residential Code provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~

Group R-3 buildings and structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R327 of the IRC.

**310.6.1 Condition 1.** This occupancy condition shall include buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete *building* evacuation ~~and hospice facilities.~~ or, in which not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a level of exit discharge and the path of egress to the exit does not include steps .

**Revise as follows:**

**310.5.2 Lodging houses.** *Owner*-occupied or proprietor-occupied *lodging houses* and other transient boarding facilities not more than three stories above grade plane in height, with five or fewer guest rooms and 10 or fewer total occupants shall be permitted to be ~~constructed in accordance with the International Residential Code~~ . classified as either Group R-3 or R-5, provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3, or Section R314 of the IRC for Group R-5.

**~~310.8.1~~ 310.7.1 Additional requirements.** Methods of *construction*, materials, systems, *equipment* or components for Group R-5 structures not addressed by prescriptive or performance provisions of the IRC shall comply with applicable IBC requirements.

**Revise as follows:**

**310.6 Residential Group R-4.** ~~This occupancy shall include buildings, structures or portions thereof for~~ Residential occupancies with more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive *custodial care.* Buildings of Group R-4, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 310.6.1. Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancy conditions indicated in Section 310.6.1 or ~~310.6.2. This group shall include, but not be limited to, the following:~~ 310.6.2.

~~Alcohol and drug centers~~
~~Assisted living facilities~~
~~Congregate care facilities~~
~~Group homes~~
~~Halfway houses~~
~~Residential board and care facilities~~
~~Social rehabilitation facilities~~

~~This occupancy shall also include hospice facilities with not more than 16 occupants, excluding staff.~~

~~Group R-4 occupancies shall meet the requirements for *construction* as defined for Group R-3, except as otherwise provided for in this code.~~

~~**Exceptions:**~~

~~1. Group homes licensed by the Virginia Department of Behavioral Health and Developmental Services that house no more than eight persons with one or more resident counselors shall be classified as Group R-2, R-3, R-4 or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.~~

2. ~~In Group R-4 occupancies classified as the occupancy condition indicated in Section 310.6.1, other than in hospice facilities, not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a single level of exit discharge and other than using a ramp, a change of elevation using steps or stairs is not within the path of egress to an exit door.~~

3. ~~Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, and all of the residents are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5.~~

4. ~~Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, may be classified as Group R-5 when in compliance with all of the following:~~

   4.1. ~~The *building* is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.~~

   4.2. ~~Not more than five of the residents may require physical assistance from staff to respond to an emergency situation.~~

   4.3. ~~All residents who may require physical assistance from staff to respond to an emergency situation reside on a single level of exit discharge and other than using a ramp, a change in elevation using steps or stairs is not within the path of egress to an exit door.~~

5. ~~Hospice facilities with five or fewer occupants are permitted to comply with the IRC provided the *building* is protected by an automatic sprinkler system in accordance with IRC Section P2904 or IBC Section 903.3.~~

**Delete without substitution:**

**~~310.10 Radon-resistant construction in Groups R-3 and R-4 structures.~~** ~~Groups R-3 and R-4 structures shall be subject to the radon-resistant *construction* requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.~~

**Add new text as follows:**

**310.6.3 New Code Section Radon-resistant construction** Groups R-4 buildings and structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R327 of the IRC.

**Revise as follows:**

**310.7 Residential Group R-5.** Residential occupancies within the scope of the IRC, other occupancies ~~in detached single- and two-family dwellings, townhouses and accessory structures within the scope of the IRC.~~ specifically permitted in this code to be classified as Group R-5, and manufactured homes in accordance with the Virginia Manufactured Home Safety Regulations (23VAC5-91).

The provisions of the International Residential Code for One- and Two-family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of the following when classified as Group R-5:

1. Detached single-family and two-family dwellings
2. Townhouses
3. Care facilities for five or fewer people
4. Owner- or proprietor-occupied lodging houses with no more than five guest rooms and 10 or fewer total occupants.
5. Accessory structures of group R-5 occupancies.

The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC and the IBC shall be considered to be references to this section.

**Add new text as follows:**

**313 New Code Section State Regulated Care Facilities (SRCF) 313.1 General** . Notwithstanding any other requirements of this code, this section applies to the use and occupancy classification of state regulated care facilities addressed in this section.

**313.2 Assisted Living Facilities** . Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancies specified in sections 432.2.1 through 432.2.6.

**313.2.1 Group I-1 Condition 1** . Facilities with more than sixteen persons receiving care, in which all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**313.2.2 Group I-1 Condition 2** . Facilities with more than sixteen persons receiving care, in which there are persons who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation, shall be classified as Group I-1

Condition 2. Not more than five of the persons may require physical assistance from more than one staff member to respond to an emergency situation.

**313.2.3 Group I-2 Condition 1** . Facilities with more than five persons receiving care who require assistance by more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group I-2 Condition 1.

**313.2.4 Group R-4 Condition 1** . Facilities with nine to sixteen persons receiving care, where all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**313.2.5 Group R-4 Condition 2** . Buildings with nine to sixteen persons receiving care, who may require assistance by not more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group R-4 Condition 2. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

**313.2.6 Group R-2, R-3 or R-5** . Facilities with no more than eight persons receiving care, with one or more resident counselors, and all persons are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5. Up to five of the persons may require physical assistance from staff to respond to an emergency situation when in compliance with the following:

1. All residents that require physical assistance from staff reside on a level of exit discharge and the path of egress to the exit does not include steps.

2. The building is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.

**313.3 Family Day Homes** . Family day homes registered or licensed by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.

**313.4 Group Homes** . Group Homes licensed by the Virginia Department of Behavioral Health and Developmental Services shall be classified as one of the occupancies specified in sections 432.4.1 through 432.4.3.

**313.4.1 Groups R-2, R-3, R-4 Condition 1 or 2 or R-5** . Facilities with no more than eight persons receiving care, with one or more resident counselors, shall be classified as Group R-2, R-3, R-4 (Condition 1 or 2) or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

**313.4.2 Group R-4 Condition 1** . Facilities with eight to sixteen persons receiving care, where all persons, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as Group R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency , provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**313.4.3 Group R-4 Condition 2** . Facilities with eight to sixteen persons receiving care or facilities with more than five persons requiring physical assistance from staff to respond to an emergency situation shall be classified as Group R-4 Condition 2.

**313.5 Hospice Facilities** . Hospice facilities licensed by the Virginia Department of Health shall be classified as one of the occupancies specified in sections 432.5.1 through 432.5.3.

**313.5.1 Group I-2** . Facilities with sixteen or more persons receiving care shall be classified as Group I-2.

**313.5.2 Group R-4 Condition 1** . Facilities with less than sixteen persons receiving care shall be classified as Group R-4 Condition 1.

**313.5.3 Group R-5** . Facilities with five or fewer persons receiving care are permitted to be classified as Group R-5.

**Delete without substitution:**

~~**310.8 Group R-5.** The *construction* of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.~~

~~**310.9 Family day homes.** Family day homes where program oversight is provided by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.~~

~~**Note:** Family day homes may generally care for up to 12 children. See the DHCD "Related Laws Package" for additional information.~~

**Revise as follows:**

**427.2 Site work for manufactured homes.** Footing design, basements, grading, drainage, decks, stoops, porches and utility connections shall comply with the provisions of this code applicable to Group R-5 occupancies. Manufactured homes shall be classified as Group R-5, in accordance with Chapter 3 of this code. Additionally, all applicable provisions of Chapter 1 of this code, including but not limited to requirements for permits, inspections, certificates of occupancy and requiring compliance, are applicable to the installation and set-up of a *manufactured home*. Where the installation or erection of a *manufactured home* utilizes components that are to be concealed, the installer shall notify the building official that an inspection is necessary and assure that an inspection is performed and approved prior to concealment of such components, unless the building official has agreed to an alternative method of verification.

## 2015 Virginia Statewide Prevention Fire Code

**STATE REGULATED CARE FACILITY (SRCF).** A building ~~with an occupancy in Group R-2, R-3, R-4, or R-5~~ occupied by persons in the care of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education , the Virginia Department of Health, or the Virginia Department of Juvenile Justice.

**TABLE 405.2**
**FIRE AND EVACUATION DRILL FREQUENCY AND PARTICIPATION**

| GROUP OR OCCUPANCY | FREQUENCY | PARTICIPATION |
|---|---|---|
| Group A | Quarterly | Employees |
| Group B[b] | Annually | All occupants |
| Group B[b], [c] (Ambulatory care facilities) | Annually | Employees |
| Group B[b] (Clinic, outpatient) | Annually | Employees |
| Group E | Monthly[a] | All occupants |
| Group F | Annually | Employees |
| Group I-1 | Semiannually on each shift[a] | All occupants |
| Group I-2 | Quarterly on each shift[a] | Employees |
| Group I-3 | Quarterly on each shift[a] | Employees |
| Group I-4 | Monthly on each shift[a] | All occupants |
| Group R-1 | Quarterly on each shift | Employees |
| Group R-2[d] | Four annually | All occupants |
| Group R-4 | Semiannually on each shift[a] | All occupants |
| Group R SRCF , except hospice | Monthly | All occupants |

a. In severe climates, the *fire code official* shall have the authority to modify the emergency evacuation drill frequency.

b. Emergency evacuation drills are required in Group B buildings having an *occupant load* of 500 or more persons or more than 100 persons above or below the lowest *level of exit discharge.*

c. Emergency evacuation drills are required in ambulatory care facilities in accordance with Section 403.3.

d. Emergency evacuation drills in Group R-2 college and university buildings shall be in accordance with Section 403.10.2.1. Other Group R-2 occupancies shall be in accordance with Section 403.10.2.2.

**Reason Statement:** This proposal is intended to clarify the residential use group classifications by deleting the laundry lists of examples under each group and simplifying the descriptions of each group based on the number of occupants, if the occupants are transient or not, and if the use includes sleeping and/or dwelling units.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

**Workgroup 2 - Proposed Committee Action:** Carry over to Final

**Workgroup 2 - Proposed Reason:**

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# Public Comments for: B310.1-18

This proposal doesn't have any public comments.

# B907.3.2-18

**Proponents:** SBCO Staff

## 2018 International Building Code

**Revise as follows:**

**[F] 907.3.2 Special locking systems.** Where special locking systems are installed on *means of egress* doors in accordance with ~~Sections 1010.1.9.7~~ Section 407.4.1.1 or 1010.1.9.8, an automatic detection system shall be installed as required by that section.

**Reason Statement:** Correction to change reference from 1010.1.9.7, which is deleted, to 407.4.1.1.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal will not increase or decrease the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is an editorial correction.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B907.3.2-18

This proposal doesn't have any public comments.

Proposal # 413

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# B1709.5.2-18

**Proponents:** Resiliency Subworkgroup

## 2018 International Building Code

**1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1.** Exterior window and door assemblies shall be tested in accordance with ASTM ~~E330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108.~~ E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

**Revise as follows:**

**1709.5.2.1 Garage doors and rolling doors.** Garage doors and rolling doors shall be tested in accordance with either ASTM E 330 or ANSI/DASMA 108, and shall meet the pass/fail acceptance criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be *labeled* with a permanent *label* identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

**Reason Statement:** This was a consensus item from the Resiliency Subworkgroup. Requires garage doors have a permanent label that provides a way for the owner to be able to determine their performance characteristics after the building has been occupied. The proposal still needs to be considered by the full workgroup.

**Cost Impact:** The code change proposal will increase the cost of construction
Requires additional documentation.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Provides information on performance characteristics and compliance with the applicable industry standard for positive/negative wind design pressure ratings for garage and rolling doors.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1709.5.2-18

This proposal doesn't have any public comments.

Proposal # 355

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# E402.1.4.2-18

**Proponents:** Jeff Mang, Polyisocyanurate Insulation Manufacturers Association (jeff.mang@hoganlovells.com); Energy Subworkgroup

## 2018 International Energy Conservation Code

**Add new text as follows:**

**1 C402.1.4.2 New Code Section Roof/Ceiling Assembly.** The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.4 based on construction materials used in the roof/ceiling assembly.

**1.1 C402.1.4.2.1 New Code Section Tapered, above-deck insulation based on thickness.** Where used as a component of a maximum roof/ceiling assembly *U*-factor calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) for *U*-factor compliance as prescribed in Section C402.1.4.

**1.2 C402.1.4.2.2 New Code Section Suspended ceilings.** Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof/ceiling construction.

**1.3 C402.1.4.2.3 New Code Section Multiple layers and staggered joints.** Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the roof deck at a gutter edge, roof drain or scupper.

**Revise as follows:**

**C402.2.1 Roof assembly.** The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly. ~~Insulation installed on a suspended ceiling having removable ceiling tiles shall not be considered as part of the minimum thermal resistance of the roof insulation. Continuous insulation board shall be installed in not less than 2 layers and the edge joints between each layer of insulation shall be staggered.~~

~~**Exceptions:**~~

1. ~~Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.1.3.~~
2. ~~Where tapered insulation is used with insulation entirely above deck, the *R*-value where the insulation thickness varies 1 inch (25 mm) or less from the minimum thickness of tapered insulation shall comply with the *R*-value specified in Table C402.1.3.~~
3. ~~Two layers of insulation are not required where insulation tapers to the roof deck, such as at roof drains.~~

**Add new text as follows:**

**1.1 C402.2.1.1 New Code Section Tapered, above-deck insulation based on thickness.** Where used as a component of a roof/ceiling assembly *R*-value calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) for *R*-value compliance as prescribed in Section C402.1.3.

**1.2 C402.2.1.2 New Code Section Minimum thickness, lowest point.** The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be no less than 1 inch (25 mm).

**1.3 C402.2.1.3 New Code Section Suspended ceilings.** Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling construction.

**1.4 C402.2.1.4 New Code Section Multiple layers and staggered joints.** Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the roof deck at a gutter edge, roof drain or scupper.

~~**C402.2.1.1**~~ **C402.2.1.5 Skylight curbs.** Skylight curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

**Exception:** Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

**Reason Statement:** This proposal adds missing text to Section C402.1.4 and clarifies that the U-factor compliance method is acceptable for roof/ceiling assemblies. The new text is modeled after existing text in Section C402.2. This proposal also clarifies how to calculate the U-factor contribution of tapered roof insulation, which is an important component of new and replacement roof systems. This proposal also clarifies the existing requirements in Section C402.2 by reorganizing the text into a series of easy-to-follow subsections. The original text was presented as exceptions to the general requirement; however, this added confusion to the code. The revised format will improve compliance and enforcement, as well as make the task of calculating the tapered insulation component R-value easier. Overall, this proposal is intended to simplify the code, add

clarity to users and code officials, and improve the ability of building owners to use tapered insulation for U-factor and R-value compliance.
This same proposal was adopted as part of the 2021 I-Codes at the recent Public Comment Hearings in Nevada.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal does not add any new requirements to the energy code. To the extent this proposal makes it easier for building owners to use tapered insulation to satisfy the U-factor or R-value requirements, the cost of construction may decrease.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Building energy efficiency can have a quantifiable impact on resiliency. To the extent that this proposal's clarifications will improve compliance and enforcement of the energy code, this proposal will result in improved building energy efficiency (especially for existing buildings undergoing a roof replacement) and will therefore improve resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: E402.1.4.2-18

This proposal doesn't have any public comments.

Proposal # 310

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# E402.4.2-18

**Proponents:** Haywood Kines (hkines@pwcgov.org); Energy Subworkgroup

## 2015 Virginia Energy Conservation Code

~~**C402.4.1.2**~~ **C402.4.2** ~~**Increased skylight**~~ **Skylight area with daylight responsive controls.** The skylight area shall be permitted to be not more than 5 percent of the roof area provided *daylight responsive controls* complying with Section C405.2.3.1 are installed in *daylight zones* under skylights.

**Delete without substitution:**

~~**C402.4.2 Minimum skylight fenestration area.** In an enclosed space greater than 2,500 square feet (232 $m^2$) in floor area, directly under a roof with not less than 75 percent of the ceiling area with a ceiling height greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop, the total *daylight zone* under skylights shall be not less than half the floor area and shall provide one of the following:~~

~~1.A minimum skylight area to *daylight zone* under skylights of not less than 3 percent where all skylights have a VT of at least 0.40 as determined in accordance with Section C303.1.3.~~
~~2.A minimum skylight effective aperture of at least 1 percent, determined in accordance with Equation 4-4.~~

~~Skylight Effective Aperture = 0.85 Skylight Area Skylight VT WF Daylight zone under skylight~~

$$\text{Skylight Effective Aperture} = \frac{0.85 \cdot \text{Skylight Area} \cdot \text{Skylight VT} \cdot \text{WF}}{\text{Daylight zone under skylight}}$$ ~~**(Equation 4-4)**~~

~~where:~~

~~Skylight area = Total fenestration area of skylights.~~

~~Skylight VT = Area weighted average visible transmittance of skylights.~~

~~WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.~~

~~Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.~~

~~**Exception:** Skylights above *daylight zones* of enclosed spaces are not required in:~~

~~1.Buildings in *Climate Zones* 6 through 8.~~
~~2.Spaces where the designed *general lighting* power densities are less than 0.5 W/$ft^2$ (5.4 W/$m^2$).~~
~~3.Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.~~
~~4.Spaces where the *daylight zone* under rooftop monitors is greater than 50 percent of the enclosed space floor area.~~
~~5.Spaces where the total area minus the area of *daylight zones* adjacent to vertical fenestration is less than 2,500 square feet (232 $m^2$), and where the lighting is controlled according to Section C405.2.3.~~

**C402.4.2.1** ~~**Lighting controls in daylight zones**~~ **Daylight Zone Controls under skylights.** *Daylight responsive controls* complying with Section C405.2.3.1 shall be provided to control all electric lights within *daylight zones* under skylights.

**C402.4.2.2 Haze factor.** Skylights that are installed in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing material or diffuser with a haze factor greater than 90 percent when tested in accordance with ASTM D1003.

**Exception:** Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of skylight and light well.

**Reason Statement:** The Section C402.4.2 has mandatory requirements for skylights in all buildings that will have an area greater than 2500 sq. ft with a ceiling height of 15 ft. this Code section lists building uses that by design is technically infeasible to install skylights to meet the minimum area requirements. Typically these roof areas are used for HVAC equipment, and PV systems as well as possible structural issues based on actual design of the buildings.

**Cost Impact:** The code change proposal will decrease the cost of construction
This change will element the additional cost of skylights in buildings that are already providing Daylight Zones with the windows and doors. This lighting is required to have separate Daylight Zone controls from the general lighting controls as well as meeting the requirements for the allowable lighting Budget and comply with additional efficiency requirements in Section C406 Additional Efficiency Package Options.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will help industry for compliance with the VECC, the number of possible skylights that could be required may not be practicable or improve energy efficiency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: E402.4.2-18

This proposal doesn't have any public comments.

Proposal # 332

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# E404.5-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Energy Subworkgroup

## 2018 International Energy Conservation Code

**Delete without substitution:**

~~**C404.5 Heated water supply piping.** Heated water supply piping shall be in accordance with Section C404.5.1 or C404.5.2. The flow rate through $^{1}/_{4}$ inch (6.4 mm) piping shall be not greater than 0.5 gpm (1.9 L/m). The flow rate through $^{5}/_{16}$ inch (7.9 mm) piping shall be not greater than 1 gpm (3.8 L/m). The flow rate through $^{3}/_{8}$ inch (9.5 mm) piping shall be not greater than 1.5 gpm (5.7 L/m).~~

~~**C404.5.1 Maximum allowable pipe length method.** The maximum allowable piping length from the nearest source of heated water to the termination of the fixture supply pipe shall be in accordance with the following. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.~~

~~1.For a public lavatory faucet, use the "Public lavatory faucets" column in Table C404.5.1.~~
~~2.For all other plumbing fixtures and plumbing appliances, use the "Other fixtures and appliances" column in Table C404.5.1.~~

~~**TABLE C404.5.1**~~
~~**PIPING VOLUME AND MAXIMUM PIPING LENGTHS**~~

| ~~NOMINAL PIPE SIZE (inches)~~ | ~~VOLUME (liquid ounces per foot length)~~ | ~~MAXIMUM PIPING LENGTH (feet)~~ | |
|---|---|---|---|
| | | ~~Public lavatory faucets~~ | ~~Other fixtures and appliances~~ |
| ~~1/4~~ | ~~0.33~~ | ~~6~~ | ~~50~~ |
| ~~5/16~~ | ~~0.5~~ | ~~4~~ | ~~50~~ |
| ~~3/8~~ | ~~0.75~~ | ~~3~~ | ~~50~~ |
| ~~1/2~~ | ~~1.5~~ | ~~2~~ | ~~43~~ |
| ~~5/8~~ | ~~2~~ | ~~1~~ | ~~32~~ |
| ~~3/4~~ | ~~3~~ | ~~0.5~~ | ~~21~~ |
| ~~7/8~~ | ~~4~~ | ~~0.5~~ | ~~16~~ |
| ~~1~~ | ~~5~~ | ~~0.5~~ | ~~13~~ |
| ~~1 1/4~~ | ~~8~~ | ~~0.5~~ | ~~8~~ |
| ~~1 1/2~~ | ~~11~~ | ~~0.5~~ | ~~6~~ |
| ~~2 or larger~~ | ~~18~~ | ~~0.5~~ | ~~4~~ |

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L, 1 gallon = 128 ounces.~~

~~**C404.5.2 Maximum allowable pipe volume method.** The water volume in the piping shall be calculated in accordance with Section C404.5.2.1. Water heaters, circulating water systems and heat trace temperature maintenance systems shall be considered to be sources of heated water.~~

~~The volume from the nearest source of heated water to the termination of the fixture supply pipe shall be as follows:~~

~~1.For a public lavatory faucet: not more than 2 ounces (0.06 L).~~
~~2.For other plumbing fixtures or plumbing appliances; not more than 0.5 gallon (1.89 L).~~

~~**C404.5.2.1 Water volume determination.** The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the "Volume" column in Table C404.5.1. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.~~

**Reason Statement:** The problem of heated water taking an excessively long time to arrive at lavatory faucets in public restrooms is well known. The length of time the faucets are used during each hand washing event is very short, often around 5 seconds. Federal law requires low flow rate or small, metered volumes for the faucets in these applications. Health codes expect heated water for washing hands in these applications. The dilemma is that the volume of not-hot water in the piping from the source of hot water to the faucets is much too large for the heated water to arrive in a timely fashion; even at the 50-foot limit currently required in the 2012 IPC. Supporting this proposal will correlate the IECC with Federal law and local health codes by providing heated water for hand washing in a timely manner. The delivery of hot water to public lavatory faucets needs to be considered separately because of potential health issues. The events are short and the flow rates are low. Table 1 shows the time-to-tap performance based on the requirements in the proposal. The 0.25 and 0.5 gpm columns are typical of the flow rates for public lavatory faucets. The volume in the pipe was chosen so that heated water would arrive in the first part of the hot water event so that every person who uses the public lavatory will have the benefits of hot water.

The energy savings comes from not losing the heat from the water as it tries to arrive at the faucets. For more information and background on issues related to hot water distribution please read the 4-part series at:
*http://www.allianceforwaterefficiency.org/Residential_Hot_Water_Distribution_System_Introduction.aspx*

**Providing heated water "in the first part of the hot water event" is a noble goal, but it conflicts with the IPC and increases cost (initial and operating).**

Generally the energy code should not be governing plumbing code topics like this, the plumbing code is where this should live and govern maximum distances from heating sources to fixtures that require hot water.

To recap, in order to meet section C404.5 of the Virginia energy code this would require very unusual hot water piping design strategies (looped/ serpentine mains) and lots of recirculation taps and/or lots of instantaneous/ tankless water heating strategies. This would certainly cost a lot more money to install with little or no energy benefit in most applications (most likely uses more energy).

This proposal would get hot water to fixtures much faster, should be in the plumbing code, which is covered by Chapter 6 of Plumbing Code, Section

607.2 Hot or Tempered Supply to Fixtures and requires maximum developed length of 50 feet from source to fixture.
Distance requirement imposes excessive restrictions to the hot water system layout and design. Added return branches and increase pipe sizes for serpentine-like systems will require large up front and maintenance costs as well as require larger recirculation pumps (using more energy) to account for the additional flow, head, and heat loss created from the IECC restrictions. Instead recommend reducing the distance requirement in IPC and indicating that the usage of the space and end flow rates be reviewed to determine appropriate pipe size and application of return branches, etc.

To avoid this, we could follow the following energy code compliance paths: ASHRAE 90.1-2013 compliance path , which does not require this.

Without any revisions, the proposed solutions are either to route recirculating HW mains near the fixtures – which increases the installed cost and recirculating pump energy – or incorporate heat tracing systems for temperature maintenance – which also add initial and operating costs for the heat tracing, power circuits, and additional controls.

**Cost Impact:**
Most likely, this proposal would result in overall first cost savings as well as long term savings, especially as they relate to energy efficiency.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: E404.5-18

This proposal doesn't have any public comments.

Proposal # 318

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# E501.1-18

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

## 2015 Virginia Energy Conservation Code

### CHAPTER 5 [RE]
### EXISTING BUILDINGS

### SECTION R501
### GENERAL

**Revise as follows:**

**R501.1 Scope.** The provisions of the Virginia Existing Building Code~~this chapter~~ shall control the *alteration*, repair, addition and change of occupancy of existing buildings and structures.

**Delete without substitution:**

~~**R501.1.1 Additions, alterations, or repairs: General.** Additions, alterations, or repairs to an existing building, building system or portion thereof shall comply with Section R502, R503 or R504. Unaltered portions of the existing building or building supply system shall not be required to comply with this code.~~

~~**R501.2 Existing buildings.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.~~

~~**R501.3 Maintenance.** Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and systems that are required by this code shall be maintained in conformance to the code edition under which installed. The owner or the owner's authorized agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.~~

~~**R501.4 Compliance.** *Alterations*, *repairs*, *additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in the *International Residential Code*, *International Building Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *International Plumbing Code*, *International Property Maintenance Code*, *International Private Sewage Disposal Code* and NFPA 70.~~

~~**R501.5 New and replacement materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided hazards to life, health or property are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.~~

~~**R501.6 Historic buildings.** No provision of this code relating to the construction, *repair*, *alteration*, restoration and movement of structures, and *change of occupancy* shall be mandatory for *historic buildings* provided a report has been submitted to the code official and signed by the owner, a registered *design professional*, or a representative of the State Historic Preservation Office or the historic preservation authority having jurisdiction, demonstrating that compliance with that provision would threaten, degrade or destroy the historic form, fabric or function of the *building*.~~

**Reason Statement:** This proposal deletes the administrative portion of the VECC Chapter 5 regarding existing buildings except to clarify that code officials should refer to the Virginia Existing Building Code for relevant energy provisions relating to alterations, repairs, additions, and changes of occupancy.
This proposal aligns with other code proposals which will place all existing building requirements in the VEBC, including energy requirement which have been in Chapter 5 of the VECC until now. This proposal also leaves a pointer for certain code officials who have in the past referred to Chapter 5 of the VECC to direct them to the appropriate chapters of the VEBC for the energy provisions relating to existing buildings.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is administrative and will not impact the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is administrative by moving energy provisions relating to existing buildings from the VECC to the VEBC and will not impact resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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## Public Comments for: E501.1-18

This proposal doesn't have any public comments.

Proposal # 439

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# E502-18

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

## 2015 Virginia Energy Conservation Code

### CHAPTER 5 [CE]
### EXISTING BUILDINGS

**SECTION C502 ADDITIONS**

**Revise as follows:**

**C502.1 General.** *Additions* to an existing building, building system or portion thereof shall conform to the provisions of Section 811 of the VEBC.~~this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. *Additions* shall not create an unsafe or hazardous condition or overload existing building systems. An *addition* shall be deemed to comply with this code if the *addition* alone complies or if the existing building and *addition* comply with this code as a single building. *Additions* shall comply with Section C502.2.~~

~~*Additions* complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.~~

**Delete without substitution:**

~~**C502.2 Prescriptive compliance.** *Additions* shall comply with Sections C502.2.1 through C502.2.6.2.~~

~~**C502.2.1 Vertical fenestration.** New *vertical fenestration* area that results in a total building *fenestration* area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.4. *Additions* with *vertical fenestration* that result in a total building *fenestration* area greater than Section C402.4.1 or *additions* that exceed the fenestration area greater than Section C402.4.1 shall comply with Section C402.4.1.1 for the *addition* only. *Additions* that result in a total building vertical glass area exceeding that specified in Section C402.4.1.1 shall comply with Section C407.~~

~~**C502.2.2 Skylight area.** New *skylight* area that results in a total building *fenestration* area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.4. *Additions* with *skylight* area that result in a total building *skylight* area greater than C402.4.1 or additions that exceed the *skylight* area shall comply with Section C402.4.1.2 for the *addition* only. *Additions* that result in a total building *skylight* area exceeding that specified in Section C402.4.1.2 shall comply with Section C407.~~

~~**C502.2.3 Building mechanical systems.** New mechanical systems and equipment that are part of the *addition* and serve the building heating, cooling and ventilation needs shall comply with Section C403.~~

~~**C502.2.4 Service water-heating systems.** New service water-heating equipment, controls and service water heating piping shall comply with Section C404.~~

~~**C502.2.5 Pools and inground permanently installed spas.** New pools and inground permanently installed spas shall comply with Section C404.9.~~

~~**C502.2.6 Lighting power and systems.** New lighting systems that are installed as part of the addition shall comply with Section C405.~~

~~**C502.2.6.1 Interior lighting power.** The total interior lighting power for the *addition* shall comply with Section C405.4.2 for the *addition* alone, or the existing building and the *addition* shall comply as a single building.~~

~~**C502.2.6.2 Exterior lighting power.** The total exterior lighting power for the *addition* shall comply with Section C405.5.1 for the *addition* alone, or the existing building and the *addition* shall comply as a single building.~~

### CHAPTER 5 [RE]
### EXISTING BUILDINGS

### SECTION R502
### ADDITIONS

**Revise as follows:**

**R502.1 General.** Additions to an existing building, building system or portion thereof shall conform to the provisions of Section 811 of the VEBC.~~this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition uses no more energy than the existing building. Additions shall be in accordance with Section R502.1.1 or R502.1.2.~~

**Delete without substitution:**

~~**R502.1.1 Prescriptive compliance.** Additions shall comply with Sections R502.1.1.1 through R502.1.1.4.~~

~~**R502.1.1.1 Building envelope.** New building envelope assemblies that are part of the addition shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4.~~

~~**Exception:** Where nonconditioned space is changed to conditioned space, the building envelope of the addition shall comply where the UA, as determined in Section 402.1.5, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to UA generated for the existing building.~~

~~**R502.1.1.2 Heating and cooling systems.** New heating, cooling and duct systems that are part of the addition shall comply with Sections R403.1, R403.2, R403.3, R403.5 and R403.6.~~

~~**Exception:** Where ducts from an existing heating and cooling system are extended to an addition, duct systems with less than 40 linear feet (12.19 m) in unconditioned spaces shall not be required to be tested in accordance with Section R403.3.3.~~

~~**R502.1.1.3 Service hot water systems.** New service hot water systems that are part of the addition shall comply with Section R403.5.~~

~~**R502.1.1.4 Lighting.** New lighting systems that are part of the addition shall comply with Section R404.1.~~

~~**R502.1.2 Existing plus addition compliance (Simulated Performance Alternative).** Where nonconditioned space is changed to conditioned space, the addition shall comply where the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy cost of the existing building when modeled in accordance with Section R405. The addition and any alterations that are part of the project shall comply with Section R405 in its entirety.~~

## 2015 Virginia Existing Building Code

**Revise as follows:**

**SECTION ~~811~~ 805 ENERGY CONSERVATION ~~Deleted~~**

### CHAPTER ~~8~~ SECTION 805
### ADDITIONS

**Add new text as follows:**

**805.1 General.** Additions to an existing building, or portion thereof, shall conform to the provisions of the VECC as those provisions relate to new construction without requiring the unaltered portion of the existing building to comply with the VECC. Additions shall not overload existing building systems. An addition shall be deemed to comply with the VECC if the addition alone complies or if the existing building and addition comply with the VECC as a single building.

**805.2 Residential Compliance.** Residential additions shall comply with Section 811.2.1 or 811.2.2.

**805.2.1 Prescriptive Compliance.** Additions shall comply with Sections 811.2.1.1 through 811.2.1.4.

**805.2.1.1 Building Envelope.** New building envelope assemblies that are part of the addition shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4 of the VECC.

**Exception:** The building envelope of the addition shall be permitted to comply through a Total UA analysis, as determined in Section R402.1.5 of the VECC, where the existing building and the addition, and any alterations that are part of the project, is less than or equal to the Total UA generated for the existing building.

**805.2.1.2 Heating and Cooling Systems.** New heating, cooling and duct systems that are part of the addition shall comply with Section R403 of the VECC.

**805.2.1.4 Lighting.** New lighting systems that are part of the addition shall comply with Section R404.1 of the VECC.

**805.2.2 Performance compliance.** The addition shall comply with the simulated performance alternative where the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy code of the existing building when modeled in accordance with Section R405 of the VECC.

**805.2.1.3 Service hot water systems.** New service hot water systems that are part of the addition shall comply with Section R403.4 of the VECC.

**805.3 Commercial Compliance.** Commercial additions shall comply with Sections 811.3.1 or 811.3.2.

Exception: Commercial additions complying with ANSI/ASHRAE/IESNA 90.1.

**805.3.1 Prescriptive compliance.** Additions shall comply with Sections C402, C403, C404, and C405 of the VECC.

**805.3.2 Performance compliance.** The addition shall comply with the simulated performance alternative where the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy cost or use of

the existing building when modeled in accordance with Section C407 of the VECC.

**Reason Statement:** This proposal moves the requirements of VECC Sections C502 and R502 to Chapter 8 of the VEBC. This proposal aligns with other proposals to move the energy conservation requirements for existing buildings from the VECC to the VEBC. This proposal also provides a pointer in the VECC to the VEBC to assist code officials who may be used to looking at the VECC rather than the VEBC for existing building energy conservation requirements.Reason or explanation to clarify how these exceptions work.
The provisions of this proposal create alternate compliance paths so that either the addition *or* the addition plus the existing building, taken together, can be used to evaluate compliance with the energy provisions. This proposal would not require retrofits of existing buildings. Take, for example, a residential addition which incorporates a glass wall which would make it very difficult for the addition comply with the energy code. The builder or homeowner could instead evaluate that glass wall as a part of the whole house, so that if the whole house, including the addition, would comply with the code because of higher energy efficiency elsewhere in the home (for example, more attic insulation), then the addition would be compliant.

**Cost Impact:** The code change proposal will increase the cost of construction
This proposal will increase the cost of construction in some cases. Because the current VECC and VEBC are not in perfect alignment on energy conservation requirements for existing buildings, the cost impact will vary based on which code is used as the basis for code compliance. To the extent that code officials have been enforcing Chapter R5/C5 of the VECC for existing buildings, this proposal will not increase the cost of construction and may reduce the cost of construction in some cases, since the requirements are drawn directly from VECC Chapter R5/C5. However, where code officials have been enforcing the VEBC for all requirements for existing buildings, these changes will apply new requirements and may result in increased initial costs of construction, but may also result in reduced life cycle costs due to the anticipated energy savings.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is administrative and will neither increase nor decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:** Carryover to Sept

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# Public Comments for: E502-18

**Discussion by W Shaun Pharr**
Aug 11, 2020 4:31 UTC

AOBA/VAMA believe that BHCD is legally preluded by the Code of Virginia from adopting code provisions applicable to existing buildings which will increase the costs of compliance for such buildings.

Sec. 36-103 of the Code of Virginia reads, in part, as follows:

"[The] Board may adopt and promulgate as part of the Building Code, building regulations that facilitate the maintenance, rehabilitation, development and reuse of existing buildings at the least possible cost (emphasis added) to ensure the protection of the public health, safety and welfare."

In short, the General Assembly, as a policy matter, premised the Board's authority to develop and adopt an existing buildings code on the provisions of such a code representing the least possible costs while encouraging, rather than possibly discouraging, continued reinvestment in existing buildings. Code change proposals which would increase the costs of "construction" or "development" of existing buildings are antithetical on their face to the policy prescribed by the General Assembly and, thus, cannot be validly adopted.

The only exceptions to this "safe harbor" policy for existing buildings are regulations which are shown to be essential "to ensure the protection of the public health, safety and welfare."

Thus, as the reason statement indicates, it is true that "the current VECC and VEBC are not in perfect alignment on energy conservation requirements for existing buildings"-- but this is precisely because the Board has respected the existing buildings policy articulated by the General Assembly.

Moreover, it is sophistry to assume that, absent a regulatory mandate, property owners will just ignore the economic benefits that proponents claim will result, and will, instead, do what proponents consider to be "the wrong thing." If those benefits are there, then property owners who can manage the "first costs" required to meet higher energy standards will do so-- and much of the so-called "low hanging fruit" in existing buildings will be harvested, without a "shove it down their throats" mandate that violates the avowed purpose of the existing buildings code.

**Discussion by Kenney Payne**
Jun 24, 2020 12:45 UTC

It appears 811.1 is attempting to call “additions” to any building *system* as an “addition” that would be governed under Chapter 8. That would conflict with VEBC 601.2.2 that says any “reconfiguration or extension of any system . . . any additional equipment” is a Level 2 alteration. However, AIA VA could support the following (BTW - it would actually be Section 805 not 811 - VA deleted all the other sections)

**805.1 General.** Additions to an existing building~~, building system,~~ or portion thereof shall conform to the provisions of the VECC as those provisions relate to new construction without requiring the unaltered portion of the existing building ~~or building system~~ to comply with the VECC. ~~Additions shall not create an unsafe or hazardous condition or overload existing building systems.~~ [already covered under 801.2 and is not specific to just energy] An addition shall be deemed to comply with the VECC if the addition alone complies or if the existing building and addition comply with the VECC as a single building.

The rest is not necessary as VEBC 801.1 already requires any addition (i.e., “new” stuff) to comply with the VCC, ergo, the VECC.
**Comment by Kenney Payne**
Aug 4, 2020 13:00 UTC

The above revisions were made - THANK YOU!

One other comment: Sections C502.1 and R502.1 should reference Section 805 not 811.

Proposal # 436

# E503-18

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

## 2015 Virginia Energy Conservation Code

### CHAPTER 5 [CE]
### EXISTING BUILDINGS

**SECTION C503 ALTERATIONS**

**Revise as follows:**

**C503.1 General.** *Alterations* to any building or structure shall comply with the requirements of Chapter 6 of the VEBC.~~the code for new construction. *Alterations* shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the *alteration*. *Alterations* to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall not create an unsafe or hazardous condition or overload existing building systems.~~

~~*Alterations* complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.~~

~~**Exception:** The following *alterations* need not comply with the requirements for new construction, provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing *fenestration*.~~
2. ~~Surface-applied window film installed on existing single-pane *fenestration* assemblies reducing solar heat gain, provided the code does not require the glazing or *fenestration* to be replaced.~~
3. ~~Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
5. ~~*Roof recover*.~~
6. ~~*Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.~~
7. ~~*Alterations* that replace less than 50 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.~~

**Delete without substitution:**

~~**C503.2 Change in space conditioning.** Any nonconditioned or low-energy space that is altered to become conditioned space shall be required to be brought into full compliance with this code.~~

~~**C503.3 Building envelope.** New building envelope assemblies that are part of the *alteration* shall comply with Sections C402.1 through C402.5.~~

~~**C503.3.1 Roof replacement.** *Roof replacements* shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the *building thermal envelope* and contains insulation entirely above the roof deck.~~

~~**C503.3.2 Vertical fenestration.** The addition of *vertical fenestration* that results in a total building *fenestration* area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.4. The addition of *vertical fenestration* that results in a total building *fenestration* area greater than Section C402.4.1 shall comply with Section C402.4.1.1 for the space adjacent to the new fenestration only. *Alterations* that result in a total building vertical glass area exceeding that specified in Section C402.4.1.1 shall comply with Section C407.~~

~~**C503.3.3 Skylight area.** The addition of *skylight* area that results in a total building *skylight* area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.4. The addition of *skylight* area that results in a total building skylight area greater than Section C402.4.1 shall comply with Section C402.4.1.2 for the space adjacent to the new skylights. *Alterations* that result in a total building skylight area exceeding that specified in Section C402.4.1.2 shall comply with Section C407.~~

~~**C503.4 Heating and cooling systems.** New heating, cooling and duct systems that are part of the *alteration* shall comply with Sections C403.~~

~~**C503.4.1 Economizers.** New cooling systems that are part of *alteration* shall comply with Section C403.3.~~

~~**C503.5 Service hot water systems.** New service hot water systems that are part of the *alteration* shall comply with Section C404.~~

~~**C503.6 Lighting systems.** New lighting systems that are part of the *alteration* shall comply with Section C405.~~

~~**Exception.** *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed~~

~~interior lighting power.~~

# CHAPTER 5 [RE]
# EXISTING BUILDINGS

**SECTION R503 ALTERATIONS**

**Revise as follows:**

**R503.1 General.** *Alterations* to any building or structure shall comply with the requirements of Chapter 6 of the VEBC. ~~the code for new construction. *Alterations* shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the *alteration.*~~

~~Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems. *Alterations* shall be such that the existing building or structure uses no more energy than the existing building or structure prior to the *alteration.* Alterations to existing buildings shall comply with Sections R503.1.1 through R503.2.~~

**Delete without substitution:**

~~**R503.1.1 Building envelope.** Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.4.~~

~~**Exception:** The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing fenestration.~~
2. ~~Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~
3. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
4. ~~Roof recover.~~
5. ~~Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
6. ~~Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing or fenestration assembly to be replaced.~~

**R503.1.1.1 Replacement fenestration.** (Section deleted.)

**Delete without substitution:**

~~**R503.1.2 Heating and cooling systems.** New heating, cooling and duct systems that are part of the alteration shall comply with Sections R403.1, R403.2, R403.3 and R403.6.~~

~~**Exception:** Where ducts from an existing heating and cooling system are extended, duct systems with less than 40 linear feet (12.19 m) in unconditioned spaces shall not be required to be tested in accordance with Section R403.3.3.~~

~~**R503.1.3 Service hot water systems.** New service hot water systems that are part of the alteration shall comply with Section R403.4.~~

~~**R503.1.4 Lighting.** New lighting systems that are part of the alteration shall comply with Section 404.1.~~

~~**Exception:** Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~

~~**R503.2 Change in space conditioning.** Any nonconditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.~~

~~**Exception:** Where the simulated performance option in Section R405 is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost otherwise allowed by Section R405.3.~~

**Reason Statement:** This proposal deletes the alterations section of Chapter 5 of the VECC and leaves a pointer for code officials to let them know the energy provisions have been moved to Chapter 6 of the VEBC. This proposal coordinates with other proposals moving the energy provisions relating to existing buildings from the VECC to the VEBC.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is administrative and supports other proposals to move the requirements of Chapter 5 of the VECC to the VEBC.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

This proposal is administrative.

## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

# Public Comments for: E503-18

This proposal doesn't have any public comments.

Proposal # 438

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# E504.1-18

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

## 2015 Virginia Energy Conservation Code

### CHAPTER 5 [CE]
### EXISTING BUILDINGS

**SECTION C504 REPAIRS**

**Revise as follows:**

**C504.1 General.** Buildings and structures, and parts thereof, shall be repaired in compliance with Section 510 of the VEBC.~~C501.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C501.3, ordinary *repairs* exempt from *permit* and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.~~

~~Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1, repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405 C405.~~ .

**Delete without substitution:**

~~**C504.2 Application.** For the purposes of this code, the following shall be considered repairs:~~

1. ~~Glass-only replacements in an existing sash and frame.~~
2. ~~*Roof repairs*.~~
3. ~~Air barriers shall not be required for *roof repair* where the repairs to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.~~
4. ~~Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a conditioned space from the exterior shall not be removed.~~
5. ~~*Repairs* where only the bulb, the ballast or both within the existing luminaires in a space are replaced, provided that the replacement does not increase the installed interior lighting power.~~

### CHAPTER 5 [RE]
### EXISTING BUILDINGS

**Revise as follows:**

**R504.1 General.** Buildings, structures and parts thereof shall be repaired in compliance with Section 510 of the VEBC.~~R501.3 and this section. Work on nondamaged components necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section R501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.~~

**SECTION R504 REPAIRS**

**Delete without substitution:**

~~**R504.2 Application.** For the purposes of this code, the following shall be considered repairs:~~

1. ~~Glass-only replacements in an existing sash and frame.~~
2. ~~Roof repairs.~~
3. ~~Repairs where only the bulb and/or ballast within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.~~

## 2015 Virginia Existing Building Code

**Add new text as follows:**

### SECTION 510
### ENERGY CONSERVATION

**510.1 General.** Except as permitted by Sections 302.2 and 501.1, repairs shall comply with the VECC.

Exception: Where a building was constructed to comply with the requirements of the building code under which the building or structure or the affected portion thereof was built, or as previously approved by the building official, repairs need not comply with the VECC, provided the repairs, as documented, do not result in reduced energy efficiency.

**501.2 Application.** For the purposes of this section, the following shall be considered repairs:

1. Glass-only replacements in an existing sash and frame.

2. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a conditioned space from the exterior shall not be removed.

3. Repairs where only the bulb, the ballast or both within the existing luminaires in a space are replaced, provided that the replacement does not increase the installed interior lighting power.

**Reason Statement:** This proposal moves the requirements of Sections C504 and R504 of the VECC to Chapter 5 of the VEBC and clarifies that repairs cannot be done in a way to reduce energy efficiency. This proposal aligns with other proposals to move the energy conservation requirements for existing buildings from the VECC to the VEBC. This proposal leaves a pointer in the VECC to the VEBC to assist code officials who may be used to looking at the VECC rather than the VEBC for energy requirements for existing buildings.

**Cost Impact:** The code change proposal will increase the cost of construction
This proposal will increase the cost of construction in some cases. Because the current VECC and VEBC are not in perfect alignment on energy conservation requirements for existing buildings, the cost impact will vary based on which code is used as the basis for code compliance. To the extent that code officials have been enforcing Chapter R5/C5 of the VECC for existing buildings, this proposal will not increase the cost of construction and may reduce the cost of construction in some cases, since the requirements are drawn directly from VECC Chapter R5/C5. However, where code officials have been enforcing the VEBC for all requirements for existing buildings, these changes will apply new requirements and may result in increased initial costs of construction, but may also result in reduced life cycle costs due to the anticipated energy savings.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is administrative and does not impact resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:** Carryover to Sept

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# Public Comments for: E504.1-18

**Discussion by W Shaun Pharr**
Aug 11, 2020 4:40 UTC

AOBA/VAMA believe that BHCD is generally legally precluded by the Code of Virginia from adopting code provisions applicable to existing buildings which will increase the costs of compliance for such buildings.

Sec. 36-103 of the Code of Virginia reads, in part, as follows:

"[The] Board may adopt and promulgate as part of the Building Code, building regulations that facilitate the maintenance, rehabilitation, development and reuse of existing buildings at the least possible cost (emphasis added) to ensure the protection of the public health, safety and welfare."

In short, the General Assembly, as a policy matter, premised the Board's authority to develop and adopt an existing buildings code on the provisions of such a code representing the least possible costs while encouraging, rather than possibly discouraging, continued reinvestment in existing buildings. Code change proposals which would increase the costs of "construction" or "development" of existing buildings are antithetical on their face to the policy prescribed by the General Assembly and, thus, cannot be validly adopted.

The only exceptions to this "safe harbor" policy for existing buildings are regulations which are shown to be essential "to ensure the protection of the public health, safety and welfare."

Thus, as the reason statement indicates, it is true that "the current VECC and VEBC are not in perfect alignment on energy conservation requirements for existing buildings"-- but this is precisely because the Board has respected the existing buildings policy articulated by the General Assembly.

Moreover, it is sophistry to assume that, absent a regulatory mandate, property owners will just ignore the economic benefits that proponents claim will result, and will, instead, do what proponents consider to be "the wrong thing." If those benefits are there, then property owners who can manage the "first costs" required to meet higher energy standards will do so-- and much of the so-called "low hanging fruit" in existing buildings will be harvested, without a "shove it down their throats" mandate that violates the avowed purpose of the existing buildings code.

**Discussion by Kenney Payne**
Jun 24, 2020 12:49 UTC

VEBC 501.2 already says any repair cannot make the building less conforming than it was before the repair - so, why potentially conflate the issue by including language that might require a potential interpretation for increased energy conservation?

501.3 basically repeats what is already in VEBC 501.1 - except for the energy references - and the energy references are unnecessary because of VEBC 501.2

I'm usually not in favor of lists (501.3.1) because they almost always are never all-inclusive and if something is left off, does that mean everything else is not a repair? Sometimes lists have their place, but not in this instance.

Also, VEBC 302.2 permits replacement components to be "like" or per the code under which it was constructed - so, the proposed language could potentially conflict with this provision.

**Comment by Kenney Payne**
Aug 4, 2020 14:04 UTC

AIA Virginia withdraws its opposition as this current proposal has addressed the above concerns.

Proposal # 435

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# RE402.1.2(4)-18

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

## 2015 Virginia Energy Conservation Code

**TABLE R402.1.2**

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

| CLIMATEZONE | FENESTRATION *U*-FACTOR[b] | SKYLIGHT[b] *U*-FACTOR | GLAZEDFENESTRATION SHGC[b, e] | CEILING *R*-VALUE | WOODFRAME WALL *R*-VALUE | MASSWALL *R*-VALUE[i] | FLOOR *R*-VALUE | BASEMENT[c] WALL *R*-VALUE | SL/ *F* VAL DEI |
|---|---|---|---|---|---|---|---|---|---|
| 1 | NR | 0.75 | 0.25 | 30 | 13 | 3/4 | 13 | 0 | ( |
| 2 | 0.40 | 0.65 | 0.25 | 38 | 13 | 4/6 | 13 | 0 | ( |
| 3 | 0.35 | 0.55 | 0.25 | 38 | 20 or 13+5[h] | 8/13 | 19 | 5/13[f] | ( |
| 4 exceptMarine | 0.35 | 0.55 | 0.40 | ~~38~~ 49 | 15 or 13+1[h] | 8/13 | 19 | 10 /13 | 10, |
| 5 andMarine 4 | 0.32 | 0.55 | NR | 49 | 20 or 13+5[h] | 13/17 | 30[g] | 15/19 | 10, |
| 6 | 0.32 | 0.55 | NR | 49 | 20+5 or 13+10[h] | 15/20 | 30[g] | 15/19 | 10, |
| 7 and 8 | 0.32 | 0.55 | NR | 49 | 20+5 or 13+10[h] | 19/21 | 38[g] | 15/19 | 10, |

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. “15/19” means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. “10/13” means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. The first value is cavity insulation, the second value is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

**TABLE R402.1.4**

EQUIVALENT *U*-FACTORS[a]

| CLIMATEZONE | FENESTRATION *U*-FACTOR | SKYLIGHT *U*-FACTOR | CEILING *U*-FACTOR | FRAMEWALL *U*-FACTOR | MASS WALL *U*-FACTOR[b] | FLOOR *U*-FACTOR | BASEMENTWALL *U*-FACTOR | CRAWLSPACE WALL *U*-FACTOR |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.50 | 0.75 | 0.035 | 0.084 | 0.197 | 0.064 | 0.360 | 0.477 |
| 2 | 0.40 | 0.65 | 0.030 | 0.084 | 0.165 | 0.064 | 0.360 | 0.477 |
| 3 | 0.35 | 0.55 | 0.030 | 0.060 | 0.098 | 0.047 | 0.091[c] | 0.136 |
| 4 except Marine | 0.35 | 0.55 | ~~0.030~~ 0.026 | 0.079 | 0.098 | 0.047 | 0.059 | 0.065 |
| 5 and Marine 4 | 0.32 | 0.55 | 0.026 | 0.060 | 0.082 | 0.033 | 0.050 | 0.055 |
| 6 | 0.32 | 0.55 | 0.026 | 0.045 | 0.060 | 0.033 | 0.050 | 0.055 |
| 7 and 8 | 0.32 | 0.55 | 0.026 | 0.045 | 0.057 | 0.028 | 0.050 | 0.055 |

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure R301.1 and Table R301.1.

## 2015 Virginia Residential Code

**TABLE N1102.1.2 (R402.1.2)**

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

| CLIMATE ZONE | FENESTRATION *U*-FACTOR[b] | SKYLIGHT[b] *U*-FACTOR | GLAZED FENESTRATION SHGC[b, e] | CEILING *R*-VALUE | WOOD FRAME WALL *R*-VALUE | MASS WALL *R*-VALUE[i] | FLOOR *R*-VALUE | BASEMENT[c] WALL *R*-VALUE | SLAB[d] *R*-VALUE & DEPTH | CRAWL SPACE[c] WALL *R*-VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NR | 0.75 | 0.25 | 30 | 13 | 3/4 | 13 | 0 | 0 | 0 |
| 2 | 0.40 | 0.65 | 0.25 | 38 | 13 | 4/6 | 13 | 0 | 0 | 0 |
| 3 | 0.35 | 0.55 | 0.25 | 38 | 20 or 13 + 5[h] | 8/13 | 19 | 5/13[f] | 0 | 5/13 |
| 4 except Marine | 0.35 | 0.55 | 0.40 | ~~38~~ 49 | 15 or 13 + 1[h] | 8/13 | 19 | 10/13 | 10, 2 ft | 10/13 |
| 5 and Marine 4 | 0.32 | 0.55 | NR | 49 | 20 or 13 + 5[h] | 13/17 | 30[g] | 15/19 | 10, 2 ft | 15/19 |
| 6 | 0.32 | 0.55 | NR | 49 | 20 + 5 or 13 + 10[h] | 15/20 | 30[g] | 15/19 | 10, 4 ft | 15/19 |
| 7 and 8 | 0.32 | 0.55 | NR | 49 | 20 + 5 or 13 + 10[h] | 19/21 | 38[g] | 15/19 | 10, 4 ft | 15/19 |

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

   **Exception:** Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure N1101.10 and Table N1101.10.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. The first value is cavity insulation, the second value is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

**TABLE N1102.1.4 (R402.1.4)**

EQUIVALENT *U*-FACTORS[a]

| CLIMATEZONE | FENESTRATION *U*-FACTOR | SKYLIGHT *U*-FACTOR | CEILING *U*-FACTOR | FRAME WALL *U*-FACTOR | MASS WALL *U*-FACTOR[b] | FLOOR *U*-FACTOR | BASEMENT WALL *U*-FACTOR | CRAWL SPACE WALL *U*-FACTOR |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.50 | 0.75 | 0.035 | 0.084 | 0.197 | 0.064 | 0.360 | 0.477 |
| 2 | 0.40 | 0.65 | 0.030 | 0.084 | 0.165 | 0.064 | 0.360 | 0.477 |
| 3 | 0.35 | 0.55 | 0.030 | 0.060 | 0.098 | 0.047 | 0.091[c] | 0.136 |
| 4 except Marine | 0.35 | 0.55 | ~~0.030~~ 0.026 | 0.079 | 0.098 | 0.047 | 0.059 | 0.065 |
| 5 and Marine 4 | 0.32 | 0.55 | 0.026 | 0.060 | 0.082 | 0.033 | 0.050 | 0.055 |
| 6 | 0.32 | 0.55 | 0.026 | 0.045 | 0.060 | 0.033 | 0.050 | 0.055 |
| 7 and 8 | 0.32 | 0.55 | 0.026 | 0.045 | 0.057 | 0.028 | 0.050 | 0.055 |

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.087 in Zone 4 except Marine, 0.065 in Zone 5 and Marine 4, and 0.057 in Zones 6 through 8.

c. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure N1101.7 and Table N1101.7.

**Reason Statement:** The purpose of this proposal is to improve energy savings and increase homeowner comfort by adopting the ceiling insulation requirements of the 2018 IECC. Improving ceiling insulation from R-38 to R-49 will make Virginia's energy code consistent with insulation requirements that have been part of the 2012, 2015, and 2018 IECC.

Based on our analysis, we found that **homeowners will benefit from roughly $10-$14 annual energy cost savings as compared to a home built to Virginia's current energy code**. Using the U.S. Department of Energy's Residential Energy and Cost Analysis Methodology, we calculated the expected costs and savings associated with improving attic insulation from R-38 to R-49 for cities in three different regions of Virginia. The results, which are summarized below, show clear energy cost savings and low first cost in all three cities.

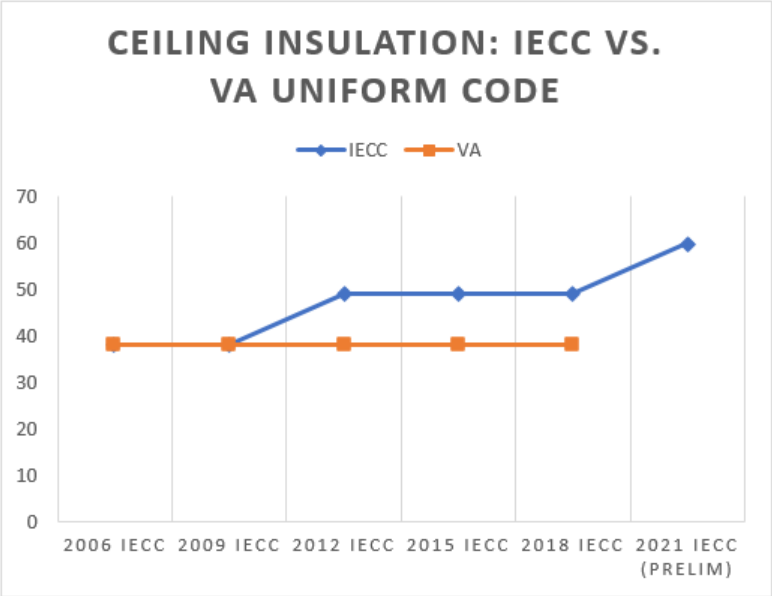
**Characteristics and Savings**

| Run Name | First Cost | Measure Life | Energy Cost Savings |
|---|---|---|---|
| Richmond Ceiling R-49 | $215 | 30 | $10 |
| Roanoke Ceiling R-49 | $215 | 30 | $13 |
| Sterling Ceiling R-49 | $215 | 30 | $14 |

This analysis assumes attic insulation upgrades from R-38 to R-49. Calculations use the standard DOE prototype home information for a single-family home and costs from BEopt v.2.8. The complete DOE Residential Energy and Cost Analysis Methodology can be found at https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology.

Most homes will have a useful lifetime of 70 or more years, which means the energy cost savings will continue to benefit Virginia homeowners for the life of the home. Insulation in the ceiling is unlikely to be changed over the building's useful lifetime, and is most cost-effective when installed at initial construction, when equipment and laborers are already present.

Virginia has lagged behind the model energy code requirements for ceilings for several cycles now. The R-49 requirement was first incorporated into the 2012 IECC update and has remained at that level in the 2015 and 2018 IECC updates. And while the 2021 IECC has not yet been published, the preliminary results indicate that ceiling insulation will improve further to R-60 for climate zone 4. The following chart shows how Virginia's ceiling R-values have compared with the IECC over the last few code updates:




This proposal also updates the equivalent U-factor in the Uniform Code to be consistent with the 2018 IRC/IECC, which is important for builders and design professionals who intend to use DOE's free REScheck compliance software. Virginia's reduced insulation requirements, among other weakening amendments in the current Uniform Code, have made compliance via REScheck problematic. We recommend that Virginia adopt the equivalent U-factor value that will be consistent with the latest version of the IECC, both to maximize cost-effective energy efficiency and to maintain consistency with available software compliance programs.

It is important to note that although this proposal would improve the prescriptive R-values and U-factors and the overall efficiency of the code, it would not require builders to use a specific R-value or assembly type for ceilings. As with Virginia's current code, builders can use one of the IECC's multiple compliance options to take advantage of efficiency trade-offs where it makes sense. The Total UA path and REScheck offer builders the flexibility to trade efficiency among building envelope components; the Simulated Performance Path and the Energy Rating Index provide even more flexibility for trade-offs.

**Cost Impact:** The code change proposal will increase the cost of construction
As noted above, this proposal will increase the cost of construction in new homes. According to our analysis, construction costs will increase by about $215 for the average home, but over a 30-year useful life of a home, homeowners will experience annual energy cost savings of $10-$14 (depending on the location of the home) for the improvements in wall and ceiling insulation. It is important to note that initial construction costs are only part of the cost consideration for homeowners. Although the decision whether to insulate to the full IECC values is made only once, homeowners will experience the costs (or benefits) of that decision every month as they pay utility bills. Over a more realistic 70-year useful lifetime of a home, a homeowner will pay 8,400 energy bills, each of which will reflect the impact of that one-time decision to meet the national standard for insulation.

Beyond the monthly costs of heating and cooling homes, high energy bills can have dramatic effects on quality of life.

- The U.S. Energy Information Administration recently reported that nearly one in three households struggle to pay energy bills or to maintain adequate temperatures in their homes every year. Worse, one in five households reported reducing or foregoing basic necessities like food or medicine to pay energy bills. *See* U.S. Energy Information Administration, *Residential Energy Consumption Survey (RECS)*, at https://www.eia.gov/consumption/residential/reports/2015.
- More efficient buildings provide a range of additional health, safety, and welfare benefits, including better indoor environmental quality and increased occupant comfort. *See* U.S. Environmental Protection Agency, *Improving Indoor Air Quality*, at http://www.imt.org/uploads/resources/files/IMT_UNC_HomeEEMortgageRisksfinal.pdf.), and Efficient Windows Collaborative, at http://www.efficientwindows.org/comfort.php.
- More efficient buildings are also associated with lower foreclosure rates. *See* UNC Center for Community Capital and Institute for Market Transformation, *Home Energy Efficiency and Mortgage Risks* (March 2013), available at http://www.imt.org/uploads/resources/files/IMT_UNC_HomeEEMortgageRisksfinal.pdf.

Thus, while construction costs and first-year affordability are an important part of the cost/benefit picture, they do not capture the full range of homeowner benefits of a reasonably efficient home.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will make buildings more resilient by reducing the volatility of indoor temperature swings and maintaining more livable conditions during power outages due to natural emergencies. These improvements fall squarely within the Governor's directive to the Department of Housing and Community Development to identify "resilience-specific improvements to the Uniform Statewide Building Code (USBC) for inclusion in the 2018 code

update," in Executive Order 24 from November 2018.

## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

# Public Comments for: RE402.1.2(4)-18

This proposal doesn't have any public comments.

Proposal # 339

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# RB200-18

**Proponents:** Resiliency Subworkgroup

## 2015 Virginia Construction Code

**Revise as follows:**

**SUBSTANTIAL IMPROVEMENT.**

~~For the purpose of determining compliance with the flood provisions of this code, any improvement, including~~ Any repair, reconstruction, rehabilitation, alteration, ~~or~~ *addition*, or other improvement of a *building* or *structure* ~~or a portion thereof~~ the cost of which equals or exceeds 50 percent of the market value of ~~the *building* or~~ the *structure* before the improvement or repair is started. If the ~~*building* or *structure* or portion thereof has~~ *structure* has sustained *substantial damage*, any ~~improvements~~ repairs are considered *substantial improvements* regardless of the actual ~~improvement~~ repair work performed. The term does not, however, include either:

1. Any project for improvement of a *building* ~~or a *structure* or portion thereof~~ required to correct existing health, sanitary, or safety code violations identified by the building official and that ~~is~~ are the minimum necessary to assure safe living conditions. ~~; or~~
2. Any alteration of a historic *structure*, provided that the alteration will not preclude the ~~*building* or~~ *structure's* continued designation as a historic ~~*building* or~~ *structure*.

## 2015 Virginia Existing Building Code

**Revise as follows:**

**[BS] SUBSTANTIAL IMPROVEMENT.**

For the purpose of determining compliance with the flood provisions of this code, ~~any improvement, including~~ any repair, ~~reconstruction, rehabilitation, *alteration*~~ addition, ~~or addition, or other~~ or improvement of a *building* or *structure* ~~or a portion thereof~~, the cost of which equals or exceeds 50 percent of the market value of the *building* or *structure* before the improvement or repair is started. If the ~~*building* or *structure*~~ has sustained substantial damage, any ~~improvements~~ repairs are considered *substantial improvement* regardless of the actual ~~improvement performed.~~ repair work performed. The term does not, however, include either of the following:

1. Any project for improvement of a *building* ~~or *structure*~~ required to correct existing health, sanitary, or safety code violations identified by the ~~building~~ code official and that is the minimum necessary to assure safe living conditions. ~~; or~~
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the ~~*building* or~~ *structure's* continued designation as a historic ~~*building* or~~ *structure*.

## 2018 International Residential Code

**Add new text as follows:**

**SUBSTANTIAL DAMAGE** Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

**SUBSTANTIAL IMPROVEMENT** Any repair, reconstruction, rehabilitation, alteration, addition or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the building official and that are the minimum necessary to assure safe living conditions.
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the *building* or structure's continued designation as a historic s*tructure* .

**Reason Statement:** This was a consensus item from the Resiliency Subworkgroup to duplicate the IBC definition of "substantial improvement" in the IRC/VRC.

July 27, 2020 Update: Based on feedback at the July 15th Workgroup 3 meeting, this proposal was carried over to the final August 4th combined Workgroup meeting in order to make some corrections. This proposal has since been modified to include removing the state amendments to the IBC and IEBC definitions of "substantial improvement". The changes shown to the VCC and VEBC definitions will ensure that the definitions in the 2018 VCC and VEBC match the 2018 IBC and IEBC respectively. Also the definitions of "substantial damage" and "substantial improvement" being proposed to add to the IRC have been modified to match the definitions in the 2018 IBC.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal aids understanding of users. The terms are used in the residential code with respect to flood resistant requirements.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This change just incorporates additional definitions and does not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB200-18

This proposal doesn't have any public comments.

Proposal # 366

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# RB301.2(1)-18

**Proponents:** Resiliency Subworkgroup

## 2015 Virginia Residential Code

**Add new text as follows:**

**TABLE R301.2(2)**

COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)[a, b, c, d, e, f, g]

| - | Zone | Effective Wind Areas (feet$^2$) | Ultimate Design Wind Speed, $V_{ult}$ | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90 | | 95 | | 100 | | 105 | | 110 | | 115 | | 120 | | 130 | | 140 | | 150 | | 160 | | 170 | |
| | | | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | N |
| Flat and Gable Roof 0 to 7 degrees | 1 | 10 | 3.6 | -13.9 | 4.0 | -15.5 | 4.4 | -17.2 | 4.8 | -19.0 | 5.3 | -20.8 | 5.8 | -22.7 | 6.3 | -24.8 | 7.4 | -29.1 | 8.6 | -33.7 | 9.9 | -38.7 | 11.2 | -44.0 | 12.7 | -49 |
| | 1 | 20 | 3.3 | -13.0 | 3.7 | -14.5 | 4.1 | -16.0 | 4.5 | -17.7 | 5.0 | -19.4 | 5.4 | -21.2 | 5.9 | -23.1 | 7.0 | -27.1 | 8.1 | -31.4 | 9.3 | -36.1 | 10.5 | -41.1 | 11.9 | -46 |
| | 1 | 50 | 3.0 | -11.8 | 3.4 | -13.1 | 3.8 | -14.5 | 4.1 | -16.0 | 4.5 | -17.6 | 5.0 | -19.2 | 5.4 | -20.9 | 6.3 | -24.5 | 7.4 | -28.4 | 8.4 | -32.6 | 9.6 | -37.1 | 10.8 | -41 |
| | 1 | 100 | 2.8 | -10.8 | 3.1 | -12.1 | 3.5 | -13.4 | 3.8 | -14.7 | 4.2 | -16.2 | 4.6 | -17.7 | 5.0 | -19.2 | 5.9 | -22.6 | 6.8 | -26.2 | 7.8 | -30.0 | 8.9 | -34.2 | 10.1 | -38 |
| | 2 | 10 | 3.6 | -18.4 | 4.0 | -20.5 | 4.4 | -22.7 | 4.8 | -25.0 | 5.3 | -27.4 | 5.8 | -30.0 | 6.3 | -32.7 | 7.4 | -38.3 | 8.6 | -44.5 | 9.9 | -51.0 | 11.2 | -28.1 | 12.7 | -65 |
| | 2 | 20 | 3.3 | -17.2 | 3.7 | -19.2 | 4.1 | -21.2 | 4.5 | -23.4 | 5.0 | -25.7 | 5.4 | -28.1 | 5.9 | -30.6 | 7.0 | -35.9 | 8.1 | -41.6 | 9.3 | -47.8 | 10.5 | -54.3 | 11.9 | -61 |
| | 2 | 50 | 3.0 | -15.6 | 3.4 | -17.4 | 3.8 | -19.3 | 4.1 | -21.3 | 4.5 | -23.3 | 5.0 | -25.5 | 5.4 | -27.8 | 6.3 | -32.6 | 7.4 | -37.8 | 8.4 | -43.4 | 9.6 | -49.4 | 10.8 | -55 |
| | 2 | 100 | 2.8 | -14.4 | 3.1 | -16.1 | 3.5 | -17.8 | 3.8 | -19.7 | 4.2 | -21.6 | 4.6 | -23.6 | 5.0 | -25.7 | 5.9 | -30.1 | 6.8 | -35.0 | 7.8 | -40.1 | 8.9 | -45.7 | 10.0 | -51 |
| | 3 | 10 | 3.6 | -25.0 | 4.0 | -27.9 | 4.4 | -30.9 | 4.8 | -34.1 | 5.3 | -37.4 | 5.8 | -40.9 | 6.3 | -44.5 | 7.4 | -52.2 | 8.6 | -60.6 | 9.9 | -69.6 | 11.2 | -79.1 | 12.7 | -89 |
| | 3 | 20 | 3.3 | -22.6 | 3.7 | -25.2 | 4.1 | -28.0 | 4.5 | -30.8 | 5.0 | -33.8 | 5.4 | -37.0 | 5.9 | -40.3 | 7.0 | -47.2 | 8.1 | -54.8 | 9.3 | -62.9 | 10.5 | -71.6 | 11.9 | -80 |
| | 3 | 50 | 3.0 | -19.4 | 3.4 | -21.7 | 3.8 | -24.0 | 4.1 | -26.5 | 4.5 | -29.0 | 5.0 | -31.7 | 5.4 | -34.6 | 6.3 | -40.6 | 7.4 | -47.0 | 8.4 | -54.0 | 9.6 | -61.4 | 10.8 | -69 |
| | 3 | 100 | 2.8 | -17.4 | 3.1 | -19.0 | 3.5 | -21.0 | 3.8 | -23.2 | 4.2 | -25.5 | 4.6 | -27.8 | 5.0 | -30.3 | 5.9 | -35.6 | 6.8 | -41.2 | 7.8 | -47.3 | 8.9 | -53.9 | 10.0 | -60 |
| Gable Roof >7 to 20 degrees | 1, 2e | 10 | 5.4 | -16.2 | 6.0 | -18.0 | 6.7 | -19.9 | 7.4 | -22.0 | 8.1 | -24.1 | 8.8 | -26.4 | 9.6 | -28.7 | 11.3 | -33.7 | 13.1 | -39.1 | 15.0 | -44.9 | 17.1 | -51.0 | 19.3 | -57 |
| | 1, 2e | 20 | 4.9 | -16.2 | 5.4 | -18.0 | 6.0 | -19.9 | 6.6 | -22.0 | 7.2 | -24.1 | 7.9 | -26.4 | 8.6 | -28.7 | 10.1 | -33.7 | 11.7 | -39.1 | 13.5 | -44.9 | 15.3 | -51.0 | 17.3 | -57 |
| | 1, 2e | 50 | 4.1 | -9.9 | 4.6 | -11.0 | 5.1 | -12.2 | 5.6 | -13.4 | 6.1 | -14.7 | 6.7 | -16.1 | 7.3 | -17.5 | 8.6 | -20.6 | 10.0 | -23.8 | 11.4 | -27.4 | 13.0 | -31.1 | 14.7 | -35 |
| | 1, 2e | 100 | 3.6 | -5.0 | 4.0 | -5.6 | 4.4 | -6.2 | 4.8 | -6.9 | 5.3 | -7.5 | 5.8 | -8.2 | 6.3 | -9.0 | 7.4 | -10.5 | 8.6 | -12.2 | 9.9 | -14.0 | 11.2 | -15.9 | 12.7 | -18 |
| | 2n, 2r, 3e | 10 | 5.4 | -23.6 | 6.0 | -26.3 | 6.7 | -29.1 | 7.4 | -32.1 | 8.1 | -35.2 | 8.8 | -38.5 | 9.6 | -41.9 | 11.3 | -49.2 | 13.1 | -57.0 | 15.0 | -65.0 | 17.1 | -74.5 | 19.3 | -84 |
| | 2n, 2r, 3e | 20 | 4.9 | -20.3 | 5.4 | -22.7 | 6.0 | -25.1 | 6.6 | -27.7 | 7.2 | -30.4 | 7.9 | -33.2 | 8.6 | -36.2 | 10.1 | -42.4 | 11.7 | -49.2 | 13.5 | -56.5 | 15.3 | -64.3 | 17.3 | -72 |
| | 2n, 2r, 3e | 50 | 4.1 | -16.0 | 4.6 | -17.9 | 5.4 | -19.8 | 5.6 | -21.8 | 6.1 | -24.0 | 6.7 | -26.2 | 7.3 | -28.5 | 8.6 | -33.5 | 10.0 | -38.8 | 11.4 | -44.6 | 130 | -50.7 | 14.7 | -57 |
| | 2n, 2r, 3e | 100 | 3.6 | -12.8 | 4.0 | -14.3 | 4.4 | -15.8 | 4.8 | -17.4 | 5.3 | -19.1 | 5.8 | -20.9 | 6.3 | -22.8 | 7.4 | -26.7 | 8.6 | -31.0 | 9.9 | -35.6 | 11.2 | -40.5 | 12.7 | -45 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3r | 10 | 5.4 | -28.0 | 6.0 | -30.2 | 6.7 | -34.6 | 7.4 | -38.1 | 8.1 | -41.8 | 8.8 | -45.7 | 9.6 | -49.8 | 11.3 | -58.4 | 13.1 | -67.8 | 15.0 | -77.8 | 17.1 | -88.5 | 19.3 | -99 |
| | 3r | 20 | 4.9 | -24.0 | 5.4 | -26.7 | 6.0 | -29.6 | 6.6 | -32.7 | 7.2 | -35.9 | 7.9 | -39.2 | 8.6 | -42.7 | 10.1 | -50.1 | 11.7 | -58.1 | 13.5 | -66.7 | 15.3 | -75.9 | 17.3 | -85 |
| | 3r | 50 | 4.1 | -18.7 | 4.6 | -20.8 | 5.1 | -23.1 | 5.6 | -25.4 | 6.1 | -27.9 | 6.7 | -30.5 | 7.3 | -33.2 | 8.6 | -39.0 | 10.0 | -45.2 | 11.4 | -51.9 | 13.0 | -59.0 | 14.7 | -66 |
| | 3r | 100 | 3.6 | -14.7 | 4.0 | -16.3 | 4.4 | -18.1 | 4.8 | -20.0 | 5.3 | -21.9 | 5.8 | -24.0 | 6.3 | -26.1 | 7.4 | -30.6 | 8.6 | -35.5 | 9.9 | -40.8 | 11.2 | -46.4 | 12.7 | -52 |
| | 1, 2e | 10 | 6.5 | -12.4 | 7.3 | -13.9 | 8.0 | -15.4 | 8.9 | -16.9 | 9.7 | -18.6 | 10.6 | -20.3 | 11.6 | -22.1 | 13.6 | -26.0 | 15.8 | -30.1 | 18.1 | -34.6 | 20.6 | -39.3 | 23.3 | -44 |
| | 1, 2e | 20 | 5.6 | -12.4 | 6.3 | -13.9 | 7.0 | -15.4 | 7.7 | -16.9 | 8.4 | -18.6 | 9.2 | -20.3 | 10.0 | -22.1 | 11.7 | -26.0 | 13.6 | -30.1 | 15.6 | -34.6 | 17.8 | -39.3 | 20.1 | -44 |
| | 1, 2e | 50 | 4.4 | -10.6 | 5.0 | -11.8 | 5.5 | -13.1 | 6.1 | -14.4 | 6.6 | -15.8 | 7.3 | -17.3 | 7.9 | -18.8 | 9.3 | -22.1 | 10.8 | -25.6 | 12.3 | -29.4 | 14.0 | -33.5 | 15.9 | -37 |
| | 1, 2e | 100 | 3.6 | -9.1 | 4.0 | -10.2 | 4.4 | -11.3 | 4.8 | -12.4 | 5.3 | -13.6 | 5.8 | -14.9 | 6.3 | -16.2 | 7.4 | -19.0 | 8.6 | -22.1 | 9.9 | -25.3 | 11.2 | -28.8 | 12.7 | -32 |
| | 2n, 2r, 3e | 10 | 6.5 | -19.9 | 7.3 | -22.1 | 8.0 | -24.5 | 8.9 | -27.0 | 9.7 | -29.7 | 10.6 | -32.4 | 11.6 | -35.3 | 13.6 | -41.4 | 15.8 | -48.0 | 18.1 | -55.2 | 20.6 | -62.8 | 23.3 | -70 |
| Gable Roof >20 to 27 degrees | 2n, 2r, 3e | 20 | 5.6 | -17.4 | 6.3 | -19.4 | 7.0 | -21.5 | 7.7 | -23.7 | 8.4 | -26.0 | 9.2 | -28.4 | 10.0 | -31.0 | 11.7 | -36.3 | 13.6 | -42.1 | 15.6 | -48.4 | 17.8 | -55.0 | 20.1 | -62 |
| | 2n, 2r, 3e | 50 | 4.4 | -14.2 | 5.0 | -15.8 | 5.5 | -17.5 | 6.1 | -19.3 | 6.6 | -21.1 | 7.3 | -23.1 | 7.9 | -25.2 | 9.3 | -29.5 | 10.8 | -34.2 | 12.3 | -39.3 | 14.0 | -44.7 | 15.9 | -50 |
| | 2n, 2r, 3e | 100 | 3.6 | -11.7 | 4.0 | -13.0 | 4.4 | -14.5 | 4.8 | -15.9 | 5.3 | -17.5 | 5.8 | -19.1 | 6.3 | -20.8 | 7.4 | -24.4 | 8.6 | -28.3 | 9.9 | -32.5 | 11.2 | -37.0 | 12.7 | -41 |
| | 3r | 10 | 6.5 | -23.6 | 7.3 | -26.3 | 8.0 | -29.1 | 8.9 | -32.1 | 9.7 | -35.2 | 10.6 | -38.5 | 11.6 | -41.9 | 13.6 | -49.2 | 15.8 | -57.0 | 18.1 | -65.4 | 20.6 | -74.5 | 23.3 | -84 |
| | 3r | 20 | 5.6 | -19.9 | 6.3 | -22.1 | 7.0 | -24.5 | 7.7 | -27.0 | 8.4 | -29.7 | 9.2 | -32.4 | 10.0 | -35.3 | 11.7 | -41.4 | 13.6 | -48.0 | 15.6 | -55.2 | 17.8 | -62.8 | 20.1 | -70 |
| | 3r | 50 | 4.4 | -14.7 | 5.0 | -16.3 | 5.5 | -18.1 | 6.1 | -20.0 | 6.6 | -21.9 | 7.3 | -24.0 | 7.9 | -26.1 | 9.3 | -30.6 | 10.8 | -35.5 | 12.3 | -40.8 | 14.0 | -46.4 | 15.9 | -52 |
| | 3r | 100 | 3.6 | -14.7 | 4.0 | -16.3 | 4.4 | -18.1 | 4.8 | -20.0 | 5.3 | -21.9 | 5.8 | -24.0 | 6.3 | -26.1 | 7.4 | -30.6 | 8.6 | -35.5 | 9.9 | -40.8 | 11.2 | -46.4 | 12.7 | -52 |
| | 1, 2e, 2r | 10 | 8.0 | -14.7 | 8.9 | -16.3 | 9.9 | -18.1 | 10.9 | -20.0 | 12.0 | -21.9 | 13.1 | -24.0 | 14.2 | -26.1 | 16.7 | -30.6 | 19.4 | -35.5 | 22.2 | -40.8 | 25.3 | -46.4 | 28.5 | -52 |
| | 1, 2e, 2r | 20 | 7.1 | -12.7 | 7.9 | -13.9 | 8.8 | -15.4 | 9.7 | -16.9 | 10.6 | -18.6 | 11.6 | -20.3 | 12.6 | -22.1 | 14.8 | -26.0 | 17.2 | -30.1 | 19.8 | -34.6 | 22.5 | -39.3 | 25.4 | -44 |
| | 1, 2e, r | 50 | 5.9 | -9.5 | 6.6 | -10.6 | 7.3 | -11.7 | 8.1 | -12.9 | 8.9 | -14.2 | 9.7 | -15.5 | 10.5 | -16.9 | 12.4 | -19.8 | 14.3 | -22.9 | 16.5 | -26.3 | 18.7 | -30.0 | 21.1 | -33 |
| | 1, 2e, 2r | 100 | 5.0 | -7.3 | 5.6 | -8.1 | 6.2 | -9.0 | 6.9 | -9.9 | 7.5 | -10.8 | 8.2 | -11.9 | 9.0 | -12.9 | 10.5 | -15.1 | 12.2 | -17.6 | 14.0 | -20.2 | 15.9 | -22.9 | 18.0 | -25 |
| | 2n, 3r | 10 | 8.0 | -16.2 | 8.9 | -18.0 | 9.9 | -19.9 | 10.9 | -22.0 | 12.0 | -24.1 | 13.1 | -26.4 | 14.2 | -28.7 | 16.7 | -33.7 | 19.4 | -39.1 | 22.2 | -44.9 | 25.3 | -51.0 | 28.5 | -57 |
| Gable Roof >27 to 45 degrees | 2n, 3r | 20 | 7.1 | -14.4 | 7.9 | -16.1 | 8.8 | -17.8 | 9.7 | -19.7 | 10.6 | -21.6 | 11.6 | -23.6 | 12.6 | -25.7 | 14.8 | -30.1 | 17.2 | -34.9 | 19.8 | -40.1 | 22.5 | -45.6 | 25.4 | -51 |
| | 2n, 3r | 50 | 5.9 | -12.2 | 6.6 | -13.5 | 7.3 | -15.0 | 8.1 | -16.5 | 8.9 | -18.2 | 9.7 | -19.9 | 10.5 | -21.6 | 12.4 | -25.4 | 14.3 | -29.4 | 16.5 | -33.8 | 18.7 | -38.4 | 21.1 | -43 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2n, 3r | 100 | 5.0 | -10.4 | 5.6 | -11.6 | 6.2 | -12.9 | 6.9 | -14.2 | 7.5 | -15.6 | 8.2 | -17.1 | 9.0 | -18.6 | 10.5 | -21.8 | 12.2 | -25.3 | 14.0 | -29.0 | 15.9 | -33.0 | 18.0 | -37 |
| | 3e | 10 | 8.0 | -19.9 | 8.9 | -22.1 | 9.9 | -24.5 | 10.9 | -27.0 | 12.0 | -29.7 | 13.1 | -32.4 | 14.2 | -35.3 | 16.7 | -41.4 | 19.4 | -48.0 | 22.2 | -55.2 | 25.3 | -62.8 | 28.8 | -70 |
| | 3e | 20 | 7.1 | -17.6 | 7.9 | -19.6 | 8.8 | -21.8 | 9.7 | -24.0 | 10.6 | -26.3 | 11.6 | -28.8 | 12.6 | -31.3 | 14.8 | -36.8 | 17.2 | -42.7 | 19.8 | -49.0 | 22.5 | -55.7 | 25.4 | -62 |
| | 3e | 50 | 5.9 | -14.7 | 6.6 | -16.3 | 7.3 | -18.1 | 8.1 | -20.0 | 8.9 | -21.9 | 9.7 | -24.0 | 10.5 | -26.1 | 12.4 | -30.6 | 14.3 | -35.5 | 16.5 | -40.8 | 18.7 | -46.4 | 21.1 | -52 |
| | 3e | 100 | 5.0 | -12.4 | 5.5 | -13.9 | 6.2 | -15.4 | 6.9 | -16.9 | 7.5 | -18.6 | 8.2 | -20.3 | 9.0 | -22.1 | 10.5 | -26.0 | 12.2 | -30.1 | 14.0 | -34.6 | 15.9 | -39.3 | 18.0 | -44 |
| Hipped Roof >7 to 20 degree | 1 | 10 | 6.5 | -14.7 | 7.3 | -16.3 | 8.0 | -18.1 | 8.9 | -20.0 | 9.7 | -21.9 | 10.6 | -24.0 | 11.6 | -26.1 | 13.6 | -30.6 | 15.8 | -35.5 | 18.1 | -40.8 | 20.6 | -46.4 | 23.3 | -52 |
| | 1 | 20 | 5.6 | -14.7 | 6.3 | -16.3 | 7.0 | -18.1 | 7.7 | -20.0 | 8.4 | -21.9 | 9.2 | -24.0 | 10.0 | -26.1 | 11.7 | -30.6 | 13.6 | -35.5 | 15.6 | -40.8 | 17.8 | -46.4 | 20.1 | -52 |
| | 1 | 50 | 4.4 | -11.3 | 5.0 | -12.6 | 5.5 | -14.0 | 6.1 | -15.4 | 6.6 | -16.9 | 7.3 | -18.5 | 7.9 | -20.2 | 9.3 | -23.7 | 10.8 | -27.4 | 12.3 | -31.5 | 14.0 | -35.8 | 15.9 | -40 |
| | 1 | 100 | 3.6 | -8.7 | 4.0 | -9.7 | 4.4 | -10.8 | 4.8 | -11.9 | 5.3 | -13.1 | 5.8 | -14.3 | 6.3 | -15.5 | 7.4 | -18.2 | 8.6 | -21.2 | 9.9 | -24.3 | 11.2 | -27.6 | 12.7 | -31 |
| | 2r | 10 | 6.5 | -19.1 | 7.3 | -21.3 | 8.0 | -23.6 | 8.9 | -26.0 | 9.7 | -28.6 | 10.6 | -31.2 | 11.6 | -34.0 | 13.6 | -39.9 | 15.8 | -46.3 | 18.1 | -53.1 | 20.6 | -60.4 | 23.3 | -68 |
| | 2r | 20 | 5.6 | -17.2 | 6.3 | -19.2 | 7.0 | -21.3 | 7.7 | -23.4 | 8.4 | -25.7 | 9.2 | -28.1 | 10.0 | -30.6 | 11.7 | -35.9 | 13.6 | -41.7 | 15.6 | -47.9 | 17.8 | -54.4 | 20.1 | -61 |
| | 2r | 50 | 4.4 | -14.7 | 5.0 | -16.4 | 5.5 | -18.2 | 6.1 | -20.0 | 6.6 | -22.0 | 7.3 | -24.0 | 7.9 | -26.1 | 9.3 | -30.7 | 10.8 | -35.6 | 12.3 | -40.9 | 14.0 | -46.5 | 15.9 | -52 |
| | 2r | 100 | 3.6 | -12.8 | 4.0 | -14.3 | 4.4 | -15.8 | 4.8 | -17.4 | 5.3 | -19.1 | 5.8 | -20.9 | 6.3 | -22.8 | 7.4 | -26.7 | 8.6 | -31.0 | 9.9 | -35.6 | 11.2 | -40.5 | 12.7 | -45 |
| | 2e, 3 | 10 | 6.5 | -20.6 | 7.3 | -22.9 | 8.0 | -25.4 | 8.9 | -28.0 | 9.7 | -30.8 | 10.6 | -33.6 | 11.6 | -36.6 | 13.6 | -43.0 | 15.8 | -49.8 | 18.1 | -57.2 | 20.6 | -65.1 | 23.3 | -73 |
| | 2e, 3 | 20 | 5.6 | -18.5 | 6.3 | -20.6 | 7.0 | -22.9 | 7.7 | -25.2 | 8.4 | -27.7 | 9.2 | -30.3 | 10.0 | -32.9 | 11.7 | -38.7 | 13.6 | -44.8 | 15.6 | -51.5 | 17.8 | -58.6 | 20.1 | -66 |
| | 2e, 3 | 50 | 4.4 | -15.8 | 5.0 | -17.6 | 5.5 | -19.5 | 6.1 | -21.5 | 6.6 | -23.6 | 7.3 | -25.8 | 7.9 | -28.0 | 9.3 | -32.7 | 10.8 | -38.2 | 12.3 | -43.8 | 14.0 | -49.9 | 15.9 | -56 |
| | 2e, 3 | 100 | 3.6 | -13.7 | 4.0 | -15.3 | 4.4 | -16.9 | 4.8 | -18.7 | 5.3 | -20.5 | 5.8 | -22.4 | 6.3 | -24.4 | 7.4 | -28.6 | 8.6 | -33.2 | 9.9 | -38.1 | 11.2 | -43.3 | 12.7 | -48 |
| Hipped Roof >20 to 27 degrees | 1 | 10 | 6.5 | -11.7 | 7.3 | -13.0 | 8.0 | -14.5 | 8.9 | -15.9 | 9.7 | -17.5 | 10.6 | -19.1 | 11.6 | -20.8 | 13.6 | -24.4 | 15.8 | -28.3 | 18.1 | -32.5 | 20.6 | -37.0 | 23.3 | -41 |
| | 1 | 20 | 5.6 | -10.4 | 6.3 | -11.6 | 7.0 | -12.8 | 7.7 | -14.1 | 8.4 | -15.5 | 9.2 | -16.9 | 10.0 | -18.4 | 11.7 | -21.6 | 13.6 | -25.1 | 15.6 | -28.8 | 17.8 | -32.8 | 20.1 | -37 |
| | 1 | 50 | 4.4 | -8.6 | 5.0 | -9.6 | 5.5 | -10.6 | 6.1 | -11.7 | 6.6 | -12.8 | 7.3 | -14.0 | 7.9 | -15.3 | 9.3 | -17.9 | 10.8 | -20.8 | 12.3 | -23.9 | 14.0 | -27.2 | 15.9 | -30 |
| | 1 | 100 | 3.6 | -7.3 | 4.0 | -8.1 | 4.4 | -9.0 | 4.8 | -9.9 | 5.3 | -10.8 | 5.8 | -11.9 | 6.3 | -12.9 | 7.4 | -15.1 | 8.6 | -17.6 | 9.9 | -20.2 | 11.2 | -22.9 | 12.7 | -25 |
| | 2e, 2r, 3 | 10 | 6.5 | -16.2 | 7.3 | -18.0 | 8.0 | -19.9 | 8.9 | -22.0 | 9.7 | -24.1 | 10.2 | -26.4 | 11.6 | -28.7 | 13.6 | -33.7 | 15.8 | -39.1 | 18.1 | -44.9 | 20.6 | -51.0 | 23.3 | -57 |
| | 2e, 2r, 3 | 20 | 5.6 | -14.4 | 6.3 | -16.1 | 7.0 | -17.8 | 7.7 | -19.7 | 8.4 | -21.6 | 8.9 | -23.6 | 10.0 | -25.7 | 11.7 | -30.1 | 13.6 | -34.9 | 15.6 | -40.1 | 17.8 | -45.6 | 20.1 | -51 |
| | 2e, 2r, 3 | 50 | 4.4 | -12.2 | 5.0 | -13.5 | 5.5 | -15.0 | 6.1 | -16.5 | 6.6 | -18.2 | 7.3 | -19.9 | 7.9 | -21.6 | 9.3 | -25.4 | 10.8 | -29.4 | 12.3 | -33.8 | 14.0 | -38.4 | 15.9 | -43 |
| | 2e, 2r, 3 | 100 | 3.6 | -10.4 | 4.0 | -11.6 | 4.4 | -12.9 | 4.8 | -14.2 | 5.3 | -15.6 | 5.8 | -17.1 | 6.3 | -18.6 | 7.4 | -21.8 | 8.6 | -25.3 | 9.9 | -29.0 | 11.2 | -33.0 | 12.7 | -37 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hipped Roof<br><br>>27 to 45 degrees | 1 | 10 | 6.2 | -12.4 | 6.9 | -13.9 | 7.7 | -15.4 | 8.5 | -16.9 | 9.3 | -18.6 | 10.2 | -20.3 | 11.1 | -22.1 | 13.0 | -26.0 | 15.1 | -30.1 | 17.3 | -34.6 | 19.7 | -39.3 | 22.2 | -44 |
| | 1 | 20 | 5.4 | -11.0 | 6.0 | -12.3 | 6.7 | -13.6 | 7.4 | -15.0 | 8.1 | -16.5 | 8.9 | -18.0 | 9.6 | -19.6 | 11.3 | -23.0 | 13.1 | -26.7 | 15.1 | -30.7 | 17.1 | -34.9 | 19.4 | -39 |
| | 1 | 50 | 4.4 | -9.2 | 4.9 | -10.2 | 5.4 | -11.3 | 5.9 | -12.5 | 6.5 | -13.7 | 7.1 | -15.0 | 7.7 | -16.3 | 9.1 | -19.2 | 10.5 | -22.2 | 12.1 | -25.5 | 13.8 | -29.0 | 15.5 | -32 |
| | 1 | 100 | 3.6 | -7.8 | 4.0 | -8.7 | 4.4 | -9.6 | 4.8 | -10.6 | 5.3 | -11.6 | 5.8 | -12.7 | 6.3 | -13.8 | 7.4 | -16.2 | 8.6 | -18.8 | 9.9 | -21.6 | 11.2 | -24.6 | 12.7 | -27 |
| | 2e | 10 | 6.2 | -14.8 | 6.9 | -16.5 | 7.7 | -18.3 | 8.5 | -20.2 | 9.3 | -22.1 | 10.2 | -24.2 | 11.1 | -26.3 | 13.0 | -30.9 | 15.1 | -35.9 | 17.3 | -41.2 | 19.7 | -46.8 | 22.2 | -52 |
| | 2e | 20 | 5.4 | -11.7 | 6.0 | -13.0 | 6.7 | -14.5 | 7.4 | -15.9 | 8.1 | -17.5 | 8.9 | -19.1 | 9.6 | -20.8 | 11.3 | -24.4 | 13.1 | -28.3 | 15.1 | -32.5 | 17.1 | -37.0 | 19.4 | -41 |
| | 2e | 50 | 4.4 | -7.3 | 4.9 | -8.1 | 5.4 | -9.0 | 5.9 | -9.9 | 6.5 | -10.8 | 7.1 | -11.9 | 7.7 | -12.9 | 9.1 | -15.1 | 10.5 | -17.6 | 12.1 | -20.2 | 13.8 | -22.9 | 15.5 | -25 |
| | 2e | 100 | 3.6 | -7.3 | 4.0 | -8.1 | 4.4 | -9.0 | 4.8 | -9.9 | 5.3 | -10.8 | 5.8 | -11.9 | 6.3 | -12.9 | 7.4 | -15.1 | 8.6 | -17.6 | 9.9 | -20.2 | 11.2 | -22.9 | 12.7 | -25 |
| | 2r | 10 | 6.2 | -18.7 | 6.9 | -20.9 | 7.7 | -23.1 | 8.5 | -25.5 | 9.3 | -28.0 | 10.2 | -30.6 | 11.1 | -33.3 | 13.0 | -39.1 | 15.1 | -45.4 | 17.3 | -52.1 | 19.7 | -59.2 | 22.2 | -66 |
| | 2r | 20 | 5.4 | -15.7 | 6.0 | -17.5 | 6.7 | -19.4 | 7.4 | -21.4 | 8.1 | -23.5 | 8.9 | -25.7 | 9.6 | -28.0 | 11.3 | -32.8 | 13.1 | -38.1 | 15.1 | -43.7 | 17.1 | -49.8 | 19.4 | -56 |
| | 2r | 50 | 4.4 | -11.7 | 4.9 | -13.1 | 5.4 | -14.5 | 5.9 | -16.0 | 6.5 | -17.5 | 7.1 | -19.2 | 7.7 | -20.9 | 9.1 | -24.5 | 10.5 | -28.4 | 12.1 | -32.6 | 13.8 | -37.1 | 15.5 | -41 |
| | 2r | 100 | 3.6 | -8.7 | 4.0 | -9.7 | 4.4 | -10.8 | 4.8 | -11.9 | 5.3 | -13.1 | 5.8 | -14.3 | 6.3 | -15.5 | 7.4 | -18.2 | 8.6 | -21.2 | 9.9 | -24.3 | 11.2 | -27.6 | 12.7 | -31 |
| | 3 | 10 | 6.2 | -20.0 | 6.9 | -22.3 | 7.7 | -24.7 | 8.5 | -27.2 | 9.3 | -29.9 | 10.2 | -32.7 | 11.1 | -35.6 | 13.0 | -41.7 | 15.1 | -48.4 | 17.3 | -55.6 | 19.7 | -63.2 | 22.2 | -71 |
| | 3 | 20 | 5.4 | -15.0 | 6.0 | -16.8 | 6.7 | -18.6 | 7.4 | -20.5 | 8.1 | -22.5 | 8.9 | -24.6 | 9.6 | -26.7 | 11.3 | -31.4 | 13.1 | -36.4 | 15.1 | -41.8 | 17.1 | -47.5 | 19.4 | -53 |
| | 3 | 50 | 4.4 | -8.7 | 4.9 | -9.7 | 5.4 | -10.8 | 5.9 | -11.9 | 6.5 | -13.1 | 7.1 | -14.3 | 7.7 | -15.5 | 9.1 | -18.2 | 10.5 | -21.2 | 12.1 | -24.3 | 13.8 | -27.6 | 15.5 | -31 |
| | 3 | 100 | 3.6 | -8.7 | 4.0 | -9.7 | 4.4 | -10.8 | 4.8 | -11.9 | 5.3 | -13.1 | 5.8 | -14.3 | 6.3 | -15.5 | 7.4 | -18.2 | 8.6 | -21.2 | 9.9 | -24.3 | 11.2 | -27.6 | 12.7 | -31 |
| Wall | 4 | 10 | 8.7 | -9.5 | 9.7 | -10.6 | 10.8 | -11.7 | 11.9 | -12.9 | 13.1 | -14.2 | 14.3 | -15.5 | 15.5 | -16.9 | 18.2 | -19.8 | 21.2 | -22.9 | 24.3 | -26.3 | 27.6 | -30.0 | 31.2 | -33 |
| | 4 | 20 | 8.3 | -9.1 | 9.3 | -10.1 | 10.3 | -11.2 | 11.4 | -12.4 | 12.5 | -13.6 | 13.6 | -14.8 | 14.8 | -16.2 | 17.4 | -19.0 | 20.2 | -22.0 | 23.2 | -25.3 | 26.4 | -28.7 | 29.8 | -32 |
| | 4 | 50 | 7.8 | -8.6 | 8.7 | -9.5 | 9.7 | -10.6 | 10.7 | -11.7 | 11.7 | -12.8 | 12.8 | -14.0 | 13.9 | -15.2 | 16.3 | -17.9 | 18.9 | -20.7 | 21.7 | -23.8 | 24.7 | -27.1 | 27.9 | -30 |
| | 4 | 100 | 7.4 | -8.2 | 8.3 | -9.1 | 9.2 | -10.1 | 10.1 | -11.1 | 11.1 | -12.2 | 12.1 | -13.3 | 13.2 | -14.5 | 15.5 | -17.1 | 18.0 | -19.8 | 20.6 | -22.7 | 23.5 | -25.8 | 26.5 | -29 |
| | 4 | 500 | 6.5 | -7.3 | 7.3 | -8.1 | 8.0 | -9.0 | 8.9 | -9.9 | 9.7 | -10.8 | 10.6 | -11.9 | 11.6 | -12.9 | 13.5 | -15.1 | 15.8 | -17.6 | 18.1 | -20.2 | 20.6 | -22.9 | 23.3 | -25 |
| | 5 | 10 | 8.7 | -11.8 | 9.7 | -13.0 | 10.8 | -14.5 | 11.9 | -15.9 | 13.1 | -17.5 | 14.3 | -19.1 | 15.5 | -20.8 | 18.2 | -24.4 | 21.2 | -28.3 | 24.3 | -32.5 | 27.6 | -37.0 | 31.2 | -41 |
| | 5 | 20 | 8.3 | -10.9 | 9.3 | -12.2 | 10.3 | -13.5 | 11.4 | -14.9 | 12.5 | -16.3 | 13.6 | -17.8 | 14.8 | -19.4 | 17.4 | -22.8 | 20.2 | -26.4 | 23.2 | -30.3 | 26.4 | -34.5 | 29.8 | -39 |
| | 5 | 50 | 7.8 | -9.9 | 8.7 | -11.0 | 9.7 | -12.2 | 10.7 | -13.4 | 11.7 | -14.7 | 12.8 | -16.1 | 13.9 | -17.5 | 16.3 | -20.6 | 18.9 | -23.9 | 21.7 | -27.4 | 24.7 | -31.2 | 27.9 | -35 |
| | 5 | 100 | 7.4 | -9.1 | 8.3 | -10.1 | 9.2 | -11.2 | 10.1 | -12.4 | 11.1 | -13.6 | 12.1 | -14.8 | 13.2 | -16.1 | 15.5 | -19.0 | 18.0 | -22.0 | 20.6 | -25.2 | 23.5 | -28.7 | 26.5 | -32 |
| | 5 | 500 | 6.5 | -7.3 | 7.3 | -8.1 | 8.0 | -9.0 | 8.9 | -9.9 | 9.7 | -10.8 | 10.6 | -11.9 | 11.6 | -12.9 | 13.6 | -15.1 | 15.8 | -17.6 | 18.1 | -20.2 | 20.6 | -22.9 | 23.3 | -25 |

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 $m^2$, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

a. The effective wind area shall be equal to the span length multiplied by an effective width. This width shall be permitted to be not less than one-third the span length. For cladding fasteners, the effective wind area shall not be greater than the area that is tributary to an individual fastener.

b. For effective areas between those given, the load shall be interpolated or the load associated with the lower effective area shall be used.

c. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table R301.2(3).

d. See Figure R301.2(7) for location of zones.

e. Plus and minus signs signify pressures acting toward and away from the building surfaces.

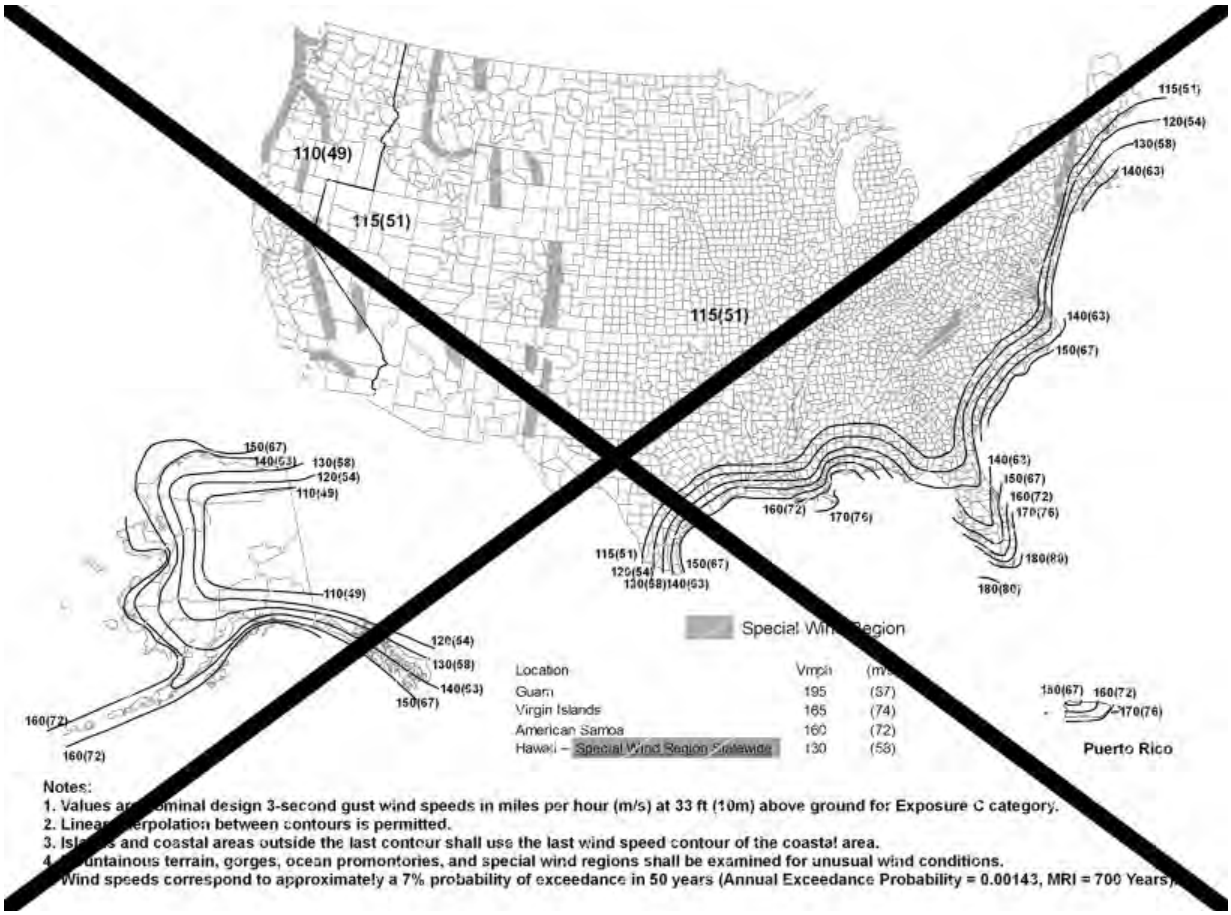
f. Positive and negative design wind pressures shall not be less than 10 psf.

g. Where the ratio of the building mean roof height to the building length or width is less than 0.8, uplift loads shall be permitted to be calculated in accordance with ASCE 7.

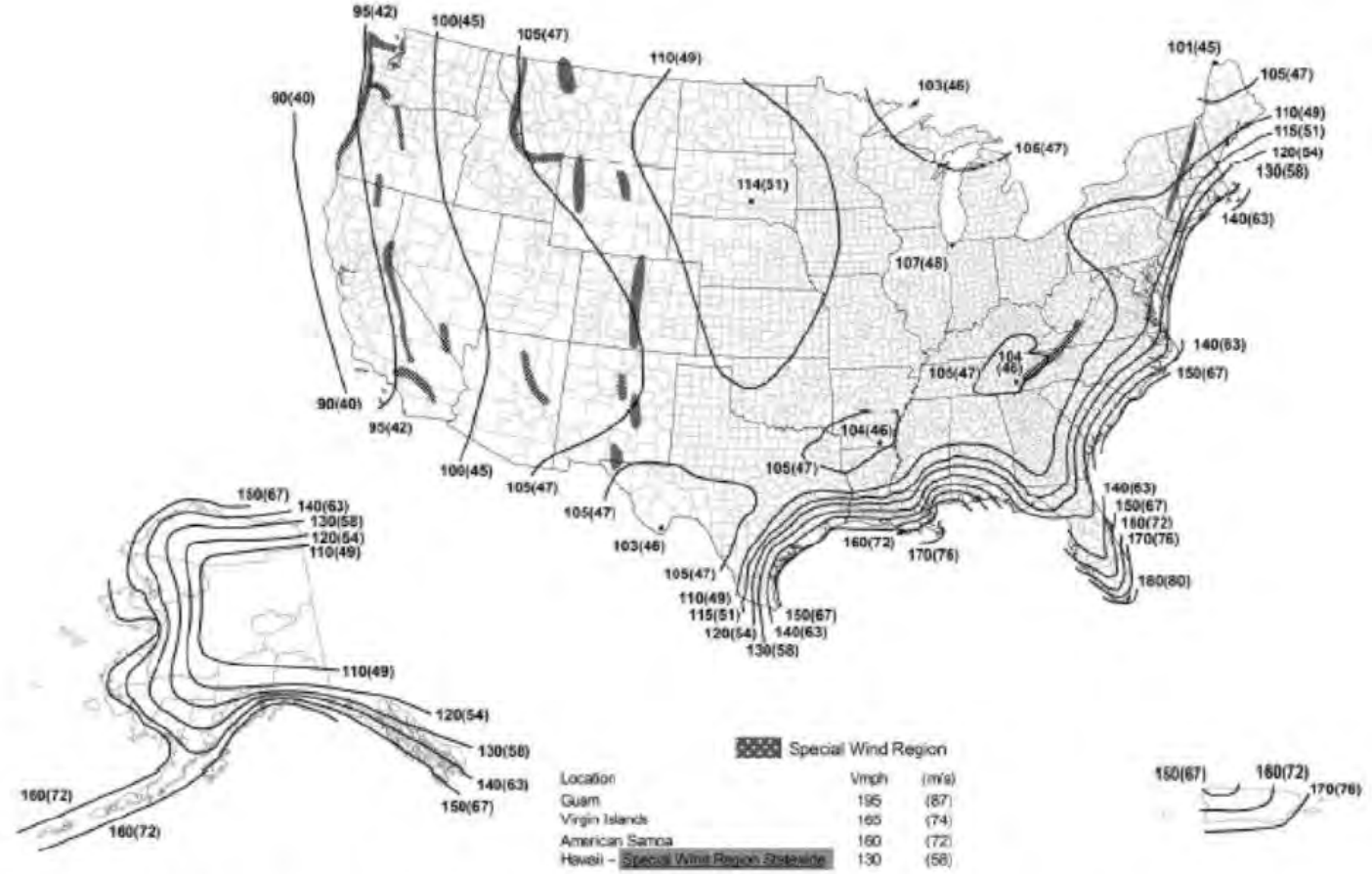
**Revise as follows:**

**TABLE R301.2(3)**
**HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE R301.2(2)**

| MEAN ROOF HEIGHT | EXPOSURE | | |
|---|---|---|---|
| | B | C | D |
| 15 | 0.82 | 1.21 | 1.47 |
| 20 | 0.89 | 1.29 | 1.55 |
| 25 | 0.94 | 1.35 | 1.61 |
| 30 | 1.00 | 1.40 | 1.66 |
| 35 | 1.05 | 1.45 | 1.70 |
| 40 | 1.09 | 1.49 | 1.74 |
| 45 | 1.12 | 1.53 | 1.78 |
| 50 | 1.16 | 1.56 | 1.81 |
| 55 | 1.19 | 1.59 | 1.84 |
| 60 | 1.22 | 1.62 | 1.87 |




Notes:
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

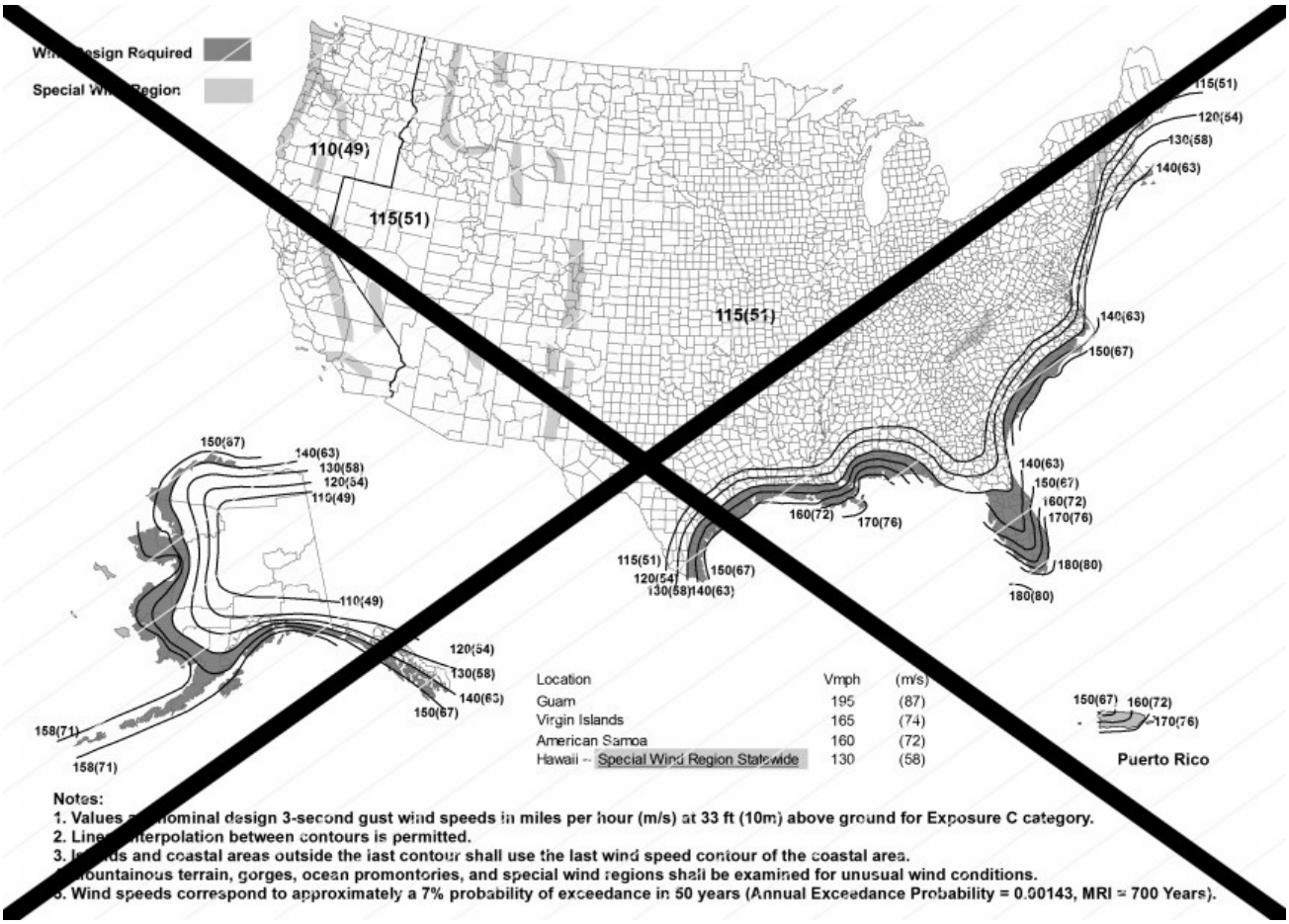



**Notes:**

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approxi… ability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds

125%

**FIGURE R301.2(4)A**
**ULTIMATE DESIGN WIND SPEEDS**


Wind Design Required
Special Wind Region
110(49)
115(51)
115(51)
115(51)
120(54)
130(58)
140(63)
140(63)
150(67)
150(67)
140(63)
130(58)
120(54)
110(49)
110(49)
140(63)
150(67)
160(72)
170(76)
115(51)
120(54)
130(58)
140(63)
150(67)
180(80)
180(80)
120(54)
130(58)
140(63)
150(67)
158(71)
158(71)
Location Vmph (m/s)
Guam 195 (87)
Virgin Islands 165 (74)
American Samoa 160 (72)
Hawaii – Special Wind Region Statewide 130 (58)
150(67) 160(72)
170(76)
Puerto Rico
Notes:
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

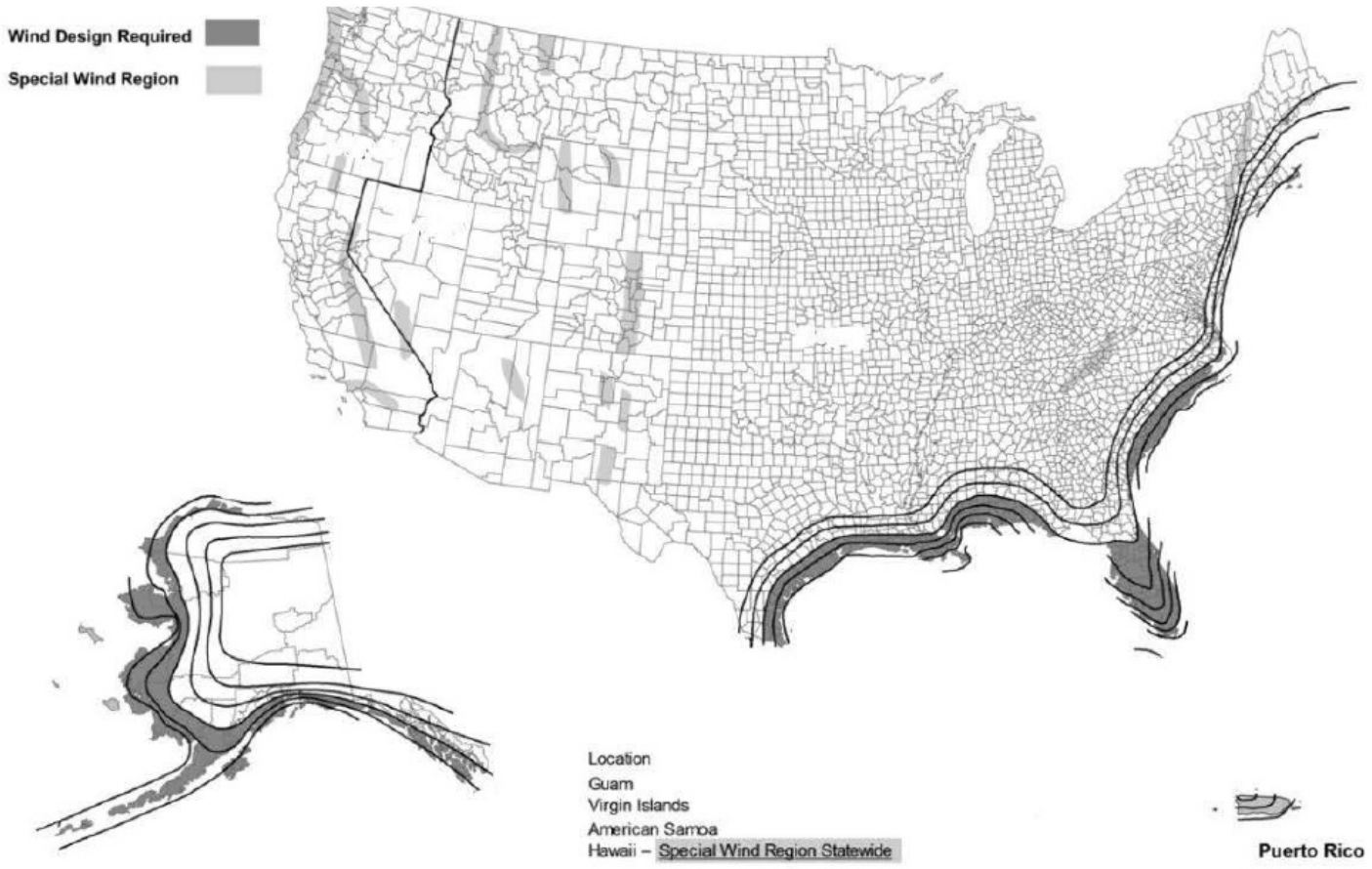
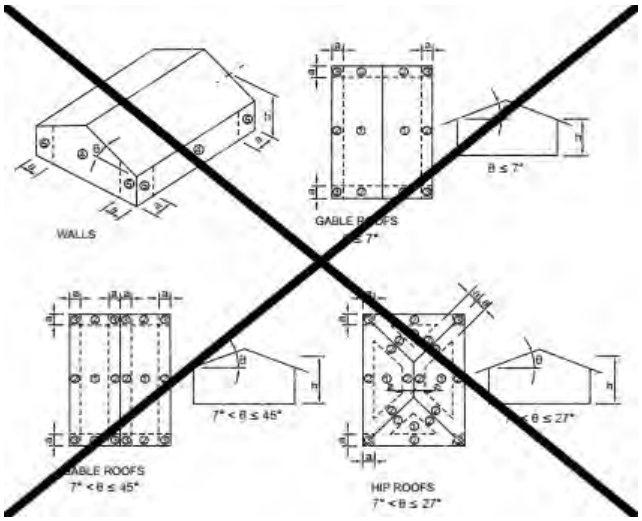
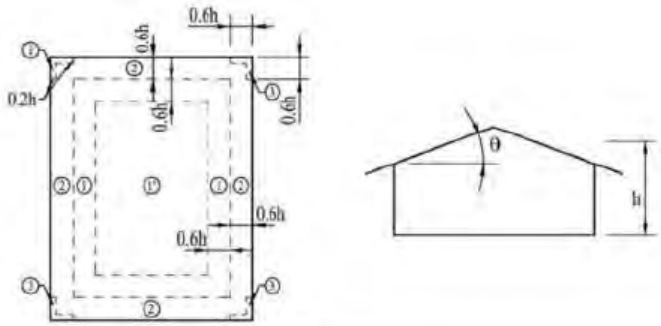
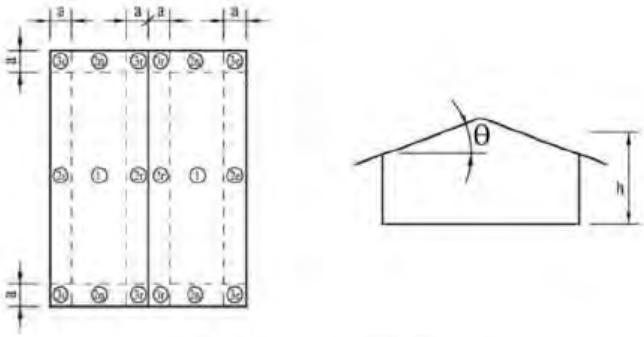



**FIGURE R301.2(4)B**
**REGIONS WHERE WIND DESIGN IS REQUIRED**

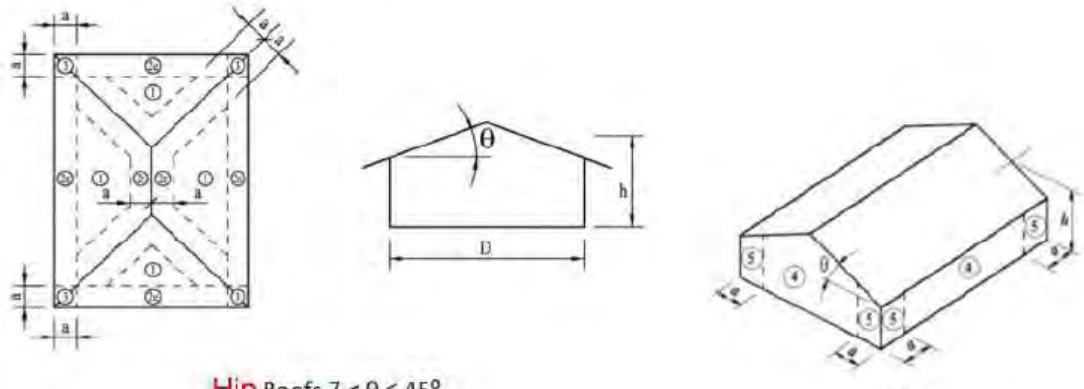



Gable and Flat Roofs θ ≤ 7°




Gable Roofs 7 < θ ≤ 45°




Hip Roofs 7 < θ ≤ 45°

Walls

For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

Note: a = 4 feet in all cases.

**FIGURE R301.2(7)**
**COMPONENT AND CLADDING PRESSURE ZONES**

**Reason Statement:** This proposal coordinates the wind design criteria in the IRC with currently referenced 2016 edition of the loading standard ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16).
There are two primary proposed changes to the IRC for coordination with the revised wind loading criteria in ASCE 7-16: (1) updated basic wind speed maps for Risk Category II buildings and (2) revised roof component and cladding loads for buildings with mean roof heights less than or equal to 60 feet.
(1) Updated Map:

In ASCE 7-16, wind speeds in non-hurricane prone areas of the contiguous United States have been revised using contours to better reflect the regional variation in the extreme wind climate. Point values are provided to aid interpolation, in a style similar to that used for the other hazard maps in ASCE 7. Summaries of the data and methods used to estimate both the non-hurricane and hurricane wind speeds are provided in the Commentary to ASCE 7-16 Chapter 26 (attached to this proposal). The wind speeds in the hurricane-prone region have not changed from ASCE 7-10, the previous edition. Revised Figure R301.2(4)A is the wind speed map from ASCE 7-16 for Risk Category II Buildings.

Update to R301.2(4)B removes the notes, only.

(2) Revised Tables:

The simplified component and cladding loads in Table R301.2(2) are proposed to be revised for correlation with the new roof component and cladding loads for buildings with mean roof heights less than or equal to 60 feet. The roof zones and pressure coefficients in ASCE 7-16 Figure 30.4-2 (which includes Figures 30.4-2A through 30.4-2I) have been revised based on an analysis of an extensive wind tunnel database. All source data used in the study are publicly accessible through the National Institute of Standards and Technology (NIST) website.
Compared to previous versions of ASCE 7, the pressure coefficients have been increased, and are now more consistent with coefficients for buildings higher than 60 feet. Roof zones sizes are also modified from those of earlier versions in order to minimize the increase of pressure coefficients in Zones 1 and 2. The data indicate that for these low-rise buildings, the size of the roof zones depend primarily on the building height, h. The GCp values given in ASCE 7-16 Figures 30.4-2A through 30.4-2I are associated with wind tunnel tests performed in both Exposure B and C. For ASCE 7-16 Figure 30.4-2A, the coefficients applly equally to Exposure B and C, based on wind tunnel data that show insignificant difference in (GCp) for Exposure B and C. Consequently, the truncation for Kz in Table 30.3-1 of ASCE 7-10 is not required for building below 30 feet, and the lower Kz values may be used as shown revised in Figure R301.2(3) of the IRC.

NOTE: Due to cdpVA functionality, the revised Table R301.2(2) was added as a NEW table, however, it is intended to replace the existing R301.2(2) (i.e., delete existing Table R301.2(2). Also, in the NEW table, only footnotes f and g are NEW. The footnotes a to e remain unchanged from previous IRC, but only look new due to cdpVA legislative format editor. Lastly, Table 301.2(3) includes only three revised values but they do not seem to appear in legislative format. The revisions are limited to the first three entries for Exposure Category B where 1.00 for each was replaced with 0.82, 0.89, and 0.94, respectively.

**Cost Impact:** The code change proposal will increase the cost of construction
Component and cladding loads for roofs in buildings with mean roof heights less than or equal to 60 feet are higher for some roof slopes and zones than for similar roof slopes in 2018 IRC. Construction costs will increase for roofing products and decking for some areas of the country in the hurricane-prone region. However, for much of the country outside the hurricane-prone region, the wind speeds are actually lower and therefore even with an increase in GCp, the loads do not change and there is no impact on costs. Also, loads for wall components such as windows, doors, siding, etc., are lower for mean roof height under 30 feet. Loads on Main Wind Force Resisting Systems, such as shear walls and diaphragms, are decreasing in areas where the design wind speed has decreased.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Increases resiliency by updating basic wind speed maps for Risk Category II buildings and strengthens roof component loads for buildings with mean roof heights less than or equal to 60 feet.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB301.2(1)-18

This proposal doesn't have any public comments.

Proposal # 392

# RB301.2.1-18

**Proponents:** Glenn Overcash (glenn.overcash@aecom.com)

## 2015 Virginia Residential Code

**Revise as follows:**

**R301.2.1 Wind design criteria.** Buildings and portions thereof shall be constructed in accordance with the wind provisions of this code using the ultimate design wind speed in Table R301.2(1) as determined from Figure R301.2(4)A. The structural provisions of this code for wind loads are not permitted where wind design is required as specified in Section R301.2.1.1. Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where not otherwise specified, the wind loads listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors, and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11.1 from the roof assembly to the ~~foundation.~~ foundation. Where ultimate design wind speeds in Figure R301.2(4)A are less than the lowest wind speed indicated in the prescriptive provisions of this code, the lowest wind speed indicated in the prescriptive provision of this code shall be used. Wind speeds for localities in special wind regions, near mountainous terrain, and near gorges shall be based on elevation. Areas at 4,000 feet (1219 m) in elevation or higher shall use the nominal design wind speed of ~~110 mph (48.4 m~~ 140 mph (62.6 m/s) and areas under 4,000 feet (1219 m) in elevation shall use nominal design wind speed of ~~90 mph (39.6 m~~ 110 mph (49.2 m/s). Gorge areas shall be based on the highest recorded speed per locality or in accordance with local jurisdiction requirements determined in accordance with Section ~~26.5.1 of~~ 26.5.2 of ASCE 7.

**TABLE R301.2.1.5.1**

ULTIMATE DESIGN WIND SPEED MODIFICATION FOR TOPOGRAPHIC WIND EFFECT[a, b]

| ULTIMATE DESIGN WIND SPEED FROM FIGURE R301.2(4)A (mph) | AVERAGE SLOPE OF THE TOP HALF OF HILL, RIDGE OR ESCARPMENT (percent) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0.10 | 0.125 | 0.15 | 0.175 | 0.20 | 0.23 | 0.25 |
| | Required ultimate design wind speed-up, modified for topographic wind speed-up (mph) | | | | | | |
| 95 | 114 | 119 | 123 | 127 | 131 | 137 | 140 |
| 100 | 120 | 125 | 129 | 134 | 138 | 144 | 147 |
| 105 | 126 | 131 | 135 | 141 | 145 | 151 | 154 |
| 110 | 132 | 137 | 142 | 147 | 152 | 158 | 162 |
| 115 | 138 | 143 | 148 | 154 | 159 | 165 | 169 |
| 120 | 144 | 149 | 155 | 160 | 166 | 172 | 176 |
| 130 | 156 | 162 | 168 | 174 | 179 | N/A | N/A |
| 140 | 168 | 174 | 181 | N/A | N/A | N/A | N/A |
| 150 | 180 | N/A | N/A | N/A | N/A | N/A | N/A |

For SI: 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.

a. Table applies to a feature height of 500 feet or less and dwellings sited a distance equal or greater than half the feature height.

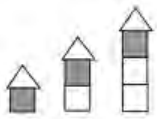
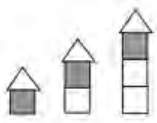
b. Where the ultimate design wind speed as modified by Table R301.2.1.5.1 equals or exceeds 140 miles per hour, the building shall be considered as “wind design required” in accordance with Section R301.2.1.1.

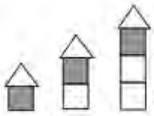
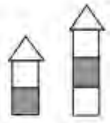
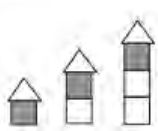
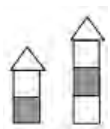
**TABLE R602.10.1.3**
**BRACED WALL LINE SPACING**

| APPLICATION | CONDITION | BUILDING TYPE | BRACED WALL LINE SPACING CRITERIA | |
|---|---|---|---|---|
| | | | Maximum Spacing | Exception to Maximum Spacing |
| Wind bracing | Ultimate design wind speed < 140 mph | Detached, townhouse | 60 feet | None |
| Seismic bracing | SDC A – C | Detached | Use wind bracing | |
| | SDC A – B | Townhouse | Use wind bracing | |
| | SDC C | Townhouse | 35 feet | Up to 50 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4). |
| | SDC $D_0$, $D_1$, $D_2$ | Detached, townhouses, one- and two-story only | 25 feet | Up to 35 feet to allow for a single room not to exceed 900 square feet. Spacing of all other braced wall lines shall not exceed 25 feet. |
| | SDC $D_0$, $D_1$, $D_2$ | Detached, townhouse | 25 feet | Up to 35 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4). |

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 $m^2$, 1 mile per hour = 0.447 m/s.

**TABLE R602.10.3(1)**
**BRACING REQUIREMENTS BASED ON WIND SPEED**

| • EXPOSURE CATEGORY B<br>• 30-FOOT MEAN ROOF HEIGHT<br>• 10-FOOT WALL HEIGHT<br>• 2 BRACED WALL LINES | | | MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a] | | | |
|---|---|---|---|---|---|---|
| **Ultimate Design Wind Speed (mph)** | **Story Location** | **Braced Wall Line Spacing[c] (feet)** | **Method LIB[b]** | **Method GB** | **Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB** | **Methods CS-WSP, CS-G, CS-PF** |
| <95 |  | 10 | 2.5 | 2.5 | 1.5 | 1.5 |
| | | 20 | 4.5 | 4.5 | 2.5 | 2.5 |
| | | 30 | 6.5 | 6.5 | 4.0 | 3.5 |
| | | 40 | 8.5 | 8.5 | 5.0 | 4.0 |
| | | 50 | 10.5 | 10.5 | 6.0 | 5.0 |
| | | 60 | 12.5 | 12.5 | 7.0 | 6.0 |
| |  | 10 | 5.0 | 5.0 | 3.0 | 2.5 |
| | | 20 | 8.5 | 8.5 | 5.0 | 4.5 |
| | | 30 | 12.5 | 12.5 | 7.0 | 6.0 |
| | | 40 | 16.0 | 16.0 | 9.5 | 8.0 |
| | | 50 | 20.0 | 20.0 | 11.5 | 10.0 |
| | | 60 | 23.5 | 23.5 | 13.5 | 11.5 |
| |  | 10 | NP | 7.0 | 4.0 | 3.5 |
| | | 20 | NP | 13.0 | 7.5 | 6.5 |
| | | 30 | NP | 18.5 | 10.5 | 9.0 |
| | | 40 | NP | 24.0 | 13.5 | 11.5 |
| | | 50 | NP | 29.5 | 17.0 | 14.5 |
| | | 60 | NP | 35.0 | 20.0 | 17.0 |
| ≤ 110 |  | 10 | 3.5 | 3.5 | 2.0 | 1.5 |
| | | 20 | 6.0 | 6.0 | 3.5 | 3.0 |
| | | 30 | 8.5 | 8.5 | 5.0 | 4.5 |
| | | 40 | 11.5 | 11.5 | 6.5 | 5.5 |
| | | 50 | 14.0 | 14.0 | 8.0 | 7.0 |
| | | 60 | 16.5 | 16.5 | 9.5 | 8.0 |
| |  | 10 | 6.5 | 6.5 | 3.5 | 3.0 |
| | | 20 | 11.5 | 11.5 | 6.5 | 5.5 |
| | | 30 | 16.5 | 16.5 | 9.5 | 8.0 |
| | | 40 | 21.5 | 21.5 | 12.5 | 10.5 |
| | | 50 | 26.5 | 26.5 | 15.5 | 13.0 |
| | | 60 | 31.5 | 31.5 | 18.0 | 15.5 |
| |  | 10 | NP | 9.5 | 5.5 | 4.5 |
| | | 20 | NP | 17.0 | 10.0 | 8.5 |
| | | 30 | NP | 24.5 | 14.0 | 12.0 |
| | | 40 | NP | 32.0 | 18.5 | 15.5 |
| | | 50 | NP | 39.5 | 22.5 | 19.0 |
| | | 60 | NP | 46.5 | 26.5 | 23.0 |
| | | 10 | 3.5 | 3.5 | 2.0 | 2.0 |
| | | 20 | 6.5 | 6.5 | 3.5 | 3.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| |  | 20 | 8.0 | 8.0 | 5.0 | 4.0 |
| | | 30 | 9.5 | 9.5 | 5.5 | 4.5 |
| | | 40 | 12.5 | 12.5 | 7.0 | 6.0 |
| | | 50 | 15.0 | 15.0 | 9.0 | 7.5 |
| | | 60 | 18.0 | 18.0 | 10.5 | 9.0 |
| |  | 10 | 7.0 | 7.0 | 4.0 | 3.5 |
| | | 20 | 12.5 | 12.5 | 7.5 | 6.5 |
| | | 30 | 18.0 | 18.0 | 10.5 | 9.0 |
| ≤ 115 | | 40 | 23.5 | 23.5 | 13.5 | 11.5 |
| | | 50 | 29.0 | 29.0 | 16.5 | 14.0 |
| | | 60 | 34.5 | 34.5 | 20.0 | 17.0 |
| |  | 10 | NP | 10.0 | 6.0 | 5.0 |
| | | 20 | NP | 18.5 | 11.0 | 9.0 |
| | | 30 | NP | 27.0 | 15.5 | 13.0 |
| | | 40 | NP | 35.0 | 20.0 | 17.0 |
| | | 50 | NP | 43.0 | 24.5 | 21.0 |
| | | 60 | NP | 51.0 | 29.0 | 25.0 |
| |  | 10 | 4.0 | 4.0 | 2.5 | 2.0 |
| | | 20 | 7.0 | 7.0 | 4.0 | 3.5 |
| | | 30 | 10.5 | 10.5 | 6.0 | 5.0 |
| | | 40 | 13.5 | 13.5 | 8.0 | 6.5 |
| | | 50 | 16.5 | 16.5 | 9.5 | 8.0 |
| | | 60 | 19.5 | 19.5 | 11.5 | 9.5 |
| |  | 10 | 7.5 | 7.5 | 4.5 | 3.5 |
| | | 20 | 14.0 | 14.0 | 8.0 | 7.0 |
| | | 30 | 20.0 | 20.0 | 11.5 | 9.5 |
| ≤ 120 | | 40 | 25.5 | 25.5 | 15.0 | 12.5 |
| | | 50 | 31.5 | 31.5 | 18.0 | 15.5 |
| | | 60 | 37.5 | 37.5 | 21.5 | 18.5 |
| |  | 10 | NP | 11.0 | 6.5 | 5.5 |
| | | 20 | NP | 20.5 | 11.5 | 10.0 |
| | | 30 | NP | 29.0 | 17.0 | 14.5 |
| | | 40 | NP | 38.0 | 22.0 | 18.5 |
| | | 50 | NP | 47.0 | 27.0 | 23.0 |
| | | 60 | NP | 55.5 | 32.0 | 27.0 |
| |  | 10 | 4.5 | 4.5 | 2.5 | 2.5 |
| | | 20 | 8.5 | 8.5 | 5.0 | 4.0 |
| | | 30 | 12.0 | 12.0 | 7.0 | 6.0 |
| | | 40 | 15.5 | 15.5 | 9.0 | 7.5 |
| | | 50 | 19.5 | 19.5 | 11.0 | 9.5 |
| | | 60 | 23.0 | 23.0 | 13.0 | 11.0 |
| |  | 10 | 8.5 | 8.5 | 5.0 | 4.5 |
| | | 20 | 16.0 | 16.0 | 9.5 | 8.0 |
| | | 30 | 23.0 | 23.0 | 13.5 | 11.5 |
| ≤ 130 | | 40 | 30.0 | 30.0 | 17.5 | 15.0 |
| | | 50 | 37.0 | 37.0 | 21.5 | 18.0 |
| | | 60 | 44.0 | 44.0 | 25.0 | 21.5 |
| | | 10 | NP | 13.0 | 7.5 | 6.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| |  | 20 | NP | 24.0 | 13.5 | 11.5 |
| | | 30 | NP | 34.5 | 19.5 | 17.0 |
| | | 40 | NP | 44.5 | 25.5 | 22.0 |
| | | 50 | NP | 55.0 | 31.5 | 26.5 |
| | | 60 | NP | 65.0 | 37.5 | 31.5 |
| < 140 |  | 10 | 5.5 | 5.5 | 3.0 | 2.5 |
| | | 20 | 10.0 | 10.0 | 5.5 | 5.0 |
| | | 30 | 14.0 | 14.0 | 8.0 | 7.0 |
| | | 40 | 18.0 | 18.0 | 10.5 | 9.0 |
| | | 50 | 22.5 | 22.5 | 13.0 | 11.0 |
| | | 60 | 26.5 | 26.5 | 15.0 | 13.0 |
| |  | 10 | 10.0 | 10.0 | 6.0 | 5.0 |
| | | 20 | 18.5 | 18.5 | 11.0 | 9.0 |
| | | 30 | 27.0 | 27.0 | 15.5 | 13.0 |
| | | 40 | 35.0 | 35.0 | 20.0 | 17.0 |
| | | 50 | 43.0 | 43.0 | 24.5 | 21.0 |
| | | 60 | 51.0 | 51.0 | 29.0 | 25.0 |
| |  | 10 | NP | 15.0 | 8.5 | 7.5 |
| | | 20 | NP | 27.5 | 16.0 | 13.5 |
| | | 30 | NP | 39.5 | 23.0 | 19.5 |
| | | 40 | NP | 51.5 | 29.5 | 25.0 |
| | | 50 | NP | 63.5 | 36.5 | 31.0 |
| | | 60 | NP | 75.5 | 43.0 | 36.5 |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Linear interpolation shall be permitted.

b. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

c. Where a braced wall line has parallel braced wall lines on one or both sides of differing dimensions, the average dimension shall be permitted to be used for braced wall line spacing.

**TABLE R602.10.6.4**
**TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHODS PFH, PFG AND CS-PF BRACED WALL PANELS**

| MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE | MAXIMUM PONY WALL HEIGHT (feet) | MAXIMUM TOTAL WALL HEIGHT (feet) | MAXIMUM OPENING WIDTH (feet) | TENSION STRAP CAPACITY REQUIRED (pounds)[a, b] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Ultimate Design Wind Speed $V_{ult}$ (mph) | | | | | |
| | | | | ≤110 | 115 | 130 | ≤110 | 115 | 130 |
| | | | | Exposure B | | | Exposure C | | |
| 2 × 4 No. 2 Grade | 0 | 10 | 18 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,050 |
| | 1 | 10 | 9 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,750 |
| | | | 16 | 1,000 | 1,025 | 2,050 | 2,075 | 2,500 | 3,950 |
| | | | 18 | 1,000 | 1,275 | 2,375 | 2,400 | 2,850 | DR |
| | 2 | 10 | 9 | 1,000 | 1,000 | 1,475 | 1,500 | 1,875 | 3,125 |
| | | | 16 | 1,775 | 2,175 | 3,525 | 3,550 | 4,125 | DR |
| | | | 18 | 2,075 | 2,500 | 3,950 | 3,975 | DR | DR |
| | 2 | 12 | 9 | 1,150 | 1,500 | 2,650 | 2,675 | 3,175 | DR |
| | | | 16 | 2,875 | 3,375 | DR | DR | DR | DR |
| | | | 18 | 3,425 | 3,975 | DR | DR | DR | DR |
| | 4 | 12 | 9 | 2,275 | 2,750 | DR | DR | DR | DR |
| | | | 12 | 3,225 | 3,775 | DR | DR | DR | DR |
| 2 × 6 Stud Grade | 2 | 12 | 9 | 1,000 | 1,000 | 1,700 | 1,700 | 2,025 | 3,050 |
| | | | 16 | 1,825 | 2,150 | 3,225 | 3,225 | 3,675 | DR |
| | | | 18 | 2,200 | 2,550 | 3,725 | 3,750 | DR | DR |
| | 4 | 12 | 9 | 1,450 | 1,750 | 2,700 | 2,725 | 3,125 | DR |
| | | | 16 | 2,050 | 2,400 | DR | DR | DR | DR |
| | | | 18 | 3,350 | 3,800 | DR | DR | DR | DR |

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. DR = Design Required.

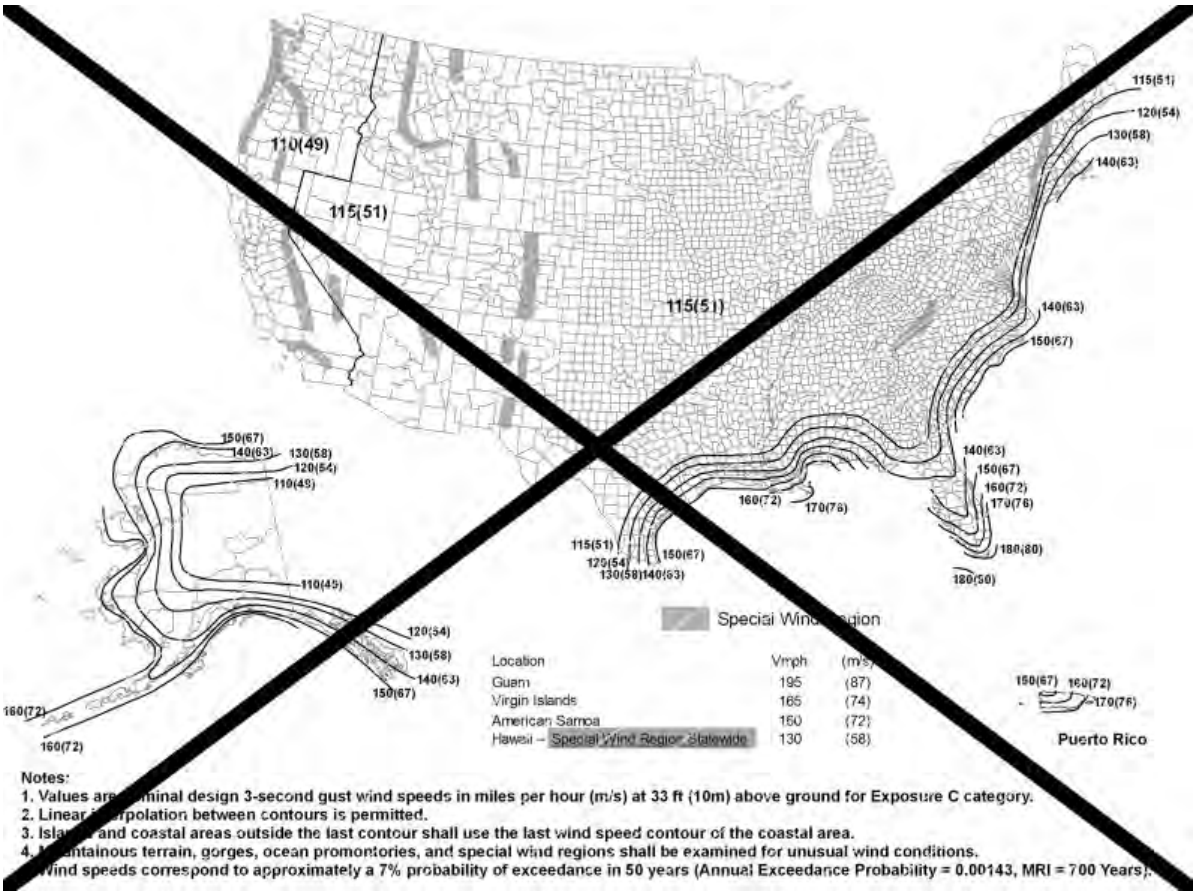
b. Straps shall be installed in accordance with manufacturer's recommendations.

**TABLE R703.3.1**
**LIMITS FOR ATTACHMENT PER TABLE R703.3(1)**

| MAXIMUM MEAN ROOF HEIGHT | | | |
|---|---|---|---|
| Ultimate Wind Speed (mph 3-second gust) | Exposure | | |
| | B | C | D |
| 95 | NL | NL | NL |
| 100 | NL | NL | NL |
| 105 | NL | NL | NL |
| 110 | NL | NL | 40' |
| 115 | NL | 50´ | 20´ |
| 120 | NL | 30´ | DR |
| 130 | 60´ | 15´ | DR |
| 140 | 35´ | DR | DR |

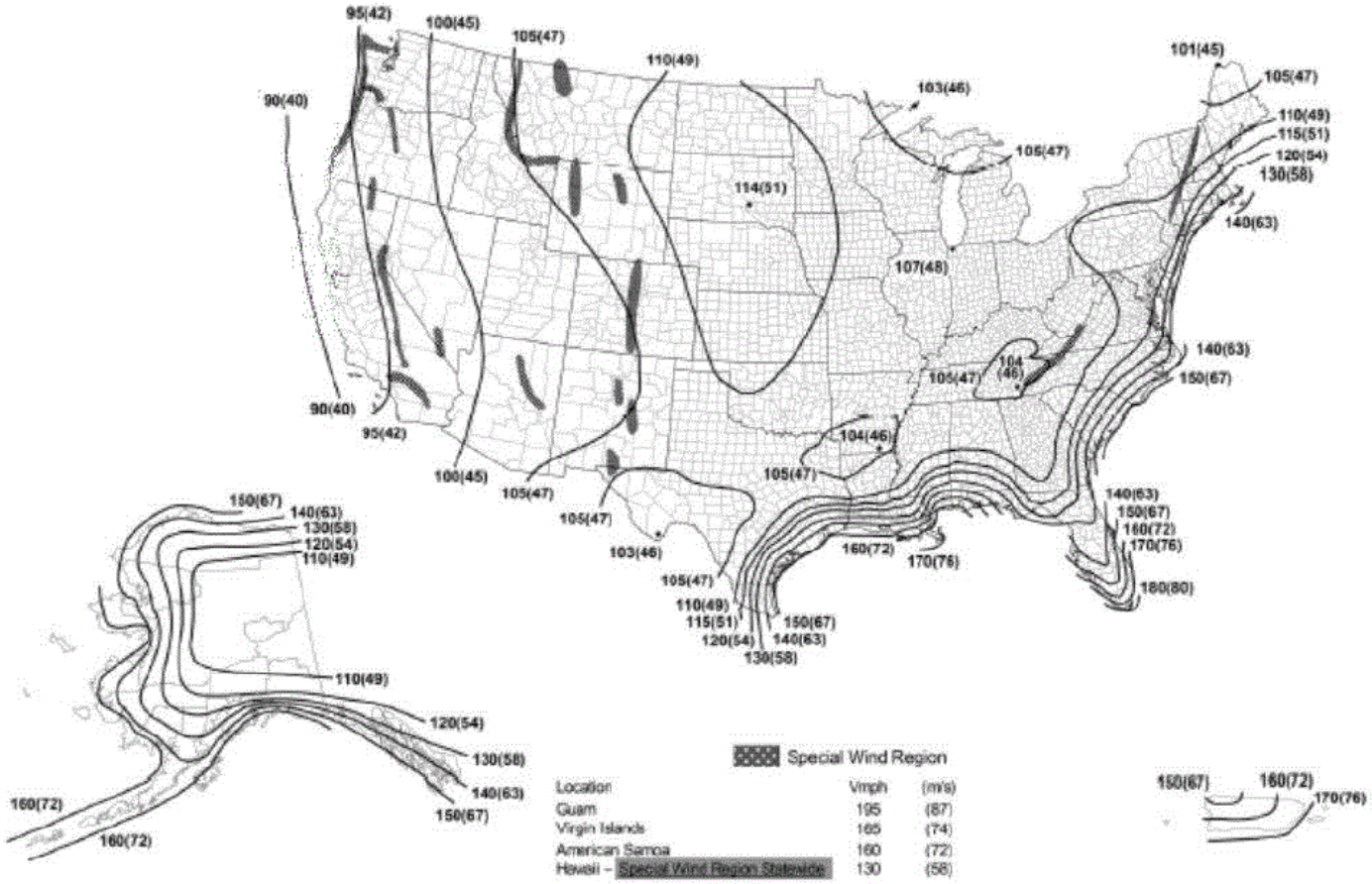
For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

NL = Not limited by Table R703.3.1, DR = Design required.




**Notes:**

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).




**Notes:**
**1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.**
**2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.**
**3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.**
**4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.**
**5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).**
**6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed**

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedence in 50 years (Annual Exceedence Probability = 0.00143, MRI = 700 Years).

**FIGURE AH106.4.1**
**ULTIMATE DESIGN WIND SPEEDS FOR PATIO COVERS AND SCREEN ENCLOSURES**

**Reason Statement:** This proposal is a coordination proposal to accompany the proposal to update the wind map in Figure R301.2(4)A to the currently referenced ASCE 7-16 standard. As has been stated, the ASCE 7-16 wind maps include many areas of the country where wind speeds decreased below the speeds of the previous maps. To coordinate the IRC with the areas of lower wind speeds, this proposal adds or modifies existing provisions to account for these lower speeds. This proposal includes several changes that are bundled together in one proposal because they all reflect the effort to accommodate for these lower speeds in the existing tables and figures. Each change within this proposal is explained below.

**R301.2.1 Wind design criteria**.

The last sentence was added to acknowledge the lower speeds and permit use of the prescriptive provisions. Also, VA-specific prescriptive special wind region wind speeds had not been updated from ASD values indicated in the 2012 VRC wind speed maps (based on ASCE 7-05). Updated values were based on the assumption that lower bound was based on wind speed value for surrounding area (approximately 110 mph in Figure 301.2.(5)A); upper bound was generated from Table 301.2.1.3 (i.e., $V_{ASD}$ of 110 mph = $V_{ULT}$ of ~140 mph).

**Table R301.2.1.5.1 Ultimate Design Wind Speed Modification for Topographic Wind Effect**
Three new lines are added to this table to accommodate the lower wind speeds of 95, 100, and 105mph.

**Table R602.10.1.3 Braced Wall Line Spacing**
Revision to this table includes removing the lower boundary of 100 mph to account for lower speeds now included on the map.

**Table R602.10.3(1) Bracing Requirements Based on Wind Speed**
This additional data is added to accommodate the lower wind speeds of <95mph.

**Table R602.10.6.4 Tension Strap Capacity for Resisting Wind Pressures Perpendicular to Methods PFH, PFG and CS-PF Braces Wall Panels**
The small revision to this table is to add "<=" to the lowest wind speed of 110, for both Exposure B and C, to indicate this is appropriate for use with lower wind speeds.

**Table R703.3.2 Limits for Attachment Per Table R703.3(1)**
This table was updated to include new lines for lower wind speeds of 95, 100, 105, and 110.

**Table AH106.4(1) Design Wind Pressures for Screen Enclosures Framing**
This update adds columns for lower wind speeds of 90 and 95 mph.

**Figure AH106.4.1 Ultimate Design Wind Speeds for Patio Covers and Screen Enclosures**
This updates the map to the ASCE 7-16 RC

**Cost Impact:**
The code change proposal will decrease the cost of construction
By updating and adding in prescriptive provisions to reflect the lower wind speeds that appear in some areas of the country, this proposal on its own will lower construction costs. However, as this is a coordination proposal, the impacts of this proposal will depend on the situation and overall design.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB301.2.1-18

This proposal doesn't have any public comments.

Proposal # 470

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# RB301.2.1.1-18

**Proponents:** Resiliency Subworkgroup

## 2018 International Residential Code

**R301.2.1.1 Wind limitations and wind design required.** The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure ~~R301.2(5)B.~~ R301.2(5)B or where the ultimate design wind speed, $V_{alt}$ in Figure R301.2(5)A equals or exceeds 140 mph in a special wind region.

**Exceptions:**

1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R608.
2. For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R610.
3. For cold-formed steel light-frame construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R505, R603 and R804.

In regions where wind design is required in accordance with Figure R301.2(5)B or where the ultimate design wind speed $V_{alt}$ in Figure R301.2(5)A equals or exceeds 140 mph in a special wind region, the design of buildings for wind loads shall be in accordance with one or more of the following methods:

1. AWC *Wood Frame Construction Manual* (WFCM).
2. ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600).
3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).
4. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings* (AISI S230).
5. International Building Code.

The elements of design not addressed by the methods in Items 1 through 5 shall be in accordance with the provisions of this code.

Where ASCE 7 or the International Building Code is used for the design of the building, the wind speed map and exposure category requirements as specified in ASCE 7 and the International Building Code shall be used.

**Reason Statement:** This was a consensus item from the Resiliency Subworkgroup. It still needs to be considered by the full workgroup. Corrects errors regarding the applicability of the IRC to areas where wind speeds exceed the prescriptive provisions of the IRC.

**Cost Impact:** The code change proposal will increase the cost of construction
Alters wind design criteria which could alter the cost of construction.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal clarifies and updates the sections for Ultimate Wind Design

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB301.2.1.1-18

This proposal doesn't have any public comments.

Proposal # 357

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# RB302.1-18

**Proponents:** Ronald Clements Jr (clementsro@chesterfield.gov)

## 2018 International Residential Code

**TABLE R302.1(1)**
**EXTERIOR WALLS**

| EXTERIOR WALL ELEMENT | | MINIMUMFIRE-RESISTANCE RATING | MINIMUM FIRESEPARATION DISTANCE |
|---|---|---|---|
| Walls | Fire-resistance rated | 1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from both sides | 0 feet |
| | Not fire-resistance rated | 0 hours | ≥ 5 feet |
| Projections | ~~Not allowed~~ | ~~NA~~ | ~~< 2 feet~~ |
| | Fire-resistance rated | 1 hour on the underside, or heavy timber, or fire-retardant-treated wood[a, b] | ~~≥ 2 feet to~~ < 5 feet |
| | Not fire-resistance rated | 0 hours | ≥ 5 feet |
| Openings in walls | Not allowed | NA | < 3 feet |
| | 25% maximum of wall area | 0 hours | 3 feet |
| | Unlimited | 0 hours | 5 feet |
| Penetrations | All | Comply with Section R302.4 | < 3 feet |
| | | None required | 3 feet |

For SI: 1 foot = 304.8 mm.
NA = Not Applicable.

a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.

**Reason Statement:** Most townhouse projects in Virginia involve soffit projections up to the property line. Limiting projections to within 2 feet of the property line creates an unnecessary burden to construct for little gain in safety. There is already an exception for decks and open porches, which has not become problematic. Many jurisdictions interpreted the table prior to the 2015 edition to permit this and it was the 2015 new line that specifically prohibits projections within 2 feet that brought this up as an issue.

**Cost Impact:** The code change proposal will decrease the cost of construction
This will decrease construction cost by making it easier to construct typical town house designs.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This is not related to resiliency.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB302.1-18

This proposal doesn't have any public comments.

Proposal # 276

# RB302.2-18

**Proponents:** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com)

## 2018 International Residential Code

**Revise as follows:**

**R302.2 Townhouses.** Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or ~~R302.2.2.~~ R302.2.2, and shall comply with Sections 302.2.3 through 302.2.5.

**Reason Statement:** Sections 302.2.3 through 302.2.5 also apply to townhouse wall construction. It is appropriate for these sections to be referenced by the introductory section on townhouses, which is focused on townhouse walls.
This change was processed as Item RB57-19 and has been approved by ICC for inclusion in the 2021 IRC. It was Approved as Submitted by the code development committee and no public comments were submitted.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB302.2-18

This proposal doesn't have any public comments.

Proposal # 406

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# RB302.2.2-18

**Proponents:** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com)

## 2018 International Residential Code

**Revise as follows:**

**R302.2.2 Common walls.** Common walls separating *townhouses* shall be assigned a fire-resistance rating in accordance with Item 1 or 2. The common wall shared by two *townhouses* shall be constructed without plumbing or mechanical equipment, ducts or vents ~~in~~, other than water-filled fire sprinkler piping, in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

**R302.4.1 Through penetrations.** Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

~~**Exception:**~~ **Exceptions:**

**1.** Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:

~~1.~~ 1.1 In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided that both of the following are complied with:

~~1.1.~~

1.1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).

~~1.2.~~ 1.1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm2).

~~2.~~ 1.2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time temperature fire conditions under a positive pressure differential of not less than 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

2. The annular space created by the penetration of water-filled fire sprinkler piping, provided the annular space is filled using a material complying with Exception 1.2 above.

**R302.4.2 Membrane penetrations.** Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

**Exceptions:**

1. Membrane penetrations of not more than 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m2) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m2) in any 100 square feet (9.29 m2) of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:

1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
1.3. By solid fireblocking in accordance with Section R302.11.
1.4. By protecting both boxes with listed putty pads.
1.5. By other listed materials and methods.

2. Membrane penetrations by listed electrical boxes of any materials provided that the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm) unless listed otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:

2.1. By the horizontal distance specified in the listing of the electrical boxes.
2.2. By solid fireblocking in accordance with Section R302.11.
2.3. By protecting both boxes with listed putty pads.
2.4. By other listed materials and methods.

3. The annular space created by the penetration of a fire sprinkler or water-filled fire sprinkler piping, provided that the annular space is covered by a metal escutcheon plate.
4. Ceiling membrane penetrations by listed luminaires or by luminaires protected with listed materials that have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.

**Reason Statement:** Allowing common fire sprinkler piping to protect multiple units in a townhouse can significantly reduce installation costs, and the IBC now allows penetration of townhouse separation walls in any townhouse that does not exceed the height and area limits. For reference, IBC Section 706.1.1, Exception 2 states: *Fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the code official's review and approval, he or she shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.* It makes no sense for the IRC to be more restrictive than the IBC with respect to allowing penetration of sprinkler piping through townhouse separation walls.
This proposal limits application of the proposed sprinkler penetration allowance to water-filled pipes. Although plastic pipe has been listed for dry residential sprinkler applications, use of those systems is not common enough to warrant arguing the point and missing this opportunity for progress with wet-pipe systems. Use of this allowance will require following the already recognized/tested method (in the current exception) for protecting annular spaces surrounding through penetrations. With that increased level of protection, a fire could only pass the membrane by melting the pipe and causing water to leak, which would inherently protect the opening. Flame would be stopped at the barrier.

Additionally, water-filled sprinkler pipes will be allowed in common walls. This option provides for improved sprinkler designs for townhouses by allowing sidewall sprinklers to be deployed from common walls, which unlike exterior walls, are not exposed to freezing exterior conditions. By using sidewall sprinklers to protect the top floor instead of pendent sprinklers in the ceiling, sprinkler piping can be kept out of attics, which are subject to freezing.

This change was processed as Item RB67-19 and has been approved by ICC for inclusion in the 2021 IRC. It was Approved as Modified by PC1 by the ICC membership.

**Cost Impact:** The code change proposal will decrease the cost of construction
The allowance for sprinkler piping to penetrate townhouse separation walls will reduce the infrastructure required to install a fire sprinkler system in some cases by allowing a shared feed for multiple units.

**Resiliency Impact Statement:** This proposal will increase Resiliency
The reduced cost of installing fire sprinkler systems associated with this proposal and the allowance to run piping through and in interior walls separating townhouses will increase system reliability and performance.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB302.2.2-18

This proposal doesn't have any public comments.

Proposal # 410

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# RB302.2.6-18

**Proponents:** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com)

## 2018 International Residential Code

**Revise as follows:**

**R302.2.6 Structural independence.** Each individual *townhouse* shall be structurally independent.

**Exceptions:**

1. Foundations supporting *exterior walls* or common walls.
2. Structural roof and wall sheathing from each unit fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. *Townhouses* separated by a common wall as provided in Section R302.2.2, Item 1 or 2.
6. Townhouses protected by a fire sprinkler system complying with Section P2904, NFPA 13, NFPA 13R or NFPA 13D.

**Reason Statement:** The IBC now allows townhouses to be built without structural independence provided that height and area limits for the overall townhouse building are not exceeded. This is true because the firewall requirement to separate units is no longer applicable in such cases. Therefore, only the 1-hour dwelling unit requirement applies, and that assembly is a fire barrier, which has no structural independence requirement. For reference IBC Section 706.1.1, Exception 2 states: Fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the code official's review and approval, he or she shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.
It makes no sense for the IRC to be more restrictive than the IBC with respect to requiring structural independence when townhouses are sprinklered.

This change was processed as Item RB60-19 and has been approved by ICC for inclusion in the 2021 IRC. It was Approved as Submitted by the code development committee and that action was sustained by the ICC membership.

**Cost Impact:** The code change proposal will decrease the cost of construction
Construction costs are reduced, consistent with the IBC, based on the allowance to not require structural independence of townhouse units.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB302.2.6-18

This proposal doesn't have any public comments.

Proposal # 408

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# RB302.3(1)-18

**Proponents:** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com)

## 2018 International Residential Code

**Revise as follows:**

**R302.3 Two-family dwellings.** *Dwelling units* in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code. Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the *exterior wall*, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

**Exceptions:**

1. A fire-resistance rating of 1/2 hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13, NFPA 13R or Section P2904.

2. Wall assemblies need not extend through attic spaces where the ceiling is protected by not less than 5/8-inch (15.9 mm) Type X gypsum board, an attic draft stop constructed as specified in Section R302.12.1 is provided above
and along the wall assembly separating the dwellings and the structural framing supporting the ceiling is protected by not less than 1/2-inch (12.7 mm) gypsum board or equivalent.

# NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy MA 02169-7471

~~**13—16: Standard for Installation of Sprinkler Systems**~~

**Reason Statement:** The current exception will never be used because the cost of installing a full NFPA 13 system (typically associated with commercial structures) in a duplex will far outweigh savings associated with reducing the separation wall rating from one-hour to 30 minutes. From a parity perspective, it makes no sense to allow Section P2904 (equivalent of NFPA 13D) protection as a basis for reducing townhouse separations but require NFPA 13 for duplexes.
Perhaps the logic associated with the current provision was intending to gain sprinkler protection in the attic (which would typically be required by NFPA 13) as a basis of qualifying for the reduced fire rating. But, townhouse separations are allowed to be reduced in unsprinklered attics of sprinklered townhouses, recognizing that the vast majority of residential fires start in occupied spaces, where sprinklers are present to control a fire before extension into the attic. True, a reduced townhouse separation maintains a one-hour rating, versus 30 minutes in a duplex, but 30 minutes is still a sufficient separation rating to accommodate fire department response and setup at a duplex.

Note that IRC Section R313 only requires NFPA 13D for duplexes, so this change will align with Section R313. Also, the reference to NFPA 13 is proposed for deletion since this is the only place in the IRC where that standard is referenced.

This change was processed as Item RB64-19 and has been approved by ICC for inclusion in the 2021 IRC. It was Approved as Modified by the code development committee (as reflected in this proposal) and no public comments were submitted.

**Cost Impact:** The code change proposal will decrease the cost of construction
This change will allow a reduction from an NFPA 13 sprinkler system to an residential sprinkler system as a basis for reducing the fire rating of duplex separation walls.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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## Public Comments for: RB302.3(1)-18

This proposal doesn't have any public comments.

# RB302.13-18

**Proponents:** DHCD Staff (sbco@dhcd.virginia.gov)

## 2018 International Residential Code

**Revise as follows:**

**R313.1.1 Design and installation.** Automatic residential fire sprinkler systems for *townhouses* shall be designed and installed in accordance with Section P2904~~ or NFPA 13D.~~ , NFPA 13D, 13, or 13R.

**R313.2.1 Design and installation.** Automatic residential fire sprinkler systems shall be designed and installed in accordance with Section P2904~~ or NFPA 13D.~~ , NFPA 13D, 13 or 13R.

**R324.6.2.1 Alternative setback at ridge.** Where an automatic sprinkler system is installed within the dwelling in accordance with NFPA 13D, 13, 13R or Section P2904, setbacks at ridges shall comply with one of the following:

1. For photovoltaic arrays occupying not more than 66 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge.
2. For photovoltaic arrays occupying more than 66 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.

## 2015 Virginia Residential Code

**Revise as follows:**

**R313.1 Townhouse automatic fire sprinkler systems.** Notwithstanding the requirements of Section 103.3, where installed, an automatic residential fire sprinkler system for townhouses shall be designed and installed in accordance with NFPA 13D, 13, 13R or Section P2904.

**Exception:** An automatic residential fire sprinkler system shall not be required when additions or alterations are made to existing townhouses that do not have an automatic residential fire sprinkler system installed.

**R313.2 One- and two-family dwellings automatic fire sprinkler systems.** Notwithstanding the requirements of Section 103.3, where installed, an automatic residential fire sprinkler system shall be designed and installed in accordance with NFPA 13D, 13, 13R or Section P2904.

**Exception:** An automatic residential fire sprinkler system shall not be required for additions or alterations to existing buildings that are not already provided with an automatic residential fire sprinkler system.

## 2018 International Residential Code

**Revise as follows:**

**P2904.1 General.** The design and installation of residential fire sprinkler systems shall be in accordance with NFPA 13D, 13, 13R or Section P2904, which shall be considered to be equivalent to NFPA 13D. Partial residential sprinkler systems shall be permitted to be installed only in buildings not required to be equipped with a residential sprinkler system. Section P2904 shall apply to stand-alone and multipurpose wet-pipe sprinkler systems that do not include the use of antifreeze. A multipurpose fire sprinkler system shall provide domestic water to both fire sprinklers and plumbing fixtures. A stand-alone sprinkler system shall be separate and independent from the water distribution system. A backflow preventer shall not be required to separate a sprinkler system from the water distribution system, provided that the sprinkler system complies with all of the following:

1. The system complies with NFPA 13D , 13, 13R or Section P2904.
2. The piping material complies with Section P2906.
3. The system does not contain antifreeze.
4. The system does not have a fire department connection.

**Reason Statement:** Change is to correlate these sections with proposals RB302.3(1) and RB302.2.6 that were approved by Workgroup 3 where there was the addition of NFPA 13 and 13R references.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal will not increase or decrease the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal will neither increase nor decrease Resiliency.

## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: RB302.13-18

This proposal doesn't have any public comments.

Proposal # 484

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# RB314.6(1)-18

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)

## 2015 Virginia Residential Code

**R314.6 Power source.** Smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

**Exceptions:**

1. Smoke alarms shall be permitted to be battery operated with a minimum 10-year battery where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

**Reason Statement:** Technology, including smoke alarms, has continued to progress to more effective and life-saving devices. The code for new construction needs to keep pace with these advancements in technology - particularly where it is known to save lives. This proposal reflects the movement towards low-maintenance style smoke alarms (10-year devices) that last for the entire lifespan of the device. Instead of installing a smoke alarm that requires the battery to be changed every few months, using 10-year devices allows the entire device to be properly powered until it is time to replace the entire device. This also means no costly battery replacements offering a cost-saving over the life of the alarm. Plus, since the battery pack is sealed, the batteries can't be removed from your smoke alarm or tampered with. Dead batteries or no batteries have been statistically noted to be a factor in numerous loss of life fire incidents in residential homes. Having smoke alarms that are quietly vigilant until they are needed - not chirping at 2 AM and then being removed from protection to just stop the chirp - increases the reliability that these devices will be ready and working if they are ever needed. Many states including Maryland, North Carolina, Louisiana, New York, Oregon, and California already have such requirements for all smoke alarms. This proposal is only for smoke alarms in new construction that are not powered by the household power system. It is important to remember: Three out of five home fire deaths result from fires in properties without working smoke alarms. More than one-third (38 percent) of home fire deaths result from fires in which no smoke alarms are present. The risk of dying in a home fire is cut in half in homes with working smoke alarms (Source: National Fire Protection Association).NOTE: The deletion of item 2 is not related to this proposal. This is an existing VRC deletion.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The cost saving of replacement batteries over the life of the device makes this proposal cost-neutral.

**Resiliency Impact Statement:** This proposal will increase Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB314.6(1)-18

**Discussion by Andrew Clark**
Aug 13, 2020 14:46 UTC

The Home Builders Association of Virginia supports this proposal for the reasons articulated by the proponent. Smoke alarms are one of the most effective ways to save lives during a residential fire - this proposal will help keep Virginia's code in-line with the latest smoke alarm technology and reduce the burden on homeowners to replace batteries every few months.

**Discussion by Wendy Gifford**
Jul 13, 2020 19:34 UTC

The proposal has the potential to create confusion and should be rejected.

Section R314.4 of the Virginia Residential Code requires that alarms be interconnected in new construction. (The lifesaving importance of interconnection is well established. I have cited quotes from studies below.)

Because of the power requirements for wireless interconnection, interconnected, sealed ten-year smoke alarms are a rarity. (I was able to find one in an online search, but it is not listed to the upcoming, 8th edition of UL 217.) Because of the lifesaving importance of interconnection, most laws and codes mandating sealed ten-year devices have created an exception for wireless interconnection. (Florida, Illinois, California, etc.)

This is also the position of the National Electrical Manufacturers Association, according to the organization's position statement, that requirements for sealed ten-year units include an exception for interconnection. (See online here: https://www.lifefiresafety.org/wp-content/uploads/2017/10/NEMA-Position-Statement-on-10-year-Mandates.pdf )

Since the original language of "battery powered" would accommodate the possibility of interconnection as well as allowing sealed ten-year devices if only one alarm is needed, the existing language should not be changed.

Importance of interconnection, a sampling of the research:

"…interconnected smoke alarms were both more likely to have operated and more likely to have provided the only alert. Michael A. Greene and Craig Andres. 2004-2005 National Sample Survey of Unreported Residential Fires. U.S. CPSC, July 2009

"...to achieve early detection and adequate notification, smoke alarms are required in every room and should be interconnected." Khalid Moinuddin, Dorothy Bruck and Long Shi (2017), "An experimental study on timely activation of smoke alarms and their effective notification in typical residential buildings. Fire Safety Journal. Accessed online at https://www.researchgate.net/publication/318917639_An_experimental_study_on_timely_activation_of_smoke_alarms_and_their_effective_notification_ in November 2018

Submitted by

Wendy Gifford

Consultant, Codes, Standards, Regulatory Affairs
Attachments: https://va.cdpaccess.com/proposal/326/discuss/88/file/download/302/NEMA-Position-Statement-on-10-year-Mandates.pdf

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Proposal # 326

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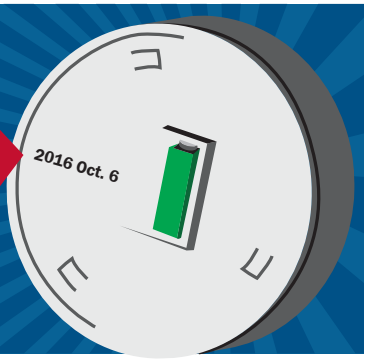
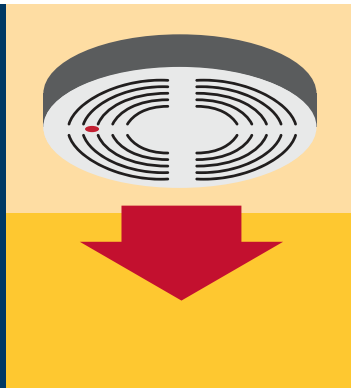
# Don't Wait — Check the Date!

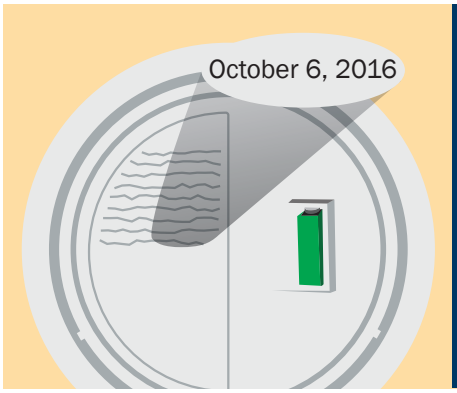
## Replace Smoke Alarms Every 10 Years




**Age matters when it comes to your smoke alarms.**
**Check the manufacture dates on your smoke alarms today!**

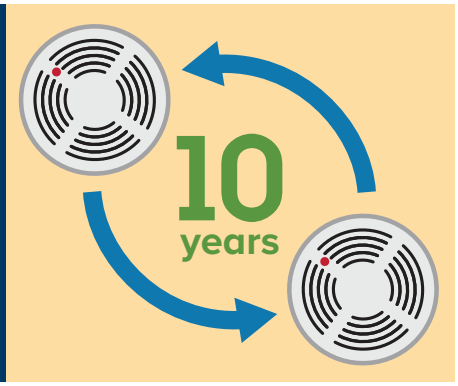
**1** Remove the smoke alarm from the wall or ceiling.

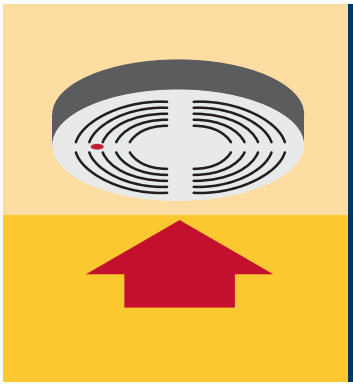





**2** Look at the back of the alarm for the date of manufacture.

**3** Smoke alarms should be replaced 10 years from the date of manufacture.



**4** Put the alarm back on the ceiling or wall if it is less than 10 years old.



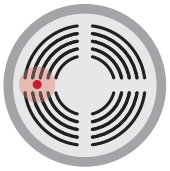
A closed door may slow the spread of smoke, heat and fire.



Test smoke alarms at least once a month by pushing the test button.



If the smoke alarm sounds, get outside and stay outside. Go to your outside meeting place.



Install smoke alarms in every bedroom, outside each separate sleeping area, and on every level of the home, including the basement. Larger homes may need more alarms. For the best protection, make sure all smoke alarms are interconnected. When one sounds, they all sound.




Call the fire department from a cellphone or a neighbor's phone. Stay outside until the fire department says it's safe to go back inside.

**For more information about smoke alarms, visit usfa.fema.gov and www.nfpa.org.**

Click here to add image.

U.S. Fire Administration | FEMA

Fire is Everyone's Fight™



NFPA®

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# RB314.6(2)-18

**Proponents:** DHCD Staff

## 2018 International Residential Code

**Revise as follows:**

**R314.6 Power source.** Smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

~~**Exceptions**~~ **Exception:**

1. ~~1.~~ Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. ~~2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.~~

**Reason Statement:** Removes an exception that references a deleted section. The deleted section is for smoke alarms in existing buildings.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is an editorial correction that will not affect the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is an editorial correction that will not affect resiliency.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB314.6(2)-18

This proposal doesn't have any public comments.

Proposal # 347

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# RB322.2.1-18

**Proponents:** HBAV; City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; City of Newport News

## 2018 International Residential Code

**R309.3 Flood hazard areas.** Garages and carports ~~For buildings~~ located in flood hazard areas as established by Table R301.2(1) shall be constructed in accordance with Section R322.~~, garage floors shall be one of the following:~~

~~1. Elevated to or above the design flood required lowest floor elevation as determined in accordance with Section R322.~~

~~2. Located below the design flood required lowest floor elevation provided that the floors are at or above *grade* on not less than one side, are used solely for parking, building access or storage, meet the requirements of Section R322 and are otherwise constructed in accordance with this code.~~

**R322.2.1 Elevation requirements.**

1. Buildings and structures in flood hazard areas, including flood hazard areas not designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
4. Garage and carport floors shall comply with one of the following:
   4.1. They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.
   4.2. They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage.

**Exception:** Enclosed areas below the ~~design flood~~ elevation required in this section, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

**R322.3.2 Elevation requirements.**

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. Garages used solely for parking, building access or storage and carports, shall comply with Item 1, or shall be at or above grade on not less than one side, and where enclosed with walls such walls shall comply with Item 6.
4. The use of fill for structural support is prohibited.
5. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
6. Walls and partitions enclosing areas below the ~~design flood~~ elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

**Reason Statement:** Consensus This proposal clarifies an existing requirement that garages and carports ALSO must comply with elevation requirements for flood areas.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is not a technical requirement, it just forbids a practice already limited in flood prone localities.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will increase resiliency by ensuring garages and carports are not enclosed in Flood Hazard Areas.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

# Public Comments for: RB322.2.1-18

**Discussion by Kenney Payne**
Jun 19, 2020 20:32 UTC

Our concern is related to R322.3.2, **Item #3**. It basically reads as “garages used solely for parking” or “garages used solely for building access” or “garages used solely for storage” shall comply . . . I’m not versed on any garage used solely for building access - it most likely would not be called a garage but a breezeway or something. Also, if a garage is designed as a space solely for storage, then it isn’t a garage - it’s a storage room. If it is an existing garage that is then used solely for storage - its too late to “comply with Item 1 or shall be above grade . . .” and might be considered a change of occupancy, but I’m not going to get into that conversation.

Also, how would a plan reviewer at the time the documents are submitted for permit KNOW if such a garage is used SOLELY for any purpose other than parking? How would something like that be enforced? If I have some boxes in my garage instead of my car (thus my garage is now being used “solely for storage,” do I now need to raise my house up (because if I raise my garage, I most likely will also need to raise my house)? Finally, since the term “solely” is used, if I use a garage for parking and storage, or parking and building access, or storage and building access - then would I need to comply with either Item 1 or Item 3? So many questions - so little time!

AIA VA could SUPPORT the following:

3. Garages ~~used solely for parking, building access or storage~~ and carports, shall comply with Item 1, or shall be at or above grade on not less than one side.

**Comment by Kenney Payne**
Jun 24, 2020 13:55 UTC

The proposed code text does not reflect what is in the applicable regulation (below).

- 44 Code of Federal Regulations 60.3 (c): (5) Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria: A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

It also doesn’t get into the actual design parameters; but, I’m guessing that isn’t critical to this code change.

My intent is not to change anything “technically” - only to use clear, enforceable code language.

Suggest it be revised as follows to more closely follow the federal reg:

- Carports and fully enclosed areas below the BFE that are usable solely for parking of vehicles, or building access or storage in an area other than a basement, and which are subject to flooding, shall comply with Item 1, or shall be at or above grade on not less than one side.

We would be receptive to other suggested language, but cannot support as written - especially knowing what the regulation actually says. AIA VA is for clear and concise code language that can be easily interpreted, reviewed, and enforced. Federal regulations are oftentimes not written in “code language” and Virginia has considered revising such language when it deems necessary, provided it results in the same requirements technically and in this case, would not jeopardize coverage provided under FEMA.

However, if 2021 IRC uses the language being proposed, then we withdraw our opposition and take ‘NO POSITION.’ While supporting the intent and desire to increase resiliency, we should not do so at the expense of questionable language - especially when a potential solution may be available.

Proposal # 350

# RB322.3.3-18

**Proponents:** HBAV; City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; City of Newport News

## 2018 International Residential Code

**R322.3.3 Foundations.** Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns.

1. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.

2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). ~~Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.~~ Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling.~~Pile systems design and installation shall be certified in accordance with Section R322.3.9. Spread~~

3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24 .

4. Flood and wave loads shall be those associated with the design flood. Wind loads shall be those required by this code.

5. Foundation designs and construction documents shall be prepared and sealed in accordance with Section R322.3.9.

Exception: In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided that the foundations are designed to account for wave action, debris impact, erosion and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.

**Reason Statement:** Foundation section for coastal high-hazard areas and Coastal A Zones reorganized and clarified regarding pilings and columns. Still needs to be considered by full workgroup.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
No new requirements are added. Just organized for clarity.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This is just a reorganization and makes no changes to increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB322.3.3-18

**Discussion by Kenney Payne**
Jun 19, 2020 20:34 UTC

Our concern is related to **Item 3**. Some of the language seems to read more like commentary than code. Just say what the columns and foundations need to do.

AIA VA could SUPPORT the following:

3. Columns and their supporting foundations shall ~~be designed to~~ resist combined wave and wind loads, lateral and uplift, and ~~shall include consideration of~~ decreased resistance capacity caused by scour of soil strata surrounding the columns.

**Comment by Kenney Payne**
Jun 24, 2020 13:57 UTC

Our intent is not to change anything “technically” - only to delete unnecessary and redundant language. For example, if the code requires a building not to exceed XX SF, it doesn’t say, “Building shall be designed to not exceed XX SF.” It says, “Building shall not exceed XX SF.”BTW - just because something is “designed” to meet the code, doesn’t mean it always gets “constructed” to meet the code - so, the suggested changes take away that loophole!

However, we will not stand in the way if everyone else agrees the original language is best.

Proposal # 351

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# RB403.1.6-18

**Proponents:** Ronald Clements Jr (clementsro@chesterfield.gov)

## 2018 International Residential Code

**R403.1.6 Foundation anchorage.** Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum $^1/_2$-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to $^1/_2$-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. The bolts shall be located ~~in the middle third of the width of the~~ a minimum of 1.75 inches (44.45 mm) from the edge of the sill plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318.

**Exceptions:**

1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

**Reason Statement:** The code change that resulted in the middle 1/3 requirement originally specified 1.75 inches. 1.75 inches allows use of a 4 inch CMU and 4 inch brick composite foundation wall and to embed the anchor bolt into the 4 inch CMU cell to comply with the embedment requirement. The 1/3 requirement prohibits use of 8 inch composite foundation walls that have been used for decades.

**Cost Impact:** The code change proposal will decrease the cost of construction
This code change will decrease the cost of construction by allowing the continued use of 8" composite foundation walls.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This is not related to resiliency.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB403.1.6-18

This proposal doesn't have any public comments.

Proposal # 277

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# RB609.4-18

**Proponents:** Resiliency Subworkgroup

## 2018 International Residential Code

**R609.4 Garage doors.** Garage doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the ~~acceptance~~ pass/fail criteria of ANSI/DASMA 108.

**Revise as follows:**

**R609.4.1 Garage door labeling.** Garage doors shall be *labeled* with a permanent *label* affixed to the garage door by the manufacturer. The *label* shall identify the garage door manufacturer, the garage door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

**Reason Statement:** This was a consensus item from the Resiliency Subworkgroup. Requires garage doors have a permanent label that provides a way for the owner to be able to determine their performance characteristics after the building has been occupied. The proposal still needs to be considered by the full workgroup.

**Cost Impact:** The code change proposal will increase the cost of construction
It requires additional documentation.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Provides information on performance characteristics and compliance with the applicable industry design standard for garage and rolling doors for negative/positive wind pressure.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB609.4-18

This proposal doesn't have any public comments.

Proposal # 356

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# RTE3902.16(2)-18

**Proponents:** Allen Turner (allen.turner@jamescitycountyva.gov)

## 2018 International Residential Code

**E3902.16 Arc-fault circuit-interrupter protection ~~of bedroom outlets~~.** Branch circuits that supply 120-volt, single-phase, 15- and 20-ampere outlets installed in kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms , sunrooms, recreations rooms, closets, hallways, laundry areas and similar rooms or areas shall be protected by any of the following: [210.12(A)]

1. A listed combination-type arc-fault circuit-interrupter, installed to provide protection of the entire branch circuit. [210.12(A)(1)]
2. A listed branch/feeder-type AFCI installed at the origin of the branch-circuit in combination with a listed outlet branch-circuit-type arc-fault circuit-interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit. [210.12(A)(2)]
3. A listed supplemental arc-protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit-interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
    3.1. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit-interrupter.
    3.2. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 50 feet (15.2 m) for 14 AWG conductors and 70 feet (21.3 m) for 12 AWG conductors.
    3.3. The first outlet box on the branch circuit shall be marked to indicate that it is the first outlet on the circuit. [210.12(A)(3)]
4. A listed outlet branch-circuit-type arc-fault circuit-interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:
    4.1. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit-interrupter.
    4.2. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 50 feet (15.2 m) for 14 AWG conductors and 70 feet (21.3 m) for 12 AWG conductors.
    4.3. The first outlet box on the branch circuit shall be marked to indicate that it is the first outlet on the circuit.
    4.4. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and shall be listed as such. [210.12(A)(4)]
5. Where metal outlet boxes and junction boxes and RMC, IMC, EMT, Type MC or steel-armored Type AC cables meeting the requirements of Section E3908.8, metal wireways or metal auxiliary gutters are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, a listed outlet branch-circuit type AFCI installed at the first outlet shall be considered as providing protection for the remaining portion of the branch circuit. [210.12(A)(5)]
6. Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 2 inches (50.8 mm) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, a listed outlet branch-circuit-type AFCI installed at the first outlet shall be considered as providing protection for the remaining portion of the branch circuit. [210.12(A)(6)]

**Exceptions : 1.** AFCI protection is not required for an individual branch circuit supplying only a fire alarm system where the branch circuit is wired with metal outlet and junction boxes and RMC, IMC, EMT or steel-sheathed armored cable Type AC or Type MC meeting the requirements of Section E3908.8.

**2. AFCI protection is not required where GFCI protection is required in accordance with E3902 and NEC 210.8(A)**

**Reason Statement:** This new Exception # 2 recognizes the need to protect VA citizens from electrical arcing faults resulting in fires while at the same time provides an incremental approach by eliminating certain areas from the AFCI requirements. Areas that would be exempt from AFCI protection include Laundry area receptacles, Garage receptacles, Bathroom receptacles, Wet Bar area receptacles, Unfinished basement receptacles, Kitchen receptacles as well as Outdoor and Crawlspace receptacles. This new Exception also provides relief from having to provide a more expensive "Dual Purpose" AFCI/GFCI breaker for these areas of the home. A typical 2000 sq. foot home would typically only require 2 or 3 more AFCI breakers(at 37.00 each) than the current code requires under this new Exception.

**Cost Impact:** The code change proposal will increase the cost of construction
The increased cost of 2-3 AFCI breakers at 37.00ea. is a small price to pay for protecting our citizens from electrical fires that start in branch circuit wiring and devices. These devices have proven their effectiveness via studies by the National Fire Protection Association, National Electrical Manufactures Association and many other reputable organizations.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

**Workgroup 3 - Proposed Committee Action:** Non-Consensus

**Workgroup 3 - Proposed Reason:**

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# Public Comments for: RTE3902.16(2)-18

**Discussion by Andrew Clark**
Aug 13, 2020 14:33 UTC

The Home Builders Association of Virginia supports this proposal to incrementally expand the utilization of AFCI devices in new homes. This proposal received unanimous support during the workgroup meetings.

Proposal # 182

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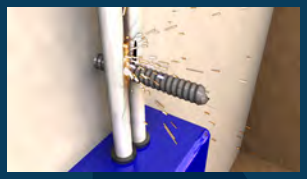
# ARC-FAULT CIRCUIT INTERRUPTERS (AFCIs)

# PREVENT ELECTRICAL FIRES

## What is an Arc-Fault?

An arc-fault is a dangerous electrical problem **caused by damaged, overheated, or stressed electrical wiring or devices**. Arc-faults can occur when older wires become frayed or cracked, when a nail or screw damages a wire behind a wall, or when outlets or circuits are compromised.

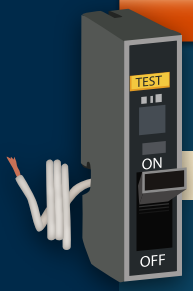





## Why do I need Arc-Fault Protection?

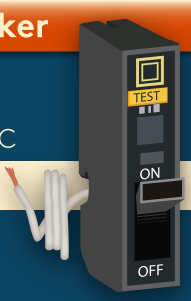
The National Fire Protection Association reported **47,700 home fires** involved some type of electrical failure or malfunction in 2011. The Consumer Product Safety Commission estimates **more than 50% of electrical fires that occur every year can be prevented by Arc-Fault Circuit Interrupters (AFCIs)**.

## Arc-Fault Circuit Interrupters are available as:



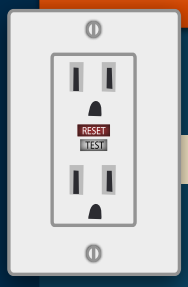

### Branch/Feeder AFCI Breaker

- First generation AFCI breaker protection. AFCI protection originally required by the 1999 NEC
- Moderate fire prevention
- Trips when a parallel arc between hot and neutral conductors is detected




### Combination Type AFCI Breaker

- Branch/Feeder AFCI breakers were phased out as of January 2008 and replaced with Combination Type AFCIs
- Enhanced fire protection
- Provides the **same protection as Branch/Feeder AFCIs and detects lower level series arcing** in both branch circuits and power cords




### AFCI Receptacle

- Provides protection from arc-faults beyond branch circuit wiring extending to appliances and cords plugged into the receptacle
- Enhanced Fire Protection
- Protects all downstream wire and appliances from both parallel and series arcs, and also protects from series arcs upstream in the wiring between the source of the circuit and the first outlet on the circuit.

AFCI breakers and receptacles should be tested **monthly**.

All electrical systems should have an electrical inspection if the home is older than **40 years** or has had a major addition, renovation, or large appliance added.

AFCIs should be installed by a **qualified electrician**.

**Parallel Arc:**
Arc between **hot and neutral conductor** or between the **hot and ground conductor**





**Series Arc:**
Arc along the **same conductor** or at **connections**

**MAY IS NATIONAL ELECTRICAL SAFETY MONTH**

ESFI.org www.facebook.com/ESFI.org www.twitter.com/ESFIdotorg www.youtube.com/ESFIdotorg

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# T2701.1.1(2)-18

**Proponents:** Haywood Kines (hkines@pwcgov.org)

## 2015 Virginia Construction Code

**Add new text as follows:**

**2701.1.1 Changes to NFPA 70.** The following changes shall be made to NFPA 70:

1. Change Sections 334.10(2) and 334.10(3) of NFPA 70 to read:
   (2) Multifamily dwellings not exceeding four floors above grade and multifamily dwellings of any height permitted to be of Types III, IV and V *construction* except in any case as prohibited in 334.12.

   (3) Other structures not exceeding four floors above grade and other structures of any height permitted to be of Types III, IV and V *construction* except in any case as prohibited in 334.12. In structures exceeding four floors above grade, cables shall be concealed within walls, floors or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

   For the purpose of Items 2 and 3 above, the first floor of a *building* shall be that floor that has 50 percent or more of the exterior wall surface area level with or above finished grade. One additional level that is the first level and not designed for human habitation and used only for vehicle parking, storage or similar use shall be permitted.

2. Change Section 700.12(F)(2)(6) of NFPA 70 to read:
   (6) Where the normal power branch circuits that supply luminaries providing illumination immediately on the inside and outside of exit doors are supplied by the same service or feeder, the remote heads providing emergency illumination for the exterior of an exit door shall be permitted to be supplied by the unit *equipment* serving the area immediately inside the exit door.

3. Change Article 555 of NFPA 70 2017 Edition to NFPA 70 2020 Edition for all code requirements related to Marinas, Boatyards, and Commercial and Noncommercial Docking Facilities.

**Reason Statement:** This proposal will include the changes and new sections that was added in the 2017 NEC Edition as well as adding four new Articles ( 242, 311, 337, & 800) in the 2020 NEC. This will also provide additional protection for Docks and Marinas covered in the 2020 NEC Article 555. With technology changing every day and new equipment and electrical systems available we need to stay current on the latest edition of the Electrical Code.

**Cost Impact:** The code change proposal will decrease the cost of construction
This change will allow wiring methods and equipment that will lower cost of labor and materials for both residential and commercial. New Articles; Art. 337 "P" Cable for use in Hazardous locations, new equipment in Art. 590 for PV systems, Changes in Art. 555, at Docks for protection, etc. This Change will help keep Virginia current with national Standards and products currently available for construction.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will allow for new wiring methods and equipment not permitted in the current 2014 NEC and going to the 2020 NEC will include 4 new articles not covered in the 2017 NEC. We are currently two code cycles behind on the National Electrical Code and products that are available will not be in the 2018 VUSBC if this change is not adopted.

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: T2701.1.1(2)-18

**Discussion by Haywood Kines**
Jul 10, 2020 15:20 UTC

3. Change Article 555 of NFPA 70 2017 Edition to NFPA 70 2020 Edition for all Code requirements related to Marinas, Boatyards, and Commercial andNoncommercial Docking Facilities.

This change is intended to address discussion and comments at Work Group meeting as a replace of previous proposal for adopting the entire

edition of the NFPA 2020 NEC .

Proposal # 466

## T2701.1.1 New #3

**3.** Change Article 555 of NFPA 70 2017 Edition to NFPA 70 2020 Edition for all Code requirements related to **Marinas, Boatyards, and Commercial and Noncommercial Docking Facilities.**

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# TM403.3.1.1-18

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

## 2015 Virginia Mechanical Code

**Revise as follows:**

**TABLE 403.3.1.1**
**MINIMUM VENTILATION RATES**

| | OCCUPANCY CLASSIFICATION | OCCUPANT DENSITY #/1000 FT$^{2}$ [a] | PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_p$ CFM/PERSON | AREA OUTDOOR AIRFLOW RATE INBREATHING ZONE, $R_a$ CFM/FT$^{2}$ [a] | EXHAUST AIRFLOW RATE CFM/FT$^{2}$ [a] |
|---|---|---|---|---|---|
| | **Offices** | | | | |
| | Conference rooms | 50 | 5 | 0.06 | — |
| | Main entry lobbies | 10 | 5 | 0.06 | — |
| | Office spaces | 5 | 5 | 0.06 | — |
| | Reception areas | 30 | 5 | 0.06 | — |
| | Telephone/data entry | 60 | 5 | 0.06 | — |
| | Medical procedure rooms[i] | 20 | 15 | — | — |
| | Patient rooms[i] | 10 | 25 | — | — |
| | Physical therapy rooms[i] | 20 | 15 | — | — |

For SI: 1 cubic foot per minute = 0.0004719 $m^3/s$, 1 ton = 908 kg, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$, °C = [(°F) -32]/1.8, 1 square foot = 0.0929 $m^2$.

a. Based upon *net occupiable floor area.*

b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Item 3).

c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.

d. Ventilation systems in enclosed parking garages shall comply with Section 404.

e. Rates are per water closet or urinal. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted only where the exhaust system is designed to operate continuously while occupied.

g. Mechanical exhaust is required and recirculation from such spaces is prohibited except that recirculation shall be permitted where the resulting supply airstream consists of not more than 10 percent air recirculated from these spaces. Recirculation of air that is contained completely within such spaces shall not be prohibited (see Section 403.2.1, Items 2 and 4).

h. For nail salons, each manicure and pedicure station shall be provided with a *source capture system* capable of exhausting not less than 50 cfm per station. Exhaust inlets shall be located in accordance with Section 502.20. Where one or more required source capture systems operate continuously during occupancy, the exhaust rate from such systems shall be permitted to be applied to the exhaust flow rate required by Table 403.3.1.1 for the nail salon.

i. For spaces that are not located in an *ambulatory care facility* or *clinic, outpatient* as defined in Chapter 2 of the VCC.

**Reason Statement:** Based on a review of the USBC code change proposals to edit definitions of *ambulatory care facility* and *clinic, outpatient*, the intent of which was to prevent classification of all dental and doctor's offices as ambulatory care facilities or outpatient clinics (see attached CB-202-15), this proposal falls in line with that reasoning by providing ventilation requirements for these facilities rather than send them to ASHRAE 170 as prescribed by VMC Section 407. These occupancy classifications and ventilation rates - medical procedure, patient and physical therapy rooms - were extracted from the 2012 VMC prior to ASHRAE 170 implementation.

**Cost Impact:** The code change proposal will decrease the cost of construction
This should decrease the cost of construction as these facilities would no longer be required to comply with the more rigorous requirements of ASHRAE 170.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TM403.3.1.1-18

This proposal doesn't have any public comments.

Proposal # 368

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# Attachment - CB-202 cdpVA-15

**Proponent :** Ronald Clements, Jr (clementsro@chesterfield.gov)

## 2012 Virginia Construction Code

### SECTION 202 DEFINITIONS

**AMBULATORY HEALTH CARE FACILITY.**
Buildings or portions thereof used to provide *medical care* on less than a 24-hour basis that are licensed by the Virginia Department of Health as outpatient surgical hospitals.

**CLINIC, OUTPATIENT.**
*Buildings* or portions thereof used to provide *medical care* on less than a 24-hour basis ~~to persons who~~ that are not ~~rendered *incapable of self-preservation*~~licensed by the ~~services provided.~~
Virginia Department of Health as outpatient surgical hospitals.

**Reason:** The IBC was amended to address medical care facilities that care for patients for less than 24 hours as group B occupancies. A distinction was made between facilities that render the patients incapable of self-preservation (Ambulatory Health Care Facility) and those where patients are not rendered incapable of self-preservation (Outpatient Clinic). Though both defined types of facilities are group B occupancies, ambulatory health care facilities require additional fire safety features. The two definitions are intended to be companion definitions in the IBC with the distinction being whether or not patients are rendered incapable of self-preservation.
As part of the 2012 USBC code update the definition of ambulatory care facility was changed to:

*Ambulatory Health Care Facility . Buildings or portions thereof that are licensed by the Virginia Department of Health as outpatient surgical hospitals.*

Based on review of the USBC code change proposals, the intent of the change from the IBC distinction was to prevent classification of dental and doctor's offices as ambulatory health care facilities. For example, under the IBC if an oral surgeon puts one patient at a time under sedation on the second floor of a 2 story office building then the building must be sprinklered.

The problem caused was the definition of outpatient clinic was not changed to have the same distinction so the definitions are no longer companions and have different distinctions. One is based on the type of licensed issued and the other is based on self-preservation capability. This code change will coordinate the two definitions based on the Virginia distinction based on VHD licensure.

**Cost Impact:** There is no cost impact this is making two related definitions consistent.

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## Workgroup Recommendation

**Workgroup 2 Recommendation Recommendation:** Consensus for Approval

**Workgroup 2 Reason:** Ron is trying to cleanup the two definitions, Emory stated Ron's change is consistent with the boards action that they did not want doctors and dentist offices included in this category.

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# TM504.10-18

**Proponents:** DHCD Staff

## 2018 International Mechanical Code

**504.10 Common exhaust systems for clothes dryers located in multistory structures.** Where a common multistory duct system is designed and installed to convey exhaust from multiple clothes dryers, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the International Building Code .
2. Dampers shall be prohibited in the exhaust duct. Penetrations of the shaft and ductwork shall be protected in accordance with Section 607.5.5, Exception ~~2~~ 1.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage) and in accordance with SMACNA *Duct Construction Standards*.
4. The ductwork within the shaft shall be designed and installed without offsets.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a standby power source.
8. Exhaust fan operation shall be monitored in an *approved* location and shall initiate an audible or visual signal when the fan is not in operation.
9. Makeup air shall be provided for the exhaust system.
10. A cleanout opening shall be located at the base of the shaft to provide *access* to the duct to allow for cleaning and inspection. The finished opening shall be not less than 12 inches by 12 inches (305 mm by 305 mm).
11. Screens shall not be installed at the termination.
12. The common multistory duct system shall serve only clothes dryers and shall be independent of other exhaust systems.

**Reason Statement:** This is an editorial change to fix a broken reference. 504.10 references 607.5.5, which was revised by a state amendment and exception 2 was changed and moved to exception 1.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This is only an editorial change and will have no effect on the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This is only an editorial change and will have no effect on resiliency.

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TM504.10-18

This proposal doesn't have any public comments.

Proposal # 345

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# TM505.5-18

**Proponents:** Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov); Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

## 2018 International Mechanical Code

**Revise as follows:**

**505.5 Common exhaust systems for domestic kitchens located in multistory structures.** Where a common multistory duct system is designed and installed to convey exhaust from multiple domestic kitchen exhaust systems, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the *International Building Code*.
2. ~~Dampers shall be prohibited in the exhaust duct, except as specified in Section 505.3.~~ Penetrations of the shaft and ductwork shall be protected in accordance with Section 607.5.5~~, Exception 2~~.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage) and in accordance with SMACNA *Duct Construction Standards*.
4. The ductwork within the shaft shall be designed and installed without offsets.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a standby power source.
8. Exhaust fan operation shall be monitored in an approved location and shall initiate an audible or visual signal when the fan is not in operation.
9. Where the exhaust rate for an individual kitchen exceeds 400 cfm (0.19 $m^3/s$) makeup air shall be provided in accordance with Section 505.4.
10. A cleanout opening shall be located at the base of the shaft to provide access to the duct to allow for cleanout and inspection. The finished openings shall be not less than 12 inches by 12 inches (305 mm by 305 mm).
11. Screens shall not be installed at the termination.
12. The common multistory duct system shall serve only kitchen exhaust and shall be independent of other exhaust systems.

**Reason Statement:** IMC 505.5 was added to the IMC in 2015 (VMC 505.3). This was a copy-and-paste job from 504.10 (clothes dryer exhaust) that wasn't completely applicable to domestic kitchen exhaust systems. Dampers are prohibited in a clothes dryer exhaust duct per IMC 504.2, so logic requires that dampers are prohibited in the common dryer exhaust duct. Section 505 does not prohibit dampers from being installed in a single domestic kitchen exhaust duct, so logic would not prohibit this in the common domestic kitchen exhaust duct. IMC 607.6.2 requires individual domestic kitchen exhaust ducts (routed to the common exhaust system) that penetrates the rated ceiling membrane to have a ceiling radiation damper installed. Dampers are permitted in domestic kitchen exhaust duct. This change will direct you to IMC 607.5.5 which provides provisions on how to protect ductwork and penetrations into a shaft, which includes the use of a fire damper.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TM505.5-18

This proposal doesn't have any public comments.

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# RTP608.15-18

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

## 2018 International Plumbing Code

**Revise as follows:**

**608.15 Location of backflow preventers.** *Access* for inspection, testing, service, repair and replacement shall be provided to backflow ~~preventers~~ prevention assemblies. Backflow prevention assemblies shall be installed between 12 inches (305 mm) and 60 inches (1525 mm) from grade, floor level or service platform and as specified by the manufacturer's instructions. Where the manufacturer's listed installation height conflicts with this requirement, the manufacturer's listed heights shall apply *Access* shall be provided to backflow prevention devices and as specified by the manufacturer's instructions.

## 2018 International Residential Code

**Revise as follows:**

**P2902.6 Location of backflow preventers.** *Access* for inspection, testing, service, repair and replacement shall be provided to backflow ~~preventers~~ prevention assemblies. Backflow prevention assemblies shall be installed between 12 inches (305 mm) and 60 inches (1525 mm) from grade, floor level or service platform and as specified by the ~~manufacturer's installation~~ manufacturer's instructions. Where the manufacturer's listed installation height conflicts with this requirement, the manufacturer's listed heights shall apply. *Access* shall be provided to backflow prevention devices and as specified by the manufacturer's instructions.

**Reason Statement:** As is necessary with many appliances, control devices and other equipment, backflow prevention assemblies and devices require inspection, testing, service, repair and replacement. Currently, there are provisions in the I codes to provide access to appliances, control devices and other equipment for inspection, service, repair and replacement. This proposal looks to provide similar provisions for backflow preventers. "Testing" has been included to align with VPC 312.10 and VRC P2503.8 requirements. It is important to address access for backflow prevention assemblies and devices at the new installation stage to ensure proper access is provided for future inspection, testing, service, repair and replacement.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: RTP608.15-18

This proposal doesn't have any public comments.

Proposal # 397

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# RTP2801.6-18

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

## 2018 International Residential Code

**Revise as follows:**

**P2801.6 Required pan.** Where a storage tank-type water heater or a hot water storage tank is installed in a location where water leakage from the tank will cause damage, the tank shall be installed in a pan constructed of one of the following:

1. Galvanized steel or aluminum of not less than 0.0236 inch (0.6010 mm) in thickness.
2. Plastic not less than 0.036 inch (0.9 mm) in thickness.
3. Other *approved* materials.

A plastic pan shall not be installed beneath a gas-fired water ~~heater shall be constructed of material having a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723.~~ heater.

**Reason Statement:** This proposed change attempts to continue the practice of prohibiting plastic pans from being installed beneath gas-fired water heaters in R5 structures. The proposed language is a continuance to the current language in the 2015 VRC. The current 2015 VPC (used for all other residential structures) provides options for a galvanized steel pan or other pans *approved* for such use. This language has changed in the 2018 IPC to the same language being proposed here, and continues with that same language into the 2021 IPC. Water heater manufacturers are split with their recommendations for pans. Some recommend a metal pan and some a "suitable" pan without actually defining the term "suitable." This inconsistency creates difficulties for contractors when a pan must be replaced after an inspection reveals that the water heater manufacturer recommends a metal pan. The ability for a building official to accept an alternate pan, or "other *approved* materials," remains a viable option for those who choose to consider such through USBC 112.2.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
However, this code change proposal could prevent a pan replacement (increasing the cost of construction) with the knowledge that all plastic pans were prohibited beneath all gas-fired water heaters.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Consensus Approval

**Workgroup 3 - Final Reason:**

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# Public Comments for: RTP2801.6-18

This proposal doesn't have any public comments.

Proposal # 376

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# TP403.3.3-18

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov); Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov)

## 2018 International Building Code

**Revise as follows:**

**[P] 2902.3.3 Location of toilet facilities in occupancies other than malls.** In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one *story* above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

~~**Exception:**~~ **Exceptions:**

1. The location and maximum distances of travel to required employee facilities in factory and industrial occupancies are permitted to exceed that required by this section, provided that the location and maximum distance of travel are *approved*.

2. The location and maximum distances of travel to the required public facilities located on cemetery property are permitted to exceed that required by this section, provided that the location and maximum travel distance are located on the same property and approved.

3. The location and maximum distances of travel to required public and employee facilities in Group S occupancies are permitted to exceed that required by this section, provided that the location and maximum distance of travel are *approved* .

## 2015 Virginia Plumbing Code

**Revise as follows:**

**403.3.3 Location of toilet facilities in occupancies other than malls.** In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

**Exceptions:**

1. The location and maximum distances of travel to required employee facilities in factory and industrial occupancies are permitted to exceed that required by this section, provided that the location and maximum travel distance are approved.
2. The location and maximum distances of travel to the required public facilities located on cemetery property are permitted to exceed that required by this section, provided that the location and maximum travel distance are located on the same property and approved.
3. The location and maximum distances of travel to required public and employee facilities in Group S occupancies are permitted to exceed that required by this section, provided that the location and maximum distance of travel are approved.

**Reason Statement:** First, a note about the VCC proposed change. Exception 2 was introduced as a Virginia change into the 2012 VPC, however the exception did not transfer into the VCC, though it should have. These two code sections (VCC/VPC) should be identical. I've added exception 2 to the VCC portion of this proposal to provide clarity, and have also requested that DHCD submit an administrative proposal to add exception 2 to the VCC should this proposal, in its entirety, not receive consensus.
The exception 3 proposed language is taken directly from the 2021 code language. Exception 3 will permit a code official to increase the number of floors in between restrooms in a multi-level self-storage facility. The current requirement is every other floor. This proposal will permit the code official to consider restrooms locations that may exceed every other floor. An example where this may be utilized is in a 4 or 5 story self-storage business, where instead of 2 clusters of restrooms being required, there would only need to be one. Due to the low occupancy density in Group S facilities, and the fact that the amount of time an occupant typically spends in a Group S space is limited, it is appropriate to allow the code official to reduce the location requirement. Having the language “the location and maximum distance of travel are approved” allows the code official to verify, for example, that the toilet facilities are readily accessible to all occupants even if a facility offers 24-hour access to their storage space. In this case, the toilet facilities must be located where occupants will also have 24-hour access.

**Cost Impact:** The code change proposal will decrease the cost of construction
The proposed change will likely decrease construction costs where two separately located toilet facilities may be combined into one location.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TP403.3.3-18

This proposal doesn't have any public comments.

Proposal # 420

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# TP1209.3.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2018 International Building Code

**Revise as follows:**

**1109.2 Toilet and bathing facilities.** Each toilet room and bathing room shall be *accessible*. Where a floor level is not required to be connected by an *accessible route*, the only toilet rooms or bathing rooms provided within the facility shall not be located on the inaccessible floor. Except as provided for in Sections 1109.2.2 ~~and 1109.2.3~~ through 1109.2.4, at least one of each type of fixture, element, control or dispenser in each accessible toilet room and bathing room shall be *accessible*.

**Exceptions:**

1. Toilet rooms or bathing rooms accessed only through a private office, not for *common* or *public use* and intended for use by a single occupant, shall be permitted to comply with the specific exceptions in ICC A117.1.
2. This section is not applicable to toilet and bathing rooms that serve *dwelling units* or *sleeping units* that are not required to be *accessible* by Section 1107.
3. Where multiple single-user toilet rooms or bathing rooms are clustered at a single location, at least 50 percent but not less than one room for each use at each cluster shall be *accessible*.
4. Where no more than one urinal is provided in a toilet room or bathing room, the urinal is not required to be *accessible*.
5. Toilet rooms or bathing rooms that are part of critical care or intensive care patient sleeping rooms serving *Accessible units* are not required to be *accessible*.
6. Toilet rooms or bathing rooms designed for bariatrics patients are not required to comply with the toilet room and bathing room requirement in ICC A117.1. The *sleeping units* served by bariatrics toilet or bathing rooms shall not count toward the required number of *Accessible sleeping units*.
7. Where toilet facilities are primarily for children's use, required *accessible* water closets, toilet compartments and lavatories shall be permitted to comply with children's provision of ICC A117.1.

**1109.2.4 Multi-user gender-neutral toilet facility fixtures.** Where multi-user facilities are provided to serve all genders, at least two of each fixture type, but only one urinal if more than one urinal is provided, shall comply with ICC A117.1. Water closet and urinal compartments shall comply with Section 1209.3.

**[P] 1209.3 Privacy.** Privacy at water closets and urinals shall be provided in accordance with Sections 1209.3.1 and 1209.3.2.

**[P] 1209.3.1 Water closet compartment.** Each water ~~closet utilized~~ closet utilized by the public or employees ~~shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.~~

~~**Exceptions:**~~

~~1. Water closet compartments~~
shall comply with Sections 1209.3.1.1 and 1209.3.1.2, as applicable. All fully-enclosed compartments shall be provided with occupancy indicators.

**Exceptions:**

1. A separate room or compartment shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

**1209.3.1.1 Separate facilities.** Each water closet provided in separate facilities shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy and shall comply with Section 405.3.1 of the VPC. Accessible water closets and compartments shall comply with ICC A117.1.

**1209.3.1.2 Multi-user gender-neutral facilities.** Each water closet provided in a multi-user gender-neutral toilet facility shall occupy a separate compartment with walls or partitions including the doors thereto, which shall extend to the floor and to the ceiling with maximum 1/2-inch (13 mm) clearances at the floor and ceiling, with gaps not exceeding 1/8-inch (3 mm) between the doors and partitions and partitions and walls, and shall

comply with Section 405.3.1 of the VPC. Accessible water closet compartments shall comply with ICC A117.1 and the increased toe clearance requirements

**[P] 1209.3.2 Urinal separation and partitions.** Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide ~~privacy. The walls or partitions shall begin at a height not more than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.~~ privacy, and with Sections 1209.3.1.1 and 1209.3.1.2, as applicable. All fully-enclosed compartments shall be provided with occupy indicators.

**Exceptions:**

1. Urinal partitions shall not be required in a single-occupant or family or assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.

3. A separate room or compartment shall not be required in a single-occupant toilet room with a lockable door.

4. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

**1209.3.2.1 Separate facilities.** The walls or partitions for urinals in separate facilities shall begin at a height not more than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

**1209.3.2.2 Multi-user gender-neutral facilities.** Each urinal provided in a multi-user gender-neutral toilet facility shall occupy a separate compartment with walls or partitions, including the doors thereto, where the partitions extend to the floor and to the ceiling with maximum 1/2-inch (13 mm) clearances, with gaps not exceeding 1/8-inch (3 mm) between the doors and partitions and partitions and walls, or shall all be located in a separate room with a door, enclosing the urinals to ensure privacy. Where an accessible urinal is located within a compartment, grab bars shall not be required for the urinal, the door shall be located to allow for a forward approach to the urinal, and increased toe clearances shall be provided in accordance with A117.1.

**[P] 2902.1 Minimum number of fixtures.** Plumbing fixtures shall be provided in the minimum number as shown in Table 2902.1 based on the actual use of the building or space. Uses not shown in Table 2902.1 shall be considered individually by the code official. The number of occupants shall be determined by this code.

**Revise as follows:**

**[P] TABLE 2902.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 2902.1.1 and 2902.2)

| No. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS SEE SECTION 2902.1.4 ~~424.2 OF THE INTERNATIONAL PLUMBING CODE~~) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAINS ~~(SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE)~~ | OTHER |
|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Male | Female | | | |
| 1 | Assembly | Theaters and other buildings for the performing arts and motion pictures[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | 1 per 85.5[g] | | | | | | |
| | | Nightclubs, bars, taverns, dance halls and buildings for similar purposes[d] | 1 per 40 | 1 per 40 | 1 per 75 | | — | 1 per 500 | 1 service sink |
| | | Restaurants, banquet halls and food courts[d] | 1 per 75 | 1 per 75 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Casino gaming areas | 1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400 | 1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400 | 1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750 | | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 66.67 for the first 800 and 1 per 187.5 for the remainder exceeding 800[g] | | | | | | |
| | | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | 1 per 85.5[g] | | | | | | |
| | | Passenger terminals and transportation facilities[d] | 1 per 500 | 1 per 500 | 1 per 750 | | — | 1 per 1,000 | 1 service sink |
| | | Places of worship and other religious services[d] | 1 per 150 | 1 per 75 | 1 per 200 | | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 100[g] | | | | | | |
| | | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 52.2 for the first 3,025 and 1 per 80 for the remainder exceeding 3,025[g] | | 1 per 171.4[g] | | | | |
| | | Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities[f] | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 52.2 for the first 3,025 and 1 per 80 for the remainder exceeding 3,025[g] | | 1 per 171.4[g] | | | | |

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code.

b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted, provided that each patient sleeping unit has direct access to the toilet room and provisions for privacy for the toilet room user are provided.

d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e. For business and mercantile classifications with an occupant load of 15 or fewer, a service sink shall not be required.

f. The required number and type of plumbing fixtures for outdoor swimming pools shall be in accordance with Section 609 of the International Swimming Pool and Spa Code.

g. Use this fixture ratio for determining the minimum number of fixtures for multi-user gender-neutral toilet facilities.

**[P] 2902.1.1 Fixture calculations.** To determine the *occupant load* of each sex, the total *occupant load* shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the *occupant load* of each sex in accordance with Table 2902.1. Fractional numbers resulting from applying the fixture ratios of Table 2902.1 shall be rounded up to the next whole number. For calculations involving multiple occupancies, such fractional numbers for each occupancy shall first be summed and then rounded up to the next whole number.

**~~Exception~~ Exceptions:**

1. The total *occupant load* shall not be required to be divided in half where *approved* statistical data indicate a distribution of the sexes of other than 50 percent of each sex.

2. Where multi-user facilities are designed to serve all genders, the minimum fixture count shall be calculated 100 percent, based on the total occupant load.

3. The total occupant load shall not be required to be divided in half where single-user water closets and bathing room fixtures are provided in accordance with Section 2902.1.2.3.

**[P] 2902.1.2 Single-user toilet ~~facility~~ and bathing room fixtures.** The plumbing fixtures located in single-user toilet ~~facilities~~ and bathing rooms, including family or assisted-use toilet and bathing rooms that are required by Section 1109.2, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet ~~facilities~~ and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified as being available for use by ~~either sex.~~ all persons regardless of their sex. The total number of fixtures shall be permitted to be based on the required number of separate facilities or based on the aggregate of any combination of single-user or separate facilities.

**[P] 2902.1.3 Lavatory distribution.** Where two or more toilet rooms are provided for each sex, the required number of lavatories shall be distributed proportionately to the required number of water closets.

**Revise as follows:**

**2902.1.5 Substitution for drinking fountains.** Where restaurants provide drinking water in a container free of charge, drinking fountains shall not be required in those restaurants. In other occupancies where drinking fountains are required, water dispensers shall be permitted to be substituted for not more than 50 percent of the required number of drinking fountains.

**2902.1.4 Substitution for water closets.** In each bathroom or toilet room, urinals shall not be substituted for more than 67 percent of the required number of male water closets in assembly and educational occupancies. Urinals shall not be substituted for more than 50 percent of the required number of male water closets in all other occupancies.

**Exception** : In each multi-user gender-neutral bathroom or toilet room, urinals shall not be substituted for more than 22.5 percent of the total number of water closets in assembly and educational occupancies. Urinals shall not be substituted for more than 25 percent of the total number of water closets in all other occupancies.

**[P] 2902.2 Separate facilities.** Where plumbing fixtures are required, separate facilities shall be provided for each sex.

**Exceptions:**

1. Separate facilities shall not be required for *dwelling units* and *sleeping units*.
2. Separate facilities shall not be required in structures or tenant spaces with a total *occupant load*, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile occupancies in which the maximum occupant load is 100 or fewer.

4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.

5. Separate facilities shall not be required to be designated by sex where single-user toilet rooms are provided in accordance with Section 2902.1.2.

6. Separate facilities shall not be required where multi-user gender-neutral facilities are provided in accordance with Sections 1109.2.4 and 1209.3.

**[P] 2902.2.1 Family or assisted-use toilet facilities serving as separate facilities.** Where a building or tenant space requires a separate toilet facility for each sex and each toilet facility is required to have only one water closet, two family or assisted-use toilet facilities shall be permitted to serve as the required separate facilities. Family or assisted-use toilet facilities shall not be required to be identified for exclusive use by either sex as required by Section 2902.4.

## 2018 International Plumbing Code

**Revise as follows:**

### 2018 International Plumbing Code

**403.1 Minimum number of fixtures.** Plumbing fixtures shall be provided in the minimum number as shown in Table 403.1, based on the actual use of the building or space. Uses not shown in Table 403.1 shall be considered individually by the code official. The number of occupants shall be determined by the *International Building Code*.

**Revise as follows:**

**TABLE 403.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 403.1.1 and 403.2)

| NO. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS: SEE SECTION 424.2) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAIN (SEE SECTION 410) | OTHER |
|---|---|---|---|---|---|---|---|---|---|
| | | | MALE | FEMALE | MALE | FEMALE | | | |
| 1 | Assembly | Theaters and other buildings for the performing arts and motion pictures[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | 1 per 85.5[g] | | | | | | |
| | | Nightclubs, bars, taverns, dance halls and buildings for similar purposes[d] | 1 per 40 | 1 per 40 | 1 per 75 | | — | 1 per 500 | 1 service sink |
| | | Restaurants, banquet halls and food courts[d] | 1 per 75 | 1 per 75 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Gaming areas | 1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400 | 1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400 | 1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750 | | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 66.67 for the first 800 and 1 per 187.5 for the remainder exceeding 800[g] | | | | | | |
| | | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | 1 per 85.5[g] | | | | | | |
| | | Passenger terminals and transportation facilities[d] | 1 per 500 | 1 per 500 | 1 per 750 | | — | 1 per 1,000 | 1 service sink |
| | | Places of worship and other religious services[d] | 1 per 150 | 1 per 75 | 1 per 200 | | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 100[g] | | | | | | |
| | | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 52.2 for the first 3,025 and 1 per 80 for the remainder exceeding 3, 025[g] | | 1 per 171.4[g] | | | | |
| | | Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities[f] | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | | 1 per 52.2 for the first 3,025 and 1 per 80 for the remainder exceeding 3,025[g] | | 1 per 171.4[g] | | | | |

a.The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by the *International Building Code*.

b.Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c.A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted provided that each patient sleeping unit has direct access to the toilet room and provision for privacy for the toilet room user is provided.

d.The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e.For business and mercantile classifications with an occupant load of 15 or fewer, service sinks shall not be required.

f.The required number and type of plumbing fixtures for outdoor public swimming pools shall be in accordance with Section 609 of the International Swimming Pool and Spa Code.

g. Use this fixture ratio for determining the minimum number of fixtures for multi-user gender-neutral toilet facilities.

**403.1.1 Fixture calculations.** To determine the occupant load of each sex, the total occupant load shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the occupant load of each sex in accordance with Table 403.1. Fractional numbers resulting from applying the fixture ratios of Table 403.1 shall be rounded up to the next whole number. For calculations involving multiple *occupancies*, such fractional numbers for each *occupancy* shall first be summed and then rounded up to the next whole number.

**~~Exception~~ Exceptions:**

1. The total occupant load shall not be required to be divided in half where *approved* statistical data indicates a distribution of the sexes of other than 50 percent of each sex.

2. Where multi-user facilities are designed to serve all genders, the minimum fixture count shall be calculated 100 percent, based on the total occupant load

3. The total occupant load shall not be required to be divided in half with a distribution of sexes where singer-user water closets and bathing room fixtures are provided in accordance with Section 403.1.2.3.

**403.1.2 Single-user toilet facility and bathing room fixtures.** The plumbing fixtures located in single-user toilet ~~facilities~~ and bathing rooms, including family or ~~assisteduse~~ assisted use toilet and bathing rooms that are required by Section 1109.2.1 of the International Building Code, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet ~~facilities~~ and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified as being available for use by ~~either sex.~~ all persons regardless of their sex. The total number of fixtures shall be permitted to be based on the required number of separate facilities or based on the aggregate of any combination of single-user or separate facilities.

**405.3.1 Water closets, urinals, lavatories and bidets.** A water closet, urinal, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition, vanity or other obstruction. Where partitions or other obstructions do not separate adjacent fixtures, fixtures shall not be set closer than 30 inches (762 mm) center to center between adjacent fixtures. There shall be not less than a 21-inch (533 mm) clearance in front of a water closet, urinal, lavatory or bidet to any wall, fixture or door. Water closet compartments shall be not less than 30 inches (762 mm) in width and not less than 60 inches (1524 mm) in depth for floor-mounted water closets and not less than 30 inches (762 mm) in width and 56 inches (1422 mm) in depth for wall-hung water closets.

**Exception:** An accessible children's water closet shall be set not closer than 12 inches (305 mm) from its center to the required partition or to the wall on one side.

**403.1.3 Lavatory distribution.** Where two or more toilet rooms are provided for each sex, the required number of lavatories shall be distributed proportionately to the required number of water closets.

**403.2 Separate facilities.** Where plumbing fixtures are required, separate facilities shall be provided for each sex.

**Exceptions:**

1. Separate facilities shall not be required for dwelling units and sleeping units.
2. Separate facilities shall not be required in structures or tenant spaces with a total occupant load, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile *occupancies* in which the maximum occupant load is 100 or fewer.
4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.

5. Separate facilities shall not be required to be designated by sex where single-user toilet rooms are provided in accordance with Section 403.1.2.

6. Separate facilities shall not be required where multi-user gender-neutral facilities are provided in accordance with Section 405.3 and Section

1109.2.4 of the VCC.

**403.2.1 Family or assisted-use toilet facilities serving as separate facilities.** Where a building or tenant space requires a separate toilet facility for each sex and each toilet facility is required to have only one water closet, two family or assisted-use toilet facilities shall be permitted to serve as the required separate facilities. Family or assisted-use toilet facilities shall not be required to be identified for exclusive use by either sex as required by Section 403.4.

**Revise as follows:**

**405.3.4 Water closet compartment.** Each water closet utilized by the *public* or employees shall ~~occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.~~ comply with Sections 405.3.4.1 and 405.3.4.2, as applicable. All fully-enclosed compartments shall be provided with occupancy indicators.

**Exceptions:**

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 housing areas.

**405.3.4.1 Separate facilities.** Each water closet provided in separate facilities shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy and shall comply with Section 405.3.1. Accessible water closets and compartments shall comply with ICC A117.1.

**405.3.4.2 Multi-user gender-neutral facilities.** Each water closet provided in a multi-user gender-neutral toilet facility shall occupy a separate compartment with walls or partitions including the doors thereto, which shall extend to the floor and to the ceiling with maximum 1/2-inch (13 mm) clearances at the floor and ceiling, with gaps not exceeding 1/8-inch (3 mm) between the doors and partitions and partitions and walls, and shall comply with Section 405.3.1. Accessible water closet compartments shall comply with ICC A117.1 and the increased toe clearance requirements.

**405.3.5 Urinal separation and partitions.** Each ~~urinal utilized~~ urinal utilized by the *public* or employees shall occupy a separate area with walls or partitions to provide privacy. The horizontal dimension between walls or partitions at each urinal shall be not less than 30 inches (762 mm). The walls or partitions shall begin at a height not greater than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is ~~greater.~~ greater. All fully-enclosed compartments shall be provided with occupancy indicators.

**Exceptions:**

1. Urinal partitions shall not be required in a singleoccupant or family/assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.

**405.3.5.1 Separate facilities.** The walls or partitions for urinals in separate facilities shall begin at a height not more than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

**405.3.5.2 Multi-user gender-neutral facilities.** Each urinal provided in a multi-user gender-neutral toilet facility shall occupy a separate compartment with walls or partitions, including the doors thereto, where the partitions extend to the floor and to the ceiling with maximum 1/2-inch (13 mm) clearances, with gaps not exceeding 1/8-inch (3 mm) between the doors and partitions and partitions and walls, or shall all be located in a separate room with a door, enclosing the urinals to ensure privacy. Where an accessible urinal is located within a compartment, grab bars shall not be required for the urinal, the door shall be located to allow for a forward approach to the urinal, and increased toe clearances shall be provided in accordance with A117.1.

**Exceptions** :

1. A separate room or compartment shall not be required in a single-occupant toilet room with a lockable door.

2. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

**424.2 Substitution for water closets.** In each bathroom or toilet room, urinals shall not be substituted for more than 67 percent of the required water closets in assembly and educational *occupancies*. Urinals shall not be substituted for more than 50 percent of the required water closets in all other *occupancies*.

**Exception** : In each multi-user gender-neutral bathroom or toilet room, urinals shall not be substituted for more than 22.5 percent of the total number of water closets in assembly and educational occupancies. Urinals shall not be substituted for more than 25 percent of the total number of water closets in all other occupancies.

**Reason Statement:** A growing number of owners/clients are requiring gender-neutral toilet facilities and with the recent Supreme Court decision, this may become the norm rather than the exception. Therefore, both designers and code officials need guidance on how to properly design, regulate, and enforce such toilet facilities. This subject was addressed at ICC during the 2021 code cycle with numerous code changes being submitted (e.g., P14-18 (AS), P15-18 (AM), and P16-18 (AS)) - all of which were approved in some fashion. This code change is a culmination of those proposals - **with further enhancements**, including addressing accessibility, urinal substitutions, and equivalency issues when basing the ratios on 100% of the occupants and the "math" implications that creates.
IBC 1109.2.4: Addresses accessibility requirements to avoid having just one (1) accessible fixture (water closet and lavatory) serving all genders - whereas, there would be at least one serving each gender in separate facilities (thus requiring at least two (2) total between them).

IBC 1209.3.1 / IPC 405.3.4: These were reformatted to more easily address the different requirements between *separate* and *multi-user gender-neutral* facilities - including adding a requirement for occupancy indicators when fully-enclosed, since you would not be able to "peek under" to see if such stall was occupied.

IBC 1209.3.1.1 / IPC 405.3.4.1

: Text from IBC 1209.3.1 / IPC 405.3.4 was relocated here - and a pointer for compliance with accessibility was added.

IBC 1209.3.1.2 / IPC 405.3.4.2: This also addresses the gap requirements for such enclosures (top, bottom, and sides) was well as adds a reminder to increase the size of the compartment because you would no longer have "toe clearance" if fully enclosed.

IBC 1209.3.2 / IPC 405.3.5: Similar to what was done for toilet compartments, the same was done for urinals and their separation.

Tables IBC 2902.1 / IPC 403.1: In order to maintain equivalency between the total number of fixtures for separate facilities (doing the "math") and gender-neutral facilities, the ratios had to be adjusted for those 'A' classifications that already had different ratios between males and females (water closets and lavs). Footnote 'g' was added to ensure the proper ratio is used for multi-user gender-neutral facilities. Some examples: Using 1000 occupants, unless indicated otherwise:

**Separate (top) / Multi-User Gender-Neutral (bottom)**

| | | |
|---|---|---|
| Theaters – | 4 male WC / 8 female WC (12) | 4 male x .67 = 2 UR |
| | 12 WC | 12 total x .225 = 2 UR (actually equals 3, but cannot exceed 22.5%) |
| Casino - | 5 male WC / 9 female WC (14) | 5 male x .67 = 3 UR |
| | 15 WC | 15 total x .225 = 3 UR (cannot exceed 22.5%) |
| Auditorium - | 4 male WC / 8 female WC (12) | 4 male x .67 = 2 UR |
| | 12 WC | 12 total x .225 = 2 UR (cannot exceed 22.5%) |
| Worship - | 4 male WC / 7 female WC (11) | 4 male x .67 = 2 UR |
| | 10 WC | 10 total x .225 = 2 UR (cannot exceed 22.5%) |

Coliseum and Stadium using 5000 occupants:

| | | |
|---|---|---|
| | 29 male WC / 55 female WC (84) | 29 male x .67 = 20 |
| | 83 WC | 83 total x .225 = 18 (cannot exceed 22.5%) |

IBC 2902.1.1 / IPC 403.2: Exceptions were needed to address how to calculate for the number of fixtures when using single-user and multi-user

gender-neutral facilities.

IBC 2902.1.2 / IPC 403.1.2: The following is generally from the "Reason Statement" of P16-18: The language "for use by either sex" remains vague and subject to competing interpretations. For example, a designer might interpret "identified for use by either sex" to mean that such facilities could be identified for use by men or women, but not both. In response to this ambiguity, the suggested language is provided. This resolves the problem of ambiguous interpretations because it could not logically be construed that it is permissible to exclude one gender over another.

IBC 2902.1.4: The charging paragraph was copied from the IPC. Since this provision has a direct impact on the number of minimum fixtures - especially as they relate to multi-user gender-neutral facilities (urinals in lieu of water closets) - it should also be located in the IBC. Just about everything else associated with the number of fixtures is already in the IBC, so it begs the question why isn't this also located in the IBC? The exception is needed so the equivalency of urinal substitutions remains relatively the same when compared to the result of "separate" facilities. The same exception is required for IPC 424.2.

IBC 2902.1.5: Using the same logic as above for drinking fountains, is makes sense to copy this from the IPC as well.

IBC 2902.2 / IPC 403.2: This clarifies (for single user and when water closets and lavs are in the same compartment) and adds (for multi-user gender-neutral) exceptions to having to provide separate facilities for each gender/sex - since of the added exceptions do not deal directly with separate sexes/genders but allow for either to utilize such facilities.

**SEPARATE CODE PROPOSAL**: Makes the changes to the IPC only - and deletes IBC Section 2902 in its entirety except it keeps 2902.1 as a "pointer" to IPC Section 403. As you can see from above, when one thing changes in the IBC (or IPC), it must be changed in the corresponding code. Duplicated code provisions lead to conflicts (if said differently) or omissions (when it is not changed in the other code).

- IBC **2902.1 Minimum number of fixtures**. Plumbing fixtures shall be provided in the minimum number as shown in Table ~~2902.1~~ 403.1 of the VPC based on the actual use of the building or space. Uses not shown in Table ~~2902.1~~ 403.1 of the VPC shall be considered individually by the code official. The number of occupants shall be determined by this code.

**Cost Impact:**
When multi-user gender-neutral facilities are provided, they may result in a decrease in the cost of construction if the reduction of associated walls, chases, drains, separate piping, etc. is more than the increased cost for enclosing such fixtures completely (floor-to-ceiling) when compared to one larger consolidated space/room. Otherwise, this could possibly increase the cost of construction.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TP1209.3.1-18

This proposal doesn't have any public comments.

Proposal # 303

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# TP2902.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2018 International Building Code

### SECTION 2902
### MINIMUM PLUMBING FACILITIES

**Revise as follows:**

**[P] 2902.1 Minimum number of fixtures.** Plumbing fixtures shall be provided in the minimum number as shown in Table ~~2902.1~~ 403.1 of the VPC based on the actual use of the building or space. Uses not shown in Table ~~2902.1~~ 403.1 of the VPC shall be considered individually by the code official. The number of occupants shall be determined by this code.

**Delete without substitution:**

**[P] TABLE 2902.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 2902.1.1 and 2902.2)

| | No. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE) | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Male | Female | | | |
| | 1 | Assembly | Theaters and other buildings for the performing arts and motion pictures[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | Nightclubs, bars, taverns, dance halls and buildings for similar purposes[d] | 1 per 40 | 1 per 40 | 1 per 75 | | — | 1 per 500 | 1 service sink |
| | | | Restaurants, banquet halls and food courts[d] | 1 per 75 | 1 per 75 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | Casino gaming areas | 1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400 | 1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400 | 1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750 | | — | 1 per 1,000 | 1 service sink |
| | | | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | | Passenger terminals and transportation facilities[d] | 1 per 500 | 1 per 500 | 1 per 750 | | — | 1 per 1,000 | 1 service sink |
| | | | Places of worship and other religious services[d] | 1 per 150 | 1 per 75 | 1 per 200 | | — | 1 per 1,000 | 1 service sink |
| | | | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | | Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities[f] | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | 2 | Business | Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial, ambulatory care and similar uses | 1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50 | | 1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80 | | — | 1 per 100 | 1 service sink[e] |

| No. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE) | OTHER |
|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Male | Female | | | |
| 3 | Educational | Educational facilities | 1 per 50 | | 1 per 50 | | — | 1 per 100 | 1 service sink |
| 4 | Factory and industrial | Structures in which occupants are engaged in work fabricating, assembly or processing of products or materials | 1 per 100 | | 1 per 100 | | — | 1 per 400 | 1 service sink |
| 5 | Institutional | Custodial care facilities | 1 per 10 | | 1 per 10 | | 1 per 8 | 1 per 100 | 1 service sink |
| | | Medical care recipients in hospitals and nursing homes[b] | 1 per room[c] | | 1 per room[c] | | 1 per 15 | 1 per 100 | 1 service sink |
| | | Employees in hospitals and nursing homes[b] | 1 per 25 | | 1 per 35 | | — | 1 per 100 | — |
| | | Visitors in hospitals and nursing homes | 1 per 75 | | 1 per 100 | | — | 1 per 500 | — |
| | | Prisons[b] | 1 per cell | | 1 per cell | | 1 per 15 | 1 per 100 | 1 service sink |
| | | Reformatories, detention centers and correctional centers[b] | 1 per 15 | | 1 per 15 | | 1 per 15 | 1 per 100 | 1 service sink |
| | | Employees in reformitories, detention centers and correctional centers[b] | 1 per 25 | | 1 per 35 | | — | 1 per 100 | — |
| | | Adult day care and child day care | 1 per 15 | | 1 per 15 | | 1 | 1 per 100 | 1 service sink |
| 6 | Mercantile | Retail stores, service stations, shops, salesrooms, markets and shopping centers | 1 per 500 | | 1 per 750 | | — | 1 per 1,000 | 1 service sink[e] |
| | | Hotels, motels, boarding houses (transient) | 1 per sleeping unit | | 1 per sleeping unit | | 1 per sleeping unit | — | 1 service sink |
| | | Dormitories, fraternities, sororities and boarding houses (not transient) | 1 per 10 | | 1 per 10 | | 1 per 8 | 1 per 100 | 1 service sink |
| | | Apartment house | 1 per dwelling unit | | 1 per dwelling unit | | 1 per dwelling unit | — | 1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units |

| | No. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE) | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Male | Female | | | |
| | 7 | Residential | One- and two-family dwellings and lodging houses with five or fewer guestrooms | 1 per dwelling unit | | 1 per 10 | | 1 per dwelling unit | — | 1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit |
| ➡ | | | Congregate living facilities with 16 or fewer persons | 1 per 10 | | 1 per 10 | | 1 per 8 | 1 per 100 | 1 service sink |
| | 8 | Storage | Structures for the storage of goods, warehouses, storehouses and freight depots, low and moderate hazard | 1 per 100 | | 1 per 100 | | — | 1 per 1,000 | 1 service sink |

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code.

b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted, provided that each patient sleeping unit has direct access to the toilet room and provisions for privacy for the toilet room user are provided.

d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e. For business and mercantile classifications with an occupant load of 15 or fewer, a service sink shall not be required.

f. The required number and type of plumbing fixtures for outdoor swimming pools shall be in accordance with Section 609 of the International Swimming Pool and Spa Code.

**[P] 2902.1.1 Fixture calculations.** To determine the *occupant load* of each sex, the total *occupant load* shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the *occupant load* of each sex in accordance with Table 2902.1. Fractional numbers resulting from applying the fixture ratios of Table 2902.1 shall be rounded up to the next whole number. For calculations involving multiple occupancies, such fractional numbers for each occupancy shall first be summed and then rounded up to the next whole number.

**Exception:** The total *occupant load* shall not be required to be divided in half where *approved* statistical data indicate a distribution of the sexes of other than 50 percent of each sex.

**[P] 2902.1.2 Single-user toilet facility and bathing room fixtures.** The plumbing fixtures located in single-user toilet facilities and bathing rooms, including family or assisted-use toilet and bathing rooms that are required by Section 1109.2, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet facilities and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified for use by either sex.

**[P] 2902.1.3 Lavatory distribution.** Where two or more toilet rooms are provided for each sex, the required number of lavatories shall be distributed proportionately to the required number of water closets.

**[P] 2902.2 Separate facilities.** Where plumbing fixtures are required, separate facilities shall be provided for each sex.

**Exceptions:**

1. Separate facilities shall not be required for *dwelling units* and *sleeping units*.

2. Separate facilities shall not be required in structures or tenant spaces with a total *occupant load*, including both employees and customers, of 15 or fewer.

3. Separate facilities shall not be required in mercantile occupancies in which the maximum occupant load is 100 or fewer.

4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.

**[P] 2902.2.1 Family or assisted-use toilet facilities serving as separate facilities.** Where a building or tenant space requires a separate toilet facility for each sex and each toilet facility is required to have only one water closet, two family or assisted-use toilet facilities shall be permitted to serve as the required separate facilities. Family or assisted-use toilet facilities shall not be required to be identified for exclusive use by either sex as required by Section 2902.4.

**[P] 2902.3 Employee and public toilet facilities.** For structures and tenant spaces intended for public utilization, customers, patrons and visitors shall be provided with public toilet facilities. Employees associated with structures and tenant spaces shall be provided with toilet facilities. The number of plumbing fixtures located within the required toilet facilities shall be provided in accordance with Section 2902 for all users. Employee toilet facilities shall be either separate or combined employee and public toilet facilities.

**Exception:** Public toilet facilities shall not be required for:

1. Parking garages where operated without parking attendants.

2. Structures and tenant spaces intended for quick transactions, including takeout, pickup and drop-off, having a public access area less than or equal to 300 square feet (28 $m^2$).

**[P] 2902.3.1 Access.** The route to the public toilet facilities required by Section 2902.3 shall not pass through kitchens, storage rooms or closets. Access to the required facilities shall be from within the building or from the exterior of the building. Routes shall comply with the accessibility requirements of this code. The public shall have access to the required toilet facilities at all times that the building is occupied.

**[P] 2902.3.2 Prohibited toilet room location.** Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

**[P] 2902.3.3 Location of toilet facilities in occupancies other than malls.** In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one *story* above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

**Exception:** The location and maximum distances of travel to required employee facilities in factory and industrial occupancies are permitted to exceed that required by this section, provided that the location and maximum distance of travel are *approved*.

**[P] 2902.3.4 Location of toilet facilities in malls.** In covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 mm). In mall buildings, the required facilities shall be based on total square footage ($m^2$) within a covered mall building or within the perimeter line of an open mall building, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum distance of travel to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum distance of travel shall be measured from the employees' work area of the store or tenant space.

**[P] 2902.3.5 Pay facilities.** Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

**[P] 2902.3.6 Door locking.** Where a toilet room is provided for the use of multiple occupants, the egress door for the room shall not be lockable from the inside of the room. This section does not apply to family or assisted-use toilet rooms.

**[P] 2902.4 Signage.** Required public facilities shall be provided with signs that designate the sex as required by Section 2902.2. Signs shall be readily visible and located near the entrance to each toilet facility. Signs for accessible toilet facilities shall comply with Section 1111.

**[P] 2902.4.1 Directional signage.** Directional signage indicating the route to the required public toilet facilities shall be posted in a lobby, corridor, aisle or similar space, such that the sign can be readily seen from the main entrance to the building or tenant space.

**[P] 2902.5 Drinking fountain location.** Drinking fountains shall not be required to be located in individual tenant spaces provided that public drinking fountains are located within a distance of travel of 500 feet (152 m) of the most remote location in the tenant space and not more than one story above or below the tenant space. Where the tenant space is in a covered or open mall, such distance shall not exceed 300 feet (91 440 mm). Drinking fountains shall be located on an accessible route.

**[P] 2902.6 Small occupancies.** Drinking fountains shall not be required for an occupant load of 15 or fewer.

**Reason Statement:** Given the overarching concept of trying to avoid duplicated provisions across multiple code books, this should be given due consideration.
There are other "pointers" throughout the code books, including the VCC - e.g., 1301.1.1 and 1403.8 - and this would be no different.

Most, if not all, proposals that revise the minimum number of plumbing fixtures originate in the *plumbing* code submitted by plumbing engineers, plumbing associations, and/or code enforcement associated with plumbing - and all such changes must then be correlated to VCC 2902. Things may get lost in translation or the translation may be missed altogether. Now, if there are any changes to the minimum number of plumbing fixtures and/or the Table, such changes would only need to occur in one location - the *plumbing* code.

The deleted provisions in the VCC are addressed in the following VPC sections:

- VCC Table 2902.1: VPC Table 403.1
- 2902.1.1 Fixture calculations: 403.1.1
- 2902.1.2 Single-user toilet facility and bathing room fixtures: 403.1.2
- 2902.1.3 Lavatory distribution: 403.1.3
- 2902.2 Separate facilities: 403.2
- 2902.2.1 Family or assisted-use toilet facilities serving as separate facilities: 403.2.1
- 2902.3 Employee and public toilet facilities: 403.3
- 2902.3.1 Access: 403.3.1
- 2902.3.2 Prohibited toilet room locations: 403.3.2
- 2902.3.3 Location of toilet facilities in occupancies other than malls: 403.3.3
- 2902.3.4 Location of toilet facilities in malls: 403.3.4
- 2902.3.5 Pay facilities: 403.3.5
- 2902.3.6 Door locking: 403.3.6
- 2902.4 Signage: 403.4
- 2902.4.1 Directional signage: 403.4.1
- 2902.5 Drinking fountain location: 403.5
- 2902.6 Small occupancies: 410.2

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TP2902.1-18

This proposal doesn't have any public comments.

Proposal # 422

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# TP2902.1.1-18

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

## 2018 International Building Code

**Revise as follows:**

**[P] 2902.1.1 Fixture calculations.** To determine the *occupant load* of each sex, the total *occupant load* shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the *occupant load* of each sex in accordance with Table 2902.1. Fractional numbers resulting from applying the fixture ratios of Table 2902.1 shall be rounded up to the next whole number. For calculations involving multiple occupancies, such fractional numbers for each occupancy shall first be summed and then rounded up to the next whole number.

~~**Exception:**~~ **Exceptions:**

1. The total *occupant load* shall not be required to be divided in half where *approved* statistical data indicate a distribution of the sexes of other than 50 percent of each sex.
2. In other than Group A occupancies where occupant ratios differ from a 50/50 split, distribution of the sexes is not required where single-user water closets and bathing room fixtures are provided in accordance with Section 2902.1.2.

**[P] 2902.1.2 Single-user toilet ~~facility~~ and bathing room fixtures.** The plumbing fixtures located in single-user toilet ~~facilities~~ and bathing rooms, including family or assisted-use toilet and bathing rooms that are required by Section 1109.2, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet ~~facilities~~ and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified as being available for use by ~~either~~ all persons regardless of their sex.

The total number of fixtures shall be permitted to be based on the required number of separate facilities or based on the aggregate of any combination of single-user or separate facilities.

**[P] 2902.2 Separate facilities.** Where plumbing fixtures are required, separate facilities shall be provided for each sex.

**Exceptions:**

1. Separate facilities shall not be required for *dwelling units* and *sleeping units*.
2. Separate facilities shall not be required in structures or tenant spaces with a total *occupant load*, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile occupancies in which the maximum occupant load is 100 or fewer.
4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.
5. Separate facilities shall not be required to be designated by sex where single-user toilets rooms are provided in accordance with Section 2902.1.2.

## 2018 International Plumbing Code

**Revise as follows:**

**403.1.1 Fixture calculations.** To determine the occupant load of each sex, the total occupant load shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the occupant load of each sex in accordance with Table 403.1. Fractional numbers resulting from applying the fixture ratios of Table 403.1 shall be rounded up to the next whole number. For calculations involving multiple *occupancies*, such fractional numbers for each *occupancy* shall first be summed and then rounded up to the next whole number.

~~**Exception:**~~ **Exceptions:**

1. The total occupant load shall not be required to be divided in half where *approved* statistical data indicates a distribution of the sexes of other than 50 percent of each sex.
2. In other than Group A occupancies where occupant ratios differ from a 50/50 split, distribution of the sexes is not required where single-user water closets and bathing room fixtures are provided in accordance with Section 403.1.2.

**403.1.2 Single-user toilet ~~facility~~ and bathing room fixtures.** The plumbing fixtures located in single-user toilet ~~facilities~~ and bathing rooms, including family or ~~assisteduse~~ assisted use toilet and bathing rooms that are required by Section 1109.2.1 of the International Building Code, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet ~~facilities~~ and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified as being available for use by ~~either~~ all persons regardless of their sex.

The total number of fixtures shall be permitted to be based on the required number of separate facilities or based on the aggregate of any combination of single-user or separate facilities.

**403.2 Separate facilities.** Where plumbing fixtures are required, separate facilities shall be provided for each sex.

**Exceptions:**

1. Separate facilities shall not be required for dwelling units and sleeping units.
2. Separate facilities shall not be required in structures or tenant spaces with a total occupant load, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile *occupancies* in which the maximum occupant load is 100 or fewer.
4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.
5. Separate facilities shall not be required to be designated by sex where single-user toilets rooms are provided in accordance with Section 403.1.2.

**Reason Statement:** As part of the changes made to the 2018 codes, provisions were added to allow single-user and family or assisted-use toilet rooms to be counted toward the total number of required fixtures in IBC 2902.1.2 and IPC 403.1.2. However, despite the good intentions, the adopted language “for use by either sex” remains vague and subject to competing interpretations. For example, a designer might interpret “identified for use by either sex” to mean that single-user and family or assisted-use toilet facilities could be identified for use by men, or they could be identified for use by women, but not necessarily be identified for use by both men and women. The proposed language (taken from approved P16-18 for inclusion in the 2021 codes) clears this misinterpretation up. Additions to IBC 2902.2 and IPC 403.2 emphasize this point as well. The additional sentence at the end of 2902.1.2 and 403.1.2 allows minimum fixtures to be counted regardless if they are in separate facilities, single-user rooms or a combination of both. Lastly, where single-user toilet rooms are provided and utilized by all persons regardless of their sex, it is not necessary to divide the sexes in half before calculating the minimum number of required fixtures, except in those Group A occupancies where potty parity is evident.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
Because this is an optional design, the cost of construction could only increase should this option be elected.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval . **Withdraw if TP1209.3.1 is approved.**

**Workgroup 4 - Final Reason:**

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# Public Comments for: TP2902.1.1-18

This proposal doesn't have any public comments.

Proposal # 419

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# EB102.2.3-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

**Revise as follows:**

**102.2.3 Additions.** Where one or more newly constructed fire walls that comply with Section 706 of the VCC is provided between an addition and the existing building or structure or portions thereof, the addition shall be considered a separate building, and therefore, not an addition within the scope of this code. Such separate building including the fire wall shall be constructed in accordance with the VCC and shall not place the existing building or structure in non-conformance with the building code under which the existing building or structure or the affected portions thereof was built, or as previously approved.

**801.1 Scope.** Additions to any *building* or *structure* shall comply with the requirements of the VCC for new construction without requiring the *existing building* or *structure* to comply with any requirements of those codes or of these provisions, except as required by this chapter. Where an addition impacts the *existing building* or *structure*, that portion shall comply with this code. Where a fire wall that complies with Section 706 of the VCC is provided between the addition and the *existing building*, the addition shall be considered a separate *building*.

Note: Where one or more newly constructed fire walls that comply with Section 706 of the VCC are provided between and existing building or structure or portions thereof, and a new building, this chapter is not applicable per Section 102.2.3.

**Reason Statement:** How to address a *new* building ("addition") connected to an *existing* building with a fire wall is a source of confusion and non-uniform enforcement and interpretation around the Commonwealth.
At issue is the use of the USBC defined term “addition” and its application of VEBC Chapter 8 (including 801.2 is oftentimes applied). A firewall-separated adjacent building is not - by definition or code requirements - an *addition*; but, such buildings may be mistakenly treated as an addition due to lack of guidance in VEBC Chapter 1.

VCC Section 706 states that fire walls create separate buildings. The VEBC definition of “addition” (“*an extension or increase in floor area, number of stories, or height of a building or structure*”) implies that an addition is an increase in area or height to a building, not the placement of a new building adjacent to the existing building.

The last sentence of VEBC Section 801.1 reinforces this fact stating, “*Where a fire wall that complies with Section 706 of the VCC is provided between the addition and the existing building, the addition shall be considered a separate building.*” With the VEBC definition of “addition” coupled with this statement in VEBC 801, it is clear that a new building connected to an existing building with a fire wall is not an addition.

So, what is missing in the VEBC is direction for what to do when the adjacent building is separated by a fire wall.This proposal fills in the missing piece by addressing it directly in VEBC Section 102.2 - Scope, and providing the specific requirement for what to do with the new building and fire wall (build it per the VCC), as well as how to handle the impact on the existing building (make sure it does not take the existing building out of compliance with the code under which it was built). The "Note" added to VEBC Section 801.1 makes it clear that the provisions in VEBC Chapter 8 are not applicable in this case because a firewall-separated adjacent building is not an addition in the context of the USBC.

**Cost Impact:** The code change proposal will decrease the cost of construction
This code change proposal will DECREASE the cost of construction in cases where firewall-separated adjacent buildings are being treated as additions, which oftentimes leads to the following being required for the existing building:

- add sprinkler system throughout
- add additional fire walls within the existing building
- upgrade the construction type in the existing building (e.g., add fire proofing)
- locate "addition" 30 feet or more away from existing building
- any combination of the above

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:** Returned to proponent to strike the last four words from 102.2.3 and add "newly constructed" before fire walls.

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# Public Comments for: EB102.2.3-18

This proposal doesn't have any public comments.

Proposal # 418

# EB307-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr (clementsro@chesterfield.gov)

## 2015 Virginia Existing Building Code

**Add new text as follows:**

**New Definition ROOF COVERING.** The covering applied to the roof deck or spaced supports for weather resistance, energy performance, fire classification or appearance.

**Delete without substitution:**

**[BS] ROOF REPAIR.** Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

### SECTION 307
### REROOFING AND ROOF REPAIR

**307.1 Reroofing.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with this section and the applicable requirements of Chapter 15 of the VCC.

**Exceptions:**

1. Roof replacement of roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the VCC for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement of secondary (emergency overflow) drains or scuppers in Section 1503.4 of the VCC for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with the VCC shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4 of the VCC.

**307.2 Structural and construction loads.** Structural roof components shall be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the system.

**Exceptions:**

1. Structural elements where the additional dead load from the roofing or equipment does not increase the force in the element by more than 5 percent.
2. Buildings constructed in accordance with the International Residential Code or the conventional lightframe construction methods of the International Building Code and where the dead load from the roofing or equipment is not increased by more than 5 percent.
3. Addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m$^2$) or less over an existing, single layer of roof covering.

**307.3 Roof replacement.** Roof replacement shall include the removal of all existing layers of roof coverings down to the roof deck.

**Exception:** Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the VCC.

**307.3.1 Roof recover.** The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the *building's* structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of exiting roof coverings.
2. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 307.4.
3. The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.
4. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.

**Exception:** A roof recover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

~~**307.4 Roof recovering.** Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.~~

~~**307.5 Reinstallation of materials.** Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counter-flashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.~~

~~**307.6 Flashings.** Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.~~

~~**307.7 Roof repair.** Roof repairs shall comply with this section. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the roof repair and shall not be subject to the requirements of other parts of this code.~~

~~**Exception:** Routine maintenance required by this section, ordinary repairs exempt from permit in accordance with Section 108.2 of the VCC, and abatement of wear due to normal service conditions shall not be subject to the requirements for roof repairs in this section.~~

~~**307.7.1 Building materials and systems.** Building materials and systems shall comply with the requirements of Sections 307.7.1.1 and 307.7.1.2.~~

~~**307.7.1.1 Existing materials.** Materials already in use in a *building* in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the building official to be unsafe.~~

~~**307.7.1.2 New and replacement materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in *buildings* of similar occupancy, purpose and location.~~

## SECTION 602
## LEVEL 1 ALTERATIONS

**602.1 Scope.** Level 1 *alterations* as described in Section 601.2.1 shall comply with the requirements of this section. Level 1 *alterations* to historic *buildings* shall comply with this chapter, except as modified in Chapter 9.

**602.2 Conformance.** *Alterations* shall be done in a manner that maintains the following:

1. Level of fire protection that is existing.
2. Level of protection that is existing for the means of egress.

**602.3 Building elements and materials.** *Building* elements and materials shall comply with the applicable provisions of Sections 302 and 602.3.1 through 602.3.5.

**602.3.1 Interior finishes.** All newly installed interior wall and ceiling finishes shall comply with Chapter 8 of the VCC.

**602.3.2 Interior floor finish.** New interior floor finish, including new carpeting used as an interior floor finish material, shall comply with Section 804 of the VCC.

**602.3.3 Interior trim.** All newly installed interior trim materials shall comply with Section 806 of the VCC.

**602.3.4 Materials and methods.** All new work shall comply with the materials and methods requirements in the VCC, International Energy Conservation Code , International Mechanical Code , and International Plumbing Code , as applicable, that specify material standards, detail of installation and connection, joints, penetrations, and continuity of any element, component, or system in the *building*.

**Revise as follows:**

**602.3.4.1 Reroofing.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with Chapter 15 of the VCC, except as modified by Section 302.2 and this section.

**Exceptions** :

1. Roof replacement of roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the VCC for roofs that provide positive roof drainage.

2. Recovering or replacing an existing roof covering shall not be required to meet the requirement of secondary (emergency overflow) drains or scuppers in Section 1503.4 of the VCC for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with the VCC shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4 of the VCC.

3. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the VCC.

**602.3.4.1.1 Roof recover permitted.** The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of exiting roof coverings.

2. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface is covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

3. The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tearoff of existing roof coverings.

4. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.

**602.3.4.1.2 Roof recover not permitted.** A roof recover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.

2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.

3. Where the existing roof has two or more applications of any type of roof covering.

**602.3.4.1.3 Reinstallation of materials.** Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counter-flashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

**602.3.4.2 Structural and construction loads.** Structural roof components shall be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the system.

**Exception:** Structural elements where the additional dead load from the roofing or equipment does not increase the force in the element by more than 5 percent; or where the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m ) or less over an existing, single layer of roof covering.

**602.3.5 International Fuel Gas Code.** The following sections of the International Fuel Gas Code shall constitute the fuel gas materials and methods requirements for Level 1 *alterations*.

1. All of Chapter 3, entitled "General Regulations," except Sections 303.7 and 306.
2. All of Chapter 4, entitled "Gas Piping Installations," except Sections 401.8 and 402.3.2.1. Sections 401.8 and 402.3 shall apply when the work being performed increases the load on the system such that the existing pipe does not meet the size required by code. Existing systems that are modified shall not require resizing as long as the load on the system is not increased and the system length is not increased even if the altered system does not meet code minimums.
3. All of Chapter 5, entitled "Chimneys and Vents."
4. All of Chapter 6, entitled "Specific Appliances."

## 2018 International Building Code

**Delete without substitution:**

~~**[BS] ROOF REPAIR.** Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.~~

## 2015 Virginia Construction Code

### SECTION 1511
### ~~ROOFING~~ REROOFING AND ROOFING REPAIR

**1511.1 General.** Materials and methods of application used for reroofing and roof repair shall comply with the applicable requirements of Chapter 15 and the requirements of ~~Section 303 of the VEBC.~~ Sections 302.2, 501.1 and 602.3.4 of the VEBC, as applicable.

**Reason Statement: NOTE to Codes & Standards Committee and BHCD: This proposal originally received "CONSENSUS FOR APPROVAL" in an earlier workgroup meeting. I was then asked by DHCD to add "spaced supports" to the "Roof covering" definition -**

**which I did. But as a result of that change, I had to bring it back to another workgroup meeting (which I was not able to attend because I was teaching the 2015 VEBC at a Code Academy training module - of which I am a VEBC instructor for the Virginia Building Code Academy), only to have someone oppose. That person did not contact me to address any concerns they may had. So, I am resubmitting the "same" proposal for BHCD approval.**
Definition of ROOF REPAIR is not needed as it is duplicative and already covered under the definition of REPAIR. It is also being proposed to be deleted from the IBC/VCC as well.

Definition of ROOF COVERING was brought over from the IBC/VCC since it is vital to how to apply the VEBC when it comes to roof recover and replacement. We also added the "or spaced supports" component to capture coverings that might not be installed over a deck - e.g., structural metal roofs.

The entire Section 307 has been deleted and its relevant sections relocated to Section 602.3.4 for the following reasons:

1. Reroofing (roof recover and roof replacement) is considered a Level 1 alteration.
2. Roof repair is still a repair and its language duplicated language already existing in Sections 302 and 501.1.
3. The IEBC locates reroofing under Level 1 alterations.
4. The entire Section 307 basically deals with materials and methods - and thus relocating these sections to 602.3.4 makes sense.

307.1 and its exceptions are relocated to the new 602.3.4.1.

307.2 and its exceptions are relocated to the new 602.3.4.2. The multiple exceptions were consolidated into one exception.

307.3 didn't require or direct anything, so the text in the charging paragraph was unnecessary. However, its exception was relocated to the new 602.3.4.1, Exception 3.

307.3.1 was previously revised under a separate proposal that was approved by the BHCD and is being relocated to the new 602.3.4.1.1 and 602.3.4.1.2.

307.4 basically duplicated the language in 307.3.1, Exception 2, so this proposal consolidates them and relocates them to the new 602.3.4.1.1, Exception 2.

307.5 and 307.6 were consolidated and relocated under the new 602.3.4.1.3.

307.7 (roof repair) was deleted in its entirety as it is already covered under Sections 302.2 and 501.1. A roof repair is still a repair and should not be treated differently from any other repair that doesn't get its "own" section (i.e., brick repair doesn't get a "Brick repair" section, and so forth). By deleting this section, it allowed the deletion of the definition as well.

1511 of the VCC also needs to be revised to comport to the proposed changes herein.

**Cost Impact:**
Will not increase or decrease cost of construction.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:** Was consensus for approval at the June WG2 meeting. Staff reached out to proponent to address some concerns related to the language and proponent agreed to change. Changed status to carry over for WG2 to review this revision.

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# Public Comments for: EB307-18

**Discussion by Kenney Payne**
Aug 4, 2020 13:44 UTC

This proposal received "Consensus for Approval" in the earlier WG meeting; however, a request was made to include the words "or spaced supports" to the definition to address roofs that did not have an actual "deck."

If this proposal does NOT receive "Consensus for Approval" this time around because of the added words, we ask that the definition return to its previous state and move forward as originally intended.

Thank you!

Proposal # 305

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# EB402.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

### SECTION 402
### CHANGE OF OCCUPANCY

**402.1 Change of occupancy.** *Existing buildings* or *structures* that undergo a *change of occupancy* ~~shall comply with this section.~~ are not required to be provided with additional accessibility features. Any alterations undertaken in connection with a change of occupancy shall conform to the applicable requirements of Section 404.

> ~~**Exception:** Type B dwelling or sleeping units required by Section 1107 of the VCC are not required to be provided in *existing buildings* and facilities undergoing a *change of occupancy* in conjunction with *alterations* where the *work area* is 50 percent or less of the aggregate area of the *building*.~~

**Delete without substitution:**

~~**402.2 Partial change in occupancy.** Where a portion of the *building* is changed to a new occupancy classification, additional accessible features are not required due to the *change of occupancy*.~~

~~**402.3 Complete change of occupancy.** Where an entire *building* undergoes a *change of occupancy* classification, it shall have all of the following accessible features:~~

> ~~1.At least one accessible *building* entrance.~~
> ~~2.At least one accessible route from an accessible *building* entrance to primary function areas.~~
> ~~3.Signage complying with Section 1111 of the VCC.~~
> ~~4.Accessible parking, where parking is being provided.~~
> ~~5.At least one accessible passenger loading zone, when loading zones are provided.~~
> ~~6.At least one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.~~

~~Where it is technically infeasible to comply with the new construction standards for any of these requirements of a *change of occupancy*, the above items shall conform to the requirements to the maximum extent technically feasible.~~

> ~~**Exception:** The accessible features listed in Items 1 through 6 are not required for an accessible route to Type B units.~~

**Reason Statement:** Even under the 2010 ADA Standards, a change of occupancy (COO) does not trigger the need to provide "additional" accessibility features, since the Standards do not address COO. However, some advisories have indicated that the DOJ considers a COO as an "alteration." Therefore, it is the alterations occurring as a *part* of the COO that provides such triggers. Just as repairs do not trigger the need for additional accessibility features, nor should a COO.
This was recognized at ICC for the 2021 code cycle when EB25-19 was submitted by the ICC Building Code Action Committee (BCAC) to basically achieve the same results. Below are excerpts from their reason statement:

- Takes a COO and makes it consistent with requirements for an alteration.
- The federal requirements in the 2010 ADA Standards do not address a COO - they treat all alterations the same.
- The arguments against revising this section in the past code cycles have all been around the issue of a COO without alterations.
    - [Kenney Payne] The 2010 ADA Standards do not address COO directly, but defines "alterations" as "a change that affects, or could affect, the usability of a facility or portion thereof." It goes on to further describe the following: remodeling, renovation, rehabilitation, reconstruction, restoration, etc. - all of which would fall under the "alteration" definition in VEBC 202. So, one could say that even the ADA does not require such accessibility features for a COO w/o doing one of those "alteration-type" activities.

**Cost Impact:**
Decrease cost of construction - if undergoing a *complete* COO without alterations by not having to provide those original six (6) features - that are not even required by the 2010 ADA Standards under the same circumstances (without some form of alterations).

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB402.1-18

This proposal doesn't have any public comments.

Proposal # 301

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# EB404.3-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

**[BS] 404.3 Alterations affecting an area containing a primary function.** Where an *alteration* affects ~~the accessibility to, or contains an area of~~ or could affect the usability of or access to an area containing a primary function, the route to the primary function area shall be accessible. The accessible route to the primary function area shall include toilet facilities and drinking fountains that shall also be accessible to and useable by individuals with disabilities, serving the area of primary function.

**Exceptions:**

1. The costs of providing the accessible route are not required to exceed 20 percent of the costs of the *alterations* affecting the area of primary function.
2. This provision does not apply to *alterations* limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to *alterations* limited solely to mechanical systems, electrical systems, installation or *alteration* of fire protection systems and abatement of hazardous materials.
4. This provision does not apply to *alterations* undertaken for the primary purpose of increasing the accessibility of a facility.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

**Reason Statement:**
The revised language is identical to that used in the 2010 ADA Standards and is clearer than the current language.

When covering VEBC 404.3 at the Code Academy on VEBC, we spend a lot of time discussing "how does an alteration actually "contain" an area of primary function?" In other words, does the alteration itself "contain" the area? And if so, what does that mean? It has led and continues to lead to misapplication and misunderstanding of this provision.

At least by following the language in the ADA Standards it should be a little easier to interpret whether an alteration affects the "usability of" or "access to" an area rather than if it "contains" it.

A real world example: An existing pavilion requires replacement of the entire existing roof and its column supports.

Under the current language: If not a repair, it would be considered a Level 1 alteration. So, under the current language, does the new roof and columns (i.e., alterations) "contain" the primary function area (i.e., the open space underneath the new roof where events will occur) and thus might trigger the need for accessibility? The new roof does "contain" the area underneath it - so, "yes?" Do you think that is the intent? Replacing a roof would trigger accessibility?

Under the proposed language: Does the new roof and columns affect the "usability of" or "access to" the primary function area? A clear 'No." Thus, no question and no trigger.

**Cost Impact:**
Depending on how the current provision is interpreted, this proposal *could* DECREASE the cost of construction by not triggering the need for accessibility. However, from an "intent" standpoint, I believe the language in the IEBC/VEBC have always tried to mimic the 2010 ADA Standards in this case and thus would not increase or decrease the cost of construction.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB404.3-18

This proposal doesn't have any public comments.

# EB405.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

### SECTION 405
### HISTORIC BUILDINGS

**405.1 General.** These provisions shall apply to facilities designated as historic *buildings* or *structures* that undergo *alterations* ~~or a *change of occupancy*~~, unless technically infeasible. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the facility, the alternative requirements of Sections 405.1.1 through ~~405.1.4~~ 405.1.5 for that element shall be permitted.

~~**Exception:** Type B dwelling or sleeping units required by Section 1107 of the VCC are not required to be provided in historical *buildings*.~~

**405.1.1 Site arrival points.** At least one accessible route from a site arrival point to an accessible entrance shall be provided.

**405.1.2 Multilevel buildings and facilities.** An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

**405.1.3 Entrances.** ~~At least one main entrance shall be accessible.~~

Where an entrance cannot be made accessible in accordance with Section 404.4.1, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

~~**Exceptions:**~~

1. ~~If a main entrance cannot be made accessible, an accessible nonpublic entrance that is unlocked while the *building* is occupied shall be provided; or~~
2. ~~If a main entrance cannot be made accessible, a locked accessible entrance with a notification system or remote monitoring shall be provided.~~

Signs complying with Section 1111 of the VCC shall be provided at the primary ~~entrance~~ entrances and the accessible entrance.

**405.1.4 Toilet and bathing facilities.** Where toilet rooms are provided, at least one accessible single-user or family or assisted-use toilet room complying with ~~Section~~ Sections 1109.2.1 and 2902.1.2 of the VCC shall be provided.

**Revise as follows:**

**405.1.5 Type B units.** Type B dwelling or sleeping units required by Section 1107 of the VCC are not required to be provided in historic buildings or structures.

**Reason Statement:**
Change of occupancy (COO): If the code proposal #301 is approved, then 405.1 would also need to be revised to delete the COO reference since only alterations trigger the need for additional accessibility features.

Entrances: Revised to make a statement rather than treat them as exceptions to be consistent with the other provisions in this section.

Toilet rooms: Added the 2018 new term "single-user" to address gender-neutral concerns.

Type B units: Relocated from an *exception* to become a *statement* so it is consistent with the other provisions in this section.

This is very similar to the code proposal EB37-19 submitted at ICC.

**Cost Impact:**
Will not increase or decrease cost of construction.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB405.1-18

This proposal doesn't have any public comments.

Proposal # 302

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# EB504.1.6-18

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)

## 2015 Virginia Existing Building Code

**Add new text as follows:**

**302.2.1 Smoke alarms.** Repair or replacement of smoke alarms shall be with devices listed in accordance with UL217 and that are no more than ten years from the date of manufacture. Battery-only powered devices shall be powered by a 10-year sealed battery.

**Reason Statement:** Technology, including smoke alarms, has continued to progress to more effective and life-saving devices. The codes for replacement devices need to keep pace with these advancements in technology - particularly where it is known to save lives. This proposal reflects the movement towards eliminating nuisance activations as well as low-maintenance style smoke alarms (10-year devices) that last for the entire lifespan of the device (for battery only installations). The UL 217 requirements have been expanded to include technological advancements of smoke alarms and smoke detectors as well as to respond to new fire conditions.
For battery only devices, instead of installing a smoke alarm that requires the battery to be changed every few months, using 10-year devices allows the entire device to be properly powered until it is time to replace the entire device. This also means no costly battery replacements offering a cost-saving over the life of the alarm. Plus, since the battery pack is sealed, the batteries can't be removed from your smoke alarm or tampered with. Dead batteries or no batteries have been statistically noted to be a factor in numerous loss of life fire incidents in residential homes. Having smoke alarms that are quietly vigilant until they are needed - not chirping at 2 AM and then being removed from protection to just stop the chirp - increases the reliability that these devices will be ready and working if they are ever needed.

UL conducted research for the National Fire Protection Research Foundation that showed smoke characteristics are different between fast moving and smoldering polyurethane fires. Additional research found that fire dynamics in a home have changed over the last several decades. Newer synthetic materials in the home, more open layouts and lighter construction materials all burn hotter and faster, leading to escape times being reduced from an average of 17 minutes to three-to-four minutes.

According to the National Fire Protection Association (NFPA), nuisance alarms are the leading reason for disconnected smoke alarms. In order to enable manufacturers to produce more responsive alarms that don't introduce nuisance alarming during cooking, UL conducted a research project to develop data on smoke characteristics during normal cooking events. The research led to new test requirements for cooking alarm tests.

Many states including Maryland, North Carolina, Louisiana, New York, Oregon, and California already have such requirements for all smoke alarms. This proposal is only for the smoke alarms device itself and ensures that all existing wiring can continue to be used. It is important to remember: Three out of five home fire deaths result from fires in properties without working smoke alarms. More than one-third (38 percent) of home fire deaths result from fires in which no smoke alarms are present. The risk of dying in a home fire is cut in half in homes with working smoke alarms (Source: National Fire Protection Association).

**Cost Impact:** The code change proposal will increase the cost of construction
The difference between the cost of legacy smoke alarms and those meeting the UL217 standard is at most $10. In battery-only device installations, the cost saving of replacement batteries over the life of the device makes this proposal cost-neutral.

**Resiliency Impact Statement:** This proposal will increase Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB504.1.6-18

**Discussion by Kenney Payne**
Apr 17, 2020 19:31 UTC

While I do not oppose, I question whether this is located in the correct section. A *replacement*, unless it is associated with a repair (which this might be), would be classified as a Level 1 alteration and therefore would be located in Section 602. Also, Section 504 only kicks in when something is already "undergoing" a repair (per 504.1). If a device doesn't need to be repaired - versus needing to be maintained (which really belongs in the VMC) - then where is the path to get to Section 504?

If something still works after 10 years - is that still a repair? If yes - then keep it where it is. If not, it should be relocated elsewhere in the VEBC. If it is questionable, then it probably still should be relocated to eliminate any question.

Would VEBC 302.2 or Chapter 11 be a better location where the path is clear?

Proposal # 327

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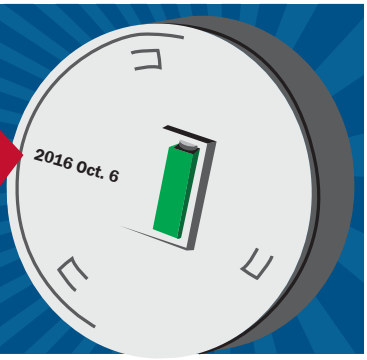
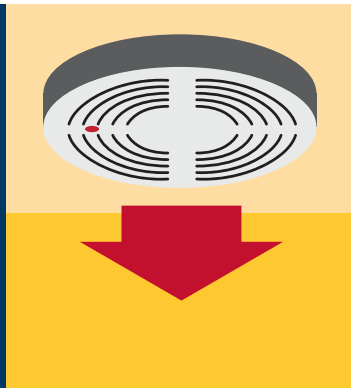
# Don't Wait — Check the Date!

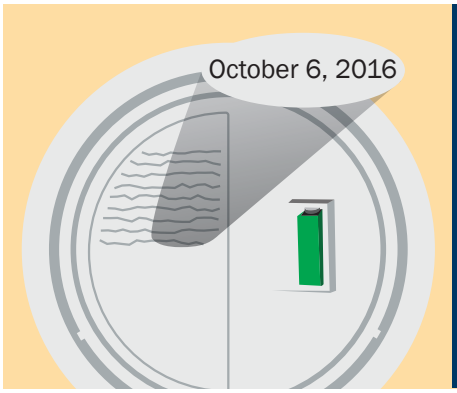
## Replace Smoke Alarms Every 10 Years




**Age matters when it comes to your smoke alarms.**
**Check the manufacture dates on your smoke alarms today!**

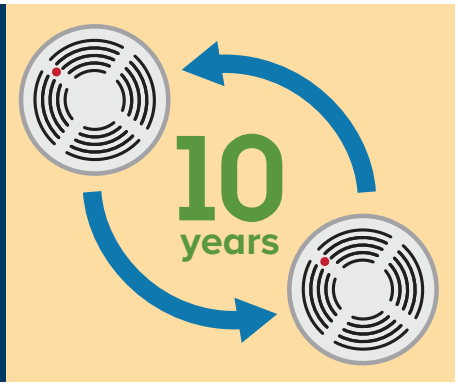
**1** Remove the smoke alarm from the wall or ceiling.

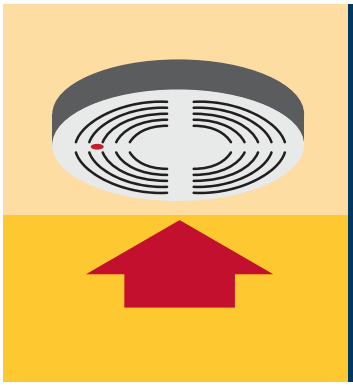





**2** Look at the back of the alarm for the date of manufacture.

**3** Smoke alarms should be replaced 10 years from the date of manufacture.



**4** Put the alarm back on the ceiling or wall if it is less than 10 years old.



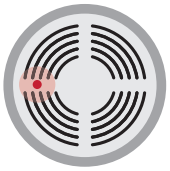
A closed door may slow the spread of smoke, heat and fire.



Test smoke alarms at least once a month by pushing the test button.



If the smoke alarm sounds, get outside and stay outside. Go to your outside meeting place.



Install smoke alarms in every bedroom, outside each separate sleeping area, and on every level of the home, including the basement. Larger homes may need more alarms. For the best protection, make sure all smoke alarms are interconnected. When one sounds, they all sound.




Call the fire department from a cellphone or a neighbor's phone. Stay outside until the fire department says it's safe to go back inside.

**For more information about smoke alarms, visit usfa.fema.gov and www.nfpa.org.**

Click here to add image.

U.S. Fire Administration | FEMA

Fire is Everyone's Fight™



NFPA®

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# EB601.4(3)-18

**Proponents:** Eric Lacey (eric@reca-codes.com); Energy Subworkgroup

## 2015 Virginia Existing Building Code

**601.4 Energy conservation.** ~~Level 1, 2, and 3~~ Except as modified by this section, *alterations* to an *existing* ~~*buildings*~~ *building, building system,* ~~or *structures* are permitted without requiring the entire *building*~~ or *structure* shall conform to the applicable provisions of the Virginia Energy Conservation Code or Virginia Residential Code as they relate to new construction without requiring the unaltered portions of the existing *building* , *building system* , or *structure* to comply with the VECC or VRC. Only the alterations themselves are required to conform to the applicable energy requirements of the ~~International Energy Conservation Code or International Residential Code . The *alterations* shall conform to the energy requirements of the International Energy Conservation Code or International Residential Code as they relate to new construction only .~~ VECC or VRC.

~~**Exception:** Except for window and door openings, like materials, assemblies or thicknesses shall be permitted for *alterations* involving the exterior *building* thermal envelope, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in *buildings* of similar occupancy, purpose and location.~~

**601.4.1 Opaque Walls.** Where the existing stud wall cavity that is part of the thermal envelope is exposed during the alteration, such exposed cavities between framing members shall be filled with insulation having a minimum nominal value of ≥R-3.0/inch or filled to the minimum prescriptive insulation requirement in Table R402.1.2 or Table C402.1.3 of the VECC.

**Exception:** Where less than 60 square feet (5.574 $m^2$ ) of the existing stud cavities that are part of the thermal envelope is exposed.

**601.4.2 Floors.** Where the existing framed floor cavity that is part of the thermal envelope is exposed during the alteration, such exposed cavities between framing members shall be filled with insulation having a minimum nominal value of ≥R-3.0/inch or filled to the minimum prescriptive insulation requirement in Table R402.1.2 or Table C402.1.3 of the VECC.

**Exception:** Where less than 60 square feet (5.574 $m^2$ ) of the existing framed floor cavities that are part of the thermal envelope is exposed.

**601.4.3 Ceilings and vented attics.** Where the existing rafter cavity that is part of the thermal envelope is exposed during the alteration, such exposed cavities between framing members shall be filled with insulation having a minimum nominal value of ≥R-3.0/inch or to the minimum prescriptive insulation requirement in Table R402.1.2 or Table C402.1.3 of the VECC. Where the existing framed floor or truss bottom chord cavity of a vented attic is exposed during the alteration, the exposed cavities shall be filled with insulation having a minimum nominal value of ≥R-3.0/inch or filled to the minimum prescriptive insulation requirement in Table R402.1.2 or Table C402.1.3 of the VECC. If the existing insulation laying on such vented attic floor is removed, such insulation shall be replaced with insulation complying with the minimum prescriptive insulation requirement in Table R402.1.2 or Table C402.1.3 of the VECC.

**Exception:** Where less than 60 square feet (5.574 $m^2$ ) of the existing rafter, framed vented attic floor, or truss bottom chord cavities that are part of the thermal envelope is exposed.

**601.4.4 Fenestration.** Where an existing fenestration unit is replaced, the replacement fenestration unit shall comply with the requirements for U-factor and SHGC as specified in Table R402.1.2 or Table C402.4 of the VECC, as applicable. Where more than one fenestration unit is to be replaced, an area-weighted average of the U-factor, SHGC or both of all replacement fenestration units shall be permitted.

**601.4.4.1 Converting fenestration unit to opaque wall.** Where existing fenestration units are converted into an opaque exterior wall assembly, the new portion of wall shall comply with Section 601.4.1.

**601.4.5 Roof replacement** . Roof replacements shall comply with Section C402.2.1 and Section C402.1.3, C402.1.4, C402.1.5 or C407 of the VECC where all of the following conditions are met. For purposes of this section, roof area shall mean an area of the existing roof of the same building that is bounded by exterior walls, different roof levels, roof edges or perimeters, roof dividers, building expansion joints, or parapets.

1. The roof replacement exceeds 75% or 30,000 square feet (2787.1 $m^2$ ) of the roof area, whichever is less.

2. The roof assembly is part of the building thermal envelope, as defined by the VECC.

3. The roof assembly contains insulation entirely above the roof deck.

**601.4.6 Lighting.** Lighting alterations shall comply with Section 601.4.4.1 or 601.4.4.2, as applicable.

**601.4.6.1 Commercial Lighting.** Altered commercial lighting shall comply with Section C405 of the VECC.

**Exception:** Alterations that replace less than 10 percent of the luminaires within a space, provided the replacement luminaires do not increase the existing interior lighting power as determined by Section C405.4.1 of the VECC.

**601.4.6.2 Residential Lighting.** Altered residential lighting shall comply with Section R404 of the VECC.

**Exception:** Alterations that replace less than 50 percent of the total luminaires within a space, provided the replacement luminaires do not decrease the efficacy of the lighting equipment as required by Section R404.1 of the VECC.

**601.4.7 Ducts.** In R-5 occupancies, where ducts from an existing heating and cooling system are extended, such duct systems with less than 40 linear feet (12.19 m) in unconditioned spaces shall not be required to be tested in accordance with Section R403.3.3 of the VECC.

**Reason Statement:** This proposal would improve the Virginia Existing Building Code by providing important details about efficiency requirements that apply to common alterations to existing buildings. Virginia's codes currently contain efficiency requirements for existing buildings in two places: The VECC Chapters C5 and R5, and VEBC Section 601.4. In the International Codes, the 2018 International Existing Building Code simply references the International Energy Conservation Code (Chapters C5 and R5) for efficiency requirements, so that the two codes are consistent. Virginia's Energy Conservation Code largely adopts the IECC provisions for existing buildings into the VECC; however, the 2015 VEBC includes only a summary version of these efficiency requirements and does not reference the VECC at all. The result is that Virginia has two sets of efficiency requirements that may not be directly contradictory, but that provide differing levels of specificity. This has created unnecessary confusion among building code officials.
This proposal summarizes the efficiency requirements for the most common alterations to existing buildings and adds these details to VEBC 601.4. It also addresses common situations identified by stakeholders throughout the VA code development process. While we would prefer the simpler approach of the I-Codes (where the IECC contains the efficiency requirements and the IEBC simply references the IECC), if Virginia intends to include all existing buildings requirements in the VEBC, it should at least include the provisions contained in this proposal.

This proposal generally follows the principle that if an assembly is not altered, it need not be brought up to current code; however, where assemblies are altered, they should comply with reasonable efficiency improvements that can be incorporated in a straightforward way. None of the requirements would force building assemblies to be more stringent than new construction, and none would force a "retrofit" of a part of the building that is not undergoing alterations.

If the VEBC is amended to include these requirements, the VECC Chapters C5 and R5 could be revised to match this proposal or a simple reference to the VEBC provisions could be added in their place.

Note that proposed section 601.4.5, related to roof replacement, is intended as a placeholder for language being proposed separately in this process. We expect that this section would be modified to reflect whatever changes are approved in the stakeholder discussions related to roof replacement.

**Importance of Efficiency in Existing Buildings**

It is crucial that Virginia apply a reasonable and consistent set of efficiency requirements for buildings undergoing alteration, but the current VEBC language is not specific enough to make this happen. In a given year, only 1-2% of the building stock is replaced, whereas the remaining 98-99% of buildings, which were built to earlier versions of the codes, continue to consume energy at far higher rates. If Virginia is ever to achieve sustainable energy efficiency or net-zero at some point in its future, improving efficiency in existing buildings must be an integral part of the statewide building codes. It is unrealistic to force retrofits of existing buildings; however, where an alteration is already taking place, Virginia's Existing Building Code and/or Energy Conservation Code should require the alterations to result in improved efficiency where feasible. This proposal provides very specific measures that can be taken—for minimal incremental cost—to improve the efficiency of existing buildings in meaningful ways.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is intended to clarify requirements currently contained in VECC Chapters C5 and R5, and to bring them into the VEBC. Overall, we expect the cost impact to be neutral, but we believe owners of residential and commercial buildings will benefit from efficiency requirements that are clearly and consistently applied.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal is unique in that it will make existing buildings more resilient and will help VA address broader resiliency concerns due to a changing climate. These improvements fall squarely within the Governor's directive to the Department of Housing and Community Development to identify "resilience-specific improvements to the Uniform Statewide Building Code (USBC) for inclusion in the 2018 code update," in Executive Order 24 from November 2018.

At the macro level, buildings currently account for over 40% of the nation's energy use and over 70% of the nation's electricity use. A significant portion of that electricity comes from burning fossil fuels, which is one of the causes of climate change. Improvements in efficiency – particularly peak electric demand reductions – will help curb Virginia's need to build and site peak generation (which tends to be both more expensive and more carbon-intensive).

At the building-specific level, improvements to the building's thermal envelope will improve the resiliency of Virginia's buildings. For example, efficient windows maintain better occupant comfort by reducing the volatility of indoor temperature swings. Moreover, these windows will help maintain more livable conditions during power outages due to natural emergencies. Efficient fenestration is designed to reduce both heating and cooling demand, reducing the need to build and site peak generation, resulting in benefits to building owners and all of Virginia's citizens.

Energy codes are increasingly being recognized as playing a role in maintaining resilience and passive survivability, particularly during extended power outages. A recent white paper released by the International Code Council (ICC) and the Alliance for National and Community Resilience

(ANCR) recommended that "**[a]ny policies, guidance or criteria that includes building codes as a strategy should explicitly incorporate energy codes as a fundamental resilience strategy.**" *See* International Code Council, *The Important Role of Energy Codes in Achieving Resilience*, at 15 (Dec. 2019).

Among these resiliency benefits are improved habitability, more grid stability, moisture management, and improved durability of buildings, and others. It is well within Virginia's interests in improving resiliency to a changing climate to reduce energy demand wherever possible.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB601.4(3)-18

**Discussion by Kenney Payne**
Jun 24, 2020 13:29 UTC

We applaud Eric's (and others) willingness to work with other interested parties and openness to potential compromises to move things forward. We believe this serves as a great first step toward incorporating additional energy conservation strategies for existing buildings, while maintaining to a great degree "The Virginia Way" and adheres to the "Purpose" of the VEBC as described in 102.1.

Proposal # 344

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# EB1101.18(2)-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2018 International Building Code

**Revise as follows:**

**[F] 502.1 Address identification.** ~~New and existing buildings~~ New buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be a minimum of 4 inches (102 mm) high with a minimum stroke width of $^1/_2$ inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other approved sign or means shall be used to identify the structure. ~~Address identification shall be maintained.~~

**Delete without substitution:**

~~**[F] 912.2.2 Existing buildings.** On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an *approved* sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be subject to the approval of the *fire code official.*~~

## 2015 Virginia Existing Building Code

**Add new text as follows:**

**1 1101.18 New Code Section Address identification.** Existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be a minimum of 4 inches (102 mm) high with a minimum stroke width of $^1/_2$ inch (12.7 mm). Address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other approved sign or means shall be used to identify the structure.

**1101.19 Fire department connection sign.** On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an *approved* sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be maintained and subject to the approval of the fire code official.

**Reason Statement:** Both provisions in the IBC deal with existing buildings and thus should be located in the VEBC. They were relocated in the retrofit chapter since such signs can be requested by the fire official essentially at any time it is deemed necessary. Otherwise, it could be located in Chapter 3, but that implies that some other work (repairs, alterations, addition, change of occupancy) would be required before triggering the need for such signs - so, Chapter 11 seems the most appropriate location.

**Cost Impact:**
Will not increase or decrease cost of construction. Remember - it is in the code NOW!

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB1101.18(2)-18

**Discussion by Kenney Payne**
Aug 4, 2020 13:28 UTC

I addressed the comments made in the previous WG meeting, including adding back the "Such signs shall be maintained and subject to the approval of the fire code official" language.

Proposal # 336

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# EB1401.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

### SECTION 1401
### GENERAL

**1401.1 Scope.** The provisions of this chapter are intended to maintain or increase the current degree of public safety, health, and general welfare in *existing buildings* or *structures*, while permitting changes of occupancy without requiring full compliance with Chapter 7, except where compliance with other provisions of this code is specifically required in this chapter.

**Exception:** The provisions of this chapter shall not apply to *buildings* with occupancies in Group H or I.

~~**1401.1.1**~~ **1401.2 Complete change of occupancy.** Where an entire *existing building* undergoes a *change of occupancy*, the applicable provisions of this chapter for the new occupancy shall be used to determine compliance with this code.

**Exception:** Plumbing, mechanical and electrical systems in *buildings* undergoing a *change of occupancy* shall be subject to any applicable requirements of Chapter 7

~~**1401.1.2**~~ **1401.3 Partial change of occupancy.** Where a portion of the *building* undergoes a *change of occupancy* and that portion is separated from the remainder of the *building* with fire barrier or horizontal assemblies having a fire-resistance rating as required by Table 508.4 of the VCC or Section R317 of the International Residential Code for the separate occupancies, or with approved compliance alternatives, the portion changed shall be made to conform to the provisions of this chapter.

Where a portion of the *building* undergoes a *change of occupancy* and that portion is not separated from the remainder of the *building* with fire barriers or horizontal assemblies having a fire-resistance rating as required by Table 508.4 of the VCC or Section R317 of the International Residential Code for the separate occupancies, or with approved compliance alternatives, the provisions of this chapter which apply to each occupancy shall apply to the entire *building*. Where there are conflicting provisions, those requirements which are the most restrictive shall apply to the entire *building* or *structure*.

~~**1401.2**~~ **1401.4 Accessibility requirements.** All portions of the ~~*buildings*~~ *building* proposed for a *change of occupancy* ~~*to existing buildings* or *structures*~~ shall conform to the applicable accessibility provisions of Chapter 4.

**Delete without substitution:**

~~**1401.3 Acceptance.** For changes of occupancy to existing buildings that are evaluated in accordance with this chapter, compliance with this chapter shall be accepted by the code official.~~

~~**1401.3.1**~~ **1401.5 Compliance with flood hazard provisions.** In flood hazard areas, *buildings* or *structures* that are evaluated in accordance with this chapter shall comply with Section 1612 of the VCC, or Section R322 of the ~~International Residential Code~~ VRC, as applicable if the work covered by this chapter constitutes *substantial improvement*.

**Revise as follows:**

### SECTION 1402
### EVALUATION PROCESS

~~**1401.4**~~ **1402.1 ~~Investigation and evaluation.~~ Evaluation process.** ~~For proposed~~ The evaluation process specified herein shall be followed in its entirety to evaluate existing buildings for work covered by this ~~chapter, the building owner shall cause the existing building to be investigated and~~ chapter. The existing building shall be evaluated in accordance with the provisions of ~~Sections 1401.4 through 1401.9.~~ this section and Sections 1403 and 1401.4. The evaluation shall be comprised of three categories as described in Sections 1402.1.1 through 1402.1.3.

~~**1401.5.1**~~ **1402.1.1 Fire safety.** Included within the fire safety category are the structural fire resistance, automatic fire detection, fire alarm, automatic sprinkler system and fire suppression system features of the *facility*.

~~**1401.5.2**~~ **1402.1.2 Means of egress.** Included within the means of egress category are the configuration, characteristics, and support features for means of egress in the facility.

~~**1401.5.3**~~ **1402.1.3 General safety.** Included within the general safety category are the fire safety parameters and the means-of-egress parameters.

**[BS]** ~~**1401.4.1**~~ **1402.2 Structural ~~analysis.~~ evaluation.** ~~The owner shall have a structural analysis of the~~ The *existing building* ~~made~~ shall be evaluated to determine adequacy of the existing structural systems for the proposed ~~*alteration*, addition or~~ change of occupancy. The ~~analysis~~ evaluation shall demonstrate that the ~~*building*~~ *existing building* with the work completed is capable of resisting the loads specified in Chapter 16 of the VCC.

~~1401.4.2~~ **1402.3 Submittal.** The results of ~~the investigation and evaluation~~ the evaluation as required in Section ~~1401.4, along with proposed compliance alternatives, shall~~ 1402.1 shall be submitted to the code ~~official.~~ official. Table 1404.1 shall be utilized for tabulating the results of the evaluation. References to other sections of this code indicate that compliance with those sections is required in order to gain credit in the evaluation herein outlined.

**Delete without substitution:**

~~**1401.4.3 Determination of compliance.** The code official shall determine whether the *existing building*, with the proposed *change of occupancy*, complies with the provisions of this section in accordance with the evaluation process in Sections 1401.5 through 1401.9.~~

~~**1401.5 Evaluation.** The evaluation shall be comprised of three categories: fire safety, means of egress, and general safety, as defined in Sections 1401.5.1 through 1401.5.3.~~

**Revise as follows:**

## SECTION 1403
## EVALUATION DATA

**Delete without substitution:**

~~**1401.6 Evaluation process.** The evaluation process specified herein shall be followed in its entirety to evaluate *existing buildings*. Table 1401.7 shall be utilized for tabulating the results of the evaluation. References to other sections of this code indicate that compliance with those sections is required in order to gain credit in the evaluation herein outlined. In applying this section to a *building* with mixed occupancies, where the separation between the mixed occupancies does not qualify for any category indicated in Section 1401.6.16, the score for each occupancy shall be determined, and the lower score determined for each section of the evaluation process shall apply to the entire *building*.~~

~~Where the separation between the mixed occupancies qualifies for any category indicated in Section 1401.6.16, the score for each occupancy shall apply to each portion, or smoke compartment of the building based on the occupancy of the space.~~

~~**1401.6.1**~~ **1403.1 Building height and number of stories.** The value for *building* height and number of stories shall be the lesser value determined by the formula in Section ~~1401.6.1.1.~~ 1403.1.1. Section 504 of the ~~International Building Code~~ VCC shall be used to determine the allowable height and number of stories of the *building*. Subtract the actual *building* height from the allowable height and divide by $12^1/_2$ feet (3810 mm). Enter the height value and its sign (positive or negative) in Table ~~1401.7 under~~ 1404.1 under Safety Parameter ~~1401.6.1~~ 1403.1, Building Height, for fire safety, means of egress, and general safety. The maximum score for a *building* shall be 10.

~~**1401.6.1.1**~~ **1403.1.1 Height formula.** The following formulas shall be used in computing the building height value.

~~$\text{Height value} = \frac{(AH) - (EBH)}{125} \times CF$~~ **(Equation 14-1)**

**Note:** Where mixed occupancies are separated and individually evaluated as indicated in Section ~~1401.6~~ 1404.3.1, the values *AH*, *AS*, *EBH* and *EBS* shall be based on the height of the occupancy being evaluated.

~~Height value, stories = (AS – EBS) × CF~~ **(Equation 14-2)**

where:

*AH* = Allowable height in feet (mm) from Section 504 of the ~~International Building CodeCode.~~ VCC .

*EBH* = *Existing building* height in feet (mm).

*AS* = Allowable height in stories from Section 504 of the ~~International Building CodeCode.~~ VCC .

*EBS* = *Existing building* height in stories.

*CF* = 1 if *(AH) – (EBH)* is positive.

*CF* = Construction-type factor shown in Table ~~1401.6.6(2)~~ 1403.6(2)if *(AH) – (EBH)* is negative.

~~**1401.6.2**~~ **1403.2 Building area.** The value for building area shall be determined by the formula in Section ~~1401.6.2.2.~~ 1403.2.2. Section 506 of the VCC and the formula in Section ~~1401.6.2.1~~ 1403.2.1 shall be used to determine the allowable area of the *building*. Subtract the actual building area from the allowable area and divide by 1,200 square feet (112 $m^2$). Enter the area value and its sign (positive or negative) in Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.2~~ 1403.2, Building Area, for fire safety, means of egress and general safety. In determining the area value, the maximum permitted positive value for area is 50 percent of the fire safety score as listed in Table ~~1401.8~~ 1404.2, Mandatory Safety Scores.

~~**1401.6.2.1**~~ **1403.2.1 Allowable area formula.** The following formula shall be used in computing allowable area:

~~$A_a = A_t + (NS \times I_f)$~~ **(Equation 14-3)**

where:

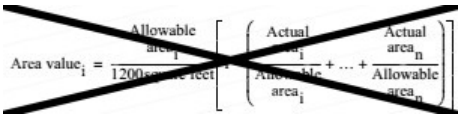
$A_a$ = Allowable building area per story (square feet).

$A_t$ = Tabular allowable area factor (NS, S1, S13R, or SM value, as applicable) in accordance with Table 506.2 of the ~~International Building Code Code.~~ VCC .

$NS$ = Tabular allowable area factor in accordance with Table 506.2 of the ~~International Building Code~~ VCC for a nonsprinklered building (regardless of whether the building is sprinklered).

$I_f$ = Area factor increase due to frontage as calculated in accordance with Section 506.3 of the ~~International Building Code Code.~~ VCC .

**~~1401.6.2.2~~ 1403.2.2 Area formula.** The following formula shall be used in computing the area value. Determine the area value for each occupancy floor area on a floor-by-floor basis. For each occupancy, choose the minimum area value of the set of values obtained for the particular occupancy.



**(Equation 14-4)**

where:

$i$ = Value for an individual separated occupancy on a floor.

$n$ = Number of separated occupancies on a floor.

**~~1401.6.3~~ 1403.3 Compartmentation.** Evaluate the compartments created by fire barriers or horizontal assemblies which comply with Sections ~~1401.6.3.1~~ 1403.3.1 and ~~1401.6.3.2~~ 1403.3.2 and which are exclusive of the wall elements considered under Sections ~~1401.6.4~~ 1403.4 and ~~1401.6.5.~~ 1403.5. Conforming compartments shall be figured as the net area and do not include shafts, chases, stairways, walls, or columns. Using Table ~~1401.6.3~~ 1403.3, determine the appropriate compartmentation value (CV) and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.3~~ 1403.3, Compartmentation, for fire safety, means of egress, and general safety.

**TABLE ~~1401.6.3~~ 1403.3**
**COMPARTMENTATION VALUES**

| OCCUPANCY | CATEGORIES | | | | |
|---|---|---|---|---|---|
| | **a Compartment size equal to or greater than 15,000 square feet** | **b Compartment size of 10,000 square feet** | **c Compartment size of 7,500 square feet** | **d Compartment size of 5,000 square feet** | **e Compartment size of 2,500 square feet or less** |
| A-1, A-3 | 0 | 6 | 10 | 14 | 18 |
| A-2 | 0 | 4 | 10 | 14 | 18 |
| A-4, B, E, S-2 | 0 | 5 | 10 | 15 | 20 |
| F, M, R, S-1 | 0 | 4 | 10 | 16 | 22 |

For SI: 1 square foot = 0.0929 $m^2$.

**~~1401.6.3.1~~ 1403.3.1 Wall construction.** A wall used to create separate compartments shall be a fire barrier conforming to Section 707 of the ~~International Building Code~~ VCC with a fire-resistance rating of not less than 2 hours. Where the building is not divided into more than one compartment, the compartment size shall be taken as the total floor area on all floors. Where there is more than one compartment within a story, each compartmented area on such story shall be provided with a horizontal exit conforming to Section 1026 of the ~~International Building Code.~~ VCC. The fire door serving as the horizontal exit between compartments shall be so installed, fitted, and gasketed that such fire door will provide a substantial barrier to the passage of smoke.

**~~1401.6.3.2~~ 1403.3.2 Floor/ceiling construction.** A floor/ceiling assembly used to create compartments shall conform to Section 711 of the ~~International Building Code~~ VCC and shall have a fire-resistance rating of not less than 2 hours.

**~~1401.6.4~~ 1403.4 Tenant and dwelling unit separations.** Evaluate the fire-resistance rating of floors and walls separating tenants, including dwelling units, and not evaluated under Sections ~~1401.6.3~~ 1403.3 and ~~1401.6.5.~~ 1403.5.

**TABLE ~~1401.6.4~~ 1403.4**
**SEPARATION VALUES**

| OCCUPANCY | CATEGORIES | | | | |
|---|---|---|---|---|---|
| | **a** | **b** | **c** | **d** | **e** |
| A-1 | 0 | 0 | 0 | 0 | 1 |
| A-2 | -5 | -3 | 0 | 1 | 3 |
| R | -4 | -2 | 0 | 2 | 4 |
| A-3, A-4, B, E, F, M, S-1 | -4 | -3 | 0 | 2 | 4 |
| ~~I-2~~ | ~~0~~ | ~~1~~ | ~~2~~ | ~~3~~ | ~~4~~ |
| S-2 | -5 | -2 | 0 | 2 | 4 |

**~~1401.6.4.1~~ 1403.4.1 Categories.** The categories for tenant and dwelling unit separations are:

1. Category a—No fire partitions; incomplete fire partitions; no doors; doors not self-closing or automatic-closing.
2. Category b—Fire partitions or floor assemblies with less than 1-hour fire-resistance ratings or not constructed in accordance with Section 708 or 711 of the ~~International Building Code~~ VCC, respectively.
3. Category c—Fire partitions with 1-hour or greater fire-resistance ratings constructed in accordance with Section 708 of the ~~International Building Code~~ VCC and floor assemblies with 1-hour but less than 2-hour fire-resistance ratings constructed in accordance with Section 711 of the ~~International Building Code~~ VCC or with only one tenant within the floor area.
4. Category d—Fire barriers with 1-hour but less than 2-hour fire-resistance ratings constructed in accordance with Section 707 of the ~~International Building Code~~ VCC and floor assemblies with 2-hour or greater fire-resistance ratings constructed in accordance with Section 711 of the ~~International Building Code.~~ VCC.
5. Category e—Fire barriers and floor assemblies with 2-hour or greater fire-resistance ratings and constructed in accordance with Sections 707 and 711 of the ~~International Building Code~~ VCC, respectively.

**~~1401.6.5~~ 1403.5 Corridor walls.** Evaluate the fire-resistance rating and degree of completeness of walls which create corridors serving the floor and that are constructed in accordance with Section 1020 of the ~~International Building Code.~~ VCC. This evaluation shall not include the wall elements considered under Sections ~~1401.6.3~~ 1403.3 and ~~1401.6.4.~~ 1403.4. Under the categories and groups in Table ~~1401.6.5~~ 1403.5, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.5~~ 1403.5, Corridor Walls, for fire safety, means of egress, and general safety.

**TABLE ~~1401.6.5~~ 1403.5**
**CORRIDOR WALL VALUES**

| OCCUPANCY | CATEGORIES | | | |
|---|---|---|---|---|
| | a | b | c[a] | d[a] |
| A-1 | -10 | -4 | 0 | 2 |
| A-2 | -30 | -12 | 0 | 2 |
| A-3, F, M, R, S-1 | -7 | -3 | 0 | 2 |
| A-4, B, E, S-2 | -5 | -2 | 0 | 5 |
| ~~I-2~~ | ~~-10~~ | ~~0~~ | ~~1~~ | ~~2~~ |

a Corridors not providing at least one-half the exit access travel distance for all occupants on a floor shall use Category b.

~~1401.6.5.1~~ **1403.5.1 Categories.** The categories for corridor walls are:

1. Category a—No fire partitions; incomplete fire partitions; no doors; or doors not self-closing.
2. Category b—Less than 1-hour fire-resistance rating or not constructed in accordance with Section 708.4 of the ~~International Building Code.~~ VCC.
3. Category c—1-hour to less than 2-hour fire-resistance rating, with doors conforming to Section 716 of the ~~International Building Code~~ VCC or without corridors as permitted by Section 1020 of the ~~International Building Code.~~ VCC.
4. Category d—2-hour or greater fire-resistance rating, with doors conforming to Section 716 of the ~~International Building Code.~~ VCC.

~~1401.6.6~~ **1403.6 Vertical openings.** Evaluate the fire-resistance rating of interior exit stairways or ramps, hoistways, escalator openings, and other shaft enclosures within the building, and openings between two or more floors. Table ~~1401.6.6(1)~~ 1403.6(1) contains the appropriate protection values. Multiply that value by the construction-type factor found in Table ~~1401.6.6(2).~~ 1403.6(2). Enter the vertical opening value and its sign (positive or negative) in Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.6~~ 1403.6, Vertical Openings, for fire safety, means of egress, and general safety. If the structure is a one-story building or if all the unenclosed vertical openings within the building conform to the requirements of Section 713 of the ~~International Building Code~~ VCC, enter a value of 2. The maximum positive value for this requirement shall be 2.

**TABLE ~~1401.6.6(1)~~ 1403.6(1)**
**VERTICAL OPENING PROTECTION VALUE**

| PROTECTION | VALUE |
|---|---|
| None (unprotected opening) | -2 times number of floors connected |
| Less than 1 hour | -1 times number of floors connected |
| 1 to less than 2 hours | 1 |
| 2 hours or more | 2 |

**TABLE ~~1401.6.6(2)~~ 1403.6(2)**
**CONSTRUCTION-TYPE FACTOR**

| FACTOR | TYPE OF CONSTRUCTION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | IA | IB | IIA | IIB | IIIA | IIIB | IV | VA | VB |
| | 1.2 | 1.5 | 2.2 | 3.5 | 2.5 | 3.5 | 2.3 | 3.3 | 7 |

**~~1401.6.6.1~~ 1403.6.1 Vertical opening formula.** The following formula shall be used in computing vertical opening value.

~~VO = PV × CF~~ **(Equation 14-5)**

where:

*VO* = Vertical opening value.

*PV* = Protection value from Table ~~1401.6.6(1).~~ 1403.6(1).

*CF* = Construction-type factor from Table ~~1401.6.6(2).~~ 1403.6(2).

**~~1401.6.7~~ 1403.7 HVAC systems.** Evaluate the ability of the HVAC system to resist the movement of smoke and fire beyond the point of origin. Under the categories in Section ~~1401.6.7.1~~ 1403.7.1, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.7~~ 1403.7, HVAC Systems, for fire safety, means of egress, and general safety.

**~~1401.6.7.1~~ 1403.7.1 Categories.** The categories for HVAC systems are:

1. Category a—Plenums not in accordance with Section 602 of the International Mechanical Code. -10 points.
2. Category b—Air movement in egress elements not in accordance with Section 1018.5 of the ~~International Building Code.~~ VCC. -5 points.
3. Category c—Both Categories a and b are applicable. -15 points.
4. Category d—Compliance of the HVAC system with Section 1020.5 of the ~~International Building Code~~ VCC and Section 602 of the International Mechanical Code. 0 points.
5. Category e—Systems serving one story; or a central boiler/chiller system without ductwork connecting two or more stories. +5 points.

**~~1401.6.8~~ 1403.8 Automatic fire detection.** Evaluate the smoke detection capability based on the location and operation of automatic fire detectors in accordance with Section 907 of the VCC and Section 606 the International Mechanical Code . Under the categories and occupancies in Table ~~1401.6.8~~ 1403.8, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.8~~ 1403.8, Automatic Fire Detection, for fire safety, means of egress, and general safety.

**TABLE ~~1401.6.8~~ 1403.8**
**AUTOMATIC FIRE DETECTION VALUES**

| OCCUPANCY | CATEGORIES | | | | | |
|---|---|---|---|---|---|---|
| | **a** | **b** | **c** | **d** | **e** | **f** |
| A-1, A-3, F, M, R, S-1 | -10 | -5 | 0 | 2 | 6 | — |
| A-2 | -25 | -5 | 0 | 5 | 9 | — |
| A-4, B, E, S-2 | -4 | -2 | 0 | 4 | 8 | — |
| ~~I-2~~ | ~~NP~~ | ~~NP~~ | ~~NP~~ | ~~4~~ | ~~5~~ | ~~2~~ |

**~~1401.6.8.1~~ 1403.8.1 Categories.** The categories for automatic fire detection are:

1. Category a—None.
2. Category b—Existing smoke detectors in HVAC systems.
3. Category c—Smoke detectors in HVAC systems. The detectors are installed in accordance with the requirements for new *buildings* in the International Mechanical Code .
4. Category d—Smoke detectors throughout all floor areas other than individual sleeping units, tenant spaces and dwelling units.
5. Category e—Smoke detectors installed throughout the floor area.
6. Category f—Smoke detectors in corridors only.

**~~1401.6.9~~ 1403.9 Fire alarm systems.** Evaluate the capability of the fire alarm system in accordance with Section 907 of the ~~International Building Code.~~ VCC. Under the categories and occupancies in Table ~~1401.6.9~~ 1403.9, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.9~~ 1403.9, Fire Alarm System, for fire safety, means of egress, and general safety.

**TABLE ~~1401.6.9~~ 1403.9**
**FIRE ALARM SYSTEM VALUES**

| OCCUPANCY | CATEGORIES | | | |
|---|---|---|---|---|
| | a | b[a] | c | d |
| A-1, A-2, A-3, A-4, B, E, R | -10 | -5 | 0 | 5 |
| F, M, S | 0 | 5 | 10 | 15 |
| ~~I-2~~ | ~~-4~~ | ~~-1~~ | ~~2~~ | ~~5~~ |

a. For buildings equipped throughout with an automatic sprinkler system, add 2 points for activation by a sprinkler water-flow device.

**~~1401.6.9.1~~ 1403.9.1 Categories.** The categories for fire alarm systems are:

1. Category a—None.
2. Category b—Fire alarm system with manual fire alarm boxes in accordance with Section 907.4 of the ~~International Building Code~~ VCC and alarm notification appliances in accordance with Section 907.5.2 of the ~~International Building Code.~~ VCC.
3. Category c—Fire alarm system in accordance with Section 907 of the ~~International Building Code.~~ VCC.
4. Category d—Category c plus a required emergency voice/alarm communications system and a fire command station that conforms to Section 911 of the ~~International Building Code~~ VCC and contains the emergency voice/alarm communications system controls, fire department communication system controls, and any other controls specified in Section 911 of the ~~International Building Code~~ VCC where those systems are provided.

**~~1401.6.10~~ 1403.10 Smoke control.** Evaluate the ability of a natural or mechanical venting, exhaust, or pressurization system to control the movement of smoke from a fire. Under the categories and occupancies in Table ~~1401.6.10~~ 1403.10, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.10~~ 1403.10, Smoke Control, for means of egress and general safety.

**TABLE ~~1401.6.10~~ 1403.10**
**SMOKE CONTROL VALUES**

| OCCUPANCY | CATEGORIES | | | | | |
|---|---|---|---|---|---|---|
| | **a** | **b[a]** | **c** | **d** | **e** | **f** |
| A-1, A-2, A-3 | 0 | 1 | 2 | 3 | 6 | 6 |
| A-4, E | 0 | 0 | 0 | 1 | 3 | 5 |
| B, M, R | 0 | 2a | 3a | 3a | 3a | 4a |
| F, S | 0 | 2a | 2a | 3a | 3a | 3a |
| ~~I-2~~ | ~~4~~ | ~~0~~ | ~~0~~ | ~~0~~ | ~~3~~ | ~~0~~ |

a. This value shall be 0 if compliance with Category d or e in Section ~~1401.6.8.1~~ 1403.8.1 has not been obtained.

~~**1401.6.10.1**~~ **1403.10.1 Categories.** The categories for smoke control are:

1. Category a—None.
2. Category b—The building is equipped throughout with an automatic sprinkler system. Openings are provided in exterior walls at the rate of 20 square feet (1.86 $m^2$) per 50 linear feet (15 240 mm) of exterior wall in each story and distributed around the building perimeter at intervals not exceeding 50 feet (15 240 mm). Such openings shall be readily openable from the inside without a key or separate tool and shall be provided with ready access thereto. In lieu of operable openings, clearly and permanently marked tempered glass panels shall be used.
3. Category c—One enclosed exit stairway, with ready access thereto, from each occupied floor of the building. The stairway has operable exterior windows, and the building has openings in accordance with Category b.
4. Category d—One smokeproof enclosure and the building has openings in accordance with Category b.
5. Category e—The building is equipped throughout with an automatic sprinkler system. Each floor area is provided with a mechanical air-handling system designed to accomplish smoke containment. Return and exhaust air shall be moved directly to the outside without recirculation to other floor areas of the building under fire conditions. The system shall exhaust not less than six air changes per hour from the floor area. Supply air by mechanical means to the floor area is not required. Containment of smoke shall be considered as confining smoke to the floor area involved without migration to other floor areas. Any other tested and approved design that will adequately accomplish smoke containment is permitted.
6. Category f—Each stairway shall be one of the following: a smokeproof enclosure in accordance with Section 1023.11 of the ~~International Building Code~~ VCC; pressurized in accordance with Section 909.20.5 of the ~~International Building Code~~ VCC; or shall have operable exterior windows.

~~**1401.6.11**~~ **1403.11 Means of egress capacity and number.** Evaluate the means of egress capacity and the number of exits available to the building occupants. In applying this section, the means of egress are required to conform to the following sections of the ~~International Building Code~~ VCC: 1003.7, 1004, 1005, 1006, 1007, 1016.2, 1026.1, 1028.2, 1028.5, 1029.2, 1029.3, 1029.4 and 1030. The number of exits credited is the number that is available to each occupant of the area being evaluated. Existing fire escapes shall be accepted as a component in the means of egress when conforming to Section 405.

Under the categories and occupancies in Table ~~1401.6.11~~ 1403.11, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.11~~ 1403.11, Means of Egress Capacity, for means of egress and general safety.

**TABLE ~~1401.6.11~~ 1403.11**

MEANS OF EGRESS VALUES[a]

| OCCUPANCY | CATEGORIES | | | | |
|---|---|---|---|---|---|
| | **a** | **b** | **c** | **d** | **e** |
| A-1, A-2, A-3, A-4, E~~, I-2~~ | -10 | 0 | 2 | 8 | 10 |
| M | -3 | 0 | 1 | 2 | 4 |
| B, F, S | -1 | 0 | 0 | 0 | 0 |
| R | -3 | 0 | 0 | 0 | 0 |

a. The values indicated are for buildings six stories or less in height. For buildings over six stories above grade plane, add an additional -10 points.

**~~1401.6.11.1~~ 1403.11.1 Categories.** The categories for means-of-egress capacity and number of exits are:

1. Category a—Compliance with the minimum required means-of-egress capacity or number of exits is achieved through the use of a fire escape in accordance with Section 405.
2. Category b—Capacity of the means of egress complies with Section 1005 of the ~~International Building Code~~ VCC, and the number of exits complies with the minimum number required by Section 1006 of the ~~International Building Code.~~ VCC.
3. Category c—Capacity of the means of egress is equal to or exceeds 125 percent of the required means-of-egress capacity, the means of egress complies with the minimum required width dimensions specified in the ~~International Building Code~~ VCC , and the number of exits complies with the minimum number required by Section 1006 of the ~~International Building Code.~~ VCC.
4. Category d—The number of exits provided exceeds the number of exits required by Section 1006 of the ~~International Building Code.~~ VCC. Exits shall be located a distance apart from each other equal to not less than that specified in Section 1007 of the ~~International Building Code.~~ VCC.
5. Category e—The area being evaluated meets both Categories c and d.

**~~1401.6.12~~ 1403.12 Dead ends.** In spaces required to be served by more than one means of egress, evaluate the length of the exit access travel path in which the building occupants are confined to a single path of travel. Under the categories and occupancies in Table ~~1401.6.12~~ 1403.12, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.12~~ 1403.12, Dead Ends, for means of egress and general safety.

**TABLE ~~1401.6.12~~ 1403.12**
**DEAD-END VALUES**

| OCCUPANCY | CATEGORIES[a] | | | |
|---|---|---|---|---|
| | a | b | c | d |
| A-1, A-3, A-4, B, F, M, R, S | -2 | 0 | 2 | -4 |
| A-2, E | -2 | 0 | 2 | -4 |
| ~~I-2~~ | ~~-2~~ | ~~0~~ | ~~2~~ | ~~-6~~ |

a. For dead-end distances between categories, the dead-end value shall be obtained by linear interpolation.

**~~1401.6.12.1~~ 1403.12.1 Categories.** The categories for dead ends are:

1. Category a—Dead end of 35 feet (10 670 mm) in nonsprinklered buildings or 70 feet (21 340 mm) in sprinklered buildings.
2. Category b—Dead end of 20 feet (6096 mm); or 50 feet (15 240 mm) in Group B in accordance with Section 1020.4, Exception 2, of the ~~International Building Code.~~ VCC.
3. Category c—No dead ends; or ratio of length to width (l/w) is less than 2.5:1.
4. Category d—Dead ends exceeding Category a.

**~~1401.6.13~~ 1403.13 Maximum exit access travel distance to an exit.** Evaluate the length of exit access travel to an approved exit. Determine the appropriate points in accordance with the following equation and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.13~~ 1403.13, Maximum Exit Access Travel Distance for means of egress and general safety. The maximum allowable exit access travel distance shall be determined in accordance with Section 1017.1 of the ~~International Building Code.~~

~~Points = 20 × Maximum allowable travel distance / Maximum actual travel distance~~

VCC.

**(Equation 14-6)**

**~~1401.6.14~~ 1403.14 Elevator control.** Evaluate the passenger elevator equipment and controls that are available to the fire department to reach all occupied floors. Emergency recall and in-car operation of elevators shall be provided in accordance with the building code under which the *building* or the affected portion thereof was constructed or previously approved. Under the categories and occupancies in Table ~~1401.5.14~~ 1403.14, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.5.14~~ 1403.14, Elevator Control, for fire safety, means of egress and general safety. The values shall be zero for a single-story *building*.

**TABLE ~~1401.6.14~~ 1403.14**
**ELEVATOR CONTROL VALUES**

| ELEVATOR TRAVEL | CATEGORIES | | | |
|---|---|---|---|---|
| | a | b | c | d |
| Less than 25 feet of travel above or below the primary level of elevator access for emergency fire-fighting or rescue personnel | -2 | 0 | 0 | +2 |
| Travel of 25 feet or more above or below the primary level of elevator access for emergency fire-fighting or rescue personnel | -4 | NP | 0 | +4 |

For SI: 1 foot = 304.8 mm.

NP = Not permitted.

**~~1401.6.14.1~~ 1403.14.1 Categories.** The categories for elevator controls are:

1. Category a—No elevator.
2. Category b—Any elevator without Phase I emergency recall operation and Phase II emergency in-car operation.
3. Category c—All elevators with Phase I emergency recall operation and Phase II emergency in-car operation as required by the building code under which the *building* or the affected portion thereof was constructed or previously approved.
4. Category d—All meet Category c; or Category b where permitted to be without Phase I emergency recall operation and Phase II emergency in-car operation; and at least one elevator that complies with new construction requirements serves all occupied floors.

**~~1401.6.15~~ 1403.15 Means-of-egress emergency lighting.** Evaluate the presence of and reliability of means-of-egress emergency lighting. Under the categories and occupancies in Table ~~1401.6.15~~ 1403.15, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.15~~ 1403.15, Means-of-Egress Emergency Lighting, for means of egress and general safety.

**TABLE ~~1401.6.15~~ 1403.15**
**MEANS-OF-EGRESS EMERGENCY LIGHTING VALUES**

| NUMBER OF EXITS REQUIRED BY SECTION 1015 OF THE INTERNATIONAL BUILDING CODE | CATEGORIES | | |
|---|---|---|---|
| | a | b | c |
| Two or more exits | NP | 0 | 4 |
| Minimum of one exit | 0 | 1 | 1 |

NP = Not permitted.

**~~1401.6.15.1~~ 1403.15.1 Categories.** The categories for means-of-egress emergency lighting are:

1. Category a—Means-of-egress lighting and exit signs not provided with emergency power in accordance with Section 2702 of the ~~International Building Code.~~ VCC.
2. Category b—Means-of-egress lighting and exit signs provided with emergency power in accordance with Section 2702 of the ~~International Building Code.~~ VCC.
3. Category c—Emergency power provided to means-of-egress lighting and exit signs, which provides protection in the event of power failure to the site or building.

**~~1401.6.16~~ 1403.16 Mixed occupancies.** Where a *building* has two or more occupancies that are not in the same occupancy classification, the separation between the mixed occupancies shall be evaluated in accordance with this section. Where there is no separation between the mixed occupancies or the separation between mixed occupancies does not qualify for any of the categories indicated in Section ~~1401.6.16.1~~ 1403.16.1, the *building* shall be evaluated as indicated in Section ~~1401.6~~ 1404.3.1, and the value for mixed occupancies shall be zero. Under the categories and occupancies in Table ~~1401.6.16~~ 1403.16, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.16~~ 1403.16, Mixed Occupancies, for fire safety and general safety. For *buildings* without mixed occupancies, the value shall be zero.

**TABLE ~~1401.6.16~~ 1403.16**

MIXED OCCUPANCY VALUES[a]

| OCCUPANCY | CATEGORIES | | |
|---|---|---|---|
| | a | b | c |
| A-1, A-2, R | -10 | 0 | 10 |
| A-3, A-4, B, E, F, M, S | -5 | 0 | 5 |
| ~~I-2~~ | ~~NP~~ | ~~0~~ | ~~5~~ |

NP = not permitted.

a. For fire-resistance ratings between categories, the value shall be obtained by linear interpolation.

**~~1401.6.16.1~~ 1403.16.1 Categories.** The categories for mixed occupancies are:

1. Category a—Occupancies separated by minimum 1-hour fire barriers or minimum 1-hour horizontal assemblies, or both.
2. Category b—Separations between occupancies in accordance with Section 508.4 of the ~~International Building Code.~~ VCC.
3. Category c—Separations between occupancies having a fire-resistance rating of not less than twice that required by Section 508.4 of the ~~International Building Code.~~ VCC.

**~~1401.6.17~~ 1403.17 Automatic sprinklers.** Evaluate the ability to suppress a fire based on the installation of an automatic sprinkler system in accordance with Section 903.3.1.1 of the VCC. “Required sprinklers” shall be based on the requirements of this code. Under the categories and occupancies in Table ~~1401.6.17~~ 1403.17, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.17~~ 1403.17, Automatic Sprinklers, for fire safety, means of egress divided by 2, and general safety. High-rise *buildings* defined in Chapter 2 of the VCC that undergo a *change of occupancy* to Group R shall be equipped throughout with an automatic sprinkler system in accordance with Section 403 of the VCC and Chapter 9 of the VCC.

**TABLE ~~1401.6.17~~ 1403.17**
**SPRINKLER SYSTEM VALUES**

| OCCUPANCY | CATEGORIES | | | | | |
|---|---|---|---|---|---|---|
| | a[a] | b[a] | c | d | e | f |
| A-1, A-3, F, M, R, S-1 | -6 | -3 | 0 | 2 | 4 | 6 |
| A-2 | -4 | -2 | 0 | 1 | 2 | 4 |
| A-4, B, E, S-2 | -12 | -6 | 0 | 3 | 6 | 12 |
| ~~I-2~~ | ~~NP~~ | ~~NP~~ | ~~NP~~ | ~~8~~ | ~~10~~ | ~~NP~~ |

NP = not permitted.

a. These options cannot be taken if Category a in Section ~~1401.6.18~~ 1403.18 is used.

**~~1401.6.17.1~~ 1403.17.1 Categories.** The categories for automatic sprinkler system protection are:

1. Category a—Sprinklers are required throughout; sprinkler protection is not provided or the sprinkler system design is not adequate for the hazard protected in accordance with Section 903 of the ~~International Building Code.~~ VCC.
2. Category b—Sprinklers are required in a portion of the building; sprinkler protection is not provided or the sprinkler system design is not adequate for the hazard protected in accordance with Section 903 of the ~~International Building Code.~~ VCC.
3. Category c—Sprinklers are not required; none are provided.
4. Category d—Sprinklers are required in a portion of the building; sprinklers are provided in such portion; the system is one that complied with the code at the time of installation and is maintained and supervised in accordance with Section 903 of the ~~International Building Code.~~ VCC.
5. Category e—Sprinklers are required throughout; sprinklers are provided throughout in accordance with Chapter 9 of the ~~International Building Code.~~ VCC.
6. Category f—Sprinklers are not required throughout; sprinklers are provided throughout in accordance with Chapter 9 of the ~~International Building Code.~~ VCC.

**~~1401.6.18~~ 1403.18 Standpipes.** Evaluate the ability to initiate attack on a fire by a making supply of water available readily through the installation of standpipes in accordance with Section 905 of the ~~International Building Code.~~ VCC. "Required Standpipes" shall be based on the requirements of the ~~International Building Code~~ VCC . Under the categories and occupancies in Table ~~1401.6.18~~ 1403.18, determine the appropriate value and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.18~~ 1403.18, Standpipes, for fire safety, means of egress, and general safety.

**TABLE ~~1401.6.18~~ 1403.18**
**STANDPIPE SYSTEM VALUES**

| OCCUPANCY | CATEGORIES | | | |
|---|---|---|---|---|
| | a[a] | b | c | d |
| A-1, A-3, F, M, R, S-1 | -6 | 0 | 4 | 6 |
| A-2 | -4 | 0 | 2 | 4 |
| A-4, B, E, S-2 | -12 | 0 | 6 | 12 |
| ~~I-2~~ | ~~-2~~ | ~~0~~ | ~~1~~ | ~~2~~ |

a. This option cannot be taken if Category a or Category b in Section ~~1401.6.17~~ 1403.17 is used.

**~~1401.6.18.1~~ 1403.18.1 Standpipe categories.** The categories for standpipe systems are:

1. Category a—Standpipes are required; standpipe is not provided or the standpipe system design is not in compliance with Section 905.3 of the ~~International Building Code.~~ VCC.
2. Category b—Standpipes are not required; none are provided.
3. Category c—Standpipes are required; standpipes are provided in accordance with Section 905 of the ~~International Building Code.~~ VCC.
4. Category d—Standpipes are not required; standpipes are provided in accordance with Section 905 of the ~~International Building Code.~~ VCC.

**~~1401.6.19~~ 1403.19 Incidental uses.** Evaluate the protection of incidental uses in accordance with Section 509.4.2 of the ~~International Building Code.~~ VCC. Do not include those where this code requires automatic sprinkler systems throughout the building including covered and open mall buildings, high-rise buildings, public garages and unlimited area buildings. Assign the lowest score from Table ~~1401.6.19~~ 1403.19 for the building or floor area being evaluated and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.19~~ 1403.19, Incidental Uses, for fire safety, means of egress and general safety. If there are no specific occupancy areas in the building or floor area being evaluated, the value shall be zero.

**TABLE ~~1401.6.19~~ 1403.19**
**INCIDENTAL USE AREA VALUES**

| PROTECTION REQUIRED BY TABLE 509 OF THE ~~*INTERNATIONAL BUILDING CODE*~~ *VCC* | PROTECTION PROVIDED | | | | | | |
|---|---|---|---|---|---|---|---|
| | None | 1 hour | AS | AS with CRS | 1 hour and AS | 2 hours | 2 hours and AS |
| 2 hours and AS | -4 | -3 | -2 | -2 | -1 | -2 | 0 |
| 2 hours, or 1 hour and AS | -3 | -2 | -1 | -1 | 0 | 0 | 0 |
| 1 hour and AS | -3 | -2 | -1 | -1 | 0 | -1 | 0 |
| 1 hour | -1 | 0 | -1 | -1 | 0 | 0 | 0 |
| 1 hour, or AS with CRS | -1 | 0 | -1 | -1 | 0 | 0 | 0 |
| AS with CRS | -1 | -1 | -1 | -1 | 0 | -1 | 0 |
| 1 hour or AS | -1 | 0 | 0 | 0 | 0 | 0 | 0 |

AS = Automatic sprinkler system;

CRS = Construction capable of resisting the passage of smoke (see IBC Section 509.4.2 of the ~~International Building Code).~~ VCC).

~~**Note:** For Table 1401.7, see page 75.~~

**~~1401.6.20~~ 1403.20 Smoke compartmentation.** Evaluate the smoke compartments for compliance with Section 407.5 of the VCC. Under the categories and occupancies in Table ~~1401.6.20~~ 1403.20, determine the appropriate smoke compartmentation value (SCV) and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.20~~ 1403.20, Smoke Compartmentation, for fire safety, means of egress and general safety.

**TABLE ~~1401.6.20~~ 1403.20**
**SMOKE COMPARTMENTATION VALUES**

| OCCUPANCY | CATEGORIES[a] | | |
|---|---|---|---|
| | a | b | c |
| A, B, E, F, M, R and S | 0 | 0 | 0 |
| ~~I-2~~ | ~~0~~ | ~~NP~~ | ~~NP~~ |

For SI: 1 square foot = 0.093 $m^2$.

NP = Not permitted.

a. For areas between categories, the smoke compartmentation value shall be obtained by linear interpolation.

~~**1401.6.20.1**~~ **1403.20.1 Categories.** Categories for smoke compartment size are:

1. Category a—Smoke compartment size is equal to or less than 22,500 square feet (2092 $m^2$).
2. Category b—Smoke compartment size is greater than 22,500 square feet (2092 $m^2$).
3. Category c—Smoke compartments are not provided.

**Delete without substitution:**

~~**1401.6.21 Patient ability, concentration, smoke compartment location and ratio to attendant.** In I-2 occupancies, the ability of patients, their concentration and ratio to attendants shall be evaluated and applied in accordance with this section. Evaluate each smoke compartment using the categories in Sections 1401.6.21.1, 1401.6.21.2 and 1401.6.21.3 and enter the value in Table 1401.7. To determine the safety factor, multiply the three values together, if the sum is 9 or greater, compliance has failed.~~

~~**1401.6.21.1 Patient ability for self-preservation.** Evaluate the ability of the patients for self-preservation in each smoke compartment in an emergency. Under the categories and occupancies in Table 1401.6.21.1 determine the appropriate value and enter that value in Table 1401.7 under Safety Parameter 1401.6.21.1, Patient Ability for Self-preservation, for means of egress and general safety.~~

**TABLE 1401.6.21.1**
**PATIENT ABILITY VALUES**

| OCCUPANCY | CATEGORIES | | |
|---|---|---|---|
| | a | b | c |
| 12 | 1 | 2 | 3 |

**1401.6.21.1.1 Categories.** The categories for patient ability for self-preservation are:

1. Category a—(mobile) Patients are capable of self-preservation without assistance.
2. Category c—(not mobile) Patients rely on assistance for evacuation or relocation.
3. Category d—(not movable) Patients cannot be evacuated or relocated.

**1401.6.21.2 Patient concentration.** Evaluate the concentration of patients in each smoke compartment under Section 1401.6.21.2. Under the categories and occupancies in Table 1401.6.21.2 determine the appropriate value and enter that value in Table 1401.7 under Safety Parameter 1401.6.21.2, Patient Concentration, for means of egress and general safety.

**TABLE 1401.6.21.2**
**PATIENT CONCENTRATION VALUES**

| OCCUPANCY | CATEGORIES | | |
|---|---|---|---|
| | a | b | c |
| 12 | 1 | 2 | 3 |

**1401.6.21.2.1 Categories:** The categories for patient concentration are:

1. Category a—smoke compartment has 1 to 10 patients.
2. Category b—smoke compartment has more than 10 to 40 patients.
3. Category d—smoke compartment has greater than 40 patients.

**1401.6.21.3 Attendant-to-patient ratio.** Evaluate the attendant-to-patient ratio for each compartment under Section 1401.6.21.3. Under the categories and occupancies in Table 1401.6.21.3 determine the appropriate value and enter that value in Table 1401.7 under Safety Parameter 1401.6.21.3, Attendant-to-patient Ratio, for means of egress and general safety.

~~**TABLE 1401.6.21.3**~~
~~**ATTENDANT-TO-PATIENT RATIO VALUES**~~

| ~~OCCUPANCY~~ | ~~CATEGORIES~~ | | |
|---|---|---|---|
| | ~~a~~ | ~~b~~ | ~~c~~ |
| ~~I-2~~ | ~~1~~ | ~~2~~ | ~~3~~ |

~~**1401.6.21.3.1 Categories.** The categories for attendant-to-patient concentrations are:~~

~~1.Category a—attendant-to-patient concentrations is 1:5.~~
~~2.Category b—attendant-to-patient concentrations is 1:6 to 1:10.~~
~~3.Category c—attendant-to-patient concentrations is greater than 1:10 or no patients.~~

**Revise as follows:**

## SECTION 1404
## EVALUATION SCORES

~~**1401.7**~~ **1404.1 Building score.** After determining the appropriate data from Section ~~1401.6~~ 1403, enter those data in Table ~~1401.7~~ 1404.1 and total the building score.

**TABLE ~~1401.7~~ 1404.1**
**SUMMARY SHEET-BUILDING CODE**

| | | | | | |
|---|---|---|---|---|---|
| Existing occupancy _____ | | | Proposed occupancy _____ | | |
| Year building was constructed _____ | | | Number of stories _____ Height in feet _____ | | |
| Type of construction _____ | | | Area per floor _____ | | |
| Percentage of open perimeter increase _____ % | | | | | |
| Completely suppressed: | Yes_____ | No_____ | Corridor wall rating _____ | | |
| | | | Type:_____ | | |
| Compartmentation: | Yes_____ | No_____ | Required door closers: | Yes_____ | No_____ |
| Fire-resistance rating of vertical opening enclosures_____ | | | | | |
| Type of HVAC system _____, serving number of floors_____ | | | | | |
| Automatic fire detection: | Yes_____ | No_____ | Type and location_____ | | |
| Fire alarm system: | Yes_____ | No_____ | Type _____ | | |
| Smoke control: | Yes_____ | No_____ | Type _____ | | |
| Adequate exit routes: | Yes_____ | No_____ | Dead ends:_____ | Yes_____ | No_____ |
| Maximum exit access travel distance _____ | | | Elevator controls: | Yes_____ | No_____ |
| Means of egress emergency lighting: Yes_____ No _____ | | | Mixed occupancies: | Yes_____ | No_____ |
| Standpipes | Yes_____ | No_____ | Patient ability for self-preservation _____ | | |
| Incidental use | Yes_____ | No_____ | Patient concentration _____ | | |
| Smoke compartmentation less than 22,500 sq. feet (2092 m2) | Yes_____ | No_____ | Attendant-to-patient ratio _____ | | |

* * * *No applicable value to be inserted.

**~~1401.8~~ 1404.2 Safety scores.** The values in Table ~~1401.8~~ 1404.2 are the required mandatory safety scores for the evaluation process listed in Section ~~1401.6.~~ 1403.

**TABLE ~~1401.8~~ 1404.2**

MANDATORY SAFETY SCORES[a]

| OCCUPANCY | FIRE SAFETY (MFS) | MEANS OFEGRESS (MME) | GENERALSAFETY (MGS) |
|---|---|---|---|
| A-1 | 20 | 31 | 31 |
| A-2 | 21 | 32 | 32 |
| A-3 | 22 | 33 | 33 |
| A-4, E | 29 | 40 | 40 |
| B | 30 | 40 | 40 |
| F | 24 | 34 | 34 |
| ~~I-2~~ | ~~19~~ | ~~34~~ | ~~34~~ |
| M | 23 | 40 | 40 |
| R | 21 | 38 | 38 |
| S-1 | 19 | 29 | 29 |
| S-2 | 29 | 39 | 39 |

**~~1401.9~~ 1404.3 ~~Evaluation of building safety.~~ Final scores.** The mandatory safety score in Table ~~1401.8~~ 1404.2 shall be subtracted from the building score in Table ~~1401.7~~ 1404.1 for each category. Where the final score for any category equals zero or more, the building is in compliance with the requirements of this section for that category. Where the final score for any category is less than zero, the building is not in compliance with the requirements of this section.

**~~1401.9.1~~ 1404.3.1 Mixed occupancies.** For mixed occupancies, the following provisions shall apply:

1. Where the separation between mixed occupancies does not qualify for any category indicated in Section ~~1401.6.16~~ 1403.16, the mandatory safety scores for the occupancy with the lowest general safety score in Table 1401.8 shall be utilized. (See Section ~~1401.6.)~~ 1404.3.1.)
2. Where the separation between mixed occupancies qualifies for any category indicated in Section ~~1401.6.16~~ 1403.16, the mandatory safety scores for each occupancy shall be placed against the evaluation scores for the appropriate occupancy.

**TABLE ~~1401.9~~ 1404.3**

~~EVALUATION FORMULAS~~ FINAL SCORES[a]

| FORMULA | T~~1401.7~~ 1404.1 | T~~1401.8~~ 1404.2 | | SCORE | PASS | FAIL |
|---|---|---|---|---|---|---|
| FS - MFS ≥ 0 | _____ (FS) – | _____ (MFS) | = | _____ | _____ | _____ |
| ME – MME ≥ 0 | _____ (ME) – | _____ (MME) | = | _____ | _____ | _____ |
| GS – MGS ≥ 0 | _____ (GS) – | _____ (MGS) | = | _____ | _____ | _____ |

a. FS = Fire Safety. MFS = Mandatory Fire Safety.

ME = Means of Egress. MME = Mandatory Means of Egress.

GS = General Safety. MGS = Mandatory Means of Safety.

**Revise as follows:**

**1403 Revise Code Sections** 1403.1.1 Height formula.
where:
AH = Allowable height in feet (mm) from Section 504 of the ~~International Building Code~~ VCC.
EBH = Existing building height in feet (mm).

AS = Allowable height in stories from Section 504 of the ~~International Building Code~~ VCC.

EBS = Existing building height in stories.

CF = 1 if (AH) – (EBH) is positive.

CF = Construction-type factor shown in Table ~~1401.6.6(2)~~ 1403.6(2) if (AH) – (EBH) is negative.

1403.2.1 Allowable area formula.
where:
Aa = Allowable building area per story (square feet).

At = Tabular allowable area factor (NS, S1, S13R, or SM value, as applicable) in accordance with Table 506.2 of the ~~International Building Code~~ VCC.

NS = Tabular allowable area factor in accordance with Table 506.2 of the ~~International Building Code~~ VCC for a nonsprinklered building (regardless of whether the building is sprinklered).

= Area factor increase due to frontage as calculated in accordance with Section 506.3 of the ~~International Building Code~~ VCC.

1403.13 Maximum exit access travel distance to an exit.

Evaluate the length of exit access travel to an approved exit. Determine the appropriate points in accordance with the following equation and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.13~~ 1403.13, Maximum Exit Access Travel Distance for means of egress and general safety. The maximum allowable exit access travel distance shall be determined in accordance with Section 1017.1 of the VCC.

1403.6.1 Vertical opening formula.

where:
VO = Vertical opening value.

PV = Protection value from Table ~~1401.6.6(1)~~ 1403.6(1).

CF = Construction-type factor from Table ~~1401.6.6(2)~~ 1403.6(2).

Bottom left portion of Table 1404.1

| | |
|---|---|
| ~~1401.6.1~~ | 1403.1 |
| ~~1401.6.2~~ | 1403.2 |
| ~~1401.6.3~~ | 1403.3 |
| ~~1401.6.4~~ | 1403.4 |
| ~~1401.6.5~~ | 1403.5 |
| ~~1401.6.6~~ | 1403.6 |
| ~~1401.6.7~~ | 1403.7 |
| ~~1401.6.8~~ | 1403.8 |
| ~~1401.6.9~~ | 1403.9 |
| ~~1401.6.10~~ | 1403.10 |
| ~~1401.6.11~~ | 1403.11 |
| ~~1401.6.12~~ | 1403.12 |
| ~~1401.6.13~~ | 1403.13 |
| ~~1401.6.14~~ | 1403.14 |
| ~~1401.6.15~~ | 1403.15 |
| ~~1401.6.16~~ | 1403.16 |
| ~~1401.6.17~~ | 1403.17 |
| ~~1401.6.18~~ | 1403.18 |
| ~~1401.6.19~~ | 1403.19 |
| ~~1401.6.20~~ | 1403.20 |
| ~~1401.6.21.1~~ | |
| ~~1401.6.21.2~~ | |
| ~~1401.6.21.3~~ | |

**Reason Statement:**
Generally, the current chapter . . .

1. Has duplicated provisions - especially as they relate to the term "evaluation" (1401.4, 1401.4.1, 1401.5, and 1401.6) - with each saying something different.
2. The entire chapter is just one section (1401)
3. References to I-2 remain, even though 1401.1, Exception says this chapter cannot be used for 'I' occupancies
4. Still contains numerous references to the IBC, even though we have basically deleted that reference throughout the rest of the VEBC and replaced it with VCC

Generally, this proposal . . .

1. Deletes the duplicated provisions - especially as they relate to the term "evaluation" by consolidating them into a new Section 1402
2. The chapter would consist of four (4) sections
3. References to I-2 and its related provisions have been deleted
4. Revised all references to IBC to VCC

OLD 1401.3 Acceptance: Deleted as unnecessary. Basically, unless indicated otherwise, compliance with any portion of the VEBC "shall be accepted by the code official."

NEW SECTION: All evaluation provisions would be located under this new section.

NEW 1402.1: Made up of portions of the old 1401.5 and 1401.6.

NEW 1402.1.1, 1402.1.2, and 1402.1.3: Relocated from OLD 1401.5.1 through 1401.5.3.

NEW 1402.3: Relocated portion of OLD 1401.6 here.

OLD 1401.5.3: Already addressed under NEW 1401.2 and 1401.3 (OLD 1401.1.1 and 1401.1.2, respectively).

OLD 1401.5 (and subsections 1401.5.1 through 1401.5.3): Relocated to NEW 1402.1 (and NEW subsections 1402.1.1 through 1402.1.3) - no technical changes.

NEW SECTION: All of the evaluation data provisions would be located under this new section.

OLD 1401.6: Relocated to NEW 1402.1 and 1402.3. The deleted provisions dealing with mixed occupancies are essentially addressed under NEW 1404.3.1.1 and 1404.3.1.2 (OLD 1401.9.1).

NEW SECTION: All scoring would be located under this new section.

NEW 1404.1 through 1404.3, including subsections and Tables: Essentially just renumbered and cross-referenced to new numbers.

**REMAINDER OF PROVISIONS WERE MOSTLY JUST RENUMBERED, CROSS-REFERENCED, AND/OR I-2 OCCUPANCY REFERENCES DELETED - EXCEPT AS NOTED BELOW:**

OLD 1401.6.21 and all subsections: Deleted because they all relate to I-2 occupancies - which cannot use this chapter per 1401.1, Exception.

**THE BELOW WERE NOT ABLE TO UPDATE IN cdpVA - BUT NEED TO BE REVISED AS FOLLOWS:**

**1403.1.1 Height formula.**

where:

*AH* = Allowable height in feet (mm) from Section 504 of the ~~International Building Code~~ VCC.

*EBH* = *Existing building* height in feet (mm).

*AS* = Allowable height in stories from Section 504 of the ~~International Building Code~~ VCC.

*EBS* = *Existing building* height in stories.

*CF* = 1 if *(AH) – (EBH)* is positive.

*CF* = Construction-type factor shown in Table ~~1401.6.6(2)~~ 1403.6(2) if *(AH) – (EBH)* is negative.

**1403.2.1 Allowable area formula.**

where:

$A_a$ = Allowable building area per story (square feet).

$A_t$ = Tabular allowable area factor (NS, S1, S13R, or SM value, as applicable) in accordance with Table 506.2 of the ~~International Building Code~~ VCC.

*NS* = Tabular allowable area factor in accordance with Table 506.2 of the ~~International Building Code~~ VCC for a nonsprinklered building (regardless of whether the building is sprinklered).

$I_f$ = Area factor increase due to frontage as calculated in accordance with Section 506.3 of the ~~International Building Code~~ VCC.

**1403.13 Maximum exit access travel distance to an exit.**

Evaluate the length of exit access travel to an approved exit. Determine the appropriate points in accordance with the following equation and enter that value into Table ~~1401.7~~ 1404.1 under Safety Parameter ~~1401.6.13~~ 1403.13, Maximum Exit Access Travel Distance for means of egress and general safety. The maximum allowable exit access travel distance shall be determined in accordance with Section 1017.1 of the VCC.

**1403.6.1 Vertical opening formula.**

where:

*VO* = Vertical opening value.

*PV* = Protection value from Table ~~1401.6.6(1)~~ 1403.6(1).

*CF* = Construction-type factor from Table ~~1401.6.6(2)~~ 1403.6(2).

**Bottom left portion of Table 1404.1**

| | |
|---|---|
| ~~1401.6.1~~ | 1403.1 |
| ~~1401.6.2~~ | 1403.2 |
| ~~1401.6.3~~ | 1403.3 |
| ~~1401.6.4~~ | 1403.4 |
| ~~1401.6.5~~ | 1403.5 |
| ~~1401.6.6~~ | 1403.6 |
| ~~1401.6.7~~ | 1403.7 |
| ~~1401.6.8~~ | 1403.8 |
| ~~1401.6.9~~ | 1403.9 |
| ~~1401.6.10~~ | 1403.10 |
| ~~1401.6.11~~ | 1403.11 |
| ~~1401.6.12~~ | 1403.12 |
| ~~1401.6.13~~ | 1403.13 |
| ~~1401.6.14~~ | 1403.14 |
| ~~1401.6.15~~ | 1403.15 |
| ~~1401.6.16~~ | 1403.16 |

~~1401.6.17~~ 1403.17

~~1401.6.18~~ 1403.18

~~1401.6.19~~ 1403.19

~~1401.6.20~~ 1403.20

~~1401.6.21.1~~

~~1401.6.21.2~~

~~1401.6.21.3~~

**Cost Impact:**
Will not increase or decrease cost of construction.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB1401.1-18

This proposal doesn't have any public comments.

Proposal # 334

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# PM105.2(2)-18

**Proponents:** Ronald Clements (clementsro@chesterfield.gov)

## 2015 Virginia Maintenance Code

**105.2 Notices, reports and orders.** Upon findings by the code official that violations of this code exist, the code official shall issue a correction notice or notice of violation to the owner or the person responsible for the maintenance of the structure. Work done to correct violations of this code subject to the permit, inspection and approval provisions of the VCC shall not be construed as authorization to extend the time limits established for compliance with this code. When the owner is not the responsible party to whom the notice of violation or correction notice is issued, a copy of the notice shall also be delivered to the owner.

## 2015 Virginia Statewide Prevention Fire Code

**111.2 Service.** The written notice of violation of this code shall be served upon the owner, a duly authorized agent or upon the occupant or other person responsible for the conditions under violation. Such notice shall be served either by delivering a copy of same to such persons by mail to the last known post office address; by delivering in person or by delivering it to and leaving it in the possession of any person in charge of the premises; or, in the case such person is not found upon the premises, by affixing a copy thereof in a conspicuous place at the entrance door or avenue of access. Such procedure shall be deemed the equivalent of personal notice.When the owner is not the responsible party to whom the notice of violation or correction notice is issued, a copy of the notice shall also be delivered to the owner or owner's agent.

**Reason Statement:** This code change is being submitted at the request of Virginia Senator Stuart consistent with SB141 2020. This was prompted by a building that caught fire after numerous maintenance and fire prevention code violations were cited, which were never brought to the attention of the building owner. The bill is below:

# 2020 SESSION

- history | hilite | pdf | print version

20100053D

**SENATE BILL NO. 141**
Offered January 8, 2020
Prefiled December 18, 2019
*A BILL to amend the Code of Virginia by adding sections numbered 27-97.01 and 36-98.02, relating to building and fire codes; notice requirements.*

---
Patron-- Stuart
---
Referred to Committee on General Laws and Technology
---

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding sections numbered 27-97.01 and 36-98.02 as follows:

*§ 27-97.01. Notice requirements.*

*Where Code provisions direct an enforcement agency to provide notice related to enforcement of the Fire Prevention Code, such notice shall be provided to the owner of the building, structure, property, or premises in question. Code provisions may also direct that such notice be provided to other persons as appropriate.*

*§ 36-98.02. Notice requirements.*

*Where Code provisions direct a local building department to provide notice related to enforcement of the Building Code, such notice shall be provided to the owner of the building, structure, property, or premises in question. Code provisions may also direct that such notice be provided to other persons as appropriate.*

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is administrative and has no impact on cost.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is administrative and has no impact on resiliency.

## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: PM105.2-18

This proposal doesn't have any public comments.

Proposal # 320

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# PM604.3.1.1-18

**Proponents:** Haywood Kines (hkines@pwcgov.org)

## 2015 Virginia Maintenance Code

**604.3.1.1 Electrical equipment.** Electrical distribution equipment, motor circuits, power equipment, transformers, wire, cable, flexible cords, wiring devices, ground fault circuit interrupters, surge protectors, molded case circuit breakers, low-voltage fuses, luminaires, ballasts, motors, and electronic control, signaling, and communication equipment that have been exposed to water shall be replaced in accordance with the provisions of the VCC.

**Exception:** The following equipment shall be allowed to be repaired or reused where an inspection report from the equipment manufacturer, an approved representative of the equipment manufacturer, a ~~third-party licensed or certified electrician~~ Third-party inspector per Section 113.7 of the VCC, or an electrical engineer indicates that the exposed equipment has not sustained damage that requires replacement:

1. Enclosed switches, rated 600 volts or less;
2. Busway, rated 600 volts or less;
3. Panelboards, rated 600 volts or less;
4. Switchboards, rated 600 volts or less;
5. Fire pump controllers, rated 600 volts or less;
6. Manual and magnetic motor controllers;
7. Motor control centers;
8. Alternating current high-voltage circuit breakers;
9. Low-voltage power circuit breakers;
10. Protective relays, meters and current transformers;
11. Low- and medium-voltage switchgear;
12. Liquid-filled transformers;
13. Cast-resin transformers;
14. Wire or cable that is suitable for wet locations and whose ends have not been exposed to water;
15. Wire or cable, not containing fillers, that is suitable for wet locations and whose ends have not been exposed to water;
16. Luminaires that are listed as submersible;
17. Motors; or
18. Electronic control, signaling and communication equipment.

**Reason Statement:** The protective components of the electrical equipment and materials are critical to the safe operation of the electrical system. Their ability to protect the electrical system is adversely affected by exposure to fire, heat, and to contaminated water from sprinkler systems or Fire fighting equipment. Listed cable assemblies, molded case circuit breakers, all electronic devices such as AFCI's , GFCI's , Smoke Alarms, Luminaires, etc. are devices that cannot be repaired per NEMA Standards.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is intended to assure the electrical systems and equipment is undamaged and still safe to operate per its original listing and installation requirements. Having qualified inspectors that understand electrical systems and have to perform the evaluation will assure the buildings are safe for occupancy.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This will increase the level of safety for all residential and commercial buildings that have been exposed to damaged electrical systems from flooding, exposure to water from Fire Fighting, and heat from exposure to fires. This allows the Building Official to determine the qualifications for the agency and/or inspectors performing the evaluations on these systems.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Approval

**Workgroup 2 - Final Reason:**

# Public Comments for: PM604.3.1.1-18

This proposal doesn't have any public comments.

Proposal # 298

# PM105.2-18

**Proponents:** W Shaun Pharr (spharr@aoba-metro.org)

## 2015 Virginia Maintenance Code

**105.2 Notices, reports and orders.** Upon findings by the code official that violations of this code exist, the code official shall issue a correction notice or notice of violation to the owner, tenant or the person responsible for the maintenance of the structure. Work done to correct violations of this code subject to the permit, inspection and approval provisions of the VCC shall not be construed as authorization to extend the time limits established for compliance with this code.

**Reason Statement:** The Virginia Residential Landlord and Tenant Act (VRLTA) requires that a rental housing provider “maintain fit premises.” However, it also specifically provides that “a landlord and tenant may agree in writing that the tenant perform” certain of the landlord's specified duties (see excerpts below from Section 55.1-1220). Thus, a tenant, rather than a property owner, may be the responsible party to whom a code official should issue a notice of correction or notice of violation, depending on the maintenance duty in question.

Some code officials, though, are unaware that the General Assembly has authorized such limited transfers of maintenance responsibilities, while others do not always recognize the right of parties to a lease to make such an agreement, and will cite only the owner or managing agent. In either case, the General Assembly’s intent is defeated.

This code change proposal provides clarity to code officials, tenants and owners by including specific reference to tenants as possible recipients of a correction notice or notice of violation.

**Cost Impact:**
This code change proposal will have no effect whatsoever on the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Proposed Committee Action:** Consensus Approval

**Workgroup 1 - Proposed Reason:**

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# Public Comments for: PM105.2-18

This proposal doesn't have any public comments.

Proposal # 259

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# PM105.4-18

**Proponents:** W Shaun Pharr (spharr@aoba-metro.org)

## 2015 Virginia Maintenance Code

**105.4 Notice of violation.** If the code official determines there are violations of this code a written notice of violation may be issued to the owner, tenant or the person responsible for the maintenance or use of the building or structure in lieu of a correction notice as provided for in Section 105.3. In addition, the code official shall issue a notice of violation for any uncorrected violation remaining from a correction notice established in Section 105.3. The code official shall provide the ~~section numbers to the owner for any~~ section numbers for any code provisions cited in the notice of ~~violation.~~ violation to the owner, tenant or the person responsible for the maintenance or use of the building or structure. The notice shall require correction of the violation or violations within a reasonable time. The owner, tenant or person to whom the notice of violation has been issued shall be responsible for contacting the code official within the time frame established for any re-inspections to assure the violations have been corrected. The code official will be *responsible* for making such inspection and verifying the violations have been corrected. In addition, the notice of violation shall indicate the right of appeal by referencing the appeals section of this code.

**Exceptions:**

1. Notices issued, and legal proceedings or emergency actions taken, under Section 106 for *unsafe structures*, *unsafe equipment* or *structures unfit for human occupancy*.
2. Notices issued for failing to maintain buildings and structures as required by Section 103.2, as evidenced by multiple or repeated violations on the same property, are not required to include a compliance deadline for correcting defects.

**Reason Statement:** The Virginia Residential Landlord and Tenant Act (VRLTA) requires that a rental housing provider “maintain fit premises.” However, it also specifically provides that “a landlord and tenant may agree in writing that the tenant perform” certain of the landlord's specified duties (see excerpts below from Section 55.1-1220). Thus, a tenant, rather than a property owner, may be the responsible party to whom a code official should issue a notice of correction or notice of violation, depending on the maintenance duty in question.

Some code officials, though, are unaware that the General Assembly has authorized such limited transfers of maintenance responsibilities, while others do not always recognize the right of parties to a lease to make such an agreement, and will cite only the owner or managing agent. In either case, the General Assembly’s intent is defeated.

This code change proposal provides clarity to code officials, tenants and owners by including specific reference to tenants as possible recipients of a correction notice or notice of violation, and also makes a technical insertion, for consistency, of language appearing earlier in the section.

**Cost Impact:**
This code change proposal will have no effect whatsoever on the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Proposed Committee Action:** Consensus Approval

**Workgroup 1 - Proposed Reason:**

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# Public Comments for: PM105.4-18

This proposal doesn't have any public comments.

Proposal # 260

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# TP403.1(1)-18

**Proponents:** Cornelia Weiss (koislmeier@yahoo.com)

## 2015 Virginia Plumbing Code

**TABLE 403.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 403.1.1 and 403.2)

| NO. | CLASSIFICATION | OCCUPANCY | DESCRIPTION | WATER CLOSETS (URINALS: SEE SECTION 419.2) | | LAVATORIES | | BATHTUBS/SHOWERS | DRINKING FOUNTAIN (SEE SECTION 410 | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MALE | FEMALE | MALE | FEMALE | | | |
| 1 | Assembly | A-1[d] | Theaters and other buildings for the performing arts and motion pictures | 1 per 125 | 1 per 65 | 1 per 200 | | 1 per 500 | 1 service sink | |
| | | A-2[d] | Nightclubs, bars, taverns, dance halls and buildings for similar purposes | 1 per 40 | 1 per 40 | 1 per 75 | | 1 per 500 | 1 service sink | |
| | | | Restaurants, banquet halls and food courts | 1 per 75 | 1 per 75 | 1 per 200 | | 1 per 500 | 1 service sink | |
| | | A-3[d] | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums | 1 per 125 | 1 per 65 | 1 per 200 | | 1 per 500 | 1 service sink | |
| | | | Passenger terminals and transportation facilities, to include before and after any passenger screening checkpoints. | 1 per ~~500~~ 125 | 1 per ~~500~~ 65 | 1 per 750 | | 1 per 1,000 | 1 service sink | |
| | | | Places of worship and other religious services | 1 per 150 | 1 per 75 | 1 per 200 | | 1 per 1,000 | 1 service sink | |
| | | A-4 | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | 1 per 1,000 | 1 service sink | |
| | | A-5 | Stadiums, amusement parks, pools, bleachers, and grandstands for | 1 per 75 for the first 1,500 and 1 per 120 for the | 1 per 40 for the first 1,520 and 1 per 60 for the | 1 per 200 | 1 per 150 | 1 per 1,000 | 1 service sink | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | outdoor sporting events and activities[f] | remainder exceeding 1,500 | remainder exceeding 1,520 | | | | |
| 2 | Business | B | Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial and similar uses | 1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50 | | 1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80 | | 1 per 100 | 1 service sinke |
| 3 | Educational | E | Educational facilities | 1 per 50 | | 1 per 50 | | 1 per 100 | 1 service sink |
| 4 | Factory and industrial | F-1 and F-2 | Structures in which occupants are engaged in work fabricating, assembly or processing of products or materials | 1 per 100 | | 1 per 100 | | (see Section 411) | 1 per 400 | 1 service sink |
| 5 | Institutional | I-1 | Residential care | 1 per 10 | | 1 per 10 | | 1 per 8 | 1 per 100 | 1 service sink |
| | | I-2 | Hospitals, ambulatory nursing home care recipient | 1 per room[c] | | 1 per room[c] | | 1 per 15 | 1 per 100 | 1 service sink per floor |
| | | | Employees, other than residential care[b] | 1 per 25 | | 1 per 35 | | 1 per 100 | | |
| | | | Visitors, other than residential care | 1 per 75 | | 1 per 100 | | 1 per 500 | | |
| | | I-3 | Prisons[b] | 1 per cell | | 1 per cell | | 1 per 15 | 1 per 100 | 1 service sink |
| | | | Reformitories, detention centers, and correctional centers[b] | 1 per 15 | | 1 per 15 | | 1 per 15 | 1 per 100 | 1 service sink |
| | | | Employees[b] | 1 per 25 | | 1 per 35 | | 1 per 100 | | |
| | | I-4 | Adult day care and child day care | 1 per 15 | | 1 per 15 | | 1 | 1 per 100 | 1 service sink |
| 6 | Mercantile | M | Retail stores, service stations, shops, salesrooms, markets and shopping centers | 1 per 500 | | 1 per 750 | | 1 per 1,000 | 1 service sink[e] | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | Residential | R-1 | Hotels, motels, boarding houses (transient) | 1 per sleeping unit | 1 per sleeping unit | 1 per sleeping unit | 1 service sink | |
| | | R-2 | Dormitories, fraternities, sororities and boarding houses (not transient) | 1 per 10 | 1 per 10 | 1 per 8 | 1 per 100 | 1 service sink |
| | | R-2 | Apartment house | 1 per dwelling unit | 1 per dwelling unit | 1 per dwelling unit | 1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units | |
| | | R-3 | Congregate living facilities with 16 or fewer persons | 1 per 10 | 1 per 10 | 1 per 8 | 1 per 100 | 1 service sink |
| | | R-3 | One- and two-family dwellings and lodging houses with five or fewer guestrooms | 1 per dwelling unit | 1 per dwelling unit | 1 per dwelling unit | 1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit | |
| | | R-4 | Congregate living facilities with 16 or fewer persons | 1 per 10 | 1 per 10 | 1 per 8 | 1 per 100 | 1 service sink |
| 8 | Storage | S-1 S-2 | Structures for the storage of goods, warehouses, storehouse and freight depots. Low and Moderate Hazard. | 1 per 100 | 1 per 100 | See Section 411 | 1 per 1,000 | 1 service sink |

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by the International Building Code .

b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted provided that each patient sleeping unit has direct access to the toilet room and provision for privacy for the toilet room user is provided.

d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e. For business and mercantile occupancies with an occupant load of 15 or fewer, service sinks shall not be required.

f. The occupant load for pools shall be in accordance with the "Skating rinks, swimming pools" category of Table 1004.1.2 of the IBC.

## 2015 Virginia Construction Code

**[P] TABLE 2902.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See **Sections 2902.1.1** and **2902.2**)

| No. | CLASSIFICATION | OCCUPANCY | DESCRIPTION | WATER CLOSETS (URINALS SEE SECTION 419.2 OF THE INTERNATIONAL PLUMBING CODE) | | LAVATORIES | | BATHTUBS/SHOWERS | DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE) | OTHE |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Male | Female | | | |
| 1 | Assembly | A-1[d] | Theaters and other buildings for the performing arts and motion pictures | 1 per 125 | 1 per 65 | 1 per 200 | | 1 per 500 | 1 service sink | |
| | | A-2[d] | Nightclubs, bars, taverns, dance halls and buildings for similar purposes | 1 per 40 | 1 per 40 | 1 per 75 | | 1 per 500 | 1 service sink | |
| | | | Restaurants, banquet halls and food courts | 1 per 75 | 1 per 75 | 1 per 200 | | 1 per 500 | 1 service sink | |
| | | A-3[d] | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums | 1 per 125 | 1 per 65 | 1 per 200 | | 1 per 500 | 1 service sink | |
| | | | Passenger terminals and transportation facilities, to include before and after any passenger screening checkpoints. | 1 per ~~500~~ 125 | 1 per ~~500~~ 65 | 1 per 750 | | 1 per 1,000 | 1 service sink | |
| | | | Places of worship and other religious services | 1 per 150 | 1 per 75 | 1 per 200 | | 1 per 1,000 | 1 service sink | |
| | | A-4 | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | 1 per 1,000 | 1 service sink | |
| | | | | 1 per 75 | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A-5 | Stadiums, amusement parks, pools, bleachers, and grandstands for outdoor sporting events and activities[f] | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | 1 per 1,000 | 1 service sink | |
| 2 | Business | B | Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial and similar uses | 1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50 | | 1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80 | | 1 per 100 | 1 service sink[e] | |
| 3 | Educational | E | Educational facilities | 1 per 50 | | 1 per 50 | | 1 per 100 | 1 service sink | |
| 4 | Factory and industrial | F-1 and F-2 | Structures in which occupants are engaged in work fabricating, assembly or processing of products or materials | 1 per 100 | | 1 per 100 | | See Section 411 of the International Plumbing Code | 1 per 400 | 1 servic sink |
| 5 | Institutional | I-1 | Residential care | 1 per 10 | | 1 per 10 | | 1 per 8 | 1 per 100 | 1 servic sink |
| | | I-2 | Hospitals, ambulatory nursing home care recipient[b] | 1 per room[c] | | 1 per room[c] | | 1 per 15 | 1 per 100 | 1 servic sink |
| | | Employees, other than residential care[b] | 1 per 25 | | 1 per 35 | | 1 per 100 | | | |
| | | Visitors, other than residential care | 1 per 75 | | 1 per 100 | | 1 per 500 | | | |
| | | I-3 | Prisons[b] | 1 per cell | | 1 per cell | | 1 per 15 | 1 per 100 | 1 servic sink |
| | | I-3 | Reformatories, detention centers and correctional centers[b] | 1 per 15 | | 1 per 15 | | 1 per 15 | 1 per 100 | 1 servic sink |
| | | | Employees[b] | 1 per 25 | | 1 per 35 | | 1 per 100 | | |
| | | I-4 | Adult day care and child day care | 1 per 15 | | 1 per 15 | | 1 | 1 per 100 | 1 servic sink |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | Mercantile | M | Retail stores, service stations, shops, salesrooms, markets and shopping centers | 1 per 500 | 1 per 750 | 1 per 1,000 | 1 service sink[e] | |
| 7 | Residential | R-1 | Hotels, motels, boarding houses (transient) | 1 per sleeping unit | 1 per sleeping unit | 1 per sleeping unit | 1 service sink | |
| | | R-2 | Dormitories, fraternities, sororities and boarding houses (not transient) | 1 per 10 | 1 per 10 | 1 per 8 | 1 per 100 | 1 servic sink |
| | | R-2 | Apartment house | 1 per dwelling unit | 1 per dwelling unit | 1 per dwelling unit | 1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units | |
| | | R-3 | One- and two-family dwellings and lodging houses with five or fewer guest rooms | 1 per dwelling unit | 1 per 10 | 1 per dwelling unit | 1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit | |
| | | R-3 | Congregate living facilities with 16 or fewer persons | 1 per 10 | 1 per 10 | 1 per 8 | 1 per 100 | 1 servic sink |
| | | R-4 | Congregate living facilities with 16 or fewer persons | 1 per 10 | 1 per 10 | 1 per 8 | 1 per 100 | 1 servic sink |
| 8 | Storage | S-1 S-2 | Structures for the storage of goods, warehouses, store- houses and freight depots, low and moderate hazard | 1 per 100 | 1 per 100 | See Section 411 of the International Plumbing Code | 1 per 1,000 | 1 servic sink |

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code.

b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient *sleeping units* shall be permitted, provided that each patient *sleeping unit* has direct access to the toilet room and provisions for privacy for the toilet room user are provided.

d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e. For business and mercantile occupancies with an occupant load of 15 or fewer, service sinks shall not be required.

f. The occupant load for pools shall be in accordance with the "Skating rinks, swimming pools" category of Table 1004.1.2.

**Reason Statement:** People spend as much time, if not more, in an airport than in a museum. Simply because one is in an airport, instead of in a museum, does not reduce the basic biological need to urinate and defecate. Therefore, the number of toilet fixtures required for an airport should, at minimum, be the same as for a museum.

**Cost Impact:**
Unknown

**Resiliency Impact Statement:**
Unknown

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

**Workgroup 4 - Proposed Committee Action:** Carry over to Final

**Workgroup 4 - Proposed Reason:**

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# Public Comments for: TP403.1(1)-18

This proposal doesn't have any public comments.

Proposal # 188

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Commonwealth of Virginia

**Potts, Richard <richard.potts@dhcd.virginia.gov>**

# Re: 1) Specified URL cannot be found 2) Code Change Proposal

1 message

**Cornelia Weiss** <koislmeier@yahoo.com> Thu, Jun 27, 2019 at 12:37 AM
To: "Potts, Richard" <richard.potts@dhcd.virginia.gov>
Cc: Jeff Brown <jeff.brown@dhcd.virginia.gov>, "King, Thomas" <thomas.king@dhcd.virginia.gov>

Dear Richard Potts:

Completed. Please let me know if I need/should do anything else.

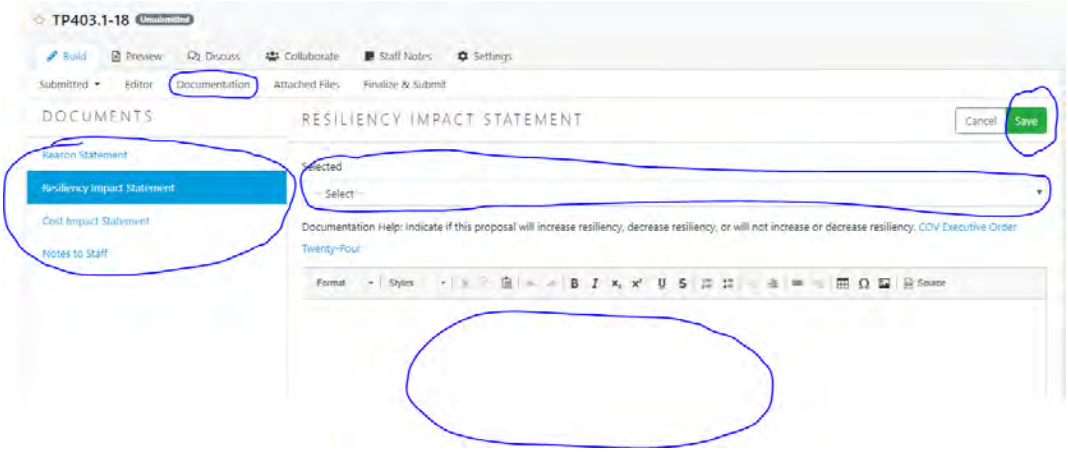
With appreciation for all your work,

Cornelia Weiss

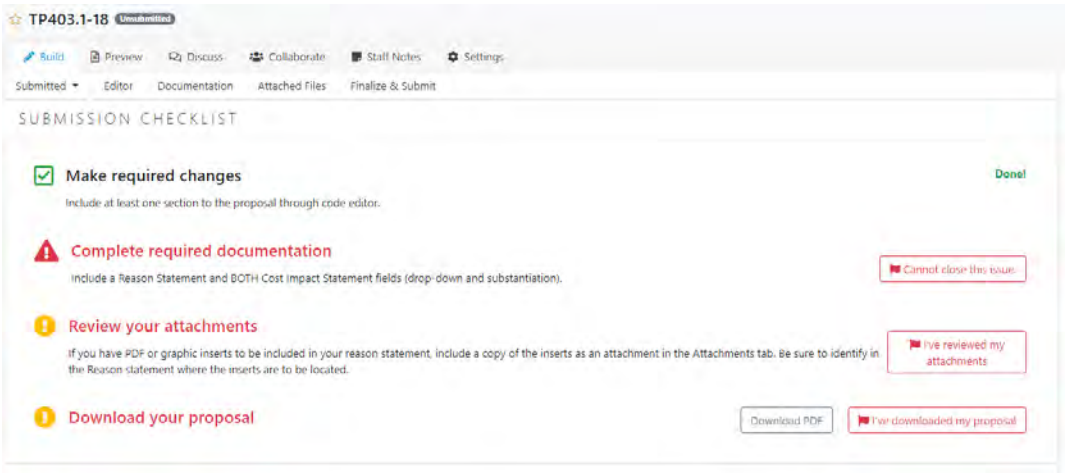
On Wednesday, June 26, 2019, 8:51:27 PM GMT+2, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:

Ms. Weiss,

You will need to complete and submit the proposal in cdpVA. Once you open your proposal, click on the documentation tab. This will open the screen shown shown below. The reason statement, resiliency impact statement and cost impact statements are on the left and are required to finalize and submit. Please note, in addition to the drop box, an actual statement needs to be entered in the bottom text box for both the resiliency and cost impact statements (don't forget to save).




After completing the documentation portion, you will now select the finalize and submit tab. Just verify that you've completed the items shown below and then you'll be able to submit.




Take care,

**Richard Potts II, CBO**
**Code Development and Technical Support Administrator**
**Department of Housing & Community Development (DHCD)**
**600 E. Main Street, Suite 300**
**Richmond, VA 23219**
**(804) 786-1157 - Office**

**(804) 371-7092- Fax**

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On Wed, Jun 26, 2019 at 4:17 AM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Please let me know in what format and how I submit my proposal, to include a reason statement. I regret I will be on the other side of the Atlantic on the 24th and do not fly back until the 25th. I could present, if the members are still in session, on the 26th of July.
>
> With appreciation,
>
> Cornelia Weiss
>
> On Monday, June 24, 2019, 8:30:30 PM GMT+2, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:
>
> The workgroups are open to the public and are typically attended by a wide range of stakeholders, including building and fire officials, designers and various associations. We strongly recommend proponents attend to speak on behalf of their proposals.
>
> I failed to mention that once you take ownership you will need to finish submitting your proposal. This will include providing a reason statement, which if you're unable to attend, will be what your proposal will stand on.
>
> Sincerely,
>
> **Richard Potts II, CBO**
> **Code Development and Technical Support Administrator**
> **Department of Housing & Community Development (DHCD)**
> **600 E. Main Street, Suite 300**

**Richmond, VA 23219**
**(804) 786-1157 - Office**

**(804) 371-7092- Fax**

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On Mon, Jun 24, 2019 at 12:54 PM Cornelia Weiss <koislmeier@yahoo.com> wrote:

I thank you. Who are the members of the workgroup? Will the rationale for the proposal be communicated to them?

On Monday, June 24, 2019, 10:24:08 AM EDT, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:

Good morning,

I've sent the transfer proposal request in cdpVA. I believe it will show up as a notification (see image below).

The next step is the proposal will be discussed during the next workgroup meeting on July 24th. The meeting details are below and can also be found at https://va.cdpaccess.com/ under upcoming events section on the home page. Each proposal receives a designation based on whether there is support or not.

The workgroup recommendations are as follows:

Consensus for approval--Everyone is in support
Consensus for disapproval--Everyone, other than the proponent of the proposals. does not support
Non-consensus--There is not 100% agreement (other than the proponent)
Pending/Carryover--Proposal is moved to the next meeting or next phase

All proposals go to the board of housing and community development to be voted on and they take the workgroup recommendations into consideration.

Let me know if you have additional questions.

CALENDAR EVENT: COMBINED WORKGROUPS 1 & 2

Location: VHC at VHDA – 4224 Cox Road, Glen Allen, VA 23060

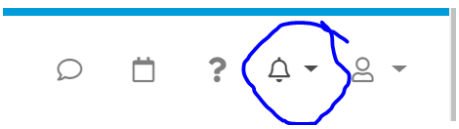
**Event Start** Jul 24 2019 9:30 AM EDT
**Event End** Jul 24 2019 3:30 PM EDT

***Workgroup 1:** Administrative provisions of VCC, VMC, VRC and SFPC regulations; VADR/ADTAC regulations (amusement rides); VCS/BCAAC (certification requirements; IBSR (modular buildings); MHSR (manufactured housing); Related Laws; Manufactured Housing Licensing and Transaction Recovery Fund Regulations and, other state agency's regulations for functional design.

**Workgroup 2**-Technical provisions of VCC, VMC, VRC and SFPC (IBC, IFC, IEBC and IPMC and other model codes).

**The deadline for submitting proposals for this meeting is 12:00 PM on July 16th.** Proposals submitted after the deadline will be carried over to the final phase.

*The 2nd Workgroup 1 meeting that was tentatively scheduled for July 10th was postponed and has now been combined with the 2nd Workgroup 2 meeting



Take care,

**Richard Potts II, CBO**
**Code Development and Technical Support Administrator**
**Department of Housing & Community Development (DHCD)**
**600 E. Main Street, Suite 300**
**Richmond, VA 23219**
**(804) 786-1157 - Office**

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On Thu, Jun 20, 2019 at 5:40 PM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Dear Richard Potts:
>
> I approve. I thank you.
>
> What are the next steps?
>
> With appreciation,
>
> Cornelia Weiss
>
> On Thursday, June 20, 2019, 2:30:38 PM EDT, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:
>
> Ms. Weiss,
>
> I've updated the proposal based on the language you've provided. Let me know if you approve and I will transfer ownership.
>
> Sincerely,
>
> **Richard Potts II, CBO**
>
> **Code Development and Technical Support Administrator**
> **Department of Housing & Community Development (DHCD)**
> **600 E. Main Street, Suite 300**
> **Richmond, VA 23219**
> **(804) 786-1157 - Office**
>
> **(804) 371-7092- Fax**




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On Thu, Jun 20, 2019 at 10:17 AM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Dear Richard Potts:
>
> To ensure that adequate toilets exist AFTER one has gone through security screening, request after the word "facilities," a comma be inserted, followed by the words "to include before and after any passenger screening checkpoints."

I thank you in advance,

Cornelia Weiss

On Wednesday, June 19, 2019, 10:18:37 AM EDT, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:

Good morning,

Before I transfer the proposal to you, please review the attached and confirm this is what you wanted.

Take care,

**Richard Potts II, CBO**
**Code Development and Technical Support Administrator**
**Department of Housing & Community Development (DHCD)**
**600 E. Main Street, Suite 300**
**Richmond, VA 23219**
**(804) 786-1157 - Office**

**(804) 371-7092- Fax**




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On Mon, Jun 17, 2019 at 11:18 AM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Dear Richard Potts:
>
> I have created the account. Please let me know where/how I can see the submitted proposal.
>
> With appreciation,
>
> Cornelia Weiss
>
> On Monday, June 17, 2019, 8:13:29 AM EDT, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:
>
> Ms. Weiss:
>
> I am creating your proposal in cdpVA ( https://va.cdpaccess.com/ ). You will still need to create an account so that I can transfer the proposal to you. When you click to register it will redirect you to ICC's website because our site is built on their platform. Once you create your account, just let me know and I'll transfer it over.
>
> Just for clarification, the Virginia Construction Code applies to new buildings and some renovations/additions and is not retroactive. Aside from a handful of retrofit provisions that are required by state law, buildings are maintained to the code they were built under in Virginia.
>
> Take care,
> Richard
>
> **Richard Potts II, CBO**
> **Code Development and Technical Support Administrator**
> **Department of Housing & Community Development (DHCD)**
> **600 E. Main Street, Suite 300**
> **Richmond, VA 23219**
> **(804) 786-1157 - Office**

**(804) 371-7092- Fax**

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On Fri, Jun 14, 2019 at 9:19 AM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Dear Jeff Brown:
>
> The link provided is for the ICC, not the Virginia Construction Code.
>
> Given that it appears that the links provided do not permit this member of the general public to submit a change proposal for the Virginia Construction Code, please submit on my behalf a code change proposal requiring the minimum number of fixtures for passenger terminals and transportation facilities, to include before and after the security checkpoints, be the same as museums: 1/65 for females and 1/125 for males (instead of the 1/500 currently in the Code for passenger terminals and transportation facilities). Rationale: People spend as much time, if not more, in an airport than in a museum. Simply because one is in an airport, instead of in a museum, does not reduce the basic biological need to urinate and defecate.
>
> In advance, I thank you.
>
> Cornelia Weiss
>
> On Friday, May 31, 2019, 12:30:54 PM EDT, Brown, Jeffrey <jeff.brown@dhcd.virginia.gov> wrote:
>
> Hi Ms. Weiss,
>
> I apologize for the inconvenience. Please try this link and let us know if it works.
>
> https://www.iccsafe.org/register/
>
> Sincerely,
>
> **JEFF BROWN, MCP**
> Director of State Building Codes Office
> Division of Building and Fire Regulaon
> Va. Department of Housing and Community Development
> 600 E. Main Street – Suite 1100
> Richmond, VA 23219
> 804-371-7161
> Jeff.Brown@dhcd.virginia.gov
>
> ***Click and Follow: Code Connection Blog***
>
> On Thu, May 30, 2019 at 6:52 PM Cornelia Weiss <koislmeier@yahoo.com> wrote:
>
> > Mr Potts:

When I click the register button, this is what appears: **The specified URL cannot be found.**

On Thursday, May 30, 2019, 3:26:59 PM GMT+2, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:

Ms. Weiss,

Are you receiving the error when you click on the link ( https://va.cdpaccess.com/login/ ) or is it after you attempt to register?

**Richard Potts II, CBO**
**Code Development and Technical Support Administrator**
**Department of Housing & Community Development (DHCD)**
**600 E. Main Street, Suite 300**
**Richmond, VA 23219**
**(804) 786-1157 - Office**

**(804) 371-7092- Fax**




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On Wed, May 29, 2019 at 7:01 PM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Mr Potts:
>
> When I attempted to register via the link provided, to submit a code change proposal, I received the message "the specified URL cannot be found."
>
> Please advise, as I wish to submit a code change proposal to the effect that the minimum number of fixtures for passenger terminals and transportation facilities should be the same as museums: 1/65 for females and 1/125 for males (instead of the 1/500 currently in the Code for passenger terminals and transportation facilities). Rationale: People spend as much time, if not more, in an airport than in a museum. Simply because one is in an airport, instead of in a museum, does not reduce the basic biological need to urinate and defecate. (And airports have restaurants and places of worship, which should fall under the toilet fixture requirements for restaurants and places of worship, rather than under "passenger terminals and transportation facilities.")
>
> Regards,
>
> Cornelia Weiss
>
> On Wednesday, May 29, 2019, 10:30:30 PM GMT+2, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:
>
> Ms. Weiss,
>
> The section/table that determines the number of plumbing fixtures is 2902.1 in the Virginia Construction Code. Section 2902 is the overall section for minimum plumbing facilities. Let me know if you need anything further.
>
> Sincerely,
> Richard
>
> **Richard Potts II, CBO**
> **Code Development and Technical Support Administrator**

**Department of Housing & Community Development (DHCD)**
**600 E. Main Street, Suite 300**
**Richmond, VA 23219**
**(804) 786-1157 - Office**

**(804) 371-7092- Fax**




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On Wed, May 29, 2019 at 1:42 PM Cornelia Weiss <koislmeier@yahoo.com> wrote:

> Dear Richard Potts:
>
> I would be happy to submit a proposed modification to the Code. Would you be willing to provide me with the section(s) regarding water closets? My searches of your on-line Code have yielded no results.
>
> With appreciation,
>
> Cornelia Weiss
>
> On Wednesday, May 29, 2019, 1:16:52 PM EDT, Potts, Richard <richard.potts@dhcd.virginia.gov> wrote:
>
> Good afternoon,
>
> Thank you for contacting our office, Jeff Brown forwarded your email to me concerning the required number and distance of plumbing fixtures, specifically water closets. The building code establishes the number of fixtures based on the number of occupants and the occupancy classification. The code has a maximum travel distance to reach these facilities, but doesn't provide restrictions for distances between the Male and Female facilities. The Uniform Statewide Building Code is a minimum code and it's the building owner's discretion whether to go beyond these requirements.
>
> Virginia updates its codes every 3 years or so and we are currently in the process of updating to the 2018 edition of the codes. We adopt the national codes with Virginia-specific amendments. These proposed amendments to the code are typically brought forward by stakeholders and vetted through public workgroups and ultimately voted on by the Board of Housing and Community Development. If you are interested in submitting a code change proposal to change these requirements, you can do so at https://va.cdpaccess.com/. Also, here is a link to an overview of our code change process -- https://www.dhcd.virginia.gov/code-development-process.
>
> Please let me know if you have any questions.
>
> Take care,
>
> **Richard Potts II, CBO**
> **Code Development and Technical Support Administrator**
> **Department of Housing & Community Development (DHCD)**
> **600 E. Main Street, Suite 300**
> **Richmond, VA 23219**
> **(804) 786-1157 - Office**
>
> **(804) 371-7092- Fax**
>
> 
> 

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---------- Forwarded message ---------
From: **Cornelia Weiss** <koislmeier@yahoo.com>
Date: Mon, May 27, 2019 at 8:33 AM
Subject: Virginia Uniform Statewide Building Code
To: jeff.brown@dhcd.virginia.gov <jeff.brown@dhcd.virginia.gov>

Dear Jeff Brown:

Respectfully request that the Virginia Uniform Statewide Building Code mandate toilet design and construction not discriminate against females, be it in location, wait time, or other, by requiring females to travel farther than males to use a toilet, by requiring females to wait longer to use a toilet. The Building Code should require that design and construction of toilets not result in females having to travel longer and wait longer than males to use a toilet.

Currently, design and construction generally places male lavatories before female lavatories so that females are required to travel farther than males to access a toilet. In addition to an appearance of unfairness, this has health and other implications for handicapped females, a parent with child(ren), menstruating women, and women needing to urinate and defecate.

Currently, design and construction results in [longer] waiting times for females to use a toilet than for men. In addition to an appearance of unfairness to require females to wait longer than males, this has health and other implications for handicapped females, a parent with child(ren), menstruating women, and women needing to urinate and defecate.

For example, as you may know, either from personal experience or from observation, that wait times (wait lines) to use a toilet at Reagan National Airport are much longer for women than for men.

Concerned, on April 15, 2019, I wrote to Mr. Warner Sessions of the Metropolitian Washington Airports Authority to ask that he remedy this inequality (if he determined that wait times were longer for women than for men); that is, ensure that women are not placed in a position by the Metropolitan Washington Airports Authority to have to wait longer than men to use a toilet.

The response I received from Acting Vice President of Operational Support Richard Golinowski (with a cc to Mr. Warner H. Session, Mr. John E. Potter, and Mr. Jerome L. Davis) stated that Authority's airports

"generally provide three times the number of toilet fixtures in restrooms than are required by the Virginia Plumbing Code," that it has received "complaints about restroom wait times for women," that it had responded by "installing an additional women's restroom," and that it does "not monitor wait times for individuals using restrooms."

The response failed to address that the Authority forces women to wait longer than men to use a restroom. The response failed to indicate interest in collecting data to ensure that any remedies provided (the Authority's "additional restroom") solve the issue of forcing women to wait longer than men to use a restroom. It is unclear whether this lack of willingness to address the issue of women having to wait longer than men to use a restroom is because the Metropolitan Washington Airports Authority is composed entirely of individuals who are not forced to have to wait in a line to use a women's restroom; that is, men. The individuals addressed on the letter I received are all men. I anticipate that the all-male composition of the Authority is a temporary aberration, not a norm.

I thank you in advance for remedying toilet issues so that women are not forced to wait longer than men to use a toilet, to include in the new construction at Reagan National. Further, in light of the response I received from the Authority, I urge you to also address in the Code whether it is desirable that the Authority continue to be all-male.

With appreciation,

Cornelia Weiss

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# TP403.1(2)-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2018 International Building Code

**Revise as follows:**

**[P] TABLE 2902.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 2902.1.1 and 2902.2)

| No. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE) | OTHER |
|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Male | Female | | | |
| 1 | Assembly | Theaters and other buildings for the performing arts and motion pictures[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Nightclubs, bars, taverns, dance halls and buildings for similar purposes[d] | 1 per 40 | 1 per 40 | 1 per 75 | | — | 1 per 500 | 1 service sink |
| | | Restaurants, banquet halls and food courts[d] | 1 per 75 | 1 per 75 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Casino gaming areas | 1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400 | 1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400 | 1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750 | | — | 1 per 1,000 | 1 service sink |
| | | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Passenger terminals (other than airport terminals) and transportation facilities[d] | 1 per 500 | 1 per 500 | 1 per 750 | | — | 1 per 1,000 | 1 service sink |
| | | Airport terminals | 1 per 500 | 1 per 100 for the first 500 and 1 per 150 for the remainder exceeding 500 | 1 per 750 | 1 per 250 for the first 500 and 1 per 500 for the remainder exceeding 500 | - | 1 per 1,000 | 1 service sink |
| | | Places of worship and other religious services[d] | 1 per 150 | 1 per 75 | 1 per 200 | | — | 1 per 1,000 | 1 service sink |
| | | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities[f] | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code.

b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted, provided that each patient sleeping unit has direct access to the toilet room and provisions for privacy for the toilet room user are provided.

d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e. For business and mercantile classifications with an occupant load of 15 or fewer, a service sink shall not be required.

f. The required number and type of plumbing fixtures for outdoor swimming pools shall be in accordance with Section 609 of the International Swimming Pool and Spa Code.

**[P] 2902.3.3 Location of toilet facilities in occupancies other than ~~malls.~~ malls and airports.** In occupancies other than covered and open mall buildings and airport terminals, the required public and employee toilet facilities shall be located not more than one *story* above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

**Exception:** The location and maximum distances of travel to required employee facilities in factory and industrial occupancies are permitted to exceed that required by this section, provided that the location and maximum distance of travel are *approved*.

**[P] 2902.3.4 Location of toilet facilities in malls.** In covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 mm). In mall buildings, the required facilities shall be based on total square footage ($m^2$) within a covered mall building or within the perimeter line of an open mall building, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum distance of travel to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum distance of travel shall be measured from the employees' work area of the store or tenant space.

**Revise as follows:**

**2902.3.5 Location of toilet facilities in airport terminals.** In airport terminals, the minimum number of public and employee toilet fixtures shall be located before arriving at and after leaving the main security screening checkpoints and shall comply with the following:

1. Shall be based on the actual use and occupant load of those spaces before and after the main security screening checkpoints.

2. Shall not be more than one story above or below the space required to be provided with toilet facilities.

3. The path of travel to such facilities shall not exceed a distance of 300 feet (91 mm). For employees' toilet facilities, the maximum distance of travel shall be measured from the employees' work area.

**[P] ~~2902.3.5~~ 2902.3.6 Pay facilities.** Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

**[P] ~~2902.3.6~~ 2902.3.7 Door locking.** Where a toilet room is provided for the use of multiple occupants, the egress door for the room shall not be lockable from the inside of the room. This section does not apply to family or assisted-use toilet rooms.

## 2018 International Plumbing Code

**Revise as follows:**

**TABLE 403.1**

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES[a] (See Sections 403.1.1 and 403.2)

| NO. | CLASSIFICATION | DESCRIPTION | WATER CLOSETS (URINALS: SEE SECTION 424.2) | | LAVATORIES | | BATHTUBS/ SHOWERS | DRINKING FOUNTAIN (SEE SECTION 410) | OTHER |
|---|---|---|---|---|---|---|---|---|---|
| | | | MALE | FEMALE | MALE | FEMALE | | | |
| 1 | Assembly | Theaters and other buildings for the performing arts and motion pictures[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Nightclubs, bars, taverns, dance halls and buildings for similar purposes[d] | 1 per 40 | 1 per 40 | 1 per 75 | | — | 1 per 500 | 1 service sink |
| | | Restaurants, banquet halls and food courts[d] | 1 per 75 | 1 per 75 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Gaming areas | 1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400 | 1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400 | 1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750 | | — | 1 per 1,000 | 1 service sink |
| | | Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums[d] | 1 per 125 | 1 per 65 | 1 per 200 | | — | 1 per 500 | 1 service sink |
| | | Passenger terminals (other than airport terminals) and transportation facilities[d] | 1 per 500 | 1 per 500 | 1 per 750 | | — | 1 per 1,000 | 1 service sink |
| | | Airport terminals | 1 per 500 | 1 per 100 for the first 500 and 1 per 150 for the remainder exceeding 500 | 1 per 750 | | - | 1 per 1,000 | 1 service sink |
| | | Places of worship and other religious services[d] | 1 per 150 | 1 per 75 | 1 per 200 | | — | 1 per 1,000 | 1 service sink |
| | | Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |
| | | Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities[f] | 1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500 | 1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520 | 1 per 200 | 1 per 150 | — | 1 per 1,000 | 1 service sink |

a.The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by the *International Building Code*.

b.Toilet facilities for employees shall be separate from facilities for inmates or care recipients.

c.A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted provided that each patient sleeping unit has direct access to the toilet room and provision for privacy for the toilet room user is provided.

d.The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.

e.For business and mercantile classifications with an occupant load of 15 or fewer, service sinks shall not be required.

f.The required number and type of plumbing fixtures for outdoor public swimming pools shall be in accordance with Section 609 of the International Swimming Pool and Spa Code.

**403.3.3 Location of toilet facilities in occupancies other than ~~malls.~~ malls and airports.** In occupancies other than covered and open mall buildings and airport terminals, the required *public* and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

**Exception:** The location and maximum distances of travel to required employee facilities in factory and industrial *occupancies* are permitted to exceed that required by this section, provided that the location and maximum distance of travel are *approved*.

**403.3.4 Location of toilet facilities in malls.** In covered and open mall buildings, the required *public* and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 m). In mall buildings, the required facilities shall be based on total square footage within a covered mall building or within the perimeter line of an open mall building, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum distance of travel to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum distance of travel shall be measured from the employees' work area of the store or tenant space.

**Revise as follows:**

**403.3.5 Location of toilet facilities in airport terminals.** In airport terminals, the minimum number of public and employee toilet fixtures shall be located before arriving at and after leaving the main security screening checkpoints and shall comply with the following:

1. Shall be based on the actual use and occupant load of those spaces before and after the main security screening checkpoints.

2. Shall not be more than one story above or below the space required to be provided with toilet facilities.

3. The path of travel to such facilities shall not exceed a distance of 300 feet (91 mm). For employees' toilet facilities, the maximum distance of travel shall be measured from the employees' work area.

**~~403.3.5~~ 403.3.6 Pay facilities.** Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

**~~403.3.6~~ 403.3.7 Door locking.** Where a toilet room is provided for the use of multiple occupants, the egress door for the room shall not be lockable from the inside of the room. This section does not apply to family or assisted-use toilet rooms.

**Reason Statement:** This issue was first brought up by Cornelia Weiss in one of the workgroups during the "Proposed" phase. I agreed to prepare a code change on her behalf and this has been commented on by those folks who "volunteered" to participate as well.
I chose the term "airport terminal" because that is the term used in Table 1004.5 of the IBC when determining occupant loads. As for *where* such plumbing fixtures/facilities are located, I thought it would be easier to create a separate provision (VPC 403.3.5 and VCC 2902.3.5) especially if we are trying to convey that the fixtures need to occur before and after security checkpoints. I just took the language from "malls" and went from there.

I kept the numbers for drinking fountains and service sinks - and men's water closets - the same as they were previously under "passenger terminals"– since the only comment received thus far is that there are not enough *women's* water closets. It is strange that they did not originally address "potty parity" for the number of women's fixtures which has been around forever!

So for the first 500 occupants, it would be slightly more than before (1 vs. 5) – this should help those smaller airports where they don't get the volumes of people, but still would offer some level of "potty parity." After 500 occupants I used the numbers similar to those for the casino gaming areas. Casinos have masses or people sitting and standing around and moving between games.

For the women's lavatories – the same concept was used. Usually the number of lavs is somewhat correlated to the number of water closets by some factor. In other words, we would not have 100 water closets and only 2 lavs.

**Cost Impact:** The code change proposal will increase the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Approval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TP403.1(2)-18

This proposal doesn't have any public comments.

Proposal # 423

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# B307.1(1)-18

**Proponents:** Glenn Dean (gad.pompier@gmail.com)

## 2015 Virginia Construction Code

**TABLE 307.1(1)**

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

| MATERIAL | CLASS | GROUP WHENTHE MAXIMUMALLOWABLEQUANTITY ISEXCEEDED | STORAGE[b] | | | |
|---|---|---|---|---|---|---|
| | | | Solidpounds(cubic feet) | Liquidgallons(pounds) | Gas cubicfeet at NTP | Solidpo (cubic |
| Combustible dust | NA | H-2 | SeeNote q | NA | NA | SeeNo |
| Combustible fiber[q] | LooseBaled[o] | H-3 | (100)(1,000) | NA | NA | (100)(1 |
| Combustible liquid[c, i] | IIIIIAIIIB | H-2 or H-3H-2 or H-3NA | NA | 120[d, e] 330[d, e] 13,200[e, f] | NA | NA |
| Consumer fireworks | 1.4G | H-3 | 125[e, l] | NA | NA | NA |
| Cryogenic flammable | NA | H-2 | NA | 45[d] | NA | NA |
| Cryogenic inert | NA | NA | NA | NA | NL | NA |
| Cryogenic oxidizing | NA | H-3 | NA | 45[d] | NA | NA |
| Explosives | Division 1.1Division 1.2Division 1.3Division 1.4Division 1.4GDivision 1.5Division 1.6 | H-1H-1H-1 or H-2H-3H-3H-1H-1 | 1[e, g] 1[e, g] 5[e, g] 50[e, g] 125[d, e, l] 1[e, g] 1[e, g] | (1)[e, g] (1)[e, g] (5)[e, g] (50)[e, g] NA(1)[e, g] NA | NA | 0.25[g] 0.2 50[g] NA( NA |
| Flammable gas | GaseousLiquefied | H-2 | NA | NA(150)[d, e] | 1,000[d, e] NA | NA |
| Flammable liquid[c] | IAIB and IC | H-2or H-3 | NA | 30[d, e] 120[d, e] | NA | NA |
| Flammable liquid,combination(IA, IB, IC) | NA | H-2 or H-3 | NA | 120[d, e, h] | NA | NA |
| Flammable solid | NA | H-3 | 125[d, e] | NA | NA | 125 |
| Inert gas | GaseousLiquefied | NANA | NANA | NANA | NLNL | NAN |
| Organic peroxide | UDIIIIIIIVV | H-1H-2H-3H-3NANA | 1[e, g] 5[d, e] 50[d, e] 125[d, e] NLNL | (1)[e, g] (5)[d, e] (50)[d, e] (125)[d, e] NLNL | NA | 0.25[g] 1 125[d] N |
| Oxidizer | 43[k] 21 | H-1H-2 or H-3H-3NA | 1[g] 10[d, e] 250[d, e] 4,000[e, f] | (1)[e, g] (10)[d, e] (250)[d, e] (4,000)[e, f] | NA | 0.25[g] 2[d] 4,00 |
| Oxidizing gas | GaseousLiquefied | H-3 | NA | NA(150)[d, e] | 1,500[d, e] NA | NA |
| ~~*Permissible fireworks*~~ | ~~1.4G~~ | ~~H-3~~ | ~~125[d, e, l]~~ | ~~N/A~~ | ~~N/A~~ | ~~N/A~~ |
| Pyrophoric | NA | H-2 | 4[e, g] | (4)[e, g] | 50[e, g] | 1[g] |
| Unstable (reactive) | 4321 | H-1H-1 or H-2H-3NA | 1[e, g] 5[d, e] 50[d, e] NL | (1)[e, g] (5)[d, e] (50)[d, e] NL | 10[e, g] 50[d, e] 750[d, e] NL | 0.25[g] 1 NL |
| Water reactive | 321 | H-2H-3NA | 5[d, e] 50[d, e] NL | (5)[d, e] (50)[d, e] NL | NA | 5[d] 50[d] |

For SI: 1 cubic foot = 0.028 $m^3$, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; NA = Not Applicable; UD = Unclassified Detonable.

a. For use of control areas, see Section 414.2.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in *listed* safety cans in accordance with Section 5003.9.10 of the International Fire Code. Where Note d also applies, the increase for both notes shall be applied accumulatively.

f. Quantities shall not be limited in a *building* equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

g. Allowed only in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

h. Containing not more than the maximum allowable quantity per *control area* of Class IA, IB or IC flammable liquids.

i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 603.3.2 of the International Fire Code.

j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of *equipment* when the storage containers and the manner of storage are approved.

l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.

m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the International Fire Code.

n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).

o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

p. The following shall not be included in determining the maximum allowable quantities:

1. Liquid or gaseous fuel in fuel tanks on vehicles.
2. Liquid or gaseous fuel in fuel tanks on motorized *equipment* operated in accordance with the International Fire Code .
3. Gaseous fuels in piping systems and fixed appliances regulated by the International Fuel Gas Code .
4. Liquid fuels in piping systems and fixed appliances regulated by the International Mechanical Code .
5. Alcohol-based hand rubs classified as Class I or II liquids in dispensers that are installed in accordance with Sections 5705.5 and 5705.5.1 of the International Fire Code. The location of the alcohol-based hand rub (ABHR) dispensers shall be provided in the *construction* documents.

q. Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.

r. The tabular value for distilled spirit distillation and blending rooms is 120 gallons.

## 2015 Virginia Statewide Prevention Fire Code

**TABLE 5003.1.1(1)**

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

| MATERIAL | CLASS | GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED | STORAGE[b] | | | USE-CLOSED SYSTEMS[b] | | | USE-OPEN SYSTEMS[b] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Solid pounds (cubic feet) | Liquid gallons (pounds) | Gas (cubic feet at NTP) | Solid pounds (cubic feet) | Liquid gallons (pounds) | Gas (cubic feet at NTP) | Solid pounds (cubic feet) | Liquid gallons (pounds) |
| Combustible dust | NA | H-2 | See Note q | NA | NA | See Note q | NA | NA | See Note q | NA |
| Combustible fibers[q] | Loose | H-3 | (100) | NA | NA | (100) | NA | NA | (20) | NA |
| | Baled[o] | | (1,000) | | | (1,000) | | | (200) | |
| Combustible liquid[c, i] | II | H-2 or H-3 | | 120[d, e] | | | 120[d] | | | 30[d] |
| | IIIA | H-2 or H-3 | NA | 330[d, e] | NA | NA | 330[d] | NA | NA | 80[d] |
| | IIIB | NA | | 13,200[e, f] | | | 13,200[f] | | | 3,300[f] |
| Consumer *fireworks* | 1.4G | H-3 | 125[e, l] | NA | NA | NA | NA | NA | NA | NA |
| Cryogenic Flammable | NA | H-2 | NA | 45[d] | NA | NA | 45[d] | NA | NA | 10[d] |
| Cryogenic Inert | NA | NA | NA | NA | NL | NA | NA | NL | NA | NA |
| Cryogenic Oxidizing | NA | H-3 | NA | 45[d] | NA | NA | 45[d] | NA | NA | 10[d] |
| Explosives | Division 1.1 | H-1 | 1[e, g] | (1)[e, g] | | 0.25[g] | (0.25)[g] | | 0.25[g] | (0.25)[g] |
| | Division 1.2 | H-1 | 1[e, g] | (1)[e, g] | | 0.25[g] | (0.25)[g] | | 0.25[g] | (0.25)[g] |
| | Division 1.3 | H-1 or H-2 | 5[e, g] | (5)[e, g] | | 1[g] | (1)[g] | | 1[g] | (1)[g] |
| | Division 1.4 | H-3 | 50[e, g] | (50)[e, g] | NA | 50[g] | (50)[g] | NA | NA | NA |
| | Division 1.4G | H-3 | 125[d, e, l] | NA | | NA | NA | | NA | NA |
| | Division 1.5 | H-1 | 1[e, g] | (1)[e, g] | | 0.25[g] | (0.25)[g] | | 0.25[g] | (0.25)[g] |
| | Division 1.6 | H-1 | 1[e, g] | NA | | NA | NA | | NA | NA |
| Flammable gas | Gaseous | H-2 | NA | NA | 1,000[d, e] | NA | NA | 1,000[d, e] | NA | NA |
| | Liquefied | | | (150)[d, e] | NA | | (150)[d, e] | NA | | |
| Flammable liquid[c] | IA | H-2 | | 30[d, e] | | | 30[d] | | | 10[d] |
| | | or | NA | | NA | NA | | NA | NA | |
| | IB and IC | H-3 | | 120[d, e] | | | 120[d] | | | 30[d] |
| Flammable liquid, combination (IA, IB, IC) | | H-2 | | | | | | | | |
| | NA | or | NA | 120[d, e, h] | NA | NA | 120[d, h] | NA | NA | 30[d, h] |
| | | H-3 | | | | | | | | |
| Flammable solid | NA | H-3 | 125[d, e] | NA | NA | 125[d] | NA | NA | 25[d] | NA |
| Inert Gas | Gaseous | NA | NA | NA | NL | NA | NA | NL | NA | NA |
| | Liquefied | NA | NA | NA | NL | NA | NA | NL | NA | NA |
| Organic | UD | H-1 | 1[e, g] | (1)[e, g] | | 0.25[g] | (0.25)[g] | | 0.25[g] | (0.25)[g] |
| | I | H-2 | 5[d, e] | (5)[d, e] | | 1[d] | (1)[d] | | 1[d] | (1)[d] |
| | II | H-3 | 50[d, e] | (50)[d, e] | | 50[d] | (50)[d] | | 10[d] | (10)[d] |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Organic peroxide | II | H-3 | 50 | (50) | NA | 50 | (50) | NA | 10 | (10) |
| | | III | H-3 | 125[d, e] | (125)[d, e] | | 125[d] | (125)[d] | | 25[d] | (25)[d] |
| | | IV | NA | NL | NL | | NL | NL | | NL | NL |
| | | V | NA | NL | NL | | NL | NL | | NL | NL |
| | Oxidizer | 4 | H-1 | 1[g] | (1)[e, g] | NA | 0.25[g] | (0.25)[g] | NA | 0.25[g] | (0.25)[g] |
| | | 3[k] | H-2 or H-3 | 10[d,e] | (10)[d, e] | | 2[d] | (2)[d] | | 2[d] | (2)[d] |
| | | 2 | H-3 | 250[d, e] | (250)[d, e] | | 250[d] | (250)[d] | | 50[d] | (50)[d] |
| | | 1 | NA | 4,000[e, f] | (4,000)[e, f] | | 4,000[f] | (4,000)[f] | | 1,000[f] | (1,000)[f] |
| | Oxidizing gas | Gaseous | H-3 | NA | NA | 1,500[d, e] | NA | NA | 1,500[d, e] | NA | NA |
| | | Liquefied | | | (150)[d, e] | NA | | (150)[d, e] | NA | | |
| | ~~Permissible fireworks~~ | ~~1.4G~~ | ~~H-3~~ | ~~125[d, e, l]~~ | ~~NA~~ | ~~NA~~ | ~~NA~~ | ~~NA~~ | ~~NA~~ | ~~NA~~ | ~~NA~~ |
| | Pyrophoric | NA | H-2 | 4[e, g] | (4)[e, g] | 50[e, g] | 1[g] | (1)[g] | 10[e, g] | 0 | 0 |
| | Unstable (reactive) | 4 | H-1 | 1[e, g] | (1)[e, g] | 10[e, g] | 0.25[g] | (0.25)[g] | 2[e, g] | 0.25[g] | (0.25)[g] |
| | | 3 | H-1 or H-2 | 5[d, e] | (5)[d, e] | 50[d, e] | 1[d] | (1)[d] | 10[d, e] | 1[d] | (1)[d] |
| | | 2 | H-3 | 50[d, e] | (50)[d, e] | 750[d, e] | 50[d] | (50)[d] | 750[d, e] | 10[d] | (10)[d] |
| | | 1 | NA | NL | NL | NL | NL | NL | NL | NL | NL |
| | Water reactive | 3 | H-2 | 5[d, e] | (5)[d, e] | | 5[d] | (5)[d] | | 1[d] | (1)[d] |
| | | 2 | H-3 | 50[d, e] | (50)[d, e] | NA | 50[d] | (50)[d] | NA | 10[d] | (10)[d] |
| | | 1 | NA | NL | NL | | NL | NL | | NL | NL |

For SI: 1 cubic foot = 0.02832 $m^3$, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NA = Not Applicable, NL = Not Limited, UD = Unclassified Detonable.

a. For use of control areas, see Section 5003.8.3.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited providing the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuff or consumer products and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

e. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, day boxes, gas cabinets, gas rooms, exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10. Where Note d also applies, the increase for both notes shall be applied accumulatively.

f. Quantities shall not be limited in a building equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

g. Allowed only in buildings equipped throughout with an approved automatic sprinkler system.

h. Containing not more than the maximum allowable quantity per control area of Class IA, Class IB or Class IC flammable liquids.

i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 603.3.2.

j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed where such materials are necessary for maintenance purposes, operation or sanitation of equipment where the storage containers and the manner of storage are approved.

l. Net weight of pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks including packaging shall be used.

m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.

n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 5003.11, see Table 5003.11.1.

o. Densely-packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

p. The following shall not be included in determining the maximum allowable quantities:

1. Liquid or gaseous fuel in fuel tanks on vehicles.
2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with this code.
3. Gaseous fuels in piping systems and fixed appliances regulated by the International Fuel Gas Code .
4. Liquid fuels in piping systems and fixed appliances regulated by the International Mechanical Code .
5. Alcohol-based hand rubs classified as Class I or II liquids in dispensers that are installed in accordance with Sections 5705.5 and 5705.5.1. The location of the alcohol-based hand rub (ABHR) dispensers shall be provided in the construction documents.

q. Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.7.2.

**Reason Statement:** The deletion of line "permissible fireworks" is simply the removal of redundant language and values and reverts to model code language. Both "permissible fireworks" and "consumer fireworks" use the same pyrotechnic material in its content and have the same values listed in USBC Table 307.1(1) and SFPC Table 5003.1.1(1). Also, for transportation purposes, and because they are effectively one and the same, the Federal DOTn and Virginia Motor Carrier Safety Regulations have "permissible fireworks" and "consumer fireworks" listed as Explosives, Division 1.4G. As can be seen in USBC Table 307.1(1) and SFPC Table 5003.1.1(1), Explosives, Division 1.4G has the same Maximum Allowable Quantity (MAQ) (value) as "permissible fireworks" and "consumer fireworks". Hence, the same material is actually listed 3 times in each table.

**Cost Impact:**
This proposal will not increase or decrease the cost of construction.

**Resiliency Impact Statement:**
This proposal will neither increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

**Workgroup 2 - Proposed Committee Action:** None

**Workgroup 2 - Proposed Reason:**

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## Committee Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

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# Public Comments for: B307.1(1)-18

This proposal doesn't have any public comments.

Proposal # 253

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# B404.5-18

**Proponents:** Christopher Campbell (christopher.campbell@arup.com); Raymond Grill (ray.grill@arup.com)

## 2018 International Building Code

**404.5 Smoke control.** A smoke control system shall be installed in accordance with Section 909.

**Exception 1:** In other than Group I-2, and Group I-1, Condition 2, smoke control is not required for *atriums* that connect only two stories.

**Exception 2:** In other than Group I-2 and Group I-1, Condition 2, smoke control is not required for *atriums* where all exit access above the lowest level of the atrium is separated from the *atrium* in accordance with Section 404.6 Exception 3 to Section 404.6 shall not apply.

**Reason:** In the event of a fire on the lowest level of the atrium, the atrium space will provide a heat and smoke sink that would enhance the safety of occupants at the base of the atrium. Heated products of combustion will rise and will allow more time for egress. The separation of upper levels in accordance with 404.6 precludes exposure to occupants on upper levels.

Smoke removal after the event can be performed in the same manner as in any other building without an atrium. There is no greater exposure presented. In other sections of the code, multiple interconnected levels are allowed without smoke control. Section 712.1.3.1 allows an unlimited number of levels in Group B and M occupancies to be interconnected by escalators when draft stops and sprinklers are provided around the floor opening. Section 1019.3 allows exit access stairs to interconnect an unlimited number of stories in Group B and M occupancies to be interconnected without shaft enclosures if draft stops and sprinklers are provided around the openings. The code allows escalators and exit access stairs to interconnect up to 4 stories in other occupancies without shaft enclosures provided draft stops and sprinklers are provided around the floor openings.

The proposed exception would present less of a fire safety risk than is currently allowed by the code.

**Reason Statement:**

**Cost Impact:** The code change proposal will decrease the cost of construction
Eliminating the requirement for a smoke controls system will reduce the cost of construction, however, as explained previously, will maintain the level of life safety required by the code.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

## Workgroup Recommendation

**Workgroup 2 - Final Committee**

**Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

## Public Comments for: B404.5-18

This proposal doesn't have any public comments.

Proposal # 291

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# B903.2.6-18

**Proponents:** William Hall, Virginia Dept of Corrections (william.hall@vadoc.virginia.gov)

## 2015 Virginia Construction Code

**Revise as follows:**

**[F] 903.2.6 Group I.** An *automatic sprinkler system* shall be provided throughout buildings with a Group I *fire area*.

Except:

1. An automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be permitted in Group I-1 Condition 1 facilities.
2. An automatic sprinkler system is not required where Group I-4 day care facilities are at the level of exit discharge and where every room where care is provided has not fewer than one exterior exit door.
3. In buildings where Group I-4 day care is provided on levels other than the level of exit discharge, an automatic sprinkler system in accordance with Section 903.3.1.1 shall be installed on the entire floor where care is provided, all floors between the level of care and the level of exit discharge, and all floors below the level of exit discharge other than areas classified as an open parking garage.
4. An automatic sprinkler system shall not be required for open-sided or chain link-sided buildings and overhangs over exercise yards ~~200~~ 1800 square feet (~~18.58~~ 167 m2) or less in Group I-3 facilities, provided such buildings and overhangs are of noncombustible construction.

**Reason Statement:** This code change from last cycle actually has the potential to make the cost of construction more expensive. Section 903.3.1.1.1 (exc #4) already allows for the exemption of sprinklers in areas which have non-combustible construction and which the contents are wholly non-combustible. This section, as currently written would limit that exception to 200 sq. ft. due to more specific language. This will cause the AJH to require sprinkler protection when they exceed 200 sq. ft. DOC is installing exterior recreation pens designed to give offenders the opportunity to go outside for a period of time everyday. Building multiple pens with only a maximum of 200 sq. ft. is cost prohibitive as well providing a weather protected (dry system) sprinkler system to protect an area with no potential to burn. We ask that this section be modified to permit the construction of recreation pens without limits of size and without un-needed sprinkler protection as presently allowed in Section 903.3.1.1.1.
Update:

After collaboration with the fire services board Mr. Andrew Milligen during stakeholder meetings, we have edited the proposal to permit structures up to 12,000 sq. ft. rather than unlimited. The building code currently allows buildings of higher risk to be built to 12,000 sq. ft. without a sprinkler. These recreation pens will have open sides and completely non-combustible. We believe this to be a good compromise proposal, however we need these and are open further compromise.

**Cost Impact:** The code change proposal will decrease the cost of construction
The current section increased the cost of construction, this revision will reduce the cost of construction by not requiring sprinkler protection for outdoor enviroment locations.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
N/A

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B903.2.6-18

This proposal doesn't have any public comments.

Proposal # 279

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# B903.4.2-18

**Proponents:** Charles Littlefield (caseylittlefieldmcp@gmail.com)

## 2015 Virginia Construction Code

**Revise as follows:**

**903.4.2 Alarms.** Approved audible devices shall be connected to every automatic sprinkler system. Such sprinkler water-flow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Alarm devices shall be provided on the exterior of the *building* in an approved location. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the *building* fire alarm system. Group R-2 occupancies that contain 16 or more dwelling units or sleeping units, any dwelling unit or sleeping unit two or more stories above the lowest level of exit discharge, or any dwelling unit or sleeping unit more than one story below the highest level of exit discharge of exits serving the dwelling unit or sleeping unit shall provide a manual fire alarm box at an approved location to activate the suppression system alarm.

Exception: Buildings supplied with an off-site monitored fire alarm system that also monitors the fire sprinkler system.

**Reason Statement:** The intent of 903.4.2 is to provide an outside alarm that notifies anyone in the immediate vicinity that the fire sprinkler system in the building has been activated.
Almost all new building that have a Fire Sprinkler system installed also have a Fire Alarm system that provides both occupant notification and monitoring of the fire sprinkler system as in accordance with 903.4.1. with the requirement to add an alarm on a building that has off-site monitoring of the fire alarm system is redundant and unnecessary. A case in point would be a building in an urban environment would most likely get attention from passerby's on the street where that same building located in an rural environment most likely would not. To be clear the exception is only allowed if a off-site monitored Fire alarm system also monitors the fire sprinkler system.

**Cost Impact:** The code change proposal will decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B903.4.2-18

This proposal doesn't have any public comments.

Proposal # 430

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# B1010.1.9.6-18

**Proponents:** John Mather (john@matherarchitects.com)

## 2015 Virginia Construction Code

**1010.1.9.6 Controlled egress doors in Groups I-1 and I-2.** ~~(Section deleted.)~~

Electric locking systems, including electro-mechanical locking systems and electromagnetic locking systems, shall be permitted to be locked in the means of egress in Group I-1, **Condition 2** , or I-2 occupancies where the clinical needs of persons receiving care require their containment. Controlled egress doors shall be permitted in such occupancies where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or an approved automatic smoke or heat detection system installed in accordance with Section 907, provided that the doors are installed and operate in accordance with all of the following:

1. The door locks shall unlock on actuation of the automatic sprinkler system or automatic fire detection system.

2. The door locks shall unlock on loss of power controlling the lock or lock mechanism.

3. The door locking system shall be installed to have the capability of being unlocked by a switch located at the fire command center, a nursing station or other approved location. The switch shall directly break power to the lock.

4. A building occupant shall not be required to pass through more than one door equipped with controlled egress locking system before entering an exit.

5. The procedures for unlocking the doors shall be described and approved as part of the emergency planning and preparedness required by Chapter 4 of the International Fire Code.

6. All clinical staff shall have the keys, codes or other means necessary to operate the locking systems.

7. Emergency lighting shall be provided at the door.

8. The door locking system units shall be listed in accordance with UL 294.

Exceptions:

1. Items 1 through 4 shall not apply to doors to areas occupied by persons who, because of clinical needs, require restraint or containment as part of the function of a psychiatric treatment area, **nursing home or Dementia Care facility** .

2. Items 1 through 4 shall not apply to doors to areas where a listed egress control system is utilized to reduce the risk of child abduction from nursery and obstetric areas of a Group I-2 hospital.

**Reason Statement:** I am submitting this requested change in order to ensure the safety of those persons who reside in Dementia/Alzheimers care units. The current code does not allow "controlled egress" of such units which are classified as an I-1 Use Group. This is a common Use Group utilized to house such patients.
I believe that the 2015 IBC does a good job of addressing this situation by including Use Group I-1 in the provisions for "controlled egress". In the Commentary, they specifically reference this need for dementia and Alzheimers units and allows for a "balance between maintaining a safe and secure environment and providing for emergency egress".

I know of an actual incident here in the Shenandoah Valley where an Alzheimers resident, living in a specialized Memory Care wing of a well-know and respected Retirement community, was able to leave the facility after hitting the exit door hardware, which had delayed egress hardware. A staff member was busy with another resident and did not get to the door in time before the lock was released (typically 15 seconds). That resident then exited the facility and almost immediately feel down a set of concrete steps.

Any sort of egress that is not controlled is a very bad idea when dealing with Dementia and Alzheimers patients. Often times these folk are quite **physically** able to leave, but are not safe cognitively. This population in particular will try to "leave", since often in their minds they need to go somewhere or go "home", but is just is not safe at all.

**Cost Impact:** The code change proposal will decrease the cost of construction
Allowing "controlled egress" of doors leading out of Alzheimers/Dementia care areas will actually decrease the cost of construction, as it will allow the facility to avoid the cost of special alarms and related automatic door actuation hardware.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal will add resiliency to facilities that provide care to Alzheimers patients in terms of not needing to constantly react to alarms which

indicate that a patient is trying to leave the facility. Improved operations of facilities will result in improved care to patients.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1010.1.9.6-18

This proposal doesn't have any public comments.

Proposal # 299

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# B1703.1.3-18

**Proponents:** Kerry Sutton, American Concrete Institute (kerry.sutton@concrete.org); Keith Kesner (kkesner3006@gmail.com); William Gaspar (wgaspar@moseleyarchitects.com); David Whitmore (davidw@vector-corrosion.com); Jeff Jezzard (jeffj@vector-construction.com); Matt Miltenberger (mattm@vcservices.com); Bill Horne (bhorne@ndtcorporation.com); Scott Stannard (sstannard@ecslimited.com)

## 2015 Virginia Construction Code

**Revise as follows:**

**1703.1.3 Personnel.** An *approved agency* shall employ experienced personnel educated in conducting, supervising and evaluating tests or inspections, or both. Upon request by the building official, documentation shall be provided demonstrating the applicable agency's accreditation as noted in ASTM E329 and individuals' resumes indicating pertinent training, certifications and other qualifications for special inspection personnel associated with the proposed *construction* requiring special inspections. The building official may prescribe the manner of qualification documentation and frequency of updating information regarding agency or individual inspector approval.

Firms providing special inspection services or individual inspectors seeking approval of alternative certifications or qualifications, or both, listed in ASTM E329 may submit documentation demonstrating equivalency. This documentation may include evidence of meeting other recognized standards or alternative certifications to demonstrate that the minimum qualifications, certification and experience intended by ASTM E329 have been met. The building official may, if satisfied that equivalency has been demonstrated, approve the credentials of the firm or individual.

1703.1.3.1 Concrete Testing Personnel. Individuals with current credentials as provided in Table 1704.2 or equivalent credentials approved by the building official. shall be considered qualified for sampling and testing of concrete.

**1704.2.1 Special inspector qualifications.** Prior to the start of the *construction*, the *approved agencies* shall provide written documentation to the *building official* demonstrating the competence and relevant experience or training of the *special inspectors* who will perform the *special inspections* and tests during *construction*. Experience or training shall be considered relevant where the documented experience or training is related in complexity to the same type of *special inspection* or testing activities for projects of similar complexity and material qualities. The special inspector shall be qualified in accordance with Table 1704.2 or demonstrate equivalent qualifications for approval by the building official. These qualifications are in addition to qualifications specified in other sections of this code.
The *registered design professional in responsible charge* and engineers of record involved in the design of the project are permitted to act as the *approved agency* and their personnel are permitted to act as special inspectors for the work designed by them, provided they qualify as special inspectors.

**Add new text as follows:**

**1704.2**
**Minimum Special Inspector and Technician Qualifications**

| **Category of Testing and Inspection** | **Minimum Qualifications (refer to key at end of Table)** | | |
|---|---|---|---|
| | **Shop Testing or Inspection** | **Field Testing or Inspection** | **Review Testing, Certification,** |
| **1704.2.5 Inspection of Fabricators** | | | |
| Pre-cast concrete | A, C, E, or R | | |
| Structural steel construction | C, F, or G | | |
| Wood construction | A | | |
| Cold formed metal construction | A, or R | | |
| **1705.2, 1705.10, 1705.11& 1705.12 Steel Construction** | | | |
| Verification of welding consumables, filler metals, procedure specifications, procedure qualification records and personnel performance qualification records | | | C, F, or R |
| Nondestructive testing of welding | G | G | |
| Inspection of welding | C, F or R* | C, F, or R* | |
| Verification of fabricator and erector documents as listed in AISC 360, chapter N, paragraph 3.2 | R | | A, or C |
| Material verification of weld filler materials | R | | C, or F |

| | | | |
|---|---|---|---|
| **1705.2, 1705.10, 1705.11& 1705.12 Steel Construction, continued** | | | |
| Inspection of high strength bolting and steel frame joint Details | | A, C, or R | |
| Inspection of embedments | | A, C, F, or R | |
| Inspection of steel elements of composite construction | | A, C, F, or R | |
| Verification of reinforcing steel, cold formed steel deck and truss materials | | | A, C, or F |
| Inspection of reinforcing steel, cold formed steel deck and trusses | | A, C, or R | |
| **1705.3 & 1705.12 Concrete Construction** | | | |
| Reinforcing placement, cast-in-place bolts, post installed anchors concrete and shotcrete placement and curing operations. Inspection of formwork for shape, location and dimensions | | A, C, H, or S | |
| Pre-stressing steel installation | | A, C, D, E, or S | |
| Erection of pre-cast concrete members | | A, C, or H | |

| | | | |
|---|---|---|---|
| Concrete field sampling and testing | | A, J, or T | |
| Laboratory testing, any | | A, N, AA, or BB | A or B |
| Laboratory strength testing only | | A, N, O, or AA, | A or B |
| Review certified mill reports | | | A or C |
| Verify use of required design mix | | A, I, J, H, C, or T | |
| Pre-stressed (pre-tensioned) concrete force application | A, C, E, or U | | |
| Post-tensioned concrete force application | | A, C, D, or U | |
| Review of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs | | A, C, D, H, or U | |
| Reinforcing steel weldability, reinforcing welding, weld filler material | | C or F | |
| Testing of welding of reinforcing steel | | G | |
| Post-installed concrete anchor inspection | A or P | A, P, or U | |
| Shotcrete installation inspection | | A or Q | |
| **1705.4 Masonry** | | | |
| Verification of *f'm* and *f'AAC* | | A, C, L, or M | |
| Mortar joint construction, grout protection and placement, materials proportion, type/size/location of reinforcement, structural elements, anchorage, and connectors | | A, C, K, or V | |
| Observe preparation of masonry prisms for testing of compressive strength of masonry, *f'm* and *f'AAC* | | A, C, K, L, M, or V | |
| Inspection of welding of reinforcing steel | | C or F | |
| Testing of welding of reinforcing steel | | G | |

| | | | | |
|---|---|---|---|---|
| **1705.6 & 1804 Soils** | | | | |
| Observe site preparation, fill placement testing of compaction for compliance with the construction documents for the project | | A, C, I, L, or W | | |
| Observe test bearing materials below shallow foundations for ability to achieve design bearing capacity | | A, C, L, I (Level III), or X | | |
| Review compaction testing for compliance with the construction documents for the project | | | A | |
| **1705.5, 1705.10, 1705.11 & 1705.12 Wood Construction** | | | | |
| Observe structural panel sheathing, size of framing members, nail or staple diameter and length, number of fastener lines, and spacing of fastener lines and fasteners for compliance with construction documents for the project | | A | | |

| | | | | |
|---|---|---|---|---|
| Observe temporary and permanent truss member restraint/bracing, field gluing of elements.<br><br>Observe bolting, anchoring, or other fastening of: shear walls, diaphragms, drag struts, braces and hold-downs | | <br><br>A | | |
| **1705.7, 1705.8, 1705.9 & 1810 Pile and Pier Foundations** | | | | |
| Observe installation | | A, L, or X | | |
| Observe load tests | | A | | |
| **1705.13 Sprayed Fire-Resistant Materials** | | | | |
| Observe surface conditions, application, average thickness and density of applied material, and cohesive/adhesive bond | | A, C, or Y | | |
| **1705.14 Mastic and Intumescent Fire-Resistant Coatings** | | | | |
| Observe application compliance with AWCI 12-B | | A, C, or Y | | |
| **1705.15 Exterior Insulation and Finish Systems** | | | | |
| Inspect EIFS systems | | A, B, C, M, or Y | | |
| **1705.1 Special Cases** | | | | |
| Work of unusual or special nature | | A, B, or M | | |
| **1705.16 Fire-Resistant Penetrations and Joints** | *See Requirements of IBC Sections 1705.16.1 and 1705.16.2, Z* | | | |
| **1705.17 Smoke Control** | *See Requirements of IBC Section 1705.17.2* | | | |
| **1705.10, 1705.11 & 1705.12 Seismic and Wind Resistance** | | | | |
| Periodic inspection of fabrication, installation and/or anchorage of building systems and components | | A | | |

*Limited to 5/16th single pass welds

KEY:

A. Professional Engineer (PE) competent in the specific task area or graduate of accredited engineering/engineering technology program under the direct supervision of a PE.

B. Registered Architect (RA) or graduate of accredited architecture/architecture technology program under the direction of a RA.

C. International Code Council (ICC) Special Inspector Certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.

D. Post-tensioning Institute (PTI) Certification, Level 2, bonded or unbonded as applicable. E. Pre-stressed Concrete Institute (PCI) Certified Inspector.

F. American Welding Society (AWS) Certified Welding Inspector (CWI) or AWS Certified Associate Welding Inspector working under the direct on-site supervision of a CWI.

G. American Society for Nondestructive Testing (ASNT) Level II certification, or a Level III certification if previously

certified as a Level II in the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.

H. American Concrete Institute (ACI) Concrete Construction Special Inspector.

I. National Institute for Certification in Engineering Technologies (NICET) Level II or higher certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.

J. ACI Concrete Field-Testing Technician with Grade 1 certification.

K. ICC/The Masonry Society Masonry (TMS) Construction Inspector Certification.

L. National Institute for Certification in Engineering Laboratories (NICET) Certified Engineering Technologist (CT).

M. Other Qualified Special Inspector as approved by the Building Official.

N. American Concrete Institute Concrete Laboratory Testing Technician - Level 1 or American Concrete Institute Concrete Laboratory Testing Technician - Level 2

O. American Concrete Institute Concrete Strength Testing Technician

P. American Concrete Institute Post -Installed Concrete Anchor Installation Inspector

Q. American Concrete Institute Shotcrete Inspector

R. Washington Area Council of Engineering Laboratories (WACEL) Structural Steel Technician I

S. WACEL Reinforced Concrete Special Inspector

T. WACEL Concrete Level I Technician

U. WACEL Structural Concrete Special Inspector

V. WACEL Masonry Special Inspector

W. WACEL Soil I

X. WACEL Foundations Special Inspector

Y. WACEL Fireproofing Special Inspector

Z. WACEL Firestopping Special Inspector

AA. WACEL Concrete/Masonry Strength Testing Technician

BB. WACEL Soil Laboratory Technician

**Reason Statement:** This proposal addresses the need to better ensure proper sampling, testing, and inspection of structural concrete. Improper testing and inspection may result in deficiencies regarding the performance of structural concrete. Concrete is one of the few structural materials that is not in its final form and condition until after being placed on the construction site. It is important that sampling, testing, and inspection are conducted by qualified individuals to ensure proper performance. Improper sampling and testing can lead to costly additional testing and construction delays. In some instances, unnecessary removal and replacement of concrete. The latter may result in challenges to ensure proper structural integrity and load paths.
This proposal adds provisions for individuals qualified through ACI, ICC or WACEL programs to conduct sampling, testing and inspections. The intent of this proposal is to assist the building official in identifying qualified personnel. The existing provisions of the code are not preempted by this proposal. Any individual approved as qualified by the building official remains permitted to conduct inspections and tests.

By citing specific certification programs which are regularly accepted in the construction industry, this proposal establishes a baseline for qualifications of individuals for consideration by the building official when approving individuals to conduct sampling, testing and special inspection.

Other authorities having jurisdiction are adding these requirements to their codes. For example, the Georgia Building Code now includes certified inspectors. See pages 11 through 15 of the attached Georgia Building Code. https://dca.ga.gov/sites/default/files/2014_ibcamendments.pdf

The Pennsylvania Structural Technical Advisory Committee has modified the Georgia table and will be making a recommendation to their Review and Advisory Committee.

The two co-proponents that develop and maintain certification programs are the American Concrete Institute (ACI) and the Washington Area Council of Engineering Laboratories (WACEL)

The American Concrete Institute. as a professional society whose mission includes working to facilitate the use and adoption of current concrete technology to assure the desired performance for the benefit of the public, encourages the committee to approve of this code change as submitted.

WACEL is an association of engineering laboratories, inspection agencies and building officials and has been certifying engineering technicians providing special inspection services since 1974 and pioneered the development of the nation's first special inspections program with Fairfax County, VA in 1975. The purpose of the WACEL Technician Certification program is to assess an individual's knowledge of information deemed critical to the proper performance of the special inspection services tasks for which certification is sought. Certification implies solely that an individual has met WACEL criteria and prerequisites and has passed a written examination and in some cases, a performance exam. A certification is valid for five years. WACEL criteria, prerequisites and examinations are compatible with guidelines established by ACI, ASTM, NICET, ICC and local governments.

The ACI requirements are provided in the attachment files as follows:

Concrete Special Inspector:

CPP-630.1-15 https://www.concrete.org/Portals/0/Files/PDF/cpp_6301-15.pdf

Concrete Laboratory Testing Technician Level 1 and Level 2:

CPP 620.1-19 https://www.concrete.org/Portals/0/Files/PDF/cpp_6201-19.pdf

Concrete Strength Testing Technician:

CPP 620.2-19 https://www.concrete.org/Portals/0/Files/PDF/cpp_6202-19.pdf

Concrete Field Testing Technician – Grade I

CPP 610.1-18 https://www.concrete.org/Portals/0/Files/PDF/cpp_6101-18.pdf

ICC certification requirements can be found at: https://www.iccsafe.org/certification-exam-categories/national-certification-exams/

WACEL certification requirements are provided in the attached certification concept statement: https://www.wacel.org/WACEL/document-server/?cfp=WACEL/assets/File/Certificatation_Concept_Statement.pdf

The proponent is in possession of emails from the following individuals and organizations indicating their acceptance as co-proponents.

Keith Kesner, CVM Professionals, representing CVM Professionals, kkesner3006@gmail.com, 5 Rockland Cir., Wayne, PA 19087

William Gaspar, Moseley Architects, representing Mosely Architects, wgaspar@moseleyarchitects.com, 3200 Norfolk Street, Richmond, VA 23230

Scott Campbell, National Ready Mixed Concrete Association, representing National Ready Mixed Concrete Association, scampbell@nrmca.org, 66 Canal Center Plaza, Suite 250, Alexandria, VA 22314

David Whitmore, Vector Corrosion Technologies, representing Vector Corrosion Technologies, davidw@vector-corrosion.com, 8413 Laurel Fair Circle, Suite 200A, Tampa, FL 33610

Jeff Jezzard, Vector Construction Inc., representing Vector Construction Inc., jeffj@vector-construction.com, 2504 Main Avenue West, West Fargo, ND 58078

Matt Miltenberger, Vector Corrosion Services, representing Vector Corrosion Services, mattm@vcservices.com, 8413 Laurel Fair Circle, Suite 200B, Tampa, FL 33610

Bill Horne, NDT Corporation, representing NDT Corporation, bhorne@ndtcorporation.com, 153 Clinton Road, Sterling, MA 01564

Scott Stannard, ECS Mid-Atlantic, LCC, representing Washington Area Council of Engineering Laboratories, sstanndard@ecslimited.com, 7508 Wisconsin Ave, #400, Bethesda, MD 20814

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
ACI 318-19 Building Code Requirements for Structural Concrete, already include requirements for qualified individuals performing tests and inspections. Section 26.12.1.1(d) states "Certified laboratory technicians shall perform required laboratory tests." and Section 26.13.1.2 states

”Inspection of concrete construction shall be conducted by the licensed design professional responsible for the design, a person under the supervision of the licensed design professional, or a qualified inspector.” This proposal increases the ease for the building official to determine the qualifications of individuals conducting sampling, testing and inspection of structural concrete.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Qualified individuals sampling, testing and inspecting concrete, helps ensure that concrete quality meets the intent of the code.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1703.1.3-18

This proposal doesn't have any public comments.

Proposal # 441

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# B1703.1.3.1-18

**Proponents:** Kerry Sutton, American Concrete Institute (kerry.sutton@concrete.org); Keith Kesner (kkesner3006@gmail.com); William Gaspar, Moseley Architects (wgaspar@moseleyarchitects.com); David Whitmore (davidw@vector-corrosion.com); Jeff Jezzard (jeffj@vector-construction.com); Matt Miltenberger (mattm@vcservices.com); Bill Horne (bhorne@ndtcorporation.com)

## 2015 Virginia Construction Code

**Revise as follows:**

**1703.1.3 Personnel.** An *approved agency* shall employ experienced personnel educated in conducting, supervising and evaluating tests or inspections, or both. Upon request by the building official, documentation shall be provided demonstrating the applicable agency's accreditation as noted in ASTM E329 and individuals' resumes indicating pertinent training, certifications and other qualifications for special inspection personnel associated with the proposed *construction* requiring special inspections. The building official may prescribe the manner of qualification documentation and frequency of updating information regarding agency or individual inspector approval.

Firms providing special inspection services or individual inspectors seeking approval of alternative certifications or qualifications, or both, listed in ASTM E329 may submit documentation demonstrating equivalency. This documentation may include evidence of meeting other recognized standards or alternative certifications to demonstrate that the minimum qualifications, certification and experience intended by ASTM E329 have been met. The building official may, if satisfied that equivalency has been demonstrated, approve the credentials of the firm or individual.

1703.1.3.1 Concrete Inspection and Testing Personnel. Individuals with current credentials listed in this section or having credentials otherwise approved by the building official shall be considered qualified for inspections and tests of concrete.

1. For special inspection of structural concrete - International Code Council Reinforced Concrete Special Inspector, American Concrete Institute Concrete Construction Special Inspector or Washington Area Council of Engineering Laboratories Structural Concrete Inspector.

2. For post-installed concrete anchor installation inspection – American Concrete Institute Post- Installed Concrete Anchor Installation Inspector or Washington Area Council of Engineering Laboratories Reinforced Concrete Special Inspector.

3. For inspection of shotcrete – American Concrete Institute Shotcrete Inspector.

4. For field sampling and testing of concrete – American Concrete Institute Concrete Field Testing Technician - Grade I or Washington Area Council of Engineering Laboratories Concrete Level I.

5. For laboratory testing of concrete including strength tests – American Concrete Institute Concrete Laboratory Testing Technician - Level 1 or American Concrete Institute Concrete Laboratory Testing Technician - Level 2 or Washington Area Council of Engineering Laboratories Concrete Masonry Strength Technician.

6. For laboratory strength testing only - American Concrete Institute Concrete Strength Testing Technician or Washington Area Council of Engineering Laboratories Concrete Masonry Strength Technician.

**Reason Statement:** This proposal addresses the need to better ensure proper sampling, testing, and inspection of structural concrete. Improper testing and inspection may result in deficiencies regarding the performance of structural concrete. Concrete is one of the few structural materials that is not in its final form and condition until after being placed on the construction site. It is important that sampling, testing, and inspection are conducted by qualified individuals to ensure proper performance. Improper sampling and testing can lead to costly additional testing and construction delays. In some instances, unnecessary removal and replacement of concrete. The latter may result in challenges to ensure proper structural integrity and load paths.
This proposal adds provisions for individuals qualified through ACI, ICC or WACEL programs to conduct sampling, testing and inspections. The intent of this proposal is to assist the building official in identifying qualified personnel. The existing provisions of the code are not preempted by this proposal. Any individual approved as qualified by the building official remains permitted to conduct inspections and tests.

By citing specific certification programs which are regularly accepted in the construction industry, this proposal establishes a baseline for qualifications of individuals for consideration by the building official when approving individuals to conduct sampling, testing and special inspection.

Other authorities having jurisdiction are adding these requirements to their codes. For example, the Georgia Building Code now includes certified inspectors. See pages 11 through 15 of the attached Georgia Building Code. https://dca.ga.gov/sites/default/files/2014_ibcamendments.pdf

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The two co-proponents that develop and maintain certification programs are the American Concrete Institute (ACI) and the Washington Area Council of Engineering Laboratories (WACEL).

The American Concrete Institute, as a professional society whose mission includes working to facilitate the use and adoption of current concrete technology to assure the desired performance for the benefit of the public, encourages the committee to approve of this code change as submitted.

WACEL is an association of engineering laboratories, inspection agencies and building officials and has been certifying engineering technicians providing special inspection services since 1974 and pioneered the development of the nation's first special inspections program with Fairfax County, VA in 1975. The purpose of the WACEL Technician Certification program is to assess an individual's knowledge of information deemed critical to the proper performance of the special inspection services tasks for which certification is sought. Certification implies solely that an individual has met WACEL criteria and prerequisites and has passed a written examination and in some cases, a performance exam. A certification is valid for five years. WACEL criteria, prerequisites and examinations are compatible with guidelines established by ACI, ASTM, NICET, ICC and local governments.

The ACI requirements are provided in the attachment files as follows:

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Concrete Field Testing Technician – Grade I

CPP 610.1-18 https://www.concrete.org/Portals/0/Files/PDF/cpp_6101-18.pdf

ICC certification requirements can be found at: https://www.iccsafe.org/certification-exam-categories/national-certification-exams/

WACEL certification requirements are provided in the attached certification concept statement: https://www.wacel.org/WACEL/document-server/?cfp=WACEL/assets/File/Certificatation_Concept_Statement.pdf

The proponent is in possession of emails from the following individuals and organizations indicating their acceptance as co-proponents.

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Scott Stannard, ECS Mid-Atlantic, LCC, representing Washington Area Council of Engineering Laboratories sstanndard@ecslimited.com,7508 Wisconsin Ave, #400, Bethesda, MD 20814

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
ACI 318-19 Building Code Requirements for Structural Concrete, already include requirements for qualified individuals performing tests and inspections. Section 26.12.1.1(d) states “Certified laboratory technicians shall perform required laboratory tests.” and Section 26.13.1.2 states ”Inspection of concrete construction shall be conducted by the licensed design professional responsible for the design, a person under the supervision of the licensed design professional, or a qualified inspector.” This proposal increases the ease for the building official to determine the qualifications of individuals conducting sampling, testing and inspection of structural concrete.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Qualified individuals sampling, testing and inspecting concrete, helps ensure that concrete quality meets the intent of the code.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1703.1.3.1-18

This proposal doesn't have any public comments.

Proposal # 440

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# T2701.1.1(1)-18

**Proponents:** James Erler (jim@erlerdesign.com); John Lane (redcloudjl@aol.com); Neil Harrington, Smith Mountain Lake Marine Volunteer Fire Rescue (neil.r.harrington@gmail.com)

## 2015 Virginia Construction Code

**Revise as follows:**

**2701.1.1** Add to 2701.1.1 Changes to NFPA 70.

3. Change Section 555.15(E) of NFPA 70 to read:

(E) **Feeder Equipment Grounding Conductors.** Where a feeder supplies a remote panelboard, an insulated equipment grounding conductor shall extend from a grounding terminal in the service equipment to a grounding terminal in the remote panelboard.

***Exception:*** Private, noncommercial docking facilities constructed or occupied for the use of the owner or residents of the associated single-family dwelling shall not have a grounding conductor between the grounding terminal in the service equipment and the grounding terminal in the remote panelboard.

**Reason Statement:**

## 1. Introduction

Death and injury by Electric Shock Drowning (ESD) due to intermittent voltages delivered by the ground conductor between the house service panel and the dock service panel was documented by Donald Johnson in 2009 (Ref 1: "The Case of Stray Voltage in a Lake", Donald R. Johnson, P.E., Johnson Engineering, Nov 01, 2009.).

"Seeing the swimmers' plight, the remaining teenagers standing on the dock called to the adults in the house for help. Several of them came running out, called 911, and dove into the water, trying to retrieve the kids who were underwater. (Note: It was determined later during testing that the currents in the water were intermittent, thus not causing any harm to the adults.) After multiple dives, the adults retrieved the two boys and one girl who had been submerged for some time.

"At the hospital, one boy was pronounced dead (cause of death was drowning), and the other two received brain damage due to lack of oxygen caused by the near-drowning experience.

"After going to trial, a jury awarded the plaintiffs a total judgment of $2,325,000. No appeal was filed by the electric utility defendant."

The green ground wire connected to the neutral wire is an unprotected path for lethal electrical voltages/currents to flow to/through the body of a swimmer at a dock. There is no protection on the green ground wire. Removing the green wire ground eliminates this risk and leaves only GFCI protected circuits at the dock. The proposed exception to the National Electric Code (NEC/NFPA 70) is to remove the requirement for an ground conductor between the house service panel and the dock service panel.

## 2. Proposed Exception:

### a. Changes in the NEC/NFPA 70 between 2014 and 2017

The presently approved code in Virginia is the 2014 edition. Residential docks are covered by Article 225, Outside Branch Circuits and Feeders and Section 250.32(B) concerning grounding. In the 2017 edition, residential docks are covered by Article 555, Marinas, Boatyards, and Commercial and Noncommercial Docking Facilities.

### b. Location within the NEC/NFPA 70:

We assume that the 2017 edition of Article 555 will be approved in this review of the VCC (Virginia Constuction Code), and therefore we have placed the proposed exception in Article 555. If single-family residential docks are excluded from Article 555 in the present review (as in the presently approved code), the proposed exception would need to be moved to Article 225, Outside Branch Circuits and Feeders, and a new Section covering single-family residential docks.

### c. Present Code:

Section 555.15(E) requires a ground conductor between the house service panel (Feeder Equipment) and the sub-panel at the dock (dock service panel/remote panelboard) and the ground conductor is to be connected to the neutral conductor in the house service panel (Article 250), but not in the dock service panel. GCFIs are required on all circuits in the dock service panel and on the circuit that feeds the dock service panel in the house service panel.

## d. Variance/Exception:

There shall be no ground conductor between the house service (feeder equipment) and the dock service panel. The ground conductor at the dock shall not be connected to the neutral conductor at the sub-panel at the dock (as in the present code) GCFIs are required on all circuits in the sub-panel at the dock and on the circuit that feeds the sub-panel in the primary panel at the house (as in the present code) and all GFCIs must be present if the ground wire between the primary panel and sub-panel is being removed in an existing installation.

## e. Suggestion:

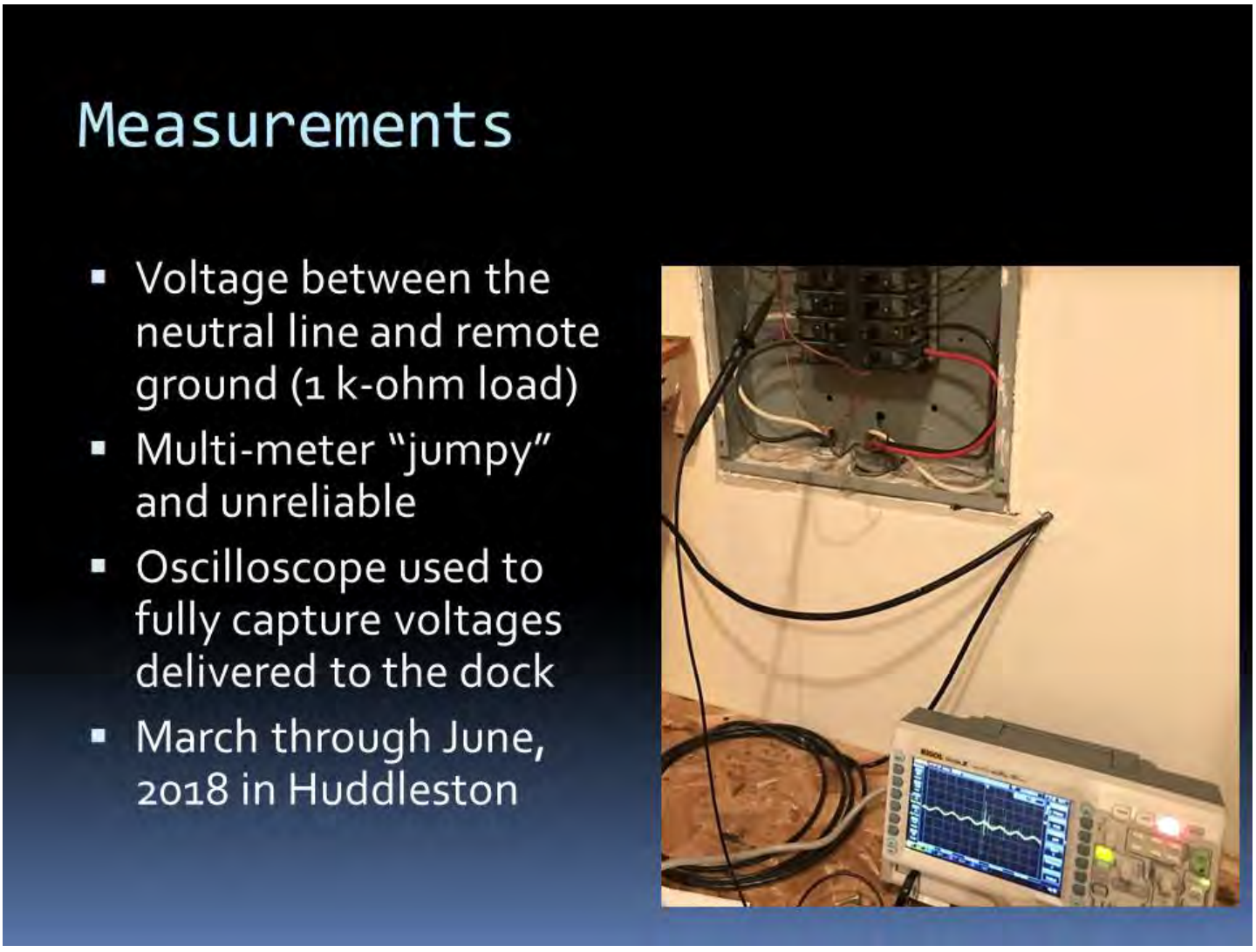
While GFCIs include a warning that they should be tested at regular intervals by homeowners/leaseholders, regular testing at docks is especially critical for safety whether the ground conductor between the house and dock is removed or not. It is also suggested that docks at short-term rentals be required to satisfy the latest electrical code as part of the county permitting process (e.g. A statement from a licensed electrician that the dock has been inspected and is up to present code). Furthermore, owners/property managers are to self-report to the county, testing of GFCIs at intervals required by the manufacturer (e.g. This could be a checkbox on the monthly short-term occupancy tax form) .

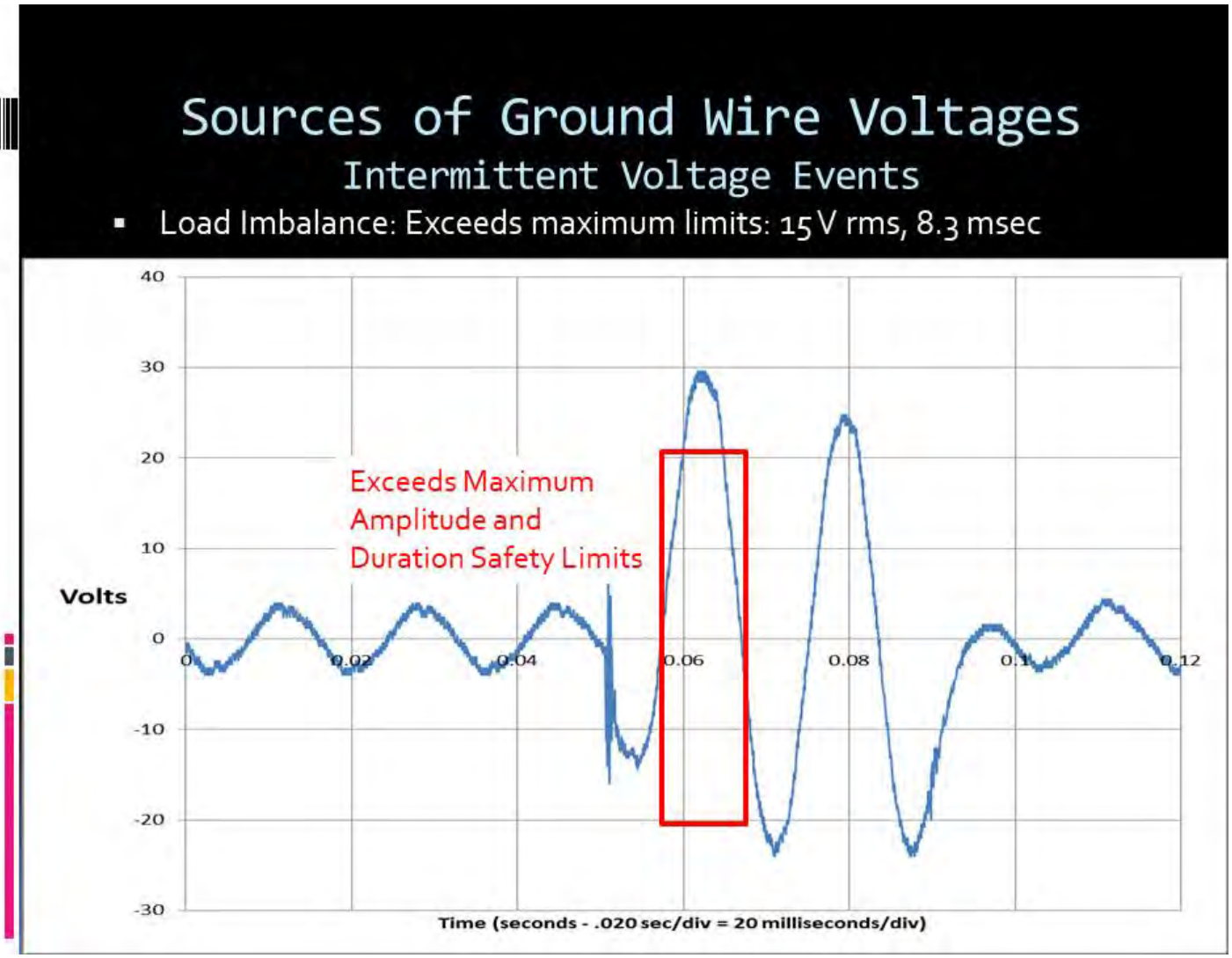
# 3. Reason for Proposed Exception:

## a. Electric Shock Drowning and Injury Caused due to the presence of the ground conductor between the primary panel at the house and the sub-panel at the dock

i. Intermittent lethal voltages

Intermittent lethal voltages between the neutral conductor and “remote” ground (the potential of the earth/body of water) have been measured and documented (Ref 2: “Electric Shock Drowning”, James Erler, July 2018, slides 52 - 63; Ref 1: “The Case of Stray Voltage in a Lake”, Donald R. Johnson, P.E., Johnson Engineering, Nov 01, 2009; Ref 3: "Boat Dock Exposure Voltage Mitigation," Frank Lambert and Shashi Patel, Georgia Tech/NEETRAC, January 2013, slides 4, 6, 8, 9).






These intermittent events are a normal part of the electrical power system. They are induced by several different events:

- Load imbalances when motors start and draw high currents (e.g. refrigerators, air conditioners, boat lift motors etc.)
- Arcing between high voltage and neutral/ground conductors
- Lightning strikes

These events may take place at the house associated with the dock or at neighboring properties that share the same neutral line.

ii. Continuous lethal voltages

Problems in the power delivery system can result with elevated neutral/ground conductor voltages. These include:

- Corrosion of neutral return conductors between a house panel and the power feed (Ref 1: "The Case of Stray Voltage in a Lake", Donald R. Johnson, P.E., Johnson Engineering, Nov 01, 2009; Ref 2: "Electric Shock Drowning", James Erler, July 2018, slide 51)
- Errors in repairs performed by the power company (neutral and power conductors reversed) (personal communication, Doug Dorr, Electric Power Research Institute)
- Nearby power usage causing regular load imbalances (Ref 3: "Boat Dock Exposure Voltage Mitigation", Frank Lambert and Shashi Patel, Georgia Tech/NEETRAC, January 2013, slide 9)

## b. Death and Injury

While death by electrocution requires relatively high voltages, electric shock drowning may occur at modest voltages of 15 volts or less since it disables the swimmer (Ref 1: "The Case of Stray Voltage in a Lake", Donald R. Johnson, P.E., Johnson Engineering, Nov 01, 2009; Virginia Residential Code, Chapter 42, E4201.2 Definitions). Measurements and analysis by Mr. Erler (Ref 2: "Electric Shock Drowning", James Erler, July

2018, slides 52 - 63 ) clearly demonstrate that intermittent lethal voltages are delivered to docks by the presently required ground conductor. In June 2018 a girl was injured when she was shocked by an intermittent voltage event while sitting on a boat lift and dangling her feet in the water. She would have drowned if she had not been pulled from the water. She was hospitalized for 3 days following the injury. (personal communication, Neil Harrington, Smith Mountain Lake Marine Volunteer Fire/Rescue).

An autopsy after an electric shock drowning (ESD) cannot reveal that death was caused by an electric shock, so unless the cause is a continuous lethal voltage, there is no way to know the cause of death was ESD. Unexplained drownings at docks are not tabulated, so it is impossible to know the number of drownings that are caused by intermittent voltage events. There are numerous reports in the media of unexplained drownings of healthy and experienced swimmers at docks.

# 4. Removal of the ground conductor and dependence on GFCIs

## a. Function of the ground conductor if there are no GFCIs

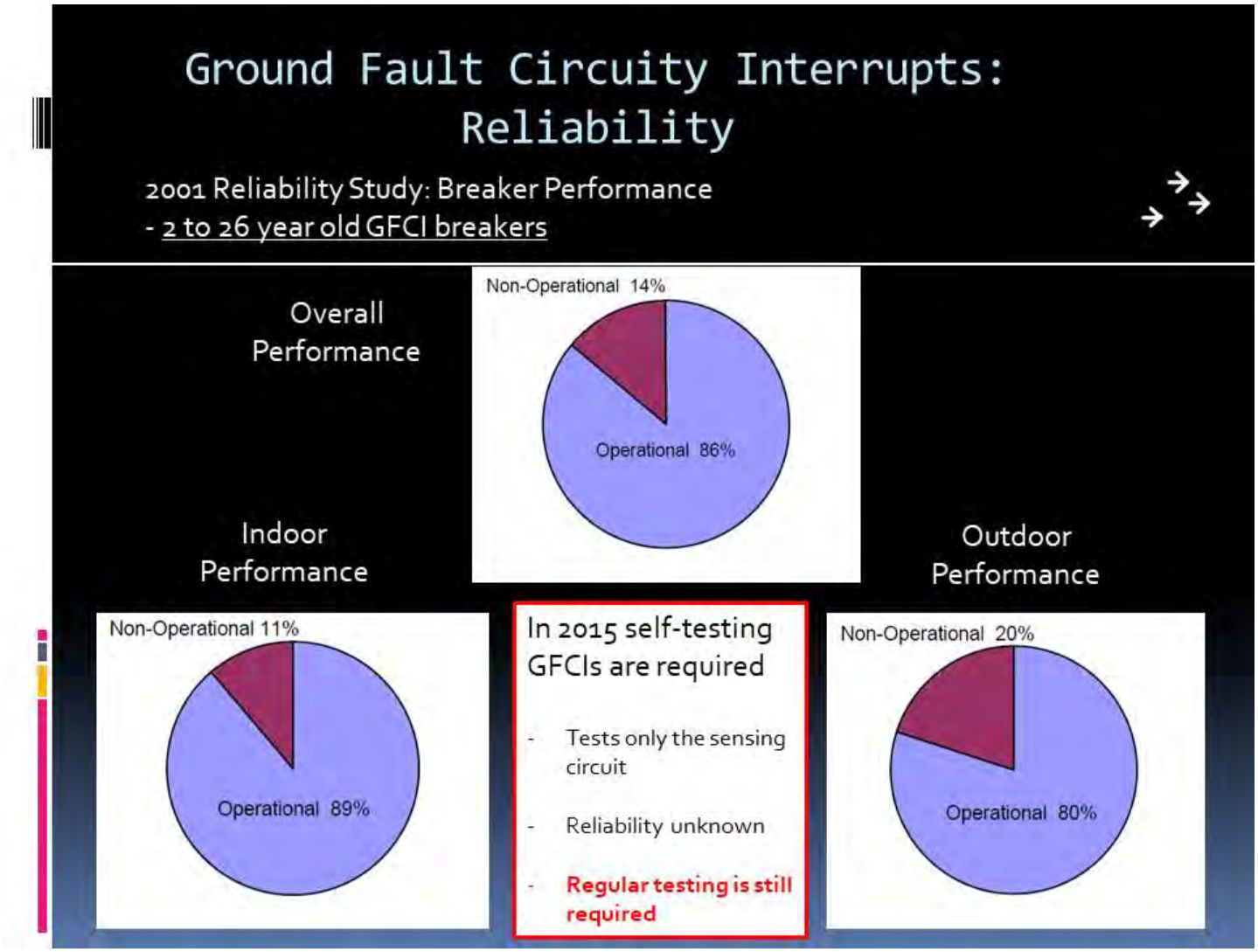
The ground conductor provides a return path to the breaker if there is a high-current fault to ground, enabling the breaker to trip if the current exceeds its rated current (typically 12 or 20 amps). It takes about 5 seconds for a breaker to trip. They are designed to trip if the load exceeds the rated current of the breaker. If a high-current fault occurs to a grounded dock component that is in contact with the water and swimmers are in the vicinity, they will be shocked and may drown, since the breaker is too slow to provide adequate protection. However, the tripped breaker will cut the power before an electrical fire could break out and provides protection for swimmers entering the water after the breaker has tripped. IMPORTANT NUMBERS: Exposure longer than 0.0083 seconds (8.3 milliseconds) can cause lethal ESD; standard breakers trip is ~5 seconds; GFCI breakers required at docks trip in 0.007 seconds (7 milliseconds) or less.

## b. Function of GFCI Breakers

GFCI breakers will trip if there is a low (or high) current fault to ground and are will trip within 0.007 seconds, which is less than the exposure time required to cause ESD. A GFCI breaker will trip more quickly and at lower currents (0.004 Amps) than a conventional breaker (12 or 20 Amps). Since a GFCI is tripped by a current imbalance between the hot and neutral conductor, *the ground conductor between the primary panel at the house and the sub-panel at the dock is not needed for GFCIs to trip properly.*

## c. Reliability of GFCI Breakers

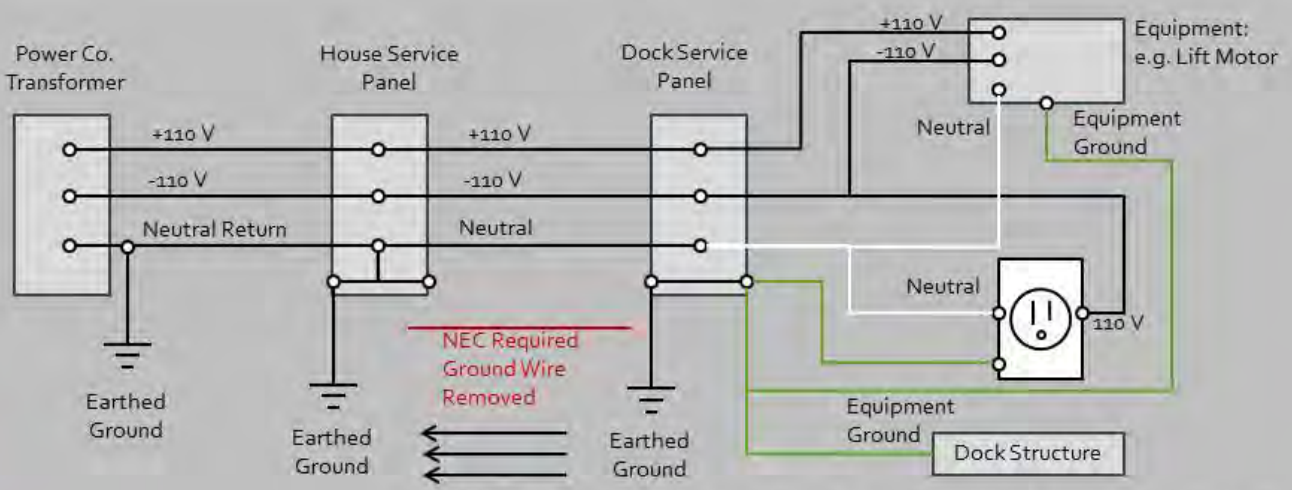
A study performed in 2001 Evaluated the reliability of installed GFCIs that were up to 26 years old. (Ref 4: “GFCI Field Test Survey Report,” National Electrical Manufacturers Association, January 2001; Ref 2: “Electric Shock Drowning”, James Erler, July 2018, slides 74 - 79) This led to the development of a self-testing design in 2015 (self-testing of only the sensing circuit but NOT the cutoff switch), but there is no known reliability data on the newer units. However, anecdotal reports from electricians indicate that there are still reliability issues with outlet GFCIs, especially in dirty environments (hair spray can cause the mechanism to stick). The 2001 data indicates a failure rate of ~20% in outdoor environments over a period of many years. Regular testing of GFCIs should help keep them operational by operating the cutoff switch, as well as detecting failures. The reliability of a post-2015 GFCI over a period of 30 days is likely to be very high.



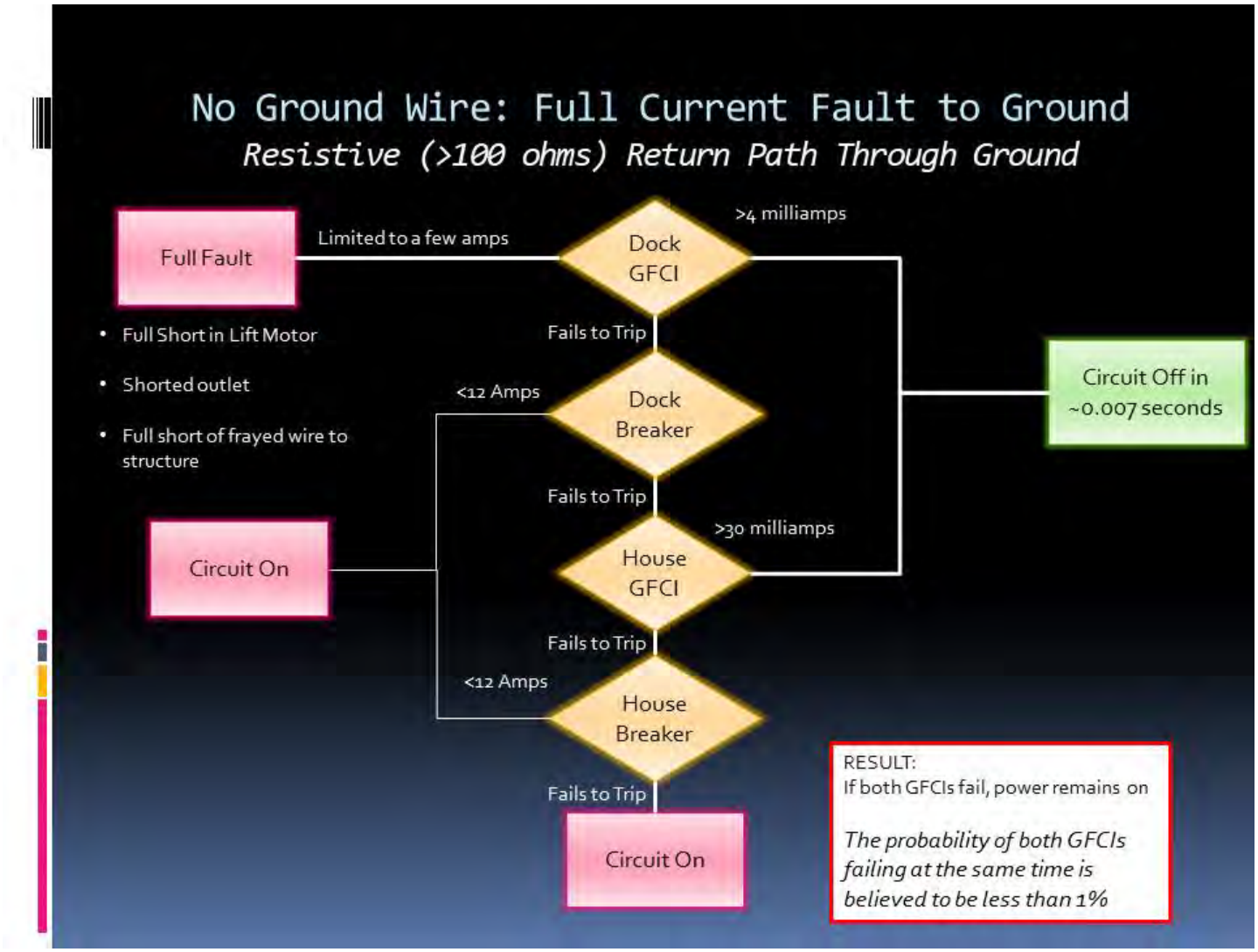

## d. Safety Impact of Removing the Ground Wire

The improvement is safety for swimmers at the dock is established above, but does the removal of the ground wire create added risks? The flow diagram in slide 89 of Mr. Erler's brief (Ref 2: "Electric Shock Drowning", James Erler, July 2018, slides 88 - 90) follows the electrical path logic sequence should there be a high current fault to ground.

# Remove NEC Ground Wire




- Removing NEC Ground Wire Eliminates Fault Return Path to Dock and House Service Panels




Without the ground wire, the only return path to the neutral conductor is through the ground which is estimated to be greater than 100 ohms. This limits the current to a few amps which would be insufficient to trip the load side of the breaker. However, BOTH the dock GFCI and the house GFCI would have to fail for the circuit to remain on.

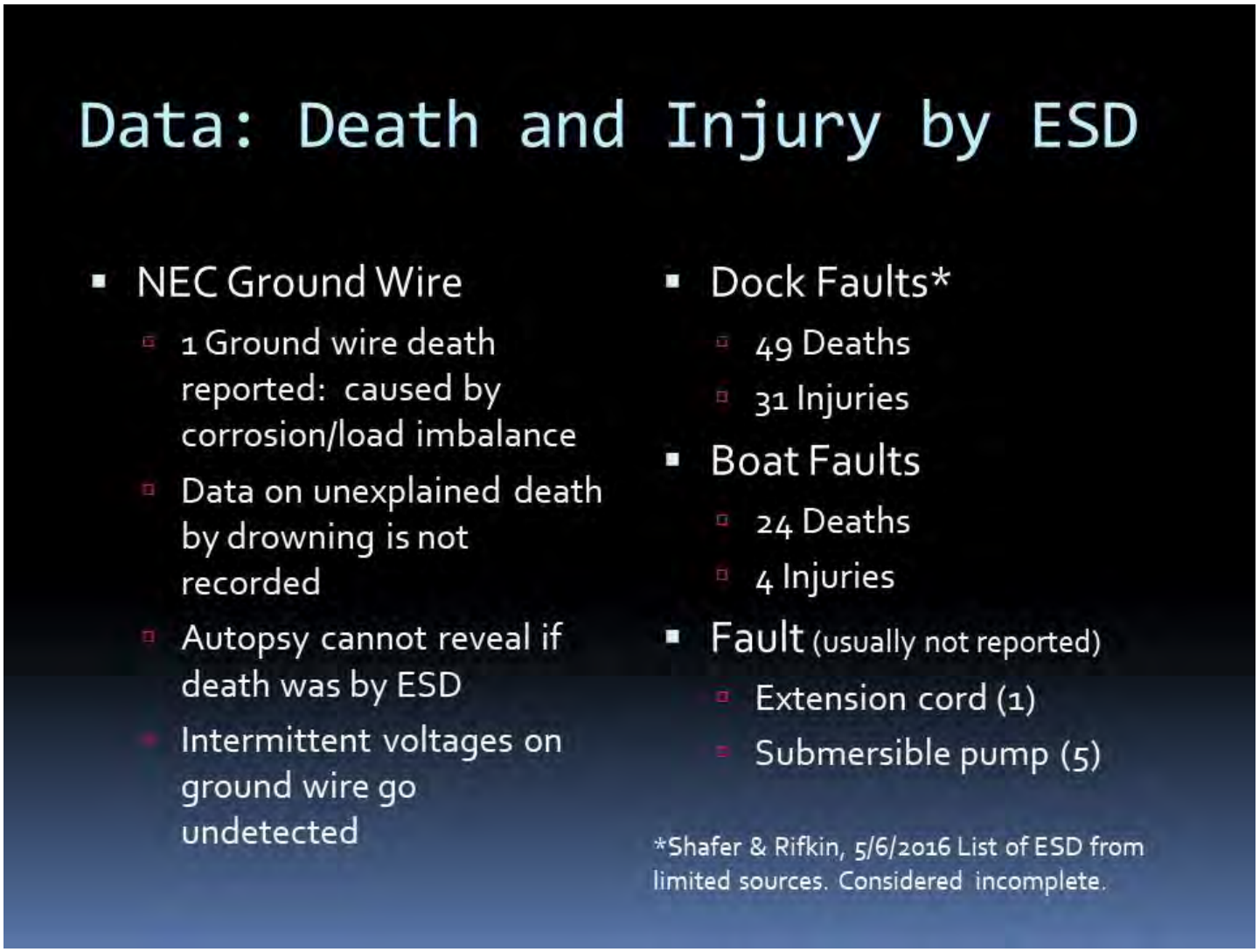
*If the probability of failure of GFCIs is the same as the 2001 data, the probability of both failing at the same time drops to 4%. The newer GFCIs with regular testing will likely put this figure well below 1%.*

Note: NEMA has not responded to requests for reliability data on newer GFCIs.

This risk is certainly much lower than the risk of death due to ESD caused by the ground conductor.

## 5. Public Interest and Concern

The introduction of devices that detect electricity in the water, such as the Shock Alert (Ref 5: "Shock Alert Owner's Manual"), made it possible to easily detect electricity around docks. Neil Harrington (Smith Mountain Lake Marine Volunteer Fire/Rescue) tested over 200 docks at Smith Mountain Lake, Virginia, and found that over 90% of them had electricity in the water (Ref 6: "Stray voltage common around docks," Laker Weekly, January 16, 2018). On June 2, 2018, a girl was injured by an intermittent electric shock at a dock on Smith Mountain Lake (Ref 7: "Teen injured after shock at dock," Laker Weekly, June 12, 2018; Ref 8: "Teen recovers after shock at dock," Laker Weekly June 6, 2018) further heightened public concern. Press releases and newspaper articles about ESD at Smith Mountain Lake reflect the growing public awareness and their desire for a safe environment at their docks (Ref 9: "Research Dock shock from home ground wire," Laker Weekly, July 18, 2018; Ref 10: "Stray voltage found around lake docks," Laker Weekly, June 12, 2018; Ref 11: "Use these tips to avoid shocks at docks," Laker Weekly, June 19, 2018; Ref 12: "Boat lifts a common source of stray voltage in water," Laker Weekly, June 26, 2019; Ref 13 "WSC to combat stray voltage," Smith Mountain Eagle, July 10, 2019)




Submitted August 1, 2019 by James Erler, Neil Harrington and John Lane

**Cost Impact:** The code change proposal will decrease the cost of construction

a. Existing Installations

Installations that followed all prior versions of the NEC present significant risks to swimmers at docks (Ref 2: “Electric Shock Drowning”, James Erler, July 2018, slides 22 - 23), as they either include the lethal ground conductor and/or may not include GFCIs on all dock circuits in the dock service panel and on the circuit feeding the dock in the house service panel. While the recommended code exception may not be retroactive, most homeowners with docks are highly motivated to eliminate the risk of ESD for themselves, their family and their guests (Ref 13: “WSC to combat stray voltage,” Smith Mountain Eagle, July 10, 2019; Ref 12: “Boat lifts a common source of stray voltage in water,” Laker Weekly, June 26, 2019; Ref 9: “Research: Dock shock from home ground wire,” Laker Weekly, July 18, 2018). The cost to upgrade these installations could range from ~$100 to inspect and remove the ground conductor to ~$1,000 or more to upgrade the house and dock service panels with GFCIs.

b. New Construction

In new construction the ground conductor between the house and dock service panels is no longer needed, and the ground conductor/bonding at the dock is no longer needed. The cost savings is either negligible or perhaps a few hundred dollars.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
The proposed exception will neither increase nor decrease Resiliency as defined in COV Executive Order Twenty-Four.

## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Disapproval

**Workgroup 4 - Final Reason:**

**Workgroup 4 - Proposed Committee Action:** Carry over to Final

**Workgroup 4 - Proposed Reason:** IAEI VA opposes. Delegate Byron in support. Will develop SWG in final phase to discuss further.

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# Public Comments for: T2701.1.1(1)-18

**Discussion by Bryan Holland**
Jun 29, 2020 19:22 UTC

NEMA strongly opposes this proposal. As a member of the Virginia Residential Dock Electrical Safety Subworkgroup, we outlined several of the flaws and hazards associated with this proposal, as written. This includes, but is not limited to:

1. The exception being added to Section 555.15(E) would violate not less than (10) other Sections of the code specifically included in the code to protect persons and property from the hazards of shock, electrocution, and fire. This includes 250.4(A)(4), 250.4(A)(5), 250.6, 250.96, 250.110, 250.112, 250.120, 250.134, 250.148, and the general requirements of 555.15.
2. The proposal implies all private noncommercial docking facility panelboards are supplied from service equipment and does not address panelboards at docking facilities supplied by other panelboards on the premises wiring system nor does the proposal address branch circuits that supply a docking facility and where no panelboard is installed at the dock.
3. The proposal relies heavily on the operation of GFCI protection in locations not currently required by the code. More importantly, it relies on the operation of GFCI protection not intended by the NEC, UL product standards, or the manufacturer's installation instructions.
4. The proposal also relies on the installation of grounding electrode systems at various locations not currently required by the code and attempts to use the earth as an effective ground-fault current path in violation of the code.

In short, there are simply too many flaws, unknown consequences, and potentially even greater electrical hazards at docking facilities as a result of this proposal. NEMA believes a better solution is for the BHCD to adopt the most current electrical installations requirements outlined in Article 555 of the 2020 NEC as proposed in T26701.1.1(2)-18. The NEC and VA Building Code requirements should be enhanced to mitigate stray voltage and should not trade-off other electrical system safety features such as equipment grounding and bonding. Stray voltage and objectionable current needs to be corrected at its source and cannot be mitigated by noncompliant electrical installations.

**Discussion by Richard Potts**
Aug 22, 2019 14:43 UTC

Provided at the 08/21/2019 combined workgroup meeting.
Attachments: https://va.cdpaccess.com/proposal/214/discuss/42/file/download/103/T2701.1.1%20Statement%20from%20Delegate%20Byron.pdf

**Discussion by Thomas King**
Aug 20, 2019 20:29 UTC

Including comments received via email from Rhonnie Smith
Attachments: https://va.cdpaccess.com/proposal/214/discuss/40/file/download/101/Comments%20Electric%20Shock%20Drowning.pdf

**Discussion by Richard Potts**
Aug 20, 2019 17:38 UTC

Comments were submitted as an attachment via email.
Attachments: https://va.cdpaccess.com/proposal/214/discuss/38/file/download/100/Comments-NT.pdf

**Discussion by Thomas King**
Aug 13, 2019 16:20 UTC

Attached are comments received on August 13
Attachments: https://va.cdpaccess.com/proposal/214/discuss/33/file/download/89/Fwd-%20Eliminate%20equipment%20grounding%20conductor%20in%20Virginia%20Aug%2013.pdf

**Discussion by Thomas King**
Aug 13, 2019 13:29 UTC

Attachments of comments received August 9
Attachments: https://va.cdpaccess.com/proposal/214/discuss/30/file/download/87/Fwd-%20Elimination%20of%20Equipment%20Grounding%20Conductor%20to%20Boat%20Docks%20Proposed%20for%20Virginia%20Aug%209.pdf

**Discussion by Thomas King**
Aug 13, 2019 13:27 UTC

Attachments of comments received August 10th
Attachments: https://va.cdpaccess.com/proposal/214/discuss/29/file/download/86/Fwd-%20Elimination%20of%20grounding%20conductor%20from%20boat%20docks%20Aug%2010.pdf, https://va.cdpaccess.com/proposal/214/discuss/29/file/download/85/Fwd-%20Elimination%20of%20Equipment%20Grounding%20Conductor%20to%20Boat%20Docks%20Proposed%20for%20Virginia%20Aug%2010.pdf

**Discussion by Thomas King**
Aug 13, 2019 13:25 UTC

Comments received are attached here.
Attachments: https://va.cdpaccess.com/proposal/214/discuss/28/file/download/84/Fwd-%20An%20Alternative%20to%20Removal%20of%20Dock%20Ground%20Aug%2012.pdf, https://va.cdpaccess.com/proposal/214/discuss/28/file/download/83/Fwd-%20equipment%20grounding%20conductor%20to%20boat%20docks%20Aug%2012.pdf

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COMMONWEALTH OF VIRGINIA
HOUSE OF DELEGATES
RICHMOND

KATHY J. BYRON
POST OFFICE BOX 900
FOREST, VIRGINIA 24551

TWENTY-SECOND DISTRICT

COMMITTEE ASSIGNMENTS:
COMMERCE AND LABOR (VICE CHAIRMAN)
FINANCE
SCIENCE AND TECHNOLOGY

August 21, 2019

Department of Housing and Community Development
Comments for Workgroup 4, Proposal T2701.1.1-18 Feeder equipment grounding conductor.

When I was first contacted by Misters Erler, Lane, and Harrington about Electric Shock Drowning and learned of their proposal, I was surprised that a danger as serious as this could continue to exist. The more I learned about this issue, and about the loss of life it has already caused, I became concerned that government was failing in one of its core missions: keeping our citizens safe.

Representing an area like Smith Mountain Lake, I am no stranger to issues related to personal safety. Not long ago, I successfully worked to enact measures related to boating safety that are now the standard in our state and among our nation's strongest.

The solution these gentlemen are proposing is not novel. Already enacted in England, France, Germany, and Italy, their proposal is actually representative of a new and already proven safety standard. In this instance, we are simply behind the times.

Inaction on this matter is not an option. A genuine risk – one that has resulted in the loss of life – has been identified. Electrical current leakage adjacent to lakes and waterways is not a problem we can ignore. By adopting the recommendations of Misters Erler, Lane, and Harrington, we can dramatically reduce the risk of Electric Shock Drowning and prevent the loss of life.

What Misters Erler, Lane, and Harrington have produced with their proposal is evidence that engaged citizens who are willing to research a problem and propose a workable solution can make a very big difference. I urge this Board to give its strongest possible consideration to adopting the reasonable and proven solution these gentlemen have advanced.

Sincerely,

Kathy J. Byron, Member
House of Delegates

DISTRICT: (434) 582-1592 • RICHMOND: (804) 698-1022 • E-MAIL: KATHY@KATHYBYRON.COM

Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

# Electric Shock Drowning

2 messages

**Rhonnie Smith** <rhonniesmth2@gmail.com> Tue, Aug 20, 2019 at 4:14 PM
To: richard.potts@dhcd.virginia.gov, thomas.king@dhcd.virginia.gov, jeff.brown@dhch.virginia.gov

I write you in support of the proposed change to Virginia electric code to allow removal of the ground wire connection from our house to our dock. We had the stray voltage in the water measured by Neil Harrington and, though the voltage measured was very low, it shows that a pathway exists for high voltage spikes to flow to our dock and into the water. Should a person happen to be in the water or touching the water and the boat lift, a dangerous situation would result. With the ground wire from the house to our dock removed, this pathway would not exist. As to electrical shocks from electrical apparatus on the dock, multiple GFCI's, which we have installed, on our dock would prevent electrical shock. I ask that you give the data and proposal presented by James Erler, John Lane and Neil Harrington serious consideration and make the necessary changes to our State's electrical code to alleviate this silent killer.

--
**If we are dead when our heart stops beating, why aren't we alive when our heart starts beating?**

**King, Thomas** <thomas.king@dhcd.virginia.gov> Tue, Aug 20, 2019 at 4:28 PM
Draft To: Rhonnie Smith <rhonniesmth2@gmail.com>
Cc: Potts Richard ilv62300 <richard.potts@dhcd.virginia.gov>, jeff.brown@dhch.virginia.gov

Mr Smith

I have attached your comments to the original proposal. If you want to view the original proposal you can go to va.cdpaccess.com and make a Free account
[Quoted text hidden]
--
Thomas B. King, MBA
Code & Regulation Specialist
(804) 371-7018



Regarding "*Remove Electric Shock Drowning Hazard at Residential Docks : 2701.1.1 (New)*", by Erler, Lane & Harrington, as a proposal for Virginia Construction Code.

Comments for Workgroup 4, *Proposal T2701.1.1-18 Feeder equipment grounding conductor*.

By Nathaniel Taylor, KTH (Royal Institute of Technology), Stockholm, Sweden.
20/August/2019

My purpose here is to support the proposal's basic technical principle.
In my work I have followed the subjects of international practices and differences within electrical safety and protection systems, and of electric shock drowning. Because the proposal goes outside strongly entrenched US practice, and can be misrepresented along the lines of "they just want to remove the safety wire", I suspect it risks being too quickly judged. In fact, its principle is what is widely and successfully used in many other countries for installations in homes as well as in outdoor environments; this is the main point that I make.
I do not feel competent to comment on other issues of the proposal: for example, how great its benefit and cost will be in the conditions found in your docks and electrical supply systems, and whether the cost/benefit ratio is justifiable by your standards; or whether users will in fact routinely bypass GFCIs, etc. Such questions generally are very hard to answer well, due to weak statistics about failures of components and behavior of people. Local people would probably have more feeling for these matters.

The proposal's key points are:
(1) By avoiding a metallic connection from accessible metallic parts at the dock back to the service neutral, one avoids 'importing' to the dock the potentials that can arise on that neutral due to events in the low-voltage or medium-voltage supply system. This is the proposal's objective.
(2) By using sensitive detection devices (GFCIs) one can obtain rapid disconnection of a ground fault in spite of the lack of a metallic path back to the supply neutral. This point is necessary to deal with the consequence of (1).

A good comment *against* the proposal should consider both of the above points. If attacking the proposal on the grounds that it is 'dangerous' to implement point (1), the comment should explain the nature of that danger, in the light of point (2). I have seen six comments on this proposal, made between August 9th and 13th. Several claimed it to be dangerous, without explanation and without any hint of having noticed point (2). Two seemed to miss the important point (1) that the present system can import danger to the dock, which is what motivates the proposal. One mentioned a 'neutral blocker', which could stop some influences from the medium voltage network but would not help against events in the low-voltage network or against more severe potentials on the medium-voltage neutral (I believe the level is several tens of volts, for existing neutral-blockers). Good comments that I have no good answer to were about the scale of the problem that the proposal aims to solve, and about users bypassing GFCIs if there are nuisance trips.

Below, I give some introduction to existing use abroad of systems like the proposed one, and then some further comments about details of the proposal.

**Background: International Practice**

The terminology in the following is aimed to avoid strict following of either the NEC or the IEC-60364 standard (bonding, protective earthing, grounding etc), as the IEC terms may confuse this audience, and the NEC terms are not designed for describing systems outside the present US practice.

Consider a 'ground fault', in which a conductor with dangerous potential comes into contact with an accessible metallic part of some electrical equipment. Several distinct methods are used in international practice to mitigate the danger in this event. Widely accepted methods can be found in the international standard IEC-60364 (particularly part -41), which is adopted with minor regional

variations across Europe and beyond. Common features of the methods are that: (i) accessible metallic parts that risk contact with conductors of dangerous potential (e.g. the frame of a motor), or that introduce external potentials into the vicinity of such parts (e.g. a metal water pipe) are connected together to reduce the voltages between them that people could be exposed to; and (ii) this set of connected parts is further connected to a path through which current can flow to ensure disconnection of the supply in the event of a fault that causes a dangerous voltage between these parts or from these parts to the ground.

Several distinct methods are found for achieving (ii). The following two are the ones concerned in the proposal.

In the US's NEC, the required method for systems at the voltage-level used in homes is what the IEC standard defines as 'TN-C-S': the accessible metallic parts, through their equipment grounding conductors, connect back to the service neutral near the point where it enters the installation. In this way, a low-resistance equipment 'ground fault' becomes like a short-circuit fault, with a metallic path that ensures high enough current to operate normal overcurrent protection devices such as fuses or breakers.

A quite different method is called 'TT': this has no metallic connection of the accessible metallic parts to a supply conductor; instead they are connected to a ground electrode independent of the supply's ground electrodes. The resistance of the ground path means that it is seldom possible to rely on the simple overcurrent protection devices to disconnect a ground fault. Therefore, more sensitive devices such as GFCIs (US terminology) are usually required when using the TT method.

Both of these methods have their good and bad points. Given a perfect supply-source, which keeps its neutral very close to the general ground potential in all circumstances, the TN-C-S method would seem advantageous, as it avoids a dependence on sensitive devices such as GFCIs, whose reliability isn't expected to be quite as high as that of simple fuses and overcurrent breakers. However, a real supply source can introduce dangers in the TN-C-S method, when its neutral reaches a dangerous potential above the surrounding ground and thus causes the accessible metallic parts in the installation to do likewise. This can happen due to bad connections in the neutral of the low-voltage supply system - the 'open neutral'. In the situation in much of the US, where low-voltage neutrals are connected to medium-voltage neutrals at the supply transformer, faults in the medium voltage system - even at distant points - can also drive up the low-voltage neutral's potential. Indeed, even a high load current traveling some kilometers along the medium-voltage neutral can cause tens of volts of potential relative to the general ground. Adding an extra ground electrode at the home typically does little to affect this. Within a building, this negative feature of the TN-C-S method can be largely avoided, if the parts that people might touch are either insulating, or are conductive but connected together to reduce the voltages between them. However, in an outdoors situation with easy contact with the ground, this 'well bonded' situation is more difficult to attain. With some effort, it can be done for pools. For a dock it seems distinctly less practicable. The TT method avoids the problem of putting people in contact with potentials introduced from the supply neutral, or indeed of fires due to high currents in bonding connections during conditions of open neutral in the supply. However, as mentioned above, it has the downside of depending on less simple devices for disconnection of ground faults.

The proposal in question in Virginia (T2701.1.1-18) - if it comes with a requirement of a ground electrode at the dock - simply describes the TT method in the sense of IEC-60364. Although not considered (or permitted) in the present NEC, this method is to my direct knowledge used for homes and/or their outbuildings in parts of the UK and Germany, and is the normal choice in France and Italy. One attempt at listing the choices of different countries is Schneider Electric's "Earthing systems worldwide and evolutions",
https://www.schneider-electric.com/en/download/document/ECT173/ .

Separating the dock from the house in the proposed way is what electricians in the UK would call "making the dock a separate TT system" (i.e. separate from the house). There, that is a common choice for situations where people are exposed to contact with the ground around electrical equipment, such as in simple outbuildings. In the UK the TN-C-S method is forbidden by legislation

("Electricity Safety, Quality and Continuity Regulations, 2002" and earlier equivalents) for very exposed situations such as supplies to metal caravans or boats, due to the fear of people being exposed to dangerous voltages in the event of an open neutral in the supply. Some other countries in Europe are not so fearful of TN-C-S in these situations, but, as mentioned above, there are also many countries that use the TT method widely even for indoors situations.

I hope the above indicates that the basic principle of the proposal is in fact a well established method elsewhere in the world.

**Further comments on details of the proposal**

The proposal's requirement of two cascaded GFCIs is a higher demand than is commonly made by users of TT systems, although it is a principle that I normally choose for added security. I approve, and don't think this requirement should be weakened.

It should be noted that the 'RCD' used in European countries (same basic principle as GFCI, but usually 30 mA rather than 4 or 6 mA) is commonly not electronic but electromechanical, and is designed to be able to operate independently of the supply source. Thus, even if the neutral upstream of a two-pole RCD were to break, leaving no voltage between the RCD poles, the RCD is still able to trip if current leaks out of the circuit downstream. If US GFCIs might fail to operate in this situation, that is a further consideration for the evaluation of what requirements a change in code should have. Even electronic RCDs can be made able to operate in this situation by having a ‘functional earth’ connection that allows a small current into the equipment grounding conductors, to power their electronics.

From the proposal I am not sure whether a separate ground electrode would be present at the dock. The proposal’s image ‘Remove NEC Ground Wire’ does show a ground electrode there. If metallic parts at the dock are already assumed to be connected together by equipment grounding conductors, and some of these parts will have contact with ground and/or water, then I accept it is practically certain that enough current would flow during a ground fault to operate a GFCI. However, in countries using the IEC standard's TT method, a suitably durable ground electrode would anyway have to be identified and tested. It could possibly be chosen to use an existing structure rather than having to drive a new rod into the ground. Its resistance to ground would have to be shown to be low enough to cause operation of the protection device (GFCI) in the event of a dangerous level of potential on the accessible parts, which is very easily achieved with a sensitive GFCI. Within dry buildings, ‘dangerous’ is often taken as 50 V ac. In a very exposed situation such as swimming, a lower value would be chosen, such as 12 V ac or less.

When using the TT method, transient potentials arriving on the supply conductors, due to faults or to lightning near the lines, do not pull the equipment grounding conductors up to the same level in the way that they would if using the TN-C-S method. Consequently, higher transient capacitive currents can pass from the active conductors to the grounding conductors, e.g. through the capacitance of filters inside electronic equipment. This increases the chance of GFCIs tripping during transients, if the GFCIs are not designed to tolerate brief transients. There is also more chance of needing transient voltage suppression (arrester) to protect equipment insulation. The existing design of equipment and GFCIs may make it unnecessary to take further action; I simply mention these as additional points to bear in mind.

Alternative approaches also exist by which metallic parts at a dock could be separated from the system neutral in the desired way while not becoming dependent on GFCIs or other sensitive equipment. The most obvious is to “make the dock a separate TN-S system”, for which an isolating transformer and ground electrode would be needed. I believe this would also go against the present NEC, and it would presumably have considerably higher cost than a couple of GFCIs, which are desirable to have anyway.

Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

## Fwd: Eliminate equipment grounding conductor in Virginia

1 message

**Donaldson, Nicole** <nicole.donaldson@dhcd.virginia.gov> Tue, Aug 13, 2019 at 12:17 PM
To: Richard Potts <richard.potts@dhcd.virginia.gov>, Jeffrey Brown <jeff.brown@dhcd.virginia.gov>, "Davis, Cindy" <cindy.davis@dhcd.virginia.gov>, Thomas King <thomas.king@dhcd.virginia.gov>

FYI

---------- Forwarded message ---------
From: **Kipfinger, Jeff** <Jeff.Kipfinger@dot.state.fl.us>
Date: Tue, Aug 13, 2019 at 11:51 AM
Subject: Eliminate equipment grounding conductor in Virginia
To: Nicole.donaldson@dhcd.virginia.gov <Nicole.donaldson@dhcd.virginia.gov>

Hello Nicole,

Several of my colleagues think this is a hoax e-mail concerning a change to the Virginia building codes.

Eliminating the equipment grounding conductor would result in ungrounded metal boxes, parts, lights, and equipment on the docks which could lead to getting shocks from faulty energized electrical equipment.

Jeff Kipfinger, PE

Electrical Engineer

Florida's Turnpike Enterprise/HNTB

**From:** "Mike Holt Enterprises" <newsletters@newsletters.mikeholt.com>

**To:** "jkipfinger@yahoo.com" <jkipfinger@yahoo.com>

**Cc:**

**Sent:** Fri, Aug 9, 2019 at 7:16 PM

**Subject:** Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia






**Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia**

It was brought to my attention that a proposal has been submitted to the Virginia Department of Housing and Community Development (DHCD) to change regulations in the Virginia Construction Code to eliminate the requirement for the circuit equipment grounding conductor to boat docks.

I believe that this is a violation of the National Electrical Code 250.4(A)(3) and 250.4(A)(5), and the basis for that can be found in my video Electrical Safety Fundamentals. Please watch this video in its entirety (1 hour, 13 minutes), and if you feel motivated, or have any feedback for or against this proposal you can contact Nicole Donaldson at DHCD, or proponents Jim Erler or Neil Harrington.

**Related documents - links below:**
Press Release: Electric Shock Drowning Hazards at Docks: Call to Action
Proposal to Remove Electric Shock Drowning Hazard at Residential Docks
Stray Voltage Common Around Docks



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## Remove Electric Shock Drowning Hazard at Residential Docks

: 2701.1.1 (New)

**Proponents:** James Erler (jim@erlerdesign.com); John Lane (redcloud@aol.com); Neil Harrington, Smith Mountain Lake Marine Volunteer Fire Rescue (neilcharrington@gmail.com)

### 2015 Virginia Construction Code

**Revise as follows:**

2701.1.1 Add to 2701.1.1 Changes to NFPA 70.
3. Change Section 555.19(B)(e) of NFPA 70 to read:

(E) **Feeder Equipment Grounding Conductors.** Where a feeder supplies a remote panelboard, an insulated equipment grounding conductor shall extend from a grounding terminal in the service equipment to a grounding terminal in the remote panelboard.

**Exception:** Private, non-commercial docking facilities constructed or occupied for the use of the owner or residents of the associated single-family dwelling shall not have a grounding conductor between the grounding terminal in the service equipment and the grounding terminal in the remote panelboard.

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**Reason Statement:**

### 1. Introduction

Death and injury by Electric Shock Drowning (ESD) due to intermittent voltages delivered by the ground conductor between the house service panel and the dock service panel was documented by Donald Johnson in 2009 (Ref 1. "The Case of Stray Voltage in a Lake", Donald R. Johnson, P.E., Johnson Engineering, Nov 01, 2009.)

"Seeing the swimmers' plight, the remaining teenagers standing on the dock called to the adults in the house for help. Several of them came running out, called 911, and dove into the water, trying to retrieve the kids who were underwater. (Note: It was determined later during testing that the currents in the water were intermittent, thus not causing any harm to the adults.) After multiple dives, the adults retrieved the two boys and one girl who had been submerged for some time.

"At the hospital, one boy was pronounced dead (cause of death was drowning), and the other two received brain damage due to lack of oxygen caused by the near-drowning experience.

"After going to trial, a jury awarded the plaintiffs a total judgment of $2,325,000. No appeal was filed by the electric utility defendant."

The green ground wire connected to the neutral wire is an unprotected path for lethal electrical voltages/currents to flow out through the body of a swimmer at a dock. There is no protection on the green ground wire. Removing the green wire ground eliminates this risk and leaves only GFCI protected circuits at the dock. The proposed exception to the National Electric Code (NEC/NFPA 70) is to remove the requirement for an ground conductor between the house service panel and the dock service panel.

--
Nicole Donaldson
*Administrative Assistant*
Division of Building & Fire Regulations
600 E. Main Street - Suite 1100
Richmond, VA 23219
804-371-7150
nicole.donaldson@dhcd.virginia.gov
www.dhcd.virginia.gov

Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

## Fwd: Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia

1 message

**Potts, Richard** <richard.potts@dhcd.virginia.gov> Tue, Aug 13, 2019 at 8:18 AM
To: "King, Thomas" <thomas.king@dhcd.virginia.gov>
Cc: Jeff Brown <jeff.brown@dhcd.virginia.gov>

---------- Forwarded message ---------
From: **Donaldson, Nicole** <nicole.donaldson@dhcd.virginia.gov>
Date: Mon, Aug 12, 2019 at 9:51 AM
Subject: Fwd: Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia
To: Richard Potts <richard.potts@dhcd.virginia.gov>, Davis, Cindy <cindy.davis@dhcd.virginia.gov>, Jeffrey Brown <jeff.brown@dhcd.virginia.gov>

FYI

---------- Forwarded message ---------
From: <mhebert@abearengineering.com>
Date: Fri, Aug 9, 2019 at 11:58 PM
Subject: RE: Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia
To: Mike Holt Enterprises <newsletters@newsletters.mikeholt.com>
Cc: <Nicole.donaldson@dhcd.virginia.gov>, <Jim@erlerdesign.com>, <nharrington@smilfireboats.com>, <hector.esquer@powereng.com>

Mike,

It would be nice if the authors of the article used the terms found in the NEC throughout the article so we could all use a common language. I'm not sure they are wrong to propose removal of the EGC if the feeder and all dock branch circuits are GFCI protected and tested at suitable intervals. I'm not through thinking about all ramifications yet. Obviously an intact EGC bonded to all equipment back to the service entrance would help trip the appropriately coordinated upstream CB but if the GFCIs are working properly, it is true that no EGC would be necessary to have either the feeder GFCI or a branch circuit GCFI open to de-energize the downstream equipment. Obviously, motor starting with winding capacitance to the frame could, and has, tripped a GFCI unnecessarily (it happened to me with the washing machine in my garage whose frame was properly tied via EGC to the service entrance ground bus... I got cute and tried to put my washing machine on a GFCI which at the time was not required by code... I'm guessing due to this issue). In the case of a motor with similar characteristics on a boat or a boat dock, there could be nuisance tripping of a feeder or branch circuit GFCI which, to the untrained end user, could cause him/her to remove the GCFI and the lose the GFCI protection in which case it would be nice to have the EGC as back-up. Untrained folks who are not familiar enough with the characteristics of electricity will do what they do and there is no stopping that unfortunately. If I were king for a day, I'd make both EGC and GFCI required in the marine environment. I'd also propose 2yr inspections of commercial or residential marine electrical equipment for safety (but that would get me hung up by rope quickly I'm sure). Not sure why the EGC and GFCI can't coexist. Special considerations would need to be entertained for motors where needed though to prevent nuisance GFCI tripping.

Malcolm

---

Malcolm Hebert, PE, Chief Financial Officer

Abear Engineering Inc.

Oceanside, CA

mhebert@AbearEngineering.com

858-213-6232

**From:** Mike Holt Enterprises <newsletters@newsletters.mikeholt.com>
**Sent:** Friday, August 09, 2019 16:08
**To:** mhebert@abearengineering.com
**Subject:** Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia




# Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia

It was brought to my attention that a proposal has been submitted to the Virginia Department of Housing and Community Development (DHCD) to change regulations in the Virginia Construction Code to eliminate the requirement for the circuit equipment grounding conductor to boat docks.

I believe that this is a violation of the National Electrical Code 250.4(A)(3) and 250.4(A)(5), and the basis for that can be found in my video Electrical Safety Fundamentals. Please watch this video in its entirety (1 hour, 13 minutes), and if you feel motivated, or have any feedback for or against this proposal you can contact Nicole Donaldson at DHCD, or proponents Jim Erler or Neil Harrington.

**Related documents - links below:**
Press Release: Electric Shock Drowning Hazards at Docks: Call to Action
Proposal to Remove Electric Shock Drowning Hazard at Residential Docks
Stray Voltage Common Around Docks

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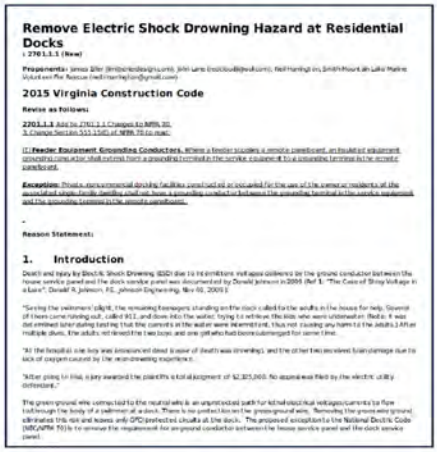

**Remove Electric Shock Drowning Hazard at Residential Docks**

**2015 Virginia Construction Code**

**Revise as follows:**

**Reason Statement:**

**1. Introduction**

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Mike Holt Enterprises, 3604 Parkway Boulevard, Ste 3, Leesburg, FL 34748
"... as for me and my house, we will serve the Lord." [Joshua 24:15]

--
Nicole Donaldson
*Administrative Assistant*
Division of Building & Fire Regulations
600 E. Main Street - Suite 1100
Richmond, VA 23219
804-371-7150
nicole.donaldson@dhcd.virginia.gov
www.dhcd.virginia.gov

Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

# Fwd: Elimination of grounding conductor from boat docks

1 message

**Potts, Richard** <richard.potts@dhcd.virginia.gov> Tue, Aug 13, 2019 at 8:18 AM
To: "King, Thomas" <thomas.king@dhcd.virginia.gov>

---------- Forwarded message ---------
From: **Donaldson, Nicole** <nicole.donaldson@dhcd.virginia.gov>
Date: Mon, Aug 12, 2019 at 9:31 AM
Subject: Fwd: Elimination of grounding conductor from boat docks
To: Jeffrey Brown <jeff.brown@dhcd.virginia.gov>, Richard Potts <richard.potts@dhcd.virginia.gov>, Davis, Cindy <cindy.davis@dhcd.virginia.gov>

FYI
---------- Forwarded message ---------
From: **John Hazen** <drgeek.john@gmail.com>
Date: Sat, Aug 10, 2019 at 12:35 AM
Subject: Elimination of grounding conductor from boat docks
To: <Nicole.donaldson@dhcd.virginia.gov>

To the point; this violation of NEC code as proposed is being based on a false pretense about the lake's grounding.
I.e. The case of stray voltage in a lake
The fault according to the P.E. was 'faulty (deteriorated) concentric neutrals'. And that Utility's lapse of judgement in replacing them. Removing the grounding from the dock may have had no different an outcome because of the bonding and grounding of the housing complex and the electric utilities grounding in proximity to that lake. The earth will continue to be "earth ground".
In my opinion, the convoluted Reason Statement for requiring docks with no grounding, IS NOT based on any facts of that lake tragedy as was reported, and is still available via the internet for public review.
May I suggest, please, reviewing the actual facts before exacerbating the problems that bonding and grounding was put in place to resolve?

J.E.Hazen

--
Nicole Donaldson
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804-371-7150
nicole.donaldson@dhcd.virginia.gov
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Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

# Fwd: Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia

1 message

**Potts, Richard** <richard.potts@dhcd.virginia.gov> Tue, Aug 13, 2019 at 8:19 AM
To: "King, Thomas" <thomas.king@dhcd.virginia.gov>
Cc: Jeff Brown <jeff.brown@dhcd.virginia.gov>

---------- Forwarded message ---------
From: **Donaldson, Nicole** <nicole.donaldson@dhcd.virginia.gov>
Date: Mon, Aug 12, 2019 at 9:31 AM
Subject: Fwd: Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia
To: Richard Potts <richard.potts@dhcd.virginia.gov>, Jeffrey Brown <jeff.brown@dhcd.virginia.gov>, Davis, Cindy <cindy.davis@dhcd.virginia.gov>

FYI

---------- Forwarded message ---------
From: **James Taylor** <tangentjt@gmail.com>
Date: Sat, Aug 10, 2019 at 9:34 AM
Subject: Elimination of Equipment Grounding Conductor to Boat Docks Proposed for Virginia
To: <Nicole.donaldson@dhcd.virginia.gov>

Good morning. I am a licensed Home Inspector in North Carolina. I also happen to be a lifelong avid boater. I have three adult children, each with two children of their own, and they each have boats, jet skis and various other "water toys" on Lake Norman here in the northern suburbs of Charlotte, NC. They all swim in Lake Norman.

Two of my children live on Lake Norman in North Carolina with their own private docks and the 3rd lives nearby and is regularly on the water.

I have been involved in the electric safety debates on both commercial and private docking facilities for years.

The proposal before the Virginia DHCD to change the requirement for an equipment grounding conductor from the service panelboard to devices at the dock is a dangerous and ill informed proposal.

You either have already heard, or will be hearing from many individuals far more knowledgeable than I. I am not an electrician or an electrical engineer, but I am an avid student of the phenomenon known as "stray current".

I will relate one story from an inspection I did at a private HOA dock just last year in Mount Holly, NC on Mountain Island Lake, which is the next Duke Energy Lake below Lake Norman on the Catawba River.

My client, who I had never met, was living in Connecticut at the time and preparing to transfer to Mount Holly. During phone conversations I could hear young children playing in the background.

As I approached their dock, I took note that the dock surface was a relatively new PVC decking material. The pilings were steel. I knew that my client's boat slip had a hydraulic boat lift, which was their reason for retaining me - to verify proper function of the lift, so I would clearly be reviewing the electric connections.

As I walked along the dock, I reached out and lightly touched the tip of my right index finger to a steel piling - and received a shock. The shock was not a "hard" or "short circuit" shock, it was simply a tingling sensation. This told me immediately that there was likely what is referred to "stray current" in the water.

Upon reaching the boat slip in question, I proceeded to make the same contact with the steel boat lift frame - and received a similar shock.

I traced the high voltage wiring from the lift's control pedestal to a duplex receptacle mounted on a dock piling. Since this was an HOA facility, I did not have access to the utility buildings and was not able to test for GFCI protection. If I had disabled a GFCI by testing, I was not in a position to re-energize it if it tripped as intended, I did not know of it's location, or whether it existed.

On my way back to my office I called my client and told her what she would be receiving in my report. That in my professional opinion there was stray current in the water and no member of the family should swim in the dock area or even sit on the dock with their feet in the water.

I also told her that she should forward my report to the HOA and pursue the topic once here in North Carolina.

The proposal as written will put Virginians in danger of immediate electrocution or drowning as a direct result of swimming in water with current present. The drowning is usually a result of the loss of motor function when in the electric field. Sadly, but understandably, most people who experience the sensation of electric current will attempt to swim back to safety (the dock) to get out of the water.

If they had the knowledge and did not panic, they would swim AWAY from the dock, as the current dissipates in relation to distance from the source.

Electricity always seeks a path back to it's source. The idea that it "goes to ground" is an artifact from the early years of electrical installations. When electricity goes to ground, in this case via the water, it is not seeking ground, it is attempting to return to the service panelboard on the shore. It wants to "go home", back to the utility's transformer.

Breaking the grounding path by eliminating the grounded conductor from the shore to the dock will force any ground fault into the water as it attempts to find a return path.

This dangerous proposal must never see the light of day. It is absolutely a life threatening, misinformed proposal and must be defeated.

***Jim Taylor***
***704-773-8337***

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www.dhcd.virginia.gov

Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

# Fwd: An Alternative to Removal of Dock Ground

2 messages

**Potts, Richard** <richard.potts@dhcd.virginia.gov> Tue, Aug 13, 2019 at 8:14 AM
To: "King, Thomas" <thomas.king@dhcd.virginia.gov>
Cc: Jeff Brown <jeff.brown@dhcd.virginia.gov>

---------- Forwarded message ---------
From: **Andress** <randalandress1507@comcast.net>
Date: Mon, Aug 12, 2019 at 5:27 PM
Subject: Re: An Alternative to Removal of Dock Ground
To: <richard.potts@dhcd.virginia.gov>
Cc: Nicole Donaldson <nicole.donaldson@dhcd.virginia.gov>, <sbco@dhcd.virginia.gov>

Hello Richard,

I am sending this to you on DHCD-SBCO request. See below.

Kind regards,
Randal

**From:** DHCD-SBCO, rr
**Sent:** Monday, August 12, 2019 2:28 PM
**To:** Andress
**Cc:** Nicole Donaldson
**Subject:** Re: An Alternative to Removal of Dock Ground

Please send this email to Richard Potts at richard.potts@dhcd.virginia.gov

Thanks

On Mon, Aug 12, 2019 at 2:24 PM Andress <randalandress1507@comcast.net> wrote:

> Hello Nicole,
>
> I am writing in response to the change to 2701.1.1 that is being proposed by Erler, Lane, and Harrington, regarding the removal of an NEC 70 required ground conductor. While this may very well address a dangerous situation, I suspect that it is not at all the best solution. Let me explain.
>
> The hazard that this change attempts to address – that of stray voltage/currents from the standard power distribution system source (typically at the 'pole transformer') flowing out and into the premises being served – is not new. Typical concern, historically, has been the

effects on livestock, animals being raised on farms – cattle, swine, chicken, etc. Current flow into a lake where power is provided to docks and marinas is just another example.

Several years ago, as I became interested in Electrical Shock Drowning (ESD) in and around fresh water, I was introduced to this problem (and a potential solution) by Donald Zipse's paper 'Death by Grounding' (available at http://donaldwzipse.com/images/PID642277.pdf). Mr. Zipse is a consulting engineer who specializes in this phenomena (http://donaldwzipse.com/home.html).

One of the contributing causes is the routine connection made by the power company between the neutral of of the primary and neutral of the secondary of the distribution transformer (e.g., the one on the pole). This provides safety in case of a lightning strike and certain system faults or wiring errors. Unfortunately, it is this path (the interconnected neutral) through which the stray current/voltage of concern that can flow over the ground wire to the water where dockside electricity is provided. Simply removing this neutral interconnection might solve a stray voltage/current problem, but it would also cause other dangerous safety issues. This is very similar to the solution of removing the ground that being proposed. Removing this ground conductor would break the flow between the distribution transformer and the dockside electrical equipment. However, like the removal of the neutral interconnection, it would causes other dangerous safety issues.

As I mentioned this is not a new problem, only another instance of an old problem. One solution that is used in the power industry, one that might prove appropriate for docks and marinas, is the use of a neutral blocker. Mr. Zipse discusses this in his section 'VI. Solutions', under option 'B' of 'Death by Grounding'. An example of one such device can be found here (https://www.ronkelectrical.com/blocker-stray-voltage-isolator.php). Instead of being directly connected, the primary and secondary neutrals are connected to a device that manages their connection based on conditions. Under normal conditions it maintains a no-connection between the two neutrals, thus breaking the subject path top the water; but it connects them when dangerous conditions arise (e.g. a lightening strike) for which they need to be connected for safety.

There are things that should be checked both in the local power distribution system and on the dock or marina premises. If stray current from the transformer neutral interconnect is still present after other problems have been corrected, then the neutral blocker is a potential solution that has been used for years.

I am no expert. But if you cannot find an expert (such as Donald Zipse) who can explain and discuss this with you to your satisfaction, I would be happy to try to help you find one.

The presence of dangerous electric voltage/current in and around docks and marinas is a very serious problem. Its causes can be many, diverse, and complex. Stray voltage/current from the power distribution system, including that from the neutral interconnect, is among the

possible sources. However we need not solve one problem by creating another since other options are readily available.

While we all work to eliminate causes and implement solutions, we should keep in mind that, in spite of its unpopularity, separating swimming areas from electricity – docks, marinas, and boathouses – is the only 100% safe solution.

Randal P. Andress
BS EE Auburn University 1971
Member National Fire Protection Association (NFPA)
Member Electric Shock Drowning Prevention Association (ESPDA)

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**Donaldson, Nicole** <nicole.donaldson@dhcd.virginia.gov> Tue, Aug 13, 2019 at 8:47 AM
To: Richard Potts <richard.potts@dhcd.virginia.gov>, Jeffrey Brown <jeff.brown@dhcd.virginia.gov>, "Davis, Cindy" <cindy.davis@dhcd.virginia.gov>, Thomas King <thomas.king@dhcd.virginia.gov>

[Quoted text hidden]

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Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

# Fwd: equipment grounding conductor to boat docks

1 message

**Potts, Richard** <richard.potts@dhcd.virginia.gov> Tue, Aug 13, 2019 at 8:16 AM
To: "King, Thomas" <thomas.king@dhcd.virginia.gov>
Cc: Jeff Brown <jeff.brown@dhcd.virginia.gov>

---------- Forwarded message ---------
From: **Donaldson, Nicole** <nicole.donaldson@dhcd.virginia.gov>
Date: Mon, Aug 12, 2019 at 12:29 PM
Subject: Fwd: equipment grounding conductor to boat docks
To: Richard Potts <richard.potts@dhcd.virginia.gov>, Jeffrey Brown <jeff.brown@dhcd.virginia.gov>, Davis, Cindy <cindy.davis@dhcd.virginia.gov>

FYI

---------- Forwarded message ---------
From: **Veuhoff, Marc** <marc.veuhoff@dgs.virginia.gov>
Date: Mon, Aug 12, 2019 at 9:45 AM
Subject: equipment grounding conductor to boat docks
To: <Nicole.donaldson@dhcd.virginia.gov>

Dear,

My name is Marc Veuhoff and I am a maintenance electrician for Department of General Services here at the 600 East Main Street Building. I have a Virginia state licence though DPOR as a Journeyman and Master electrician. I went through a 4 year apprenticeship with the International Brotherhood of Electrical Workers, Local 666 here in Richmond. I was an electrical instructor at the Chesterfield Tech Center, teaching electrical theory for students for their classroom hours needed to take the state journeyman's test though DPOR. I continue my studies to keep my self informed on whats going on in the electrical field. An example of this was in 2018, I took a 8 hour Grounding and Bonding seminar in Long Island City N.Y. with Mike Holt. Mr Holt is probably the leading person in this country who is an authority and has the expertise in Grounding and Bonding. He assisted many countries including our government and military in Grounding and Bonding issues, including legal and liable lawsuits. With all this said, I strongly disagree to eliminate the requirement for the circuit equipment grounding conductor to boat docks. there has been many deaths from drowning do to electrocution to faulty or no Equipment Grounding Conductors. Virginia should be taking the lead in electrical safety, not a step back.

Sincerely,
Marc Veuhoff

--
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POWER QUALITY & RELIABILITY

# The Case of Stray Voltage in a Lake

Faulty concentric neutrals on high-voltage underground cables lead to one teenage swimmer’s drowning and two others’ brain injuries.

Donald R. Johnson, P.E., Johnson Engineering | Nov 01, 2009

When six teenagers gathered at a friend's lake house to hang out for a casual evening, the group quickly decided to enjoy the cool night in an outdoor hot tub. When they'd had enough heat in the Jacuzzi, several of them decided it would be refreshing to run down to the homeowner's small dock and take a dip in the lake. Unaware of any underlying danger, the teens had no reason to believe their spontaneity would soon trigger an unthinkable tragedy.

## The accident

After swimming near the dock for several minutes, the teenagers began to notice a strange sensation — what would later be identified as electric current flowing through their bodies. One boy, who experienced the phenomena, recalls being unable to swim, sinking in the water as he lost muscle control.

Seeing the swimmers' plight, the remaining teenagers standing on the dock called to the adults in the house for help. Several of them came running out, called 911, and dove into the water, trying to retrieve the kids who were underwater. (*Note*: It was determined later during testing that the currents in the water were intermittent, thus not causing any harm to the adults.) After multiple dives, the adults retrieved the two boys and one girl who had been submerged for some time.

CPR was immediately administered, until the paramedics arrived. At the hospital, one boy was pronounced dead (cause of death was drowning), and the other two received brain damage due to lack of oxygen caused by the near-drowning experience.

## The investigation

After the accident, the first thought by many at the scene was that the dock wiring was somehow faulty, which, in turn, had caused the electric current to flow through the water. Tasked with determining the cause of the electric current in the lake water, I was retained as a professional electrical engineer by the attorneys representing the plaintiffs (parties who filed suit against the electric utility and others).

After numerous investigations by myself and other experts, we concluded that the dock wiring was not the cause of the electric currents in the lake water (**Photo 1**). However, I later discovered that the electric utility had major corrosion problems with the bare concentric neutrals of its high-voltage underground cables, which were buried under and around the lake where the accident occurred. To get a better idea of what a cable with a good and bad concentric neutral looks like, see **Photo 2**. Although these shots come from another case — one in which the corroded neutrals caused a dairy farmer to lose many cows to disease/death as well as suffer significant loss of milk production in the remaining cows — they clearly demonstrate the difference between normal and deteriorated products.

Up to nine years prior to the accident, the electric utility realized through concentric neutral testing procedures that the bare concentric neutrals were in a serious state of deterioration throughout the lake area and housing subdivision around the lake. Despite this discovery, the electric utility did not take immediate steps to fix the problem. Instead, it began a multi-year program of replacing the bare concentric neutral cables with new jacketed concentric neutral cables in the area. However, due to difficulty in installing new cable in two particular sections of underground cable under and around the lake, these sections were not replaced.

It turned out that these two particular sections of cable were the primary paths for the neutral current return for the entire lake area subdivision back to the electric utility substation source. This meant that the electrical load within the subdivision was essentially on an “island” in terms of an adequate return current path. Because of this island effect, the currents took the least-resistant path into the lake water heading to the dock — a structure that was more than adequately grounded to the electric utility system overhead neutral, which was then tied directly to the utility substation source.

To verify the above scenario, we completed numerous on-site tests. During one visit, we installed a recording multimeter at the dock where the accident occurred, leaving it to

record for eight to 10 consecutive days. (The wiring to the dock was totally disconnected and removed during this time.) The voltages were recorded by placing a ground rod off the end of the dock into the lake water where one meter probe was attached. The other probe was attached to the house ground, which was, in turn, attached to the electric utility ground. A 500-ohm shunt resistor was included in the voltage measuring circuit. The currents were measured using the same technique without the 500-ohm resistor in the testing circuit.

The results of the testing indicated that both the voltage and current levels followed the electric loads of the utility in that the measured peaks were at the highest levels during the morning and evening hours. (*Note:* The accident occurred during the evening hours when electric loads were at their highest.) In addition, the frequency of all voltage and current measurements were measured at 60 Hz, a direct indication that the electric utility was the source of these measured voltages and currents. The highest currents measured during this test period reached 0.5A, and the highest voltage reached 6.2V.

During another site visit — with the electric utility present to allow access to their underground cable junction enclosures — numerous readings were conducted to measure the current on both the underground electric utility energized phase conductors and the concentric neutrals. Voltage measurements were also taken from the ground system in the enclosures to a remote ground. In one particular section (right near the lake), the neutral current on the concentric neutral was less than one-tenth of an ampere, whereas the energized phase current was in excess of 6A. Obviously, the remainder of the return current was flowing through the earth and, in this case, the lake water. In addition, the voltage measured from these same junction enclosures was in excess of 7V to a remote ground test point. These measurements were a clear indication that the concentric neutrals on these underground sections were likely absent due to corrosion.

## The findings

Using an assumed human body resistance of 300 ohms when immersed in fresh water — and assuming a current range through the human body where muscle control is lost in the range of 6mA to 30mA — and applying Ohm's law, the voltage necessary to cause a drowning in fresh water is in the range of 1.8V to 9V, 60 Hz AC. The above testing results show that the necessary voltage and current levels were at a level well within the range to cause the drowning and near-drowning of the victims.

After going to trial, a jury awarded the plaintiffs a total judgment of $2,325,000. No appeal was filed by the electric utility defendant.

Demonstrating the dramatic effects of stray voltage (**Unwanted Voltage Uncovered** on page 10) in a wet environment, this case serves as a reminder to all electric utilities about the importance of being vigilant in maintaining their distribution systems — in order to keep stray voltages at extremely low levels, levels that do not pose a danger to humans or animals. As electric loads continue to increase across the nation, many experts are even encouraging electric utilities to modify their distribution systems so that the earth is not used as a current-carrying medium.

*Johnson, P.E., is president of Johnson Engineering, Afton, Wyo. He can be reached at*donjohn@silverstar.com.

## Sidebar: Unwanted Voltage Uncovered

Stray voltage is a popular term resulting from electrical currents flowing through the earth or other conductive surfaces not normally expected to carry electric currents. Small amounts of electric currents traveling through the earth are prevalent throughout the nation, primarily due to electric utilities using the earth as a grounding medium for grounded wye distribution systems.

Even though these grounded wye systems feature a neutral conductor return current path — because the neutral conductor is grounded to the earth at multiple locations (as required by the National Electrical Safety Code) — the result is the earth acts as a parallel path for these currents. Typically, depending upon the conductivity of the earth and the amount of return neutral current on the electric distribution system, the amount of current flowing through the earth is small. However, as electric loads across the country continue to increase, these earth currents are increasing as well.

These earth currents became noticeable many years ago on dairy farms when farmers noticed a significantly higher mortality rate among dairy cows along with a major loss of milk production. The culprit was directly tied to the amount of earth currents flowing through the dairy facilities. Electric utilities across the nation have found out the hard way (through multi-million dollar lawsuits) that they must reduce these earth currents to non-damaging levels.

July, 2018

# ELECTRIC SHOCK DROWNING

James W. Erler
M.S. Electrical Engineering, University of Southern California, Los Angeles CA
B.S. Physics and Chemistry, University of Redlands, Redlands CA

# About Mr. Erler

- Electrical engineer and physicist
  - Professional experience analyzing grounding issues in advanced military systems for nuclear survivability.
- Electricity detected at Mr. Erler's dock by a Fire/Rescue volunteer
  - Licensed electrician was unable to eliminate the stray electricity entering the lake
- Mr. Erler made a number of measurements around the system and determined the source.
  - Initiated extensive research, further measurements and consulting with industry experts
  - Developed recommendations and solutions

# Aquatic Electrical Safety Concerns: Executive Summary

- Electricity found in water at 96% of SML docks tested, revealed greater national risks.
- National Electric Code (NEC) requires No Swimming warning signs in lieu of proactively finding solutions (not required in Virginia)
- NEC ignores that docks are commonly used for swimming

# Safety Standards Development: Measurements

- Source traced to ground wire between house and dock
- Detailed measurements reveal intermittent high, lethal levels
- Autopsies cannot reveal ESD; ESD may be reason for unexplained drownings

# Safety Standards Development: Causes

- Sources on both sides of meter base
  - Load imbalance in home
  - Load imbalance in neighboring homes/businesses
  - Degradation of neutral return wire between home and power company transformer
- Voltages on Neutral/Ground wire is inherent characteristic of how power is delivered.
  - *Power Companies can's fix it: NEC won't fix it*

# Safety Standards Development: Industry Awareness

- Our recent measurements appear to be the first of their kind, however …
  - Every industry or regulatory official we spoke to stated that they would never allow their family to swim from a powered dock.
- Industry advocates for change not heard …
  - Finger-pointing on either side of the meter base
  - Not considering grounding effects on dock waters
  - Institutional "knowledge" that limits option

# How Regulation Works

- NEC treats docks as secondary buildings such as garages.
- NEC depends on outside R&D to propose changes and is NOT proactive
- NEC committees are mostly manufacturers who propose changes aligned with new products.
- NEC NOT like FDA where safety must first be proven

# Standards are Needed: Beyond Docks

- Aquatic environments nationwide are impacted by this shortfall
  - Docks
  - Marinas
  - Boats
  - Swimming pools
  - Ponds
  - Fountains
  - Irrigation systems

# Standards are Needed: Independent of NEC/Power Industry

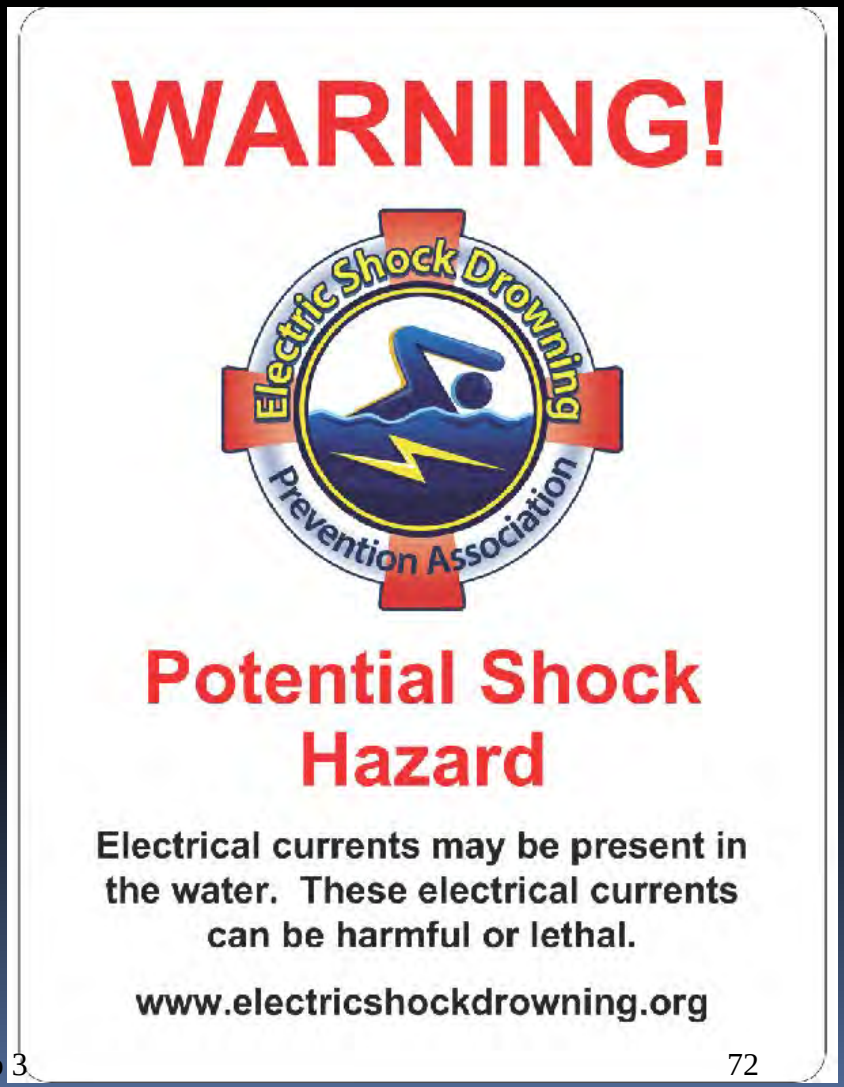
- Limited economic opportunity in safety
  - Higher costs for end user
  - ESD not tracked, may not be traceable
- Standards needed for states to adopt
- Public awareness driving demand for safe solutions

# Standards are Needed: Standards Development

- Developed from first principles
  - R&D backed by testing
- Practical Input
  - Manufacturers
  - Power industry
  - Electricians
  - Local and State Inspectors
  - Local and State Governments
  - Private citizens

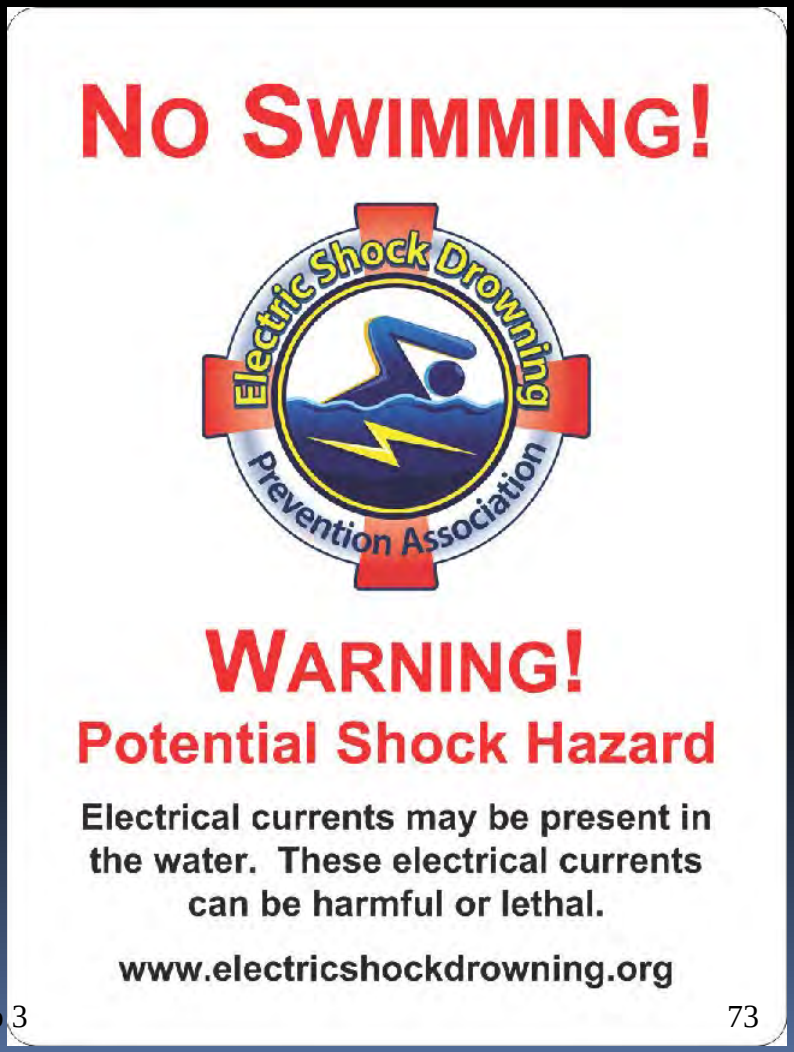
# NEC Required Warning

- 2017 National Electric Code (NEC) requires that this is posted at all docks with electric power
- Not required in Va
  - May be in 2021



# ESD Prevention Association

- Founded by families who lost loved ones to ESD
- Industry Experts Agree
  - Underwriter Labs
  - EPRI – Electric Power Research Institue



## LOST TO ESD…












## DON'T SWIM AROUND ELECTRICITY!

For More Information
www.electricshockdrowning.org

Kevin Ritz
503-709-5649
kevintritz@gmail.com

David Rifkin
904-382-7868
ESDPA@comcast.net

# ELECTRIC SHOCK DROWNING A SILENT KILLER

## What You MUST Know to Protect Your Family

www.ElectricShockDrowning.org

# “But My Dock is Up to Code …”

- Why is there electricity in the water at my dock?

A complete solution for safely electrifying a dock has not been developed by the NEC

# Why Can't the NEC Solve This?

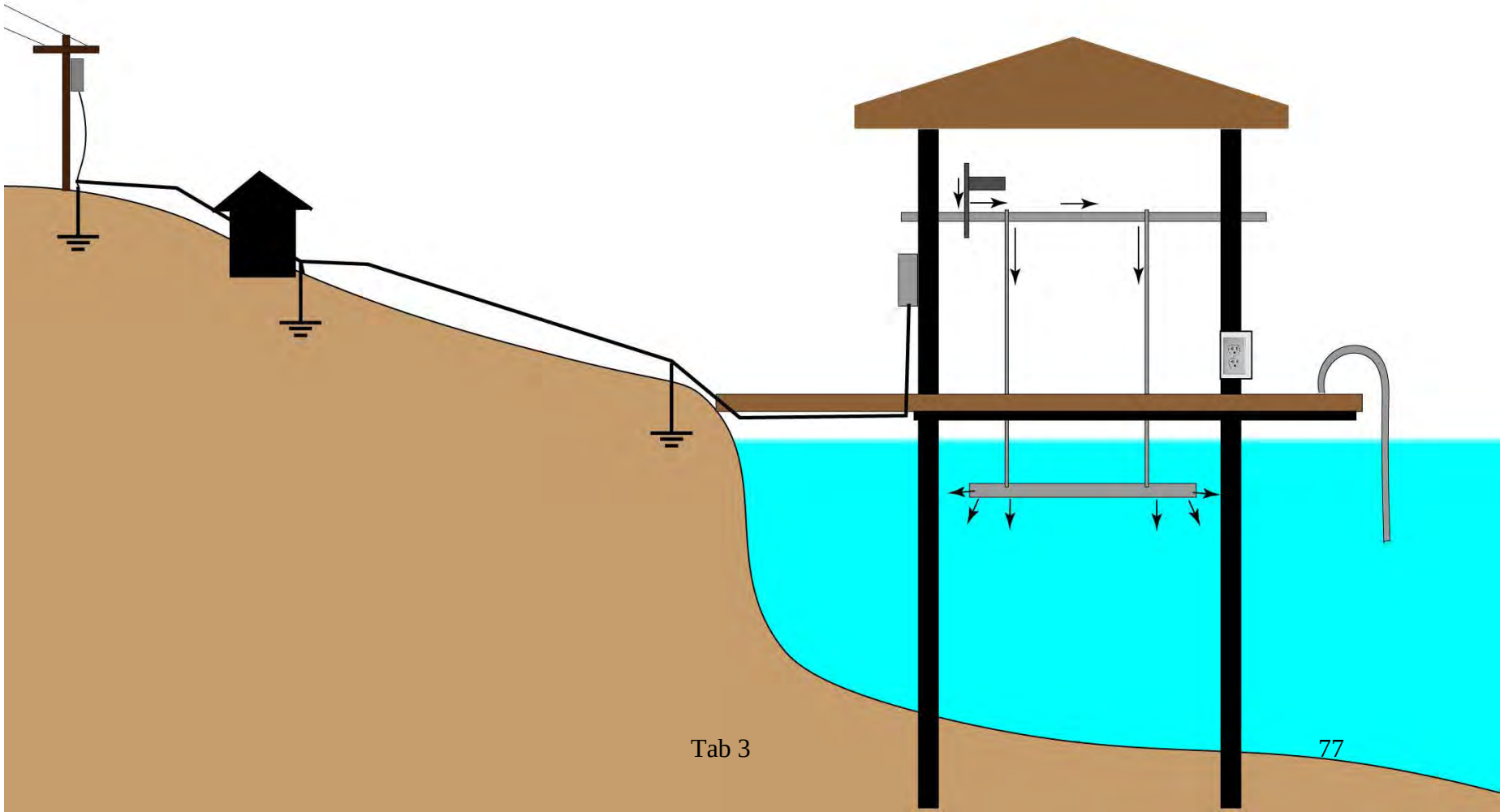
- NEC:
  - Fail to consider grounding effects on dock waters
  - Institutional "knowledge" limits options
  - Code doesn't distinguish how power is fed to docks vs. secondary buildings*
  - Politics

- Public Education
  - Electricity is Dangerous
  - Victims of ignorance

*NEC Section 250.32(B) and Article 555.1

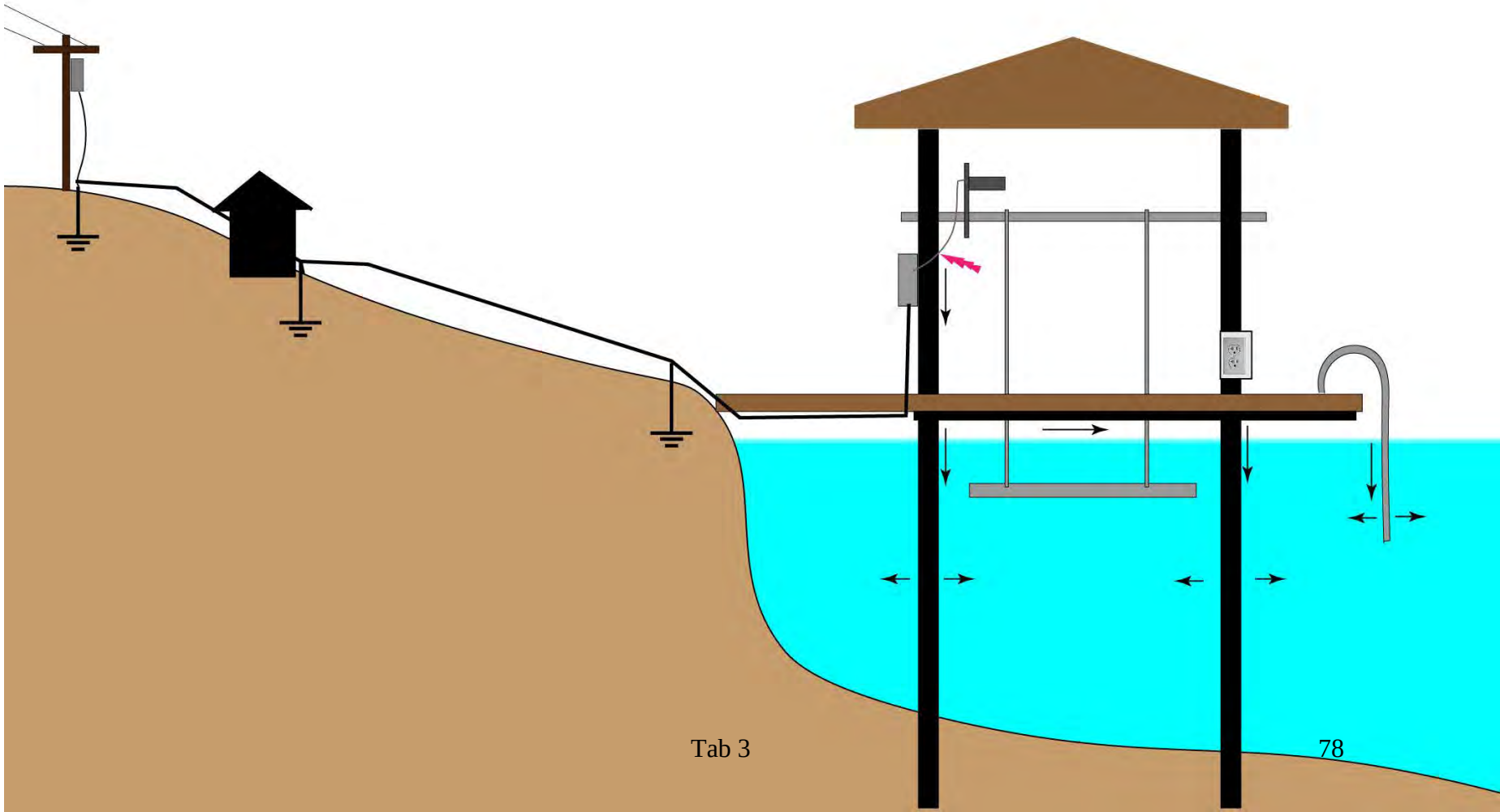
# How Electricity Enters the Water

## Shorted Power Equipment: Lift Motor Short



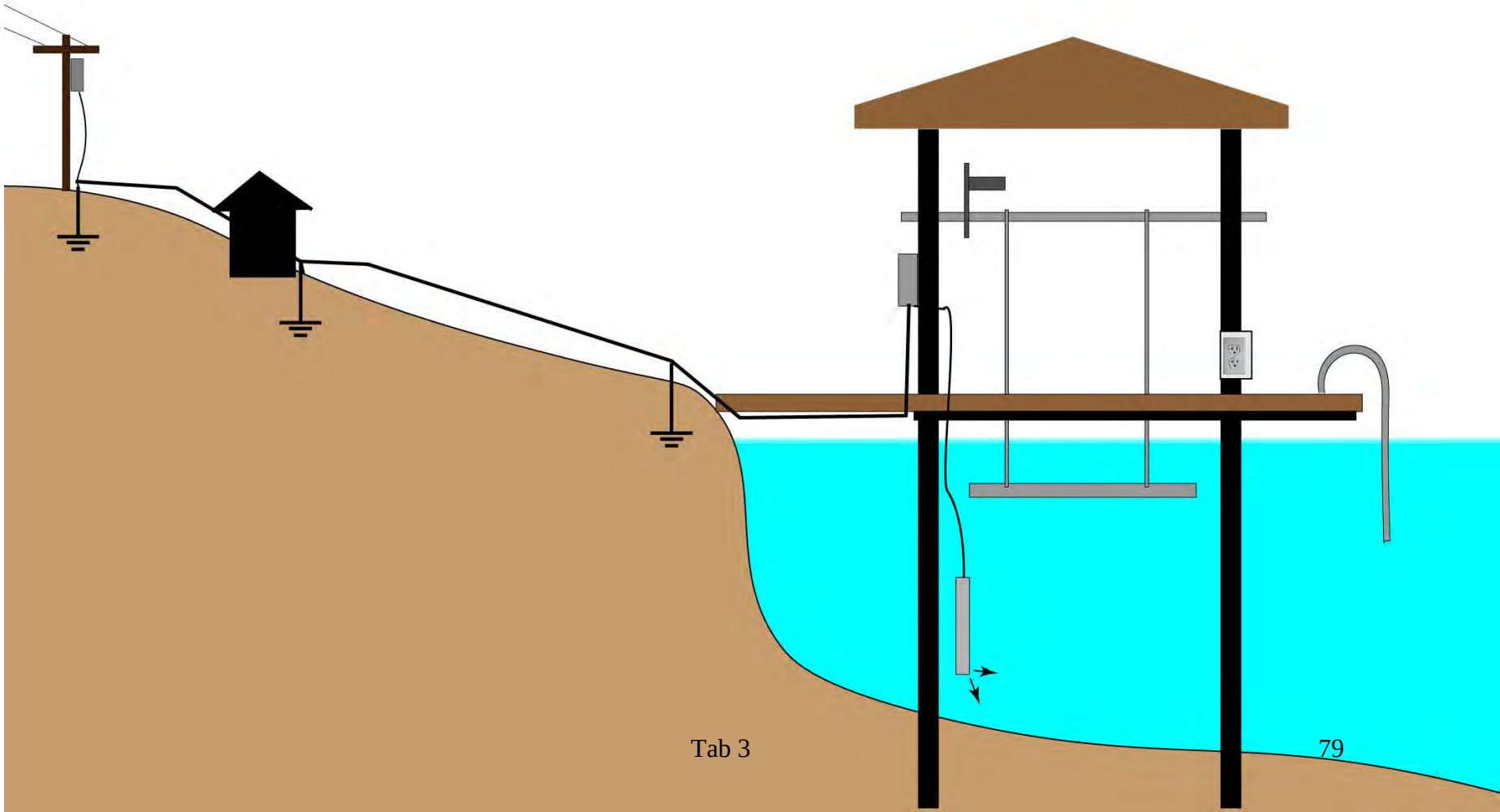
# How Electricity Enters the Water

Frayed wire insulation: Wire feeding the boat lift



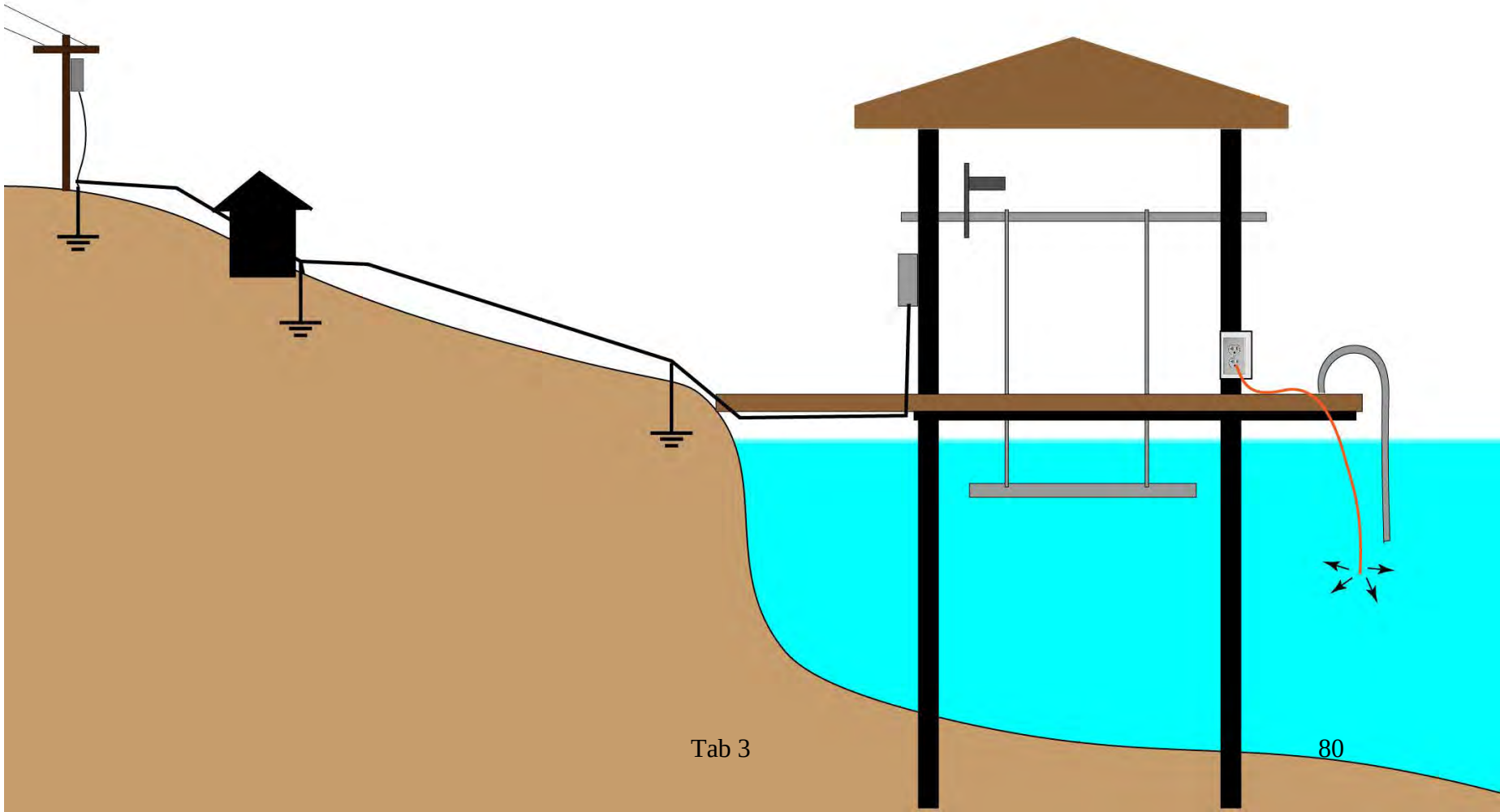
# How Electricity Enters the Water

Underwater irrigation pump



# How Electricity Enters the Water

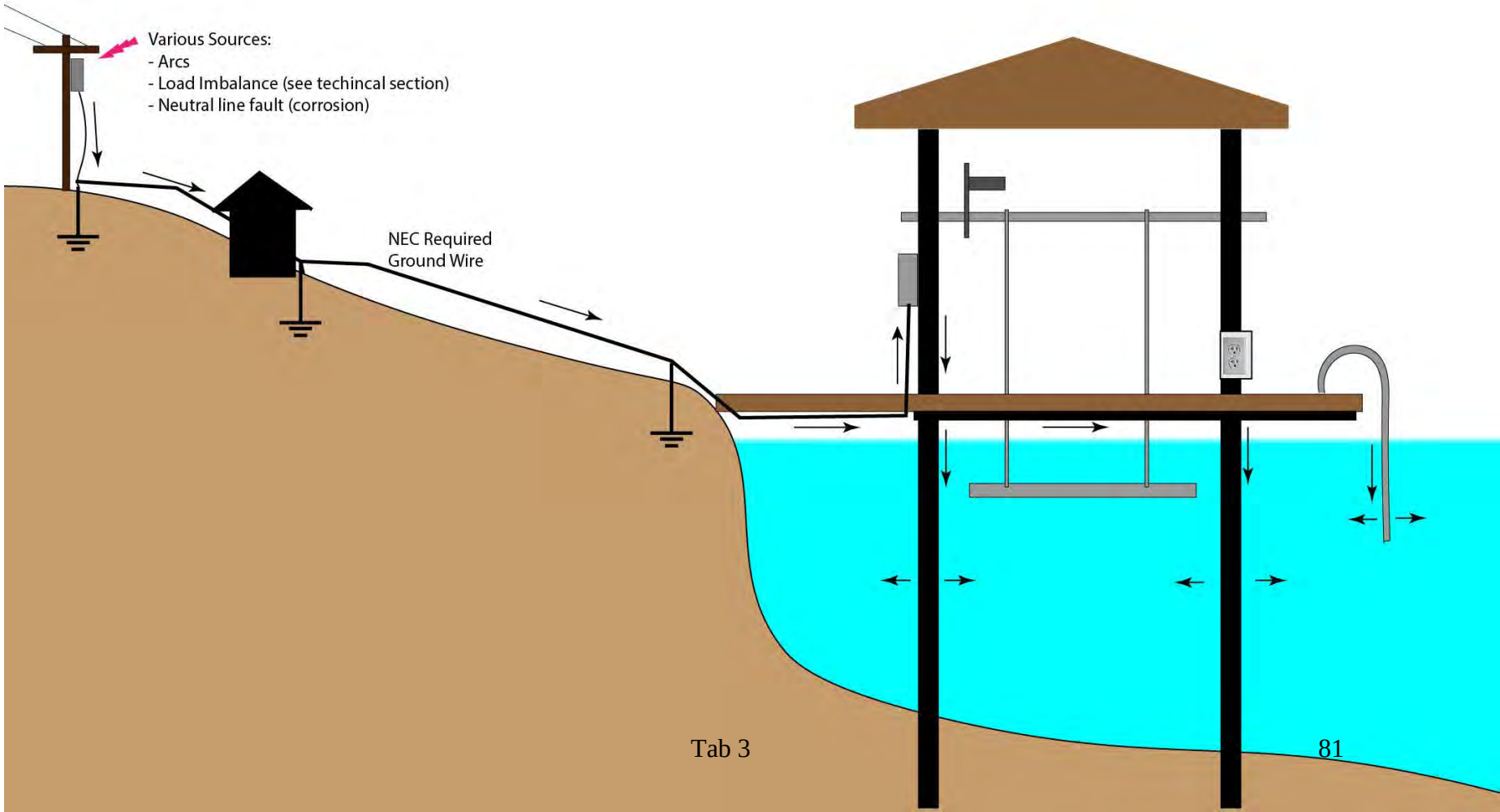
Extension cord dropped in water



# How Electricity Enters the Water

NEC required ground wire is the most likely cause of electricity at your dock

NEC required ground wire injects electricity into the water
EVEN WHEN THE POWER IS OFF!



# NEC Required Ground Wire

- Injects electricity into the water at ALL TIMES, even when the breaker at the house that feeds the dock is off!
- Normally only a few volts are detected.
- *Intermittent voltages are common and can exceed lethal levels*

# Is my dock safe?

- Early Docks (prior to ~mid 1970s)
  - "Wild West" installations
  - Ground Fault protection not available

- ~1990s – some improvement
  - Poor or nonexistent equipment grounding
  - Unreliable Ground Fault protection

# Is my dock safe?

- ~2000's
  - Thoroughly bonded grounding required*
  - Unreliable Ground Fault protection
  - NEC Required Dangerous Grounding
- After ~2016
  - Thoroughly bonded grounding required*
  - Improved Ground Fault protection
  - NEC Required Dangerous Grounding

*See Technical Section

# Summary: Code and Electrical Safety

- Electricity in the water
  - May be up to code
  - May have other problems
- No electricity in the water
  - Probably NOT up to code
  - Probably have other problems

Unsafe in either case!

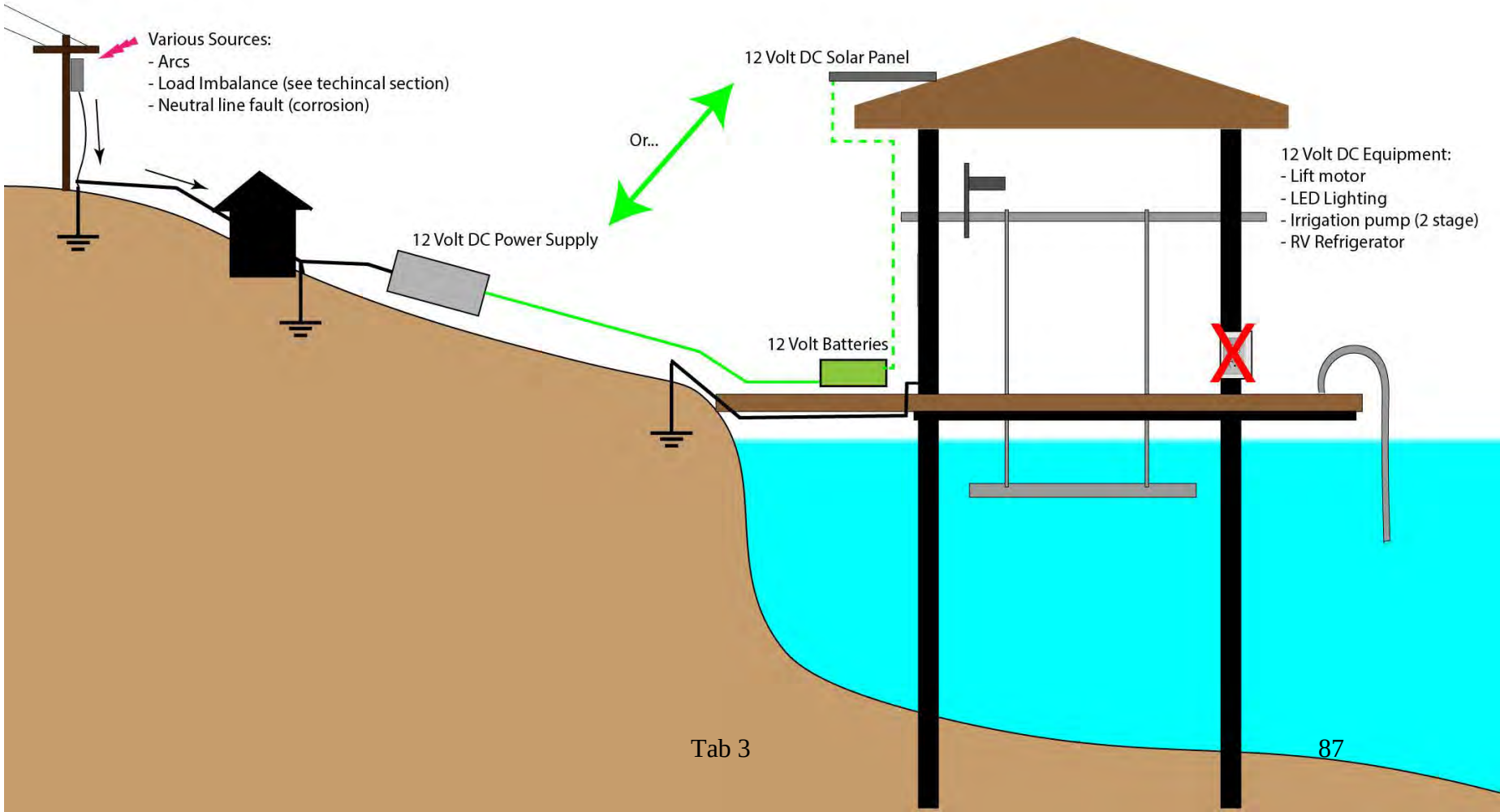
# Essential Life Protection

- Grounding
  - Reduces electric current delivered into the water
  - All power Equipment must be grounded
  - All metal elements must be bonded/grounded
- Ground Fault Circuit Interrupt (GFCI) Panel Circuit Breaker
  - Cutoff switches often fail
  - Regular testing is important
  - ALWAYS TEST BEFORE SWIMMING
- Avoid innocent errors
  - Extension cords kill
  - Use battery only powered tools

# Safest Solution: Convert to 12 V DC

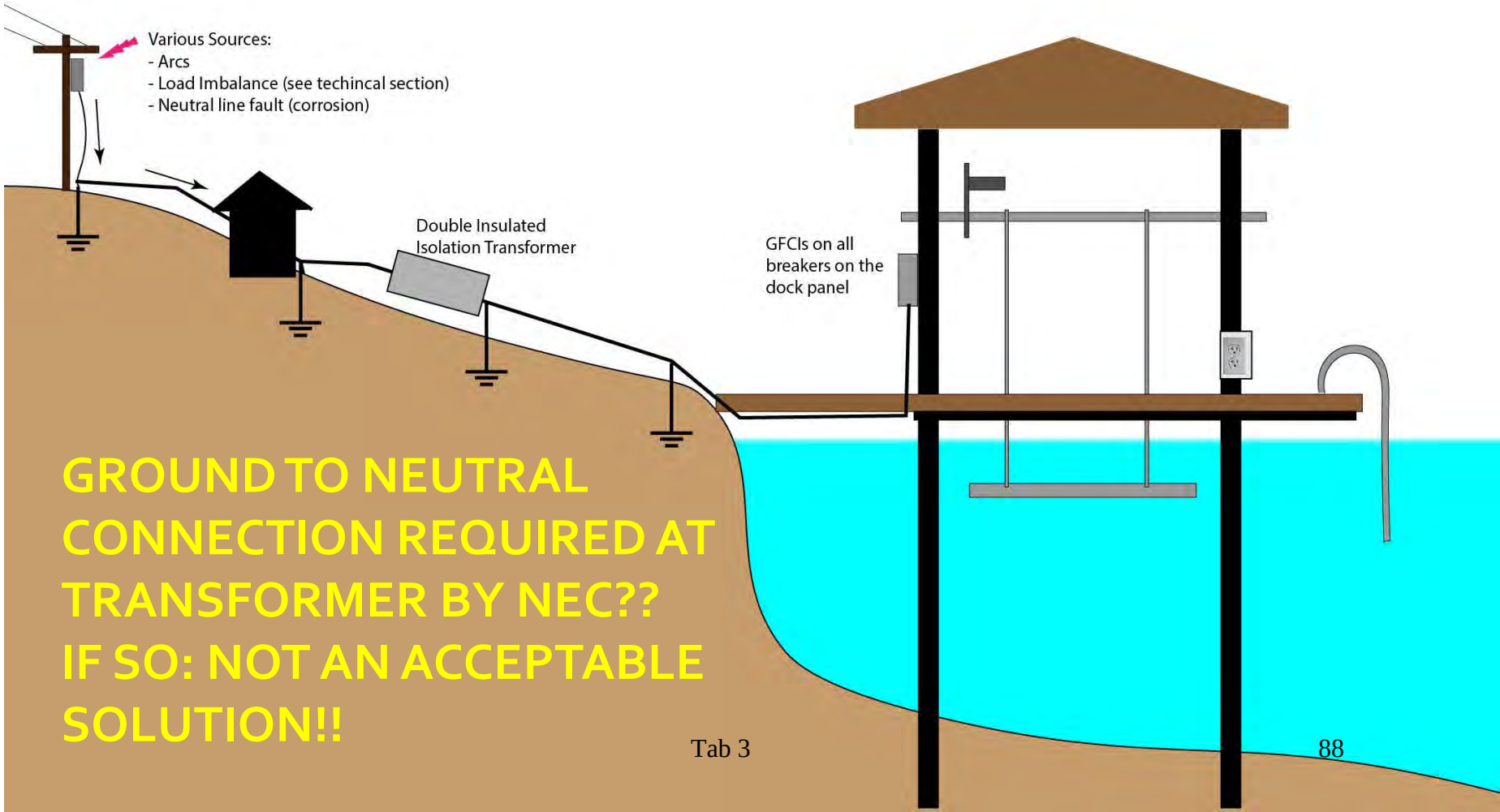
DC Power is recommended by industry experts

By eliminating external AC power, risk of ESD is drastically reduced
Danger of NEC required ground wire is eliminated. Cost: ~$3,000+



# AC Power Solution:
# Double Insulated Isolation Transformer

Bring all grounding and GFCI's up to 2019 code. *Risks of faults/GFCI failure remain.*
Danger of NEC required ground wire is eliminated. Cost: ~$2,000+




**GROUND TO NEUTRAL CONNECTION REQUIRED AT TRANSFORMER BY NEC??**
**IF SO: NOT AN ACCEPTABLE SOLUTION!!**

# AC Power Solution:
# Double Insulated Isolation Transformer

Bring all grounding and GFCI's up to 2019 code. *Risks of faults/GFCI failure remain.*
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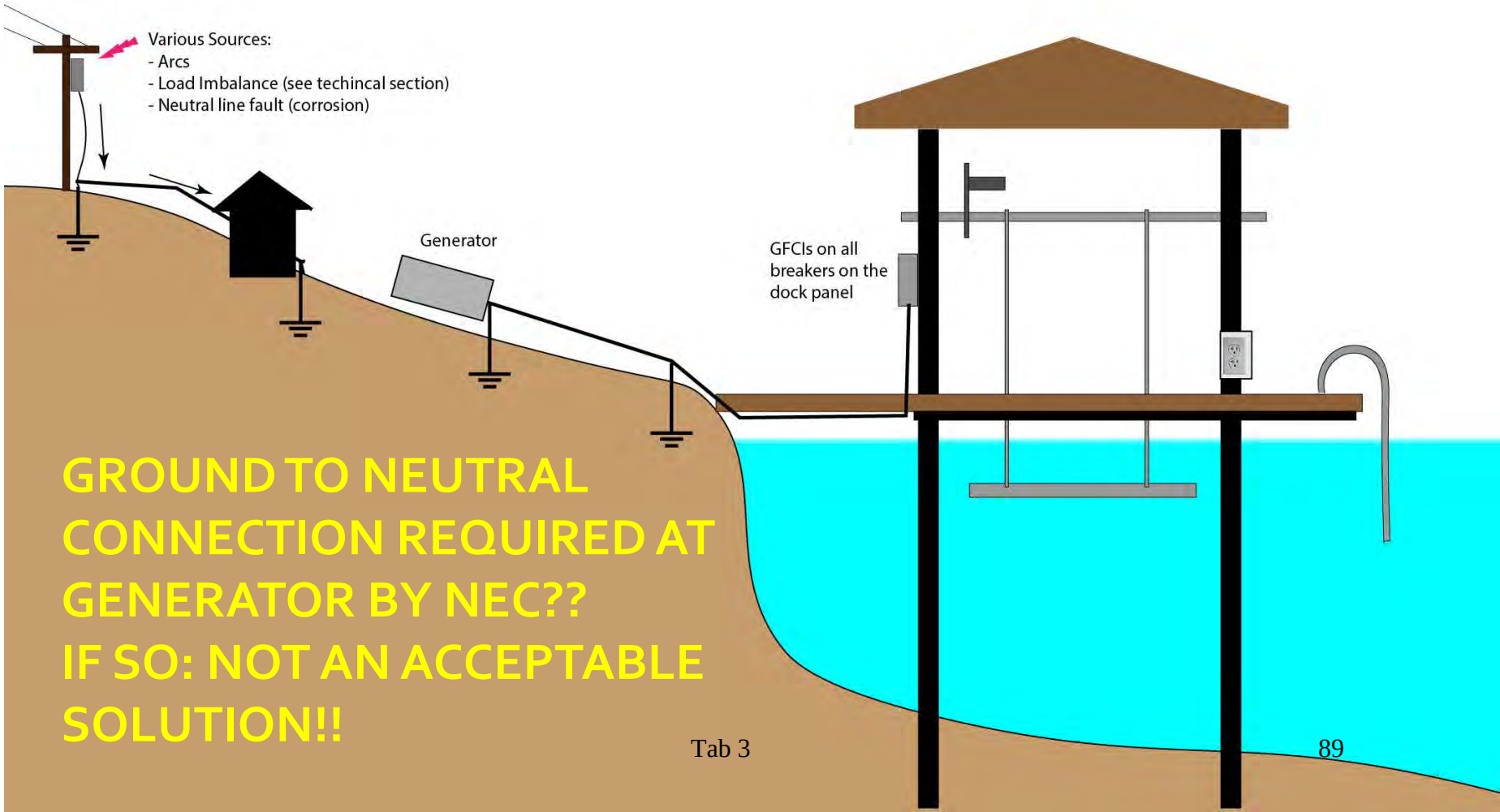
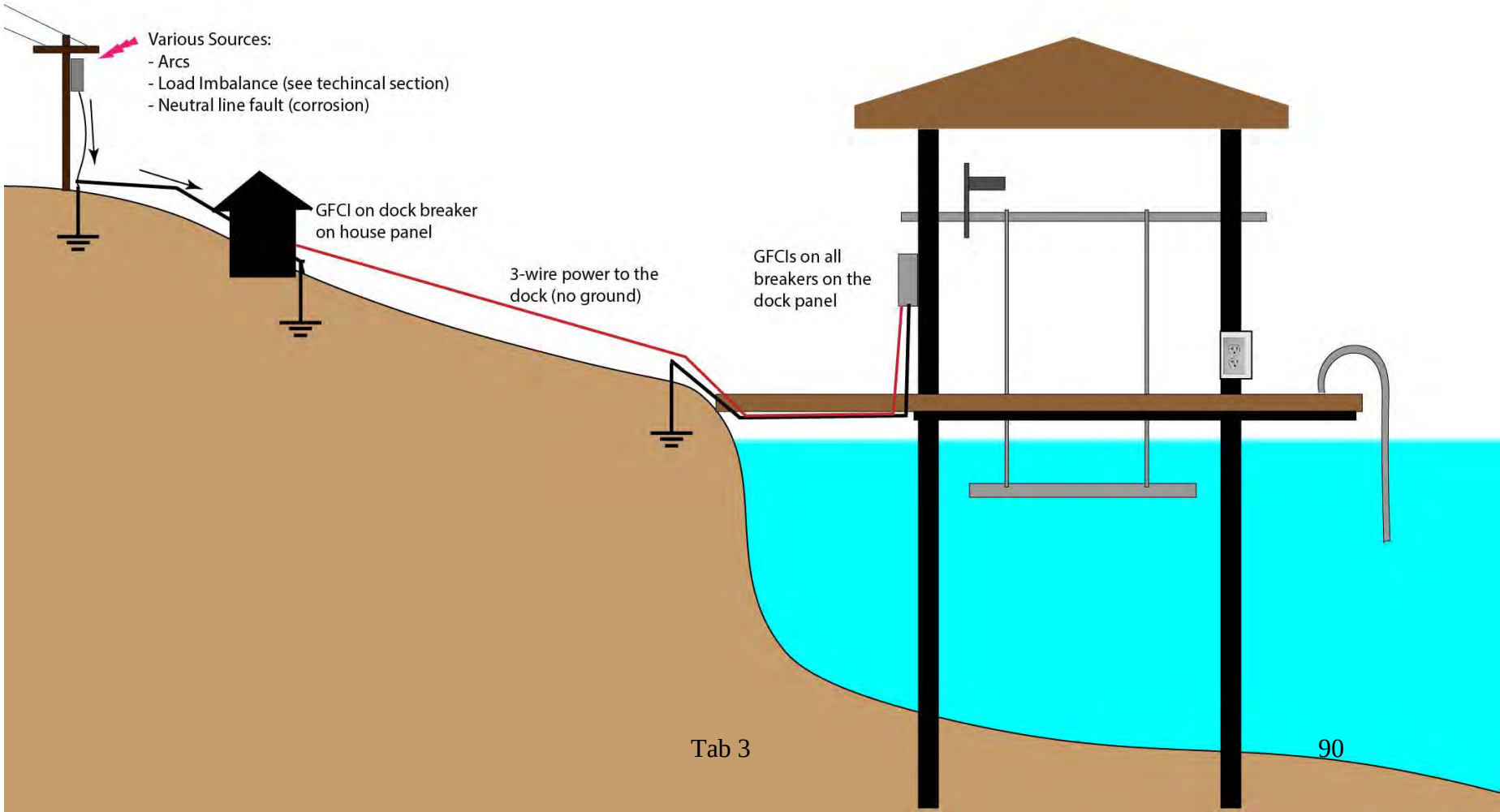



**GROUND TO NEUTRAL CONNECTION REQUIRED AT GENERATOR BY NEC??**
**IF SO: NOT AN ACCEPTABLE SOLUTION!!**

# AC Power Solution:
# Remove NEC Required Ground Wire*

Bring all grounding and GFCI's up to 2019 code. *Risks of faults/GFCI failure remain.*

*Variance from local/state inspector required  Cost: ~$100 to $500



# If you must have AC Power…

- Choose Transformer* or Variance Options
- Adopt the 2019 NEC code
  - Ground Fault Protection at Dock Panel
  - Ground Fault Protection on Dock Circuit on House Panel.
- Regularly test Ground Fault circuits
- Risks are not completely eliminated

*Only if NEC allows ground/neutral to be disconnected

# Don’t remove the ground wire without approval!

- Violating code creates a personal liability
  - You will be responsible if someone is injured or killed at your dock

- Request a variance!

# Data: Death and Injury by ESD

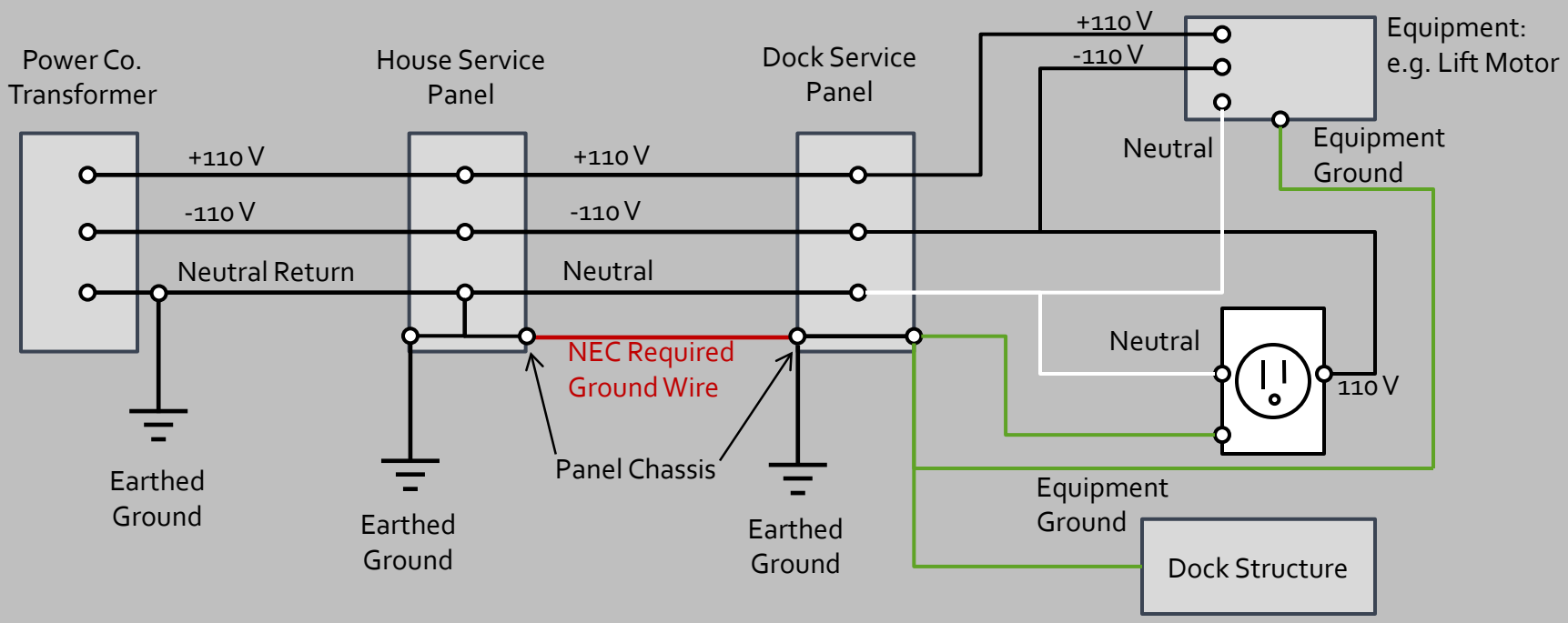
- NEC Ground Wire
  - 1 Ground wire death reported: caused by corrosion/load imbalance
  - Data on unexplained death by drowning is not recorded
  - Autopsy cannot reveal if death was by ESD
  - Intermittent voltages on ground wire go undetected
- Dock Faults*
  - 49 Deaths
  - 31 Injuries
- Boat Faults
  - 24 Deaths
  - 4 Injuries
- Fault (usually not reported)
  - Extension cord (1)
  - Submersible pump (5)

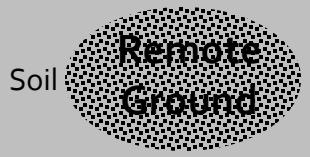
*Shafer & Rifkin, 5/6/2016 List of ESD from limited sources. Considered incomplete.

# Summary Conclusions

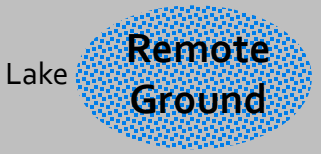
- *Inaction may cost lives: Our docks are not safe*
- NEC required ground wire must be eliminated
  - *Variance from local inspector required!*
  - *GFCIs at BOTH dock and house are critical*
  - *Regular Testing of GFCIs is critical*
- Past & Present code is inadequate
- Bring grounding and GFCIs up to code
- Lowest cost solution: Obtain a variance to remove the house-to-dock ground wire
- *Safest solution: convert to 12 V DC*

# Definition of Terms




- Remote Ground is "World" Voltage = zero
- Resistance between Earthed Ground and Remote Ground is ~50 to 200 ohms
- Equipment Ground Voltage is Elevated above Remote Ground by: Voltage = Current (I) x Resistance (R)

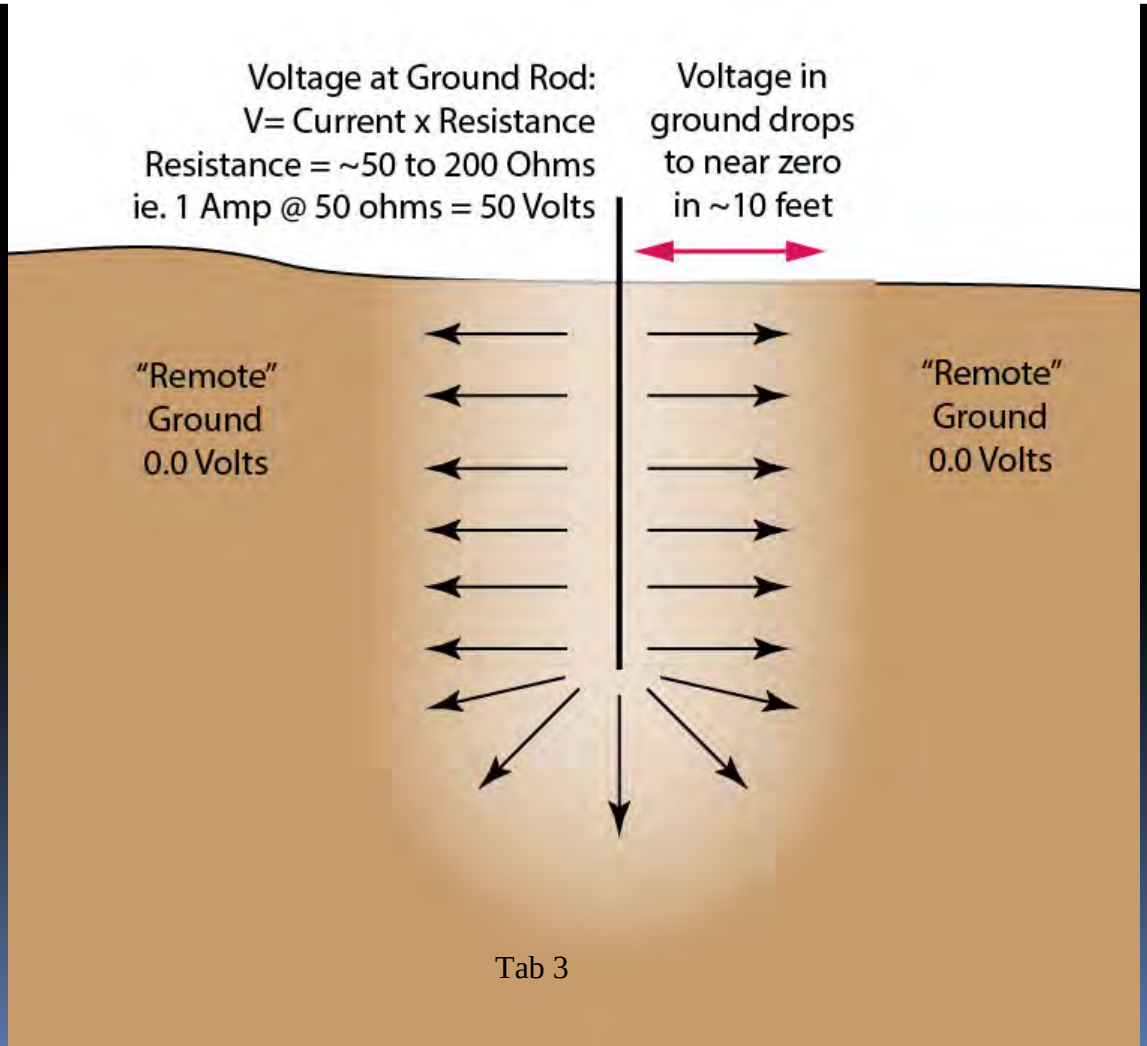


# Technical Discussion

- "Remote Ground" vs. Grounding Rods ("Earthed Ground")
- "Earthed Ground" vs. Lake Water
- Neutral Return Ground vs. Remote Ground
- Load Imbalance/Neutral Line Failure
- Intermittent Events on the Ground Wire
- How Injury Occurs
- Removal of the Ground Wire/Reliability of GFCIs

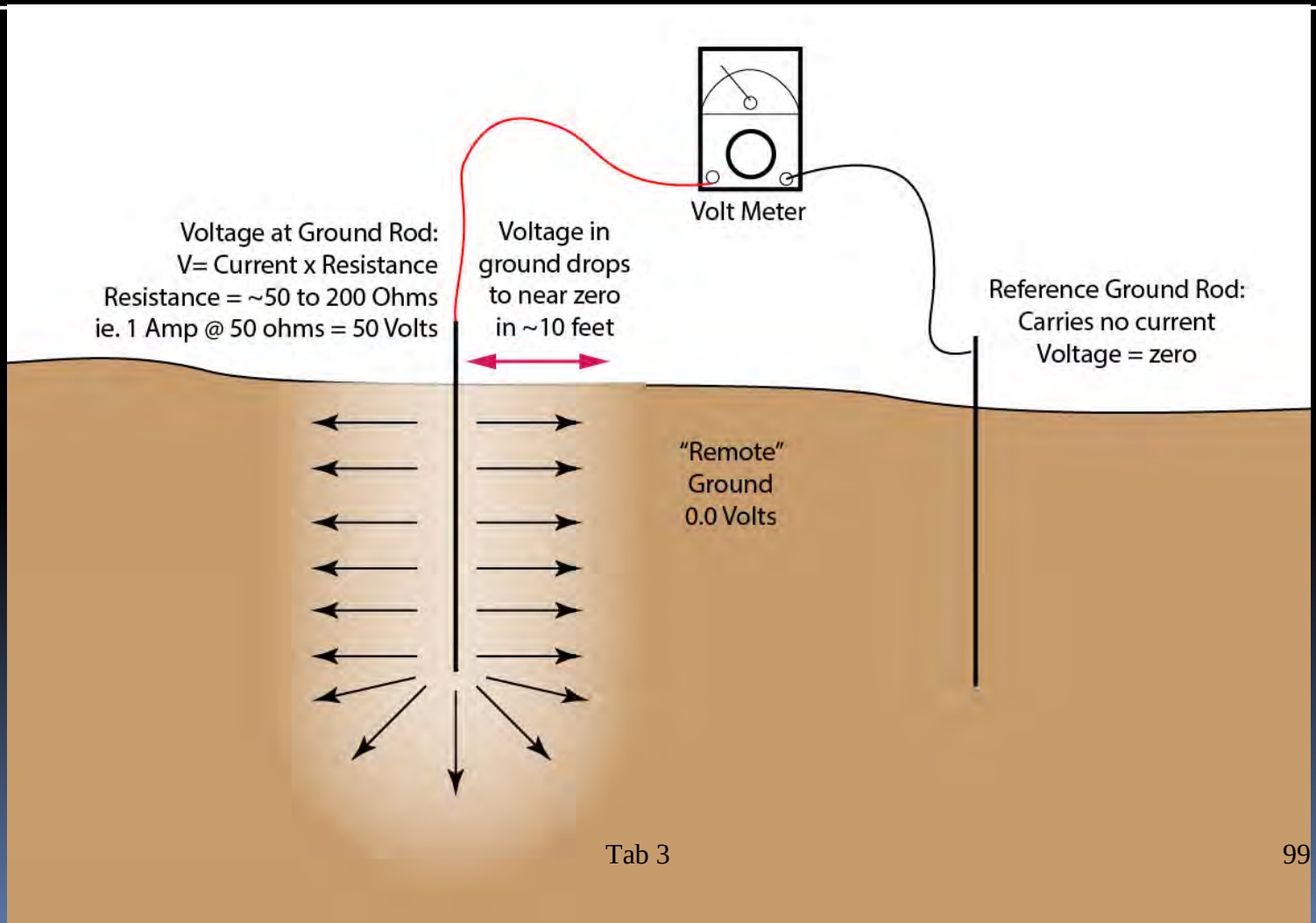
# Ground Rods are *NOT* a good connection to "Remote Ground"

Any voltage on a ground rod will *RAISE* the voltage of the surrounding soil, creating "islands" of elevated soil voltage.



# A Second Ground Rod may be used as a reference to "Remote Ground"

A ground rod that carries no current will be at "zero" volts, which is the voltage of "Remote Ground."

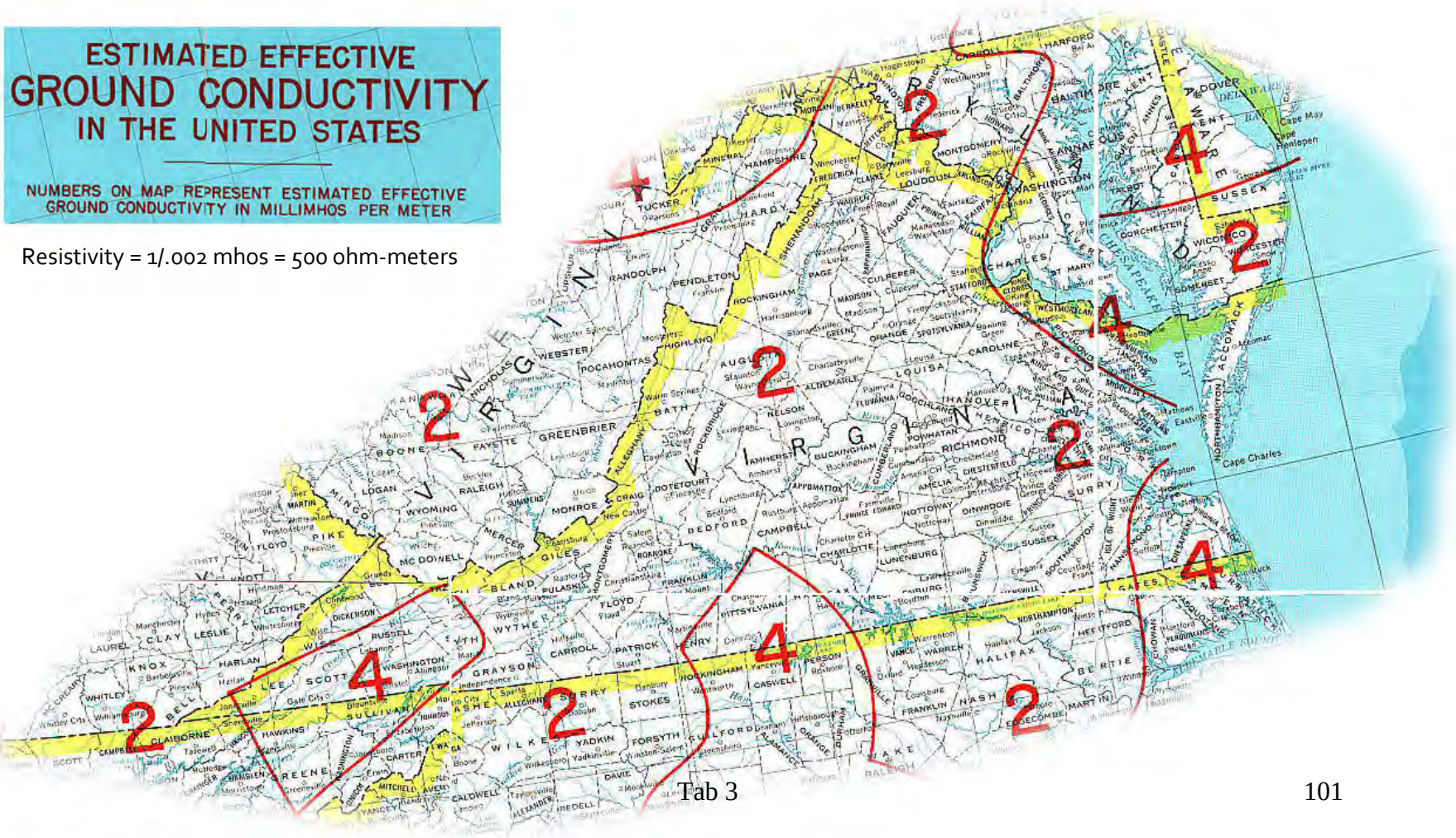


# NEC Ground Rod Resistance Requirement

The NEC has stated to "Make sure that system impedance to ground is less than 25 ohms specified in NEC 250.56. In facilities with sensitive equipment it should be 5.0 ohms or less."

# Realistic Ground Rod Resistances

## Soil Resitivity




Resistivity = 1/.002 mhos = 500 ohm-meters

# Realistic Ground Rod Resistances

At a soil resistivity of ~500 ohm-meters,
An 8 foot ground rod will be ~200 ohms

| Type of soil | Soil resistivity $R_E$ | Earthing resistance | | | | | |
|---|---|---|---|---|---|---|---|
| | | Ground electrode depth (meters) | | | Earthing strip (meters) | | |
| | ΩM | 3 | 6 | 10 | 5 | 10 | 20 |
| Very moist soil, swamplike | 30 | 10 | 5 | 3 | 12 | 6 | 3 |
| Farming soil, loamy and clay soils | 100 | 33 | 17 | 10 | 40 | 20 | 10 |
| Sandy clay soil | 150 | 50 | 25 | 15 | | | |
| Moist sandy soil | 300 | 66 | 33 | 20 | | | |
| Concrete 1:5 | 400 | - | - | - | | | |
| Moist gravel | 500 | 160 | 80 | 48 | | | |
| Dry sandy soil | 1000 | 330 | 165 | 100 | | | |
| Dry gravel | 1000 | 330 | 165 | 100 | | | |
| Stoney soil | 30,000 | 1000 | 500 | 300 | 1200 | 600 | 300 |
| Rock | $10^7$ | - | - | - | - | - | - |

25 Ohms is an unrealistic expectation

5 Ohms is near to impossible!

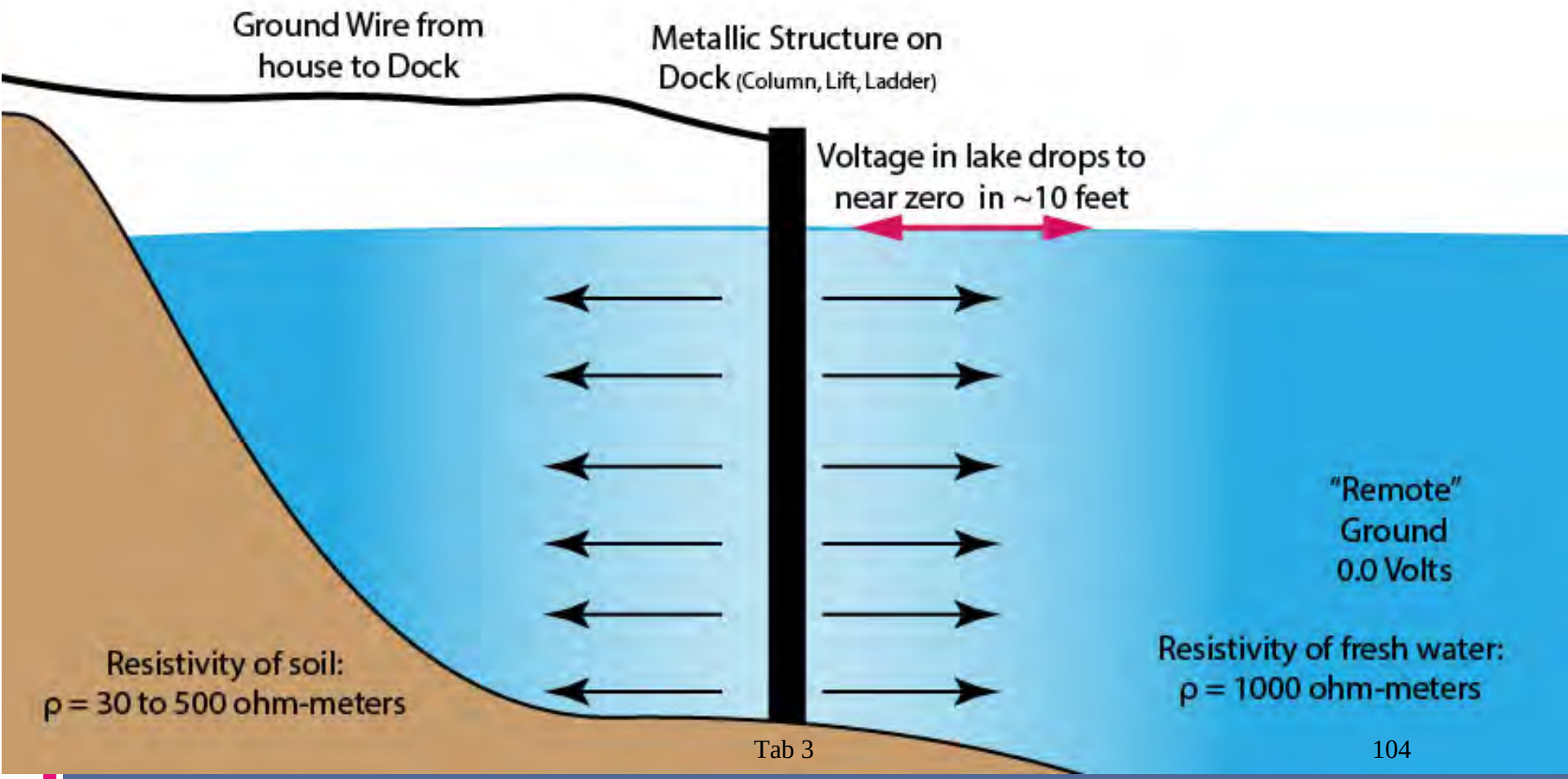
# Summary: "Earthed Ground" vs. "Remote Ground"

- "Remote Ground" = voltage potential of the world
- Earthed grounds are *resistive* connections (~70 – over 100 ohms) i.e. the voltage will rise when any current flows through them.
- Grounding rods *raise* the voltage of the earth around them when any current flows.
- Voltages on ground wires differ from remote ground.

# Metallic Structures in water are similar to ground rods

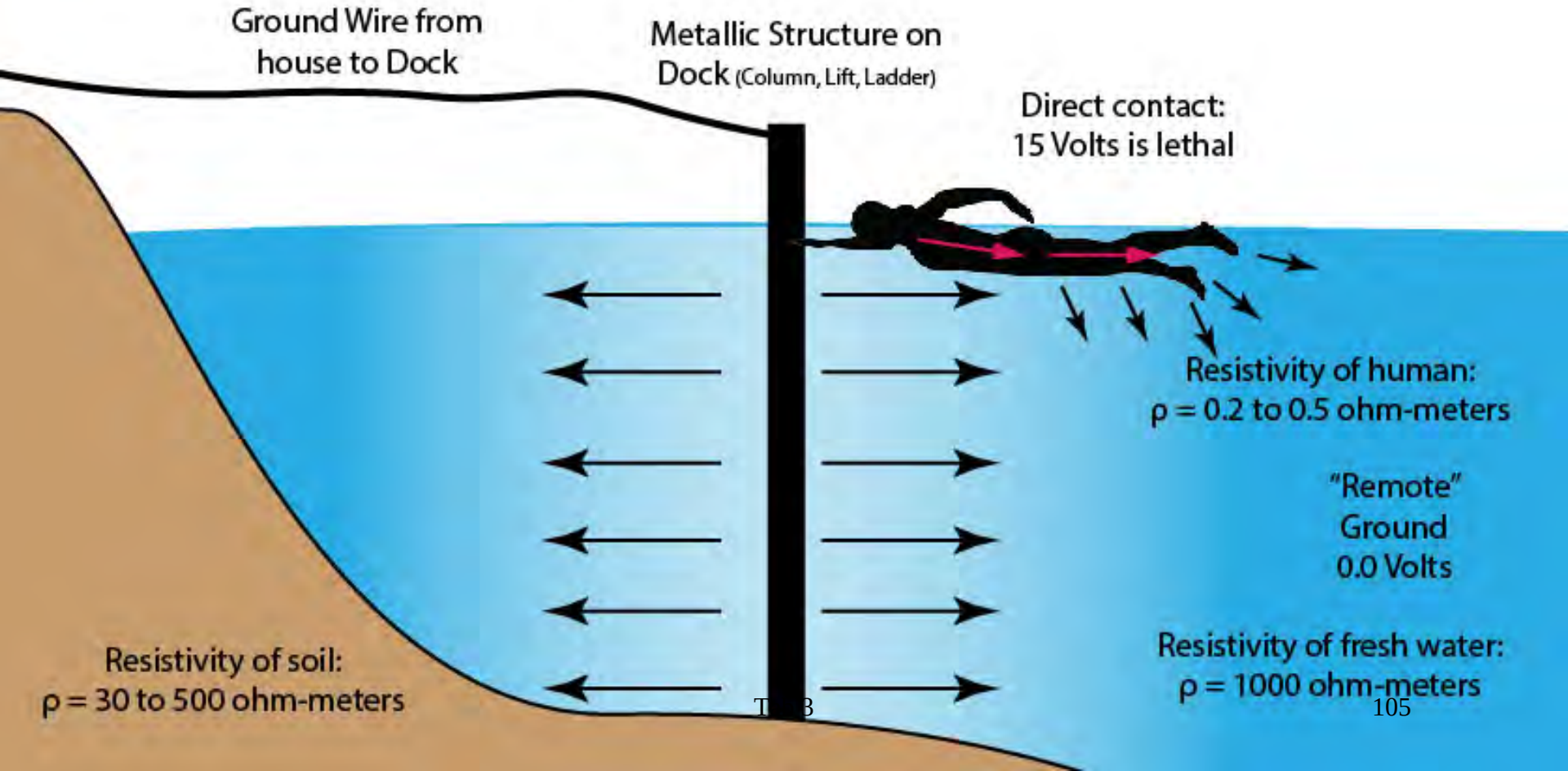
Voltage in the water around the structure is raised and drops off in ~ 10 feet

The lake is at "Remote" ground



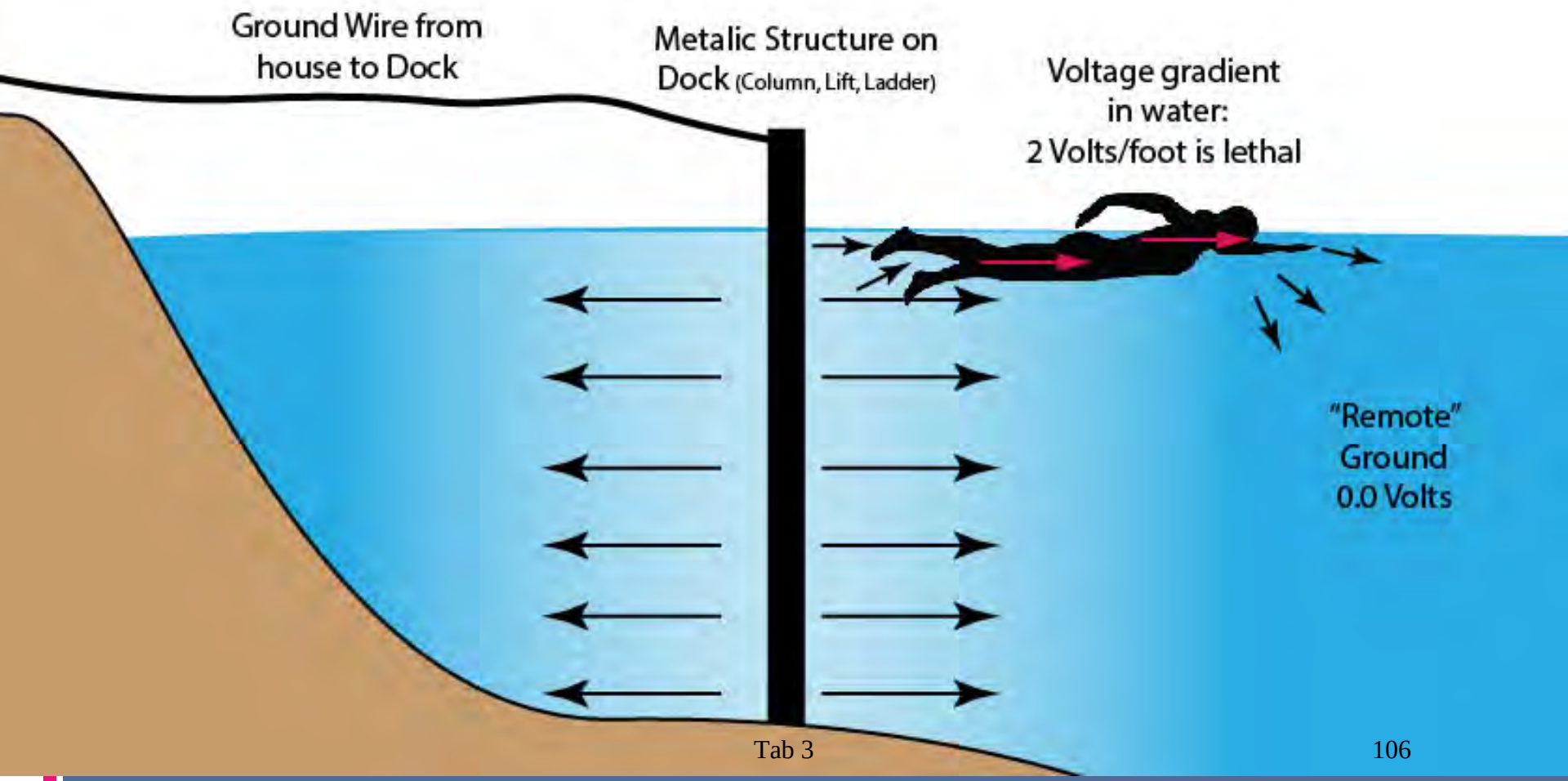
# A Person in contact with a metallic structure becomes a "ground rod" into the water

A person is more conductive than water, making them a preferential ground path.



# A Swimmer within a voltage gradient in the water is a preferred path to ground

Injury can occur without direct contact with a metallic dock structure.

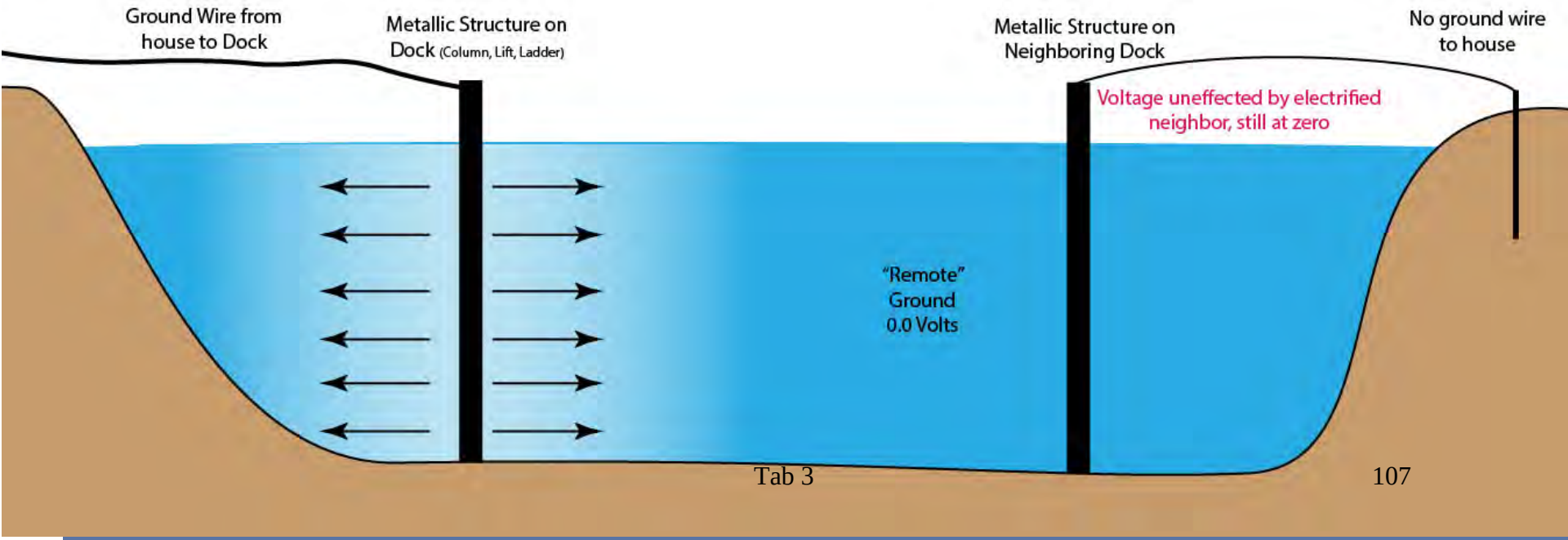


# Neighboring Docks

Myth: Electrified docks do not effect their neighbors dock.
Swimming by a neighbor's electrified dock could be dangerous!

- Theory:
  "Electricity is attracted to grounded docks and ground rods"

  -This is false!



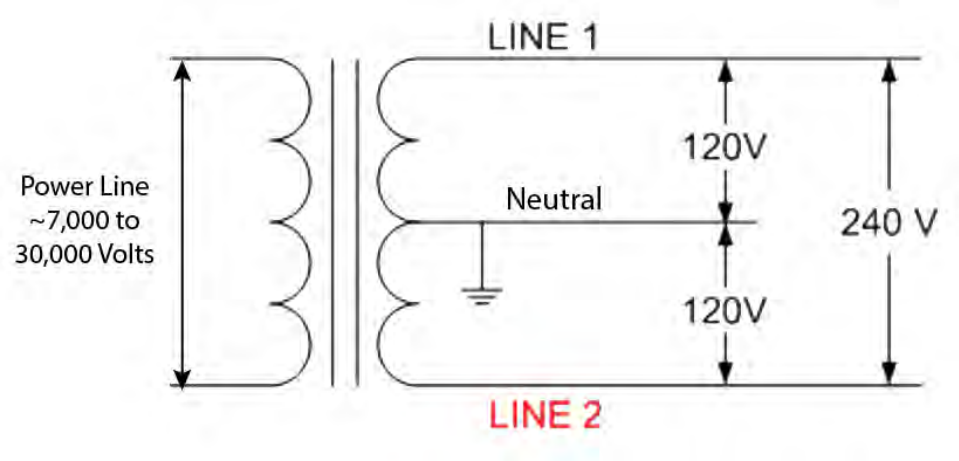
# Summary: "Earthed Ground" vs. Lake Water

- Lake voltages are at Remote Ground voltages i.e. "zero"
- Ground rods are *NOT* at the same voltage as lake water.
- Swimmers carry current better than fresh water

# The Source:

## Neutral Return Ground vs. Remote Ground

- "Neutral Return" wire from power company is earthed locally and does not connect directly back to the power source.

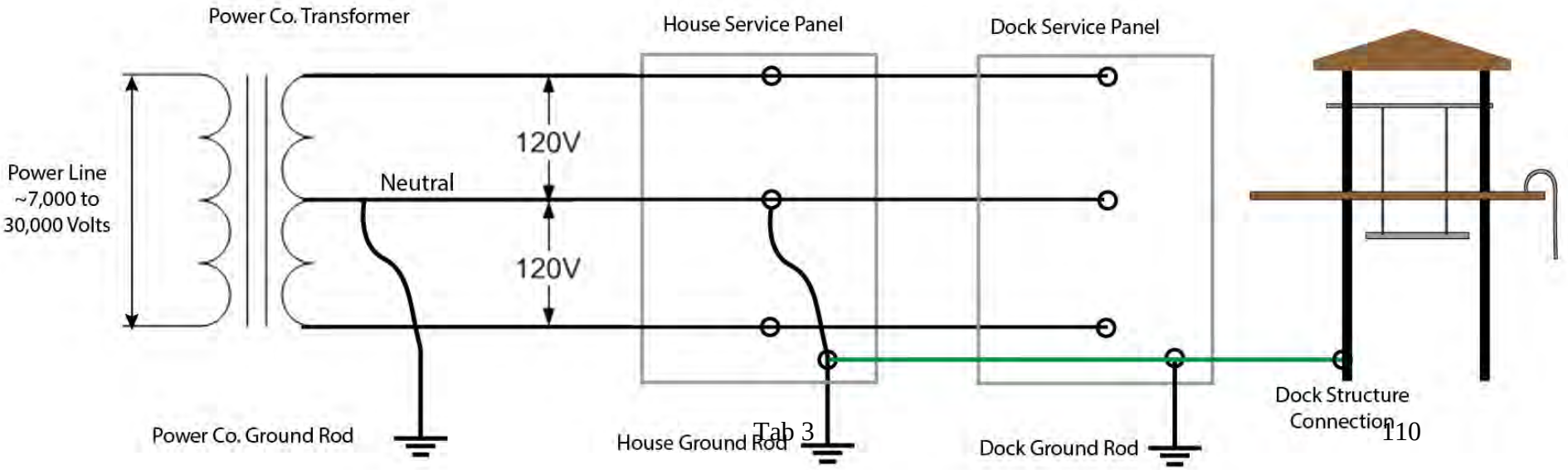



- If there is any load imbalance, current will flow through the earthed ground, *raising the voltage on the neutral line*
- Neutral Return Voltage is above Remote Ground Voltage

# The Source:

## Neutral Return is Hard Wired to the Dock Structure

- "Neutral Return" wire from power company is connected to "green" wire ground at the house service panel
- "Green" wire ground is connected to the dock service panel chassis that is connected to the dock structure
- Any load imbalance will place a voltage on the dock structure



# Sources of Ground Wire Voltages
## Load Imbalance

- Some Load Imbalance in Normal
  - Continuous 60 Hz Voltages between ~2 and 5 Volts are typical
  - *This is the primary voltage source detected at docks*

- When equipment starts up, load imbalances of 100s of amps can happen.
  - These can place large voltages on the neutral line and therefore the ground line and the dock structure.

# Sources of Ground Wire Voltages
## Neutral Line Failure

- If the neutral line corrodes and/or fails, up to 120 Volts may appear on the neutral line, ground line and dock structure
  - *ESD and Electrocution deaths have occurred due to neutral line failure. There is no protection or detection system.*

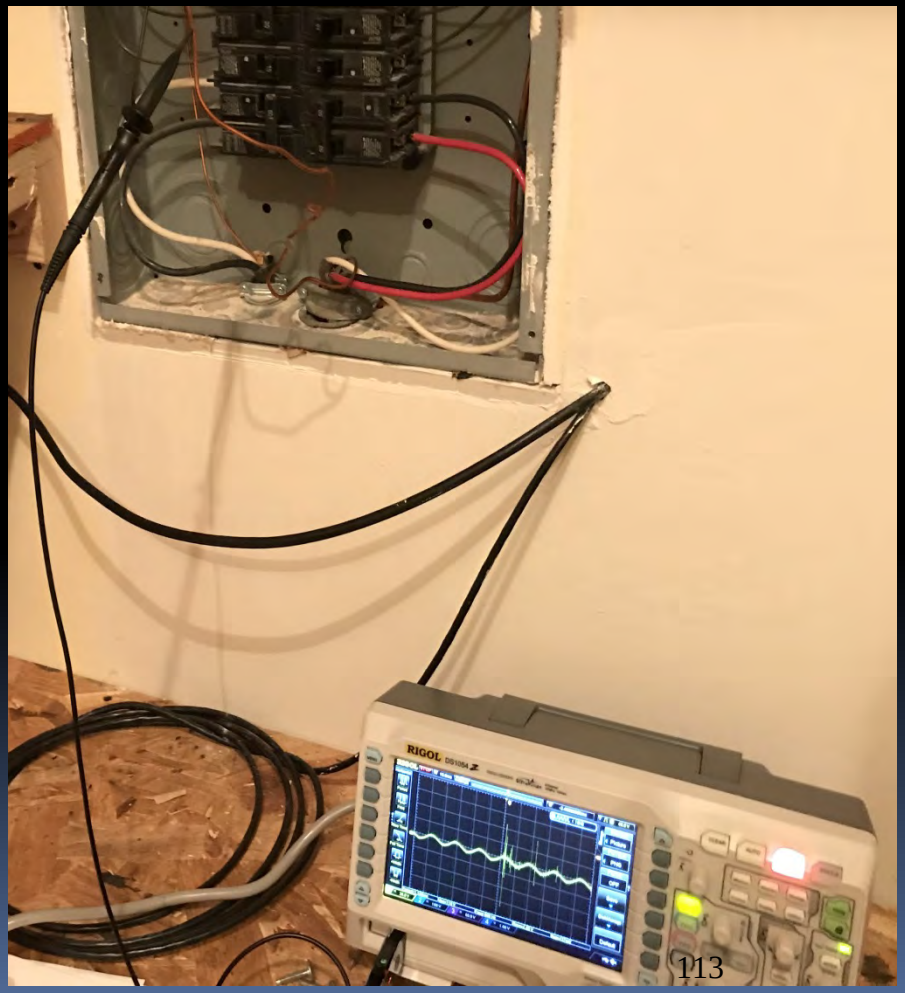


Neutral lines are often a sheath around power cable, and the first to corrode and fail.



# Measurements

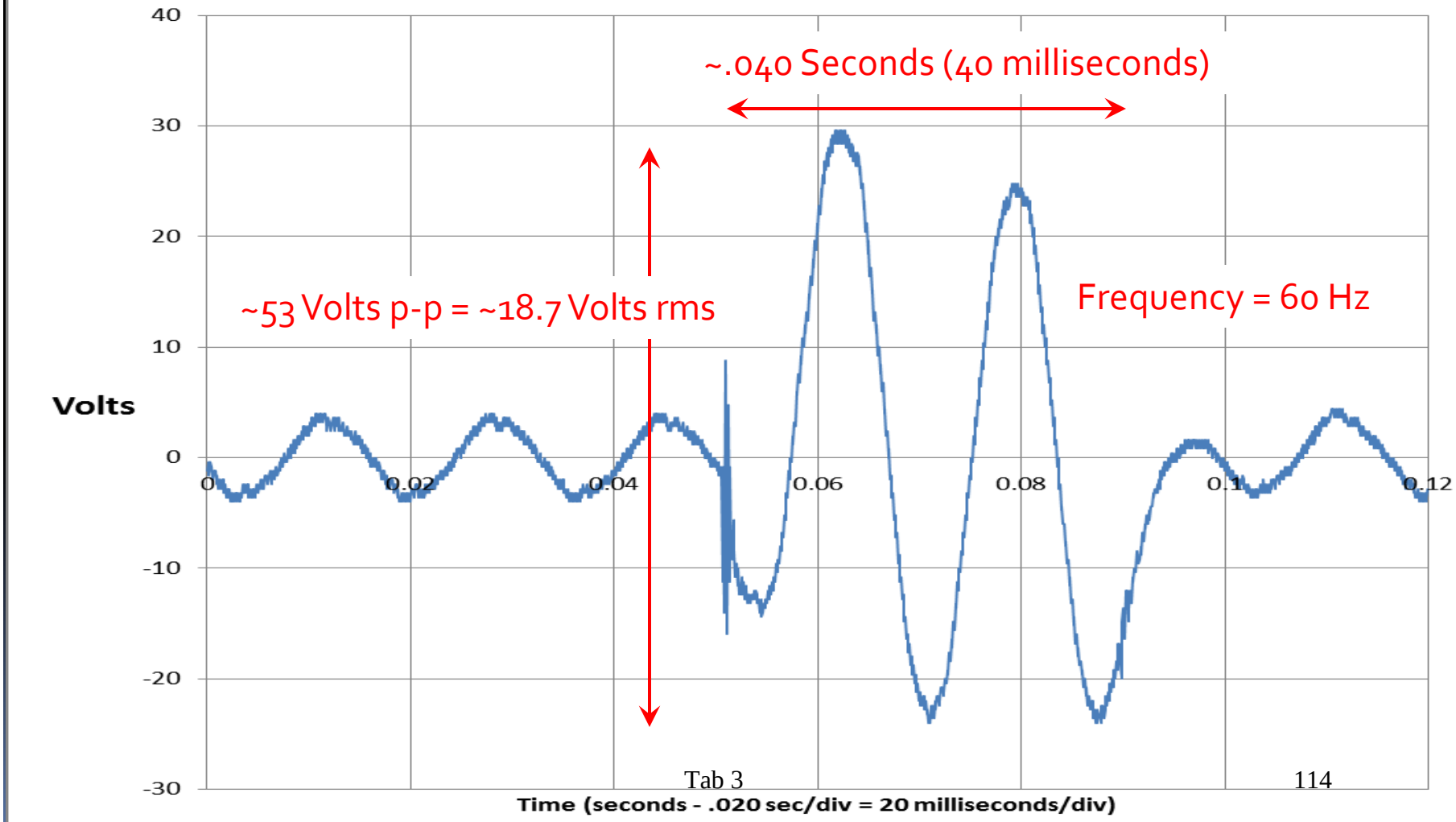
- Voltage between the neutral line and remote ground (1 k-ohm load)
- Multi-meter "jumpy" and unreliable
- Oscilloscope used to fully capture voltages delivered to the dock
- March through June, 2018 in Huddleston



# Sources of Ground Wire Voltages

## Intermittent Voltage Events

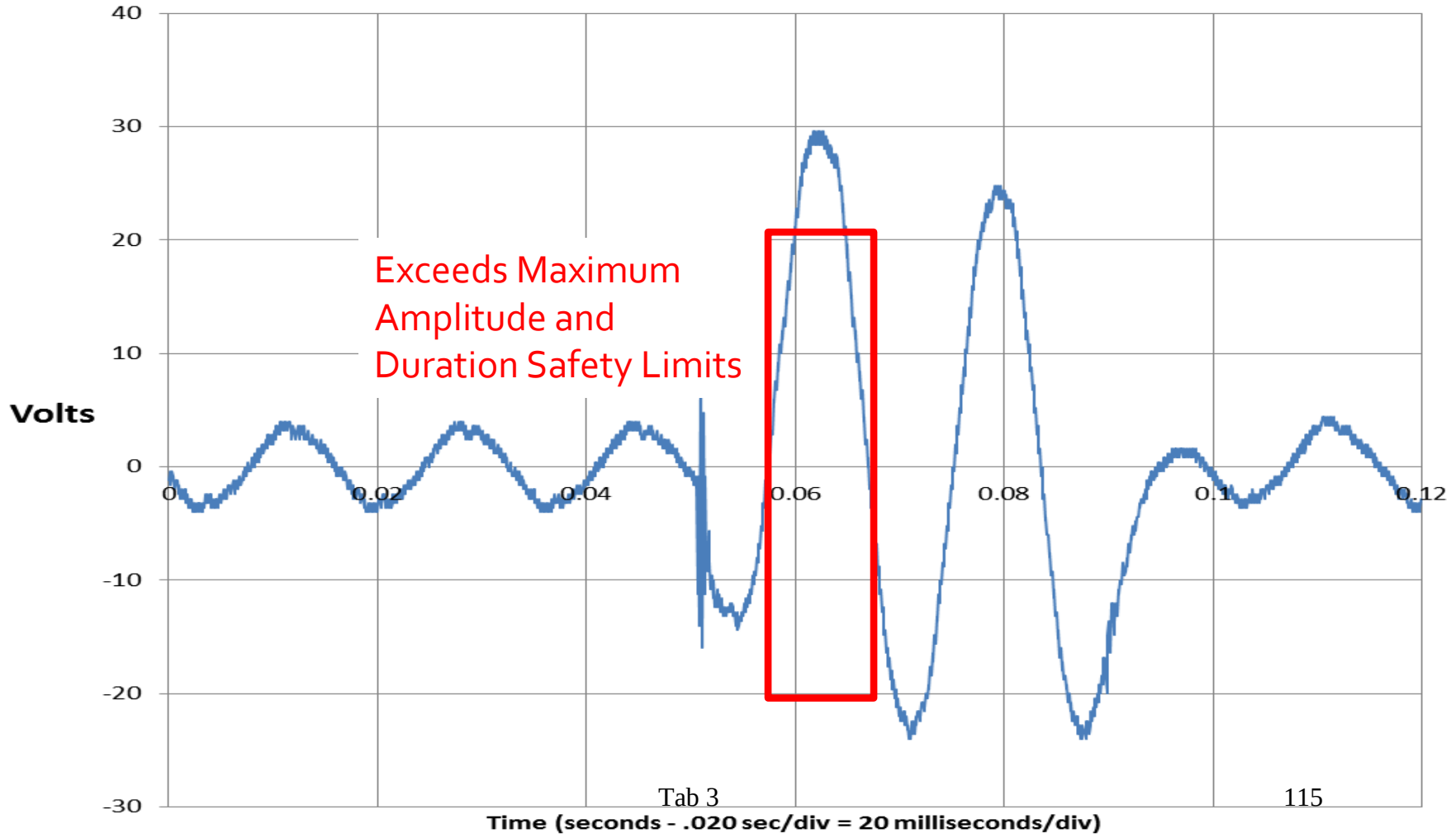
- Load Imbalance: Equipment startup?



# Sources of Ground Wire Voltages

## Intermittent Voltage Events

- Load Imbalance: Exceeds maximum limits: 15 V rms, 8.3 msec



# Danger of Electricity in Water: How Injury Occurs

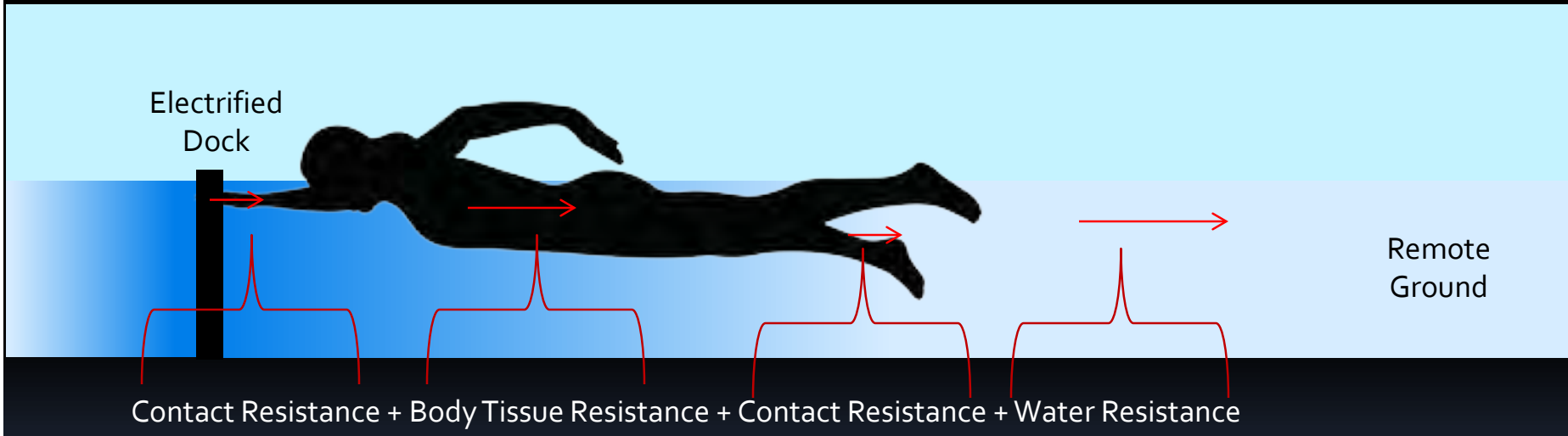
- Injury vs. electrical current
- How Electricity Enters the Body
  - Contact Resistance: Dry vs. Wet Conditions
  - Tissue Resistance
  - Water Resistance
  - Injury vs. Voltage in water
- Injury vs. Frequency
  - 60 Hz vs. DC vs. higher frequencies

# Danger of Electricity in Water: How Injury Occurs: Electric Current

| *Bodily effect* | *Gender* | *60 Hz AC* |
|---|---|---|
| Slight sensation at point(s) of contact | Men | 0.4 mA |
| | Women | 0.3 mA |
| Threshold of bodily perception | Men | 1.1 mA |
| | Women | 0.7 mA |
| Pain, with voluntary muscle control maintained | Men | 9 mA |
| | Women | 6 mA |
| Pain, with loss of voluntary muscle control | Men | 16 mA |
| | Women | 10.5 mA |
| Severe pain, difficulty breathing | Men | 23 mA |
| | Women | 15 mA |
| Possible heart fibrillation after three seconds | Men | 100 mA |
| | Women | 100 mA |

ESD – .0105 Amps/ 10.5 mA

# Danger of electricity in water:
## How Electricity Enters the Body



# Danger of electricity in water:

## How Electricity Enters the Body: Contact Resistance

**Human Resistance for Various Skin-Contact Conditions [1]**

| Description of Skin-Contact Conditions | Resistance (OHMS) | |
|---|---|---|
| | Dry | Wet |
| Hand holding wire | 15,000 to 50,000 | 3,000 to 6,000 |
| Palm touch | 3,000 to 8,000 | 1,000 to 2,000 |
| Hand around 1½-inch pipe | 1,000 to 3,000 | 500 to 1,500 |
| Hand immersed | | 200 to 500 |
| Foot immersed | | 100 to 300 |

A full body immersed ~100 ohms

# Danger of electricity in water:

## How Electricity Enters the Body:
## Body Tissue Resistance and Water Resistance

- Body Tissue Resistance

  Resistivity of Tissue x Length of body / Cross section of body = Resistance

  0.03 ohm-m x 2 m / (0.4 m x 0.25 m) = 0.6 ohms

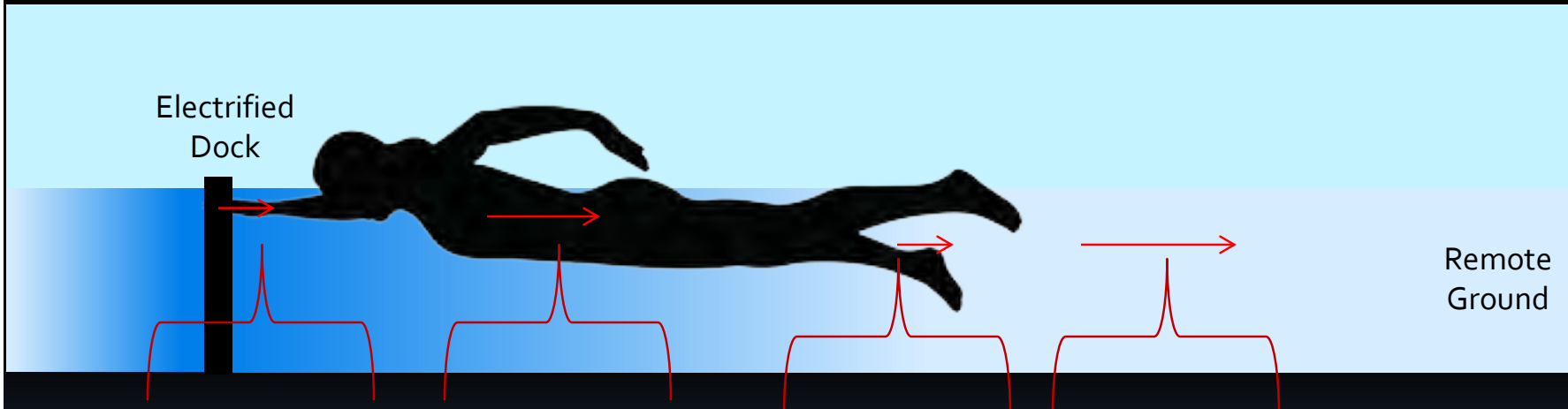
- Water Resistance

  Resistivity of Water x Length / Cross section of water = Resistance

  1000 ohm-m x 1 m / (0.5 m x 2 m) = 1000 ohms

# Danger of electricity in water:

## How Electricity Enters the Body

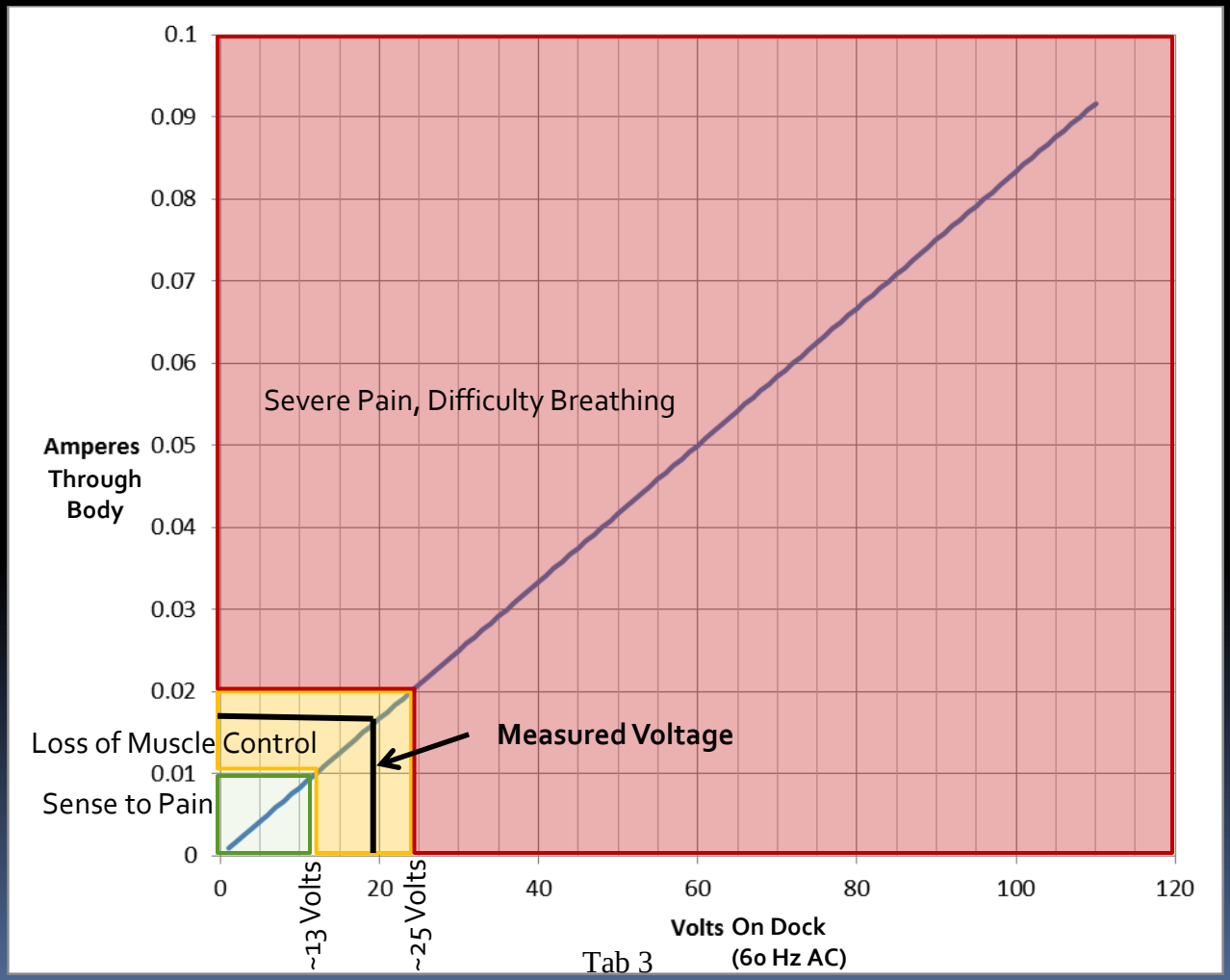



Contact Resistance + Body Tissue Resistance + Contact Resistance + Water Resistance = Total Resistance

100 Ohms + 0.6 Ohms + 100 Ohms + 1000 Ohms = ~1200 Ohms

# Estimated Voltage vs. Current

## Injury/ESD Risk Above 15 Volts*

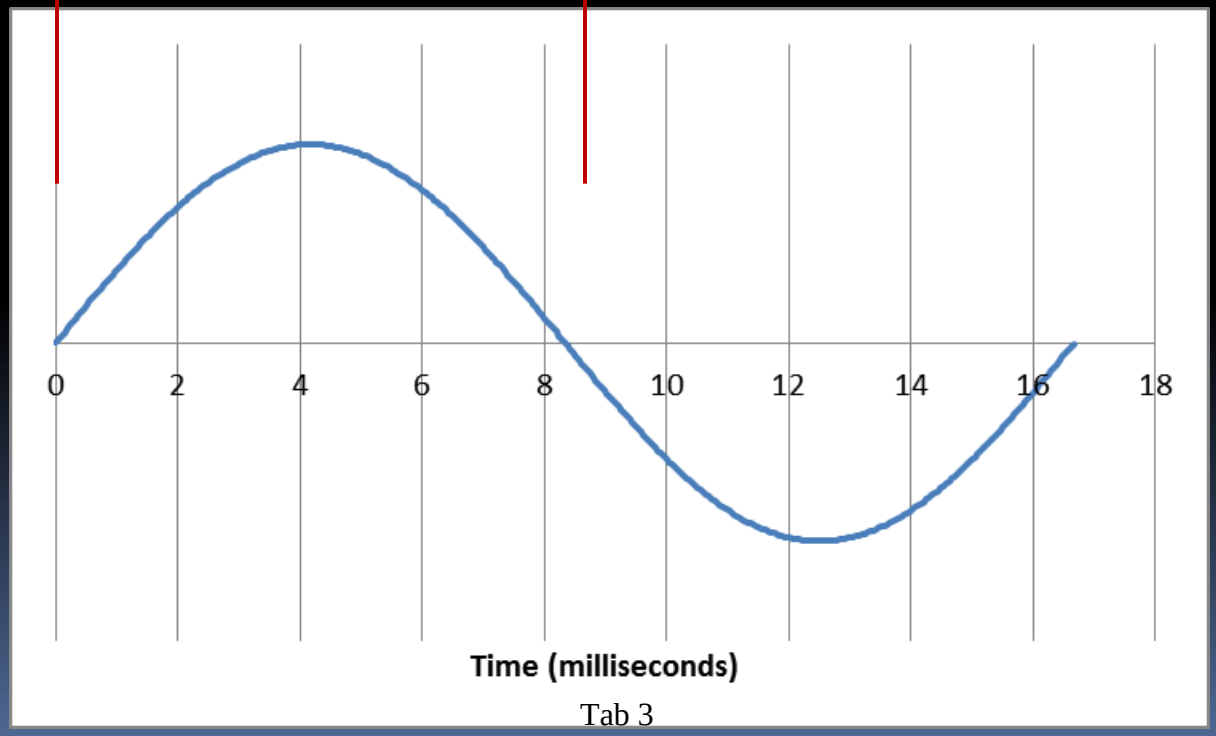



*NEC 680.23(A)(3)

# Exposure Time

## 8.3 milliseconds (.0083 seconds) at 60Hz

½ Period = 8.3 ms



# Sources of Ground Wire Voltages
## Intermittent Voltage Events

- Measured Event:
  - Voltage: 18.7 Volts rms
  - Duration: 40 milliseconds
  - Frequency: 60 Hz
- Lethal Levels
  - Voltage: 15 Volts rms
  - Duration: 8.3 milliseconds
  - Frequency: 60 Hz

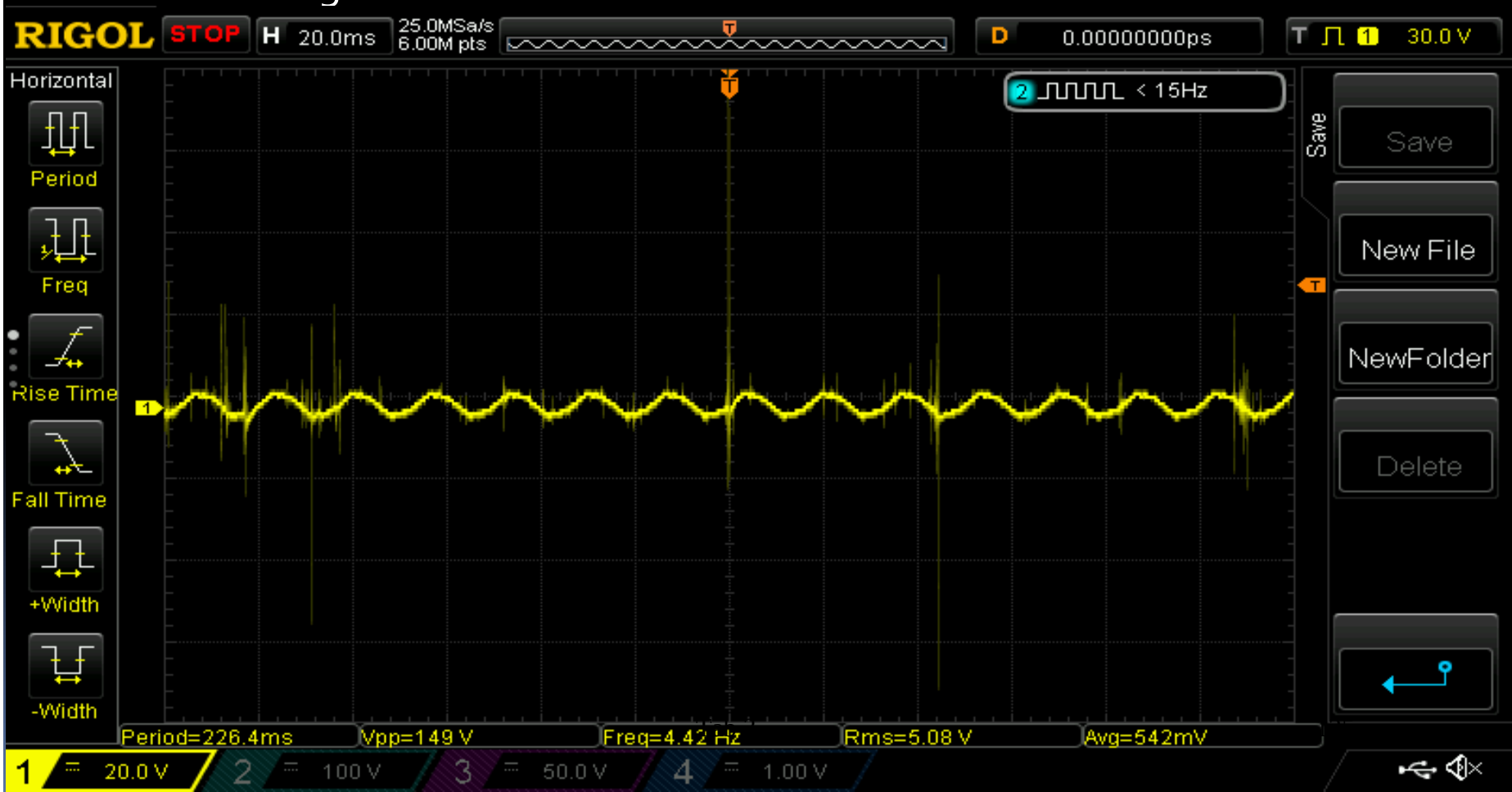
If someone were in the water, touching the dock, it would probably have disabled them and ESD is likely.

- Exceeds the lethal voltage
- Nearly 5 times the lethal exposure time

Did something similar happen on June 2st at Smith Mountain Lake?

# Sources of Ground Wire Voltages
# Intermittent Voltage Events

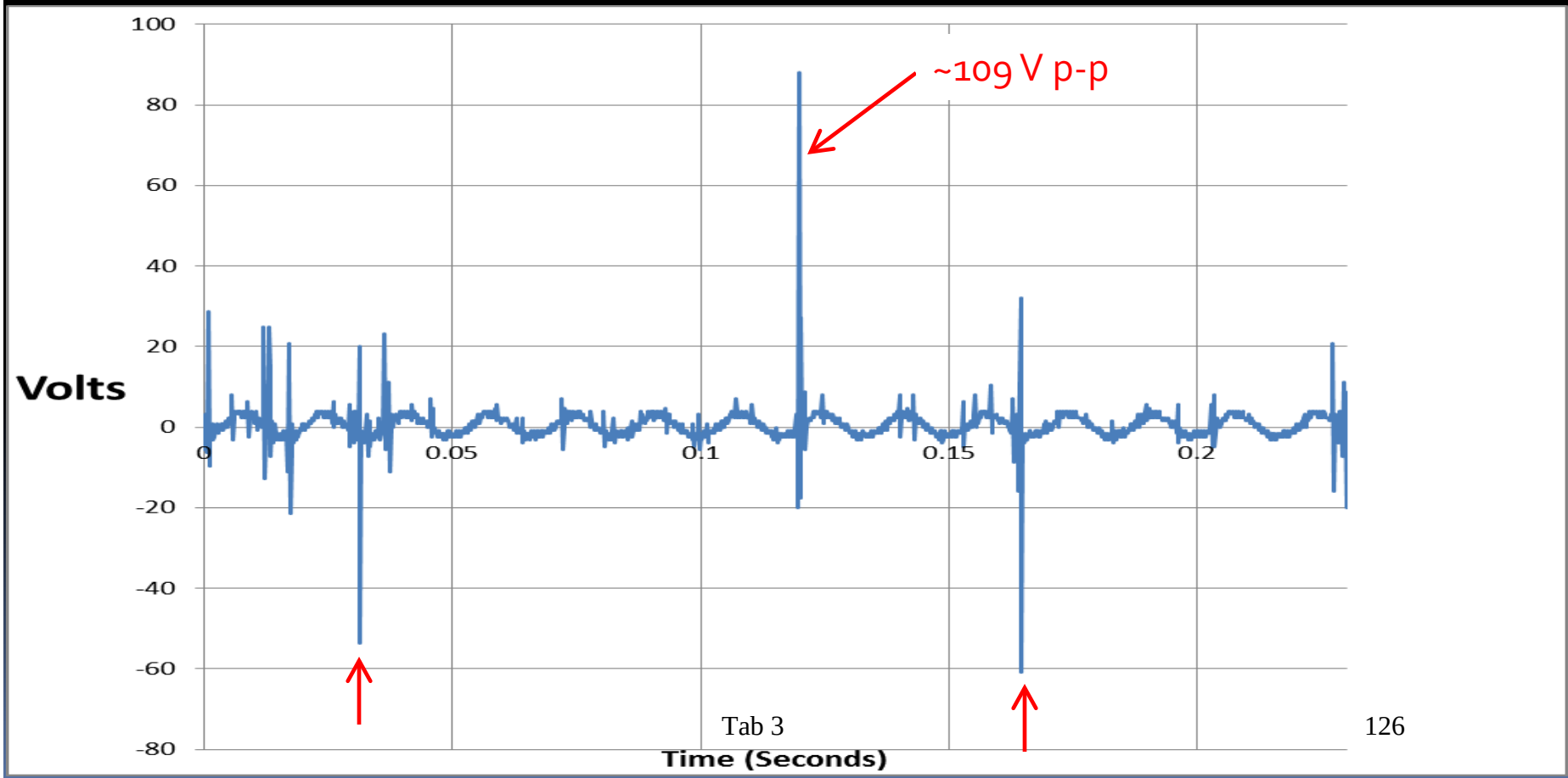
- Short Spikes
  - Believed to be caused by high voltage (7,000 to 30,000 volts) arcs along insulators.



# Sources of Ground Wire Voltages

## Intermittent Voltage Events

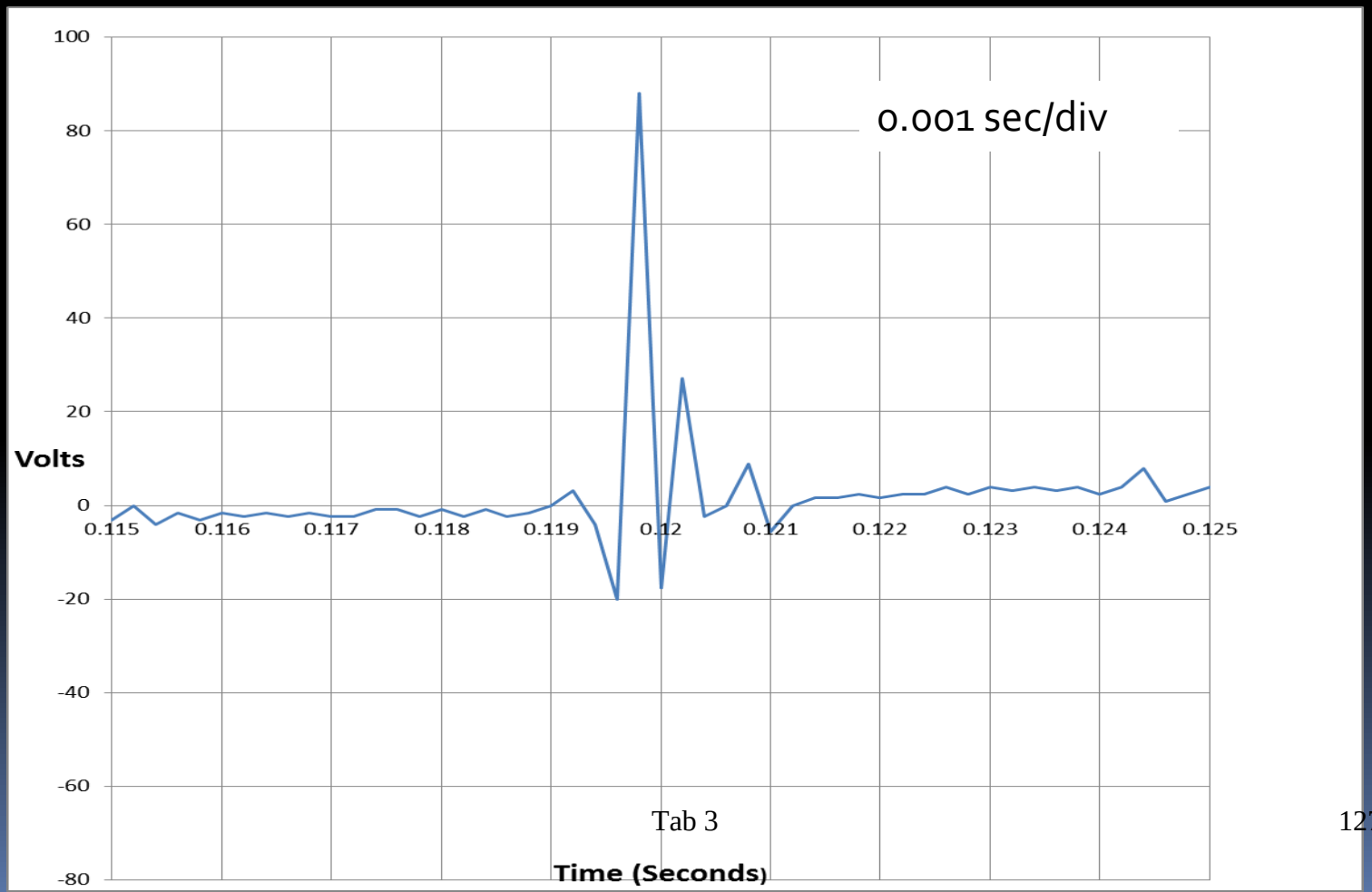
- Short Spikes
  - Believed to be caused by high voltage (7,000 to 30,000 volts) arcs along insulators but may be other events on the power grid.



# Sources of Ground Wire Voltages

## Intermittent Voltage Events

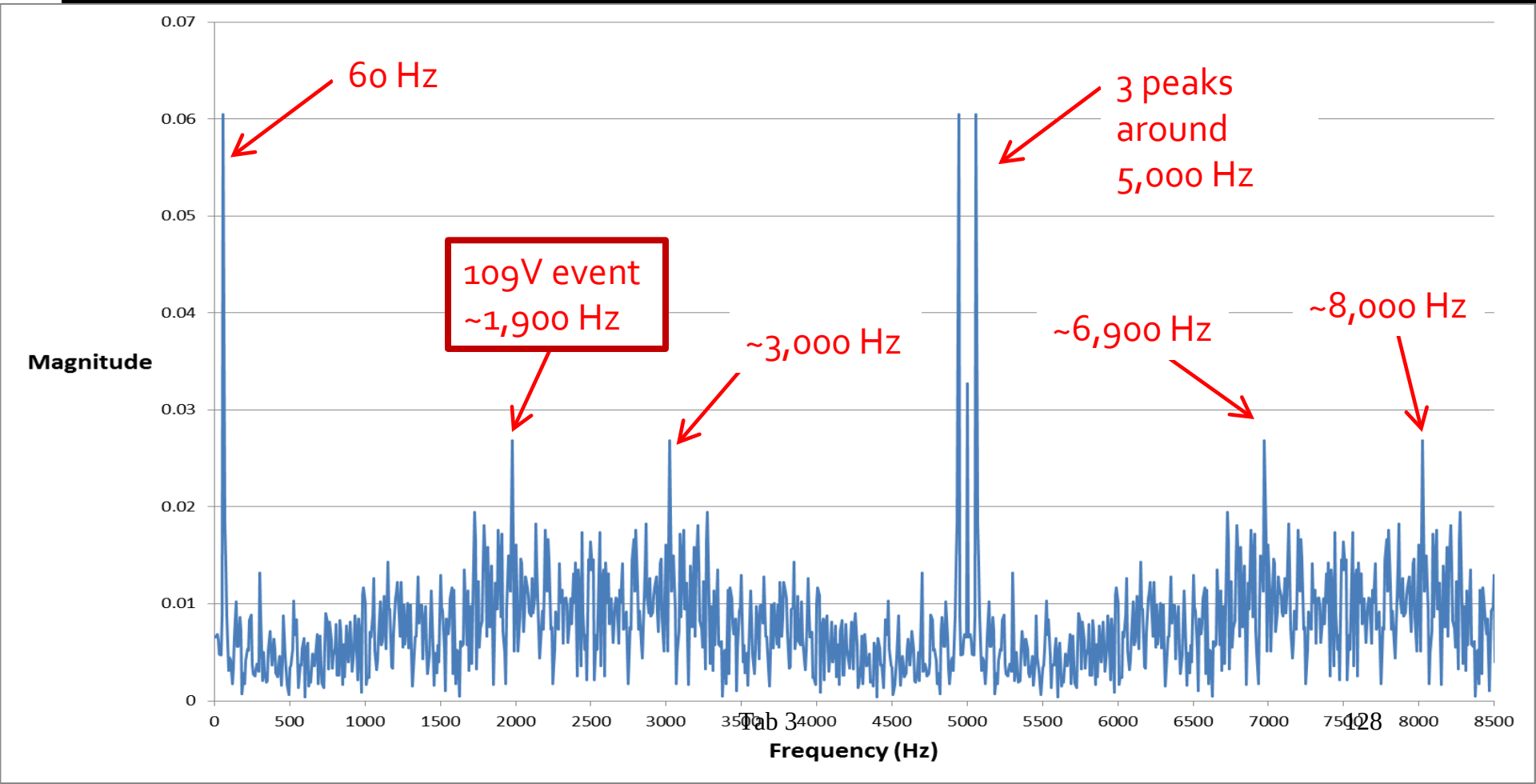
- Short Spikes
  - Pulse: ~0.0015 seconds (1.5 milliseconds), ~109 Volts p-p



# Sources of Ground Wire Voltages

## Intermittent Voltage Events

- Short Spikes
  - Frequency Content



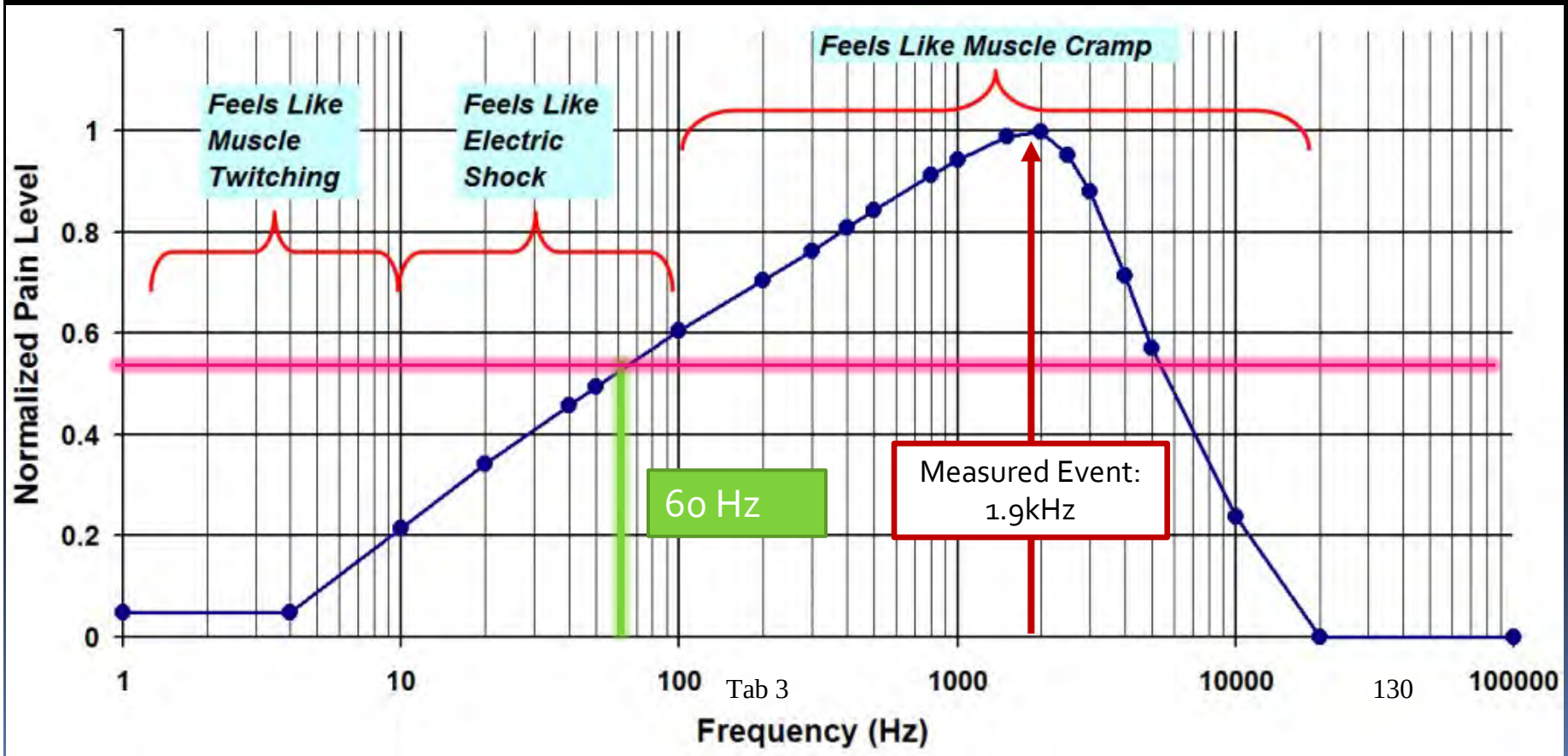
# Danger of electricity in water: Frequency

- DC vs. 60 Hz AC vs. 10kHz AC

| *Bodily effect* | *Gender* | *DC* | *60 Hz AC* | *10 kHz AC* |
|---|---|---|---|---|
| Slight sensation at point(s) of contact | Men | 1 mA | 0.4 mA | 7 mA |
| | Women | 0.6 mA | 0.3 mA | 5 mA |
| Threshold of bodily perception | Men | 5.2 mA | 1.1 mA | 12 mA |
| | Women | 3.5 mA | 0.7 mA | 8 mA |
| Pain, with voluntary muscle control maintained | Men | 62 mA | 9 mA | 55 mA |
| | Women | 41 mA | 6 mA | 37 mA |
| Pain, with loss of voluntary muscle control | Men | 76 mA | 16 mA | 75 mA |
| | Women | 51 mA | 10.5 mA | 50 mA |
| Severe pain, difficulty breathing | Men | 90 mA | 23 mA | 94 mA |
| | Women | 60 mA | 15 mA | 63 mA |
| Possible heart fibrillation after three seconds | Men | 500 mA | 100 mA | |
| | Women | 300 mA | 100 mA | |

# Danger of electricity in water: Frequency

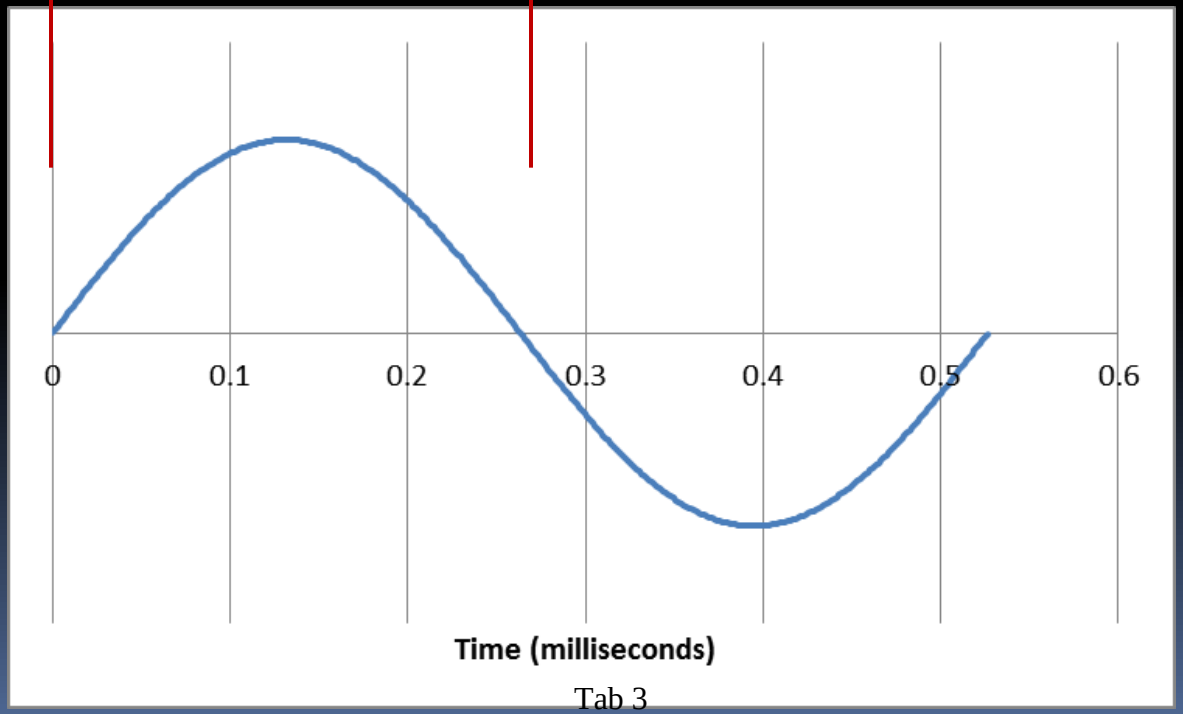
- Using perceived pain as a proxy for effect in wet conditions
  - Frequencies between 60Hz and 5 kHz may be more harmful than 60Hz



# Exposure Time

## Does ½ the period apply at 1.9kHz??

½ Period = 0.26 ms
(.00026 seconds)



# Sources of Ground Wire Voltages
## Intermittent Voltage Events

- Short Spikes
  - Events with voltages exceeding 100 volts are common
  - At 2,000 Hz, is the duration limit ½ the period as it is at 60Hz?
  - More research is needed to establish that these are *NOT* harmful.

# Differing Opinions: Intermittent Voltage Events

- Intermittent Voltage Events Occur on Neutral Lines
  - "Institutional knowledge" is that these are very short events that are too low a voltage, duration or frequency to be hazardous

- *Events have been measured that are known to be lethal in addition to events that may be lethal*
  - *Electric Shock injury on June 2, 2018 appears to be caused by an intermittent voltage event on the neutral/ground line*

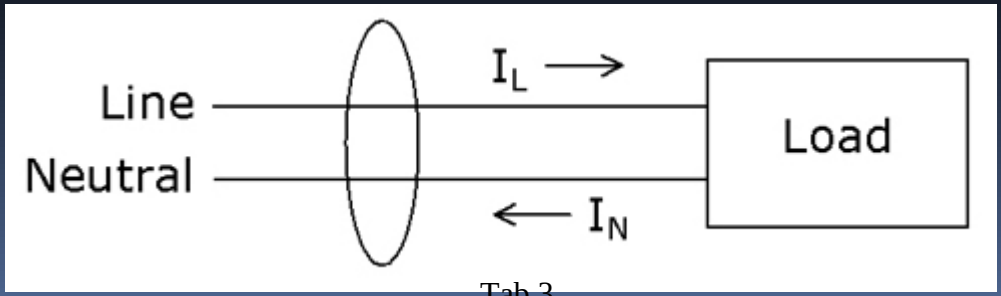
# Differing Opinions:
## Removal of Ground Wire

- Institutional Wisdom: Ground lines are critical safety features that outweigh any risks of neutral/ground voltages
  - Should GFCIs fail, ground wires provide a robust return path to the circuit breaker at the house
  - GFCIs are not as reliable as breakers (~14% failure rate)
  - Critical for fire and personal safety

Whether or not the ground conductor is present, swimmer protection in dock waters depends on GFCI performance

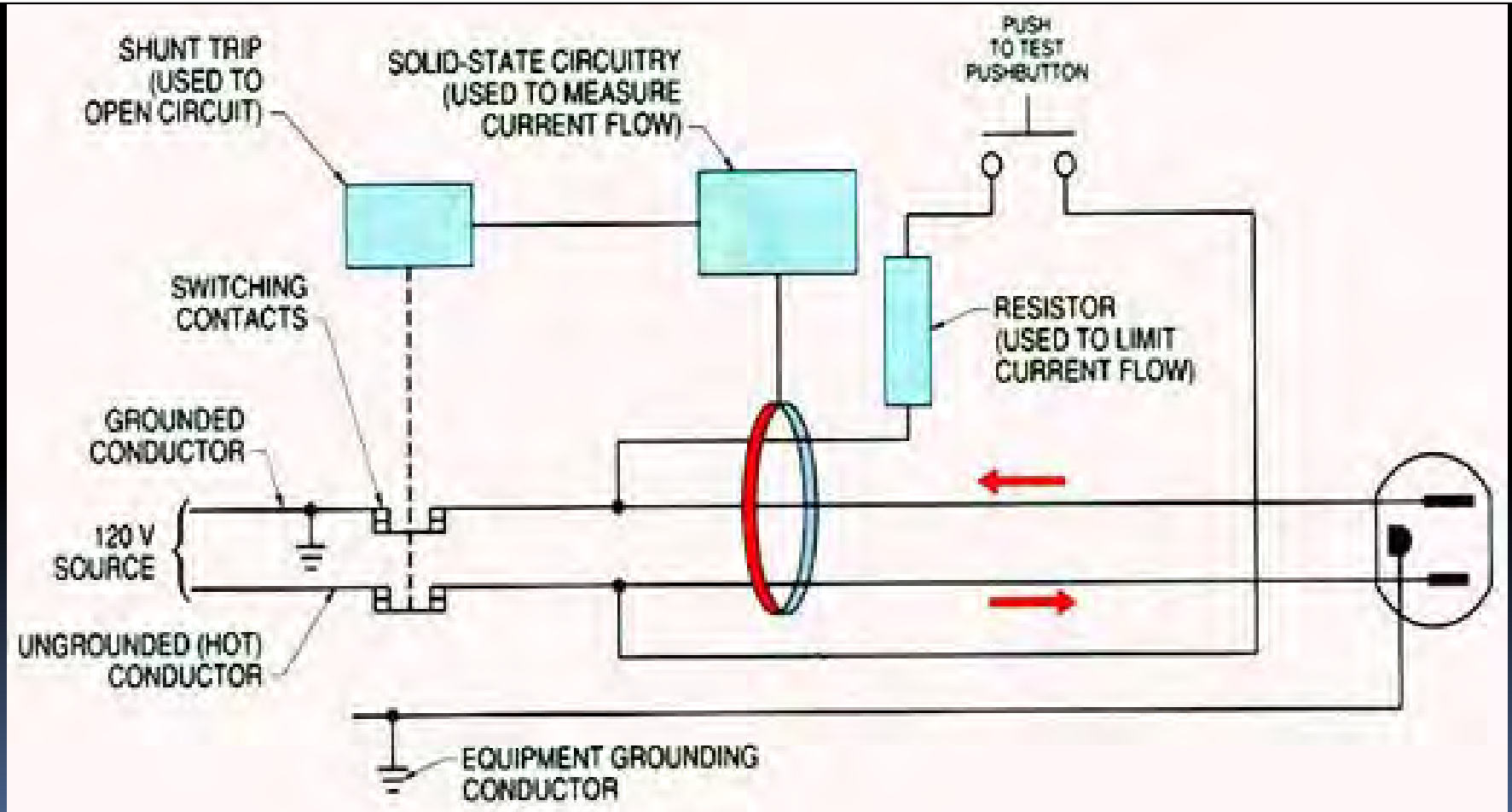
# Ground Fault Circuity Interrupts: How do they work?

- GFCIs monitor total current in and out
- Net current should always be zero
- If current exceeds 4 mA (0.004 Amps), it will disconnect within 7 milliseconds (0.007 seconds).
- Ground wire is not needed for GFCI to operate



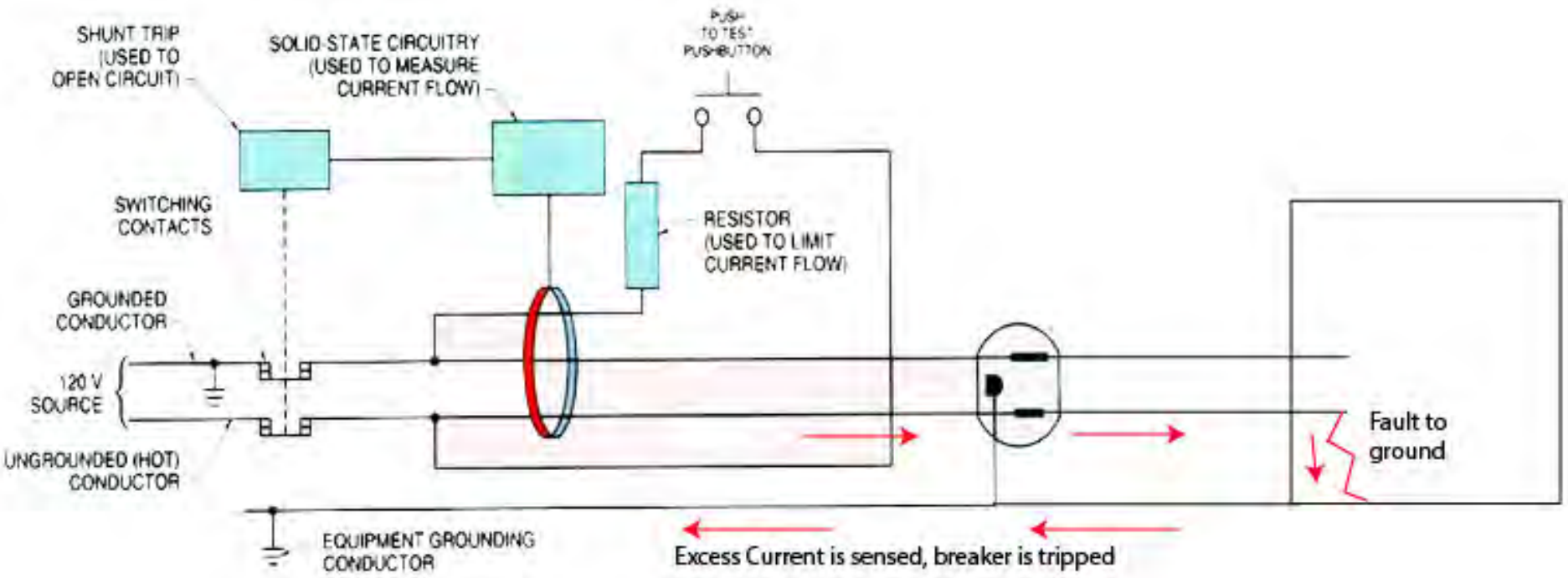
# Ground Fault Circuity Interrupts: How do they work?

What's inside



# Ground Fault Circuity Interrupts: How do they work?

Example: Fault to ground



# Breaker with GFCI

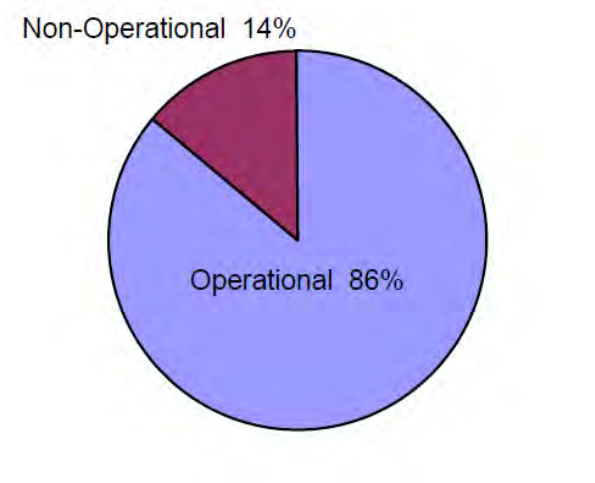



- GFCI Breaker Clears (trips) at two different current levels
  - GFCI Trip: 4 to 30 milliamps for currents NOT returning through the breaker
  - Breaker Trip: 12 to 20 amps for short circuit (load) currents
    - If GFCI fails to trip on non-load currents, breaker will trip at 12 to 20 amps

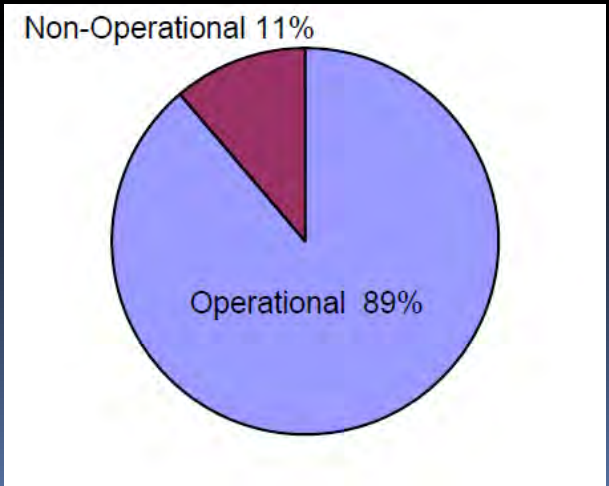
# Ground Fault Circuity Interrupts: Reliability

2001 Reliability Study: Breaker Performance
- 2 to 26 year old GFCI breakers

Overall Performance



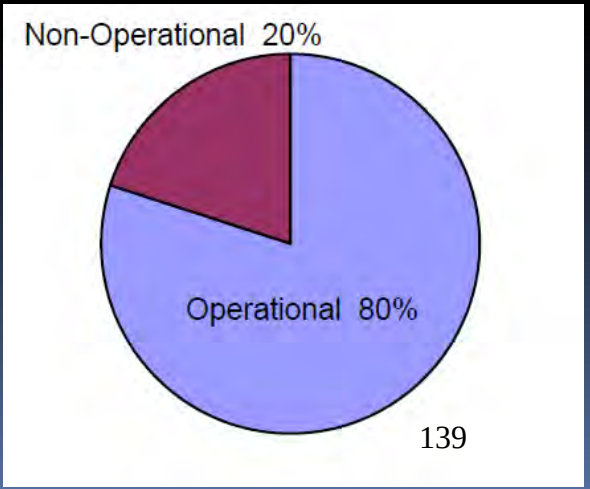

Indoor Performance




In 2015 self-testing GFCIs are required

- Tests only the sensing circuit
- Reliability unknown
- **Regular testing is still required**

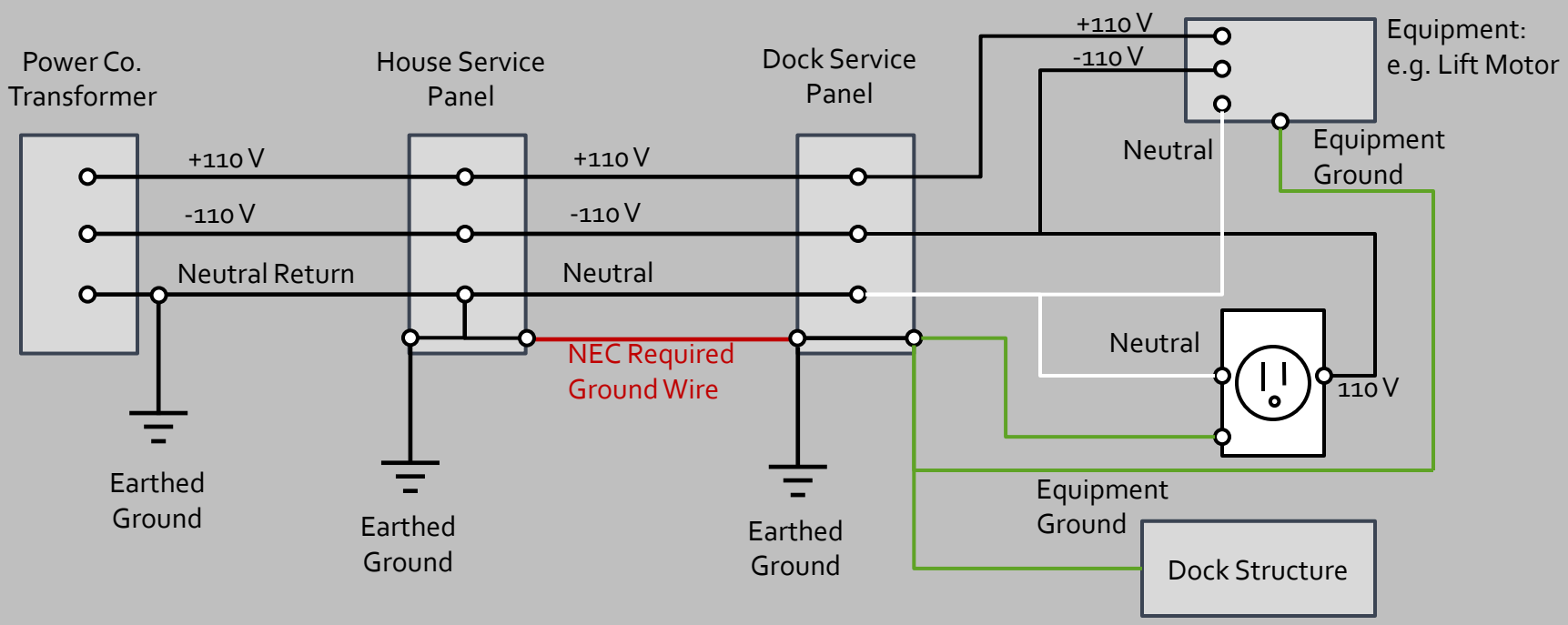
Outdoor Performance



# Can GFCI Reliability be Improved?

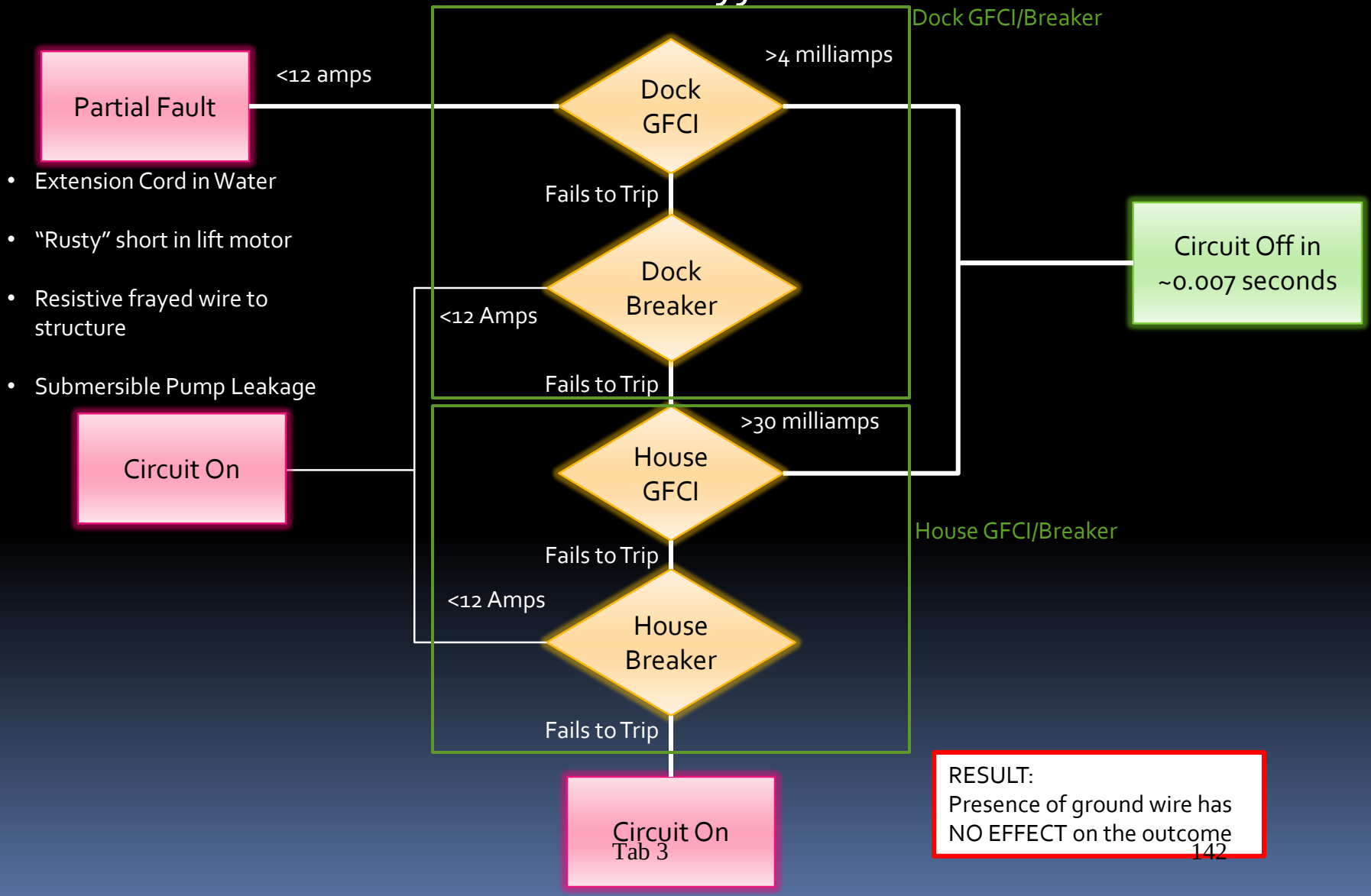
- All manufacturers recommend monthly testing
  - Failures appear to be associated with "sticky" cutoff switches
  - Self-testing sensing circuits will trip the switch upon failure, *if the switch is operational*.
  - Regular testing should help keep the switches operational while detecting failures
- More robust designs are possible, but may be cost prohibitive.
- *The risk of a two GFCIs failing in 30 days (between testing) should be very low.*

# Function of the NEC Required Ground Wire



# Function of Ground Wire: Partial Fault

## *Ground Wire Has No Effect on Outcome*

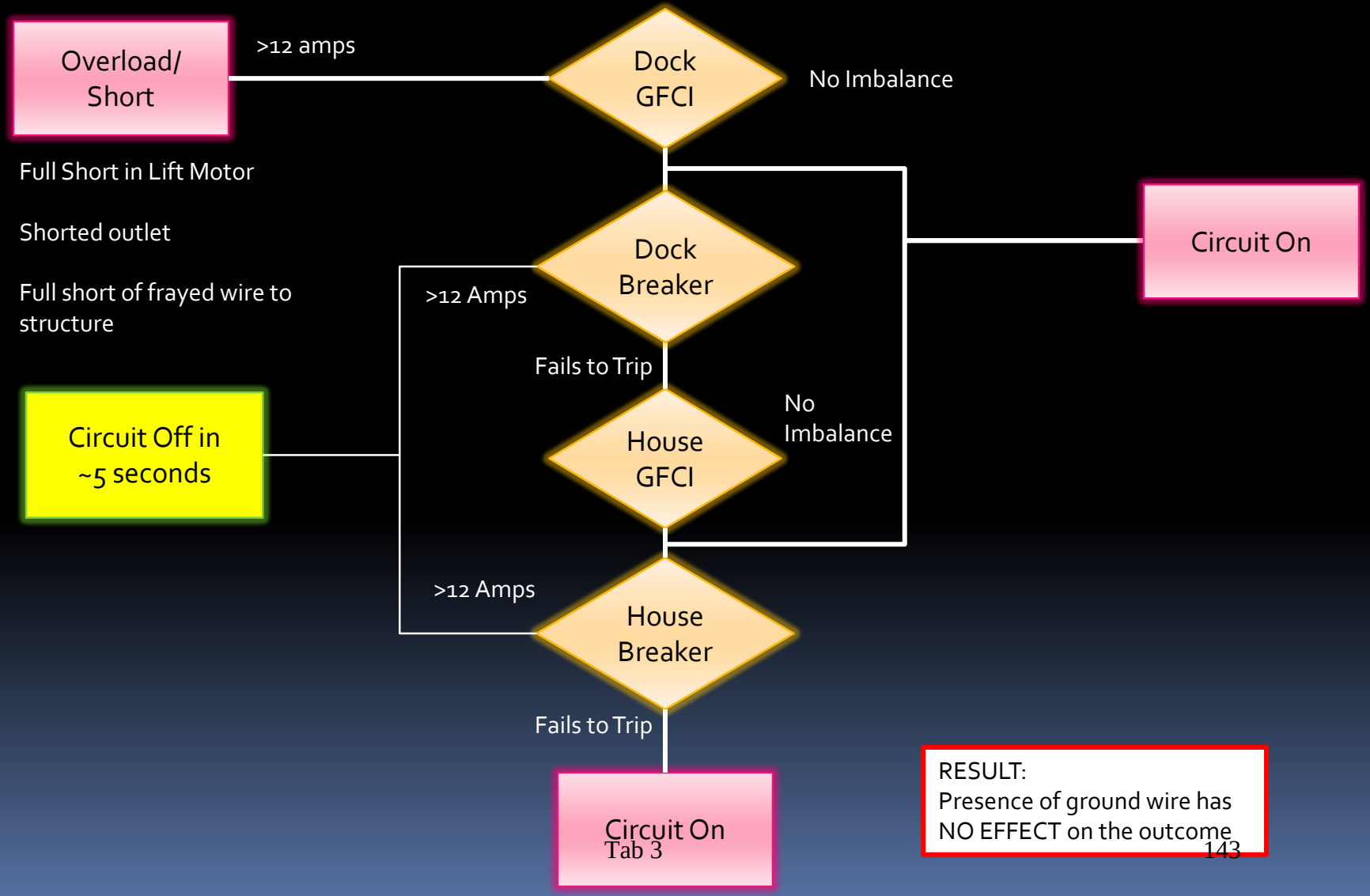



- Extension Cord in Water
- "Rusty" short in lift motor
- Resistive frayed wire to structure
- Submersible Pump Leakage

RESULT:
Presence of ground wire has NO EFFECT on the outcome

# Function of Ground Wire: Short/Over Current Load

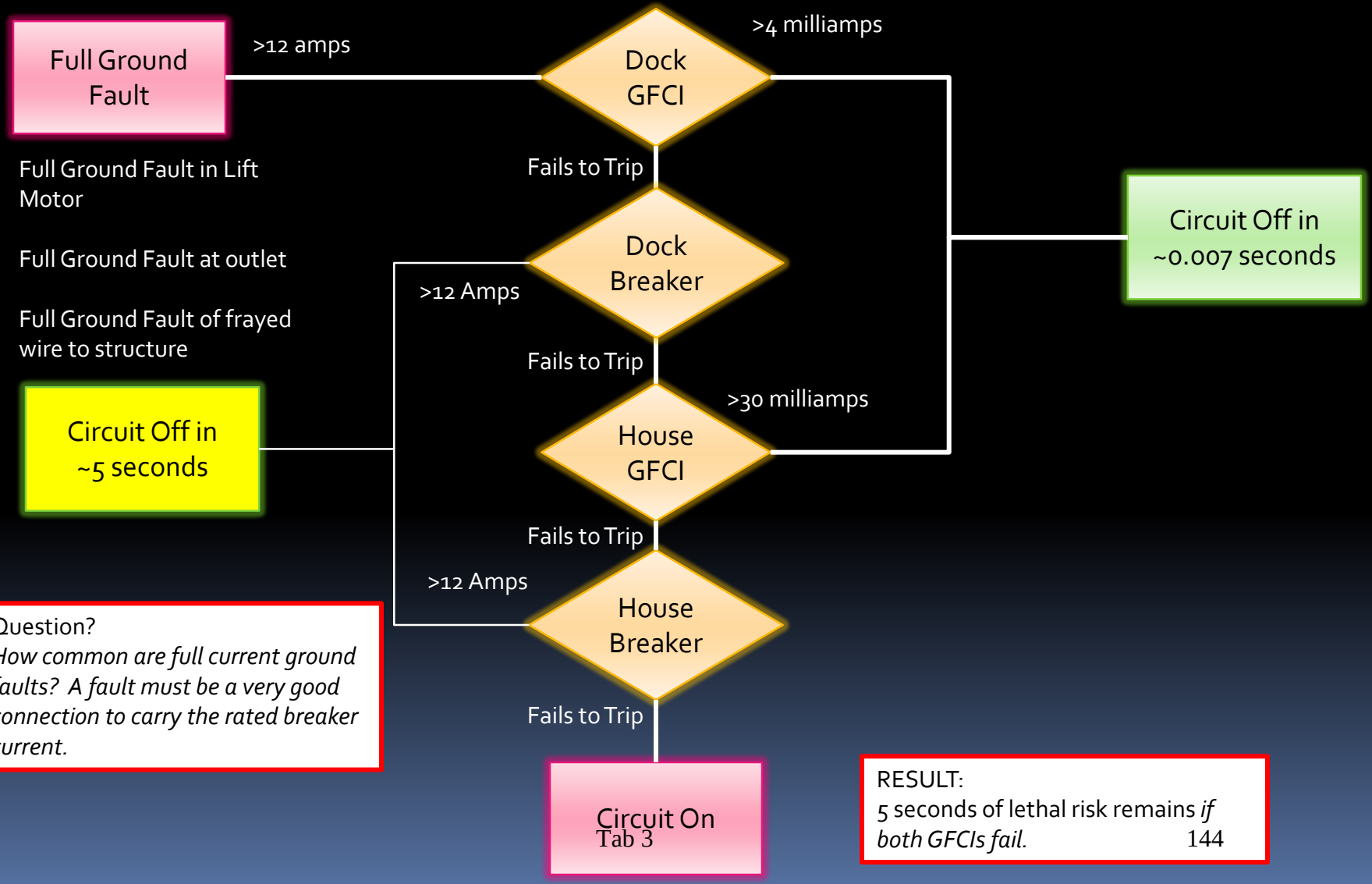
*Ground Wire is not required to clear a short*




- Full Short in Lift Motor
- Shorted outlet
- Full short of frayed wire to structure

RESULT:
Presence of ground wire has NO EFFECT on the outcome

# Function of Ground Wire: Full Current Ground Fault
## *Dock Breaker at House too Slow to Save Lives*

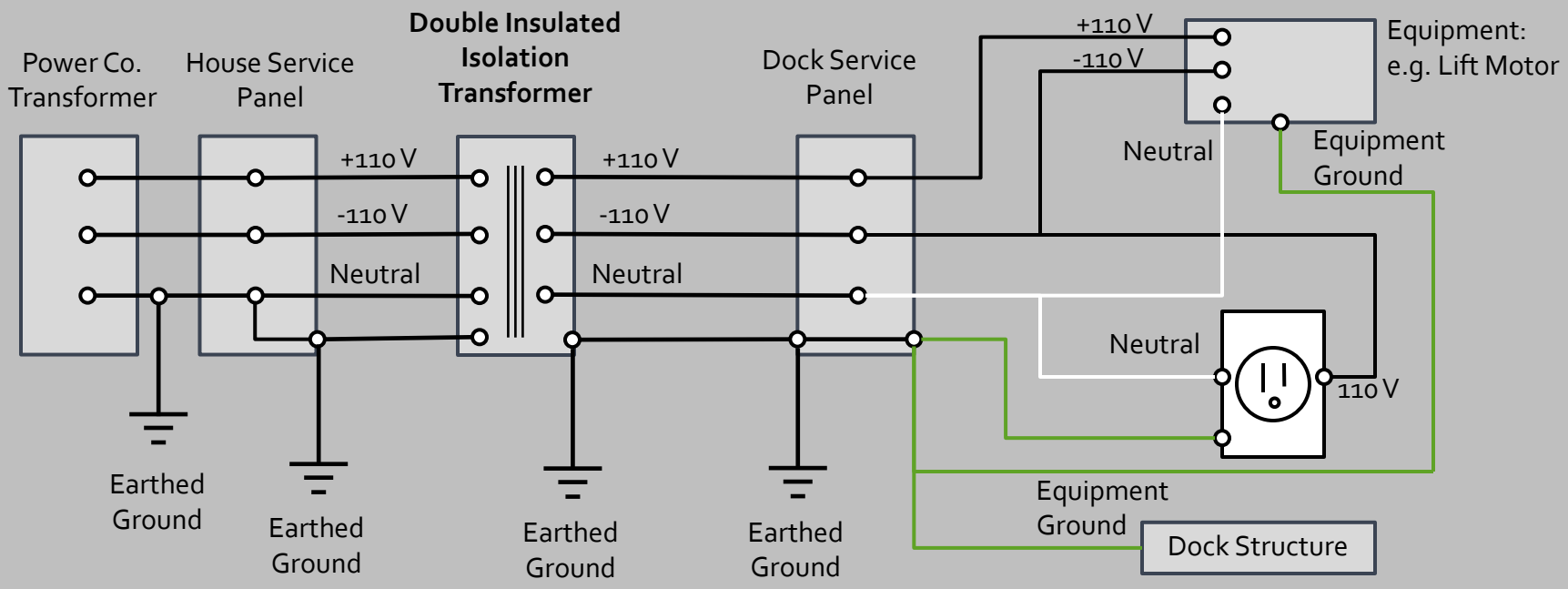



- Full Ground Fault in Lift Motor
- Full Ground Fault at outlet
- Full Ground Fault of frayed wire to structure

Question?
*How common are full current ground faults? A fault must be a very good connection to carry the rated breaker current.*

RESULT:
5 seconds of lethal risk remains *if both GFCIs fail.*

# Isolation Transformer*

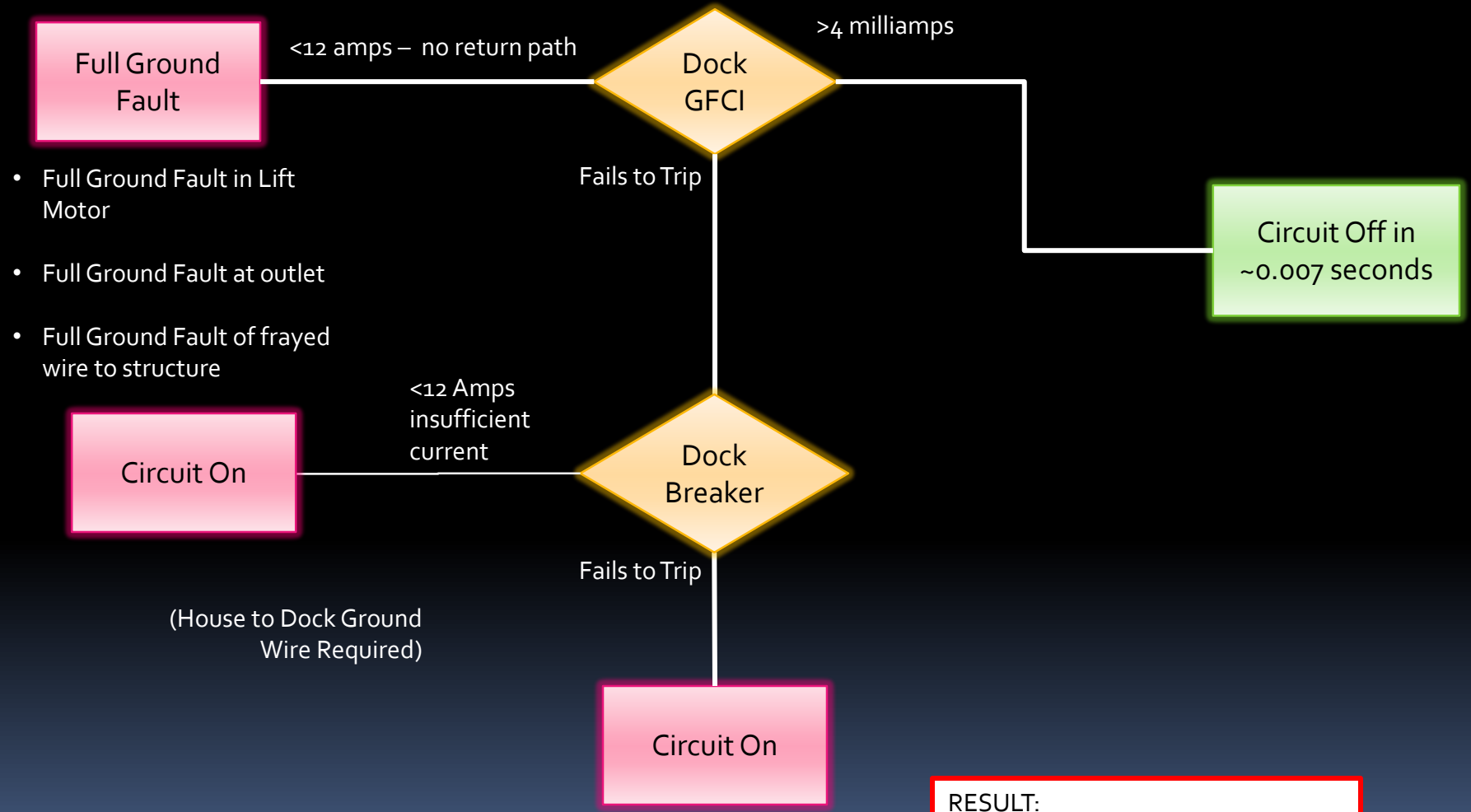



- Using an Isolation Transformer Eliminates Fault Return Path to Dock and House Service Panels

*Isolating equipment and neutral grounds is critical for ESD safety and must be approved by county building inspector.

# Isolation Transformer: Full Current Fault

*Removed Ground Wire Improves Safety, Risk of GFCI Failure Remains*

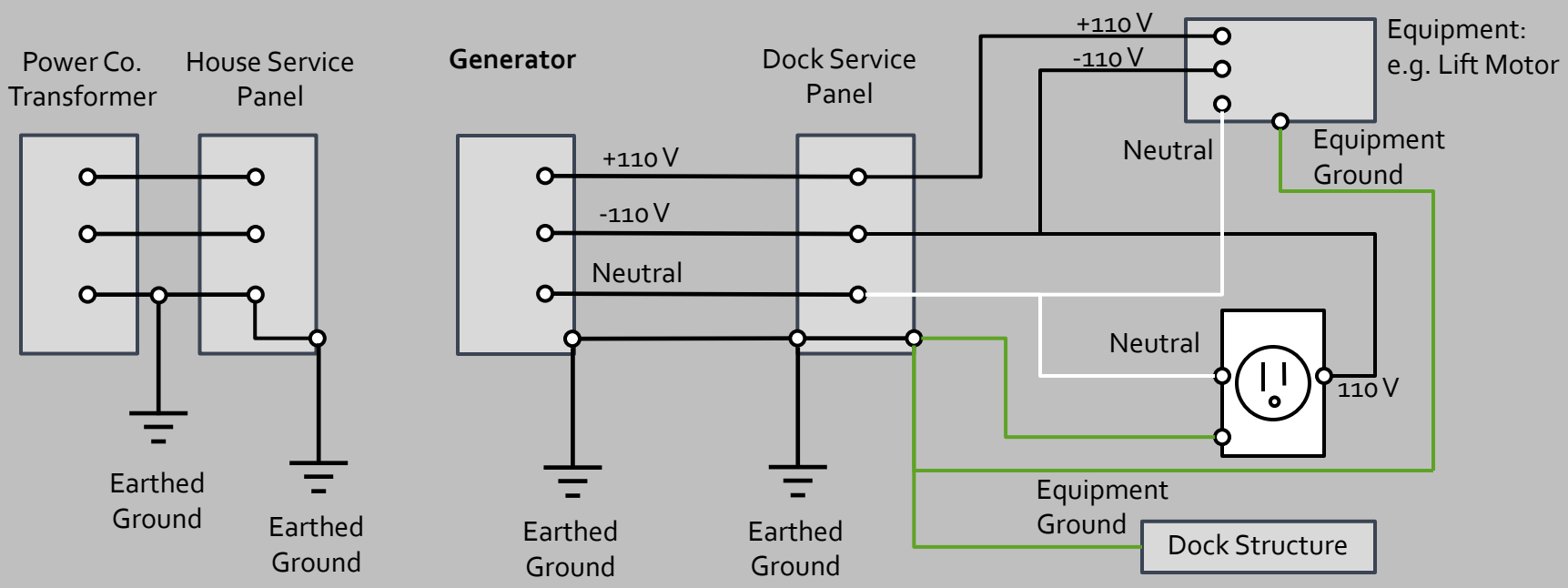



- Full Ground Fault in Lift Motor
- Full Ground Fault at outlet
- Full Ground Fault of frayed wire to structure

(House to Dock Ground Wire Required)

RESULT:
If GFCI fails, power remains on

# Generator*

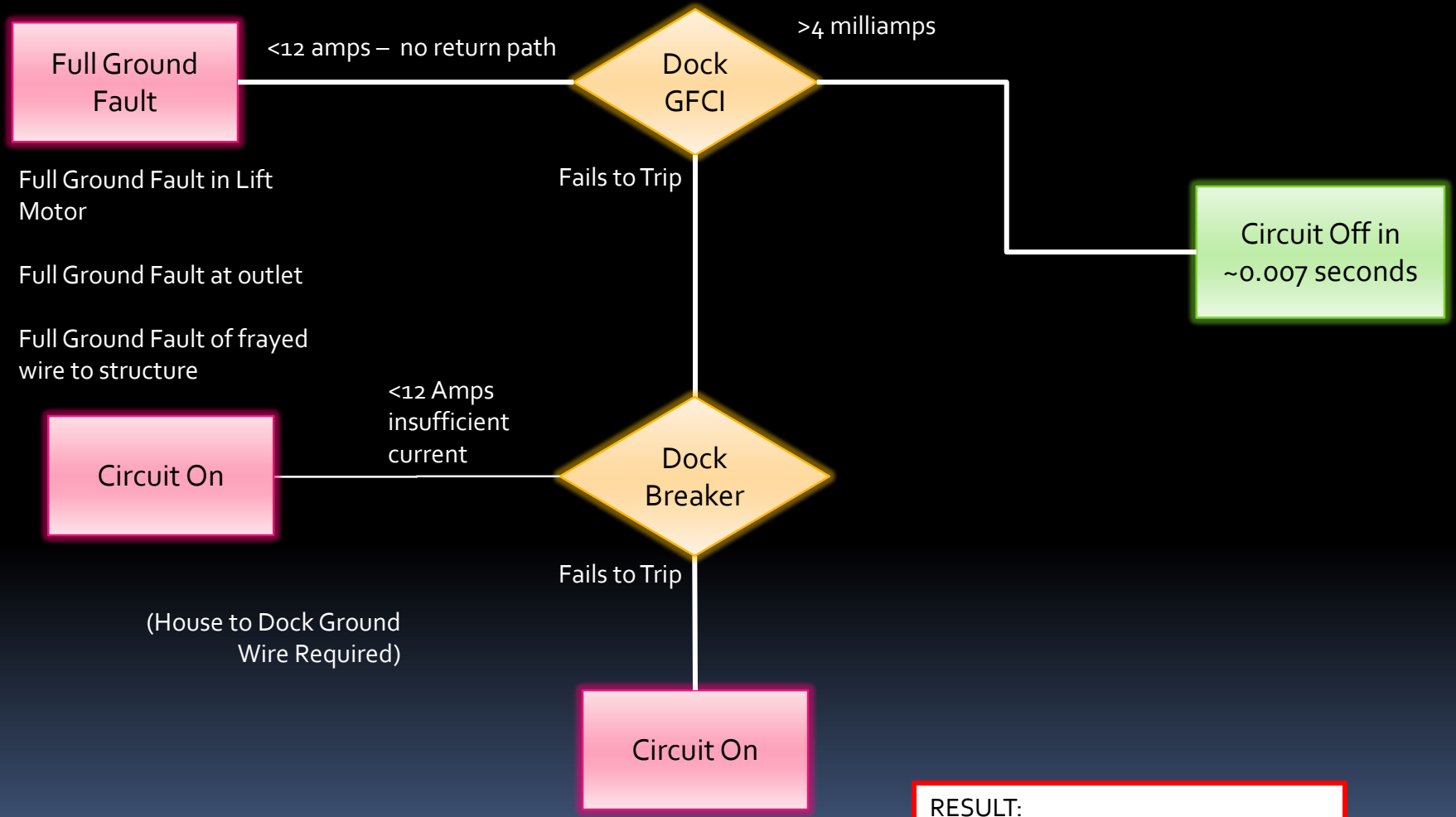



- Using an Generator Eliminates Fault Return Path to Dock and House Service Panels

*Isolating equipment and neutral grounds is critical for ESD safety and must be approved by county building inspector.

# Generator: Full Current Fault

*Removed Ground Wire Improves Safety, Risk of GFCI Failure Remains*

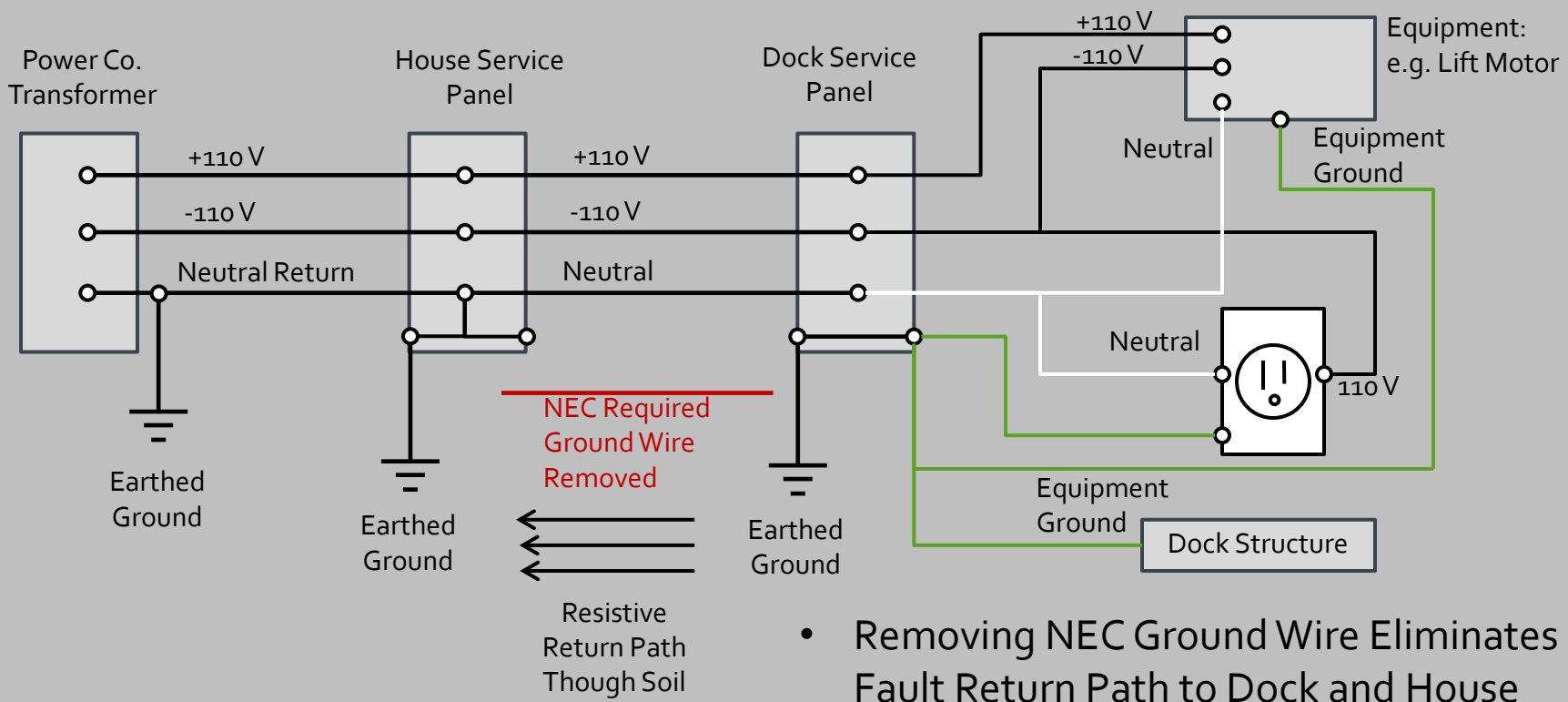



- Full Ground Fault in Lift Motor
- Full Ground Fault at outlet
- Full Ground Fault of frayed wire to structure

(House to Dock Ground Wire Required)

RESULT:
If GFCI fails, power remains on

# Remove NEC Ground Wire*

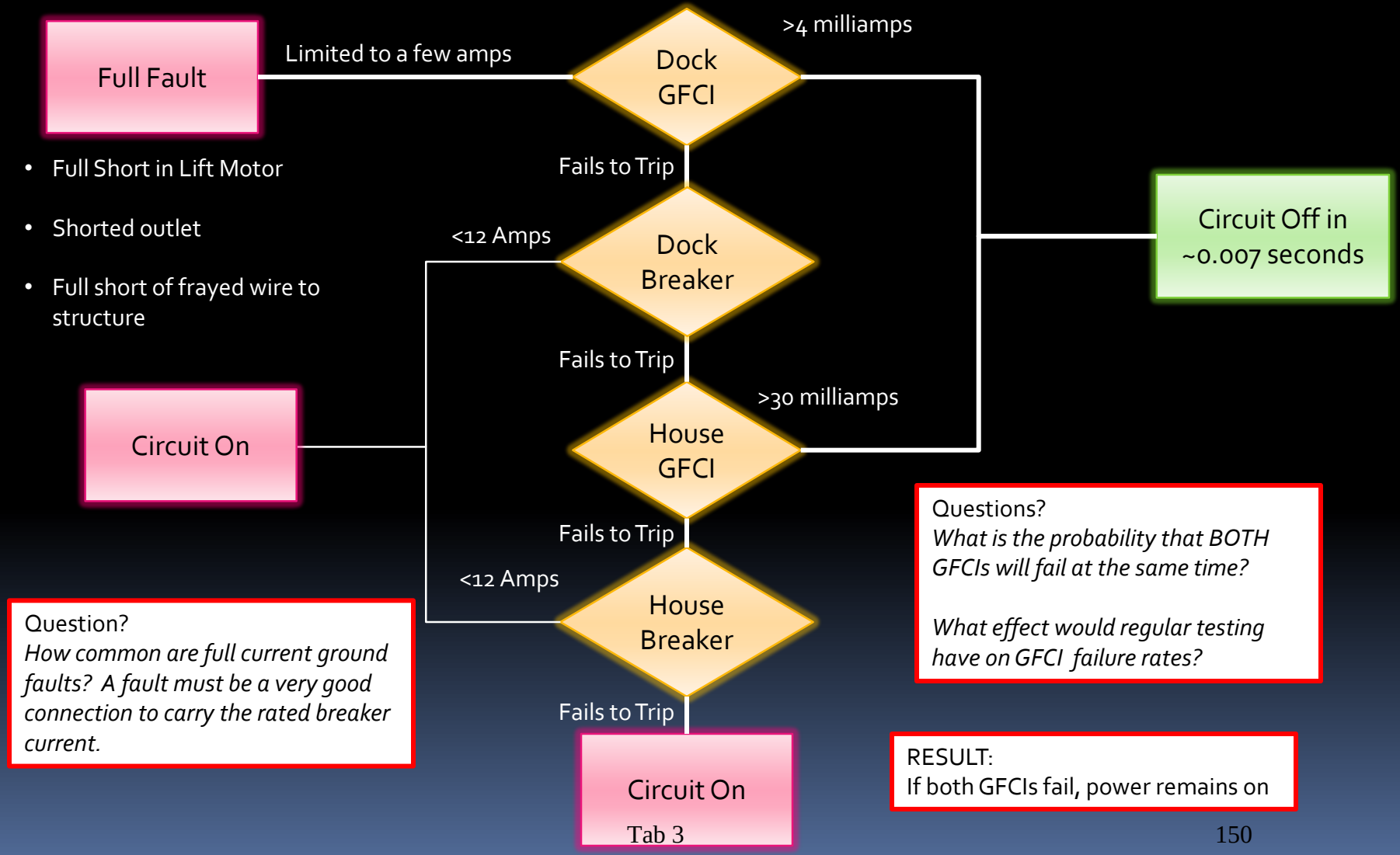



- Removing NEC Ground Wire Eliminates Fault Return Path to Dock and House Service Panels

*Removal of NEC required ground wire must be approved by county building inspector.

# No Ground Wire: Full Current Fault to Ground

## *Resistive (>100 ohms) Return Path Through Ground*




- Full Short in Lift Motor
- Shorted outlet
- Full short of frayed wire to structure

Question?
*How common are full current ground faults? A fault must be a very good connection to carry the rated breaker current.*

Questions?
*What is the probability that BOTH GFCIs will fail at the same time?*

*What effect would regular testing have on GFCI failure rates?*

RESULT:
If both GFCIs fail, power remains on

# Ground Wire Offers Limited Additional Protection *While Substantially Increasing the Risk of ESD*

- Ground wire has NO function or effect in partial faults
  - *Partial faults are believed to be the most common faults that cause ESD death or injury*
- Ground wire has NO function or effect in short/over current load faults
- Ground wire is needed ONLY for high current ground faults and ONLY IF all GFCIs in the circuit fail
  - Double GFCIs offer redundant protection
  - *The risk of a simultaneous GFCIs failures in 30 days (between testing) should be very low.*
  - How common are high current ground faults?

# Conclusions

- *Inaction may cost lives: Our docks are not safe*
- NEC required ground wire must be eliminated
  - *Variance from local inspector required!*
  - *GFCIs at BOTH dock and house are critical*
  - *Regular Testing of GFCIs is critical*
- Past & Present code is inadequate
- Bring grounding and GFCIs up to code
- Lowest cost solution: Obtain a variance to remove the house-to-dock ground wire
- *Safest solution: convert to 12 V DC*



NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

# GFCI FIELD TEST SURVEY REPORT

## January 2001

**Prepared by the NEMA Ground Fault Personnel Protection Section**

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## Foreword

For questions or further information about this report, contact:

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At the time of approval, the Ground Fault Personnel Protection Section of the National Electrical Manufacturers Association had the following members:

Bryant Electric, Inc., Milford, CT
Cooper Wiring Devices, Long Island City, NY
Eaton Corporation, Pittsburgh, PA
Ericson Manufacturing Company, Willoughby, OH
GE Industrial Systems, Plainville, CT
Hubbell Wiring Device-Kellems, Bridgeport, CT
Leviton Manufacturing Co., Inc., Little Neck, NY
Pass & Seymour/Legrand, Syracuse, NY
Siemens Energy & Automation, Inc., Norcross, GA
Square D Company, Cedar Rapids, IO
Technology Research Corporation, Clearwater, FL
Woods Industries, Inc., Carmel, IN

The GFCI Task Force membership included the following members:

Bryant Electric, Inc.
Cooper Wiring Devices
Eaton Corporation
GE Industrial Systems
Hubbell Wiring Device-Kellems
Leviton Manufacturing Co., Inc.
Pass & Seymour/Legrand
Siemens Energy & Automation, Inc.
Square D Company
Underwriters Laboratories, Inc.
Woods Industries, Inc.

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# 1 NEMA GROUND FAULT PERSONNEL PROTECTION (GFCI) SECTION ACTION

In 1999, members of the NEMA GFCI Section received reports of non-operational Ground Fault Circuit Interrupters (GFCI) whereby, after the GFCI had been installed, the GFCI could not perform its intended function or later became non-operational. In response to these reports, the members of the NEMA GFCI Section, at its meeting on September 8, 1999, passed a resolution that read:

> "NEMA 5PP Section supports the conduct of an impartial and comprehensive investigation of field performance of GFCIs. The investigation objective is to obtain statistically valid data to identify, define, and quantify long term operation of GFCIs in the installed infrastructure. For suspected field failures, both the installation and the product must be analyzed and data compiled to enable clear definition of the cause of failure (including condition of use and environment) and mode of failure (e.g., SCR failure, test button failure) sufficient to define remedial action(s) if required."

The GFCI Section formed the Field Test Survey Task Force at that meeting to define the study and how it would be conducted. The study examined 2,680 GFCIs installed in 1,090 residences in ten locations within the continental United States. The task force completed the study and this is the report of the findings. The task force has not attempted to draw conclusions on the results of the study but rather to report the results of the findings.

## 2 PERMUTATIONS

The task force considered a number of variables that could have a possible impact on the performance of GFCIs. The initial list included the following:

* Manufacturer
* Climate of geographic location
* Location within the home
* Lightning
* Surges
* Code enforcement or lack thereof
* Socio-economic background of home owner (cost of home)
* Utility service, i.e., power quality and power surge
* Type of GFCI (CB or Receptacle)
* Age of GFCI
* Age of building
* Type of building
* Seasonal or continuous use
* Urban vs. suburban vs. rural

After considerable discussion, it was decided that a random study of installed products would address many of these items. It was also noted that the same standard (UL 943) is used to evaluate all GFCI products (circuit breakers, receptacles, etc.).

Ultimately, the task force identified Climate and Lightning as being the two key issues to design the study around. Through engineering judgment, the Field Test Survey Task Force identified the following three factors as those having the most potential to affect GFCI reliability:

* Lightning Density (as measured by thunderstorm days)
* Climate (Warm vs. Cool)
* Climate (Humid vs. Dry)

The various permutations of the combinations of these factors were identified as follows:

| Permutation | Lightning Density | Climate (Warm vs. Cool) | Climate (Humid vs. Dry) |
|---|---|---|---|
| 1 | High | Warm | Humid |
| 2 | High | Warm | Dry |
| 3 | High | Cool | Humid |
| 4 | High | Cool | Dry |
| 5 | Low | Warm | Humid |
| 6 | Low | Warm | Dry |
| 7 | Low | Cool | Humid |
| 8 | Low | Cool | Dry |

Table 2.1 -- Meteorological Conditions of Permutations

## 3 SELECTION OF TEST LOCATIONS

Geographical locations were chosen which reflected prevailing conditions indicated in all of the permutations, with the exception of Permutation 5. No feasible location could be found within the contiguous United States for Permutation 5 (i.e., warm, humid environmental conditions with low lightning density); therefore, Permutation 5 was excluded from the survey.

The locations chosen were based on the remaining seven permutations. Sites were selected to get a cross-section of the country. The factors considered when choosing the locations for conducting the study included:

* Diversity in the types of construction where the GFCIs were used
* Climatic conditions likely to affect the function of the GFCI
* Lightning activity that could affect the GFCI operation
* Practicality in obtaining a sufficient number of GFCI installations in a given location to ensure the statistical validity of the survey

Each of these factors was first considered separately, and then the results were integrated to determine the best selection of locations for the survey. The experience of the survey task force members was relied upon to establish the general areas of the country that would provide diversified types of construction.

Climatic conditions were determined by consulting literature that divided the continental United States into eight distinct regions. Published data for temperature, humidity, precipitation, and other significant climatic features for specific locations in these areas were considered. The locations chosen for the survey represented the extremes of climate likely to affect the operation of a GFCI. In addition, distribution throughout the climatic regions of the United States was considered.

The lightning consideration was the most straightforward issue. Published data clearly indicates the highest levels of lightning activity in the United States.[1] This data was used to choose high lightning activity locations for the survey.

The practicality of choosing locations where the survey could be readily conducted was based on information provided by HomePro Systems, Inc. They advised the survey group as to where they have established affiliates and could therefore provide services most efficiently and confidently.

Taking into account all of the above factors, the following 12 continental United States locations were chosen for the survey:

* Birmingham, AL (Permutation 1)
* Tampa, FL (Permutation 1)
* Austin, TX (Permutation 2)

[1] As indicated in the isokernuric map referenced in IEEE C62.41.

* Phoenix, AZ (Permutation 2)
* Washington, DC (Permutation 3)
* Kansas City, KS (Permutation 4)
* Los Angeles, CA (Permutation 6)
* Portland, ME (Permutation 7)
* Seattle, WA (Permutation 7)
* Denver, CO (Permutation 8)
* Minneapolis, MN (Permutation 8)
* Salt Lake City, UT (Permutation 8)

As can be readily observed when plotted on a map, these are well distributed, diversified locations for conducting the GFCI survey.

## 4 GATHERING OF DATA — USE OF HOME INSPECTORS

Getting a comprehensive and objective understanding of the scope of any problem and its causes requires randomized data from a sufficient sample size, as well as recovery and processing of non-operational devices for inspection. Data must be collected in an objective and unbiased manner. The task force spent considerable time reviewing how this could be done.

Since existing homes were to be surveyed, access to the home was a prime consideration. This would be entirely at the discretion of the homeowner. The various options discussed for collecting data included:

* A survey done through fire departments. It was believed this could result in skewed data, and time and access would be a problem.
* Inspections conducted by electrical inspectors. How would inspectors gain access to homes? Even if they could, it might be a burden on and expense to the owner.
* Employees of the manufacturers conduct the survey. This would be fast and inexpensive. Some concern was expressed that the data might be suspect.
* Electrical contractors conduct inspection and replacement.
* Home inspectors conduct inspection.

Home inspectors were chosen as the best option to gain access to residential GFCIs in a widespread, random, and unbiased manner. Home inspectors routinely test GFCIs when they inspect homes on the sales market, so they already have the necessary access.

HomePro Systems, Inc., of Falls Church, Virginia, was identified as being able not only to collect GFCI test data for the Washington, DC, area, but to coordinate in the other eleven areas of the nationwide survey. The selection of locations for the survey was influenced, in some cases, by the ability of HomePro to facilitate every location. HomePro specializes in training people for home inspections and is familiar with the problems encountered by home inspectors. They were also asked to prepare a training and testing electronic diskette in order to provide inspectors with information on what was to be done, and how it was to be done.

## 5 FIELD SURVEY TEST PROCEDURES

It was decided to conduct a pilot study in the Washington, DC, area, in order to ascertain the effectiveness of the home inspector option, and so that adjustments to protocols and forms could be made prior to conducting a nationwide survey. With the completion of the pilot study in the spring of 2000, the program was initiated in the remaining eleven cities in July.

By and large, the pilot program yielded the necessary data in a timely manner, demonstrating that the decision to use home inspectors for collection of data was a sound one. However, it did result in some missing data and misinterpretation of the inspection data form (Appendix A) by home inspectors, even though the training covered these areas. Based on this experience, some adjustments were made in the forms and the procedures.

The inspection procedure was generally as follows:

1. Home inspectors were identified and contracted in each of the cities.
2. Electrical contractors were identified in each of the cities and contracted to replace any devices identified as non-operational.
3. When a home inspector was hired to do a home inspection, he also performed the testing as specified on the Inspection Datasheets (Appendix A) for the task force study, and the forms were completed. The completed forms were sent to Underwriters Laboratories (UL) for data collection. The first page of the form gathered data regarding installation of the GFCI and the results of the test procedure on the second page. The following procedure was used to test the GFCI:
    A. For the receptacle type GFCIs, the test consisted of plugging an indicating load, such as a lamp, into the GFCI outlet with the circuit on. The “test” button was then pushed, and the inspector noted one of the following conditions: 1) the GFCI tripped and the indicating load was turned off; 2) the GFCI tripped and the indicating load remained on; 3) the GFCI did not trip; or 4) the GFCI tripped, but could not be reset.
    B. For the circuit breaker type GFCIs, the test consisted of pushing the circuit breaker “test” button with the circuit breaker on. The inspector noted one of the following conditions: 1) the circuit breaker tripped, as evidenced by the handle moving to the trip position; 2) the circuit breaker did not trip; or 3) the circuit breaker tripped, but could not be reset.
4. If a home inspector found a non-functioning GFCI, he left a packet with the property owner identifying the non-operational device and instructions on how the owner could have the device replaced.
5. When the property owner contacted one of the participating electrical contractors, the electrician would replace the device, complete the form in Appendix B with additional information, and return the removed device and completed forms to UL.

6. Upon receiving a device, UL made an initial evaluation to determine the operation of the GFCI under laboratory conditions. It was then forwarded to the manufacturer for a full evaluation using the forms in Appendix C.
7. The manufacturer reported the results of their evaluation back to UL to be included in the data (see Appendices D and E).

## 6 STATISTICAL IMPORTANCE

To ensure statistical validity, a design of experiments was developed. The goal of the task force was to estimate the true failure rate to within +/-5% at the 95% confidence level.

Each permutation should be represented by statistically significant samples. The sample size was determined through the following calculation:

Assuming a Large Population,

| Symbol | Symbol Description | Known/Unknown |
|---|---|---|
| $n$ | Sample size | Unknown |
| $\delta$ | Acceptable error in percentage | 0.05 |
| $P$ | True proportion | Unknown |
| $P`$ | Largest reasonable guess for $P$[†] | 0.21 |
| $z$ | From normal curve | 1.96 |

Assuming that $P$ is less than $P`$

$$n = \frac{z^2 * P` * (1 - P`)}{\delta^2}$$

Solving for $n$ yields 254.92 samples.

The overall plan was to obtain at least 255 samples from each of the permutations listed to have a statistically significant sample for that permutation. A "sample" is defined as one GFCI unit.

### 6.1 Analysis of Survey Findings

Failure rates for the seven remaining permutations were determined with a statistical confidence better than +/- 5% at the 95% confidence level. Differing levels of statistical confidence were achieved for other views of the data; for example, just high lightning areas, disregarding other factors. The ANOVA (Analysis Of Variance) analysis of the failure rates of the seven permutations yields the following results:

[†] This initial value of P' was determined through a survey completed in 1999 by Leviton Manufacturing Company, Inc., of Little Neck, New York.

| Term | Coefficient for All GFCIs | Coefficient for Circuit Breakers | Coefficient for Receptacles |
|---|---|---|---|
| Constant | +0.090008 | +0.16751 | +0.086472 |
| Lightning Density Low/High | +0.002187 | -0.03908 | +0.002712 |
| Climate Cool/Warm | -0.001515 | -0.04480 | -0.000220 |
| Climate Dry/Humid | +0.015291 | +0.08204 | +0.013087 |
| Lightning Density Low/High*Climate Cool/Warm | +0.009595 | +0.08989 | +0.008178 |
| Lightning Density Low/High*Climate Dry/Humid | -0.001582 | -0.06899 | -0.000652 |
| Climate Cool/Warm*Climate Dry/Humid | -0.005109 | -0.07471 | -0.002846 |
| Lightning Density Low/High*Climate Cool/Warm*Climate Dry/Humid | +0.001535 | +0.00442 | +0.002757 |

Table 6.1 -- Table of Coefficients

In comparing term variables, coefficients departing from zero indicate trends, either positive or negative. This ANOVA analysis of the results shows that some of the second and third order interactions yield coefficients that are similar in magnitude to those of the first order variables. This may imply that these three factors do not fully capture all the variation present that determines the failure rate. (The failure rate for Permutation 5 was assumed to be the average.)

Comparison of failure rate ranges for circuit breakers in any of the permutations yields failure rate range estimates which exceed those initially set by the study because the number of samples per permutation is below the minimum of 255 samples.

## 7 STUDY RESULTS

This section contains charts presenting the data from the NEMA GFCI Field Test Survey. It is organized by inspection results, type of GFCI unit (i.e., circuit breakers and receptacles), and permutation. The data presented here was compiled from inspection results, as well as from UL and manufacturer testing.

### 7.1 Permutation Location

Figure 7.1 identifies the combinations of meteorological conditions within each permutation. Regions which were eventually abandoned are in italics.

Figure 7.1—Permutations

| Perm | Meteorological Conditions | Region/City |
|---|---|---|
| 1 | High Lightning Density, Warm, Humid | Birmingham, AL |
| | | Tampa, FL |
| 2 | High Lightning Density, Warm, Dry | Austin, TX |
| | | *Phoenix, AZ* |
| 3 | High Lightning Density, Cool, Humid | Washington, DC |
| 4 | High Lightning Density, Cool, Dry | Kansas City, MO |
| 5 | Low Lightning Density, Warm, Humid | NONE |
| 6 | Low Lightning Density, Warm, Dry | Los Angeles, CA |
| 7 | Low Lightning Density, Cool, Humid | Portland, ME |
| | | Seattle, WA |
| 8 | Low Lightning Density, Cool, Dry | Denver, CO |
| | | Minneapolis, MN |
| | | *Salt Lake City, UT* |

### 7.2 Main (Totals) Summary

Figure 7.2 presents, by operational status, the total amount of GFCI units tested in the NEMA GFCI Field Test Survey. It is organized by city, in order of permutation. This chart is based on data received from the field (inspection results) as compiled in Appendix F. Appendix G explains the terms and abbreviations used in Appendix F.

NOTE 1: The data compiled in Appendix F includes GFCIs tested in homes that were six months old and newer. This data is not used in the subsequent analysis.

NOTE 2: Although initially selected for inclusion in this survey, Phoenix, Arizona (Permutation 2), and Salt Lake City, Utah (Permutation 8), were not productive in providing any inspection results, and were eventually abandoned. However, because they appeared in the original selection of cities, they have been included in this main summary. They are not included in the remainder of the results.

NOTE 3: Not all GFCIs identified as non-operational were recovered, even after repeated efforts, and are therefore not included in the failure analysis in Appendices D and E.

Figure 7.2—Main (Totals) Summary

| | | GFCIs | Tested | Inspection Results | | | | |
|---|---|---|---|---|---|---|---|---|
| | Homes | | Quantity | Operational | Non-Operational | | | GFCIs |
| Region (Permutation) | Surveyed | Total | of Type | Trip/Off/Reset | Trip / On | No Trip | No Reset | Recovered |
| **Birmingham, AL (1)** | 43 | 107 | | | | | | |
| Circuit Breakers | | | 23 | 21 | 0 | 2 | 0 | 2 |
| Receptacles | | | 84 | 73 | 1 | 8 | 2 | 7 |
| **Tampa, FL (1)** | 100 | 210 | | | | | | |
| Circuit Breakers | | | 20 | 17 | 0 | 3 | 0 | 3 |
| Receptacles | | | 190 | 171 | 6 | 13 | 0 | 10 |
| **Austin, TX (2)** | 160 | 355 | | | | | | |
| Circuit Breakers | | | 13 | 10 | 0 | 3 | 0 | 0 |
| Receptacles | | | 342 | 313 | 11 | 15 | 3 | 5 |
| **Phoenix, AZ (2)** | 0 | 0 | | | | | | |
| Circuit Breakers | | | 0 | | | | | |
| Receptacles | | | 0 | | | | | |
| **Washington DC (3)** | 131 | 286 | | | | | | |
| Circuit Breakers | | | 30 | 25 | 0 | 5 | 0 | 3 |
| Receptacles | | | 256 | 232 | 8 | 14 | 2 | 12 |
| **Kansas City, KS (4)** | 136 | 404 | | | | | | |
| Circuit Breakers | | | 11 | 11 | 0 | 0 | 0 | 0 |
| Receptacles | | | 393 | 366 | 5 | 21 | 1 | 16 |
| **Los Angeles, CA (6)** | 183 | 361 | | | | | | |
| Circuit Breakers | | | 4 | 4 | 0 | 0 | 0 | 0 |
| Receptacles | | | 357 | 333 | 5 | 19 | 0 | 10 |
| **Portland, ME (7)** | 9 | 21 | | | | | | |
| Circuit Breakers | | | 1 | 1 | 0 | 0 | 0 | 0 |
| Receptacles | | | 20 | 19 | 0 | 0 | 1 | 0 |
| **Seattle, WA (7)** | 88 | 273 | | | | | | |
| Circuit Breakers | | | 6 | 2 | 0 | 4 | 0 | 1 |
| Receptacles | | | 267 | 236 | 9 | 21 | 1 | 15 |
| **Denver, CO (8)** | 56 | 158 | | | | | | |
| Circuit Breakers | | | 12 | 9 | 0 | 3 | 0 | 0 |
| Receptacles | | | 146 | 139 | 2 | 3 | 2 | 2 |
| **Minneapolis, MN (8)** | 184 | 505 | | | | | | |
| Circuit Breakers | | | 33 | 31 | 0 | 2 | 0 | 0 |
| Receptacles | | | 472 | 434 | 4 | 31 | 3 | 13 |
| **Salt Lake City, UT (8)** | 0 | 0 | | | | | | |
| Circuit Breakers | | | 0 | | | | | |
| Receptacles | | | 0 | | | | | |
| **Totals** | 1090 | 2680 | | | | | | |
| **Circuit Breakers** | | | 153 | 131 | 0 | 22 | 0 | 9 |
| **Receptacles** | | | 2527 | 2316 | 51 | 145 | 15 | 90 |

### 7.3 Sub-Summary by Permutation

Figure 7.3 illustrates, by permutation, the total number of operational and non-operational GFCIs in terms of quantity and percent.

Each permutation is represented by a statistically significant overall sample size of at least 255 GFCIs which combine to give an error of not more than +/- 5% at the 95% confidence level.

Figure 7.3—Sub-Summary by Permutation

| | GFCIs | | | | |
|---|---|---|---|---|---|
| **Permutation Number** | **Total** | **Operational** | | **Non-Operational** | |
| | | **Quantity** | **Percent** | **Quantity** | **Percent** |
| **Permutation 1** | | | | | |
| Circuit Breakers | 43 | 38 | 88.4% | 5 | 11.6% |
| Receptacles | 274 | 244 | 89.1% | 30 | 10.9% |
| All GFCIs | 317 | 282 | 89.0% | 35 | 11.0% |
| | | | | | |
| **Permutation 2** | | | | | |
| Circuit Breakers | 13 | 10 | 76.9% | 3 | 23.1% |
| Receptacles | 342 | 313 | 91.5% | 29 | 8.5% |
| All GFCIs | 355 | 323 | 91.0% | 32 | 9.0% |
| | | | | | |
| **Permutation 3** | | | | | |
| Circuit Breakers | 30 | 25 | 83.3% | 5 | 16.7% |
| Receptacles | 256 | 232 | 90.6% | 24 | 9.4% |
| All GFCIs | 286 | 257 | 89.9% | 29 | 10.1% |
| | | | | | |
| **Permutation 4** | | | | | |
| Circuit Breakers | 11 | 11 | 100.0% | 0 | 0.0% |
| Receptacles | 393 | 366 | 93.1% | 27 | 6.9% |
| All GFCIs | 404 | 377 | 93.3% | 27 | 6.7% |
| | | | | | |
| **Permutation 6** | | | | | |
| Circuit Breakers | 4 | 4 | 100.0% | 0 | 0.0% |
| Receptacles | 357 | 333 | 93.3% | 24 | 6.7% |
| All GFCIs | 361 | 337 | 93.4% | 24 | 6.6% |
| | | | | | |
| **Permutation 7** | | | | | |
| Circuit Breakers | 7 | 3 | 42.9% | 4 | 57.1% |
| Receptacles | 287 | 255 | 88.9% | 32 | 11.1% |
| All GFCIs | 294 | 258 | 87.8% | 36 | 12.2% |
| | | | | | |
| **Permutation 8** | | | | | |
| Circuit Breakers | 45 | 40 | 88.9% | 5 | 11.1% |
| Receptacles | 618 | 573 | 92.7% | 45 | 7.3% |
| All GFCIs | 663 | 613 | 92.5% | 50 | 7.5% |

NOTE: See Section 6.1 for statistical significance.

## 7.4 Sub-Summary by Condition

Figure 7.4a illustrates, by meteorological condition, the distribution of operational and non-operational GFCIs. The permutations in which each condition occurs are also noted.

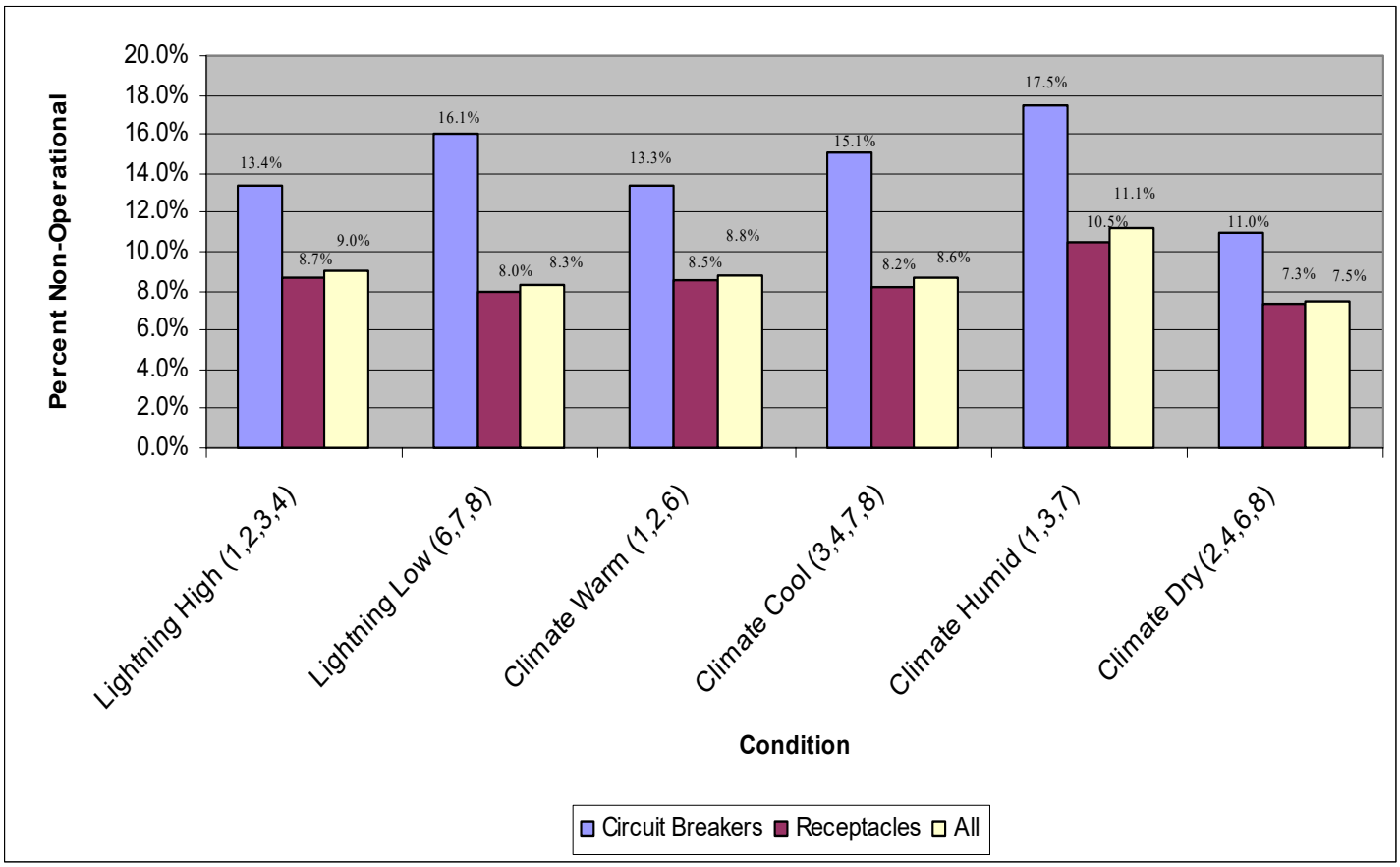
Figure 7.4a—Sub-Summary by Condition

| Condition (Permutation Nos.) | GFCIs | | | | |
|---|---|---|---|---|---|
| | Total | Operational | | Non-Operational | |
| | | Quantity | Percent | Quantity | Percent |
| **Lightning High (1,2,3,4)** | | | | | |
| Circuit Breakers | 97 | 84 | 86.6% | 13 | 13.4% |
| Receptacles | 1265 | 1155 | 91.3% | 110 | 8.7% |
| All GFCIS | 1362 | 1239 | 91.0% | 123 | 9.0% |
| | | | | | |
| **Lightning Low (6,7,8)** | | | | | |
| Circuit Breakers | 56 | 47 | 83.9% | 9 | 16.1% |
| Receptacles | 1262 | 1161 | 92.0% | 101 | 8.0% |
| All GFCIs | 1318 | 1208 | 91.7% | 110 | 8.3% |
| | | | | | |
| **Climate Warm (1,2,6)** | | | | | |
| Circuit Breakers | 60 | 52 | 86.7% | 8 | 13.3% |
| Receptacles | 973 | 890 | 91.5% | 83 | 8.5% |
| All GFCIs | 1033 | 942 | 91.2% | 91 | 8.8% |
| | | | | | |
| **Climate Cool (3,4,7,8)** | | | | | |
| Circuit Breakers | 93 | 79 | 84.9% | 14 | 15.1% |
| Receptacles | 1554 | 1426 | 91.8% | 128 | 8.2% |
| All GFCIs | 1647 | 1505 | 91.4% | 142 | 8.6% |
| | | | | | |
| **Climate Humid (1,3,7)** | | | | | |
| Circuit Breakers | 80 | 66 | 82.5% | 14 | 17.5% |
| Receptacles | 817 | 731 | 89.5% | 86 | 10.5% |
| All GFCIs | 897 | 797 | 88.9% | 100 | 11.1% |
| | | | | | |
| **Climate Dry (2,4,6,8)** | | | | | |
| Circuit Breakers | 73 | 65 | 89.0% | 8 | 11.0% |
| Receptacles | 1710 | 1585 | 92.7% | 125 | 7.3% |
| All GFCIs | 1783 | 1650 | 92.5% | 133 | 7.5% |

NOTE: See Section 6.1 for statistical significance.

Figure 7.4b expresses, by percentage, the distribution of non-operational GFCIs within each of the meteorological conditions. The permutations in which each condition occurs are also noted.

Figure 7.4b—Sub-Summary of Conditions by Percentage Non-Operational



## 7.5 GFCI Circuit Breaker Sub-Summaries

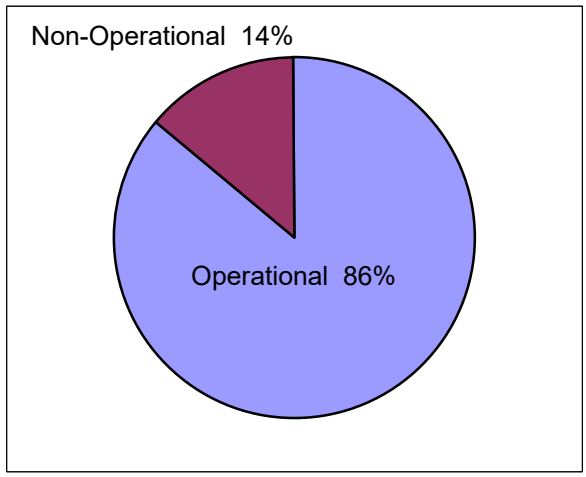
Sections 7.5.1 through 7.5.6 present sub-summaries of the GFCI circuit breaker data.

### 7.5.1 Overall Performance

Figure 7.5.1 shows the percentage of operational and non-operational GFCI circuit breakers in the survey.

**GFCI Circuit Breaker Overall Performance**

Figure 7.5.1—All Including Unknown Locations: Sample size of 153




### 7.5.2 Operational and Non-Operational Percentages by Location

Figures 7.5.2a and 7.5.2b show, by location, the percentages of GFCI circuit breakers determined by the home inspectors to be operational and non-operational. Circuit breakers were specified to be either indoors or outdoors.

Figure 7.5.2a—Indoor: Sample size of 82

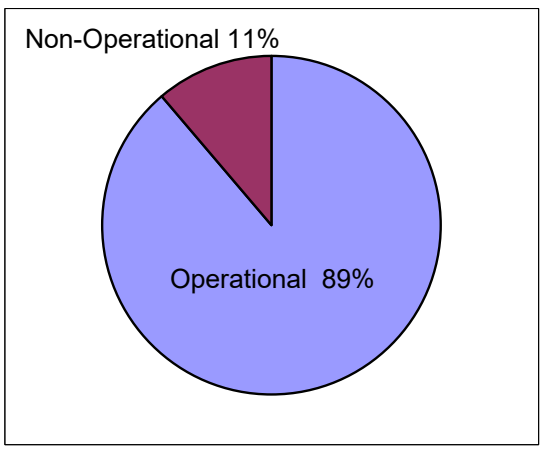
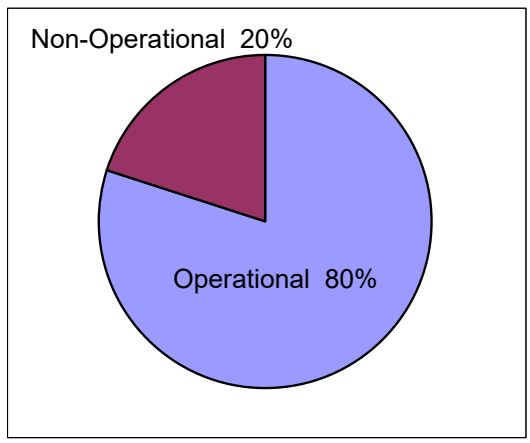



Figure 7.5.2b—Outdoor: Sample size of 20

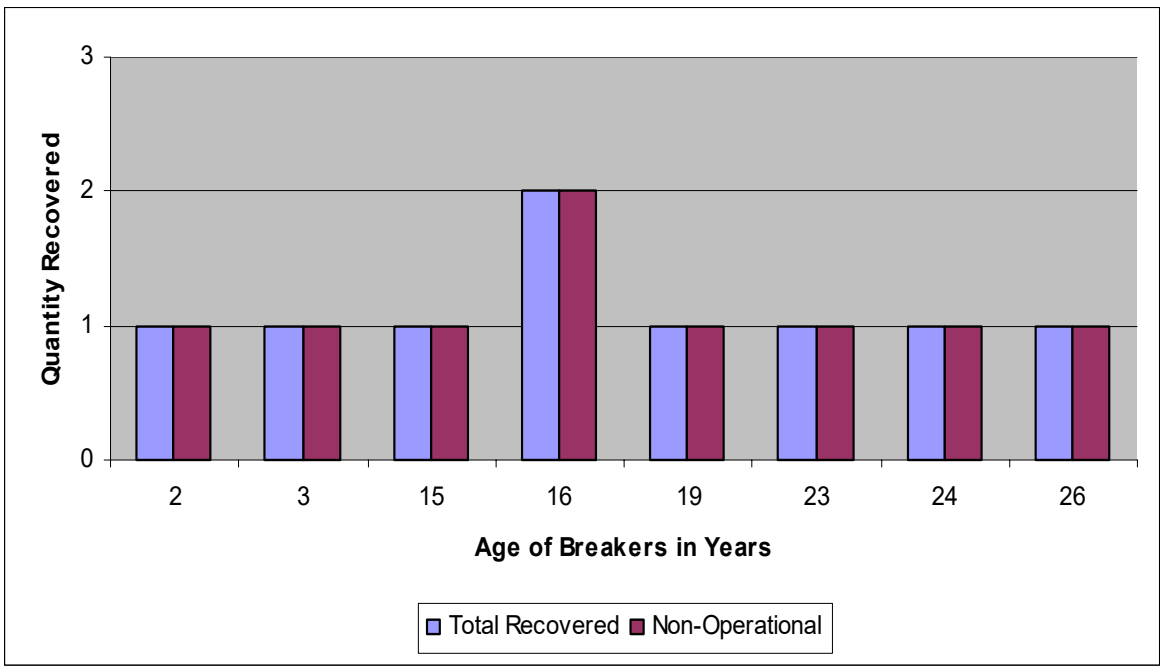


### 7.5.3 Age and Condition of GFCI Circuit Breakers

Figure 7.5.3 shows the age distribution of the recovered circuit breakers, and that each of the non-operational circuit breakers (as determined by the inspectors) was in fact non-operational when tested by UL and the manufacturer.

NOTE: Age cannot be determined by the home inspector. Age can only be determined on recovered devices.

Figure 7.5.3—Age and Condition of Non-Operational GFCI Circuit Breakers: Sample size of 9



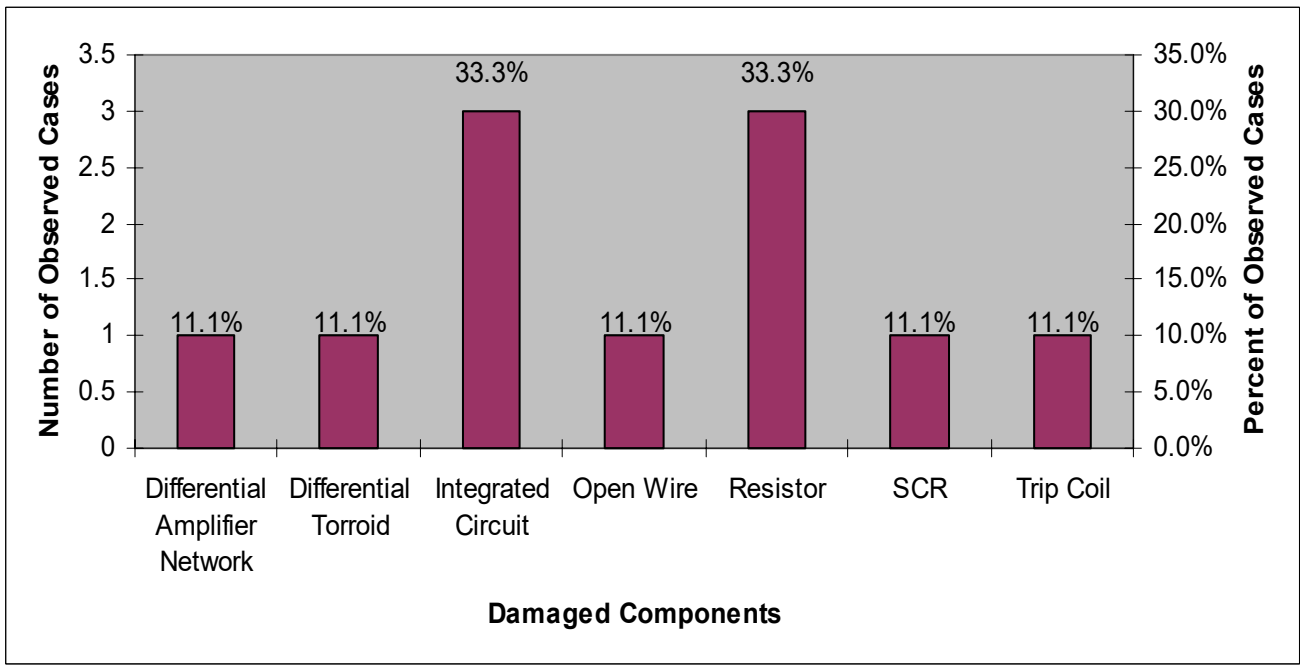
### 7.5.4 Mis-Wired GFCI Circuit Breakers

There is no figure for mis-wired GFCI circuit breakers. Mis-wiring is not an issue with circuit breaker GFCIs. This is due to the configuration of the device and its installation in the panel.

### 7.5.5 Damaged GFCI Circuit Breaker Components

Figure 7.5.6 illustrates, by quantity and percentage, the types of component damage that were found in recovered non-operational GFCI circuit breakers by the manufacturer. A given GFCI can have multiple damaged components.

Figure 7.5.5—Damaged GFCI Circuit Breaker Components: Sample size of 9



## 7.6 GFCI Receptacle Sub-Summaries

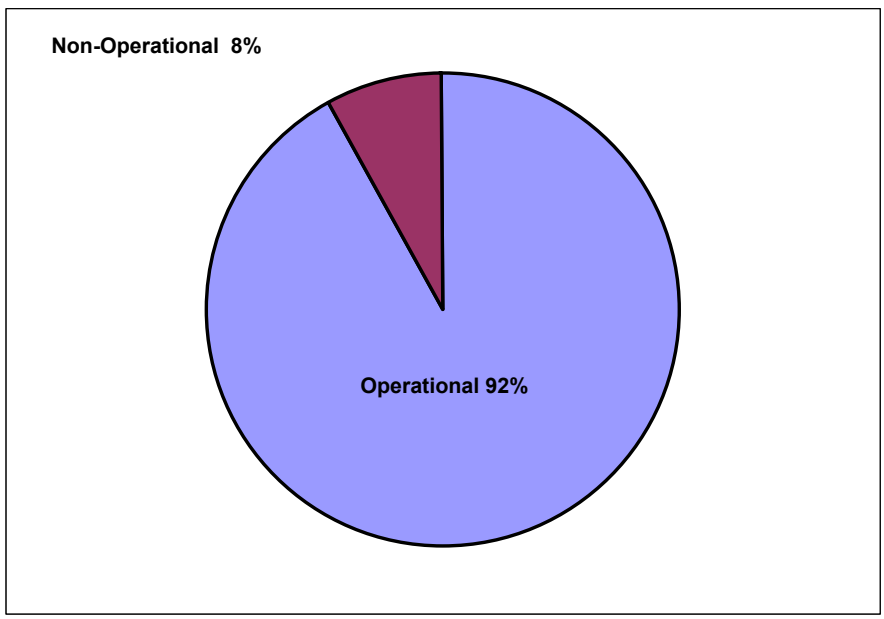
Sections 7.6.1 through 7.6.6 present sub-summaries of the GFCI receptacle data.

### 7.6.1 Overall Performance.

Figure 7.6.1 shows the percentage of operational and non-operational GFCI receptacles in the survey.

Figure 7.6.1—GFCI Receptacle Overall Performance:

Sample size of 2527

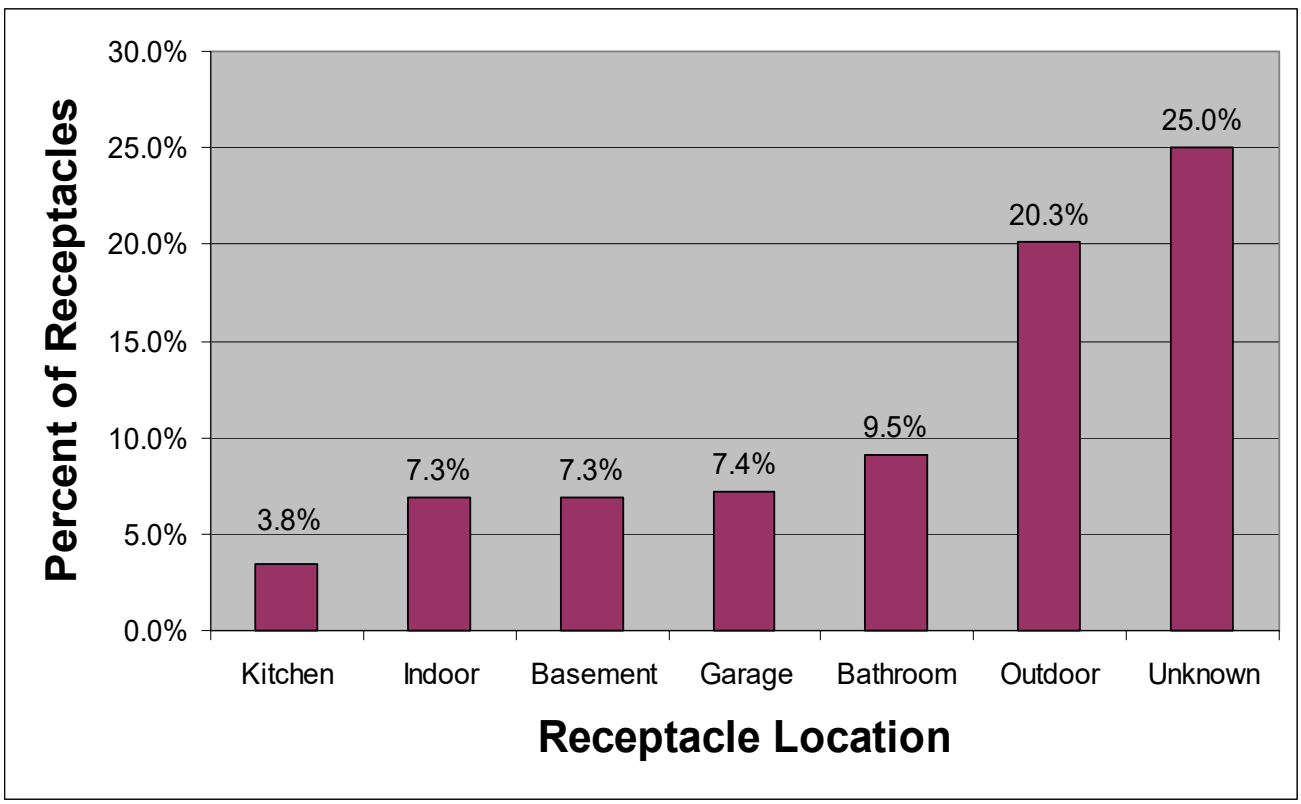


### 7.6.2 Operational and Non-Operational Percentages by Location

Figure 7.6.2 illustrates the percentage of non-operational (as determined by the home inspector) GFCI receptacles in each specified location.

The designation “unknown” refers to those units without a specified location on the inspector datasheets, as well as those units whose location, although specified, could not be definitively identified as indoor or outdoor.

Figure 7.6.2—Percentage of Non-Operational Receptacle GFCIs in Each Specific Location




“Indoor” includes the total non-operational GFCIs in kitchen, basement, garage, and bathroom.

### 7.6.3 Age and Condition of Recovered GFCI Receptacles

Figure 7.6.3a presents the age distribution of the recovered GFCI receptacles. With each age group, the figure compares, by age, the number of recovered GFCI receptacles (non-operational as determined by the home inspectors) to the number of non-operational GFCI receptacles (as determined by UL and the manufacturer).

Note: The age of the four receptacles shown as unknown could not be determined.

Figure 7.6.3a—Age and Condition of Recovered Non-Operational GFCI Receptacles: Sample size of 90

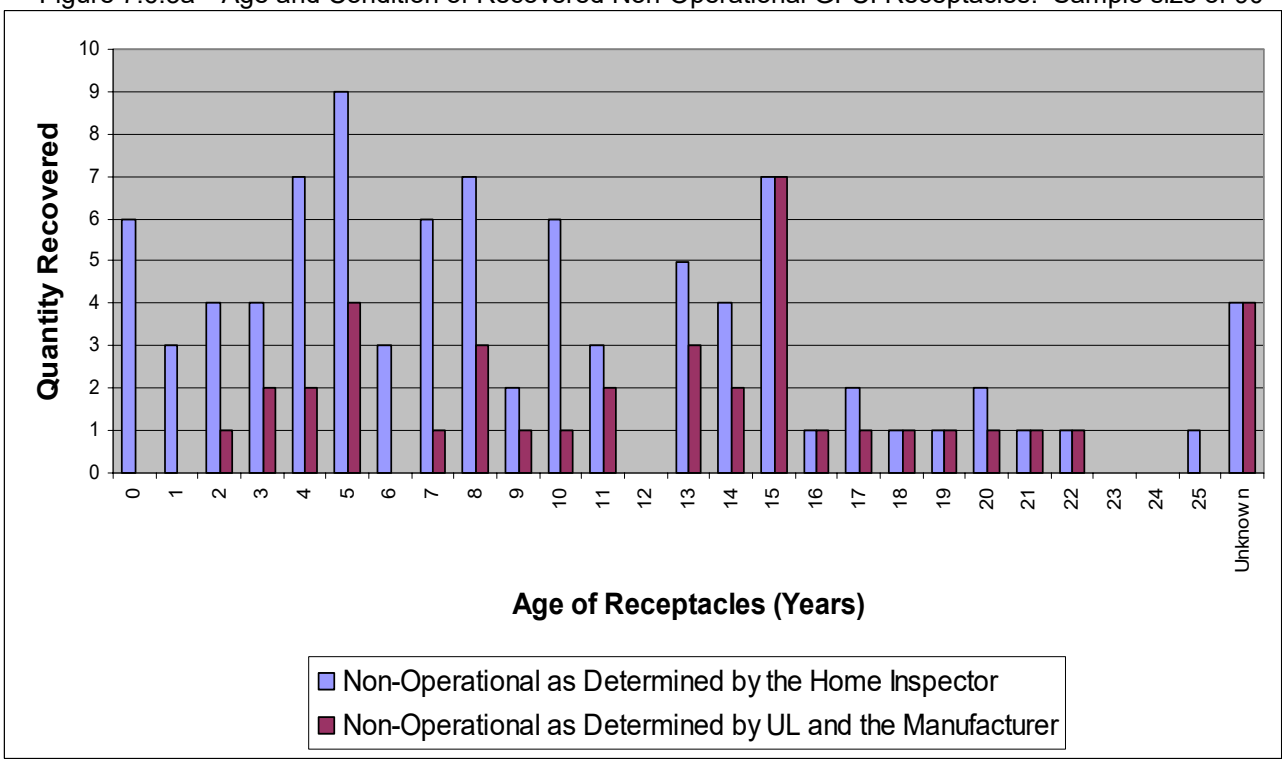
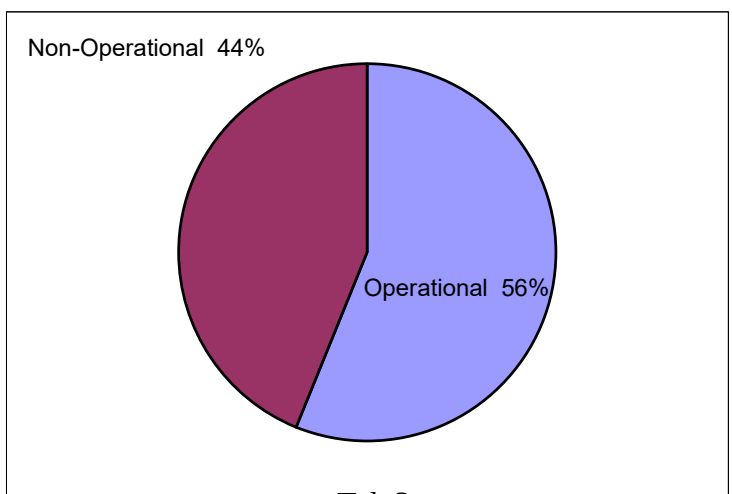



Figure 7.6.3b represents the distribution of recovered GFCI receptacles as to their operational or non-operational status, as determined by UL and the manufacturer.

7.6.3b—Recovered Receptacle Condition: Sample size of 90

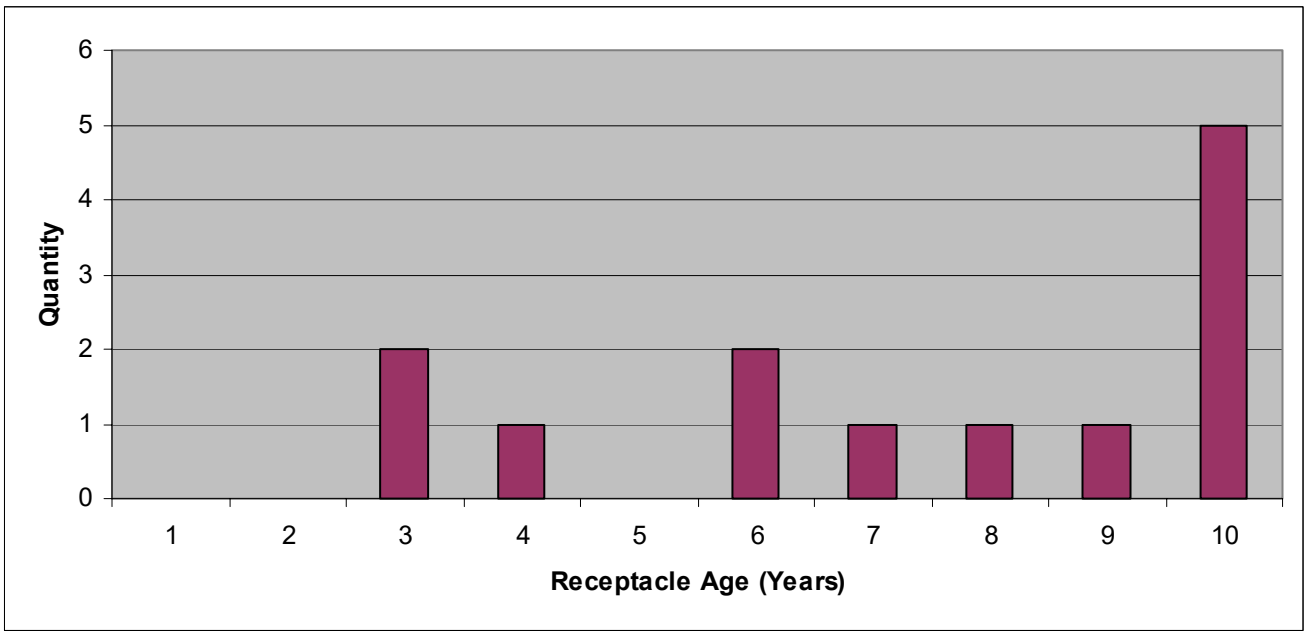


### Figure 7.6.4 Mis-Wired GFCI Receptacles

Figure 7.6.4 shows, by age grouping, the number of recovered GFCI receptacles that were identified by the electrician recovering the device as being mis-wired (non-operational) in the field, but found to be operational when subsequently tested in the laboratory by UL after being correctly wired for line and load.

NOTE: Correct wiring for line and load could not be determined by the home inspector.

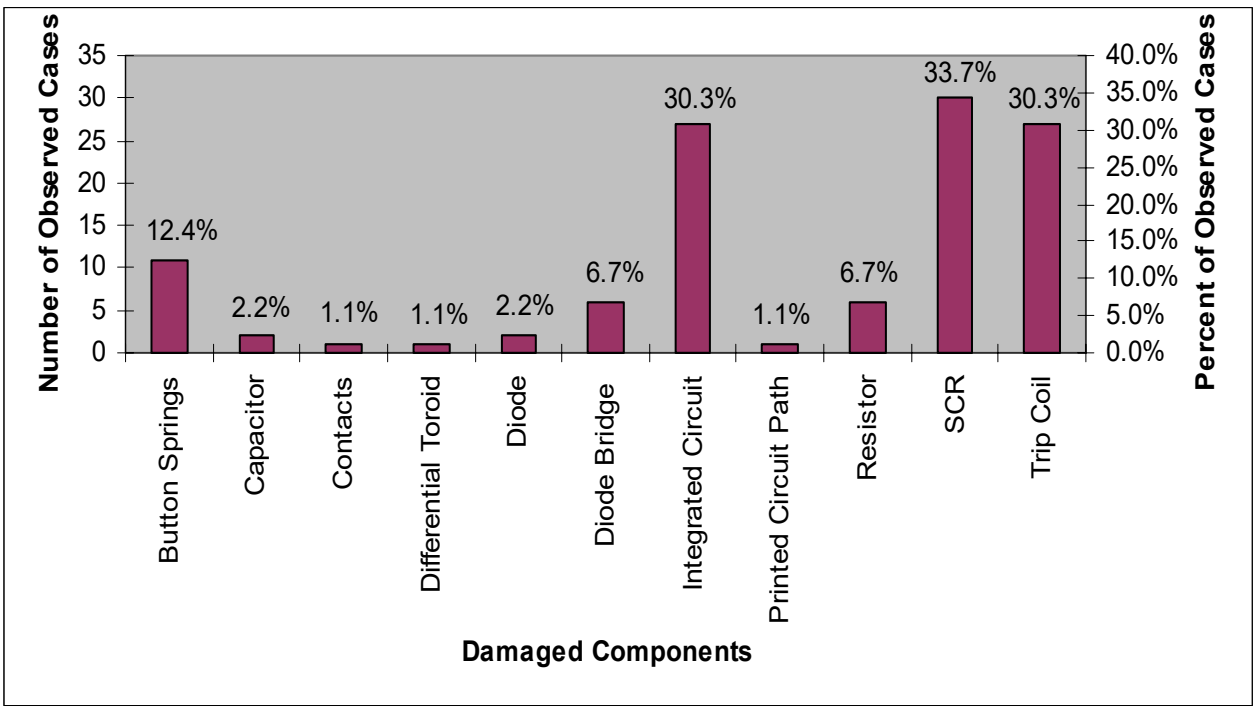
Figure 7.6.4—Mis-Wired Receptacles (Laboratory Operational)



### 7.6.5 Damaged GFCI Receptacle Components

Figure 7.6.5 identifies, by quantity and percentage, the types of component damage that were found by the manufacturer in recovered non-operational GFCI receptacles. A given GFCI can have multiple damaged components.

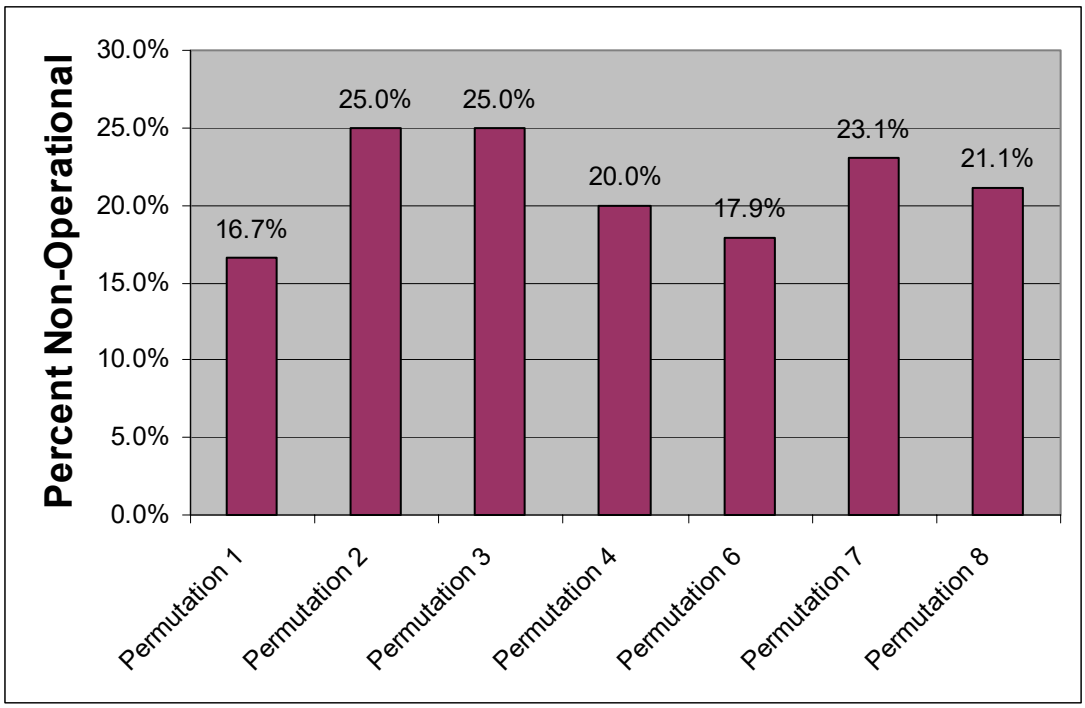
Figure 7.6.5—Damaged GFCI Receptacle Components: Sample size of 90



### 7.6.6 Outdoor Receptacles Locations

Figure 7.6.6 identifies the percentage of outdoor receptacles that were non-operational in each of the permutations.

Figure 7.6.6—Outdoor Receptacle Locations: Sample size of 197



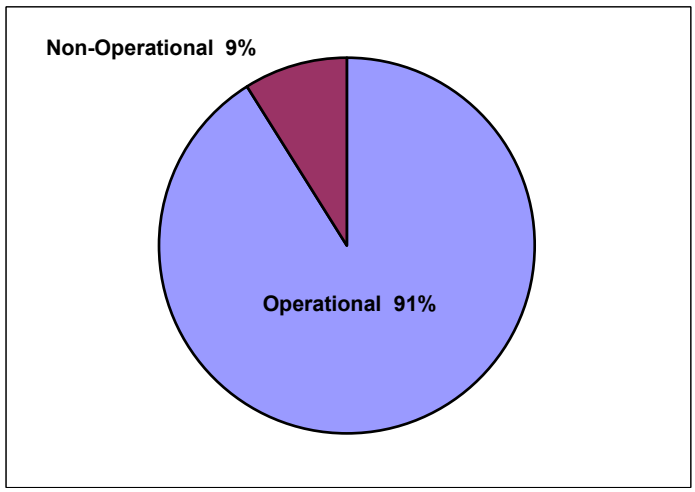
## 7.7 Permutation Sub-Summaries

### Lightning Densities High & Low, Climates Cool, Warm, Dry, and Humid

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in the total of all permutations.

Figure 7.7a—All GFCIs

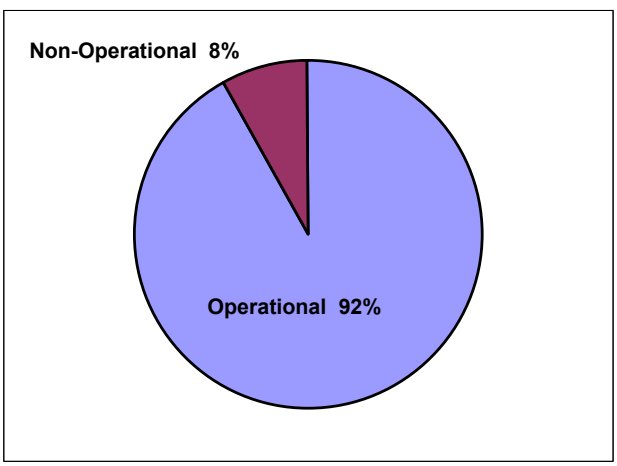



Non-Operational Rate: 7.6% to 9.8%

Sample Size: 2680

Figures 7.7b and 7.7c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in the total of all permutations. These are overall percentages, irrespective of meteorological conditions.

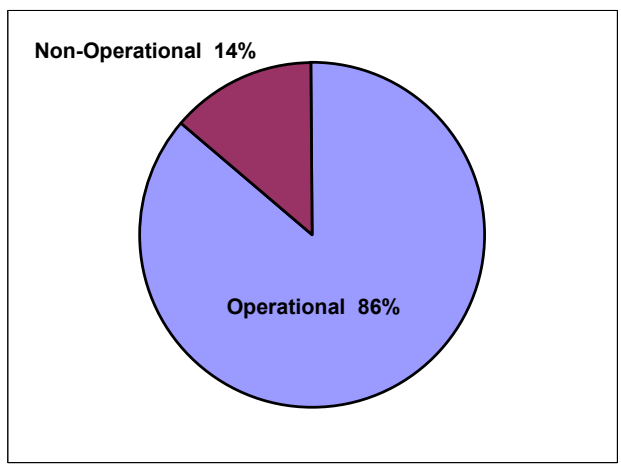
Figure 7.7b—Receptacles




Non-Operational Rate: 7.3% to 9.4%

Sample Size: 2527

Figure 7.7c—Breakers




Non-Operational Rate: 8.8% to 19.9%

Sample Size: 153

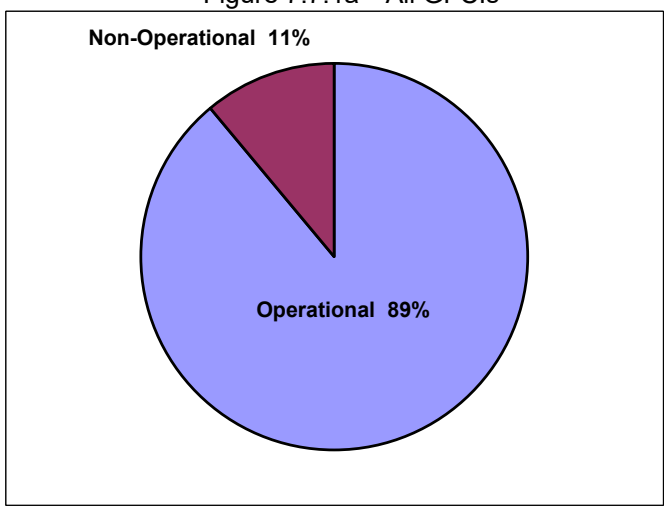
### 7.7.1 Permutation 1

**Lightning Density High, Climate Warm and Humid**

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.1a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 1. This permutation represents a warm, humid climate with a high lightning density as found in Birmingham, Alabama, and Tampa, Florida.

Figure 7.7.1a—All GFCIs

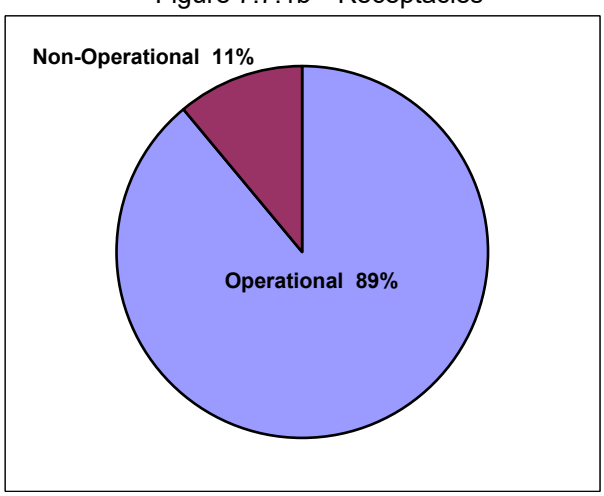



Non-Operational Rate: 7.6% to 14.5%

Sample Size: 317

Figures 7.7.1b and 7.7.1c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 1.

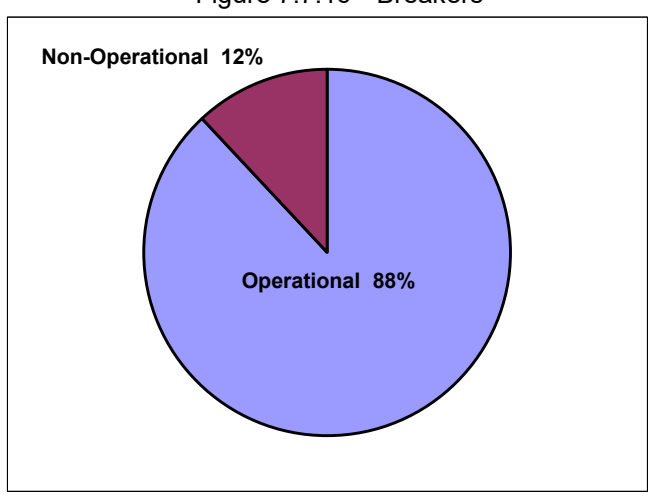
Figure 7.7.1b—Receptacles




Non-Operational Rate: 7.3% to 14.6%

Sample Size: 274

Figure 7.7.1c—Breakers




Non-Operational Rate: 2.0% to 21.2%

Sample Size: 43

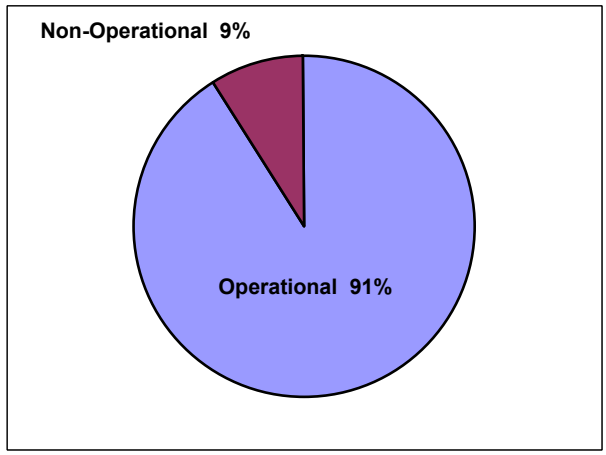
### 7.7.2 Permutation 2

### Lightning Density High, Climate Warm and Dry

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.2a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 2. This permutation represents a warm, dry climate with a high lightning density as found in Austin, Texas.

Figure 7.7.2a—All GFCIs

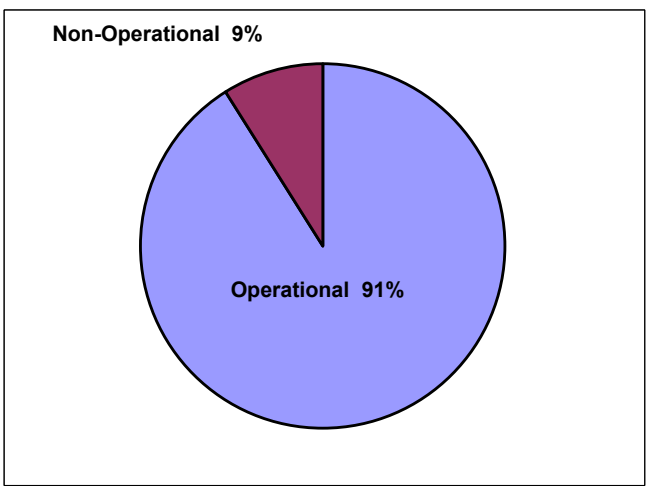



Non-Operational Rate: 6.0% to 12.0%

Sample Size: 355

Figures 7.7.2b and 7.7.2c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 2.

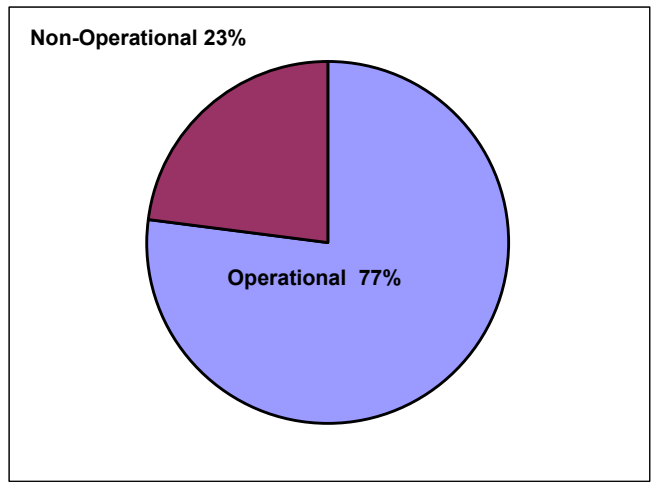
Figure 7.7.2b—Receptacles




Non-Operational Rate: 5.5% to 11.4%

Sample Size: 342

Figure 7.7.2c—Breakers




Non-Operational Rate: 0.2% to 46.0%

Sample Size: 13

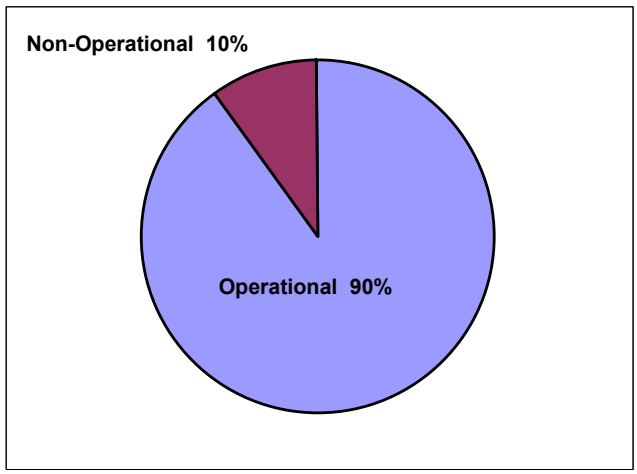
### 7.7.3 Permutation 3

### Lightning Density High, Climate Cool and Humid

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.3a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 3. This permutation represents a cool, humid climate with a high lightning density as found in Washington, DC.

Figure 7.7.3a—All GFCIs

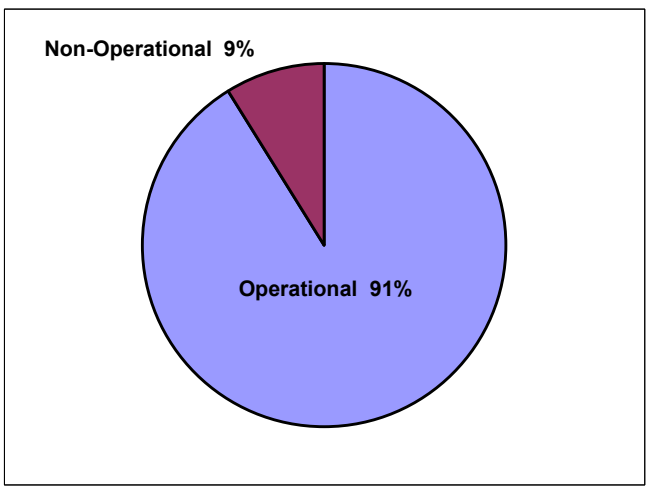



Non-Operational Rate: 6.6% to 13.6%

Sample Size: 286

Figures 7.7.3b and 7.7.3c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 3.

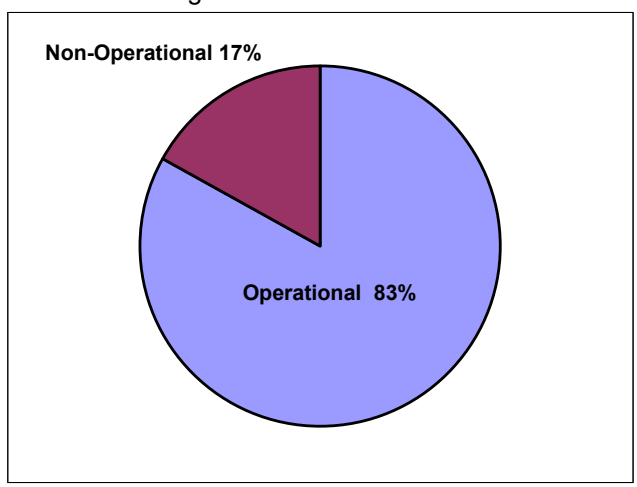
Figure 7.7.3b—Receptacles




Non-Operational Rate: 5.8% to 12.9%

Sample Size: 256

Figure 7.7.3.c—Breakers




Non-Operational Rate: 3.3% to 30.0%

Sample Size: 30

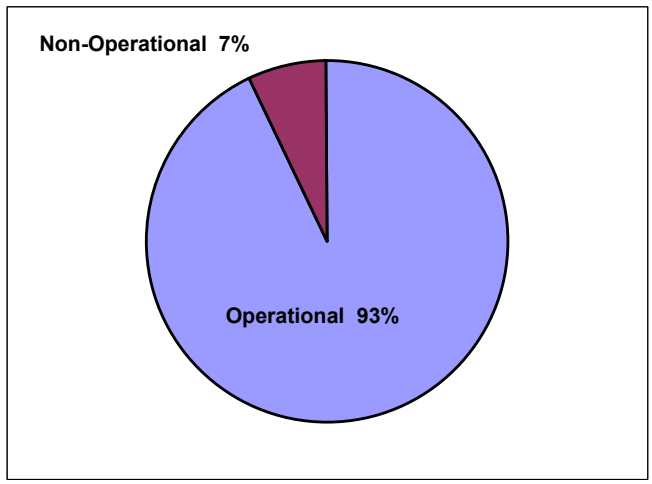
### 7.7.4 Permutation 4

**Lightning Density High, Climate Warm and Humid**

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.4a show the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 4. This permutation represents a warm, humid climate with a high lightning density as found in Kansas City, Missouri.

Figure 7.7.4a—All GFCIs

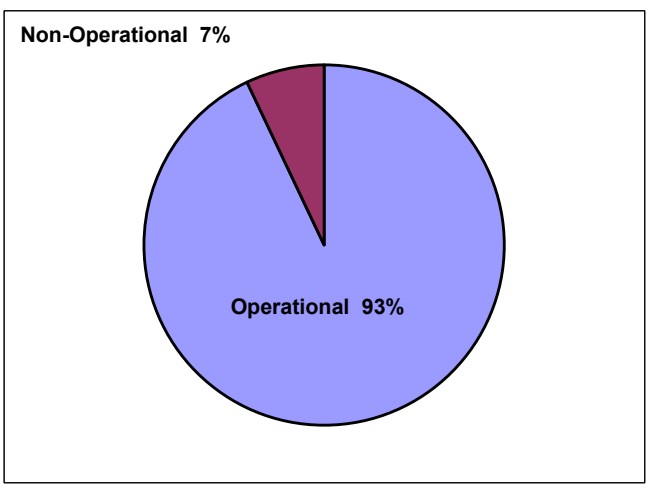



Non-Operational Rate: 4.2% to 9.1%

Sample Size: 404

Figures 7.7.4b and 7.7.4c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 4.

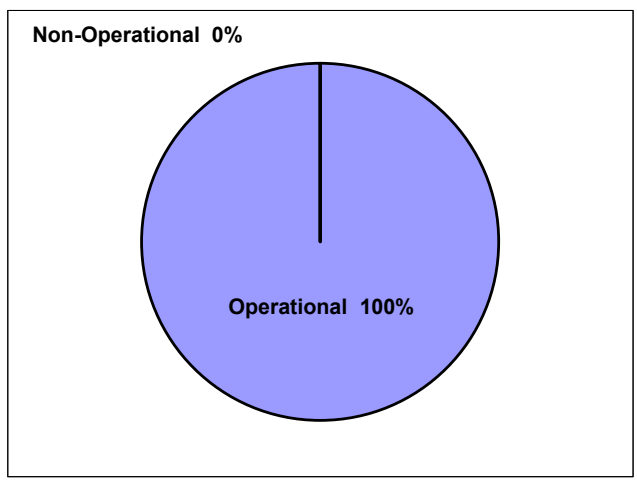
Figure 7.7.4b—Receptacles




Non-Operational Rate: 4.4% to 9.4%

Sample Size: 393

Figure 7.7.4c—Breakers




Non-Operational Rate: 0.0% to 28.5%

Sample Size: 11

### 7.7.5 Permutation 5

No location in the contiguous United States could be found to represent Permutation 5. This permutation represents a warm, humid climate with low lighting density, which is not found in the contiguous United States. Therefore, Permutation 5 was not included in this survey.

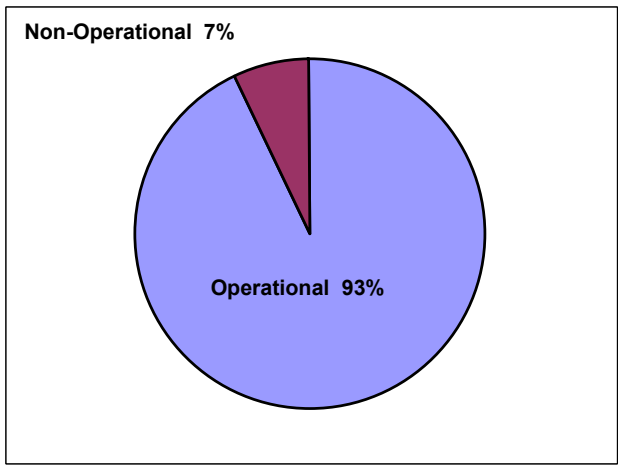
### 7.7.6 Permutation 6

**Lightning Density Low, Climate Warm and Dry**

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.6a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 6. This permutation represents a warm, dry climate with a low lightning density as found in Los Angeles, California.

Figure 7.7.6a—All GFCIs

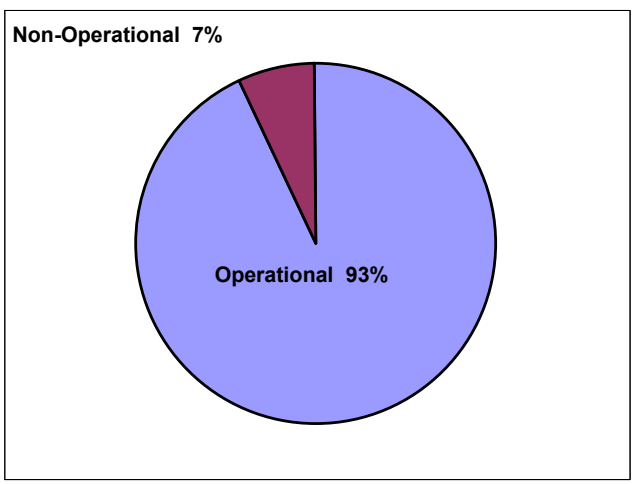



Non-Operational Rate: 4.1% to 9.2%

Sample Size: 361

Figures 7.7.6b and 7.7.6c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 6.

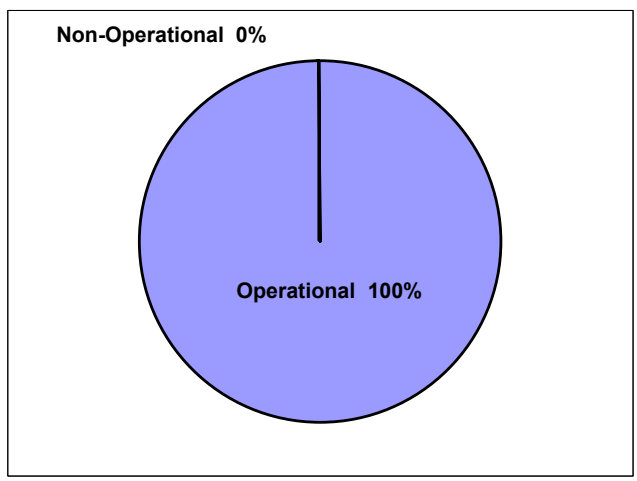
Figure 7.7.6b—Receptacles




Non-Operational Rate: 4.1% to 9.3%

Sample Size: 357

Figure 7.7.6c—Breakers




Non-Operational Rate: 0.0% to 60.2%

Sample Size: 4

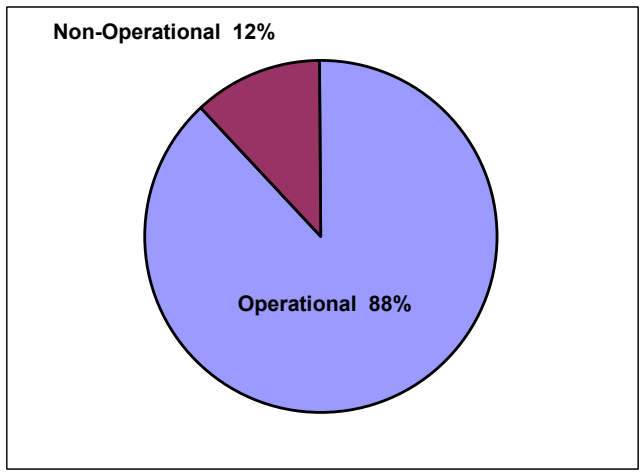
### 7.7.7 Permutation 7

**Lightning Density Low, Climate Cool and Humid**

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.7a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 7. This permutation represents a cool, humid climate with a low lightning density as found in Portland, Maine, and Seattle, Washington.

Figure 7.7.7a—All GFCIs

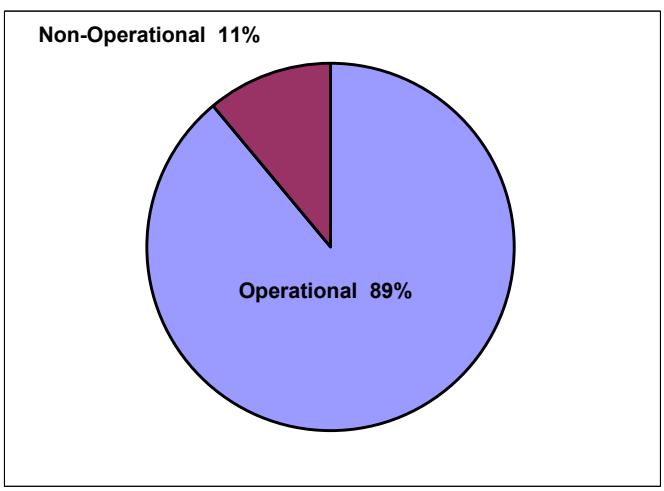



Non-Operational Rate: 8.5% to 16%

Sample Size: 294

Figures 7.7.7b and 7.7.7c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 7.

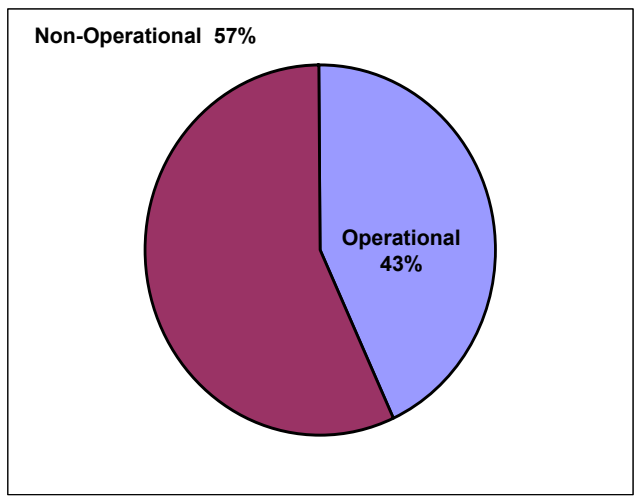
Figure 7.7.7b—Receptacles




Non-Operational Rate: 7.5% to 14.8%

Sample Size: 287

Figure 7.7.7c—Breakers




Non-Operational Rate: 20.5% to 93.8%

Sample Size: 7

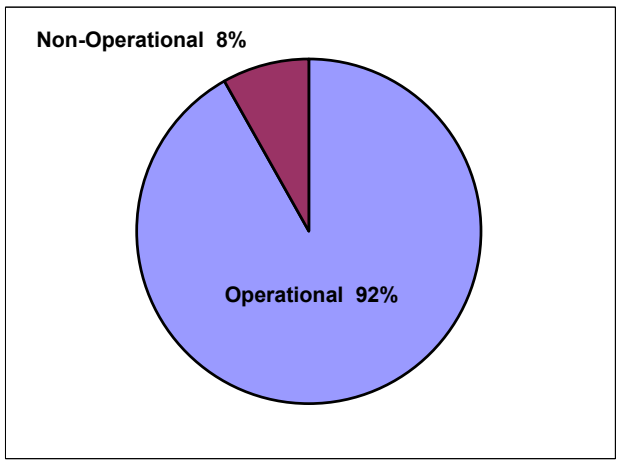
### 7.7.8 Permutation 8

### Lightning Density Low, Climate Cool and Dry

Where a non-operational rate range is indicated, the rate in the overall GFCI population falls within the range indicated with a 95% confidence level.

Figure 7.7.8a shows the percentages of operational and non-operational GFCIs (circuit breakers and receptacles combined) in Permutation 8. This permutation represents a cool, dry climate with a low lightning density as found in Minneapolis, Minnesota, and Denver, Colorado.

Figure 7.7.8a—All GFCIs

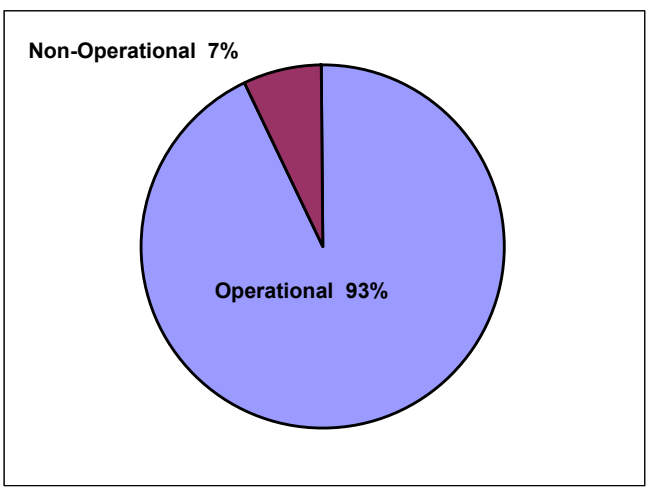



Non-Operational Rate: 5.5% to 9.6%

Sample Size: 663

Figures 7.7.8b and 7.7.8c show, by type, the percentages of operational and non-operational GFCIs (circuit breakers and receptacles separately) in Permutation 8.

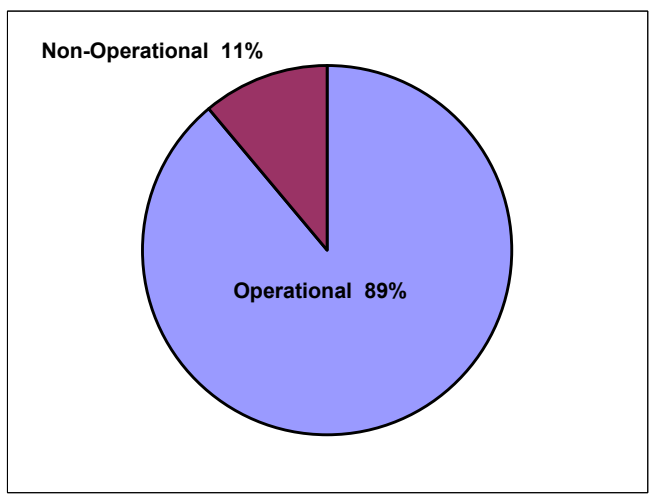
Figure 7.7.8b—Receptacles




Non-Operational Rate: 5.2% to 9.3%

Sample Size: 618

Figure 7.7.8c—Breakers




Non-Operational Rate: 1.9% to 20.3%

Sample Size: 45

## APPENDIX A

### GFCI Inspection Data Sheet

To be completed by the Home Inspector -See instructions on reverse side

**Date** _____ **Inspector** _____ ***Control No***_____

**Description of property:** **Single Family Residential** ☐ **Multi-Family** ☐ (TH, condo-no. of units, other)_____

**Location of Property:** **Urban** ☐ **Suburban** ☐ **Rural** ☐ **Approximate Age of Building**_____

**Address: Street, City, State**_____**Zip Code**_____**Tel.(owner)**_____

***Item No***.

### GFCI Circuit Breakers

| | |
|---|---|
| | ***Panelboard Manufacturer:*** _____ ***Cat No.*** _____<br>***Panelboard Location:*** ***Basement*** ☐ ***Garage*** ☐ ***Utility Room*** ☐ ***Outdoors*** ☐ ***Other*** ☐ |
| ***1*** | **Manufacturer:** ___ **Cat No** _____**Rating (Amps)**_____**Poles**____<br>**Test Results:** **Trip** ☐ **No Trip** ☐ **No Reset** ☐ **Approximate Date Installed** *(if known)*_____ |
| ***2*** | **Manufacturer:** ___ **Cat No** _____**Rating (Amps)**_____**Poles**____<br>**Test Results:** **Trip** ☐ **No Trip** ☐ **No Reset** ☐ **Approximate Date Installed** *(if known)*_____ |
| ***3*** | **Manufacturer:** ___ **Cat No** _____**Rating (Amps)**_____**Poles**____<br>**Test Results:** **Trip** ☐ **No Trip** ☐ **No Reset** ☐ **Approximate Date Installed** *(if known)*_____ |

***Item No.***

### GFCI Receptacles

| | |
|---|---|
| ***4*** | **Location:** **Basement/Crawl** ☐ **Bathroom** ☐ **Garage** ☐ **Kitchen** ☐ **Rating (Amps)** _____<br>**Installed in:** **Indoor-inside wall** ☐ **Indoor-outside wall** ☐ **Outdoor** ☐<br>**Test Results:** **Tripped–*Test Lamp Off*** ☐ **Tripped–*Test Lamp On*** ☐ **No Trip** ☐ **No Reset** ☐ |
| ***5*** | **Location:** **Basement/Crawl** ☐ **Bathroom** ☐ **Garage** ☐ **Kitchen** ☐ **Rating (Amps)** _____<br>**Installed in:** **Indoor-inside wall** ☐ **Indoor-outside wall** ☐ **Outdoor** ☐<br>**Test Results:** **Tripped–*Test Lamp Off*** ☐ **Tripped–*Test Lamp On*** ☐ **No Trip** ☐ **No Reset** ☐ |
| ***6*** | **Location:** **Basement/Crawl** ☐ **Bathroom** ☐ **Garage** ☐ **Kitchen** ☐ **Rating (Amps)** _____<br>**Installed in:** **Indoor-inside wall** ☐ **Indoor-outside wall** ☐ **Outdoor** ☐<br>**Test Results:** **Tripped–*Test Lamp Off*** ☐ **Tripped–*Test Lamp On*** ☐ **No Trip** ☐ **No Reset** ☐ |
| ***7*** | **Location:** **Basement/Crawl** ☐ **Bathroom** ☐ **Garage** ☐ **Kitchen** ☐ **Rating (Amps)**_____<br>**Installed in:** **Indoor-inside wall** ☐ **Indoor-outside wall** ☐ **Outdoor** ☐<br>**Test Results:** **Tripped–*Test Lamp Off*** ☐ **Tripped–*Test Lamp On*** ☐ **No Trip** ☐ **No Reset** ☐ |
| ***8*** | **Location:** **Basement/Crawl** ☐ **Bathroom** ☐ **Garage** ☐ **Kitchen** ☐ **Rating (Amps)** _____<br>**Installed in:** **Indoor-inside wall** ☐ **Indoor-outside wall** ☐ **Outdoor** ☐<br>**Test Results:** **Tripped–*Test Lamp Off*** ☐ **Tripped–*Test Lamp On*** ☐ **No Trip** ☐ **No Reset** ☐ |
| ***9*** | **Location:** **Basement/Crawl** ☐ **Bathroom** ☐ **Garage** ☐ **Kitchen** ☐ **Rating (Amps)** _____<br>**Installed in:** **Indoor-inside wall** ☐ **Indoor-outside wall** ☐ **Outdoor** ☐<br>**Test Results:** **Tripped–*Test Lamp Off*** ☐ **Tripped–*Test Lamp On*** ☐ **No Trip** ☐ **No Reset** ☐ |

**Other Comments** _____

# GFCI Test Procedures

| | | |
|---|---|---|
| ***To determine Amp rating***: | Circuit breakers | – Amp rating is stamped on the handle. |
| | Receptacles | – 15 Amp if openings for plug blades are parallel;<br>20 Amp if one of the plug blade opening is T shaped. |

## Circuit Breaker GFCI *(No other equipment is needed)*

1. Check to be sure that the GFCI circuit breaker handle is in the ON position. If it is not turn the device to the ON position.
2. Push the "Test" button on the circuit breaker. The circuit breaker should open which is indicated by the handle moving to the trip position. This should be recorded as "Trip".
3. If the circuit breaker trips the test is over and the circuit breaker should be reset to the ON position. If it does not reset, record on the reverse side as a "No Reset".
4. If the circuit breaker does not trip when the button is pushed verify that the circuit breaker has power to it. This can be done by checking one of the loads in the circuit that the circuit breaker is supplying to determine that it is on. (If there is no power and the main device is ON the test can not be conducted)
5. Once it is certain the circuit breaker has power push the "Test" button again. If the device trips it should be recorded as "Trip" and if it does not trip it should be recorded as "No Trip" on the reverse side.
6. Complete the rest of the form (GFCI Inspection Data Sheet) on the reverse side for this unit.
7. If you recorded No Trip or No Reset, the GFCI is considered a non-operating unit; follow instructions below: "To Prepare for Replacement".)

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## Receptacle GFCI *(Equipment required - A load, such as a lamp, to be used as an indicator)*

1. Plug the load into the GFCI receptacle and turn it on to verify that power is present. If there is no power check to be certain that the RESET button of the receptacle GFCI is fully pressed. If still no power, check to be certain that the circuit breaker for this GFCI circuit is ON. If there is no power the GFCI device can not be tested.
2. If there is power push the "Test" button. The GFCI should trip and the load should turn off. Tripping is indicated by the RESET button popping out.
    - If the GFCI trips and the indicator goes OFF it should be recorded as "Tripped – *Indicator Off*".
    - If the GFCI trips and the indicator does not go OFF it should be recorded as "Tripped – *Indicator On*".
    - If the GFCI does not trip it should be recorded as "No Trip".
3. Reset the GFCI by pressing the RESET button. If it does not reset, record on the reverse side as a "No Reset".
4. Complete the rest of the form (GFCI Inspection Data Sheet) on the reverse side for this unit.
5. If you recorded "Tripped-Indicator On" or "No Reset" or "No Trip", the GFCI is considered a non-operating unit; follow instructions below: "To Prepare for Replacement".)

---

## To Prepare for Replacement

1. For each non-operating unit, take and complete a separate "Electrician's Envelope" as shown below
2. Find the "GFCI Replacement Data Sheet" in the envelope. Complete Part 1. Note that the control number is that of the Inspection Data Sheet followed by the item number for the non-operating unit.
3. Find a tag in the envelope. Write the same control number on the tag.
4. Write the location and GFCI device information on the outside of the envelope, as well.
5. Tear off and retain the blue copy of the "GFCI Replacement Data Sheet" Return the rest of the GFCI Replacement Data Sheet and the marked tag into the "Electrician's Envelope" and seal that envelope.
6. Give the "Electrician's Envelope" to the homeowner or leave it with the other documents you leave for the homeowner.

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Inspector to mail all copies of this "Inspection Data Sheet and the blue copies of the Replacement Data Sheet(s)" to:
Home Pro Systems, 2841 Hartland Road, Suite 201, Falls Church, VA 22043

**APPENDIX B**

**GFCI REPLACEMENT DATA SHEET**

(See reverse side for instructions for changing GFCI)
(Use a separate Data Sheet for each GFCI)

# Part 1 – to be completed by home inspector.

**I found the following GFCI(s) to be nonfunctional**:

_____--_____
Control Number--Item No
(Control Number of Inspection Data Sheet --Item No.on same Data Sheet)

_____ _____
Location of Non-working GFCI in the home  Amp rating

**If circuit breaker**:_____ _____ _____ _____ **If receptacle**:_____
Brand  Mfr. Of Panel  One Pole  Two pole  Color

Description of property – Single Family Residential ☐ Multi-Family ☐ Other:_____

Location of Property – Urban ☐ Suburban ☐ Rural ☐ Approx. Age of Building _____

Address – Street, City, State_____Zip Code_____

_____ _____ _____
Date  Home Inspector's Name  Home Inspector's Signature

# Part 2 – to be completed by electrician.

_____ _____
Contractor (Company) Name,  Address, Street, City, State, Zip Code

_____ _____
Date Work Performed  Date GFCI was mailed to UL

***Description of GFCI Replaced – if Circuit Breaker:***

Manufacturer _____ Cat No _____ Rating _____ Poles _____

Was wiring correct? – Yes No Comments _____

***Description of GFCI Replaced – if Receptacle:***

Manufacturer _____Were line and load connections correct? – Yes No

GFCI Condition/Comments _____
For Outdoor Installations – Was Weatherproof cover installed ? Yes No
Was Cover Damaged? - Yes No Was cover properly sealed/caulked? - Yes No

_____
Description of work completed

_____ _____
Signature of Electrician  Printed Name of Electrician

COPIES DISTRIBUTION:
White – to be shipped with GFCI to UL
Pink – to be mailed to NEMA with electrician's invoice
Green – for contractor's records
Yellow – to be left with homeowner
Blue – taken by inspector after completing Part 1, before electrician arrives to the home.

**APPENDIX C**

## GFCI FUNCTION OPERATIONAL EVALUATION

1. Connect GFCI breaker in suitable enclosure, load center, or test set with a load on the load side of the GFCI circuit breaker. If a lamp is included in the "load", it will provide a convenient indication of the load being energized.

2. Conduct the following test 5 times (to determine intermittent or continuous performance). Reset, turn handle to the "ON" position, and push the "TEST" button. Report the cumulative response in the check boxes below.
   _____ Load is energized when breaker is turned on and trips when the "TEST button is pushed (Normal operation).
   _____ Load is not energized when breaker is turned on.
   _____ Breaker trips immediately when turned on.
   _____ Load is energized when breaker in turned on and remains energized when "TEST" button is pushed.

**EXTERNAL GFCI BREAKER EVALUATION**

____Visual damage to breaker base, cover, terminals, handle or push-to-test button or contamination.
____ No obvious damage.
____ Cracked or broken base or cover. Comment and explain:
____ Handle broken or chipped. Comment and explain:
____ Push-to-test button damaged. Comment and explain:
____ Missing or damaged rivets. Comment and explain:
____ Corrosion on load terminals. Comment and explain:
____ Corrosion on electrical connection jaw (line connection). Comment and explain:
____ Evidence of invasion by insects or parasites. Comment and explain:
____ Evidence of water damage – contamination. Comment and explain:
____ Other. Comment and explain:

**INTERNAL MECHANISM EVALUATION**

____ Measured analysis and/or visual examination of any damage or contamination of the GFCI breaker.
____ No obvious damage. All mechanism components are present, intact, and secured in their proper positions and remain fully functional.
____ Mechanism spring broken. Comment and explain:
____ Contacts "stuck" or welded. Comment and explain:
____ Trip links from module broken or non-functional. Comment and explain:
____ Solenoid jammed or binding. Comment and explain:
____ Solenoid burned, melted, or exhibits sign of overheating. Comment and explain:
____ Extraneous parts interfering with operation of mechanism. Comment and explain:
____ Mechanism compromised by insect nests or activity. Comment and explain:
____ Flexible conductor (pigtail wire) damaged or discolored. Comment and explain:

**INTERNAL ELECTRICAL/ELECTRONIC EVALUATION**

____ Analysis and/or visual examination of any damage or contamination of the GFCI breaker's electrical and electronic components and printed wiring boards (PWBs).

_____ No obvious damage. All components and the PWBs are intact and secured in their proper location(s) and remain fully functional.
_____ SCR failure(s). Comment and explain:
_____ Integrated circuit (IC) failure(s). Comment and explain:
_____ Resistor failure(s). Comment and explain:
_____ Capacitor failure(s). Comment and explain:
_____ Metal oxide varistor (MOV) failure(s). Comment and explain:
_____ Individual diode failure(s). Comment and explain:
_____ Diode bridge component failure(s). Comment and explain:
_____ Differential toroid failure(s). Comment and explain:
_____ Grounded Neutral (GN) toroid failure(s). Comment and explain:
_____ Open wire(s). Comment and explain:
_____ Open PWB path(s)/trace(s) (mechanical failure). Comment and explain:
_____ Shorted or solder-bridged PWB path(s)/trace(s) (mechanical failure). Comment and explain:
_____ Blown PWB path(s)/trace(s) (electrical failure). Comment and explain:
_____ Bridged PWB path(s)/trace(s) (electrical failure). Comment and explain:
_____ Solder-bridged component lead(s). Comment and explain:
_____ "Cold" (nonconductive) solder joint(s). Comment and explain:
_____ Solder joint(s) corroded by excess residual rosin flux. Comment and explain:
_____ Extraneous object, including assembly artifacts (e. g. conductive component clipping, etc.) conductively bridging PWB path(s)/trace(s) or component lead(s). Comment and explain:
_____ Other. Comment and explain:

**MANUFACTURER'S SUMMARY ASSESSMENT**

_____ Similar to the receptacle, however, each defect in the mechanism or electronic failure in the previous sheets should "map into" this sheet. May need to add "Random component failure – no evidence of misuse transients etc." Another entry may be "Push-to-test" failure – otherwise operational."
_____ Abuse or tampering. Comment and explain:
_____ Wear or cyclical failure. Comment and explain:
_____ Welded contacts. Comment and explain:
_____ Corrosion. Comment and explain:
_____ Transient overvoltage (e.g., lightning). Comment and explain:
_____ Sustained overvoltage. Comment and explain:
_____ Damage during shipping, handling, or installation. Comment and explain:
_____ Factory manufacturing of fabrication defect. Comment and explain:
_____ Random component failure – no obvious cause. Comment and explain:
_____ Unknown. Comment and explain:
_____ Invasion by parasites or insects. Comment and explain:
_____ Other. Comment and explain:

# GFCI Field Survey:
# Sample Evaluation (GFCI Receptacle)

*THIS INFORMATION PROVIDED BY NEMA*

**SHIP SAMPLE TO:**

*COMPANY:* [SS-01]
*SHIPPING ADDRESS:* [SS-02] [SS-03] [SS-04]
*CITY:* [SS-05] *STATE:* [SS-06] *ZIP:* [SS-07]

*ATTENTION:* [SS-08]
(*ALSO E-MAIL FORM TO SAME PERSON AT E-MAIL ADDRESS:* [SS-09])

*THIS BOX TO BE COMPLETED BY UNDERWRITERS LABORATORIES, ONE EVALUATION FORM PER GFCI RECEPTACLE*

**NEMA Control No.:** [UL-01]

**GFCI Receptacle No.:** ☐ ❹ [UL-02A] ☐ ❺ [UL-02B] ☐ ❻ [UL-02C] ☐ ❼ [UL-02D] ☐ ❽ [UL-02E] ☐ ❾ [UL-02F]
CHECK ONLY ONE BOX

UL Listing Label Issue No: [UL-03]
Approximate date-of-manufacture per Issue No: *YEAR:* [UL-04] *MONTH:* [UL-05]
UL Listing Label File No: E [UL-06]

*THIS BOX TO BE COMPLETED BY MANUFACTURER IDENTIFIED ON PRODUCT*

## Sample Identification

Manufacturer marked on product: [SI-01]

Marked manufacturer's catalog number: [SI-02]

Rating: VOLTAGE: [SI-03] V ac AMPERE: [SI-04] A [SI-05R] ☐ HOSPITAL GRADE

Exact date-of-manufacture per manufacturer's date-coding (or similar means):
*YEAR:* [SI-06] *MONTH:* [SI-07]

Is this sample's design the same as or similar to the current design? [SI-08] ☐ YES [SI-09] ☐ NO

*IF THIS GFCI RECEPTACLE IS MULTILISTED (PRIVATE-BRANDED), COMPLETE THE FOLLOWING, BY FORWARDING TO OR WITH THE ASSISTANCE OF THE ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

Actual manufacturer (UL "Basic Listee" or "Applicant"): [SI-10]

UL Basic Listing File No: E [SI-11]

Basic Listee's/Applicant's corresponding catalog number: [SI-12]

Exact date-of manufacture per manufacturer's date coding (or similar means):
*YEAR:* [SI-13] *MONTH:* [SI-14]

Is this sample's design the same as or similar to the current design? [SI-15] ☐ YES [SI-16] ☐ NO

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## GFCI Function Operational Evaluation

- Connect the GFCI receptacle's LINE (FEED) conductors to power supply of the rated voltage.
- Plug a nominal load (lamp, buzzer, etc., not exceeding the GFCI's *outlet* ampere rating) into the GFCI receptacle and turn the load on.
- Perform the following sequence **5 times** (to determine intermittent or continuous performance). Report cumulative response in check boxes below.

**1: PUSH GFCI RECEPTACLE'S "RESET" BUTTON.** Response:

[F-01] ☐ "RESET" button **sets in and holds properly**. Plugged-in load becomes **energized**.

[F-02] ☐ "RESET" button **sets in and holds properly**. Plugged-in load is **NOT energized**.

[F-03] ☐ "RESET" button **trips (does NOT hold in) CONTINUOUSLY**.

[F-04] ☐ "RESET" button **trips (does NOT hold in) INTERMITTENTLY**.

[F-05] ☐ Other. Explain: [F-06]

**2: PUSH GFCI RECEPTACLE'S "TEST" BUTTON.** Response:

[F-07] ☐ GFCI trips: "RESET" button **releases and pops out properly**. Plugged-in load becomes **de-energized**.

[F-08] ☐ GFCI didn't trip: "RESET" button **does NOT release properly**. Plugged-in load is **NOT de-energized**.

[F-09] ☐ GFCI welded contacts: "RESET" button **releases and pops out properly** *but* plugged-in load is **NOT de-energized**.

[F-10] ☐ GFCI stuck button: "RESET" button **does NOT release properly** *yet* plugged-in load becomes **de-energized**.

[F-11] ☐ Other. Explain: [F-12]

- If during **2** above the GFCI receptacle does not de-energize the load, disconnect the GFCI from the power supply and load indicated above.
- Subject the GFCI receptacle to a single external fault using a test circuit in accordance with UL standard *ANSI/UL943-1994* (Third Edition) High-Resistance Ground Faults Test for permanently connected Class A GFCIs. Fault current to ground I is to be 6 mA. The outcome is trip/no trip (i.e., time-to-trip need not be measured).
- Perform this external fault check for **one measurement only** (i.e., not the 10 measurements specified in *ANSI/UL943-1994* (Third Edition) High-Resistance Ground Faults Test). Report response in check boxes below.

**3: CONDITIONALLY APPLY EXTERNAL FAULT.** Response:

[F-13] ☐ Plugged-in load becomes **de-energized**.

[F-14] ☐ Plugged-in load is **NOT de-energized**.

[F-15] ☐ Other. Explain: [F-06]

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## Enclosure & Mounting Means Integrity Evaluation

- Visual examination of any damage or contamination of the receptacle's housing (face, back, buttons, lenses, etc.).

[EM-01] ☐ No obvious damage. All components of the GFCI's receptacle housing are present, intact and secured in their proper positions.

[EM-02] ☐ Receptacle face cracked or impact-damaged
Comment or explain: [EM-03]

[EM-04] ☐ Receptacle face separated (to any degree) from housing back and/or mounting yoke
Comment or explain: [EM-05]

[EM-06] ☐ "RESET" button and/or "TEST" button cracked or broken
Comment or explain: [EM-07]

[EM-08] ☐ "RESET" button and/or "TEST" button partially dislodged
Comment or explain: [EM-09]

[EM-10] ☐ "RESET" button and/or "TEST" button missing
Comment or explain: [EM-11]

[EM-12] ☐ Receptacle face, "RESET" button and/or "TEST" button coated with extraneous material or substance (e.g., paint, wallpaper, adhesive label, etc.)
Comment or explain: [EM-13]

[EM-14] ☐ Mounting yoke permanently deformed
Comment or explain: [EM-15]

[EM-16] ☐ Housing back cracked or impact-damaged
Comment or explain: [EM-17]

[EM-18] ☐ Housing back separated (to any degree) from mounting yoke
Comment or explain: [EM-19]

[EM-20] ☐ Housing back and/or unexposed receptacle face (portion behind cover plate) covered, smeared, encrusted or penetrated by extraneous material or substance (other than dust)
Comment or explain: [EM-21]

[EM-22] ☐ Assembly fastener failure (mechanical impact, corrosion, hydrogen embrittlement, etc.)
Comment or explain: [EM-23]

[EM-24] ☐ Evidence of inhabitation or invasion by insects
Comment or explain: [EM-25]

[EM-26] ☐ Evidence of tampering or disassembly/re-assembly
Comment or explain: [EM-27]

[EM-28] ☐ Evidence of flooding or water/mud damage
Comment or explain: [EM-29]

[EM-30] ☐ Evidence of flooding or fungal damage
Comment or explain: [EM-31]

[EM-32] ☐ Other. Comment or explain: [EM-33]

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## Internal Mechanism Evaluation

- Measured analysis and/or visual examination of any damage or contamination of the GFCI receptacle's GFCI-related mechanisms (latches, springs, buttons, lenses, etc.). This evaluation does NOT encompass receptacle-related functions or any mechanisms unrelated to GFCI-protection (e. g., outlet contacts & terminals, auto-grounding clips, etc.).

[M-01] ☐ No obvious damage. All components of the GFCI mechanism(s) are present, intact and secured in their proper positions and remain fully functional.

[M-02] ☐ "RESET" button helical spring(s) broken or fractured
Comment or explain: [M-03]

[M-04] ☐ "RESET" button helical spring(s) bent or dislodged or helixes intertwined/tangled
Comment or explain: [M-05]

[M-06] ☐ "RESET" button helical spring(s) damaged by cyclical failure and/or no longer elastically compliant
Comment or explain: [M-07]

[M-08] ☐ "RESET" button helical spring(s) corroded or hydrogen embrittled
Comment or explain: [M-09]

[M-10] ☐ "TEST" button cantilever spring(s) broken or fractured
Comment or explain: [M-11]

[M-12] ☐ "TEST" button cantilever spring(s) bent or dislodged
Comment or explain: [M-13]

[M-14] ☐ "TEST" button cantilever spring(s) damaged by cyclical failure and/or no longer elastically compliant
Comment or explain: [M-15]

[M-16] ☐ Latch(es) broken or fractured
Comment or explain: [M-17]

[M-18] ☐ Latch(es) bent or dislodged
Comment or explain: [M-19]

[M-20] ☐ Latch(es) worn cyclically to no longer being latchable
Comment or explain: [M-21]

[M-22] ☐ "RESET" mechanism(s) jammed or binding
Comment or explain: [M-23]

[M-24] ☐ "TEST" mechanism(s) jammed or binding
Comment or explain: [M-25]

(continued)

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## Internal Mechanism Evaluation (continued)

[M-26] ☐ Contacts welded
Comment or explain: [M-27]

[M-28] ☐ Solenoid jammed or binding
Comment or explain: [M-29]

[M-30] ☐ Solenoid burned or melted
Comment or explain: [M-31]

[M-32] ☐ Loose wire strand(s)
Comment or explain: [M-33]

[M-34] ☐ Extraneous object, including assembly artifacts (e. g., component clipping, molding flash, etc.) interfering with mechanism(s)
Comment or explain: [M-35]

[M-36] ☐ Other. Comment or explain: [M-37]

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## Internal Electrical/Electronic Evaluation

- Measured analysis and/or visual examination of any damage or contamination of the GFCI receptacle's electrical and electronic components and printed wiring boards (PWBs)

[EE-01] ☐ No obvious damage. All components and the PWB(s) are intact and secured in their proper location(s) and remain fully functional.

[EE-02] ☐ SCR failure(s)
Comment or explain: [EE-03]

[EE-04] ☐ Integrated circuit (IC) failure(s)
Comment or explain: [EE-05]

[EE-06] ☐ Resistor failure(s)
Comment or explain: [EE-07]

[EE-08] ☐ Capacitor failure(s)
Comment or explain: [EE-09]

[EE-10] ☐ Metal oxide varistor (MOV) failure(s)
Comment or explain: [EE-11]

[EE-12] ☐ Individual diode failure(s)
Comment or explain: [EE-13]

[EE-14] ☐ Diode bridge component failure(s)
Comment or explain: [EE-15]

[EE-16] ☐ Differential toroid failure(s)
Comment or explain: [EE-17]

[EE-18] ☐ Grounded neutral (GN) toroid failure(s)
Comment or explain: [EE-19]

[EE-20] ☐ Open wire(s)
Comment or explain: [EE-21]

[EE-22] ☐ Open PWB path(s)/trace(s) (mechanical failure)
Comment or explain: [EE-23]

[EE-24] ☐ Shorted or solder-bridged PWB path(s)/trace(s) (mechanical failure)
Comment or explain: [EE-25]

[EE-26] ☐ Blown PWB path(s)/trace(s) (electrical failure)
Comment or explain: [EE-27]

[EE-28] ☐ Bridged PWB path(s)/trace(s) (electrical failure)
Comment or explain: [EE-29]

(continued)

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## Internal Electrical/Electronic Evaluation (continued)

[EE-30] ☐ Solder-bridged component lead(s)
Comment or explain: [EE-31]

[EE-32] ☐ "Cold" (nonconductive) solder joint(s)
Comment or explain: [EE-33]

[EE-34] ☐ Solder joint(s) corroded by excess residual rosin flux
Comment or explain: [EE-35]

[EE-36] ☐ Extraneous object, including assembly artifacts (e. g., conductive component clipping, etc.) conductively bridging PWB path(s)/trace(s) or component lead(s)
Comment or explain: [EE-37]

[EE-38] ☐ Other. Comment or explain: [EE-39]

*THIS BOX TO BE COMPLETED BY ACTUAL MANUFACTURER (UL "BASIC LISTEE" or "APPLICANT")*

## Manufacturer's Summary Assessment

- Manufacturer's determination of whether the returned sample is operational or has impaired GFCI-protection. If the GFCI-protection is impaired, manufacturer's judgment as to cause.

[SA-01] ☐ **GFCI fully functional**.
Comment or explain: [SA-02]

**GFCI impairment** believed to be **caused primarily** by:

[SA-03] ☐ Abuse or tampering
Comment or explain: [SA-04]

[SA-05] ☐ Wear or cyclical failure
Comment or explain: [SA-06]

[SA-07] ☐ Welded contacts
Comment or explain: [SA-08]

[SA-09] ☐ Corrosion or weather exposure
Comment or explain: [SA-10]

[SA-11] ☐ Transient voltage surge exposure
Comment or explain: [SA-12]

[SA-13] ☐ Sustained overvoltage exposure
Comment or explain: [SA-14]

[SA-15] ☐ Lightning exposure
Comment or explain: [SA-16]

[SA-17] ☐ Damaged during installation
Comment or explain: [SA-18]

[SA-19] ☐ Electronic component failure
Comment or explain: [SA-20]

[SA-21] ☐ Factory assembly defect
Comment or explain: [SA-22]

[SA-23] ☐ Factory fabrication defect
Comment or explain: [SA-24]

[SA-25] ☐ Other. Comment or explain: [SA-26]

[SA-27] ☐ Unknown. Comment: [SA-28]

**Return** this printed Evaluation Form **completed**, with the GFCI receptacle sample analyzed, to:

**Underwriters Laboratories, Inc.**
**333 Pfingsten Road**
**Northbrook, IL 60062-2096**

**ATTN: David Dini — Engineering Research**

Also **e-mail** this Evaluation Form **completed**, with NEMA Control and Receptacle Nos. identified in the e-mail's Subject, to: **David.A.Dini@us.ul.com**

## APPENDIX D

### Recovered Circuit Breaker GFCIs

| Control Number | Year of Manufacture | Region (Permutation) | Rating Amps / Poles | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 0050-1 | 1998 | Washington, DC (3) | 50 / 2 | Yes | No Trip | Power supply resistor had failed open. Probable cause of failure was a transient overvoltage exposure. |
| 0062-1 | 1976 | Washington, DC (3) | 15 / 1 | Yes | No Trip | Differential toroid secondary winding was open. Probable cause was a random device failure. |
| 0212-1 | 1984 | Washington, DC (3) | 20 / 1 | Yes | No Trip | Integrated circuit had failed. Probable cause was a random device failure. |
| 0751-1 | 1974 | Birmingham, AL (1) | 20 / 1 | Yes | No Trip | Differential amplifier network had failed. Probable cause of failure was a transient overvoltage exposure. |
| 1199-1 | 1997 | Seattle, WA (7) | 50 / 2 | Yes | No Trip | Power supply resistor had failed open. Probable cause of failure was a transient overvoltage exposure. |
| 1459-1 | 1985 | Tampa, FL (1) | 15 / 1 | Yes | No Trip | Integrated circuit had failed. Probable cause was a random device failure. |
| 1460-1 | 1981 | Tampa, FL (1) | 15 / 1 | Yes | Unknown | Device does not trip when tested. Handle was broken off. SCR, limiting resistor, and trip coil was open. Probable cause was a random device failure of the limiting resistor which caused the SCR and trip coil to overheat and fail. |
| 3501-1 | 1984 | Birmingham, AL (1) | 15 / 1 | Yes | No Trip | Integrated circuit had failed. Probable cause was a random device failure. |
| 3776-1 | 1977 | Tampa, FL (1) | 20 / 1 | Yes | No Trip | Wire to trip coil bobbin was open. Probable cause of failure was a transient overvoltage exposure. |

## APPENDIX E

### Recovered Receptacle GFCIs

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 0044-7 | 1989 | Washington, DC (3) | Kitchen | Yes | Tripped/On | Device does not trip when tested. SCR and diode had failed shorted. There was an opened printed circuit board trace, and evidence of arcing. Probable cause of failure was an overload current condition on the receptacle contacts. |
| 0063-4 | 1990 | Washington, DC (3) | Kitchen | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 0076-4 | 1979 | Washington, DC (3) | Bathroom | Yes | No Trip | Integrated circuit not operating as intended. Probable cause of failure was a transient voltage surge exposure. |
| 0097-4 | 1980 | Washington, DC (3) | Outdoors | No | No Trip | SCR had shorted and trip coil was open. Evidence of severe overheating on printed circuit board below components. Weatherproof cover was installed, but not properly sealed. Probable cause of failure was a sustained overvoltage exposure. |
| 0098-5 | 1990 | Washington, DC (3) | Kitchen | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 0101-5 | 1987 | Washington, DC (3) | Outdoors | Yes | No Trip | Failure of integrated circuit. Evidence of possible insect invasion. Terminals and strap corroded. Probable cause of failure was corrosion or weather exposure. |
| 0113-4 | 1985 | Washington, DC (3) | Bathroom | Unknown | No Trip | Bridge rectifier diode had failed shorted and trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 0123-6 | 1990 | Washington, DC (3) | Outdoors | Yes | Tripped/On | Device does not trip when tested. Capacitor had shorted and SCR and integrated circuit had failed. Evidence of flooding or fungal damage. Probable cause of failure was water contamination. |
| 0127-4 | 1982 | Washington, DC (3) | Bathroom | Yes | No Trip | Power supply zener diode had failed. Probable cause of failure was a transient voltage surge exposure. |
| 0156-5 | 1997 | Washington, DC (3) | Bathroom | No | No Trip | SCR had ruptured and resistor was open. Trip coil was damaged. Probable cause of failure was a transient voltage surge exposure. |
| 0205-4 | 1996 | Washington, DC (3) | Bathroom | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 0211-4 | 1978 | Washington, DC (3) | Bathroom | Yes | Tripped/On | Device does not trip when tested. Capacitor had failed and SCR was shorted. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 0262-9 | 1992 | Minneapolis, MN (8) | Bathroom | Yes | No Reset | Device operates properly when tested in the laboratory. |
| 0301-6 | 1992 | Minneapolis, MN (8) | Basement | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 0306-5 | 1989 | Minneapolis, MN (8) | Bathroom | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 0307-5 | 1997 | Minneapolis, MN (8) | Unknown | No | No Trip | Device operates properly when tested in the laboratory. |
| 0309-4 | 1990 | Minneapolis, MN (8) | Garage | No | Tripped/On | Device operates properly when tested in the laboratory, but occasionally the internal cam mechanism will not allow the device to reset unless the reset button is pushed a number of times. |
| 0312-4 | 2000 | Minneapolis, MN (8) | Garage | Yes | Tripped/On | Device operates properly when tested in the laboratory, but does not trip with an external ground fault under a 20A load condition. Differential toroid was not properly assembled. |
| 0312-5 | 2000 | Minneapolis, MN (8) | Bathroom | Yes | No Reset | Device operates properly when tested in the laboratory. |
| 0327-5 | 1990 | Minneapolis, MN (8) | Bathroom | No | No Trip | Device operates properly when tested in the laboratory. |
| 0329-4 | Unknown | Minneapolis, MN (8) | Bathroom | Yes | No Trip | SCR had shorted and integrated circuit does not work as intended. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 0347-4 | 2000 | Minneapolis, MN (8) | Bathroom | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 0358-5 | 1983 | Minneapolis, MN (8) | Bathroom | Yes | No Trip | SCR had shorted and trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 0409-5 | 2000 | Minneapolis, MN (8) | Kitchen | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 0410-6 | 2000 | Minneapolis, MN (8) | Bathroom | Yes | No Trip | Device trips at 6.2 mA at 132V. |
| 0546-6 | 1996 | Los Angeles, CA (6) | Outdoors | Yes | No Trip | SCR and diode bridge components had shorted. Trip coil was open. Evidence of insect invasion. Probable cause of failure could not be determined. |
| 0564-4 | 1986 | Los Angeles, CA (6) | Bathroom | Yes | Tripped/On | Device operates properly when tested in the laboratory. |

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 0564-6 | 1993 | Los Angeles, CA (6) | Outdoors | Yes | No Trip | Weatherproof cover was installed, but not properly sealed. Evidence of corrosion on terminal screws and strap. Probable cause of failure was a power resistor that had opened. |
| 0578-4 | 1995 | Los Angeles, CA (6) | Outdoors | Yes | No Trip | Evidence of corrosion on terminal screw and strap. SCR had ruptured and integrated circuit and diode bridge components had failed. Trip coil was open. Probable cause of failure was a transient voltage surge exposure and/or water damage. |
| 0627-4 | Unknown | Kansas City, KS (4) | Bathroom | Yes | No Trip | Evidence of melting on back cover, and printed circuit board and components badly destroyed and charred. Probable cause of failure could not be determined. |
| 0627-5 | 1992 | Kansas City, KS (4) | Basement | Yes | No Trip | Probable cause of failure was a power supply resistor that had opened. |
| 0628-4 | 1994 | Kansas City, KS (4) | Basement | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 0633-4 | 1995 | Kansas City, KS (4) | Garage | Yes | No Trip | Integrated circuit had failed. Probable cause was a random component failure. |
| 0633-5 | 2000 | Kansas City, KS (4) | Basement | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 0636-4 | 1987 | Kansas City, KS (4) | Basement | Yes | No Trip | SCR had ruptured and integrated circuit had failed. Trip coil was open. Probable cause of failure was multiple firing of the SCR. |
| 0636-5 | 1987 | Kansas City, KS (4) | Bathroom | Yes | No Trip | SCR had ruptured and integrated circuit had failed. Trip coil was open. Probable cause of failure was multiple firing of the SCR. |
| 0637-4 | 1997 | Kansas City, KS (4) | Basement | Yes | No Trip | SCR had failed and integrated circuit does not work as intended. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 0638-4 | 1986 | Kansas City, KS (4) | Garage | Yes | No Trip | SCR had shorted and integrated circuit had failed. Probable cause of failure was a transient voltage surge exposure. |
| 0639-4 | 1998 | Kansas City, KS (4) | Outdoors | Yes | No Trip | Evidence of water exposure. SCR had shorted and integrated circuit does not work as intended. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 0722-4 | 1995 | Kansas City, KS (4) | Kitchen | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 0723-4 | 1986 | Kansas City, KS (4) | Bathroom | Yes | No Trip | SCR had failed and integrated circuit does not work as intended. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 0724-4 | 1994 | Kansas City, KS (4) | Bathroom | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 0753-6 | 1987 | Birmingham, AL (1) | Bathroom | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 0757-4 | 1992 | Birmingham, AL (1) | Outdoors | Yes | No Trip | SCR had shorted and integrated circuit was not working as intended. Probable cause of failure was a transient voltage surge exposure. |
| 0757-5 | 1993 | Birmingham, AL (1) | Bathroom | Yes | No Reset | Device operates properly when tested in the laboratory. Evidence of paint on "test" and "reset" buttons. |
| 0757-6 | 1993 | Birmingham, AL (1) | Bathroom | Yes | No Reset | Device operates properly when tested in the laboratory. |
| 0770-4 | 1986 | Birmingham, AL (1) | Bathroom | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 0790-4 | 1993 | Birmingham, AL (1) | Bathroom | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 1134-4 | 1987 | Seattle, WA (7) | Basement | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 1140-4 | 1984 | Seattle, WA (7) | Garage | Yes | No Trip | MOV had ruptured, and evidence of arc-over line-to-line. Probable cause of failure was a transient voltage surge exposure. |
| 1155-7 | 1998 | Seattle, WA (7) | Kitchen | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 1158-4 | 1995 | Seattle, WA (7) | Bathroom | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 1161-4 | 1999 | Seattle, WA (7) | Kitchen | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 1161-5 | 1999 | Seattle, WA (7) | Bathroom | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 1161-6 | 1999 | Seattle, WA (7) | Outdoors | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 1164-4 | 1996 | Seattle, WA (7) | Outdoors | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 1164-8 | 1996 | Seattle, WA (7) | Bathroom | Yes | No Trip | Device operates properly when tested in the laboratory. |

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 1168-4 | 1996 | Washington, DC (3) | Basement | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 1194-4 | 1975 | Washington, DC (3) | Basement | Yes | Tripped/On | Device does not trip at 6mA, but does trip at 240mA. Probable cause of failure could not be determined. |
| 1230-4 | 1995 | Washington, DC (3) | Kitchen | Yes | No Trip | Resistor had opened. Probable cause was a random component failure. |
| 1397-4 | 1993 | Tampa, FL (1) | Garage | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 1446-4 | 1995 | Tampa, FL (1) | Garage | Yes | No Trip | SCR had shorted and integrated circuit does not work as intended. Resistor shows evidence of overheating. Trip coil was open. Probable cause of failure was a sustained overvoltage exposure. |
| 1446-5 | 1995 | Tampa, FL (1) | Kitchen | Yes | No Trip | SCR had shorted and integrated circuit does not work as intended. Resistor shows evidence of overheating. Trip coil was open. Probable cause of failure was a sustained overvoltage exposure. |
| 1452-4 | 1983 | Tampa, FL (1) | Garage | Yes | Tripped/On | Device operates properly when tested in the laboratory. Evidence of paint on face and contacts. |
| 1460-6 | 1995 | Tampa, FL (1) | Bathroom | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 1476-4 | Unknown | Tampa, FL (1) | Outdoors | Yes | No Trip | Evidence of insect inhabitation. Neutral contact was deformed. SCR had ruptured and integrated circuit was not working as intended. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 1556-5 | 1990 | Denver, CO (8) | Bathroom | No | Tripped/On | Load will not energize. Reset button will not release with external ground fault. Contact had melted. Integrated circuit not working as intended. Probable cause of failure was a short circuit ground fault. |
| 1594-4 | 1981 | Denver, CO (8) | Garage | Yes | No Trip | Diode bridge component had shorted and trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 1636-5 | 1996 | Austin, TX (2) | Garage | Yes | No Trip | Device had difficulty relatching. "Reset" button springs were dislodged. Evidence of paint on "test" and "reset" buttons. Device operates properly when able to reset. |
| 1717-4 | 1990 | Austin, TX (2) | Outdoors | Yes | Tripped/On | Weatherproof cover was installed, but not properly sealed. Evidence of water damage and corrosion on terminal screws and strap. SCR, integrated circuit and diode bridge components had failed. Probable cause of failure was water contamination. |
| 1717-5 | 1991 | Austin, TX (2) | Basement | No | Tripped/On | Device operates properly when tested in the laboratory. |

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 1717-6 | 1992 | Austin, TX (2) | Basement | No | Tripped/On | Device operates properly when tested in the laboratory. |
| 1717-7 | 1992 | Austin, TX (2) | Garage | Yes | No Reset | Device operates properly when tested in the laboratory. |
| 2318-4 | 1996 | Tampa, FL (1) | Outdoors | Yes | No Trip | Evidence of insect invasion and water damage. SCR had shorted and integrated circuit had failed. Trip coil was open. Probable cause of failure was water and/or insect contamination |
| 2318-6 | 1995 | Tampa, FL (1) | Garage | Yes | No Trip | Device operates at a minimum 6.5mA. Probable cause of failure was a resistor that was out of specification. |
| 2502-4 | 1998 | Washington, DC (3) | Basement | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 2502-5 | 1998 | Washington, DC (3) | Basement | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 2524-4 | 1989 | Washington, DC (3) | Kitchen | Yes | Unknown | Device operates properly when tested in the laboratory. |
| 2863-5 | 1985 | Los Angeles, CA (6) | Basement | Yes | No Trip | Receptacle face and buttons covered with paint. Evidence of insect invasion. SCR and integrated circuit had failed. Trip coil was open. Probable cause of failure was abuse, tampering, and/or contamination. |
| 2863-6 | 1985 | Los Angeles, CA (6) | Basement | Yes | No Trip | Receptacle face and buttons covered with paint. Evidence of insect invasion. SCR and integrated circuit had failed. Trip coil was open. Probable cause of failure was abuse, tampering, and/or contamination. |
| 2863-7 | 1985 | Los Angeles, CA (6) | Basement | Yes | No Trip | Evidence of arcing at terminal. SCR had ruptured and integrated circuit had failed. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 2863-11 | 1985 | Los Angeles, CA (6) | Basement | Yes | No Trip | Receptacle face and buttons covered with paint. Evidence of insect invasion. SCR and integrated circuit had failed. Trip coil was open. Probable cause of failure was abuse, tampering, and/or contamination. |
| 2863-19 | 1985 | Los Angeles, CA (6) | Basement | Yes | No Trip | Receptacle face and buttons covered with paint. Evidence of insect invasion. SCR and integrated circuit had failed. Trip coil was open. Probable cause of failure was abuse, tampering, and/or contamination. |
| 2863-21 | 1985 | Los Angeles, CA (6) | Basement | Yes | No Trip | Receptacle face and buttons covered with paint. Evidence of insect invasion. SCR and integrated circuit had failed. Trip coil was open. Probable cause of failure was abuse, tampering, and/or contamination. |

| Control Number | Year of Manufacture | Region (Permutation) | Installed Location | Wiring Correct? | Field Test Result | Comment Based on Laboratory Analysis |
|---|---|---|---|---|---|---|
| 3559-8 | 1993 | Birmingham, AL (1) | Bathroom | Yes | Tripped/On | Device operates properly when tested in the laboratory. |
| 3579-6 | 1994 | Kansas City, KS (4) | Basement | Yes | No Trip | Device operates properly when tested in the laboratory. |
| 3580-4 | 1989 | Kansas City, KS (4) | Outdoors | Yes | No Trip | Terminal screws corroded and mounting yoke deformed. Evidence of insect invasion. SCR, integrated circuit, and diode bridge components had failed. Trip coil was open. Probable cause of failure was water and/or insect contamination |
| 3580-9 | Unknown | Kansas City, KS (4) | Outdoors | Yes | No Trip | Evidence of insect invasion and water damage. Heavy corrosion contamination on printed wiring board and components. SCR had shorted and trip coil was open. Probable cause of failure was not able to be determined. |
| 3832-4 | 1992 | Tampa, FL (1) | Garage | Yes | No Trip | SCR had ruptured and integrated circuit had failed. Trip coil was open. Probable cause of failure was a transient voltage surge exposure. |
| 3842-7 | 1997 | Tampa, FL (1) | Kitchen | No | Tripped/On | Device operates properly when tested in the laboratory. |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **APPENDIX F - Raw Data** | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Miscellaneous Information | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 5 | 1 | 751 | B1 | M | S | 25 | Birmingham | AL | 20 | 1 | No Trip | Unk | Other | Yes | Yes | | | | | | | |
| 6 | 1 | 752 | R4 | M | U | 3 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 7 | 1 | 752 | R5 | M | U | 3 | Birmingham | AL | | | | | | | | Kit | 20 | In | Off | | | |
| 8 | 1 | 752 | R6 | M | U | 3 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 9 | 1 | 752 | R7 | M | U | 3 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 10 | 1 | 753 | R4 | M | S | 13 | Pinson | AL | | | | | | | | Kit | 15 | Out | Off | | | |
| 11 | 1 | 753 | R5 | M | S | 13 | Pinson | AL | | | | | | | | Kit | 15 | In | Off | | | |
| 12 | 1 | 753 | R6 | M | S | 13 | Pinson | AL | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 13 | 1 | 754 | R4 | S | S | 42 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 14 | 1 | 754 | R5 | S | S | 42 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 15 | 1 | 755 | R4 | S | S | Unk | Birmingham | AL | | | | | | | | B | 20 | In | Off | | | |
| 16 | 1 | 755 | R5 | S | S | Unk | Birmingham | AL | | | | | | | | Kit | 20 | In | Off | | | |
| 17 | 1 | 756 | B1 | M | S | 13 | Birmingham | AL | 20 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 18 | 1 | 756 | R4 | M | S | 13 | Birmingham | AL | | | | | | | | Base | 15 | Unk | Off | | | |
| 19 | 1 | 756 | R5 | M | S | 13 | Birmingham | AL | | | | | | | No | G | 20 | Unk | No Trip | | | |
| 20 | 1 | 756 | R6 | M | S | 13 | Birmingham | AL | | | | | | | | B | 20 | Unk | Unk | | | |
| 21 | 1 | 756 | R7 | M | S | 13 | Birmingham | AL | | | | | | | | B | 20 | Unk | Unk | | | |
| 22 | 1 | 756 | R8 | M | S | 13 | Birmingham | AL | | | | | | | No | Kit | 20 | Unk | No Trip | | | |
| 23 | 1 | 757 | R4 | S | S | 60 | Birmingham | AL | | | | | | Yes | Yes | Unk | 15 | Out | No Trip | | | |
| 24 | 1 | 757 | R5 | S | S | 60 | Birmingham | AL | | | | | | Yes | Yes | B | 20 | Out | No Reset | | | |
| 25 | 1 | 757 | R6 | S | S | 60 | Birmingham | AL | | | | | | Yes | Yes | B | 20 | In | No Reset | | | |
| 26 | 1 | 758 | B1 | M | S | 21 | Birmingham | AL | 15 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 27 | 1 | 759 | R4 | M | S | 16 | Birmingham | AL | | | | | | | | B | 15 | Unk | Off | | | |
| 28 | 1 | 759 | R5 | M | S | 16 | Birmingham | AL | | | | | | | | B | 15 | Unk | Off | | | |
| 29 | 1 | 760 | B1 | M | U | 30 | Birmingham | AL | 20 | 1 | Trip | Unk | Other | | | | | | | | | |
| 30 | 1 | 760 | R4 | M | U | 30 | Birmingham | AL | | | | | | | | B | 15 | Unk | Off | | | |
| 31 | 1 | 761 | R4 | S | S | 7 | Birmingham | AL | | | | | | | | G | 20 | Unk | Off | | | |
| 32 | 1 | 761 | R5 | S | S | 7 | Birmingham | AL | | | | | | | | Kit | 20 | In | Off | | | |
| 33 | 1 | 762 | R4 | S | S | Unk | Birmingham | AL | | | | | | | | G | 20 | In | Off | | | |
| 34 | 1 | 762 | R5 | S | S | Unk | Birmingham | AL | | | | | | | | B | 20 | In | Off | | | |
| 35 | 1 | 762 | R6 | S | S | Unk | Birmingham | AL | | | | | | | | B | 20 | In | Off | | | |
| 36 | 1 | 762 | R7 | S | S | Unk | Birmingham | AL | | | | | | | | B | 20 | Out | Off | | | |
| 37 | 1 | 762 | R8 | S | S | Unk | Birmingham | AL | | | | | | | | Kit | 20 | In | Off | | | |
| 38 | 1 | 762 | R9 | S | S | Unk | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 39 | 1 | 765 | R4 | M | S | 30 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 40 | 1 | 765 | R5 | M | S | 30 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 41 | 1 | 766 | R4 | S | R | 20 | Montevallo | AL | | | | | | | | B | 15 | In | Off | | | |
| 42 | 1 | 766 | R5 | S | R | 20 | Montevallo | AL | | | | | | | | B | 15 | Unk | Off | | | |
| 43 | 1 | 766 | R6 | S | R | 20 | Montevallo | AL | | | | | | | | Kit | 20 | Unk | Off | | | |
| 44 | 1 | 766 | R7 | S | R | 20 | Montevallo | AL | | | | | | | | Kit | 20 | Unk | Off | | | |
| 45 | 1 | 767 | B1 | S | S | 9 | Birmingham | AL | 20 | 1 | Trip | Unk | G | | | | | | | | | |
| 46 | 1 | 767 | B2 | S | S | 9 | Birmingham | AL | 20 | 1 | Trip | Unk | G | | | | | | | | | |
| 47 | 1 | 767 | R4 | S | S | 9 | Birmingham | AL | | | | | | | | B | 20 | In | Off | | | |
| 48 | 1 | 767 | R5 | S | S | 9 | Birmingham | AL | | | | | | | | Base | 20 | In | Off | | | |
| 49 | 1 | 768 | R4 | S | S | 8 | Pinson | AL | | | | | | | | G | 20 | Out | Off | | | |
| 50 | 1 | 768 | R5 | S | S | 8 | Pinson | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 51 | 1 | 770 | R4 | S | S | 20 | Trussville | AL | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 52 | 1 | 773 | B1 | S | S | 20 | Birmingham | AL | 20 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 53 | 1 | 773 | B2 | S | S | 20 | Birmingham | AL | 20 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 54 | 1 | 774 | B1 | S | S | 20 | Birmingham | AL | 20 | 1 | Trip | Unk | U | | | | | | | | | |
| 55 | 1 | 774 | B2 | S | S | 20 | Birmingham | AL | 20 | 1 | Trip | Unk | U | | | | | | | | | |
| 56 | 1 | 775 | R4 | M | S | 15 | Birmingham | AL | | | | | | | | B | 20 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 57 | 1 | 780 | R4 | S | S | 12 | Birmingham | AL | | | | | | | No | G | 20 | Out | No Trip | | | |
| 58 | 1 | 780 | R5 | S | S | 12 | Birmingham | AL | | | | | | | | G | 20 | Out | Off | | | |
| 59 | 1 | 780 | R6 | S | S | 12 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 60 | 1 | 780 | R7 | S | S | 12 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 61 | 1 | 789 | B1 | S | S | 6 | Alabaster | AL | 20 | 1 | Trip | Unk | G | | | | | | | | | |
| 62 | 1 | 789 | R4 | S | S | 6 | Alabaster | AL | | | | | | | | B | 15 | In | Off | | | |
| 63 | 1 | 789 | R5 | S | S | 6 | Alabaster | AL | | | | | | | | B | 15 | In | Off | | | |
| 64 | 1 | 789 | R6 | S | S | 6 | Alabaster | AL | | | | | | | | B | 15 | In | Off | | | |
| 65 | 1 | 789 | R7 | S | S | 6 | Alabaster | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 66 | 1 | 790 | R4 | S | S | 35 | Birmingham | AL | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 67 | 1 | 790 | R5 | S | S | 35 | Birmingham | AL | | | | | | | | G | 20 | In | Off | | | |
| 68 | 1 | 790 | R6 | S | S | 35 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 69 | 1 | 791 | R4 | S | S | 5 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 70 | 1 | 791 | R5 | S | S | 5 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 71 | 1 | 792 | R4 | S | S | 4 | Birmingham | AL | | | | | | | | G | 20 | Out | Off | | | |
| 72 | 1 | 792 | R5 | S | S | 4 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 73 | 1 | 1376 | R4 | S | S | 4 mo | Valpico | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 74 | 1 | 1376 | R5 | S | S | 4 mo | Valpico | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 75 | 1 | 1376 | R6 | S | S | 4 mo | Valpico | FL* | | | | | | | | G | 15 | In | Off | | | |
| 76 | 1 | 1376 | R7 | S | S | 4 mo | Valpico | FL* | | | | | | | | B | 15 | In | Off | | | |
| 77 | 1 | 1377 | R4 | S | S | 1 | Fun City | FL | | | | | | | | G | 15 | In | Off | | | |
| 78 | 1 | 1377 | R5 | S | S | 1 | Fun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 79 | 1 | 1377 | R6 | S | S | 1 | Fun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 80 | 1 | 1377 | R7 | S | S | 1 | Fun City | FL | | | | | | | | B | 15 | In | Off | | | |
| 81 | 1 | 1378 | R4 | S | S | 8 | Lakeland | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 82 | 1 | 1378 | R5 | S | S | 8 | Lakeland | FL | | | | | | | | G | 15 | In | Off | | | |
| 83 | 1 | 1386 | B1 | S | S | 5 | Valrico | FL | 20 | 3 | Trip | | U | | | | | | | | | |
| 84 | 1 | 1386 | R4 | S | S | 5 | Valrico | FL | | | | | | | | B | 15 | In | Off | | | |
| 85 | 1 | 1388 | R4 | M | U | 50 | Anna Maria | FL | | | | | | | | B | 15 | In | Off | | | |
| 86 | 1 | 1390 | R4 | S | U | 22 | Anna Maria | FL | | | | | | | | B | 15 | In | Off | | | |
| 87 | 1 | 1397 | R4 | S | S | 7 | Valrico | FL | | | | | | No | Yes | G | 15 | In | On | | | |
| 88 | 1 | 1397 | R5 | S | S | 7 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 89 | 1 | 1397 | R6 | S | S | 7 | Valrico | FL | | | | | | | | Out | 15 | | Off | | | |
| 90 | 1 | 1438 | R4 | S | S | 34 | Brandon | FL | | | | | | | | Out | 15 | | Off | | | |
| 91 | 1 | 1439 | R4 | S | S | 13 | Plant City | FL | | | | | | | | Out | 15 | | Off | | | |
| 92 | 1 | 1440 | R4 | S | S | 17 | Sun City | FL | | | | | | | | B | 15 | In | Off | | | |
| 93 | 1 | 1441 | R4 | S | S | 14 | Valrico | FL | | | | | | | | Base | 15 | In | Off | | | |
| 94 | 1 | 1443 | R4 | S | S | 1 | Valrico | FL | | | | | | | | G | 15 | In | Off | | | |
| 95 | 1 | 1443 | R5 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 96 | 1 | 1443 | R6 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 97 | 1 | 1443 | R7 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 98 | 1 | 1443 | R8 | S | S | 1 | Valrico | FL | | | | | | | | B | 15 | In | Off | | | |
| 99 | 1 | 1443 | R9 | S | S | 1 | Valrico | FL | | | | | | | | Out | 15 | | Off | | | |
| 100 | 1 | 1444 | R4 | S | S | 18 | Olsmar | FL | | | | | | | | Out | 15 | | Off | | | |
| 101 | 1 | 1445 | R4 | S | S | 10 | Plant City | FL | | | | | | | No | G | 15 | In | No Trip | | | |
| 102 | 1 | 1446 | R4 | S | S | 3 | Brandon | FL | | | | | | Yes | Yes | G | 15 | In | No Trip | | | |
| 103 | 1 | 1446 | R5 | S | S | 3 | Brandon | FL | | | | | | Yes | Yes | Kit | 15 | Out | No Trip | | | |
| 104 | 1 | 1446 | R6 | S | S | 3 | Brandon | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 105 | 1 | 1447 | R4 | S | S | Unk | Sun City | FL | | | | | | No | No | B | 15 | In | No Trip | | | |
| 106 | 1 | 1448 | R4 | S | S | 13 | Valrico | FL | | | | | | | | Unk | 15 | Out | Off | | | |
| 107 | 1 | 1449 | R4 | S | S | 6 mo | Tampa | FL* | | | | | | | | G | 15 | In | Off | | | |
| 108 | 1 | 1449 | R5 | S | S | 6 mo | Tampa | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 109 | 1 | 1449 | R6 | S | S | 6 mo | Tampa | FL* | | | | | | | | B | 15 | In | Off | | | |
| 110 | 1 | 1449 | R7 | S | S | 6 mo | Tampa | FL* | | | | | | | | Kit | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 111 | 1 | 1450 | R4 | S | S | 13 | Brandon | FL | | | | | | | | G | 15 | In | Off | | | |
| 112 | 1 | 1450 | R5 | S | S | 13 | Brandon | FL | | | | | | | | Out | 15 | | Off | | | |
| 113 | 1 | 1451 | R4 | S | S | 4 mo | Lithia | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 114 | 1 | 1451 | R5 | S | S | 4 mo | Lithia | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 115 | 1 | 1451 | R6 | S | S | 4 mo | Lithia | FL* | | | | | | | | B | 15 | In | Off | | | |
| 116 | 1 | 1451 | R7 | S | S | 4 mo | Lithia | FL* | | | | | | | | G | 15 | In | Off | | | |
| 117 | 1 | 1452 | R4 | S | S | 13 | Tampa | FL | | | | | | Yes | Yes | G | 15 | In | On | | | |
| 118 | 1 | 1453 | R4 | S | S | 30 | Seminole | FL | | | | | | | | Out | 15 | | Off | | | |
| 119 | 1 | 1453 | R5 | S | S | 30 | Seminole | FL | | | | | | | | B | 15 | In | Off | | | |
| 120 | 1 | 1454 | B1 | S | S | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 121 | 1 | 1454 | B2 | S | S | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 122 | 1 | 1454 | B3 | S | S | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 123 | 1 | 1454 | R4 | S | S | 5 | Newport Richey | FL | | | | | | | | B | 15 | In | Off | | | |
| 124 | 1 | 1454 | R5 | S | S | 5 | Newport Richey | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 125 | 1 | 1454 | R6 | S | S | 5 | Newport Richey | FL | | | | | | | | B | 15 | In | Off | | | |
| 126 | 1 | 1454 | R7 | S | S | 5 | Newport Richey | FL | | | | | | | | Out | 15 | | Off | | | |
| 127 | 1 | 1455 | B1 | S | S | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 128 | 1 | 1455 | B2 | S | S | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 129 | 1 | 1455 | B3 | S | S | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 130 | 1 | 1456 | B1 | Unk | Unk | 5 | Newport Richey | FL | 20 | 1 | Trip | 1995 | Out | | | | | | | | | |
| 131 | 1 | 1457 | R4 | M | U | 26 | Trensore Isle | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 132 | 1 | 1458 | R4 | S | S | 15 | Seminole | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 133 | 1 | 1459 | B1 | M | U | 14 | Treasure Island | FL | 15 | 1 | No Trip | 1986 | Other | Yes | Yes | | | | | | | |
| 134 | 1 | 1460 | B1 | S | S | 18 | Largo | FL | 15 | 1 | Unk | | B | Yes | Yes | | | | | | | |
| 135 | 1 | 1460 | R4 | S | S | 18 | Largo | FL | | | | | | | | Out | 15 | | Off | | | |
| 136 | 1 | 1460 | R5 | S | S | 18 | Largo | FL | | | | | | | | B | 15 | In | Off | | | |
| 137 | 1 | 1460 | R6 | S | S | 18 | Largo | FL | | | | | | Yes | Yes | B | 15 | In | On | | | |
| 138 | 1 | 1461 | R4 | M | R | 1 | Tampa | FL | | | | | | | | Out | 15 | | Off | | | |
| 139 | 1 | 1461 | R5 | M | R | 1 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 140 | 1 | 1461 | R6 | M | R | 1 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 141 | 1 | 1461 | R7 | M | R | 1 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 142 | 1 | 1473 | B1 | S | S | 43 | Bradenton | FL | 50 | 2 | No Trip | 1979 | Out | | No | | | | | | | |
| 143 | 1 | 1473 | R4 | S | S | 43 | Bradenton | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 144 | 1 | 1474 | B1 | M | U | 22 | Bradenton | FL | 15 | 1 | Trip | 1978 | G | | | | | | | | | |
| 145 | 1 | 1476 | R4 | S | S | 20 | Clearwater | FL | | | | | | Yes | Yes | Out | 15 | | No Trip | Yes | No | Yes |
| 146 | 1 | 1477 | R4 | S | S | 50 | Tampa | FL | | | | | | | | Out | 15 | | Off | | | |
| 147 | 1 | 1477 | R5 | S | S | 50 | Tampa | FL | | | | | | | | Out | 15 | | Off | | | |
| 148 | 1 | 1477 | R6 | S | S | 50 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 149 | 1 | 1477 | R7 | S | S | 50 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 150 | 1 | 1478 | R4 | S | U | 69 | Tampa | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 151 | 1 | 1478 | R5 | S | U | 69 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 152 | 1 | 1479 | R4 | S | S | 7 | Son City | FL | | | | | | | | G | 15 | In | Off | | | |
| 153 | 1 | 1479 | R5 | S | S | 7 | Son City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 154 | 1 | 1480 | R4 | S | S | 1 | Valrico | FL | | | | | | | | G | 15 | In | Off | | | |
| 155 | 1 | 1480 | R5 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 156 | 1 | 1480 | R6 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 157 | 1 | 1480 | R7 | S | S | 1 | Valrico | FL | | | | | | | | B | 15 | In | Off | | | |
| 158 | 1 | 1480 | R8 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 159 | 1 | 1481 | R4 | S | S | 4 mo | Valrico | FL* | | | | | | | No | G | 15 | In | No Trip | | | |
| 160 | 1 | 1481 | R5 | S | S | 4 mo | Valrico | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 161 | 1 | 1481 | R6 | S | S | 4 mo | Valrico | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 162 | 1 | 1481 | R7 | S | S | 4 mo | Valrico | FL* | | | | | | | | B | 15 | In | Off | | | |
| 163 | 1 | 1484 | B1 | S | S | 30 | Bradenton | FL | 15 | 1 | Trip | 1970 | Other | | | | | | | | | |
| 164 | 1 | 1485 | R4 | S | S | 19 | Bradenton | FL | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 165 | 1 | 2301 | R4 | S | S | 4 | Sun City | FL | | | | | | | | G | 15 | In | Off | | | |
| 166 | 1 | 2301 | R5 | S | S | 4 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 167 | 1 | 2302 | R4 | S | S | 4 | Riverview | FL | | | | | | | | G | 15 | In | Off | | | |
| 168 | 1 | 2302 | R5 | S | S | 4 | Riverview | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 169 | 1 | 2302 | R6 | S | S | 4 | Riverview | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 170 | 1 | 2302 | R7 | S | S | 4 | Riverview | FL | | | | | | | | B | 15 | In | Off | | | |
| 171 | 1 | 2303 | R4 | S | S | 4 | Sun City | FL | | | | | | | | Out | 15 | | Off | | | |
| 172 | 1 | 2303 | R5 | S | S | 4 | Sun City | FL | | | | | | | | G | 15 | In | Off | | | |
| 173 | 1 | 2303 | R6 | S | S | 4 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 174 | 1 | 2304 | R4 | S | S | 8 | Sun City | FL | | | | | | | | G | 15 | In | Off | | | |
| 175 | 1 | 2304 | R5 | S | S | 8 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 176 | 1 | 2304 | R6 | S | S | 8 | Sun City | FL | | | | | | | | Out | 15 | | Off | | | |
| 177 | 1 | 2305 | R4 | S | S | 8 | Valrico | FL | | | | | | | | G | 15 | In | Off | | | |
| 178 | 1 | 2306 | R4 | S | S | 1 | Lutz | FL | | | | | | | | G | 15 | In | Off | | | |
| 179 | 1 | 2306 | R5 | S | S | 1 | Lutz | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 180 | 1 | 2306 | R6 | S | S | 1 | Lutz | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 181 | 1 | 2306 | R7 | S | S | 1 | Lutz | FL | | | | | | | | B | 15 | In | Off | | | |
| 182 | 1 | 2307 | R4 | S | S | 1 | Sun City | FL | | | | | | | No | G | 15 | In | No Trip | | | |
| 183 | 1 | 2307 | R5 | S | S | 1 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 184 | 1 | 2307 | R6 | S | S | 1 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 185 | 1 | 2307 | R7 | S | S | 1 | Sun City | FL | | | | | | | No | B | 15 | In | No Trip | | | |
| 186 | 1 | 2308 | B1 | S | S | 23 | Tampa | FL | 20 | 2 | Trip | 1977 | G | | | | | | | | | |
| 187 | 1 | 2310 | R4 | S | S | 4 | Brandon | FL | | | | | | | | G | 15 | In | Off | | | |
| 188 | 1 | 2310 | R5 | S | S | 4 | Brandon | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 189 | 1 | 2311 | R4 | S | S | 1 | Tampa | FL | | | | | | | | G | 15 | In | Off | | | |
| 190 | 1 | 2311 | R5 | S | S | 1 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 191 | 1 | 2311 | R6 | S | S | 1 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 192 | 1 | 2311 | R7 | S | S | 1 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 193 | 1 | 2312 | B1 | S | S | Unk | Brandon | FL | 20 | 3 | Trip | 1985 | G | | | | | | | | | |
| 194 | 1 | 2312 | B2 | S | S | Unk | Brandon | FL | 20 | 3 | Trip | 1985 | G | | | | | | | | | |
| 195 | 1 | 2313 | R4 | S | S | 5 mo | Valrico | FL* | | | | | | | | G | 15 | In | Off | | | |
| 196 | 1 | 2313 | R5 | S | S | 5 mo | Valrico | FL* | | | | | | | | B | 15 | In | Off | | | |
| 197 | 1 | 2313 | R6 | S | S | 5 mo | Valrico | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 198 | 1 | 2313 | R7 | S | S | 5 mo | Valrico | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 199 | 1 | 2314 | R4 | S | S | Unk | Sun City | FL | | | | | | | No | B | 15 | In | No Trip | | | |
| 200 | 1 | 2316 | R4 | S | S | 5 | Sun City | FL | | | | | | | | G | 15 | Out | Off | | | |
| 201 | 1 | 2316 | R5 | S | S | 5 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 202 | 1 | 2318 | R4 | S | S | 3 | Valrico | FL | | | | | | Yes | Yes | Out | 15 | | No Trip | | | |
| 203 | 1 | 2318 | R5 | S | S | 3 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 204 | 1 | 2318 | R6 | S | S | 3 | Valrico | FL | | | | | | Yes | Yes | G | 15 | In | No Trip | | | |
| 205 | 1 | 2318 | R7 | S | S | 3 | Valrico | FL | | | | | | | | B | 15 | In | Off | | | |
| 206 | 1 | 2319 | R4 | S | S | 20 | Sun City | FL | | | | | | | | B | 15 | Out | Off | | | |
| 207 | 1 | 2320 | R4 | S | S | 1 | Odessa | FL | | | | | | | | G | 15 | In | Off | | | |
| 208 | 1 | 2320 | R5 | S | S | 1 | Odessa | FL | | | | | | | | B | 15 | In | Off | | | |
| 209 | 1 | 2320 | R6 | S | S | 1 | Odessa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 210 | 1 | 2320 | R7 | S | S | 1 | Odessa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 211 | 1 | 2321 | R4 | Unk | S | Unk | Riverview | FL | | | | | | | | B | 15 | In | Off | | | |
| 212 | 1 | 2322 | R4 | S | S | 1 | Riverview | FL | | | | | | | | G | 15 | In | Off | | | |
| 213 | 1 | 2322 | R5 | S | S | 1 | Riverview | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 214 | 1 | 2322 | R6 | S | S | 1 | Riverview | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 215 | 1 | 2322 | R7 | S | S | 1 | Riverview | FL | | | | | | | | B | 15 | In | Off | | | |
| 216 | 1 | 2323 | R4 | S | S | 40 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 217 | 1 | 2326 | R4 | M | S | 1 | Brandon | FL | | | | | | | | Out | 15 | | On | | | |
| 218 | 1 | 2326 | R5 | M | S | 1 | Brandon | FL | | | | | | | | Kit | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 219 | 1 | 2326 | R6 | M | S | 1 | Brandon | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 220 | 1 | 2326 | R7 | M | S | 1 | Brandon | FL | | | | | | | | B | 15 | In | Off | | | |
| 221 | 1 | 2327 | R4 | S | S | 1 | Valrico | FL | | | | | | | | G | 15 | In | Off | | | |
| 222 | 1 | 2327 | R5 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 223 | 1 | 2327 | R6 | S | S | 1 | Valrico | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 224 | 1 | 2327 | R7 | S | S | 1 | Valrico | FL | | | | | | | | B | 15 | In | Off | | | |
| 225 | 1 | 2327 | R8 | S | S | 1 | Valrico | FL | | | | | | | No | B | 15 | In | On | | | |
| 226 | 1 | 2328 | R4 | S | S | 18 | Tampa | FL | | | | | | | | G | 15 | In | Off | | | |
| 227 | 1 | 2329 | R4 | S | S | 32 | Tampa | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 228 | 1 | 2329 | R5 | S | S | 32 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 229 | 1 | 2329 | R6 | S | S | 32 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 230 | 1 | 2330 | R4 | S | S | 1 | Lithia | FL | | | | | | | | G | 15 | Out | Off | | | |
| 231 | 1 | 2330 | R5 | S | S | 1 | Lithia | FL | | | | | | | | Base | 15 | In | Off | | | |
| 232 | 1 | 2330 | R6 | S | S | 1 | Lithia | FL | | | | | | | | B | 15 | In | Off | | | |
| 233 | 1 | 2330 | R7 | S | S | 1 | Lithia | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 234 | 1 | 2330 | R8 | S | S | 1 | Lithia | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 235 | 1 | 2331 | R4 | S | S | 7 | Tampa | FL | | | | | | | | G | 15 | Out | Off | | | |
| 236 | 1 | 2331 | R5 | S | S | 7 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 237 | 1 | 2331 | R6 | S | S | 7 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 238 | 1 | 2331 | R7 | S | S | 7 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 239 | 1 | 2331 | R8 | S | S | 7 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 240 | 1 | 2331 | R9 | S | S | 7 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 241 | 1 | 2332 | R4 | S | S | 11 | Riverview | FL | | | | | | | | G | 15 | Out | No Trip | | | |
| 242 | 1 | 2333 | R4 | S | S | 5 mo | Tampa | FL* | | | | | | | | B | 15 | In | Off | | | |
| 243 | 1 | 2333 | R5 | S | S | 5 mo | Tampa | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 244 | 1 | 2333 | R6 | S | S | 5 mo | Tampa | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 245 | 1 | 2333 | R7 | S | S | 5 mo | Tampa | FL* | | | | | | | | G | 15 | Out | Off | | | |
| 246 | 1 | 2334 | R4 | S | S | Unk | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 247 | 1 | 2335 | R4 | S | S | 25 | Mango | FL | | | | | | | | B | 15 | In | Off | | | |
| 248 | 1 | 2336 | R4 | S | S | 5 mo | Wesley Chapel | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 249 | 1 | 2336 | R5 | S | S | 5 mo | Wesley Chapel | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 250 | 1 | 2336 | R6 | S | S | 5 mo | Wesley Chapel | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 251 | 1 | 2336 | R7 | S | S | 5 mo | Wesley Chapel | FL* | | | | | | | | Kit | 15 | In | Off | | | |
| 252 | 1 | 2336 | R8 | S | S | 5 mo | Wesley Chapel | FL* | | | | | | | | G | 15 | In | Off | | | |
| 253 | 1 | 2336 | R9 | S | S | 5 mo | Wesley Chapel | FL* | | | | | | | | B | 15 | Out | Off | | | |
| 254 | 1 | 2337 | R4 | S | S | 8 | Sun City | FL | | | | | | | | G | 15 | In | Off | | | |
| 255 | 1 | 2337 | R5 | S | S | 8 | Sun City | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 256 | 1 | 2338 | R4 | S | S | 21 | Tampa | FL | | | | | | | | Out | 15 | | Off | | | |
| 257 | 1 | 2338 | R5 | S | S | 21 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 258 | 1 | 2339 | R4 | S | S | 14 | Lithia | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 259 | 1 | 2339 | R5 | S | S | 14 | Lithia | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 260 | 1 | 2339 | R6 | S | S | 14 | Lithia | FL | | | | | | | | B | 15 | In | Off | | | |
| 261 | 1 | 2339 | R7 | S | S | 14 | Lithia | FL | | | | | | | | G | 15 | In | Off | | | |
| 262 | 1 | 3501 | B1 | S | S | 15 | Birmingham | AL | 15 | 1 | No Trip | 1985 | G | Yes | Yes | | | | | | | |
| 263 | 1 | 3501 | B2 | S | S | 15 | Birmingham | AL | 15 | 1 | Trip | 1985 | G | | | | | | | | | |
| 264 | 1 | 3502 | R4 | S | S | 4 | Birmingham | AL | | | | | | | | G | 15 | Out | Off | | | |
| 265 | 1 | 3502 | R5 | S | S | 4 | Birmingham | AL | | | | | | | | B | 15 | Out | Off | | | |
| 266 | 1 | 3502 | R6 | S | S | 4 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 267 | 1 | 3502 | R7 | S | S | 4 | Birmingham | AL | | | | | | | | B | 15 | Out | Off | | | |
| 268 | 1 | 3503 | B1 | S | S | 50 | Stlazaoga | AL | 20 | 1 | Trip | Unk | Out | | | | | | | | | |
| 269 | 1 | 3521 | R4 | S | S | 60 | Birmingham | AL | | | | | | | | Kit | Unk | Out | Off | | | |
| 270 | 1 | 3522 | B1 | S | S | 6 | Birmingham | AL | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 271 | 1 | 3522 | R4 | S | S | 6 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 272 | 1 | 3522 | R5 | S | S | 6 | Birmingham | AL | | | | | | | | B | 20 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 273 | 1 | 3522 | R6 | S | S | 6 | Birmingham | AL | | | | | | | | G | 20 | Out | Off | | | |
| 274 | 1 | 3523 | R4 | S | Unk | 9 | Warrior | AL | | | | | | | | B | 20 | In | Off | | | |
| 275 | 1 | 3523 | R5 | S | Unk | 9 | Warrior | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 276 | 1 | 3523 | R6 | S | Unk | 9 | Warrior | AL | | | | | | | | G | 20 | In | Off | | | |
| 277 | 1 | 3525 | R4 | S | S | 32 | Birmingham | AL | | | | | | | | B | Unk | In | Off | | | |
| 278 | 1 | 3526 | R4 | S | S | 30 | Birmingham | AL | | | | | | | | Kit | Unk | In | Off | | | |
| 279 | 1 | 3527 | R4 | S | S | 5 | Birmingham | AL | | | | | | | | Kit | Unk | In | Off | | | |
| 280 | 1 | 3527 | R5 | S | S | 5 | Birmingham | AL | | | | | | | | B | Unk | In | Off | | | |
| 281 | 1 | 3528 | R4 | S | S | 6 | Alabaster | AL | | | | | | | No | Kit | Unk | In | No Trip | | | |
| 282 | 1 | 3529 | R4 | S | S | 6 | Birmingham | AL | | | | | | | | Kit | Unk | In | Off | | | |
| 283 | 1 | 3529 | R5 | S | S | 6 | Birmingham | AL | | | | | | | | B | Unk | In | Off | | | |
| 284 | 1 | 3556 | R4 | S | S | 10 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 285 | 1 | 3556 | R5 | S | S | 10 | Birmingham | AL | | | | | | | | Kit | 20 | In | Off | | | |
| 286 | 1 | 3557 | R4 | S | S | 20 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 287 | 1 | 3558 | B1 | S | S | 10 | Helena | AL | 20 | 1 | Trip | 1990 | G | | | | | | | | | |
| 288 | 1 | 3558 | B2 | S | S | 10 | Helena | AL | 15 | 1 | Trip | 1990 | G | | | | | | | | | |
| 289 | 1 | 3558 | B3 | S | S | 10 | Helena | AL | 15 | 1 | Trip | Unk | | | | | | | | | | |
| 290 | 1 | 3559 | B1 | S | U | 7 | Birmingham | AL | 15 | 1 | Trip | 1993 | Base | | | | | | | | | |
| 291 | 1 | 3559 | B2 | S | U | 7 | Birmingham | AL | 20 | 1 | Trip | 1993 | Base | | | | | | | | | |
| 292 | 1 | 3559 | R4 | S | U | 7 | Birmingham | AL | | | | | | | | Kit | 20 | Out | Off | | | |
| 293 | 1 | 3559 | R5 | S | U | 7 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 294 | 1 | 3559 | R6 | S | U | 7 | Birmingham | AL | | | | | | | | B | 15 | In | Off | | | |
| 295 | 1 | 3559 | R7 | S | U | 7 | Birmingham | AL | | | | | | | | G | 15 | In | Off | | | |
| 296 | 1 | 3559 | R8 | S | U | 7 | Birmingham | AL | | | | | | Yes | Yes | B | 15 | In | On | | | |
| 297 | 1 | 3560 | B1 | S | S | 24 | Birmingham | AL | 15 | 1 | Trip | Unk | Base | | | | | | | | | |
| 298 | 1 | 3561 | B1 | S | S | 47 | Trussville | AL | 15 | 1 | Trip | Unk | Out | | | | | | | | | |
| 299 | 1 | 3562 | B1 | S | S | 16 | Trussville | AL | Unk | Unk | Trip | Unk | G | | | | | | | | | |
| 300 | 1 | 3562 | R4 | S | S | 16 | Trussville | AL | | | | | | | | Kit | 15 | In | Off | | | |
| 301 | 1 | 3562 | R5 | S | S | 16 | Trussville | AL | | | | | | | | G | Unk | Out | Off | | | |
| 302 | 1 | 3562 | R6 | S | S | 16 | Trussville | AL | | | | | | | | B | 15 | In | Off | | | |
| 303 | 1 | 3701 | R4 | S | S | 14 | Valrico | FL | | | | | | | | G | 15 | In | Off | | | |
| 304 | 1 | 3702 | R4 | S | S | 3 | Tampa | FL | | | | | | | | G | 15 | In | Off | | | |
| 305 | 1 | 3702 | R5 | S | S | 3 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 306 | 1 | 3702 | R6 | S | S | 3 | Tampa | FL | | | | | | | No | Out | 15 | | No Trip | | | |
| 307 | 1 | 3703 | B1 | M | S | 17 | Tampa | FL | 20 | Unk | Trip | 1983 | Other | | | | | | | | | |
| 308 | 1 | 3704 | R4 | S | S | 7 | Tampa | FL | | | | | | | | Kit | 20 | In | Off | | | |
| 309 | 1 | 3705 | R4 | S | S | 16 | Tampa | FL | | | | | | | | B | 20 | In | Off | | | |
| 310 | 1 | 3705 | R5 | S | S | 16 | Tampa | FL | | | | | | | | G | 20 | In | Off | | | |
| 311 | 1 | 3767 | R4 | S | R | 28 | Dade City | FL | | | | | | | | Out | 20 | | Off | | | |
| 312 | 1 | 3768 | R4 | M | U | 15 | Tampa | FL | | | | | | | | G | 20 | Out | Off | | | |
| 313 | 1 | 3768 | R5 | M | U | 15 | Tampa | FL | | | | | | | | Kit | 20 | In | Off | | | |
| 314 | 1 | 3768 | R6 | M | U | 15 | Tampa | FL | | | | | | | | B | 20 | In | Off | | | |
| 315 | 1 | 3769 | R4 | S | U | Unk | Tampa | FL | | | | | | | | Out | 20 | | Off | | | |
| 316 | 1 | 3769 | R5 | S | U | Unk | Tampa | FL | | | | | | | | Out | 20 | | Off | | | |
| 317 | 1 | 3770 | R4 | S | U | 5 | Tampa | FL | | | | | | | | G | 20 | Out | Off | | | |
| 318 | 1 | 3770 | R5 | S | U | 5 | Tampa | FL | | | | | | | | G | 20 | In | Off | | | |
| 319 | 1 | 3770 | R6 | S | U | 5 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 320 | 1 | 3770 | R7 | S | U | 5 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 321 | 1 | 3770 | R8 | S | U | 5 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 322 | 1 | 3770 | R9 | S | U | 5 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 323 | 1 | 3771 | R4 | M | S | Unk | Tampa | FL | | | | | | | | Kit | 20 | Unk | Unk | | | |
| 324 | 1 | 3772 | R4 | S | S | 2 | Lutz | FL | | | | | | | | G | 20 | In | Off | | | |
| 325 | 1 | 3772 | R5 | S | S | 2 | Lutz | FL | | | | | | | | G | 20 | In | Off | | | |
| 326 | 1 | 3772 | R6 | S | S | 2 | Lutz | FL | | | | | | | | Kit | 20 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 327 | 1 | 3773 | B1 | M | S | 15 | Tampa | FL | 20 | 2 | Trip | 1985 | Out | | | | | | | | | |
| 328 | 1 | 3775 | B1 | M | S | 15 | Temple Terrace | FL | 20 | Unk | Trip | 1985 | | | | | | | | | | |
| 329 | 1 | 3775 | R4 | M | S | 15 | Temple Terrace | FL | | | | | | | | B | 20 | In | Off | | | |
| 330 | 1 | 3775 | R5 | M | S | 15 | Temple Terrace | FL | | | | | | | | B | 15 | In | Off | | | |
| 331 | 1 | 3776 | B1 | S | S | 23 | Tampa | FL | 20 | 1 | No Trip | 1977 | G | Yes | Yes | | | | | | | |
| 332 | 1 | 3777 | R4 | S | S | 26 | Sarasota | FL | | | | | | | | Out | 15 | | Off | | | |
| 333 | 1 | 3827 | B1 | S | S | Unk | Venice | FL | 15 | 1 | Trip | Unk | G | | | | | | | | | |
| 334 | 1 | 3828 | R4 | S | Unk | 3 | Venice | FL | | | | | | | | Kit | 20 | In | Off | | | |
| 335 | 1 | 3828 | R5 | S | Unk | 3 | Venice | FL | | | | | | | | G | 15 | In | Off | | | |
| 336 | 1 | 3828 | R6 | S | Unk | 3 | Venice | FL | | | | | | | | G | 15 | In | Off | | | |
| 337 | 1 | 3829 | R4 | M | U | 22 | Sarasota | FL | | | | | | | | Kit | 20 | Unk | Off | | | |
| 338 | 1 | 3829 | R5 | M | U | 22 | Sarasota | FL | | | | | | | | B | 15 | Unk | Off | | | |
| 339 | 1 | 3830 | R4 | M | S | 4 | Oldsmar | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 340 | 1 | 3830 | R5 | M | S | 4 | Oldsmar | FL | | | | | | | | B | 15 | In | Off | | | |
| 341 | 1 | 3831 | R4 | S | S | 23 | Sun City Center | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 342 | 1 | 3832 | R4 | S | S | 7 | Riverview | FL | | | | | | Yes | Yes | G | 15 | In | No Trip | | | |
| 343 | 1 | 3832 | R5 | S | S | 7 | Riverview | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 344 | 1 | 3842 | R4 | S | S | 2 | Tampa | FL | | | | | | | | G | 15 | In | Off | | | |
| 345 | 1 | 3842 | R5 | S | S | 2 | Tampa | FL | | | | | | | | B | 15 | In | Off | | | |
| 346 | 1 | 3842 | R6 | S | S | 2 | Tampa | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 347 | 1 | 3842 | R7 | S | S | 2 | Tampa | FL | | | | | | No | Yes | Kit | 15 | In | On | | | |
| 348 | 1 | 3844 | R4 | S | S | 1 | Riverview | FL | | | | | | | | G | 15 | In | Off | | | |
| 349 | 1 | 3844 | R5 | S | S | 1 | Riverview | FL | | | | | | | | B | 15 | In | Off | | | |
| 350 | 1 | 3844 | R6 | S | S | 1 | Riverview | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 351 | 1 | 3844 | R7 | S | S | 1 | Riverview | FL | | | | | | | | Out | 15 | | Off | | | |
| 352 | 1 | 3845 | R4 | S | S | 4 | Brandon | FL | | | | | | | | G | 15 | In | Off | | | |
| 353 | 1 | 3845 | R5 | S | S | 4 | Brandon | FL | | | | | | | | Kit | 15 | In | Off | | | |
| 354 | 1 | 3846 | R4 | S | S | 4 mo | Valrico | FL* | | | | | | | | G | 15 | In | Off | | | |
| 355 | 1 | 3846 | R5 | S | S | 4 mo | Valrico | FL* | | | | | | | | B | 15 | In | Off | | | |
| 356 | 1 | 3846 | R6 | S | S | 4 mo | Valrico | FL* | | | | | | | | Kit | 15 | Out | Off | | | |
| 357 | 1 | 3847 | R4 | S | S | Unk | Brandon | FL | | | | | | | | G | 15 | Out | Off | | | |
| 358 | 1 | 3847 | R5 | S | S | Unk | Brandon | FL | | | | | | | | Kit | 15 | Out | Off | | | |
| 359 | 2 | 1499 | R4 | M | S | 15 | Lakeway | TX | | | | | | | | B | 15 | In | Off | | | |
| 360 | 2 | 1626 | B1 | S | S | 5 | Austin | TX | 20 | 1 | Trip | 1995 | G | | | | | | | | | |
| 361 | 2 | 1626 | R4 | S | S | 5 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 362 | 2 | 1626 | R5 | S | S | 5 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 363 | 2 | 1626 | R6 | S | S | 5 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 364 | 2 | 1627 | R4 | S | S | 2 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 365 | 2 | 1627 | R5 | S | S | 2 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 366 | 2 | 1627 | R6 | S | S | 2 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 367 | 2 | 1628 | R4 | S | S | 12 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 368 | 2 | 1628 | R5 | S | S | 12 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 369 | 2 | 1629 | R4 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 370 | 2 | 1629 | R5 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 371 | 2 | 1629 | R6 | S | S | Unk | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 372 | 2 | 1629 | R7 | S | S | Unk | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 373 | 2 | 1629 | R8 | S | S | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 374 | 2 | 1629 | R9 | S | S | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 375 | 2 | 1631 | R4 | S | R | 5 | Georgetown | TX | | | | | | | | G | 20 | In | Off | | | |
| 376 | 2 | 1631 | R5 | S | R | 5 | Georgetown | TX | | | | | | | | B | 20 | In | Off | | | |
| 377 | 2 | 1631 | R6 | S | R | 5 | Georgetown | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 378 | 2 | 1631 | R7 | S | R | 5 | Georgetown | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 379 | 2 | 1632 | R4 | S | S | 25 | Unk | TX | | | | | | | | Out | 20 | | Off | | | |
| 380 | 2 | 1632 | R5 | S | S | 25 | Unk | TX | | | | | | | | Out | 20 | | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 381 | 2 | 1632 | R6 | S | S | 25 | Unk | TX | | | | | | | | Out | 20 | | Off | | | |
| 382 | 2 | 1632 | R7 | S | S | 25 | Unk | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 383 | 2 | 1632 | R8 | S | S | 25 | Unk | TX | | | | | | | | B | 20 | Out | Off | | | |
| 384 | 2 | 1632 | R9 | S | S | 25 | Unk | TX | | | | | | | | B | 20 | In | Off | | | |
| 385 | 2 | 1633 | R4 | M | U | Unk | Austin | TX | | | | | | | No | Unk | 20 | Out | No Trip | | | |
| 386 | 2 | 1633 | R5 | M | U | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 387 | 2 | 1634 | R4 | S | S | 25 | Austin | TX | | | | | | | No | B | 20 | In | On | | | |
| 388 | 2 | 1634 | R5 | S | S | 25 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 389 | 2 | 1635 | R4 | S | S | 6 | Round Rock | TX | | | | | | | | Out | 20 | | Off | | | |
| 390 | 2 | 1635 | R5 | S | S | 6 | Round Rock | TX | | | | | | | | Out | 20 | | Off | | | |
| 391 | 2 | 1636 | R4 | S | U | 40 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 392 | 2 | 1636 | R5 | S | U | 40 | Austin | TX | | | | | | Yes | Yes | G | 20 | Out | No Trip | | | |
| 393 | 2 | 1637 | R4 | S | S | 8 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 394 | 2 | 1637 | R5 | S | S | 8 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 395 | 2 | 1637 | R6 | S | S | 8 | Austin | TX | | | | | | | | Kit | 20 | Unk | Off | | | |
| 396 | 2 | 1638 | B1 | S | S | Unk | Cedar Park | TX | 20 | 1 | Trip | 1999 | G | | | | | | | | | |
| 397 | 2 | 1638 | R4 | S | S | Unk | Cedar Park | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 398 | 2 | 1638 | R5 | S | S | Unk | Cedar Park | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 399 | 2 | 1638 | R6 | S | S | Unk | Cedar Park | TX | | | | | | | | B | 20 | In | Off | | | |
| 400 | 2 | 1639 | B1 | S | S | 4 | Austin | TX | 20 | 1 | Trip | 1997 | Out | | | | | | | | | |
| 401 | 2 | 1639 | R4 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 402 | 2 | 1639 | R5 | S | S | 4 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 403 | 2 | 1639 | R6 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 404 | 2 | 1641 | R4 | S | S | 40 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 405 | 2 | 1641 | R5 | S | S | 40 | Austin | TX | | | | | | | | B | 20 | Out | Off | | | |
| 406 | 2 | 1641 | R6 | S | S | 40 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 407 | 2 | 1642 | R4 | S | U | 80 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 408 | 2 | 1642 | R5 | S | U | 80 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 409 | 2 | 1643 | R4 | S | R | 3 | Georgetown | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 410 | 2 | 1643 | R5 | S | R | 3 | Georgetown | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 411 | 2 | 1643 | R6 | S | R | 3 | Georgetown | TX | | | | | | | | G | 20 | In | Off | | | |
| 412 | 2 | 1644 | R4 | S | S | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 413 | 2 | 1644 | R5 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 414 | 2 | 1644 | R6 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 415 | 2 | 1644 | R7 | S | S | Unk | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 416 | 2 | 1644 | R8 | S | S | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 417 | 2 | 1646 | R4 | S | U | 12 | Austin | TX | | | | | | | No | G | 15 | In | No Trip | | | |
| 418 | 2 | 1652 | R4 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 419 | 2 | 1652 | R5 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 420 | 2 | 1652 | R6 | S | S | 4 | Austin | TX | | | | | | | No | G | 20 | In | No Trip | | | |
| 421 | 2 | 1652 | R7 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 422 | 2 | 1652 | R8 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 423 | 2 | 1663 | R4 | S | S | 5 | Austin | TX | | | | | | | No | B | 20 | In | No Trip | | | |
| 424 | 2 | 1666 | R4 | S | S | 2 | Round Rock | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 425 | 2 | 1666 | R5 | S | S | 2 | Round Rock | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 426 | 2 | 1666 | R6 | S | S | 2 | Round Rock | TX | | | | | | | | B | 20 | In | Off | | | |
| 427 | 2 | 1666 | R7 | S | S | 2 | Round Rock | TX | | | | | | | | B | 20 | In | Off | | | |
| 428 | 2 | 1666 | R8 | S | S | 2 | Round Rock | TX | | | | | | | | B | 20 | Out | Off | | | |
| 429 | 2 | 1666 | R9 | S | S | 2 | Round Rock | TX | | | | | | | | G | 20 | In | Off | | | |
| 430 | 2 | 1667 | R4 | S | S | 20 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 431 | 2 | 1669 | R4 | S | S | 22 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 432 | 2 | 1669 | R5 | S | S | 22 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 433 | 2 | 1670 | R4 | S | S | 25 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 434 | 2 | 1671 | R4 | S | S | 1 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 435 | 2 | 1671 | R5 | S | S | 1 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 436 | 2 | 1671 | R6 | S | S | 1 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 437 | 2 | 1672 | R4 | S | U | 24 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 438 | 2 | 1673 | R4 | S | S | 3 | Austin | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 439 | 2 | 1673 | R5 | S | S | 3 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 440 | 2 | 1673 | R6 | S | S | 3 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 441 | 2 | 1674 | R4 | S | S | 3 | Austin | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 442 | 2 | 1674 | R5 | S | S | 3 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 443 | 2 | 1675 | R4 | S | U | 45 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 444 | 2 | 1676 | R4 | S | S | 16 | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 445 | 2 | 1677 | R4 | S | S | 11 | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 446 | 2 | 1677 | R5 | S | S | 11 | Unk | TX | | | | | | | | B | 15 | In | Off | | | |
| 447 | 2 | 1678 | R4 | S | S | 17 | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 448 | 2 | 1679 | R4 | S | U | 41 | Unk | TX | | | | | | | | Out | 15 | | Off | | | |
| 449 | 2 | 1680 | R4 | S | U | 51 | Unk | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 450 | 2 | 1681 | R4 | S | S | 1 | Unk | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 451 | 2 | 1681 | R5 | S | S | 1 | Unk | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 452 | 2 | 1681 | R6 | S | S | 1 | Unk | TX | | | | | | | | B | 15 | In | Off | | | |
| 453 | 2 | 1681 | R7 | S | S | 1 | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 454 | 2 | 1682 | R4 | S | S | 12 | Round Rock | TX | | | | | | | | G | 15 | In | Off | | | |
| 455 | 2 | 1683 | R4 | S | S | 17 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 456 | 2 | 1684 | R4 | S | S | 20 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 457 | 2 | 1685 | R4 | S | U | 27 | Austin | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 458 | 2 | 1686 | R4 | S | S | 4 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 459 | 2 | 1686 | R5 | S | S | 4 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 460 | 2 | 1687 | R4 | S | U | 18 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 461 | 2 | 1688 | R4 | S | R | 20 | Briarcliff | TX | | | | | | | | G | 15 | In | Off | | | |
| 462 | 2 | 1689 | R4 | S | S | 38 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 463 | 2 | 1690 | R4 | S | S | 8 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 464 | 2 | 1691 | R4 | S | S | 18 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 465 | 2 | 1692 | R4 | S | S | 10 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 466 | 2 | 1693 | R4 | S | S | 9 | Round Rock | TX | | | | | | | | G | 15 | In | Off | | | |
| 467 | 2 | 1694 | R4 | S | S | 16 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 468 | 2 | 1695 | R4 | S | U | 8 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 469 | 2 | 1695 | R5 | S | U | 8 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 470 | 2 | 1696 | R4 | S | S | 2 | Unk | TX | | | | | | | | G | 20 | Unk | Off | | | |
| 471 | 2 | 1696 | R5 | S | S | 2 | Unk | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 472 | 2 | 1696 | R6 | S | S | 2 | Unk | TX | | | | | | | | Kit | 20 | Unk | Off | | | |
| 473 | 2 | 1697 | R4 | S | S | 10 | Unk | TX | | | | | | | | B | 20 | In | Off | | | |
| 474 | 2 | 1698 | R4 | S | S | 2 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 475 | 2 | 1698 | R5 | S | S | 2 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 476 | 2 | 1698 | R6 | S | S | 2 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 477 | 2 | 1698 | R7 | S | S | 2 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 478 | 2 | 1699 | R4 | S | S | 5 | Dripping Springs | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 479 | 2 | 1699 | R5 | S | S | 5 | Dripping Springs | TX | | | | | | | | B | 20 | In | Off | | | |
| 480 | 2 | 1700 | R4 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 481 | 2 | 1700 | R5 | S | S | Unk | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 482 | 2 | 1700 | R6 | S | S | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 483 | 2 | 1701 | R4 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 484 | 2 | 1701 | R5 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 485 | 2 | 1701 | R6 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 486 | 2 | 1701 | R7 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 487 | 2 | 1702 | R4 | S | S | 130 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 488 | 2 | 1702 | R5 | S | S | 130 | Austin | TX | | | | | | | No | B | 20 | In | No Trip | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 489 | 2 | 1702 | R6 | S | S | 130 | Austin | TX | | | | | | | No | B | 20 | Out | No Trip | | | |
| 490 | 2 | 1702 | R7 | S | S | 130 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 491 | 2 | 1702 | R8 | S | S | 130 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 492 | 2 | 1703 | R4 | S | S | Unk | Pflugerville | TX | | | | | | | | B | 20 | In | On | | | |
| 493 | 2 | 1704 | R4 | S | S | 13 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 494 | 2 | 1705 | R4 | S | U | 10 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 495 | 2 | 1705 | R5 | S | U | 10 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 496 | 2 | 1705 | R6 | S | U | 10 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 497 | 2 | 1705 | R7 | S | U | 10 | Austin | TX | | | | | | | No | B | 20 | In | No Reset | | | |
| 498 | 2 | 1705 | R8 | S | U | 10 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 499 | 2 | 1706 | R4 | S | S | 10 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 500 | 2 | 1706 | R5 | S | S | 10 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 501 | 2 | 1707 | R4 | S | S | 13 | Cedar Park | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 502 | 2 | 1707 | R5 | S | S | 13 | Cedar Park | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 503 | 2 | 1707 | R6 | S | S | 13 | Cedar Park | TX | | | | | | | | B | 20 | In | Off | | | |
| 504 | 2 | 1707 | R7 | S | S | 13 | Cedar Park | TX | | | | | | | | G | 20 | Out | Off | | | |
| 505 | 2 | 1708 | R4 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 506 | 2 | 1708 | R5 | S | S | 4 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 507 | 2 | 1708 | R6 | S | S | 4 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 508 | 2 | 1708 | R7 | S | S | 4 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 509 | 2 | 1708 | R8 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 510 | 2 | 1709 | R4 | S | S | 24 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 511 | 2 | 1709 | R5 | S | S | 24 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 512 | 2 | 1710 | R4 | S | S | 25 | Austin | TX | | | | | | | No | Base | 15 | Out | On | | | |
| 513 | 2 | 1710 | R5 | S | S | 25 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 514 | 2 | 1711 | R4 | S | R | 4 | Bastrop | TX | | | | | | | No | Out | 20 | | No Trip | | | |
| 515 | 2 | 1711 | R5 | S | R | 4 | Bastrop | TX | | | | | | | No | Out | 20 | | No Trip | | | |
| 516 | 2 | 1712 | R4 | S | R | 4 | Bastrop | TX | | | | | | | No | Kit | 20 | Out | No Trip | | | |
| 517 | 2 | 1712 | R5 | S | R | 4 | Bastrop | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 518 | 2 | 1712 | R6 | S | R | 4 | Bastrop | TX | | | | | | | | B | 20 | In | Off | | | |
| 519 | 2 | 1712 | R7 | S | R | 4 | Bastrop | TX | | | | | | | | B | 20 | In | Off | | | |
| 520 | 2 | 1712 | R8 | S | R | 4 | Bastrop | TX | | | | | | | | B | 20 | In | Off | | | |
| 521 | 2 | 1712 | R9 | S | R | 4 | Bastrop | TX | | | | | | | | G | 20 | Out | Off | | | |
| 522 | 2 | 1713 | R4 | S | S | 15 | Austin | TX | | | | | | | No | B | 15 | Out | On | | | |
| 523 | 2 | 1714 | B1 | S | U | Unk | Austin | TX | 20 | 1 | No Trip | Unk | Other | | No | | | | | | | |
| 524 | 2 | 1714 | B2 | S | U | Unk | Austin | TX | 20 | 1 | No Trip | Unk | Other | | No | | | | | | | |
| 525 | 2 | 1714 | B3 | S | U | Unk | Austin | TX | 20 | 1 | No Trip | Unk | Other | | No | | | | | | | |
| 526 | 2 | 1714 | R4 | S | U | Unk | Austin | TX | | | | | | | No | Kit | 20 | In | On | | | |
| 527 | 2 | 1715 | R4 | S | S | 4 | Austin | TX | | | | | | | No | G | 20 | In | On | | | |
| 528 | 2 | 1715 | R5 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 529 | 2 | 1715 | R6 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 530 | 2 | 1715 | R7 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 531 | 2 | 1715 | R8 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 532 | 2 | 1715 | R9 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 533 | 2 | 1717 | R10 | S | S | 10 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 534 | 2 | 1717 | R11 | S | S | 10 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 535 | 2 | 1717 | R4 | S | S | 10 | Austin | TX | | | | | | Yes | Yes | Out | 20 | | On | Yes | No | No |
| 536 | 2 | 1717 | R5 | S | S | 10 | Austin | TX | | | | | | No | Yes | B | 20 | In | On | No | | |
| 537 | 2 | 1717 | R6 | S | S | 10 | Austin | TX | | | | | | No | Yes | B | 20 | In | On | | | |
| 538 | 2 | 1717 | R7 | S | S | 10 | Austin | TX | | | | | | Yes | Yes | G | 20 | In | No Reset | | | |
| 539 | 2 | 1717 | R8 | S | S | 10 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 540 | 2 | 1717 | R9 | S | S | 10 | Austin | TX | | | | | | | | B | Unk | In | Off | | | |
| 541 | 2 | 1718 | R4 | S | S | 5 | Cedar Park | TX | | | | | | | | G | 20 | In | Off | | | |
| 542 | 2 | 1718 | R5 | S | S | 5 | Cedar Park | TX | | | | | | | | Kit | 20 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 543 | 2 | 1718 | R6 | S | S | 5 | Cedar Park | TX | | | | | | | | B | 20 | In | Off | | | |
| 544 | 2 | 1719 | R4 | S | S | 10 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 545 | 2 | 1719 | R5 | S | S | 10 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 546 | 2 | 1719 | R6 | S | S | 10 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 547 | 2 | 1719 | R7 | S | S | 10 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 548 | 2 | 1719 | R8 | S | S | 10 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 549 | 2 | 1719 | R9 | S | S | 10 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 550 | 2 | 1720 | R4 | S | S | 5 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 551 | 2 | 1720 | R5 | S | S | 5 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 552 | 2 | 1721 | R4 | S | S | 1 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 553 | 2 | 1721 | R5 | S | S | 1 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 554 | 2 | 1721 | R6 | S | S | 1 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 555 | 2 | 1721 | R7 | S | S | 1 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 556 | 2 | 1722 | R4 | S | S | Unk | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 557 | 2 | 1722 | R5 | S | S | Unk | Unk | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 558 | 2 | 1723 | R4 | S | R | 15 | Kyle | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 559 | 2 | 1723 | R5 | S | R | 15 | Kyle | TX | | | | | | | | G | 15 | In | Off | | | |
| 560 | 2 | 1724 | R4 | S | S | 1 | Cedar Park | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 561 | 2 | 1724 | R5 | S | S | 1 | Cedar Park | TX | | | | | | | | G | 15 | In | Off | | | |
| 562 | 2 | 1725 | R4 | S | S | 16 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 563 | 2 | 1726 | R4 | S | S | 8 | Round Rock | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 564 | 2 | 1726 | R5 | S | S | 8 | Round Rock | TX | | | | | | | | B | 15 | In | Off | | | |
| 565 | 2 | 1727 | R4 | M | U | 1 | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 566 | 2 | 1727 | R5 | M | U | 1 | Unk | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 567 | 2 | 1728 | R4 | S | U | 50 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 568 | 2 | 1729 | R4 | S | U | 17 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 569 | 2 | 1729 | R5 | S | U | 17 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 570 | 2 | 1729 | R6 | S | U | 17 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 571 | 2 | 1730 | R4 | S | S | 1 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 572 | 2 | 1730 | R5 | S | S | 1 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 573 | 2 | 1730 | R6 | S | S | 1 | Austin | TX | | | | | | | | B | Unk | In | Off | | | |
| 574 | 2 | 1731 | R4 | S | U | 1 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 575 | 2 | 1731 | R5 | S | U | 1 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 576 | 2 | 1731 | R6 | S | U | 1 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 577 | 2 | 1732 | R4 | S | S | 4 | Lakeway | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 578 | 2 | 1732 | R5 | S | S | 4 | Lakeway | TX | | | | | | | | Kit | Unk | In | Off | | | |
| 579 | 2 | 1732 | R6 | S | S | 4 | Lakeway | TX | | | | | | | | G | 15 | In | Off | | | |
| 580 | 2 | 1732 | R7 | S | S | 4 | Lakeway | TX | | | | | | | | B | 15 | In | Off | | | |
| 581 | 2 | 1733 | R4 | S | U | 20 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 582 | 2 | 1734 | R4 | S | U | 32 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 583 | 2 | 1735 | R4 | S | U | 3 | Cedar Park | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 584 | 2 | 1735 | R5 | S | U | 3 | Cedar Park | TX | | | | | | | | G | 15 | Out | Off | | | |
| 585 | 2 | 1736 | R4 | S | U | 45 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 586 | 2 | 1737 | R4 | S | U | 45 | Unk | TX | | | | | | | | G | 15 | In | Off | | | |
| 587 | 2 | 1738 | R4 | S | U | 70 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 588 | 2 | 1738 | R5 | S | U | 70 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 589 | 2 | 1738 | R6 | S | U | 70 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 590 | 2 | 1738 | R7 | S | U | 70 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 591 | 2 | 1738 | R8 | S | U | 70 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 592 | 2 | 1740 | R4 | S | S | Unk | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 593 | 2 | 1741 | R4 | S | U | 6 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 594 | 2 | 1742 | R4 | M | U | Unk | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 595 | 2 | 1742 | R5 | M | U | Unk | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 596 | 2 | 1743 | R4 | M | U | 5 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 597 | 2 | 1743 | R5 | M | U | 5 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 598 | 2 | 1743 | R6 | M | U | 5 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 599 | 2 | 1744 | B1 | S | S | 16 | Austin | TX | 20 | Unk | Trip | Unk | Out | | | | | | | | | |
| 600 | 2 | 1744 | B2 | S | S | 16 | Austin | TX | 20 | Unk | Trip | Unk | Out | | | | | | | | | |
| 601 | 2 | 1744 | R4 | S | S | 16 | Austin | TX | | | | | | | No | Out | 20 | | No Trip | | | |
| 602 | 2 | 1744 | R5 | S | S | 16 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 603 | 2 | 1744 | R6 | S | S | 16 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 604 | 2 | 1744 | R7 | S | S | 16 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 605 | 2 | 1745 | B1 | S | S | Unk | Austin | TX | 20 | 1 | Trip | 1999 | Unk | | | | | | | | | |
| 606 | 2 | 1745 | R4 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 607 | 2 | 1745 | R5 | S | S | Unk | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 608 | 2 | 1745 | R6 | S | S | Unk | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 609 | 2 | 1745 | R7 | S | S | Unk | Austin | TX | | | | | | | | Other | 20 | In | Off | | | |
| 610 | 2 | 1745 | R8 | S | S | Unk | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 611 | 2 | 1746 | R4 | S | S | 5 | Volente | TX | | | | | | | No | Out | 20 | | No Trip | | | |
| 612 | 2 | 1746 | R5 | S | S | 5 | Volente | TX | | | | | | | | G | Unk | In | Off | | | |
| 613 | 2 | 1746 | R6 | S | S | 5 | Volente | TX | | | | | | | No | B | 20 | In | No Reset | | | |
| 614 | 2 | 1747 | R4 | S | S | 9 | LeAnder | TX | | | | | | | | B | 20 | In | Off | | | |
| 615 | 2 | 1748 | R4 | S | S | 4 | Volente | TX | | | | | | | | B | Unk | Unk | Off | | | |
| 616 | 2 | 1748 | R5 | S | S | 4 | Volente | TX | | | | | | | | G | Unk | Unk | Off | | | |
| 617 | 2 | 1748 | R6 | S | S | 4 | Volente | TX | | | | | | | | Kit | Unk | Unk | Off | | | |
| 618 | 2 | 1749 | R10 | S | S | 6 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 619 | 2 | 1749 | R4 | S | S | 6 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 620 | 2 | 1749 | R5 | S | S | 6 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 621 | 2 | 1749 | R6 | S | S | 6 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 622 | 2 | 1749 | R7 | S | S | 6 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 623 | 2 | 1749 | R8 | S | S | 6 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 624 | 2 | 1749 | R9 | S | S | 6 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 625 | 2 | 1750 | R4 | S | S | 6 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 626 | 2 | 1750 | R5 | S | S | 6 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 627 | 2 | 1750 | R6 | S | S | 6 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 628 | 2 | 2451 | R4 | S | S | 2 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 629 | 2 | 2451 | R5 | S | S | 2 | Austin | TX | | | | | | | | G | Unk | In | Off | | | |
| 630 | 2 | 2452 | R4 | S | U | 50 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 631 | 2 | 2454 | B1 | S | S | 1 | Austin | TX | 20 | 1 | Trip | 1999 | Out | | | | | | | | | |
| 632 | 2 | 2454 | R4 | S | S | 1 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 633 | 2 | 2454 | R5 | S | S | 1 | Austin | TX | | | | | | | | G | Unk | In | Off | | | |
| 634 | 2 | 2455 | R4 | S | S | 8 | Lakeway | TX | | | | | | | | G | 15 | In | Off | | | |
| 635 | 2 | 2456 | R4 | M | U | 20 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 636 | 2 | 2457 | R4 | M | U | 30 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 637 | 2 | 2458 | R4 | S | S | 42 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 638 | 2 | 2459 | R4 | S | U | 45 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 639 | 2 | 2460 | R4 | S | S | 14 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 640 | 2 | 2461 | R4 | S | S | 13 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 641 | 2 | 2462 | R4 | S | U | 2 | Austin | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 642 | 2 | 2462 | R5 | S | U | 2 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 643 | 2 | 2463 | B1 | S | S | 17 | Austin | TX | 20 | 1 | Trip | 1983 | G | | | | | | | | | |
| 644 | 2 | 2464 | R4 | S | R | 12 | Travin County | TX | | | | | | | | G | 15 | In | Off | | | |
| 645 | 2 | 2465 | R4 | S | S | 15 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 646 | 2 | 2466 | R4 | S | S | 15 | Lakeway | TX | | | | | | | | G | 15 | In | Off | | | |
| 647 | 2 | 2467 | R4 | M | S | 16 | Lakeway | TX | | | | | | | | B | 15 | In | Off | | | |
| 648 | 2 | 2468 | R4 | M | S | 15 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 649 | 2 | 2469 | R4 | S | R | 5 | Round Lake | TX | | | | | | | | G | 15 | Out | Off | | | |
| 650 | 2 | 2469 | R5 | S | R | 5 | Round Lake | TX | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 651 | 2 | 2470 | R4 | M | U | 20 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 652 | 2 | 2471 | R4 | S | U | 40 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 653 | 2 | 2472 | R4 | S | U | 42 | Austin | TX | | | | | | | | B | 15 | Out | Off | | | |
| 654 | 2 | 2473 | R4 | S | S | 21 | Austin | TX | | | | | | | | Out | 15 | | Off | | | |
| 655 | 2 | 2474 | R4 | S | S | 12 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 656 | 2 | 2475 | R4 | M | S | 17 | Round Rock | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 657 | 2 | 2476 | R4 | S | S | 6 | Leander | TX | | | | | | | | G | 15 | In | Off | | | |
| 658 | 2 | 2477 | R4 | S | S | 11 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 659 | 2 | 2478 | R4 | M | U | 40 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 660 | 2 | 2479 | R4 | S | U | 30 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 661 | 2 | 2480 | R4 | S | U | 17 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 662 | 2 | 2481 | R4 | S | S | 9 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 663 | 2 | 2481 | R5 | S | S | 9 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 664 | 2 | 2482 | R4 | S | U | 40 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 665 | 2 | 2483 | R4 | S | U | 18 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 666 | 2 | 2484 | R4 | S | U | 18 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 667 | 2 | 2484 | R5 | S | U | 18 | Austin | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 668 | 2 | 2485 | R4 | S | U | 15 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 669 | 2 | 2486 | R4 | S | S | 16 | Pflugerville | TX | | | | | | | | G | 15 | In | Off | | | |
| 670 | 2 | 2487 | R4 | S | S | 4 | Austin | TX | | | | | | | | Kit | 20 | In | Off | | | |
| 671 | 2 | 2487 | R5 | S | S | 4 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 672 | 2 | 2487 | R6 | S | S | 4 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 673 | 2 | 2489 | R4 | S | S | 17 | Austin | TX | | | | | | | | G | 20 | In | Off | | | |
| 674 | 2 | 2490 | R4 | S | U | 15 | Unk | TX | | | | | | | | B | 20 | Out | Off | | | |
| 675 | 2 | 2491 | R4 | S | S | 8 | Lago Vista | TX | | | | | | | | B | 15 | In | Off | | | |
| 676 | 2 | 2491 | R5 | S | S | 8 | Lago Vista | TX | | | | | | | No | B | 15 | In | No Trip | | | |
| 677 | 2 | 2491 | R6 | S | S | 8 | Lago Vista | TX | | | | | | | | B | 15 | In | Off | | | |
| 678 | 2 | 2492 | R4 | S | U | 6 | Austin | TX | | | | | | | No | Kit | 20 | In | No Trip | | | |
| 679 | 2 | 2492 | R5 | S | U | 6 | Austin | TX | | | | | | | | B | 20 | Out | Off | | | |
| 680 | 2 | 2492 | R6 | S | U | 6 | Austin | TX | | | | | | | No | Out | 20 | | No Trip | | | |
| 681 | 2 | 2493 | R4 | S | S | Unk | Round Rock | TX | | | | | | | | Out | 15 | | Off | | | |
| 682 | 2 | 2493 | R5 | S | S | Unk | Round Rock | TX | | | | | | | | Out | 15 | | Off | | | |
| 683 | 2 | 2493 | R6 | S | S | Unk | Round Rock | TX | | | | | | | | Out | 15 | | Off | | | |
| 684 | 2 | 2493 | R7 | S | S | Unk | Round Rock | TX | | | | | | | | Out | 15 | | Off | | | |
| 685 | 2 | 2493 | R8 | S | S | Unk | Round Rock | TX | | | | | | | No | B | 15 | Unk | On | | | |
| 686 | 2 | 2493 | R9 | S | S | Unk | Round Rock | TX | | | | | | | | B | 15 | In | Off | | | |
| 687 | 2 | 2494 | R4 | S | S | Unk | Round Rock | TX | | | | | | | No | G | 15 | Out | On | | | |
| 688 | 2 | 2495 | R4 | S | R | 4 | Buda | TX | | | | | | | | B | 20 | In | Off | | | |
| 689 | 2 | 2496 | R4 | S | S | 8 | Austin | TX | | | | | | | | G | 20 | Out | Off | | | |
| 690 | 2 | 2496 | R5 | S | S | 8 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 691 | 2 | 2496 | R6 | S | S | 8 | Austin | TX | | | | | | | | Out | 20 | | Off | | | |
| 692 | 2 | 2497 | R4 | S | S | 9 | Pflugerville | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 693 | 2 | 2497 | R5 | S | S | 9 | Pflugerville | TX | | | | | | | | G | 20 | In | Off | | | |
| 694 | 2 | 2498 | R4 | M | U | 15 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 695 | 2 | 2498 | R5 | M | U | 15 | Austin | TX | | | | | | | | Kit | 20 | Out | Off | | | |
| 696 | 2 | 2498 | R6 | M | U | 15 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 697 | 2 | 2498 | R7 | M | U | 15 | Austin | TX | | | | | | | | B | 20 | In | Off | | | |
| 698 | 2 | 2499 | B1 | S | S | 17 | Austin | TX | 20 | 1 | Trip | 1983 | U | | | | | | | | | |
| 699 | 2 | 2499 | R4 | S | S | 17 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |
| 700 | 2 | 2500 | B1 | S | S | 15 | Austin | TX | 20 | 1 | Trip | 1984 | Out | | | | | | | | | |
| 701 | 2 | 3301 | R4 | M | S | 2 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 702 | 2 | 3301 | R5 | M | S | 2 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 703 | 2 | 3302 | R4 | M | S | 2 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 704 | 2 | 3302 | R5 | M | S | 2 | Austin | TX | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 705 | 2 | 3303 | R4 | S | S | 15 | Austin | TX | | | | | | | | G | 15 | Out | Off | | | |
| 706 | 2 | 3304 | R4 | S | S | 15 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 707 | 2 | 3305 | R4 | S | S | 10 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 708 | 2 | 3306 | R4 | S | S | 2 | Round Rock | TX | | | | | | | | Kit | 15 | In | Off | | | |
| 709 | 2 | 3306 | R5 | S | S | 2 | Round Rock | TX | | | | | | | | B | 15 | Out | Off | | | |
| 710 | 2 | 3307 | R4 | S | S | 11 mo | Lakeway | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 711 | 2 | 3307 | R5 | S | S | 11 mo | Lakeway | TX | | | | | | | | G | 15 | In | Off | | | |
| 712 | 2 | 3308 | R4 | S | U | 36 | Austin | TX | | | | | | | | Kit | 15 | Out | Off | | | |
| 713 | 2 | 3309 | R4 | S | S | 13 | Austin | TX | | | | | | | | G | 15 | In | Off | | | |
| 714 | 3 | 1 | R4 | S | S | 7 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 715 | 3 | 2 | R4 | S | S | 5 | Gaitherburg | MD | | | | | | | | B | 15 | In | Off | | | |
| 716 | 3 | 2 | R5 | S | S | 5 | Gaitherburg | MD | | | | | | | | Kit | 15 | In | Off | | | |
| 717 | 3 | 3 | R4 | S | S | 7 | Centreville | VA | | | | | | | | Base | 15 | In | Off | | | |
| 718 | 3 | 3 | R5 | S | S | 7 | Centreville | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 719 | 3 | 3 | R6 | S | S | 7 | Centreville | VA | | | | | | | | B | 15 | Out | Off | | | |
| 720 | 3 | 4 | R4 | S | S | 49 | Church | VA | | | | | | | | B | 15 | In | Off | | | |
| 721 | 3 | 5 | R4 | S | S | 20 | College Park | MD | | | | | | | | B | 15 | In | Off | | | |
| 722 | 3 | 6 | R4 | Unk | Unk | 20 | Gaitherburg | MD | | | | | | | | B | 15 | In | Off | | | |
| 723 | 3 | 7 | R4 | S | S | 5 | Ft. Washington | MD | | | | | | | | Base | 15 | In | Off | | | |
| 724 | 3 | 7 | R5 | S | S | 5 | Ft. Washington | MD | | | | | | | | Kit | 20 | In | Off | | | |
| 725 | 3 | 7 | R6 | S | S | 5 | Ft.Washington | MD | | | | | | | | Kit | 20 | In | Off | | | |
| 726 | 3 | 7 | R7 | S | S | 5 | Ft. Washington | MD | | | | | | | | B | 15 | Unk | Off | | | |
| 727 | 3 | 9 | R4 | S | Unk | 17 | Vienna | VA | | | | | | | | B | 15 | In | Off | | | |
| 728 | 3 | 10 | R4 | S | S | 87 | Tacoma Park | MD | | | | | | | | Kit | 15 | In | Off | | | |
| 729 | 3 | 10 | R5 | S | S | 87 | Tacoma Park | MD | | | | | | | | Kit | 15 | In | Off | | | |
| 730 | 3 | 10 | R6 | S | S | 87 | Tacoma Park | MD | | | | | | | | B | 15 | In | Off | | | |
| 731 | 3 | 11 | R4 | S | S | 11 | Gaithersburg | MD | | | | | | | No | Out | 15 | | No Trip | | | |
| 732 | 3 | 11 | R5 | S | S | 11 | Gaithersburg | MD | | | | | | | | B | 15 | In | Off | | | |
| 733 | 3 | 11 | R6 | S | S | 11 | Gaithersburg | MD | | | | | | | | Kit | 15 | In | Off | | | |
| 734 | 3 | 12 | R4 | S | S | 13 | Unk | VA | | | | | | | | B | 15 | In | Off | | | |
| 735 | 3 | 13 | R4 | S | S | Unk | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 736 | 3 | 13 | R5 | S | S | Unk | Alexandria | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 737 | 3 | 14 | R4 | S | S | Unk | Sterling | VA | | | | | | | | G | 15 | In | Off | | | |
| 738 | 3 | 14 | R5 | S | S | Unk | Sterling | VA | | | | | | | | B | 15 | In | Off | | | |
| 739 | 3 | 14 | R6 | S | S | Unk | Sterling | VA | | | | | | | | Kit | 15 | In | Unk | | | |
| 740 | 3 | 16 | R4 | S | S | Unk | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 741 | 3 | 17 | R4 | S | S | Unk | Unk | VA | | | | | | | | B | 15 | In | Off | | | |
| 742 | 3 | 18 | B1 | S | S | 45 | Ellicott City | MD | 15 | 1 | Trip | 1973 | | | | | | | | | | |
| 743 | 3 | 18 | R4 | S | S | 45 | Ellicott City | MD | | | | | | | | B | 15 | Unk | Off | | | |
| 744 | 3 | 19 | R4 | M | U | Unk | Alexandria | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 745 | 3 | 19 | R5 | M | U | Unk | Alexandria | VA | | | | | | | | Kit | 15 | Unk | Off | | | |
| 746 | 3 | 20 | B1 | Unk | S | Unk | Ashburn | VA | 15 | Unk | Trip | | | | | | | | | | | |
| 747 | 3 | 20 | R4 | Unk | S | Unk | Ashburn | VA | | | | | | | | B | 15 | Out | Off | | | |
| 748 | 3 | 20 | R5 | Unk | S | Unk | Ashburn | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 749 | 3 | 21 | R4 | S | S | Unk | Fairfax City | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 750 | 3 | 21 | R5 | S | S | Unk | Fairfax City | VA | | | | | | | | B | 15 | In | Off | | | |
| 751 | 3 | 21 | R6 | S | S | Unk | Fairfax City | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 752 | 3 | 22 | R4 | S | Unk | 17 | Herndon | VA | | | | | | | | B | 15 | In | Off | | | |
| 753 | 3 | 22 | R5 | S | Unk | 17 | Herndon | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 754 | 3 | 23 | R4 | S | Unk | 10 | Ashburn | VA | | | | | | | | Base | 15 | In | Off | | | |
| 755 | 3 | 25 | R4 | M | U | 72 | Washington | DC | | | | | | | | B | 15 | Unk | Off | | | |
| 756 | 3 | 26 | R4 | S | S | 6 | Leesburg | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 757 | 3 | 27 | R4 | S | S | 1 | Ashburn | VA | | | | | | | | Base | 15 | In | Off | | | |
| 758 | 3 | 27 | R5 | S | S | 1 | Ashburn | VA | | | | | | | | Base | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 759 | 3 | 27 | R6 | S | S | 1 | Ashburn | VA | | | | | | | | B | 15 | In | Off | | | |
| 760 | 3 | 27 | R7 | S | S | 1 | Ashburn | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 761 | 3 | 27 | R8 | S | S | 1 | Ashburn | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 762 | 3 | 27 | R9 | S | S | 1 | Ashburn | VA | | | | | | | | B | 15 | In | Off | | | |
| 763 | 3 | 28 | R4 | M | S | 3 | Manassas | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 764 | 3 | 28 | R5 | M | S | 3 | Manassas | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 765 | 3 | 28 | R6 | M | S | 3 | Manassas | VA | | | | | | | | B | 15 | In | Off | | | |
| 766 | 3 | 28 | R7 | M | S | 3 | Manassas | VA | | | | | | | | B | 15 | In | Off | | | |
| 767 | 3 | 29 | R4 | M | S | 11 | Springfield | VA | | | | | | | | B | 15 | In | Off | | | |
| 768 | 3 | 29 | R5 | M | S | 11 | Springfield | VA | | | | | | | | B | 15 | In | Off | | | |
| 769 | 3 | 29 | R6 | M | S | 11 | Springfield | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 770 | 3 | 32 | B1 | S | R | 16 | Manassas | VA | 20 | 1 | Trip | Unk | | | | | | | | | | |
| 771 | 3 | 43 | R4 | S | R | 3 | Clifton | VA | | | | | | | | B | 15 | In | Off | | | |
| 772 | 3 | 43 | R5 | S | R | 3 | Clifton | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 773 | 3 | 43 | R6 | S | R | 3 | Clifton | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 774 | 3 | 43 | R7 | S | R | 3 | Clifton | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 775 | 3 | 43 | R8 | S | R | 3 | Clifton | VA | | | | | | | | Out | 15 | | Off | | | |
| 776 | 3 | 43 | R9 | S | R | 3 | Clifton | VA | | | | | | | | B | 15 | In | Off | | | |
| 777 | 3 | 44 | R4 | S | S | 11 | Woodbridge | VA | | | | | | | | B | 15 | In | Off | | | |
| 778 | 3 | 44 | R5 | S | S | 11 | Woodbridge | VA | | | | | | | | B | 15 | In | Off | | | |
| 779 | 3 | 44 | R6 | S | S | 11 | Woodbridge | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 780 | 3 | 44 | R7 | S | S | 11 | Woodbridge | VA | | | | | | Yes | Yes | Kit | 15 | Out | On | | | |
| 781 | 3 | 44 | R8 | S | S | 11 | Woodbridge | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 782 | 3 | 45 | R4 | M | S | 28 | Reston | VA | | | | | | | | B | 15 | In | Off | | | |
| 783 | 3 | 45 | R5 | M | S | 28 | Reston | VA | | | | | | | | B | 15 | In | Off | | | |
| 784 | 3 | 46 | R4 | M | R | 13 | Falmouth | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 785 | 3 | 46 | R5 | M | R | 13 | Falmouth | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 786 | 3 | 47 | R4 | S | R | 3 | Round Hill | VA | | | | | | | | B | 15 | In | Off | | | |
| 787 | 3 | 47 | R5 | S | R | 3 | Round Hill | VA | | | | | | | No | G | 15 | Out | No Reset | | | |
| 788 | 3 | 47 | R6 | S | R | 3 | Round Hill | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 789 | 3 | 47 | R7 | S | R | 3 | Round Hill | VA | | | | | | | | Kit | 15 | In | Unk | | | |
| 790 | 3 | 47 | R8 | S | R | 3 | Round Hill | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 791 | 3 | 47 | R9 | S | R | 3 | Round Hill | VA | | | | | | | | Out | 15 | | Off | | | |
| 792 | 3 | 48 | R4 | M | U | 70 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 793 | 3 | 49 | R4 | M | U | 28 | Springfield | VA | | | | | | | | B | 15 | In | Off | | | |
| 794 | 3 | 50 | B1 | S | R | Unk | Leesburg | VA | 50 | 2 | No Trip | Unk | Unk | Yes | Yes | | | | | | | |
| 795 | 3 | 50 | R4 | S | R | Unk | Leesburg | VA | | | | | | | | B | 15 | In | Off | | | |
| 796 | 3 | 50 | R5 | S | R | Unk | Leesburg | VA | | | | | | | | B | 15 | In | Off | | | |
| 797 | 3 | 50 | R6 | S | R | Unk | Leesburg | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 798 | 3 | 51 | R4 | S | S | 12 | Dunn Loring | VA | | | | | | | | B | 15 | In | Off | | | |
| 799 | 3 | 51 | R5 | S | S | 12 | Dunn Loring | VA | | | | | | | | B | 15 | In | Off | | | |
| 800 | 3 | 52 | B1 | S | S | 20 | Burke | VA | 15 | 1 | Trip | 1980 | Base | | | | | | | | | |
| 801 | 3 | 52 | R4 | S | S | 15 | Burke | VA | | | | | | | | B | 15 | In | Off | | | |
| 802 | 3 | 53 | R4 | M | S | 12 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 803 | 3 | 54 | B1 | S | S | 26 | Bowie | MD | 15 | 1 | Trip | | Base | | | | | | | | | |
| 804 | 3 | 55 | R4 | S | U | 60 | Washington | DC | | | | | | | | Kit | 15 | In | Off | | | |
| 805 | 3 | 56 | R4 | S | S | 52 | Takoma Park | MD | | | | | | | | B | 15 | In | Off | | | |
| 806 | 3 | 56 | R5 | S | S | 52 | Takoma Park | MD | | | | | | | No | Out | 15 | | No Trip | | | |
| 807 | 3 | 57 | R4 | S | S | 43 | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 808 | 3 | 57 | R5 | S | S | 43 | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 809 | 3 | 57 | R6 | S | S | 43 | Arlington | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 810 | 3 | 57 | R7 | S | S | 43 | Arlington | VA | | | | | | | | Out | 15 | | Off | | | |
| 811 | 3 | 58 | R4 | S | S | 13 | Olney | MD | | | | | | | | B | 15 | In | Off | | | |
| 812 | 3 | 59 | B1 | Unk | S | 10 | Vienna | VA | 20 | 1 | Trip | 1990 | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 813 | 3 | 59 | R4 | Unk | S | 10 | Vienna | VA | | | | | | | | B | 15 | In | Off | | | |
| 814 | 3 | 59 | R5 | Unk | S | 10 | Vienna | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 815 | 3 | 60 | B1 | S | S | Unk | Fairfax | VA | 20 | 1 | Trip | 1980 | | | | | | | | | | |
| 816 | 3 | 61 | R4 | S | S | 11 | Fairfax | VA | | | | | | | | B | 15 | In | Off | | | |
| 817 | 3 | 61 | R5 | S | S | 11 | Fairfax | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 818 | 3 | 62 | B1 | M | S | 45 | Arlington | VA | 15 | 1 | No Trip | 1977 | Unk | Yes | Yes | | | | | | | |
| 819 | 3 | 63 | B1 | S | S | 53 | Vienna | VA | 20 | 1 | Trip | 1990 | | | | | | | | | | |
| 820 | 3 | 63 | R4 | S | S | 53 | Vienna | VA | | | | | | No | Yes | Kit | 15 | In | On | | | |
| 821 | 3 | 63 | R5 | S | S | 53 | Vienna | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 822 | 3 | 63 | R6 | S | S | 53 | Vienna | VA | | | | | | | | B | 15 | In | Off | | | |
| 823 | 3 | 63 | R7 | S | S | 53 | Vienna | VA | | | | | | | | B | 15 | In | Off | | | |
| 824 | 3 | 64 | B1 | S | S | 18 | Arlington | VA | 15 | 1 | Trip | Unk | | | | | | | | | | |
| 825 | 3 | 64 | R4 | S | S | 18 | Arlington | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 826 | 3 | 65 | R4 | S | S | 28 | McLean | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 827 | 3 | 65 | R5 | S | S | 28 | McLean | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 828 | 3 | 66 | B1 | S | S | Unk | Springfield | VA | 15 | 1 | Trip | 1991 | | | | | | | | | | |
| 829 | 3 | 67 | R4 | S | S | 47 | Kensington | MD | | | | | | | | B | 15 | In | Off | | | |
| 830 | 3 | 67 | R5 | S | S | 47 | Kensington | MD | | | | | | | | B | 15 | In | Off | | | |
| 831 | 3 | 67 | R6 | S | S | 47 | Kensington | MD | | | | | | | | Out | 15 | | Off | | | |
| 832 | 3 | 68 | B1 | Unk | S | 26 | Vienna | VA | 15 | 1 | Trip | 1991 | | | | | | | | | | |
| 833 | 3 | 69 | R4 | S | S | 46 | Annandale | VA | | | | | | | | G | 15 | In | Off | | | |
| 834 | 3 | 70 | B1 | M | S | 20 | Springfield | VA | 15 | 1 | Trip | 1980 | | | | | | | | | | |
| 835 | 3 | 71 | R4 | M | U | 82 | Washington | DC | | | | | | | | B | 15 | In | Off | | | |
| 836 | 3 | 71 | R5 | M | U | 82 | Washington | DC | | | | | | | | Kit | 15 | In | Off | | | |
| 837 | 3 | 72 | R4 | M | S | 3 | Fairfax | VA | | | | | | | | B | 15 | In | Off | | | |
| 838 | 3 | 72 | R5 | M | S | 3 | Fairfax | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 839 | 3 | 72 | R6 | M | S | 3 | Fairfax | VA | | | | | | | | Out | 15 | | Off | | | |
| 840 | 3 | 73 | R4 | S | S | 14 | Great Falls | VA | | | | | | | | B | 15 | In | Off | | | |
| 841 | 3 | 74 | R4 | M | S | 6 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 842 | 3 | 74 | R5 | M | S | 6 | Alexandria | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 843 | 3 | 75 | R4 | M | S | 14 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 844 | 3 | 76 | R4 | S | S | 21 | Fairfax | VA | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 845 | 3 | 76 | R5 | S | S | 21 | Fairfax | VA | | | | | | | | B | Unk | In | Off | | | |
| 846 | 3 | 78 | R4 | S | S | 35 | Rockville | MD | | | | | | | | B | 15 | In | Off | | | |
| 847 | 3 | 79 | R4 | S | S | 12 | Sterling | VA | | | | | | | | B | 15 | In | Off | | | |
| 848 | 3 | 79 | R5 | S | S | 12 | Sterling | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 849 | 3 | 80 | R4 | S | U | 86 | Arlington | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 850 | 3 | 80 | R5 | S | U | 86 | Arlington | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 851 | 3 | 80 | R6 | S | U | 86 | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 852 | 3 | 81 | R4 | S | S | 9 | North Potomac | MD | | | | | | | | Kit | 15 | Out | Off | | | |
| 853 | 3 | 81 | R5 | S | S | 9 | North Potomac | MD | | | | | | | | Kit | 15 | Out | Off | | | |
| 854 | 3 | 81 | R6 | S | S | 9 | North Potomac | MD | | | | | | | | Base | 15 | In | Off | | | |
| 855 | 3 | 82 | R4 | S | S | 0 | Centreville | VA* | | | | | | | | Kit | 15 | In | Off | | | |
| 856 | 3 | 82 | R5 | S | S | 0 | Centreville | VA* | | | | | | | | Kit | 15 | Out | Off | | | |
| 857 | 3 | 82 | R6 | S | S | 0 | Centreville | VA* | | | | | | | | B | 15 | In | Off | | | |
| 858 | 3 | 82 | R7 | S | S | 0 | Centreville | VA* | | | | | | | | G | Unk | In | Off | | | |
| 859 | 3 | 84 | R4 | S | U | 15 | Sterling | VA | | | | | | | | B | 15 | In | Off | | | |
| 860 | 3 | 97 | R4 | S | U | 61 | Arlington | VA | | | | | | No | Yes | Out | 15 | | No Trip | Yes | No | No |
| 861 | 3 | 97 | R5 | S | U | 61 | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 862 | 3 | 98 | R4 | S | S | 9 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 863 | 3 | 98 | R5 | S | S | 9 | Alexandria | VA | | | | | | No | Yes | Kit | 15 | In | On | | | |
| 864 | 3 | 98 | R6 | S | S | 9 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 865 | 3 | 99 | R4 | M | U | 11 | Leesburg | VA | | | | | | | No | Kit | 15 | In | No Trip | | | |
| 866 | 3 | 99 | R5 | M | U | 11 | Leesburg | VA | | | | | | | No | Kit | 15 | In | No Trip | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 867 | 3 | 99 | R6 | M | U | 11 | Leesburg | VA | | | | | | | | B | 15 | In | Off | | | |
| 868 | 3 | 100 | R4 | S | S | 18 | Arlington | VA | | | | | | | No | B | 15 | In | On | | | |
| 869 | 3 | 101 | B1 | Unk | U | 17 | Reston | VA | 20 | Unk | Trip | 1983 | | | | | | | | | | |
| 870 | 3 | 101 | R4 | Unk | U | 17 | Reston | VA | | | | | | | | B | 15 | In | Off | | | |
| 871 | 3 | 101 | R5 | Unk | U | 17 | Reston | VA | | | | | | Yes | Yes | Out | 15 | | No Trip | Yes | No | Yes |
| 872 | 3 | 101 | R6 | Unk | U | 17 | Reston | VA | | | | | | | | G | 15 | Out | Off | | | |
| 873 | 3 | 101 | R7 | Unk | U | 17 | Reston | VA | | | | | | | | Out | 15 | | Off | | | |
| 874 | 3 | 113 | R4 | S | U | 15 | Sterling | VA | | | | | | Unk | Yes | B | 15 | In | No Trip | | | |
| 875 | 3 | 117 | R4 | S | S | Unk | Lovettsville | VA | | | | | | | No | B | 15 | Unk | No Trip | | | |
| 876 | 3 | 117 | R5 | S | S | Unk | Lovettsville | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 877 | 3 | 117 | R6 | S | S | Unk | Lovettsville | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 878 | 3 | 120 | B1 | Unk | S | Unk | Bristow | VA | 20 | 1 | Trip | | | | | | | | | | | |
| 879 | 3 | 120 | R4 | Unk | S | Unk | Bristow | VA | | | | | | | | G | 15 | In | Off | | | |
| 880 | 3 | 120 | R5 | Unk | S | Unk | Bristow | VA | | | | | | | | B | 15 | In | Off | | | |
| 881 | 3 | 120 | R6 | Unk | S | Unk | Bristow | VA | | | | | | | | Base | 15 | In | Off | | | |
| 882 | 3 | 120 | R7 | Unk | S | Unk | Bristow | VA | | | | | | | | Base | 15 | In | Off | | | |
| 883 | 3 | 120 | R8 | Unk | S | Unk | Bristow | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 884 | 3 | 120 | R9 | Unk | S | Unk | Bristow | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 885 | 3 | 121 | R4 | S | S | 3 | Haymarket | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 886 | 3 | 121 | R5 | S | S | 3 | Haymarket | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 887 | 3 | 121 | R6 | S | S | 3 | Haymarket | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 888 | 3 | 121 | R7 | S | S | 3 | Haymarket | VA | | | | | | | | Kit | 15 | Unk | Off | | | |
| 889 | 3 | 122 | B1 | S | S | 13 | Fairfax | VA | 15 | 1 | Trip | | | | | | | | | | | |
| 890 | 3 | 122 | R4 | S | S | 13 | Fairfax | VA | | | | | | | No | Out | 15 | | No Reset | | | |
| 891 | 3 | 122 | R5 | S | S | 13 | Fairfax | VA | | | | | | | | B | Unk | Unk | Off | | | |
| 892 | 3 | 123 | B1 | S | S | 9 | Centreville | VA | 15 | 1 | Trip | | | | | | | | | | | |
| 893 | 3 | 123 | R4 | S | S | 9 | Centreville | VA | | | | | | | | B | 15 | In | Off | | | |
| 894 | 3 | 123 | R5 | S | S | 9 | Centreville | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 895 | 3 | 123 | R6 | S | S | 9 | Centreville | VA | | | | | | Yes | Yes | Base | 15 | Out | On | Yes | No | Yes |
| 896 | 3 | 124 | B1 | S | S | 30 | Woodbridge | VA | 20 | 1 | No Trip | Unk | Unk | | No | | | | | | | |
| 897 | 3 | 125 | R4 | S | S | Unk | Alexandria | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 898 | 3 | 126 | R4 | S | S | 13 | Chantilly | VA | | | | | | | No | B | 15 | In | On | | | |
| 899 | 3 | 126 | R5 | S | S | 13 | Chantilly | VA | | | | | | | | B | 15 | In | Off | | | |
| 900 | 3 | 127 | R4 | S | S | 18 | | VA | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 901 | 3 | 128 | R4 | S | S | 2 | South Ridge | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 902 | 3 | 128 | R5 | S | S | 2 | South Ridge | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 903 | 3 | 128 | R6 | S | S | 2 | South Ridge | VA | | | | | | | | Kit | 15 | Unk | Off | | | |
| 904 | 3 | 129 | R4 | S | Unk | 26 | Fort Washington | MD | | | | | | | | B | 15 | In | Off | | | |
| 905 | 3 | 129 | R5 | S | Unk | 26 | Fort Washington | MD | | | | | | | | Out | 15 | | Off | | | |
| 906 | 3 | 130 | R4 | Unk | S | 28 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 907 | 3 | 130 | R5 | Unk | S | 28 | Alexandria | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 908 | 3 | 130 | R6 | Unk | S | 28 | Alexandria | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 909 | 3 | 131 | R4 | S | S | 6 | Woodbridge | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 910 | 3 | 131 | R5 | S | S | 6 | Woodbridge | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 911 | 3 | 131 | R6 | S | S | 6 | Woodbridge | VA | | | | | | | | B | 15 | In | Off | | | |
| 912 | 3 | 134 | R4 | S | R | 36 | Clifton | VA | | | | | | | | B | 15 | In | Off | | | |
| 913 | 3 | 136 | R4 | S | S | Unk | Herndon | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 914 | 3 | 148 | R4 | S | S | 5 | Woodbridge | VA | | | | | | | | Base | 15 | In | Off | | | |
| 915 | 3 | 148 | R5 | S | S | 5 | Woodbridge | VA | | | | | | | | Base | 15 | In | Off | | | |
| 916 | 3 | 148 | R6 | S | S | 5 | Woodbridge | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 917 | 3 | 148 | R7 | S | S | 5 | Woodbridge | VA | | | | | | | | Kit | 15 | Unk | Off | | | |
| 918 | 3 | 148 | R8 | S | S | 5 | Woodbridge | VA | | | | | | | | Kit | 15 | In | Unk | | | |
| 919 | 3 | 148 | R9 | S | S | 5 | Woodbridge | VA | | | | | | | | Unk | 15 | In | Off | | | |
| 920 | 3 | 149 | R4 | S | S | 30 | Chantilly | VA | | | | | | | | Kit | 20 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 921 | 3 | 149 | R5 | S | S | 30 | Chantilly | VA | | | | | | | | Kit | 20 | Unk | Off | | | |
| 922 | 3 | 152 | R4 | S | R | 26 | Manassas | VA | | | | | | | | Out | 15 | | Off | | | |
| 923 | 3 | 153 | R4 | M | S | 14 | Herndon | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 924 | 3 | 153 | R5 | M | S | 14 | Herndon | VA | | | | | | | | Out | 15 | | Off | | | |
| 925 | 3 | 154 | R4 | S | S | 2 | Manassas | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 926 | 3 | 154 | R5 | S | S | 2 | Manassas | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 927 | 3 | 154 | R6 | S | S | 2 | Manassas | VA | | | | | | | | G | 15 | In | Off | | | |
| 928 | 3 | 154 | R7 | S | S | 2 | Manassas | VA | | | | | | | | B | 15 | In | Off | | | |
| 929 | 3 | 154 | R8 | S | S | 2 | Manassas | VA | | | | | | | | Base | 15 | Out | Off | | | |
| 930 | 3 | 155 | B1 | S | U | Unk | Mclean | VA | 20 | 1 | No Trip | 1987 | Base | | No | | | | | | | |
| 931 | 3 | 155 | R4 | S | U | Unk | Mclean | VA | | | | | | | | B | 15 | In | Off | | | |
| 932 | 3 | 155 | R5 | S | U | Unk | Mclean | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 933 | 3 | 156 | R4 | S | S | 18 | Springfield | VA | | | | | | | | B | 15 | In | Off | | | |
| 934 | 3 | 156 | R5 | S | S | 18 | Springfield | VA | | | | | | No | Yes | B | 15 | In | No Trip | | | |
| 935 | 3 | 157 | R4 | S | U | Unk | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 936 | 3 | 158 | B1 | S | S | 23 | Woodbridge | VA | 15 | 1 | Trip | | | | | | | | | | | |
| 937 | 3 | 158 | B2 | S | S | 23 | Woodbridge | VA | 15 | 1 | Trip | | | | | | | | | | | |
| 938 | 3 | 158 | R4 | S | S | 23 | Woodbridge | VA | | | | | | | | G | 15 | In | Off | | | |
| 939 | 3 | 159 | R4 | S | U | 130 | Alexandria | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 940 | 3 | 159 | R5 | S | U | 130 | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 941 | 3 | 159 | R6 | S | U | 130 | Alexandria | VA | | | | | | | | Out | 15 | Out | Off | | | |
| 942 | 3 | 159 | R7 | S | U | 130 | Alexandria | VA | | | | | | | | Out | 15 | Out | Off | | | |
| 943 | 3 | 160 | B1 | M | S | Unk | Alexandria | VA | 15 | 1 | Trip | Unk | | | | | | | | | | |
| 944 | 3 | 160 | R4 | M | S | Unk | Alexandria | VA | | | | | | | | B | 15 | In | Off | | | |
| 945 | 3 | 161 | R4 | S | U | Unk | Washington | DC | | | | | | | | Out | 15 | Out | Off | | | |
| 946 | 3 | 161 | R5 | S | U | Unk | Washington | DC | | | | | | | | Kit | 15 | Out | Off | | | |
| 947 | 3 | 161 | R6 | S | U | Unk | Washington | DC | | | | | | | | Out | 15 | Out | Off | | | |
| 948 | 3 | 162 | R4 | M | S | Unk | Falls Church | VA | | | | | | | | B | 15 | In | Off | | | |
| 949 | 3 | 177 | R4 | S | S | 6 mo | Mitchelville | VA* | | | | | | | | B | 15 | In | Off | | | |
| 950 | 3 | 177 | R5 | S | S | 6 mo | Mitchelville | VA* | | | | | | | | G | 15 | Out | Off | | | |
| 951 | 3 | 177 | R6 | S | S | 6 mo | Mitchelville | VA* | | | | | | | | Kit | 15 | In | Off | | | |
| 952 | 3 | 178 | R4 | S | S | 6 | Jessup | MD | | | | | | | | B | 15 | Unk | Off | | | |
| 953 | 3 | 178 | R5 | S | S | 6 | Jessup | MD | | | | | | | | G | 15 | Unk | Off | | | |
| 954 | 3 | 178 | R6 | S | S | 6 | Jessup | MD | | | | | | | | Kit | 15 | Unk | Off | | | |
| 955 | 3 | 179 | R4 | S | Unk | 7 | Upper Marlboro | MD | | | | | | | | B | 15 | Unk | Off | | | |
| 956 | 3 | 180 | R4 | S | S | 14 | Fairfax | VA | | | | | | | | B | 15 | Unk | Off | | | |
| 957 | 3 | 181 | B1 | S | S | 18 | Vienna | VA | 15 | 1 | Unk | | | | | | | | | | | |
| 958 | 3 | 181 | B2 | S | S | 18 | Vienna | VA | 15 | 1 | Unk | | | | | | | | | | | |
| 959 | 3 | 181 | B3 | S | S | 18 | Vienna | VA | 20 | 1 | Unk | | | | | | | | | | | |
| 960 | 3 | 181 | R4 | S | S | 18 | Vienna | VA | | | | | | | | B | 15 | In | Off | | | |
| 961 | 3 | 182 | B1 | S | S | Unk | Woodbridge | VA | 20 | 1 | Trip | 1983 | | | | | | | | | | |
| 962 | 3 | 182 | R4 | S | S | Unk | Woodbridge | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 963 | 3 | 182 | R5 | S | S | Unk | Woodbridge | VA | | | | | | | | B | 15 | In | Off | | | |
| 964 | 3 | 182 | R6 | S | S | Unk | Woodbridge | VA | | | | | | | | G | 15 | In | Off | | | |
| 965 | 3 | 183 | B1 | S | R | 14 | Fairfax Station | VA | 20 | 1 | Trip | | | | | | | | | | | |
| 966 | 3 | 183 | R4 | S | R | 14 | Fairfax Station | VA | | | | | | | | B | 15 | In | Off | | | |
| 967 | 3 | 183 | R5 | S | R | 14 | Fairfax Station | VA | | | | | | | | B | 15 | In | Off | | | |
| 968 | 3 | 183 | R6 | S | R | 14 | Fairfax Station | VA | | | | | | | No | B | 15 | In | No Trip | | | |
| 969 | 3 | 183 | R7 | S | R | 14 | Fairfax Station | VA | | | | | | | No | B | 15 | In | No Trip | | | |
| 970 | 3 | 185 | R4 | S | Unk | Unk | Lorton | VA | | | | | | | | B | 15 | In | Off | | | |
| 971 | 3 | 185 | R5 | S | Unk | Unk | Lorton | VA | | | | | | | | Out | 15 | Out | Off | | | |
| 972 | 3 | 186 | R4 | Unk | S | Unk | Reston | VA | | | | | | | | B | 15 | In | Off | | | |
| 973 | 3 | 201 | B1 | S | S | 1 1/2 mo | Rockville | MD* | 20 | 1 | Trip | 2/8/2000 | | | | | | | | | | |
| 974 | 3 | 201 | R4 | S | S | 1 1/2 mo | Rockville | MD* | | | | | | | | Kit | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 975 | 3 | 201 | R5 | S | S | 1 1/2 mo | Rockville | MD* | | | | | | | | Kit | 15 | Out | Off | | | |
| 976 | 3 | 201 | R6 | S | S | 1 1/2 mo | Rockville | MD* | | | | | | | | Kit | 15 | In | Off | | | |
| 977 | 3 | 201 | R7 | S | S | 1 1/2 mo | Rockville | MD* | | | | | | | | G | 15 | In | Off | | | |
| 978 | 3 | 201 | R8 | S | S | 1 1/2 mo | Rockville | MD* | | | | | | | | B | 15 | In | Off | | | |
| 979 | 3 | 204 | R4 | S | S | 5 | Manassas Park | VA | | | | | | | | B | 15 | In | Unk | | | |
| 980 | 3 | 204 | R5 | S | S | 5 | Manassas Park | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 981 | 3 | 204 | R6 | S | S | 5 | Manassas Park | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 982 | 3 | 205 | R4 | M | S | 22 | Burke | VA | | | | | | No | Yes | B | 15 | Out | On | | | |
| 983 | 3 | 206 | R4 | M | S | Unk | Ashburn | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 984 | 3 | 206 | R5 | M | S | Unk | Ashburn | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 985 | 3 | 206 | R6 | M | S | Unk | Ashburn | VA | | | | | | | | B | 15 | In | Off | | | |
| 986 | 3 | 207 | R4 | S | U | 31 | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 987 | 3 | 207 | R5 | S | U | 31 | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 988 | 3 | 208 | R4 | S | S | Unk | Sterling | VA | | | | | | | | B | 15 | In | Off | | | |
| 989 | 3 | 208 | R5 | S | S | Unk | Sterling | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 990 | 3 | 208 | R6 | S | S | Unk | Sterling | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 991 | 3 | 208 | R7 | S | S | Unk | Sterling | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 992 | 3 | 208 | R8 | S | S | Unk | Sterling | VA | | | | | | | | B | 15 | In | Off | | | |
| 993 | 3 | 209 | R4 | S | U | 53 | Alexandria | VA | | | | | | | | B | 15 | Out | Off | | | |
| 994 | 3 | 209 | R5 | S | U | 53 | Alexandria | VA | | | | | | | | Out | 15 | Out | Off | Yes | | |
| 995 | 3 | 211 | R4 | M | S | 22 | Burke | VA | | | | | | Yes | Yes | B | 15 | In | On | | | |
| 996 | 3 | 212 | B1 | S | S | Unk | Peston | VA | 20 | 1 | No Trip | 1984 | Base | Yes | Yes | | | | | | | |
| 997 | 3 | 212 | B2 | S | S | Unk | Peston | VA | 20 | 1 | Trip | 1984 | Base | | | | | | | | | |
| 998 | 3 | 212 | B3 | S | S | Unk | Peston | VA | 15 | 1 | Trip | 1984 | Base | | | | | | | | | |
| 999 | 3 | 213 | R4 | S | U | Unk | Arlington | VA | | | | | | | | B | 15 | In | Off | | | |
| 1000 | 3 | 213 | R5 | S | U | Unk | Arlington | VA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1001 | 3 | 213 | R6 | S | U | Unk | Arlington | VA | | | | | | | | G | 20 | Out | Off | | | |
| 1002 | 3 | 214 | R4 | M | U | Unk | Washington | DC | | | | | | | | B | 15 | In | Off | | | |
| 1003 | 3 | 216 | R4 | M | R | 5 | Riding | VA | | | | | | | | B | 15 | In | Off | | | |
| 1004 | 3 | 216 | R5 | M | R | 5 | Riding | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 1005 | 3 | 216 | R6 | M | R | 5 | Riding | VA | | | | | | | | Kit | 15 | In | Off | | | |
| 1006 | 3 | 217 | R4 | M | S | 17 | Oakton | VA | | | | | | | | B | 15 | In | Off | | | |
| 1007 | 3 | 218 | R4 | M | S | 23 | Burke | VA | | | | | | | | B | 15 | In | Off | | | |
| 1008 | 3 | 219 | R4 | S | S | 13 | Herndon | VA | | | | | | | | B | 15 | In | Off | | | |
| 1009 | 3 | 220 | B1 | M | S | 24 | Fairfax | VA | 15 | 1 | Trip | Unk | | | | | | | | | | |
| 1010 | 3 | 220 | B2 | M | S | 24 | Fairfax | VA | 15 | 1 | Trip | Unk | | | | | | | | | | |
| 1011 | 3 | 220 | R4 | M | S | 24 | Fairfax | VA | | | | | | | | B | 15 | In | Off | | | |
| 1012 | 3 | 220 | R5 | M | S | 24 | Fairfax | VA | | | | | | | | B | 15 | Out | Off | | | |
| 1013 | 3 | 222 | R4 | M | S | 13 | Fairfax | VA | | | | | | | | B | 15 | In | Off | | | |
| 1014 | 3 | 223 | R4 | M | S | 16 | Sterling | VA | | | | | | | | B | 15 | In | Off | | | |
| 1015 | 3 | 224 | R4 | S | S | 15 | Dumfries | VA | | | | | | | No | Base | 15 | In | No Trip | | | |
| 1016 | 3 | 225 | R4 | M | U | 70 | Washington | DC | | | | | | | | B | 15 | In | Off | | | |
| 1017 | 3 | 225 | R5 | M | U | 70 | Washington | DC | | | | | | | | Kit | 15 | In | Off | | | |
| 1018 | 3 | 225 | R6 | M | U | 70 | Washington | DC | | | | | | | | Kit | 15 | In | Off | | | |
| 1019 | 3 | 225 | R7 | M | U | 70 | Washington | DC | | | | | | | | Kit | 15 | In | Off | | | |
| 1020 | 4 | 626 | R4 | S | S | 30 | Lenexa | KS | | | | | | | No | B | 15 | In | On | | | |
| 1021 | 4 | 627 | R10 | S | S | 7 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1022 | 4 | 627 | R11 | S | S | 7 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1023 | 4 | 627 | R4 | S | S | 7 | Olathe | KS | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 1024 | 4 | 627 | R5 | S | S | 7 | Olathe | KS | | | | | | Yes | Yes | Base | 15 | Out | No Trip | | | |
| 1025 | 4 | 627 | R6 | S | S | 7 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1026 | 4 | 627 | R7 | S | S | 7 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1027 | 4 | 627 | R8 | S | S | 7 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1028 | 4 | 627 | R9 | S | S | 7 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1029 | 4 | 628 | R4 | S | S | 7 | Overland Park | KS | | | | | | Yes | Yes | Base | 15 | Out | On | | No | Yes |
| 1030 | 4 | 628 | R5 | S | S | 7 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1031 | 4 | 628 | R6 | S | S | 7 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1032 | 4 | 628 | R7 | S | S | 7 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1033 | 4 | 629 | R4 | S | S | 10 | Overland Park | KS | | | | | | | No | Kit | 15 | Out | No Trip | | | |
| 1034 | 4 | 629 | R5 | S | S | 10 | Overland Park | KS | | | | | | | No | B | 15 | In | No Trip | | | |
| 1035 | 4 | 629 | R6 | S | S | 10 | Overland Park | KS | | | | | | | | Base | 15 | Out | Off | | | |
| 1036 | 4 | 630 | R10 | S | S | 2 | Kansas City | MO | | | | | | | | G | 15 | In | Off | | | |
| 1037 | 4 | 630 | R4 | S | S | 2 | Kansas City | MO | | | | | | | No | Out | 15 | | No Trip | | | |
| 1038 | 4 | 630 | R5 | S | S | 2 | Kansas City | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1039 | 4 | 630 | R6 | S | S | 2 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1040 | 4 | 630 | R7 | S | S | 2 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1041 | 4 | 630 | R8 | S | S | 2 | Kansas City | MO | | | | | | | | Out | 15 | | Off | | | |
| 1042 | 4 | 630 | R9 | S | S | 2 | Kansas City | MO | | | | | | | | Out | 15 | | Off | | | |
| 1043 | 4 | 631 | R4 | S | S | 5 | Liberty | MO | | | | | | | No | Out | 15 | | No Trip | | | |
| 1044 | 4 | 631 | R5 | S | S | 5 | Liberty | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1045 | 4 | 631 | R6 | S | S | 5 | Liberty | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1046 | 4 | 631 | R7 | S | S | 5 | Liberty | MO | | | | | | | | G | 15 | In | Off | | | |
| 1047 | 4 | 631 | R8 | S | S | 5 | Liberty | MO | | | | | | | | B | 15 | In | Off | | | |
| 1048 | 4 | 631 | R9 | S | S | 5 | Liberty | MO | | | | | | | | Base | 15 | In | Off | | | |
| 1049 | 4 | 632 | R4 | S | S | 7 | Raymore | MO | | | | | | No | No | B | 15 | Unk | On | | | |
| 1050 | 4 | 632 | R5 | S | S | 7 | Raymore | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1051 | 4 | 632 | R6 | S | S | 7 | Raymore | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1052 | 4 | 632 | R7 | S | S | 7 | Raymore | MO | | | | | | | | B | 15 | In | Off | | | |
| 1053 | 4 | 632 | R8 | S | S | 7 | Raymore | MO | | | | | | | | G | 15 | In | Off | | | |
| 1054 | 4 | 633 | R4 | S | S | 5 | Olathe | KS | | | | | | Yes | Yes | G | 15 | In | No Trip | | | |
| 1055 | 4 | 633 | R5 | S | S | 5 | Olathe | KS | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 1056 | 4 | 634 | B1 | S | S | 14 | Overland Park | KS | 15 | 1 | Trip | 1986 | Base | | | | | | | | | |
| 1057 | 4 | 635 | R4 | S | S | 10 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1058 | 4 | 635 | R5 | S | S | 10 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1059 | 4 | 635 | R6 | S | S | 10 | Overland Park | KS | | | | | | | | B | Unk | In | Off | | | |
| 1060 | 4 | 635 | R7 | S | S | 10 | Overland Park | KS | | | | | | | | Kit | Unk | Out | Off | | | |
| 1061 | 4 | 636 | R4 | S | S | 80 | Kansas City | KS | | | | | | Yes | Yes | Base | 15 | Out | No Trip | | | |
| 1062 | 4 | 636 | R5 | S | S | 80 | Kansas City | KS | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 1063 | 4 | 637 | R10 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1064 | 4 | 637 | R11 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1065 | 4 | 637 | R12 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1066 | 4 | 637 | R13 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1067 | 4 | 637 | R14 | S | S | 2 | Overland Park | KS | | | | | | | | G | 15 | Unk | Off | | | |
| 1068 | 4 | 637 | R4 | S | S | 2 | Overland Park | KS | | | | | | Yes | Yes | Base | 15 | Out | No Trip | | | |
| 1069 | 4 | 637 | R5 | S | S | 2 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1070 | 4 | 637 | R6 | S | S | 2 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1071 | 4 | 637 | R7 | S | S | 2 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1072 | 4 | 637 | R8 | S | S | 2 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1073 | 4 | 637 | R9 | S | S | 2 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1074 | 4 | 638 | R4 | S | S | 13 | Overland Park | KS | | | | | | Yes | Yes | G | 15 | In | No Trip | | | |
| 1075 | 4 | 639 | R10 | S | S | 3 | Leawood | KS | | | | | | | | Out | 15 | | Off | | | |
| 1076 | 4 | 639 | R11 | S | S | 3 | Leawood | KS | | | | | | | | Out | 15 | | Off | | | |
| 1077 | 4 | 639 | R12 | S | S | 3 | Leawood | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1078 | 4 | 639 | R13 | S | S | 3 | Leawood | KS | | | | | | | | G | 15 | Out | Off | | | |
| 1079 | 4 | 639 | R14 | S | S | 3 | Leawood | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1080 | 4 | 639 | R15 | S | S | 3 | Leawood | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1081 | 4 | 639 | R16 | S | S | 3 | Leawood | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1082 | 4 | 639 | R17 | S | S | 3 | Leawood | KS | | | | | | | | Base | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1083 | 4 | 639 | R4 | S | S | 3 | Leawood | KS | | | | | | Yes | Yes | Out | 15 | | No Trip | Yes | No | Yes |
| 1084 | 4 | 639 | R6 | S | S | 3 | Leawood | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1085 | 4 | 639 | R7 | S | S | 3 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1086 | 4 | 639 | R8 | S | S | 3 | Leawood | KS | | | | | | | | B | Unk | In | Off | | | |
| 1087 | 4 | 639 | R9 | S | S | 3 | Leawood | KS | | | | | | | | Kit | Unk | In | Off | | | |
| 1088 | 4 | 640 | R4 | S | S | 50 | Roeland Park | KS | | | | | | | No | Kit | 15 | Out | No Reset | | | |
| 1089 | 4 | 640 | R5 | S | S | 50 | Roeland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1090 | 4 | 641 | B1 | S | S | 70 | Kansas City | MO | 15 | 1 | Trip | 1990 | Base | | | | | | | | | |
| 1091 | 4 | 641 | B2 | S | S | 70 | Kansas City | MO | 15 | 1 | Trip | 1990 | Base | | | | | | | | | |
| 1092 | 4 | 641 | B3 | S | S | 70 | Kansas City | MO | 20 | 1 | Trip | 1990 | Base | | | | | | | | | |
| 1093 | 4 | 641 | R4 | S | S | 70 | Kansas City | MO | | | | | | | No | Out | 15 | | No Trip | | | |
| 1094 | 4 | 642 | R10 | S | S | New | Overland Park | KS* | | | | | | | | G | Unk | Out | Off | | | |
| 1095 | 4 | 642 | R4 | S | S | New | Overland Park | KS* | | | | | | | | Base | 15 | In | Off | | | |
| 1096 | 4 | 642 | R5 | S | S | New | Overland Park | KS* | | | | | | | | Base | 15 | Out | Off | | | |
| 1097 | 4 | 642 | R6 | S | S | New | Overland Park | KS* | | | | | | | | Kit | Unk | In | Off | | | |
| 1098 | 4 | 642 | R7 | S | S | New | Overland Park | KS* | | | | | | | | Kit | Unk | Out | Off | | | |
| 1099 | 4 | 642 | R8 | S | S | New | Overland Park | KS* | | | | | | | | Kit | Unk | In | Off | | | |
| 1100 | 4 | 642 | R9 | S | S | New | Overland Park | KS* | | | | | | | | B | Unk | In | Off | | | |
| 1101 | 4 | 644 | R4 | S | S | 8 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1102 | 4 | 644 | R5 | S | S | 8 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1103 | 4 | 644 | R6 | S | S | 8 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1104 | 4 | 644 | R7 | S | S | 8 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1105 | 4 | 648 | R4 | S | S | 8 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1106 | 4 | 648 | R5 | S | S | 8 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1107 | 4 | 648 | R6 | S | S | 8 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1108 | 4 | 648 | R7 | S | S | 8 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1109 | 4 | 649 | R4 | S | S | 6 | Shawnee | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1110 | 4 | 649 | R5 | S | S | 6 | Shawnee | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1111 | 4 | 649 | R6 | S | S | 6 | Shawnee | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1112 | 4 | 649 | R7 | S | S | 6 | Shawnee | KS | | | | | | | | Base | 15 | Out | Off | | | |
| 1113 | 4 | 650 | R4 | S | S | Unk | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1114 | 4 | 650 | R5 | S | S | Unk | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1115 | 4 | 650 | R6 | S | S | Unk | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1116 | 4 | 652 | R10 | S | S | New | St. Joseph | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1117 | 4 | 652 | R11 | S | S | New | St. Joseph | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1118 | 4 | 652 | R12 | S | S | New | St. Joseph | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1119 | 4 | 652 | R13 | S | S | New | St. Joseph | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1120 | 4 | 652 | R14 | S | S | New | St. Joseph | MO* | | | | | | | | G | 15 | In | Off | | | |
| 1121 | 4 | 652 | R4 | S | S | New | St. Joseph | MO* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1122 | 4 | 652 | R5 | S | S | New | St. Joseph | MO* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1123 | 4 | 652 | R6 | S | S | New | St. Joseph | MO* | | | | | | | | Out | 15 | | Off | | | |
| 1124 | 4 | 652 | R7 | S | S | New | St. Joseph | MO* | | | | | | | | Out | 15 | | Off | | | |
| 1125 | 4 | 652 | R8 | S | S | New | St. Joseph | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1126 | 4 | 652 | R9 | S | S | New | St. Joseph | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1127 | 4 | 654 | R10 | S | S | New | Overland Park | KS* | | | | | | | | B | 15 | In | Off | | | |
| 1128 | 4 | 654 | R11 | S | S | New | Overland Park | KS* | | | | | | | | B | 15 | In | Off | | | |
| 1129 | 4 | 654 | R4 | S | S | New | Overland Park | KS* | | | | | | | | Kit | 15 | In | Off | | | |
| 1130 | 4 | 654 | R5 | S | S | New | Overland Park | KS* | | | | | | | | Kit | 15 | In | Off | | | |
| 1131 | 4 | 654 | R6 | S | S | New | Overland Park | KS* | | | | | | | | G | 15 | In | Off | | | |
| 1132 | 4 | 654 | R7 | S | S | New | Overland Park | KS* | | | | | | | | G | 15 | In | Off | | | |
| 1133 | 4 | 654 | R8 | S | S | New | Overland Park | KS* | | | | | | | | Base | 15 | In | Off | | | |
| 1134 | 4 | 654 | R9 | S | S | New | Overland Park | KS* | | | | | | | | B | 15 | In | Off | | | |
| 1135 | 4 | 656 | R4 | S | S | 12 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1136 | 4 | 656 | R5 | S | S | 12 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1137 | 4 | 656 | R6 | S | S | 12 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1138 | 4 | 656 | R7 | S | S | 12 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1139 | 4 | 656 | R8 | S | S | 12 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1140 | 4 | 657 | R4 | S | S | 28 | Lenexa | KS | | | | | | | | Out | 15 | | Off | | | |
| 1141 | 4 | 658 | R4 | S | S | 4 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1142 | 4 | 658 | R5 | S | S | 4 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1143 | 4 | 658 | R6 | S | S | 4 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1144 | 4 | 659 | R4 | S | S | New | Lenexa | KS* | | | | | | | | Kit | 15 | In | Off | | | |
| 1145 | 4 | 659 | R5 | S | S | New | Lenexa | KS* | | | | | | | | B | 15 | In | Off | | | |
| 1146 | 4 | 660 | R4 | S | S | 11 | Belton | MO | | | | | | | | B | 15 | In | Off | | | |
| 1147 | 4 | 661 | R4 | S | S | 15 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1148 | 4 | 661 | R5 | S | S | 15 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1149 | 4 | 662 | R4 | S | S | 14 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1150 | 4 | 662 | R5 | S | S | 14 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1151 | 4 | 662 | R6 | S | S | 14 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1152 | 4 | 662 | R7 | S | S | 14 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1153 | 4 | 662 | R8 | S | S | 14 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1154 | 4 | 663 | R4 | S | S | 17 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1155 | 4 | 664 | R4 | S | S | 6 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1156 | 4 | 664 | R5 | S | S | 6 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1157 | 4 | 664 | R6 | S | S | 6 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1158 | 4 | 664 | R7 | S | S | 6 | Overland Park | KS | | | | | | | | B | 15 | Out | Off | | | |
| 1159 | 4 | 664 | R8 | S | S | 6 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1160 | 4 | 665 | R4 | S | S | 5 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1161 | 4 | 665 | R5 | S | S | 5 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1162 | 4 | 665 | R6 | S | S | 5 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1163 | 4 | 665 | R7 | S | S | 5 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1164 | 4 | 678 | R4 | S | S | 7 | Gardner | KS | | | | | | | No | B | 15 | In | No Trip | | | |
| 1165 | 4 | 678 | R5 | S | S | 7 | Gardner | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1166 | 4 | 678 | R6 | S | S | 7 | Gardner | KS | | | | | | | | G | 15 | In | Off | | | |
| 1167 | 4 | 679 | R4 | S | S | 10 | Merriam | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1168 | 4 | 679 | R5 | S | S | 10 | Merriam | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1169 | 4 | 679 | R6 | S | S | 10 | Merriam | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1170 | 4 | 679 | R7 | S | S | 10 | Merriam | KS | | | | | | | | B | 15 | In | Off | | | |
| 1171 | 4 | 680 | R4 | S | S | 2 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1172 | 4 | 680 | R5 | S | S | 2 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1173 | 4 | 680 | R6 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1174 | 4 | 680 | R7 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1175 | 4 | 680 | R8 | S | S | 2 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1176 | 4 | 680 | R9 | S | S | 2 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1177 | 4 | 681 | R4 | S | S | 7 | Lees Summit | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1178 | 4 | 681 | R5 | S | S | 7 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1179 | 4 | 682 | R4 | S | S | 5 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1180 | 4 | 682 | R5 | S | S | 5 | Leawood | KS | | | | | | | | G | 15 | In | Off | | | |
| 1181 | 4 | 682 | R6 | S | S | 5 | Leawood | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1182 | 4 | 682 | R7 | S | S | 5 | Leawood | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1183 | 4 | 683 | R4 | S | S | 12 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1184 | 4 | 683 | R5 | S | S | 12 | Leawood | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1185 | 4 | 684 | R10 | S | S | 3 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1186 | 4 | 684 | R11 | S | S | 3 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1187 | 4 | 684 | R12 | S | S | 3 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1188 | 4 | 684 | R13 | S | S | 3 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1189 | 4 | 684 | R14 | S | S | 3 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1190 | 4 | 684 | R15 | S | S | 3 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1191 | 4 | 684 | R4 | S | S | 3 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1192 | 4 | 684 | R5 | S | S | 3 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1193 | 4 | 684 | R6 | S | S | 3 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1194 | 4 | 684 | R7 | S | S | 3 | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1195 | 4 | 684 | R8 | S | S | 3 | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1196 | 4 | 684 | R9 | S | S | 3 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1197 | 4 | 686 | R4 | S | S | 29 | Lawrence | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1198 | 4 | 686 | R5 | S | S | 29 | Lawrence | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1199 | 4 | 686 | R6 | S | S | 29 | Lawrence | KS | | | | | | | | G | 15 | In | Off | | | |
| 1200 | 4 | 686 | R7 | S | S | 29 | Lawrence | KS | | | | | | | | B | 15 | In | Off | | | |
| 1201 | 4 | 686 | R8 | S | S | 29 | Lawrence | KS | | | | | | | | B | 15 | In | Off | | | |
| 1202 | 4 | 686 | R9 | S | S | 29 | Lawrence | KS | | | | | | | | B | 15 | In | Off | | | |
| 1203 | 4 | 687 | R4 | S | S | 2 | Lotawana | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1204 | 4 | 688 | R4 | S | S | 6 | Leawood | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1205 | 4 | 688 | R5 | S | S | 6 | Leawood | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1206 | 4 | 688 | R6 | S | S | 6 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1207 | 4 | 689 | R4 | S | R | 4 | Pleasant Hill | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1208 | 4 | 689 | R5 | S | R | 4 | Pleasant Hill | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1209 | 4 | 689 | R6 | S | R | 4 | Pleasant Hill | MO | | | | | | | | Out | 15 | | Off | | | |
| 1210 | 4 | 689 | R7 | S | R | 4 | Pleasant Hill | MO | | | | | | | | B | 15 | In | Off | | | |
| 1211 | 4 | 690 | R4 | S | S | 11 | Edwardville | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1212 | 4 | 690 | R5 | S | S | 11 | Edwardville | KS | | | | | | | | B | 15 | In | Off | | | |
| 1213 | 4 | 691 | R4 | S | S | 53 | Lotawana | MO | | | | | | | | B | 15 | In | Off | | | |
| 1214 | 4 | 691 | R5 | S | S | 53 | Lotawana | MO | | | | | | | | B | 15 | In | Off | | | |
| 1215 | 4 | 692 | R4 | S | S | 14 | Lenexa | KS | | | | | | | | B | 15 | In | Off | | | |
| 1216 | 4 | 692 | R5 | S | S | 14 | Lenexa | KS | | | | | | | | B | 15 | In | Off | | | |
| 1217 | 4 | 693 | R4 | S | S | Unk | Lenexa | KS | | | | | | | | B | 15 | In | Off | | | |
| 1218 | 4 | 694 | R4 | S | S | 5 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1219 | 4 | 694 | R5 | S | S | 5 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1220 | 4 | 694 | R6 | S | S | 5 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1221 | 4 | 694 | R7 | S | S | 5 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1222 | 4 | 722 | R4 | S | R | 5 | Spring Hill | KS | | | | | | Yes | Yes | Kit | 15 | In | On | | | |
| 1223 | 4 | 722 | R5 | S | R | 5 | Spring Hill | KS | | | | | | | | B | 15 | In | Off | | | |
| 1224 | 4 | 722 | R6 | S | R | 5 | Spring Hill | KS | | | | | | | | G | 15 | In | Off | | | |
| 1225 | 4 | 722 | R7 | S | R | 5 | Spring Hill | KS | | | | | | | | Out | 15 | | Off | | | |
| 1226 | 4 | 723 | R4 | S | S | 16 | Lenexa | KS | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 1227 | 4 | 724 | R4 | S | S | 30 | Independence | MO | | | | | | No | Yes | B | 15 | Out | On | | | |
| 1228 | 4 | 725 | R4 | S | S | 11 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1229 | 4 | 725 | R5 | S | S | 11 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1230 | 4 | 725 | R6 | S | S | 11 | Kansas City | MO | | | | | | | | Base | 15 | In | Off | | | |
| 1231 | 4 | 726 | R4 | S | S | 5 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1232 | 4 | 726 | R5 | S | S | 5 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1233 | 4 | 726 | R6 | S | S | 5 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1234 | 4 | 726 | R7 | S | S | 5 | Olathe | KS | | | | | | | | Base | 15 | Out | Off | | | |
| 1235 | 4 | 726 | R8 | S | S | 5 | Olathe | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1236 | 4 | 727 | R4 | S | S | 1 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1237 | 4 | 727 | R5 | S | S | 1 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1238 | 4 | 727 | R6 | S | S | 1 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1239 | 4 | 727 | R7 | S | S | 1 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1240 | 4 | 727 | R8 | S | S | 1 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1241 | 4 | 727 | R9 | S | S | 1 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1242 | 4 | 728 | R4 | Unk | S | 7 | Lenexa | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1243 | 4 | 728 | R5 | Unk | S | 7 | Lenexa | KS | | | | | | | | B | 15 | In | Off | | | |
| 1244 | 4 | 728 | R6 | Unk | S | 7 | Lenexa | KS | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1245 | 4 | 731 | R10 | S | S | New | Platte City | KS* | | | | | | | | B | 15 | In | Off | | | |
| 1246 | 4 | 731 | R4 | S | S | New | Platte City | KS* | | | | | | | | G | 15 | In | Off | | | |
| 1247 | 4 | 731 | R5 | S | S | New | Platte City | KS* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1248 | 4 | 731 | R6 | S | S | New | Platte City | KS* | | | | | | | | Kit | 15 | In | Off | | | |
| 1249 | 4 | 731 | R7 | S | S | New | Platte City | KS* | | | | | | | | Base | 15 | In | Off | | | |
| 1250 | 4 | 731 | R8 | S | S | New | Platte City | KS* | | | | | | | | Base | 15 | Out | Off | | | |
| 1251 | 4 | 731 | R9 | S | S | New | Platte City | KS* | | | | | | | | B | 15 | In | Off | | | |
| 1252 | 4 | 733 | B1 | S | S | 90 | Kansas City | MO | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 1253 | 4 | 733 | B2 | S | S | 90 | Kansas City | MO | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 1254 | 4 | 734 | R4 | S | S | 4 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1255 | 4 | 734 | R5 | S | S | 4 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1256 | 4 | 734 | R6 | S | S | 4 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1257 | 4 | 734 | R7 | S | S | 4 | Olathe | KS | | | | | | | | Base | 15 | Out | Off | | | |
| 1258 | 4 | 734 | R8 | S | S | 4 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1259 | 4 | 735 | R4 | S | S | 40 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1260 | 4 | 736 | R4 | S | S | 7 | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1261 | 4 | 736 | R5 | S | S | 7 | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1262 | 4 | 736 | R6 | S | S | 7 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1263 | 4 | 736 | R7 | S | S | 7 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1264 | 4 | 737 | R4 | S | S | 13 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1265 | 4 | 737 | R5 | S | S | 13 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1266 | 4 | 737 | R6 | S | S | 13 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1267 | 4 | 738 | R4 | S | S | 41 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1268 | 4 | 738 | R5 | S | S | 41 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1269 | 4 | 738 | R6 | S | S | 41 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1270 | 4 | 738 | R7 | S | S | 41 | Overland Park | KS | | | | | | | | B | 20 | In | Off | | | |
| 1271 | 4 | 738 | R8 | S | S | 41 | Overland Park | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1272 | 4 | 739 | R4 | S | S | New | Kansas City | MO* | | | | | | | | Kit | 15 | In | Off | | | |
| 1273 | 4 | 739 | R5 | S | S | New | Kansas City | MO* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1274 | 4 | 739 | R6 | S | S | New | Kansas City | MO* | | | | | | | | B | 15 | In | Off | | | |
| 1275 | 4 | 740 | R4 | S | S | 60 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1276 | 4 | 741 | R4 | S | S | 50 | Leavenworth | KS | | | | | | | | B | 15 | In | Off | | | |
| 1277 | 4 | 741 | R5 | S | S | 50 | Leavenworth | KS | | | | | | | | Kit | 15 | Unk | Off | | | |
| 1278 | 4 | 741 | R6 | S | S | 50 | Leavenworth | KS | | | | | | | | Kit | 15 | Unk | Off | | | |
| 1279 | 4 | 742 | R4 | S | S | 12 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1280 | 4 | 743 | R4 | S | S | 22 | Blue Springs | MO | | | | | | | | B | 15 | In | Off | | | |
| 1281 | 4 | 745 | B1 | S | S | 25 | P.V. | KS | 15 | 1 | Trip | Unk | Base | | | | | | | | | |
| 1282 | 4 | 746 | R4 | S | S | 11 | Olathe | KS | | | | | | | | G | 15 | Out | Off | | | |
| 1283 | 4 | 746 | R5 | S | S | 11 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1284 | 4 | 746 | R6 | S | S | 11 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1285 | 4 | 746 | R7 | S | S | 11 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1286 | 4 | 746 | R8 | S | S | 11 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1287 | 4 | 746 | R9 | S | S | 11 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1288 | 4 | 747 | R4 | S | S | 11 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1289 | 4 | 747 | R5 | S | S | 11 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1290 | 4 | 747 | R6 | S | S | 11 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1291 | 4 | 747 | R7 | S | S | 11 | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1292 | 4 | 748 | R4 | S | S | 35 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1293 | 4 | 748 | R5 | S | S | 35 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1294 | 4 | 749 | R4 | S | S | 10 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1295 | 4 | 749 | R5 | S | S | 10 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1296 | 4 | 749 | R6 | S | S | 10 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1297 | 4 | 749 | R7 | S | S | 10 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1298 | 4 | 3566 | R4 | S | Unk | 15 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1299 | 4 | 3576 | R4 | S | U | 53 | Kansas City | KS | | | | | | | | G | 15 | Out | Off | | | |
| 1300 | 4 | 3578 | R4 | S | S | 13 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1301 | 4 | 3578 | R5 | S | S | 13 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1302 | 4 | 3579 | R4 | S | U | 22 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1303 | 4 | 3579 | R5 | S | U | 22 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1304 | 4 | 3579 | R6 | S | U | 22 | Olathe | KS | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 1305 | 4 | 3579 | R7 | S | U | 22 | Olathe | KS | | | | | | | | B | 15 | In | Unk | | | |
| 1306 | 4 | 3579 | R8 | S | U | 22 | Olathe | KS | | | | | | | | B | Unk | Unk | Unk | | | |
| 1307 | 4 | 3579 | R9 | S | U | 22 | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1308 | 4 | 3580 | R4 | S | S | 11 | Shawnee | KS | | | | | | Yes | Yes | Out | 15 | | No Trip | Yes | No | Yes |
| 1309 | 4 | 3580 | R5 | S | S | 11 | Shawnee | KS | | | | | | | | G | 15 | In | Off | | | |
| 1310 | 4 | 3580 | R6 | S | S | 11 | Shawnee | KS | | | | | | | | B | 15 | In | Off | | | |
| 1311 | 4 | 3580 | R7 | S | S | 11 | Shawnee | KS | | | | | | | | B | 15 | In | Off | | | |
| 1312 | 4 | 3580 | R8 | S | S | 11 | Shawnee | KS | | | | | | | | B | 15 | In | Off | | | |
| 1313 | 4 | 3580 | R9 | S | S | 11 | Shawnee | KS | | | | | | Yes | Yes | Out | 15 | | No Trip | Yes | No | Yes |
| 1314 | 4 | 3586 | R4 | S | S | 25 | Kansas City | MO | | | | | | | | B | Unk | In | Off | | | |
| 1315 | 4 | 3587 | B1 | S | S | 8 | Olathe | KS | 20 | 1 | Trip | 1992 | Base | | | | | | | | | |
| 1316 | 4 | 3587 | R4 | S | S | 8 | Olathe | KS | | | | | | | | Kit | Unk | Out | Off | | | |
| 1317 | 4 | 3587 | R5 | S | S | 8 | Olathe | KS | | | | | | | | Kit | Unk | Out | Off | | | |
| 1318 | 4 | 3587 | R6 | S | S | 8 | Olathe | KS | | | | | | | | B | Unk | In | Off | | | |
| 1319 | 4 | 3587 | R7 | S | S | 8 | Olathe | KS | | | | | | | | Base | Unk | Out | Off | | | |
| 1320 | 4 | 3588 | B1 | S | S | 35 | Shawnee Mission | KS | 20 | 1 | Trip | 1980 | Base | | | | | | | | | |
| 1321 | 4 | 3588 | R4 | S | S | 35 | Shawnee Mission | KS | | | | | | | | B | Unk | In | Off | | | |
| 1322 | 4 | 3589 | R4 | S | S | 5 | Kansas City | MO | | | | | | | | Kit | Unk | Out | Off | | | |
| 1323 | 4 | 3589 | R5 | S | S | 5 | Kansas City | MO | | | | | | | | B | Unk | In | Off | | | |
| 1324 | 4 | 3589 | R6 | S | S | 5 | Kansas City | MO | | | | | | | | B | Unk | In | Off | | | |
| 1325 | 4 | 3589 | R7 | S | S | 5 | Kansas City | MO | | | | | | | | B | Unk | In | Off | | | |
| 1326 | 4 | 3589 | R8 | S | S | 5 | Kansas City | MO | | | | | | | | B | Unk | In | Off | | | |
| 1327 | 4 | 3589 | R9 | S | S | 5 | Kansas City | MO | | | | | | | | G | Unk | In | Off | | | |
| 1328 | 4 | 3590 | R4 | S | S | 9 | Shawnee Mission | KS | | | | | | | | B | Unk | In | Off | | | |
| 1329 | 4 | 3591 | R4 | S | S | 35 | Shawnee Mission | KS | | | | | | | | B | Unk | In | Off | | | |
| 1330 | 4 | 3591 | R5 | S | S | 35 | Shawnee Mission | KS | | | | | | | | Base | Unk | Out | Off | | | |
| 1331 | 4 | 3592 | R4 | S | S | 8 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1332 | 4 | 3592 | R5 | S | S | 8 | Olathe | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1333 | 4 | 3592 | R6 | S | S | 8 | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1334 | 4 | 3593 | R4 | S | S | 1 | Overland Park | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1335 | 4 | 3593 | R5 | S | S | 1 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1336 | 4 | 3593 | R6 | S | S | 1 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1337 | 4 | 3593 | R7 | S | S | 1 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1338 | 4 | 3593 | R8 | S | S | 1 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1339 | 4 | 3593 | R9 | S | S | 1 | Overland Park | KS | | | | | | | | Out | 15 | | Off | | | |
| 1340 | 4 | 3594 | R4 | M | S | 16 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1341 | 4 | 3595 | R4 | S | U | 7 | Shawnee Mission | KS | | | | | | | | B | 15 | In | Off | | | |
| 1342 | 4 | 3597 | R4 | S | S | 7 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1343 | 4 | 3597 | R5 | S | S | 7 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1344 | 4 | 3597 | R6 | S | S | 7 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1345 | 4 | 3598 | B1 | S | S | 25 | Olathe | KS | 15 | 1 | Trip | Unk | Base | | | | | | | | | |
| 1346 | 4 | 3598 | R4 | S | S | 25 | Olathe | KS | | | | | | | | B | Unk | In | Off | | | |
| 1347 | 4 | 3601 | R4 | S | U | 26 | Independence | MO | | | | | | | | B | 15 | In | Off | | | |
| 1348 | 4 | 3602 | R4 | S | S | 9 | Grain Valley | MO | | | | | | | | Kit | Unk | Out | Off | | | |
| 1349 | 4 | 3602 | R5 | S | S | 9 | Grain Valley | MO | | | | | | | | B | Unk | In | Off | | | |
| 1350 | 4 | 3602 | R6 | S | S | 9 | Grain Valley | MO | | | | | | | | B | Unk | Unk | Off | | | |
| 1351 | 4 | 3603 | R4 | S | S | 5 | Lees Summit | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1352 | 4 | 3603 | R5 | S | S | 5 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1353 | 4 | 3603 | R6 | S | S | 5 | Lees Summit | MO | | | | | | | | G | 15 | In | Off | | | |
| 1354 | 4 | 3605 | R4 | S | S | Unk | Lees Summit | MO | | | | | | | | Kit | 20 | In | Off | | | |
| 1355 | 4 | 3605 | R5 | S | S | Unk | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1356 | 4 | 3605 | R6 | S | S | Unk | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1357 | 4 | 3605 | R7 | S | S | Unk | Lees Summit | MO | | | | | | | | G | 15 | In | Off | | | |
| 1358 | 4 | 3606 | R4 | S | S | 3 | Lees Summit | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1359 | 4 | 3606 | R5 | S | S | 3 | Lees Summit | MO | | | | | | | | G | Unk | Out | Off | | | |
| 1360 | 4 | 3606 | R6 | S | S | 3 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1361 | 4 | 3606 | R7 | S | S | 3 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1362 | 4 | 3606 | R8 | S | S | 3 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1363 | 4 | 3606 | R9 | S | S | 3 | Lees Summit | MO | | | | | | | No | Out | Unk | | No Trip | | | |
| 1364 | 4 | 3608 | R4 | S | S | 17 | Lees Summit | MO | | | | | | | | Out | 15 | | Off | | | |
| 1365 | 4 | 3608 | R5 | S | S | 17 | Lees Summit | MO | | | | | | | No | B | 15 | In | No Trip | | | |
| 1366 | 4 | 3610 | R4 | S | U | 31 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1367 | 4 | 3611 | R4 | S | S | 7 | Peculiar | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1368 | 4 | 3611 | R5 | S | S | 7 | Peculiar | MO | | | | | | | | B | 15 | In | Off | | | |
| 1369 | 4 | 3611 | R6 | S | S | 7 | Peculiar | MO | | | | | | | | Base | 15 | Out | Off | | | |
| 1370 | 4 | 3611 | R7 | S | S | 7 | Peculiar | MO | | | | | | | | Base | 15 | Out | Off | | | |
| 1371 | 4 | 3612 | R4 | S | S | 48 | Raytown | MO | | | | | | | | B | 15 | In | Off | | | |
| 1372 | 4 | 3613 | R4 | S | S | 5 | Raymore | MO | | | | | | | | B | 15 | Unk | Off | | | |
| 1373 | 4 | 3613 | R5 | S | S | 5 | Raymore | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1374 | 4 | 3613 | R6 | S | S | 5 | Raymore | MO | | | | | | | | G | 15 | Out | Off | | | |
| 1375 | 4 | 3613 | R7 | S | S | 5 | Raymore | MO | | | | | | | | Out | 15 | | Off | | | |
| 1376 | 4 | 3614 | R4 | S | S | 10 mo | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1377 | 4 | 3614 | R5 | S | S | 10 mo | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1378 | 4 | 3614 | R6 | S | S | 10 mo | Olathe | KS | | | | | | | | G | 15 | In | Off | | | |
| 1379 | 4 | 3614 | R7 | S | S | 10 mo | Olathe | KS | | | | | | | | Base | 15 | Out | Off | | | |
| 1380 | 4 | 3614 | R8 | S | S | 10 mo | Olathe | KS | | | | | | | | Out | 15 | | Off | | | |
| 1381 | 4 | 3615 | R4 | S | S | 5 | Shawnee Mission | KS | | | | | | | | B | 15 | In | Off | | | |
| 1382 | 4 | 3615 | R5 | S | S | 5 | Shawnee Mission | KS | | | | | | | | G | 15 | In | Off | | | |
| 1383 | 4 | 3615 | R6 | S | S | 5 | Shawnee Mission | KS | | | | | | | | Base | 15 | Out | Off | | | |
| 1384 | 4 | 3615 | R7 | S | S | 5 | Shawnee Mission | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1385 | 4 | 3615 | R8 | S | S | 5 | Shawnee Mission | KS | | | | | | | | Out | 15 | | Off | | | |
| 1386 | 4 | 3616 | R4 | S | S | 13 | Shawnee Mission | KS | | | | | | | | B | 15 | In | Off | | | |
| 1387 | 4 | 3617 | R4 | S | S | 16 | Blue Springs | MO | | | | | | | | G | 15 | In | Off | | | |
| 1388 | 4 | 3618 | R4 | S | S | 17 | Lees Summit | MO | | | | | | | | B | Unk | Unk | Off | | | |
| 1389 | 4 | 3636 | R4 | S | S | 6 | Shawnee | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1390 | 4 | 3636 | R5 | S | S | 6 | Shawnee | KS | | | | | | | | B | 15 | In | Off | | | |
| 1391 | 4 | 3636 | R6 | S | S | 6 | Shawnee | KS | | | | | | | | G | 15 | In | Off | | | |
| 1392 | 4 | 3637 | R4 | S | R | 12 | Oak Grove | MO | | | | | | | | B | 15 | In | Off | | | |
| 1393 | 4 | 3638 | R4 | S | S | 25 | Richmond | MO | | | | | | | | Base | Unk | In | Off | | | |
| 1394 | 4 | 3639 | R4 | S | U | 6 | Lees Summit | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1395 | 4 | 3639 | R5 | S | U | 6 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1396 | 4 | 3639 | R6 | S | U | 6 | Lees Summit | MO | | | | | | | | G | 15 | In | Off | | | |
| 1397 | 4 | 3639 | R7 | S | U | 6 | Lees Summit | MO | | | | | | | | Out | 15 | | Off | | | |
| 1398 | 4 | 3640 | R4 | S | U | 13 | Lees Summit | MO | | | | | | | | Kit | 20 | In | Off | | | |
| 1399 | 4 | 3640 | R5 | S | U | 13 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1400 | 4 | 3641 | R4 | S | R | 10 | Louisburg | KS | | | | | | | | B | 15 | In | Off | | | |
| 1401 | 4 | 3642 | R4 | S | Unk | 4 | Overland Park | KS | | | | | | | | Kit | 15 | Unk | Off | | | |
| 1402 | 4 | 3642 | R5 | S | Unk | 4 | Overland Park | KS | | | | | | | | B | 15 | Unk | Off | | | |
| 1403 | 4 | 3642 | R6 | S | Unk | 4 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1404 | 4 | 3643 | B1 | S | U | 25 | Gladstone | MO | 20 | 1 | Trip | 1974 | Base | | | | | | | | | |
| 1405 | 4 | 3644 | R4 | S | U | 8 | Independence | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1406 | 4 | 3644 | R5 | S | U | 8 | Independence | MO | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1407 | 4 | 3644 | R6 | S | U | 8 | Independence | MO | | | | | | | | G | 15 | In | Off | | | |
| 1408 | 4 | 3645 | R4 | Unk | U | 15 | Ray Town | MO | | | | | | | | Base | 15 | In | Off | | | |
| 1409 | 4 | 3646 | R4 | S | U | 6 | Lees Summit | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1410 | 4 | 3646 | R5 | S | U | 6 | Lees Summit | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1411 | 4 | 3646 | R6 | S | U | 6 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1412 | 4 | 3646 | R7 | S | U | 6 | Lees Summit | MO | | | | | | | | G | 15 | Out | Off | | | |
| 1413 | 4 | 3646 | R8 | S | U | 6 | Lees Summit | MO | | | | | | | | Base | 15 | In | Off | | | |
| 1414 | 4 | 3647 | R4 | S | U | 30 | Kansas City | MO | | | | | | | | G | 15 | Out | Off | | | |
| 1415 | 4 | 3648 | R4 | S | U | 45 | Kansas City | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1416 | 4 | 3648 | R5 | S | U | 45 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1417 | 4 | 3649 | R4 | S | S | 30 | Odessa | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1418 | 4 | 3650 | R4 | S | S | 35 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1419 | 4 | 3650 | R5 | S | S | 35 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1420 | 4 | 3651 | R4 | S | S | 5 | Lees Summit | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1421 | 4 | 3651 | R5 | S | S | 5 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1422 | 4 | 3651 | R6 | S | S | 5 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1423 | 4 | 3651 | R7 | S | S | 5 | Lees Summit | MO | | | | | | | | Base | 15 | Out | Off | | | |
| 1424 | 4 | 3651 | R8 | S | S | 5 | Lees Summit | MO | | | | | | | | G | 15 | Out | Off | | | |
| 1425 | 4 | 3652 | R4 | S | S | 14 | Lees Summit | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1426 | 4 | 3652 | R5 | S | S | 14 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1427 | 4 | 3652 | R6 | S | S | 14 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1428 | 4 | 3653 | R4 | S | S | 6 | Lees Summit | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1429 | 4 | 3653 | R5 | S | S | 6 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1430 | 4 | 3653 | R6 | S | S | 6 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1431 | 4 | 3653 | R7 | S | S | 6 | Lees Summit | MO | | | | | | | | Base | Unk | Out | Off | | | |
| 1432 | 4 | 3654 | R4 | S | S | 35 | Olathe | KS | | | | | | | | Kit | 15 | Out | Off | | | |
| 1433 | 4 | 3654 | R5 | S | S | 35 | Olathe | KS | | | | | | | | B | Unk | In | Off | | | |
| 1434 | 4 | 3655 | R4 | S | U | 7 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1435 | 4 | 3655 | R5 | S | U | 7 | Olathe | KS | | | | | | | | B | Unk | In | Off | | | |
| 1436 | 4 | 3655 | R6 | S | U | 7 | Olathe | KS | | | | | | | | Base | Unk | In | Off | | | |
| 1437 | 4 | 3656 | R4 | Unk | S | 18 | Lees Summit | MO | | | | | | | | Kit | 15 | Out | Off | | | |
| 1438 | 4 | 3656 | R5 | Unk | S | 18 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1439 | 4 | 3656 | R6 | Unk | S | 18 | Lees Summit | MO | | | | | | | | B | Unk | In | Off | | | |
| 1440 | 4 | 3656 | R7 | Unk | S | 18 | Lees Summit | MO | | | | | | | | G | Unk | Out | Off | | | |
| 1441 | 4 | 3657 | R4 | S | U | 30 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1442 | 4 | 3658 | R4 | S | U | 30 | Ray Town | MO | | | | | | | | Base | Unk | Out | Off | | | |
| 1443 | 4 | 3659 | R4 | S | U | 70 | Kansas City | MO | | | | | | | | B | 15 | In | Off | | | |
| 1444 | 4 | 3660 | R4 | S | U | 13 | Lees Summit | MO | | | | | | | | Kit | 15 | In | Off | | | |
| 1445 | 4 | 3660 | R5 | S | U | 13 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1446 | 4 | 3660 | R6 | S | U | 13 | Lees Summit | MO | | | | | | | | B | 15 | In | Off | | | |
| 1447 | 4 | 3661 | R4 | S | U | 0 | Olathe | KS* | | | | | | | | Kit | 15 | In | Off | | | |
| 1448 | 4 | 3661 | R5 | S | U | 0 | Olathe | KS* | | | | | | | | B | Unk | In | Off | | | |
| 1449 | 4 | 3661 | R6 | S | U | 0 | Olathe | KS* | | | | | | | | B | Unk | In | Off | | | |
| 1450 | 4 | 3661 | R7 | S | U | 0 | Olathe | KS* | | | | | | | | Base | Unk | Out | Off | | | |
| 1451 | 4 | 3661 | R8 | S | U | 0 | Olathe | KS* | | | | | | | | G | Unk | In | Off | | | |
| 1452 | 4 | 3662 | R4 | S | U | 14 | Lake Winnebago | MO | | | | | | | | Kit | 20 | In | Off | | | |
| 1453 | 4 | 3662 | R5 | S | U | 14 | Lake Winnebago | MO | | | | | | | | B | 15 | In | Off | | | |
| 1454 | 4 | 3662 | R6 | S | U | 14 | Lake Winnebago | MO | | | | | | | | B | 15 | In | Off | | | |
| 1455 | 4 | 3663 | R4 | S | U | 10 | Overland Park | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1456 | 4 | 3663 | R5 | S | U | 10 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1457 | 4 | 3663 | R6 | S | U | 10 | Overland Park | KS | | | | | | | | B | 15 | In | Off | | | |
| 1458 | 4 | 3663 | R7 | S | U | 10 | Overland Park | KS | | | | | | | | G | 15 | In | Off | | | |
| 1459 | 4 | 3664 | R4 | S | U | 12 | Olathe | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1460 | 4 | 3664 | R5 | S | U | 12 | Olathe | KS | | | | | | | | B | Unk | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1461 | 4 | 3664 | R6 | S | U | 12 | Olathe | KS | | | | | | | | G | Unk | Out | Off | | | |
| 1462 | 4 | 3665 | R4 | S | S | 10 | Olathe | KS | | | | | | | | Unk | 15 | In | Off | | | |
| 1463 | 4 | 3665 | R5 | S | S | 10 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1464 | 4 | 3665 | R6 | S | S | 10 | Olathe | KS | | | | | | | | B | 15 | In | Off | | | |
| 1465 | 4 | 3666 | R4 | S | S | 2 | Leawood | KS | | | | | | | | Kit | 15 | In | Off | | | |
| 1466 | 4 | 3666 | R5 | S | S | 2 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1467 | 4 | 3666 | R6 | S | S | 2 | Leawood | KS | | | | | | | | B | 15 | In | Off | | | |
| 1468 | 4 | 3666 | R7 | S | S | 2 | Leawood | KS | | | | | | | | Base | 15 | In | Off | | | |
| 1469 | 6 | 501 | R4 | S | S | 18 | Duarte | CA | | | | | | | | G | 15 | In | Off | | | |
| 1470 | 6 | 502 | R4 | S | S | 16 | Fullerton | CA | | | | | | | | B | 15 | In | Off | | | |
| 1471 | 6 | 503 | R4 | S | S | 11 | Walnut | CA | | | | | | | | B | 15 | In | Off | | | |
| 1472 | 6 | 504 | R4 | S | S | 12 | Cucamonga | CA | | | | | | | | G | 15 | In | Off | | | |
| 1473 | 6 | 504 | R5 | S | S | 12 | Cucamonga | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1474 | 6 | 504 | R6 | S | S | 12 | Cucamonga | CA | | | | | | | | B | 15 | In | Off | | | |
| 1475 | 6 | 505 | R4 | S | S | 20 | Yorba Linda | CA | | | | | | | | G | 15 | In | Off | | | |
| 1476 | 6 | 505 | R5 | S | S | 20 | Yorba Linda | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1477 | 6 | 505 | R6 | S | S | 20 | Yorba Linda | CA | | | | | | | | B | 15 | In | Off | | | |
| 1478 | 6 | 506 | R4 | S | S | 14 | Anaheim Hills | CA | | | | | | | | G | 15 | In | Off | | | |
| 1479 | 6 | 507 | R4 | S | S | 8 | Tustin | CA | | | | | | | | B | 15 | In | Off | | | |
| 1480 | 6 | 507 | R5 | S | S | 8 | Tustin | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1481 | 6 | 508 | R4 | S | S | 10 | La Mirada | CA | | | | | | | | B | 15 | In | Off | | | |
| 1482 | 6 | 508 | R5 | S | S | 10 | La Mirada | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1483 | 6 | 508 | R6 | S | S | 10 | La Mirada | CA | | | | | | | | G | 15 | In | Off | | | |
| 1484 | 6 | 509 | R4 | S | S | 5 | Chino Hills | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1485 | 6 | 509 | R5 | S | S | 5 | Chino Hills | CA | | | | | | | | B | 15 | In | Off | | | |
| 1486 | 6 | 510 | R4 | S | S | 11 | Chino Hills | CA | | | | | | | | B | 15 | In | Off | | | |
| 1487 | 6 | 511 | R4 | S | S | 10 | Anaheim Hills | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1488 | 6 | 512 | R4 | S | S | 16 | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1489 | 6 | 513 | R4 | S | S | 12 | Glendora | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1490 | 6 | 513 | R5 | S | S | 12 | Glendora | CA | | | | | | | | B | 15 | In | Off | | | |
| 1491 | 6 | 513 | R6 | S | S | 12 | Glendora | CA | | | | | | | | B | 15 | In | Off | | | |
| 1492 | 6 | 514 | R4 | S | S | 16 | Whittier | CA | | | | | | | | G | 15 | In | Off | | | |
| 1493 | 6 | 515 | R4 | S | S | 30 | Yorba Linda | CA | | | | | | | | B | 15 | In | Off | | | |
| 1494 | 6 | 515 | R5 | S | S | 30 | Yorba Linda | CA | | | | | | | | B | 15 | In | Off | | | |
| 1495 | 6 | 517 | R4 | S | S | 17 | Chino Hills | CA | | | | | | | | G | 15 | In | Off | | | |
| 1496 | 6 | 517 | R5 | S | S | 17 | Chino Hills | CA | | | | | | | | B | 15 | In | Off | | | |
| 1497 | 6 | 518 | R4 | S | S | 12 | Whittier | CA | | | | | | | | G | 15 | In | Off | | | |
| 1498 | 6 | 518 | R5 | S | S | 12 | Whittier | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1499 | 6 | 518 | R6 | S | S | 12 | Whittier | CA | | | | | | | | B | 15 | In | Off | | | |
| 1500 | 6 | 518 | R7 | S | S | 12 | Whittier | CA | | | | | | | | B | 15 | In | Off | | | |
| 1501 | 6 | 518 | R8 | S | S | 12 | Whittier | CA | | | | | | | | B | 15 | In | Off | | | |
| 1502 | 6 | 519 | R4 | S | S | 14 | Brea | CA | | | | | | | | B | 15 | In | Off | | | |
| 1503 | 6 | 520 | R4 | S | S | 10 | Aliso Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1504 | 6 | 525 | R4 | S | S | 5 | Anaheim Hills | CA | | | | | | | | G | 15 | In | Off | | | |
| 1505 | 6 | 525 | R5 | S | S | 5 | Ahaheim Hills | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1506 | 6 | 526 | R4 | S | S | 34 | Placentia | CA | | | | | | | | B | 15 | In | Off | | | |
| 1507 | 6 | 526 | R5 | S | S | 34 | Placentia | CA | | | | | | | | B | 15 | Unk | Off | | | |
| 1508 | 6 | 526 | R6 | S | S | 34 | Placentia | CA | | | | | | | | B | 15 | In | Off | | | |
| 1509 | 6 | 526 | R7 | S | S | 34 | Placentia | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1510 | 6 | 527 | R4 | S | S | 25 | Anaheim | CA | | | | | | | | Out | 20 | | Off | | | |
| 1511 | 6 | 527 | R5 | S | S | 25 | Anaheim | CA | | | | | | | | G | 20 | Out | Off | | | |
| 1512 | 6 | 527 | R6 | S | S | 25 | Anaheim | CA | | | | | | | | B | 20 | In | Off | | | |
| 1513 | 6 | 527 | R7 | S | S | 25 | Anaheim | CA | | | | | | | | B | 20 | In | Off | | | |
| 1514 | 6 | 528 | R4 | S | S | 14 | Rancho Cucamong | CA | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1515 | 6 | 529 | R4 | S | S | 22 | Claremont | CA | | | | | | | | Out | 15 | | Off | | | |
| 1516 | 6 | 529 | R5 | S | S | 22 | Claremont | CA | | | | | | | | B | 15 | Out | Off | | | |
| 1517 | 6 | 530 | R4 | S | S | 39 | Whittier | CA | | | | | | | | B | 15 | In | Off | | | |
| 1518 | 6 | 531 | R4 | S | S | 4 | Riverside | CA | | | | | | | | G | 15 | In | Off | | | |
| 1519 | 6 | 531 | R5 | S | S | 4 | Riverside | CA | | | | | | | | Kit | Unk | In | Off | | | |
| 1520 | 6 | 532 | R4 | S | S | 12 | Santa Ana | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1521 | 6 | 532 | R5 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1522 | 6 | 532 | R6 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1523 | 6 | 532 | R7 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1524 | 6 | 532 | R8 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1525 | 6 | 532 | R9 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1526 | 6 | 533 | R4 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1527 | 6 | 533 | R5 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1528 | 6 | 533 | R6 | S | S | 12 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1529 | 6 | 534 | R4 | S | S | 10 | Perris | CA | | | | | | | | G | 15 | In | Off | | | |
| 1530 | 6 | 535 | R4 | S | S | 25 | Chino | CA | | | | | | | | B | 15 | In | Off | | | |
| 1531 | 6 | 536 | R4 | S | S | 12 | Rowland Heights | CA | | | | | | | | B | 15 | In | Off | | | |
| 1532 | 6 | 537 | R4 | S | S | 42 | Montclair | CA | | | | | | | | B | 15 | In | Off | | | |
| 1533 | 6 | 537 | R5 | S | S | 42 | Montclair | CA | | | | | | | | B | 15 | In | Off | | | |
| 1534 | 6 | 538 | R4 | S | S | 4 | Brea | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1535 | 6 | 538 | R5 | S | S | 4 | Brea | CA | | | | | | | | G | 15 | In | Off | | | |
| 1536 | 6 | 539 | R4 | S | S | 11 | Montebello | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1537 | 6 | 539 | R5 | S | S | 11 | Montebello | CA | | | | | | | | B | 15 | In | Off | | | |
| 1538 | 6 | 540 | R4 | S | S | 7 | Victorville | CA | | | | | | | | G | 15 | In | Off | | | |
| 1539 | 6 | 540 | R5 | S | S | 7 | Victorville | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1540 | 6 | 541 | R4 | S | S | 9 | Cucamonga | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1541 | 6 | 541 | R5 | S | S | 9 | Cucamonga | CA | | | | | | | | B | 15 | In | Off | | | |
| 1542 | 6 | 543 | R4 | S | S | 11 | Laguna Beach | CA | | | | | | | | G | 20 | In | Off | | | |
| 1543 | 6 | 543 | R5 | S | S | 11 | Laguna Beach | CA | | | | | | | | B | 20 | In | Off | | | |
| 1544 | 6 | 543 | R6 | S | S | 11 | Laguna Beach | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1545 | 6 | 544 | R4 | S | S | 8 | Aliso Viejo | CA | | | | | | | | B | 20 | In | Off | | | |
| 1546 | 6 | 544 | R5 | S | S | 8 | Aliso Viejo | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1547 | 6 | 544 | R6 | S | S | 8 | Aliso Viejo | CA | | | | | | | | G | 20 | In | Off | | | |
| 1548 | 6 | 546 | R4 | S | S | 3 | Aliso Viejo | CA | | | | | | | | B | 20 | In | Off | | | |
| 1549 | 6 | 546 | R5 | S | S | 3 | Aliso Viejo | CA | | | | | | | | G | 20 | In | Off | | | |
| 1550 | 6 | 546 | R6 | S | S | 3 | Aliso Viejo | CA | | | | | | Yes | Yes | Out | 20 | | No Trip | | No | Yes |
| 1551 | 6 | 546 | R7 | S | S | 3 | Aliso Viejo | CA | | | | | | | | G | 20 | In | Off | | | |
| 1552 | 6 | 546 | R8 | S | S | 3 | Aliso Viejo | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1553 | 6 | 546 | R9 | S | S | 3 | Aliso Viejo | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1554 | 6 | 547 | R4 | S | S | 10 | Laguna Niguel | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1555 | 6 | 547 | R5 | S | S | 10 | Laguna Niguel | CA | | | | | | | | G | 15 | In | Off | | | |
| 1556 | 6 | 548 | R4 | S | S | 1 | Lus Flores | CA | | | | | | | | B | 20 | In | Off | | | |
| 1557 | 6 | 548 | R5 | S | S | 1 | Lus Flores | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1558 | 6 | 549 | R4 | S | S | 35 | Huntington Beach | CA | | | | | | | | B | 20 | In | Off | | | |
| 1559 | 6 | 550 | R4 | S | S | 11 | Aliso Viejo | CA | | | | | | | | B | 20 | In | Off | | | |
| 1560 | 6 | 551 | R4 | Unk | Unk | 10 | Mission Viejo | CA | | | | | | | | B | 20 | In | Off | | | |
| 1561 | 6 | 551 | R5 | Unk | Unk | 10 | Mission Viejo | CA | | | | | | | | G | 20 | In | Off | | | |
| 1562 | 6 | 552 | R4 | S | Unk | 10 | S J. Capistrano | CA | | | | | | | | B | 20 | Out | Off | | | |
| 1563 | 6 | 552 | R5 | S | Unk | 10 | S J. Capistrano | CA | | | | | | | | G | 20 | Out | Off | | | |
| 1564 | 6 | 552 | R6 | S | Unk | 10 | S J. Capistrano | CA | | | | | | | | Kit | 20 | Unk | Off | | | |
| 1565 | 6 | 552 | R7 | S | Unk | 10 | S J. Capistrano | CA | | | | | | | | B | 20 | Out | Off | | | |
| 1566 | 6 | 553 | R4 | S | Unk | 7 | Tustin | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1567 | 6 | 553 | R5 | S | Unk | 7 | Tustin | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1568 | 6 | 553 | R6 | S | Unk | 7 | Tustin | CA | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1569 | 6 | 554 | R4 | M | S | 15 | Huntington Beach | CA | | | | | | | | B | 15 | In | Off | | | |
| 1570 | 6 | 555 | R4 | S | U | 2 | R. S. M | CA | | | | | | | | B | 15 | In | Off | | | |
| 1571 | 6 | 555 | R5 | S | U | 2 | R. S. M | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1572 | 6 | 555 | R6 | S | U | 2 | R. S. M | CA | | | | | | | | B | 15 | In | Off | | | |
| 1573 | 6 | 555 | R7 | S | U | 2 | R. S. M | CA | | | | | | | | B | 15 | In | Off | | | |
| 1574 | 6 | 555 | R8 | S | U | 2 | R. S. M | CA | | | | | | | | Out | 15 | | Off | | | |
| 1575 | 6 | 555 | R9 | S | U | 2 | R. S. M | CA | | | | | | | | Out | 15 | | Off | | | |
| 1576 | 6 | 556 | R4 | S | U | 22 | Laguna Hills | CA | | | | | | | | G | 15 | In | Off | | | |
| 1577 | 6 | 556 | R5 | S | U | 22 | Laguna Hills | CA | | | | | | | | Base | 15 | In | Off | | | |
| 1578 | 6 | 559 | R4 | M | Unk | 20 | Irvine | CA | | | | | | | No | B | 15 | In | On | | | |
| 1579 | 6 | 560 | R4 | M | S | 20 | Irvine | CA | | | | | | | No | Out | 15 | | No Trip | | | |
| 1580 | 6 | 561 | R4 | M | S | 10 | Laguna Niguel | CA | | | | | | | | B | 20 | Out | Off | | | |
| 1581 | 6 | 561 | R5 | M | S | 10 | Laguna Niguel | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1582 | 6 | 562 | R4 | S | U | 40 | Newport Beach | CA | | | | | | | | B | 15 | In | Off | | | |
| 1583 | 6 | 562 | R5 | S | U | 40 | Newport Beach | CA | | | | | | | | G | 15 | In | Off | | | |
| 1584 | 6 | 563 | R4 | S | U | 30 | Fountain Valley | CA | | | | | | | | Out | 20 | | Off | | | |
| 1585 | 6 | 564 | B1 | S | U | 36 | Buena Park | CA | 15 | 1 | Trip | Unk | Out | | | | | | | | | |
| 1586 | 6 | 564 | R4 | S | U | 36 | Buena Park | CA | | | | | | Yes | Yes | B | 20 | In | On | | | |
| 1587 | 6 | 564 | R5 | S | U | 36 | Buena Park | CA | | | | | | | | B | 20 | Out | Off | | | |
| 1588 | 6 | 564 | R6 | S | U | 36 | Buena Park | CA | | | | | | Yes | Yes | Out | 20 | | No Trip | Yes | No | No |
| 1589 | 6 | 564 | R7 | S | U | 36 | Buena Park | CA | | | | | | | | Out | 20 | | Off | | | |
| 1590 | 6 | 565 | B1 | S | U | 24 | Laguna Hills | CA | Unk | 2 | Trip | Unk | Out | | | | | | | | | |
| 1591 | 6 | 566 | R4 | S | Unk | 16 | Mission Viejo | CA | | | | | | | | G | 20 | In | Off | | | |
| 1592 | 6 | 567 | R4 | S | U | Unk | Huntington Beach | CA | | | | | | | | B | 20 | In | Off | | | |
| 1593 | 6 | 567 | R5 | S | U | Unk | Huntington Beach | CA | | | | | | | | Out | 20 | | Off | | | |
| 1594 | 6 | 568 | R4 | S | U | 8 | Laguna Niguel | CA | | | | | | | | B | 20 | Out | Off | | | |
| 1595 | 6 | 568 | R5 | S | U | 8 | Laguna Niguel | CA | | | | | | | | Kit | 20 | Unk | Off | | | |
| 1596 | 6 | 569 | B1 | S | U | Unk | Lake Forest | CA | 20 | 2 | Trip | 1976 | Out | | | | | | | | | |
| 1597 | 6 | 571 | R4 | S | U | 3 | Placentia | CA | | | | | | | | B | 20 | In | Off | | | |
| 1598 | 6 | 571 | R5 | S | U | 3 | Placentia | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1599 | 6 | 572 | R4 | S | S | 20 | Coto de Caza | CA | | | | | | | | G | 15 | In | Off | | | |
| 1600 | 6 | 572 | R5 | S | S | 20 | Coto de Caza | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1601 | 6 | 573 | R4 | S | U | 10 | Dana Point | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1602 | 6 | 573 | R5 | S | U | 10 | Dana Point | CA | | | | | | | | B | 20 | In | Off | | | |
| 1603 | 6 | 574 | R4 | Unk | U | 43 | Costa Mesa | CA | | | | | | | No | B | 20 | In | On | | | |
| 1604 | 6 | 575 | R4 | S | U | Unk | Irvine | CA | | | | | | | | B | 20 | In | Off | | | |
| 1605 | 6 | 575 | R5 | S | U | Unk | Irvine | CA | | | | | | | | B | 20 | In | Off | | | |
| 1606 | 6 | 575 | R6 | S | U | Unk | Irvine | CA | | | | | | | | B | 20 | Out | Off | | | |
| 1607 | 6 | 575 | R7 | S | U | Unk | Irvine | CA | | | | | | | | B | 20 | In | Off | | | |
| 1608 | 6 | 575 | R8 | S | U | Unk | Irvine | CA | | | | | | | No | Out | 20 | | On | | | |
| 1609 | 6 | 577 | R4 | S | U | 19 | Orange | CA | | | | | | | | B | 20 | In | Off | | | |
| 1610 | 6 | 577 | R5 | S | U | 19 | Orange | CA | | | | | | | | B | 20 | In | Off | | | |
| 1611 | 6 | 577 | R6 | S | U | 19 | Orange | CA | | | | | | | | Out | 20 | | Off | | | |
| 1612 | 6 | 578 | B1 | S | U | 4 | Aliso Viejo | CA | 20 | 2 | Trip | 1996 | Out | | | | | | | | | |
| 1613 | 6 | 578 | R4 | S | U | 4 | Aliso Viejo | CA | | | | | | Yes | Yes | Out | 15 | | No Trip | Yes | No | Yes |
| 1614 | 6 | 579 | R4 | S | U | 33 | West Munster | CA | | | | | | | | G | 20 | In | Off | | | |
| 1615 | 6 | 579 | R5 | S | U | 33 | West Munster | CA | | | | | | | | Out | 20 | | Off | | | |
| 1616 | 6 | 580 | R4 | S | U | 22 | Capistrano Beach | CA | | | | | | | | B | 20 | In | Off | | | |
| 1617 | 6 | 580 | R5 | S | U | 22 | Capistrano Beach | CA | | | | | | | | B | 20 | In | Off | | | |
| 1618 | 6 | 580 | R6 | S | U | 22 | Capistrano Beach | CA | | | | | | | | B | 20 | In | Off | | | |
| 1619 | 6 | 581 | R4 | S | U | 4 | Aliso Viejo | CA | | | | | | | | G | 20 | In | Off | | | |
| 1620 | 6 | 581 | R5 | S | U | 4 | Aliso Viejo | CA | | | | | | | | Kit | 20 | In | Off | | | |
| 1621 | 6 | 583 | R4 | M | S | 12 | Laguna Beach | CA | | | | | | | | B | 15 | In | Off | | | |
| 1622 | 6 | 584 | R4 | M | S | 7 | Aliso Viejo | CA | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1623 | 6 | 584 | R5 | M | S | 7 | Aliso Viejo | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1624 | 6 | 584 | R6 | M | S | 7 | Aliso Viejo | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1625 | 6 | 585 | R4 | M | S | 10 | Portolo Hills | CA | | | | | | | | G | 15 | In | Off | | | |
| 1626 | 6 | 585 | R5 | M | S | 10 | Portolo Hills | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1627 | 6 | 586 | R4 | S | S | 14 | Chino Hills | CA | | | | | | | | B | 15 | In | Off | | | |
| 1628 | 6 | 587 | R4 | M | S | 20 | Huntington Beach | CA | | | | | | | | B | 15 | In | Off | | | |
| 1629 | 6 | 588 | R4 | S | S | 1 | Aliso Viejo | CA | | | | | | | | G | 15 | In | Off | | | |
| 1630 | 6 | 588 | R5 | S | S | 1 | Aliso Viejo | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1631 | 6 | 589 | R4 | M | S | 15 | Santa Margarita | CA | | | | | | | | B | 15 | In | Off | | | |
| 1632 | 6 | 589 | R5 | M | S | 15 | Santa Margarita | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1633 | 6 | 594 | R4 | S | S | 13 | Laguna Niguel | CA | | | | | | | | G | 15 | In | Off | | | |
| 1634 | 6 | 595 | R4 | M | S | 4 | Mission Viejo | CA | | | | | | | | G | 15 | In | Off | | | |
| 1635 | 6 | 595 | R5 | M | S | 4 | Mission Viejo | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1636 | 6 | 600 | R4 | S | S | 5 | Dove Canyon | CA | | | | | | | | B | 15 | In | Off | | | |
| 1637 | 6 | 600 | R5 | S | S | 5 | Dove Canyon | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1638 | 6 | 600 | R6 | S | S | 5 | Dove Canyon | CA | | | | | | | | Out | 15 | | Off | | | |
| 1639 | 6 | 601 | R4 | M | S | 13 | Santa Margarita | CA | | | | | | | | G | 15 | In | Off | | | |
| 1640 | 6 | 601 | R5 | M | S | 13 | Santa Margarita | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1641 | 6 | 602 | R4 | S | S | 1 | Santa Margarita | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1642 | 6 | 602 | R5 | S | S | 1 | Santa Margarita | CA | | | | | | | | G | 15 | In | Off | | | |
| 1643 | 6 | 603 | R4 | M | S | 18 | Lake Forest | CA | | | | | | | | B | 15 | In | Off | | | |
| 1644 | 6 | 604 | R4 | M | S | 24 | Lake Forest | CA | | | | | | | | B | 15 | In | Off | | | |
| 1645 | 6 | 609 | R4 | M | S | 15 | Aliso Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1646 | 6 | 614 | R4 | M | S | 11 | Laguna Niguel | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1647 | 6 | 614 | R5 | M | S | 11 | Laguna Niguel | CA | | | | | | | | G | 15 | In | Off | | | |
| 1648 | 6 | 618 | R4 | M | S | 14 | Laguna Niguel | CA | | | | | | | | G | 15 | In | Off | | | |
| 1649 | 6 | 621 | R4 | M | S | 11 | Mission Viejo | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1650 | 6 | 621 | R5 | M | S | 11 | Mission Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1651 | 6 | 621 | R6 | M | S | 11 | Mission Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1652 | 6 | 622 | R4 | M | S | 7 | Tustin | CA | | | | | | | | G | 15 | In | Off | | | |
| 1653 | 6 | 622 | R5 | M | S | 7 | Tustin | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1654 | 6 | 622 | R6 | M | S | 7 | Tustin | CA | | | | | | | | Base | 15 | In | Off | | | |
| 1655 | 6 | 624 | R4 | M | S | 11 | Santa Margarita | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1656 | 6 | 624 | R5 | M | S | 11 | Santa Margarita | CA | | | | | | | | B | Unk | In | Off | | | |
| 1657 | 6 | 1494 | R4 | S | U | 1 | Newport Beach | CA | | | | | | | | B | 15 | In | Off | | | |
| 1658 | 6 | 1494 | R5 | S | U | 1 | Newport Beach | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1659 | 6 | 1494 | R6 | S | U | 1 | Newport Beach | CA | | | | | | | | G | 15 | Unk | Off | | | |
| 1660 | 6 | 2400 | R4 | M | U | 22 | Mission Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1661 | 6 | 2402 | R10 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1662 | 6 | 2402 | R11 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1663 | 6 | 2402 | R12 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1664 | 6 | 2402 | R13 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1665 | 6 | 2402 | R14 | M | U | 70 | Orange | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1666 | 6 | 2402 | R15 | M | U | 70 | Orange | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1667 | 6 | 2402 | R16 | M | U | 70 | Orange | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1668 | 6 | 2402 | R17 | M | U | 70 | Orange | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1669 | 6 | 2402 | R4 | M | U | 70 | Orange | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1670 | 6 | 2402 | R5 | M | U | 70 | Orange | CA | | | | | | | No | B | 15 | In | On | | | |
| 1671 | 6 | 2402 | R6 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1672 | 6 | 2402 | R7 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1673 | 6 | 2402 | R8 | M | U | 70 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1674 | 6 | 2402 | R9 | M | U | 70 | Orange | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1675 | 6 | 2405 | R4 | S | U | Unk | Huntington Beach | CA | | | | | | | | B | 15 | In | Off | | | |
| 1676 | 6 | 2405 | R5 | S | U | Unk | Huntington Beach | CA | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1677 | 6 | 2406 | R4 | S | U | Unk | Huntington Beach | CA | | | | | | | | G | 15 | In | Off | | | |
| 1678 | 6 | 2407 | R4 | S | U | 11 | Corona | CA | | | | | | | | B | 15 | In | Off | | | |
| 1679 | 6 | 2407 | R5 | S | U | 11 | Corona | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1680 | 6 | 2408 | R4 | S | U | 3 | Coto de Caza | CA | | | | | | | | G | 15 | In | Off | | | |
| 1681 | 6 | 2408 | R5 | S | U | 3 | Coto de Caza | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1682 | 6 | 2409 | R4 | S | U | 15 | Coto de Caza | CA | | | | | | | | G | 15 | In | Off | | | |
| 1683 | 6 | 2409 | R5 | S | U | 15 | Coto de Caza | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1684 | 6 | 2409 | R6 | S | U | 15 | Coto de Caza | CA | | | | | | | | Out | 15 | | Off | | | |
| 1685 | 6 | 2410 | R4 | S | U | Unk | Coto de Caza | CA | | | | | | | | G | 15 | In | Off | | | |
| 1686 | 6 | 2410 | R5 | S | U | Unk | Coto de Caza | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1687 | 6 | 2413 | R4 | S | U | 20 | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1688 | 6 | 2415 | R4 | S | S | 4 | Orange | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1689 | 6 | 2415 | R5 | S | S | 4 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1690 | 6 | 2417 | R4 | S | S | 10 | Baldwin Park | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1691 | 6 | 2418 | R4 | S | S | 19 | Orange | CA | | | | | | | | B | 15 | In | Off | | | |
| 1692 | 6 | 2419 | R4 | S | S | 13 | Upland | CA | | | | | | | | Base | 15 | Out | Off | | | |
| 1693 | 6 | 2419 | R5 | S | S | 13 | Upland | CA | | | | | | | | Base | 15 | Out | Off | | | |
| 1694 | 6 | 2419 | R6 | S | S | 13 | Upland | CA | | | | | | | | G | 15 | In | Off | | | |
| 1695 | 6 | 2419 | R7 | S | S | 13 | Upland | CA | | | | | | | | B | 20 | In | Off | | | |
| 1696 | 6 | 2420 | R4 | S | S | 12 | Aliso Viejo | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1697 | 6 | 2420 | R5 | S | S | 12 | Aliso Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1698 | 6 | 2421 | R4 | S | U | New | La Habra | CA* | | | | | | | | G | 20 | In | Off | | | |
| 1699 | 6 | 2421 | R5 | S | U | New | La Habra | CA* | | | | | | | | Kit | 20 | In | Off | | | |
| 1700 | 6 | 2421 | R6 | S | U | New | La Habra | CA* | | | | | | | | Kit | 20 | In | Off | | | |
| 1701 | 6 | 2421 | R7 | S | U | New | La Habra | CA* | | | | | | | | B | 20 | In | Off | | | |
| 1702 | 6 | 2422 | R4 | S | S | 6 | Rancho Cucamong | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1703 | 6 | 2422 | R5 | S | S | 6 | Rancho Cucamong | CA | | | | | | | | B | 15 | In | Off | | | |
| 1704 | 6 | 2423 | R4 | S | S | 80 | Brea | CA | | | | | | | | B | 15 | In | Off | | | |
| 1705 | 6 | 2424 | R4 | S | S | 21 | Diamond Bar | CA | | | | | | | | Base | 15 | Out | Off | | | |
| 1706 | 6 | 2425 | R4 | S | S | 23 | Hacienda Hts. | CA | | | | | | | | B | 15 | In | Off | | | |
| 1707 | 6 | 2426 | R4 | S | U | 22 | Laguna Niquel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1708 | 6 | 2427 | R4 | S | U | 8 | R.S.M. | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1709 | 6 | 2427 | R5 | S | U | 8 | R.S.M. | CA | | | | | | | | G | 15 | In | Off | | | |
| 1710 | 6 | 2428 | R4 | S | U | Unk | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1711 | 6 | 2428 | R5 | S | U | Unk | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1712 | 6 | 2428 | R6 | S | U | Unk | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1713 | 6 | 2428 | R7 | S | U | Unk | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1714 | 6 | 2428 | R8 | S | U | Unk | Irvine | CA | | | | | | | | Out | 15 | | Off | | | |
| 1715 | 6 | 2429 | R4 | S | U | 3 | Mission Viejo | CA | | | | | | | | G | 15 | In | Off | | | |
| 1716 | 6 | 2429 | R5 | S | U | 3 | Mission Viejo | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1717 | 6 | 2430 | R4 | S | U | 2 | Coto de Caza | CA | | | | | | | | G | 15 | In | Off | | | |
| 1718 | 6 | 2430 | R5 | S | U | 2 | Coto de Caza | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1719 | 6 | 2431 | R4 | M | U | 12 | R.S.M. | CA | | | | | | | | B | 15 | In | Off | | | |
| 1720 | 6 | 2432 | R4 | S | U | 23 | Orange | CA | | | | | | | | Out | 15 | | Off | | | |
| 1721 | 6 | 2433 | R4 | S | S | 17 | La Habra | CA | | | | | | | | B | 15 | In | Off | | | |
| 1722 | 6 | 2434 | R4 | S | S | 73 | Anaheim | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1723 | 6 | 2434 | R5 | S | S | 73 | Anaheim | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1724 | 6 | 2434 | R6 | S | S | 73 | Anaheim | CA | | | | | | | | B | 15 | In | Off | | | |
| 1725 | 6 | 2435 | R10 | S | S | 10 | R.S.M. | CA | | | | | | | | B | 15 | In | Off | | | |
| 1726 | 6 | 2435 | R11 | S | S | 10 | R.S.M. | CA | | | | | | | | G | 15 | In | Off | | | |
| 1727 | 6 | 2435 | R4 | S | S | 10 | R.S.M. | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1728 | 6 | 2435 | R5 | S | S | 10 | R.S.M. | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1729 | 6 | 2435 | R6 | S | S | 10 | R.S.M. | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1730 | 6 | 2435 | R7 | S | S | 10 | R.S.M. | CA | | | | | | | | Kit | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1731 | 6 | 2435 | R8 | S | S | 10 | R.S.M. | CA | | | | | | | | B | 15 | In | Off | | | |
| 1732 | 6 | 2435 | R9 | S | S | 10 | R.S.M. | CA | | | | | | | | B | 15 | In | Off | | | |
| 1733 | 6 | 2437 | R4 | S | S | 6 | Laguna Niquel | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1734 | 6 | 2437 | R5 | S | S | 6 | Laguna Niquel | CA | | | | | | | | B | 15 | In | Off | | | |
| 1735 | 6 | 2438 | R4 | S | S | 30 | Long Beach | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1736 | 6 | 2438 | R5 | S | S | 30 | Long Beach | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1737 | 6 | 2439 | R4 | M | S | 13 | Anaheim | CA | | | | | | | | B | 15 | In | Off | | | |
| 1738 | 6 | 2440 | R4 | S | Unk | 4 | Aliso Viejo | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1739 | 6 | 2440 | R5 | S | Unk | 4 | Aliso Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1740 | 6 | 2440 | R6 | S | Unk | 4 | Aliso Viejo | CA | | | | | | | | G | 15 | In | Off | | | |
| 1741 | 6 | 2443 | R4 | M | S | 7 | Tustin | CA | | | | | | | | G | 15 | In | Off | | | |
| 1742 | 6 | 2443 | R5 | M | S | 7 | Tustin | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1743 | 6 | 2443 | R6 | M | S | 7 | Tustin | CA | | | | | | | | Out | 15 | | Off | | | |
| 1744 | 6 | 2444 | R4 | S | S | 13 | Upland | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1745 | 6 | 2444 | R5 | S | S | 13 | Upland | CA | | | | | | | | B | 15 | In | Off | | | |
| 1746 | 6 | 2444 | R6 | S | S | 13 | Upland | CA | | | | | | | | Out | 15 | | Off | | | |
| 1747 | 6 | 2804 | R4 | S | S | 23 | Pomona | CA | | | | | | | | B | 15 | In | Off | | | |
| 1748 | 6 | 2805 | R4 | S | S | 9 | Anaheim Hills | CA | | | | | | | | B | 15 | In | Off | | | |
| 1749 | 6 | 2805 | R5 | S | S | 9 | Anaheim Hills | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1750 | 6 | 2806 | R4 | S | S | 11 | Whittier | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1751 | 6 | 2806 | R5 | S | S | 11 | Whittier | CA | | | | | | | | G | 15 | In | Off | | | |
| 1752 | 6 | 2807 | R4 | S | S | 12 | Lake Elsinore | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1753 | 6 | 2807 | R5 | S | S | 12 | Lake Elsinore | CA | | | | | | | | G | 15 | In | Off | | | |
| 1754 | 6 | 2808 | R4 | S | S | 13 | Canyon Lake | CA | | | | | | | | B | 15 | In | Off | | | |
| 1755 | 6 | 2809 | R4 | S | S | 4 | Corona | CA | | | | | | | | B | 15 | In | Off | | | |
| 1756 | 6 | 2809 | R5 | S | S | 4 | Corona | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1757 | 6 | 2809 | R6 | S | S | 4 | Corona | CA | | | | | | | | G | 15 | In | Off | | | |
| 1758 | 6 | 2810 | R4 | S | S | 4 | La Palma | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1759 | 6 | 2810 | R5 | S | S | 4 | La Palma | CA | | | | | | | | G | 15 | In | Off | | | |
| 1760 | 6 | 2811 | R4 | S | S | 12 | Riverside | CA | | | | | | | | G | 15 | In | Off | | | |
| 1761 | 6 | 2812 | R4 | S | S | 21 | Ontario | CA | | | | | | | | B | 15 | In | Off | | | |
| 1762 | 6 | 2812 | R5 | S | S | 21 | Ontario | CA | | | | | | | | G | 15 | In | Off | | | |
| 1763 | 6 | 2813 | R4 | S | S | 16 | Whittier | CA | | | | | | | | B | 15 | In | Off | | | |
| 1764 | 6 | 2814 | R4 | S | S | 10 | Phillips Ranch | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1765 | 6 | 2814 | R5 | S | S | 10 | Phillips Ranch | CA | | | | | | | | G | 15 | In | Off | | | |
| 1766 | 6 | 2815 | R4 | S | S | 19 | Brea | CA | | | | | | | | Base | 15 | Out | Off | | | |
| 1767 | 6 | 2816 | R4 | S | S | 20 | Yorba Linda | CA | | | | | | | | B | 15 | In | Off | | | |
| 1768 | 6 | 2817 | R4 | S | S | 23 | Ontario | CA | | | | | | | | B | 15 | In | Off | | | |
| 1769 | 6 | 2818 | R4 | S | S | 70 | Placentia | CA | | | | | | | | B | 15 | In | Off | | | |
| 1770 | 6 | 2818 | R5 | S | S | 70 | Placentia | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1771 | 6 | 2819 | R4 | S | S | 19 | Whittier | CA | | | | | | | | B | 15 | In | Off | | | |
| 1772 | 6 | 2819 | R5 | S | S | 19 | Whittier | CA | | | | | | | | G | 15 | In | Off | | | |
| 1773 | 6 | 2820 | R4 | S | S | 12 | Diamond Bar | CA | | | | | | | | B | 15 | In | Off | | | |
| 1774 | 6 | 2821 | R4 | S | S | 8 | Chino Hills | CA | | | | | | | | B | 15 | In | Off | | | |
| 1775 | 6 | 2821 | R5 | S | S | 8 | Chino Hills | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1776 | 6 | 2822 | R4 | S | S | 3 | Placentia | CA | | | | | | | | B | 15 | In | Off | | | |
| 1777 | 6 | 2822 | R5 | S | S | 3 | Placentia | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1778 | 6 | 2823 | R4 | S | S | 3 | Corona | CA | | | | | | | | B | 15 | In | Off | | | |
| 1779 | 6 | 2823 | R5 | S | S | 3 | Corona | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1780 | 6 | 2854 | R4 | M | U | 26 | Irvine | CA | | | | | | | | B | 15 | In | Off | | | |
| 1781 | 6 | 2854 | R5 | M | U | 26 | Irvine | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1782 | 6 | 2855 | R4 | M | U | 22 | Lake Forest | CA | | | | | | | | B | 15 | In | Off | | | |
| 1783 | 6 | 2856 | R4 | M | U | 26 | Santa Ana | CA | | | | | | | | B | 15 | In | Off | | | |
| 1784 | 6 | 2858 | R4 | M | U | 26 | Yorba Linda | CA | | | | | | | | Base | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1785 | 6 | 2863 | R11 | M | U | 70 | Orange | CA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1786 | 6 | 2863 | R19 | M | U | 70 | Orange | CA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1787 | 6 | 2863 | R21 | M | U | 70 | Orange | CA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1788 | 6 | 2863 | R5 | M | U | 70 | Orange | CA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1789 | 6 | 2863 | R6 | M | U | 70 | Orange | CA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1790 | 6 | 2863 | R7 | M | U | 70 | Orange | CA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1791 | 6 | 2869 | R4 | S | U | 18 | Laguna Niguel | CA | | | | | | | | G | 15 | In | Off | | | |
| 1792 | 6 | 2869 | R5 | S | U | 18 | Laguna Niguel | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1793 | 6 | 2869 | R6 | S | U | 18 | Laguna Niguel | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1794 | 6 | 2869 | R7 | S | U | 18 | Laguna Niguel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1795 | 6 | 2870 | R4 | S | U | 2 | Tabuco Canyon | CA | | | | | | | | Out | 15 | | Off | | | |
| 1796 | 6 | 2870 | R5 | S | U | 2 | Tabuco Canyon | CA | | | | | | | | Out | 15 | | Off | | | |
| 1797 | 6 | 2870 | R6 | S | U | 2 | Tabuco Canyon | CA | | | | | | | | Out | 15 | | Off | | | |
| 1798 | 6 | 2870 | R7 | S | U | 2 | Tabuco Canyon | CA | | | | | | | No | Out | 15 | | No Trip | | | |
| 1799 | 6 | 2870 | R8 | S | U | 2 | Tabuco Canyon | CA | | | | | | | | B | 15 | In | Off | | | |
| 1800 | 6 | 2870 | R9 | S | U | 2 | Tabuco Canyon | CA | | | | | | | No | Out | 15 | | No Trip | | | |
| 1801 | 6 | 2871 | R4 | S | U | 40 | Santa Ana | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1802 | 6 | 2871 | R5 | S | U | 40 | Santa Ana | CA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1803 | 6 | 2871 | R6 | S | U | 40 | Santa Ana | CA | | | | | | | | Out | 15 | | Off | | | |
| 1804 | 6 | 2882 | R4 | S | S | 30 | Irvine | CA | | | | | | | | Out | 15 | | Off | | | |
| 1805 | 6 | 2883 | R4 | S | S | 7 | Foothill Ranch | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1806 | 6 | 2883 | R5 | S | S | 7 | Foothill Ranch | CA | | | | | | | | B | 15 | Out | Off | | | |
| 1807 | 6 | 2883 | R6 | S | S | 7 | Foothill Ranch | CA | | | | | | | | G | 15 | Unk | Off | | | |
| 1808 | 6 | 2887 | R4 | Unk | S | 15 | Laguna Hills | CA | | | | | | | | B | 15 | Out | Off | | | |
| 1809 | 6 | 2887 | R5 | Unk | S | 15 | Laguna Hills | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1810 | 6 | 2888 | R4 | Unk | S | 20 | Irvine | CA | | | | | | | | Out | 15 | | Off | | | |
| 1811 | 6 | 2890 | R4 | S | Unk | 8 | Laguna Niguel | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1812 | 6 | 2890 | R5 | S | U | 8 | Laguna Niguel | CA | | | | | | | | G | 15 | In | Off | | | |
| 1813 | 6 | 2890 | R6 | S | U | 8 | Laguna Niguel | CA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1814 | 6 | 2890 | R7 | S | U | 8 | Laguna Niguel | CA | | | | | | | | B | 15 | In | Off | | | |
| 1815 | 6 | 2890 | R8 | S | U | 8 | Laguna Niguel | CA | | | | | | | | B | 15 | In | Off | | | |
| 1816 | 6 | 2890 | R9 | S | U | 8 | Laguna Niguel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1817 | 6 | 2891 | R4 | Unk | Unk | 8 | Laguna Niguel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1818 | 6 | 2891 | R5 | Unk | Unk | 8 | Laguna Niguel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1819 | 6 | 2891 | R6 | Unk | Unk | 8 | Laguna Niguel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1820 | 6 | 2891 | R7 | Unk | Unk | 8 | Laguna Niguel | CA | | | | | | | | Out | 15 | | Off | | | |
| 1821 | 6 | 2891 | R8 | Unk | Unk | 8 | Laguna Niguel | CA | | | | | | | | Base | 15 | In | Off | | | |
| 1822 | 6 | 2892 | R4 | S | S | 20 | Mission Viejo | CA | | | | | | | | G | 15 | In | Off | | | |
| 1823 | 6 | 2892 | R5 | S | S | 20 | Mission Viejo | CA | | | | | | | | B | 15 | In | Off | | | |
| 1824 | 6 | 2893 | R4 | S | S | 18 | Trabuco Canyon | CA | | | | | | | | G | 15 | Out | Off | | | |
| 1825 | 6 | 2893 | R5 | S | S | 18 | Trabuco Canyon | CA | | | | | | | | B | 15 | Out | Off | | | |
| 1826 | 6 | 2893 | R6 | S | S | 18 | Trabuco Canyon | CA | | | | | | | | Out | 15 | | Off | | | |
| 1827 | 6 | 2894 | R4 | S | S | 3 | Tustin Ranch | CA | | | | | | | | Kit | 15 | In | Off | | | |
| 1828 | 6 | 2894 | R5 | S | S | 3 | Tustin Ranch | CA | | | | | | | | G | 15 | In | Off | | | |
| 1829 | 6 | 2894 | R6 | S | S | 3 | Tustin Ranch | CA | | | | | | | | B | 15 | In | Off | | | |
| 1830 | 6 | 2895 | R4 | M | U | 13 | Irvine | CA | | | | | | | | B | 15 | Out | Off | | | |
| 1831 | 6 | 2895 | R5 | M | U | 13 | Irvine | CA | | | | | | | | Out | 15 | | Off | | | |
| 1832 | 6 | 2896 | R4 | S | S | 20 | Lake Forest | CA | | | | | | | | Out | 15 | | Off | | | |
| 1833 | 6 | 2896 | R5 | S | S | 20 | Lake Forest | CA | | | | | | | | Out | 15 | | Off | | | |
| 1834 | 7 | 1126 | R4 | S | S | 59 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1835 | 7 | 1126 | R5 | S | S | 59 | Tacoma | WA | | | | | | | No | Kit | 15 | In | No Trip | | | |
| 1836 | 7 | 1126 | R6 | S | S | 59 | Tacoma | WA | | | | | | | | B | 15 | Unk | Off | | | |
| 1837 | 7 | 1127 | R4 | Unk | S | 9 | Olympia | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1838 | 7 | 1127 | R5 | Unk | S | 9 | Olympia | WA | | | | | | | | Kit | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1839 | 7 | 1127 | R6 | Unk | S | 9 | Olympia | WA | | | | | | | | B | 15 | In | Off | | | |
| 1840 | 7 | 1127 | R7 | Unk | S | 9 | Olympia | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1841 | 7 | 1128 | R4 | S | U | 10 | Federal Way | WA | | | | | | | | G | 15 | In | Off | | | |
| 1842 | 7 | 1128 | R5 | S | U | 10 | Federal Way | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1843 | 7 | 1128 | R6 | S | U | 10 | Federal Way | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1844 | 7 | 1129 | R4 | S | S | New | Kent | WA* | | | | | | | | G | 15 | In | Off | | | |
| 1845 | 7 | 1129 | R5 | S | S | New | Kent | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 1846 | 7 | 1129 | R6 | S | S | New | Kent | WA* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1847 | 7 | 1129 | R7 | S | S | New | Kent | WA* | | | | | | | | B | 15 | In | Off | | | |
| 1848 | 7 | 1130 | R4 | Unk | R | Unk | Unk | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1849 | 7 | 1130 | R5 | Unk | R | Unk | Unk | WA | | | | | | | No | B | 20 | In | On | | | |
| 1850 | 7 | 1130 | R6 | Unk | R | Unk | Unk | WA | | | | | | | | B | 15 | In | Off | | | |
| 1851 | 7 | 1131 | R4 | S | U | 7 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1852 | 7 | 1132 | R4 | Unk | Unk | Unk | Tacoma | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1853 | 7 | 1133 | R4 | S | U | Unk | Enumclaw | WA | | | | | | | | B | 15 | In | Off | | | |
| 1854 | 7 | 1134 | R4 | Unk | U | Unk | Tacoma | WA | | | | | | Yes | Yes | Base | Unk | In | No Trip | | | |
| 1855 | 7 | 1134 | R5 | Unk | U | Unk | Tacoma | WA | | | | | | | | Out | Unk | | Off | | | |
| 1856 | 7 | 1135 | R4 | S | S | Unk | Unk | WA | | | | | | | | B | 15 | In | Off | | | |
| 1857 | 7 | 1136 | B1 | Unk | S | 22 | Unk | WA | 20 | 1 | No Trip | Unk | Base | | | | | | | | | |
| 1858 | 7 | 1136 | B2 | Unk | S | 22 | Unk | WA | 15 | 1 | No Trip | Unk | Base | | | | | | | | | |
| 1859 | 7 | 1137 | R4 | Unk | U | Unk | Lakewood | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1860 | 7 | 1138 | R4 | S | S | 2 | Puyallup | WA | | | | | | | | G | 15 | In | Off | | | |
| 1861 | 7 | 1138 | R5 | S | S | 2 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1862 | 7 | 1138 | R6 | S | S | 2 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1863 | 7 | 1138 | R7 | S | S | 2 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 1864 | 7 | 1139 | R4 | S | U | 22 | Federal Way | WA | | | | | | | | B | 15 | In | Off | | | |
| 1865 | 7 | 1140 | R4 | S | U | 20 | Unk | WA | | | | | | Yes | Yes | G | 15 | Out | No Trip | | | |
| 1866 | 7 | 1155 | R4 | S | U | Unk | Renton | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1867 | 7 | 1155 | R5 | S | U | Unk | Renton | WA | | | | | | | | B | 15 | In | Off | | | |
| 1868 | 7 | 1155 | R6 | S | U | Unk | Renton | WA | | | | | | | | Base | 15 | In | Off | | | |
| 1869 | 7 | 1155 | R7 | S | U | Unk | Renton | WA | | | | | | Yes | Yes | Kit | 15 | Out | No Trip | | | |
| 1870 | 7 | 1156 | R4 | S | U | 60 | Seattle | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1871 | 7 | 1156 | R5 | S | U | 60 | Seattle | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1872 | 7 | 1157 | R4 | M | U | 22 | Kent | WA | | | | | | | | B | 15 | In | Off | | | |
| 1873 | 7 | 1158 | R4 | Unk | U | 80 | Tacoma | WA | | | | | | Yes | Yes | B | Unk | In | On | | | |
| 1874 | 7 | 1158 | R5 | Unk | U | 80 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1875 | 7 | 1158 | R6 | Unk | U | 80 | Tacoma | WA | | | | | | | | Kit | Unk | In | Off | | | |
| 1876 | 7 | 1159 | R4 | Unk | U | 55 | Lakewood | WA | | | | | | | | B | 15 | In | Off | | | |
| 1877 | 7 | 1159 | R5 | Unk | U | 55 | Lakewood | WA | | | | | | | | Kit | Unk | In | Off | | | |
| 1878 | 7 | 1159 | R6 | Unk | U | 55 | Lakewood | WA | | | | | | | | Kit | Unk | In | Off | | | |
| 1879 | 7 | 1160 | R4 | Unk | U | 10 | Steilacoom | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1880 | 7 | 1160 | R5 | Unk | U | 10 | Steilacoom | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1881 | 7 | 1160 | R6 | Unk | U | 10 | Steilacoom | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1882 | 7 | 1160 | R7 | Unk | U | 10 | Steilacoom | WA | | | | | | | | Base | 15 | In | Off | | | |
| 1883 | 7 | 1161 | R4 | S | U | 30 | Federal Way | WA | | | | | | Yes | Yes | Kit | 15 | Out | No Trip | | No | Yes |
| 1884 | 7 | 1161 | R5 | S | U | 30 | Federal Way | WA | | | | | | Yes | Yes | B | 15 | In | On | | No | Yes |
| 1885 | 7 | 1161 | R6 | S | U | 30 | Federal Way | WA | | | | | | Yes | Yes | Out | 15 | | No Trip | | No | Yes |
| 1886 | 7 | 1162 | R4 | S | S | New | Harbor | WA* | | | | | | | | G | 15 | Out | Off | | | |
| 1887 | 7 | 1162 | R5 | S | S | New | Harbor | WA* | | | | | | | | B | 15 | In | Off | | | |
| 1888 | 7 | 1162 | R6 | S | S | New | Harbor | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 1889 | 7 | 1162 | R7 | S | S | New | Harbor | WA* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1890 | 7 | 1162 | R8 | S | S | New | Harbor | WA* | | | | | | | | Kit | 15 | Out | Off | | | |
| 1891 | 7 | 1163 | R4 | S | S | 3 | Unk | WA | | | | | | | | Out | 15 | | Off | | | |
| 1892 | 7 | 1163 | R5 | S | S | 3 | Unk | WA | | | | | | | | G | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1893 | 7 | 1163 | R6 | S | S | 3 | Unk | WA | | | | | | | | G | 15 | In | Off | | | |
| 1894 | 7 | 1163 | R7 | S | S | 3 | Unk | WA | | | | | | | | Other | 15 | Unk | Off | | | |
| 1895 | 7 | 1163 | R8 | S | S | 3 | Unk | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1896 | 7 | 1163 | R9 | S | S | 3 | Unk | WA | | | | | | | | Other | 15 | In | Off | | | |
| 1897 | 7 | 1164 | R4 | S | S | 32 | Renton | WA | | | | | | Yes | Yes | Out | 15 | | No Trip | | | |
| 1898 | 7 | 1164 | R5 | S | S | 32 | Renton | WA | | | | | | | | Out | 15 | | Off | | | |
| 1899 | 7 | 1164 | R6 | S | S | 32 | Renton | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1900 | 7 | 1164 | R7 | S | S | 32 | Renton | WA | | | | | | | | B | 15 | In | Off | | | |
| 1901 | 7 | 1164 | R8 | S | S | 32 | Renton | WA | | | | | | Yes | Yes | B | 15 | Unk | No Trip | | | |
| 1902 | 7 | 1166 | R4 | S | U | 71 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 1903 | 7 | 1167 | R4 | S | U | 62 | Buckley | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1904 | 7 | 1167 | R5 | S | U | 62 | Buckley | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1905 | 7 | 1168 | R4 | S | R | 5 | Gig Harbour | WA | | | | | | Yes | Yes | B | 15 | Out | On | | | |
| 1906 | 7 | 1168 | R5 | S | R | 5 | Gig Harbour | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1907 | 7 | 1168 | R6 | S | R | 5 | Gig Harbour | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1908 | 7 | 1168 | R7 | S | R | 5 | Gig Harbour | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1909 | 7 | 1169 | R4 | S | U | 70 | Steilacoom | WA | | | | | | | | B | 15 | Out | Off | | | |
| 1910 | 7 | 1169 | R5 | S | U | 70 | Steilacoom | WA | | | | | | | No | Kit | 15 | In | No Trip | | | |
| 1911 | 7 | 1169 | R6 | S | U | 70 | Steilacoom | WA | | | | | | | No | Kit | 15 | In | No Trip | | | |
| 1912 | 7 | 1170 | R4 | S | U | 60 | Seattle | WA | | | | | | | | B | 15 | Out | Off | | | |
| 1913 | 7 | 1171 | R4 | S | S | 3 | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1914 | 7 | 1171 | R5 | S | S | 3 | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1915 | 7 | 1171 | R6 | S | S | 3 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 1916 | 7 | 1172 | R4 | S | S | 21 | Milton | WA | | | | | | | | G | 15 | In | Off | | | |
| 1917 | 7 | 1172 | R5 | S | S | 21 | Milton | WA | | | | | | | | B | 15 | In | Off | | | |
| 1918 | 7 | 1173 | R4 | Unk | R | 3 | Puyallup | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1919 | 7 | 1173 | R5 | Unk | R | 3 | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1920 | 7 | 1173 | R6 | Unk | R | 3 | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1921 | 7 | 1173 | R7 | Unk | R | 3 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 1922 | 7 | 1174 | R4 | S | S | 32 | Kent | WA | | | | | | | | B | 15 | In | Off | | | |
| 1923 | 7 | 1175 | B1 | S | S | 11 | Issaquah | WA | 20 | Unk | Trip | 1989 | G | | | | | | | | | |
| 1924 | 7 | 1175 | R4 | S | S | 11 | Issaquah | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1925 | 7 | 1176 | R4 | S | S | 10 | Renton | WA | | | | | | | No | G | 15 | In | No Trip | | | |
| 1926 | 7 | 1176 | R5 | S | S | 10 | Renton | WA | | | | | | | No | Kit | 15 | Out | No Trip | | | |
| 1927 | 7 | 1176 | R6 | S | S | 10 | Renton | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1928 | 7 | 1176 | R7 | S | S | 10 | Renton | WA | | | | | | | | B | 15 | In | Off | | | |
| 1929 | 7 | 1178 | R4 | M | S | 22 | Federal Way | WA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1930 | 7 | 1179 | R4 | S | S | 2 | Kent | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1931 | 7 | 1179 | R5 | S | S | 2 | Kent | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1932 | 7 | 1179 | R6 | S | S | 2 | Kent | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1933 | 7 | 1179 | R7 | S | S | 2 | Kent | WA | | | | | | | | B | 15 | In | Off | | | |
| 1934 | 7 | 1180 | R4 | S | S | 1 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 1935 | 7 | 1180 | R5 | S | S | 1 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1936 | 7 | 1180 | R6 | S | S | 1 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1937 | 7 | 1180 | R7 | S | S | 1 | Tacoma | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1938 | 7 | 1180 | R8 | S | S | 1 | Tacoma | WA | | | | | | | | Base | 15 | In | Off | | | |
| 1939 | 7 | 1180 | R9 | S | S | 1 | Tacoma | WA | | | | | | | | Base | 15 | In | Off | | | |
| 1940 | 7 | 1182 | R4 | S | S | 2 | Swaner | WA | | | | | | | | B | 15 | In | Off | | | |
| 1941 | 7 | 1182 | R5 | S | S | 2 | Swaner | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1942 | 7 | 1182 | R6 | S | S | 2 | Swaner | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1943 | 7 | 1182 | R7 | S | S | 2 | Swaner | WA | | | | | | | No | G | 15 | Out | No Trip | | | |
| 1944 | 7 | 1183 | R4 | S | S | 0 | Lake Stevens | WA* | | | | | | | | G | 15 | Out | Off | | | |
| 1945 | 7 | 1183 | R5 | S | S | 0 | Lake Stevens | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 1946 | 7 | 1183 | R6 | S | S | 0 | Lake Stevens | WA* | | | | | | | | Kit | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 1947 | 7 | 1183 | R7 | S | S | 0 | Lake Stevens | WA* | | | | | | | | B | 15 | In | Off | | | |
| 1948 | 7 | 1184 | R4 | S | U | 2 | Tacoma | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1949 | 7 | 1184 | R5 | S | U | 2 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1950 | 7 | 1184 | R6 | S | U | 2 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1951 | 7 | 1184 | R7 | S | U | 2 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 1952 | 7 | 1185 | R4 | S | S | Unk | Mill Creek | WA | | | | | | | | B | 15 | In | Off | | | |
| 1953 | 7 | 1185 | R5 | S | S | Unk | Mill Creek | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1954 | 7 | 1186 | R4 | S | S | 10 | Puyallup | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1955 | 7 | 1186 | R5 | S | S | 10 | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1956 | 7 | 1186 | R6 | S | S | 10 | Puyallup | WA | | | | | | | | Kit | Unk | Out | Off | | | |
| 1957 | 7 | 1187 | R4 | S | S | 9 | Tacoma | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1958 | 7 | 1187 | R5 | S | S | 9 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 1959 | 7 | 1187 | R6 | S | S | 9 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1960 | 7 | 1187 | R7 | S | S | 9 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1961 | 7 | 1189 | R4 | S | S | 3 | Unk | WA | | | | | | | | G | 15 | In | Off | | | |
| 1962 | 7 | 1189 | R5 | S | S | 3 | Unk | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1963 | 7 | 1189 | R6 | S | S | 3 | Unk | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1964 | 7 | 1189 | R7 | S | S | 3 | Unk | WA | | | | | | | No | B | 15 | In | On | | | |
| 1965 | 7 | 1189 | R8 | S | S | 3 | Unk | WA | | | | | | | | Base | 15 | Unk | Off | | | |
| 1966 | 7 | 1190 | R4 | S | R | 3 | Graham | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1967 | 7 | 1190 | R5 | S | R | 3 | Graham | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1968 | 7 | 1190 | R6 | S | R | 3 | Graham | WA | | | | | | | | B | 15 | In | Off | | | |
| 1969 | 7 | 1190 | R7 | S | R | 3 | Graham | WA | | | | | | | | Unk | 15 | Out | Off | | | |
| 1970 | 7 | 1191 | R4 | S | S | 12 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1971 | 7 | 1191 | R5 | S | S | 12 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1972 | 7 | 1191 | R6 | S | S | 12 | Tacoma | WA | | | | | | | | G | 15 | In | Off | | | |
| 1973 | 7 | 1192 | R4 | S | R | 13 | Greenwater | WA | | | | | | | No | G | 15 | Out | No Reset | | | |
| 1974 | 7 | 1192 | R5 | S | R | 13 | Greenwater | WA | | | | | | | No | G | 15 | In | No Trip | | | |
| 1975 | 7 | 1192 | R6 | S | R | 13 | Greenwater | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1976 | 7 | 1192 | R7 | S | R | 13 | Greenwater | WA | | | | | | | | B | 15 | In | Off | | | |
| 1977 | 7 | 1192 | R8 | S | R | 13 | Greenwater | WA | | | | | | | No | B | 15 | In | No Trip | | | |
| 1978 | 7 | 1193 | B1 | S | S | Unk | Tacoma | WA | 20 | 1 | Trip | 1995 | Other | | | | | | | | | |
| 1979 | 7 | 1193 | R4 | S | S | Unk | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 1980 | 7 | 1193 | R5 | S | S | Unk | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1981 | 7 | 1193 | R6 | S | S | Unk | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1982 | 7 | 1194 | R4 | S | S | 23 | Unk | WA | | | | | | Yes | Yes | B | 15 | In | On | | | |
| 1983 | 7 | 1195 | R4 | S | S | 57 | Auburn | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1984 | 7 | 1195 | R5 | S | S | 57 | Auburn | WA | | | | | | | | Out | 15 | | Off | | | |
| 1985 | 7 | 1195 | R6 | S | S | 57 | Auburn | WA | | | | | | | | B | 15 | In | Off | | | |
| 1986 | 7 | 1195 | R7 | S | S | 57 | Auburn | WA | | | | | | | | B | 15 | In | Off | | | |
| 1987 | 7 | 1196 | R4 | S | Unk | Unk | Gig Harbour | WA | | | | | | | | B | 15 | In | Off | | | |
| 1988 | 7 | 1196 | R5 | S | Unk | Unk | Gig Harbour | WA | | | | | | | | B | 15 | In | Off | | | |
| 1989 | 7 | 1197 | R4 | S | S | Unk | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 1990 | 7 | 1197 | R5 | S | S | Unk | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 1991 | 7 | 1198 | R4 | S | R | Unk | Port Orchard | WA | | | | | | | | B | 15 | Out | Off | | | |
| 1992 | 7 | 1198 | R5 | S | R | Unk | Port Orchard | WA | | | | | | | | B | 15 | In | Off | | | |
| 1993 | 7 | 1199 | B1 | S | R | Unk | Port Orchard | WA | 50 | 2 | No Trip | 1990 | G | Yes | Yes | | | | | | | |
| 1994 | 7 | 1199 | R4 | S | R | Unk | Port Orchard | WA | | | | | | | | G | 15 | Out | Off | | | |
| 1995 | 7 | 1199 | R5 | S | R | Unk | Port Orchard | WA | | | | | | | | B | 15 | In | Off | | | |
| 1996 | 7 | 1199 | R6 | S | R | Unk | Port Orchard | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 1997 | 7 | 1199 | R7 | S | R | Unk | Port Orchard | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 1998 | 7 | 1199 | R8 | S | R | Unk | Port Orchard | WA | | | | | | | | Unk | 15 | Out | Off | | | |
| 1999 | 7 | 1200 | R4 | S | R | 14 | Auburn | WA | | | | | | | | G | 15 | In | Off | | | |
| 2000 | 7 | 1200 | R5 | S | R | 14 | Auburn | WA | | | | | | | | Out | 15 | | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2001 | 7 | 1201 | R4 | S | U | 8 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2002 | 7 | 1201 | R5 | S | U | 8 | Tacoma | WA | | | | | | | | G | 15 | In | Off | | | |
| 2003 | 7 | 1201 | R6 | S | U | 8 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2004 | 7 | 1201 | R7 | S | U | 8 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2005 | 7 | 1201 | R8 | S | U | 8 | Tacoma | WA | | | | | | | | B | 15 | Out | Off | | | |
| 2006 | 7 | 1202 | R4 | S | U | New | Issaquah | WA* | | | | | | | | G | 15 | Out | Off | | | |
| 2007 | 7 | 1202 | R5 | S | U | New | Issaquah | WA* | | | | | | | | B | 15 | In | Off | | | |
| 2008 | 7 | 1202 | R6 | S | U | New | Issaquah | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 2009 | 7 | 1202 | R7 | S | U | New | Issaquah | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 2010 | 7 | 1203 | R4 | S | S | 15 | Puyallup | WA | | | | | | | | G | 15 | In | Off | | | |
| 2011 | 7 | 1204 | R4 | S | S | 15 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2012 | 7 | 1204 | R5 | S | S | 15 | Puyallup | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2013 | 7 | 1204 | R6 | S | S | 15 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2014 | 7 | 1204 | R7 | S | S | 15 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2015 | 7 | 1204 | R8 | S | S | 15 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2016 | 7 | 1204 | R9 | S | S | 15 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2017 | 7 | 1205 | R4 | S | R | Unk | Vashon Island | WA | | | | | | | | Out | 15 | | Off | | | |
| 2018 | 7 | 1205 | R5 | S | R | Unk | Vashon Island | WA | | | | | | | | Out | 15 | | Off | | | |
| 2019 | 7 | 1205 | R6 | S | R | Unk | Vashon Island | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2020 | 7 | 1205 | R7 | S | R | Unk | Vashon Island | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2021 | 7 | 1205 | R8 | S | R | Unk | Vashon Island | WA | | | | | | | | B | 15 | In | Off | | | |
| 2022 | 7 | 1205 | R9 | S | R | Unk | Vashon Island | WA | | | | | | | | B | 15 | In | Off | | | |
| 2023 | 7 | 1206 | R4 | S | R | 4 | Graham | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2024 | 7 | 1206 | R5 | S | R | 4 | Graham | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2025 | 7 | 1206 | R6 | S | R | 4 | Graham | WA | | | | | | | | B | 15 | In | Off | | | |
| 2026 | 7 | 1206 | R7 | S | R | 4 | Graham | WA | | | | | | | | B | 15 | Out | Off | | | |
| 2027 | 7 | 1207 | R4 | S | R | 7 | Grayland | WA | | | | | | | | Out | 15 | | Off | | | |
| 2028 | 7 | 1207 | R5 | S | R | 7 | Grayland | WA | | | | | | | | G | 15 | In | Off | | | |
| 2029 | 7 | 1207 | R6 | S | R | 7 | Grayland | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2030 | 7 | 1207 | R7 | S | R | 7 | Grayland | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2031 | 7 | 1207 | R8 | S | R | 7 | Grayland | WA | | | | | | | | B | 15 | In | Off | | | |
| 2032 | 7 | 1207 | R9 | S | R | 7 | Grayland | WA | | | | | | | | B | 15 | Out | Off | | | |
| 2033 | 7 | 1208 | R4 | S | R | 19 | Westport | WA | | | | | | | | G | 15 | In | Off | | | |
| 2034 | 7 | 1208 | R5 | S | R | 19 | Westport | WA | | | | | | | | B | 15 | In | Off | | | |
| 2035 | 7 | 1209 | R4 | S | S | 12 | Auburn | WA | | | | | | | | G | 15 | In | Off | | | |
| 2036 | 7 | 1210 | R4 | S | S | New | Tacoma | WA* | | | | | | | | G | 15 | Out | Off | | | |
| 2037 | 7 | 1210 | R5 | S | S | New | Tacoma | WA* | | | | | | | | B | 15 | In | Off | | | |
| 2038 | 7 | 1210 | R6 | S | S | New | Tacoma | WA* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2039 | 7 | 1210 | R7 | S | S | New | Tacoma | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 2040 | 7 | 1211 | R4 | S | S | 20 | Federal Way | WA | | | | | | | | B | 15 | Out | Off | | | |
| 2041 | 7 | 1212 | R4 | S | S | Unk | Spanaway | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2042 | 7 | 1212 | R5 | S | S | Unk | Spanaway | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2043 | 7 | 1212 | R6 | S | S | Unk | Spanaway | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2044 | 7 | 1212 | R7 | S | S | Unk | Spanaway | WA | | | | | | | | B | 15 | Out | Off | | | |
| 2045 | 7 | 1213 | R4 | S | S | 4 | Buckley | WA | | | | | | | | G | 15 | Unk | Off | | | |
| 2046 | 7 | 1213 | R5 | S | S | 4 | Buckley | WA | | | | | | | | Kit | 15 | Unk | Off | | | |
| 2047 | 7 | 1213 | R6 | S | S | 4 | Buckley | WA | | | | | | | | B | 15 | Out | Off | | | |
| 2048 | 7 | 1213 | R7 | S | S | 4 | Buckley | WA | | | | | | | | B | 15 | In | Off | | | |
| 2049 | 7 | 1214 | R4 | S | S | New | Auburn | WA* | | | | | | | | G | 15 | Out | Off | | | |
| 2050 | 7 | 1214 | R5 | S | S | New | Auburn | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 2051 | 7 | 1214 | R6 | S | S | New | Auburn | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 2052 | 7 | 1214 | R7 | S | S | New | Auburn | WA* | | | | | | | | B | 15 | Unk | Off | | | |
| 2053 | 7 | 1214 | R8 | S | S | New | Auburn | WA* | | | | | | | | Base | 15 | In | Off | | | |
| 2054 | 7 | 1215 | R4 | S | R | 9 | Olympia | WA | | | | | | | | G | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2055 | 7 | 1215 | R5 | S | R | 9 | Olympia | WA | | | | | | | | B | 15 | In | Off | | | |
| 2056 | 7 | 1215 | R6 | S | R | 9 | Olympia | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2057 | 7 | 1215 | R7 | S | R | 9 | Olympia | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2058 | 7 | 1216 | R4 | S | S | 15 | Unk | WA | | | | | | | | B | 15 | In | Off | | | |
| 2059 | 7 | 1217 | R4 | S | S | Unk | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2060 | 7 | 1217 | R5 | S | S | Unk | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2061 | 7 | 1217 | R6 | S | S | Unk | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2062 | 7 | 1217 | R6 | S | S | Unk | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2063 | 7 | 1218 | R4 | S | S | 2 | Puyallup | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2064 | 7 | 1218 | R5 | S | S | 2 | Puyallup | WA | | | | | | | | G | 15 | In | Off | | | |
| 2065 | 7 | 1218 | R6 | S | S | 2 | Puyallup | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2066 | 7 | 1218 | R7 | S | S | 2 | Puyallup | WA | | | | | | | | Kit | 15 | In | Unk | | | |
| 2067 | 7 | 1218 | R8 | S | S | 2 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2068 | 7 | 1218 | R9 | S | S | 2 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2069 | 7 | 1219 | R4 | S | S | 19 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2070 | 7 | 1220 | R4 | S | U | 18 | Unk | WA | | | | | | | No | B | 15 | In | On | | | |
| 2071 | 7 | 1221 | R4 | S | U | 26 | Bremerton | WA | | | | | | | | Out | 15 | | Off | | | |
| 2072 | 7 | 1222 | R4 | S | Unk | 15 | Federal Way | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2073 | 7 | 1223 | R4 | S | U | Unk | Tacoma | WA | | | | | | | No | B | 15 | Out | On | | | |
| 2074 | 7 | 1223 | R5 | S | U | Unk | Tacoma | WA | | | | | | | No | Out | 15 | | On | | | |
| 2075 | 7 | 1225 | R4 | S | U | 11 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2076 | 7 | 1225 | R5 | S | U | 11 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2077 | 7 | 1225 | R6 | S | U | 11 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2078 | 7 | 1226 | R4 | S | U | 11 | Federal Way | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2079 | 7 | 1226 | R5 | S | U | 11 | Federal Way | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2080 | 7 | 1226 | R6 | S | U | 11 | Federal Way | WA | | | | | | | | B | 15 | In | Off | | | |
| 2081 | 7 | 1227 | R4 | S | U | 23 | Olympia | WA | | | | | | | | B | 15 | In | Off | | | |
| 2082 | 7 | 1228 | R4 | S | U | 8 | Unk | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2083 | 7 | 1228 | R5 | S | U | 8 | Unk | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2084 | 7 | 1228 | R6 | S | U | 8 | Unk | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2085 | 7 | 1228 | R7 | S | U | 8 | Unk | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2086 | 7 | 1228 | R8 | S | U | 8 | Unk | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2087 | 7 | 1228 | R9 | S | U | 8 | Unk | WA | | | | | | | | B | 15 | In | Off | | | |
| 2088 | 7 | 1229 | R4 | S | U | 50 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2089 | 7 | 1229 | R5 | S | U | 50 | Tacoma | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2090 | 7 | 1229 | R6 | S | U | 50 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2091 | 7 | 1230 | R4 | S | U | 5 | Lakewood | WA | | | | | | Yes | Yes | Kit | 15 | Out | No Trip | | | |
| 2092 | 7 | 1230 | R5 | S | U | 5 | Lakewood | WA | | | | | | | | B | 15 | In | Off | | | |
| 2093 | 7 | 1231 | R4 | S | U | 21 | Federal Way | WA | | | | | | | | B | 15 | In | Off | | | |
| 2094 | 7 | 1232 | R4 | S | U | 21 | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2095 | 7 | 1232 | R5 | S | U | 21 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2096 | 7 | 1232 | R6 | S | U | 21 | Puyallup | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2097 | 7 | 1235 | R4 | S | S | 19 | Monroe | WA | | | | | | | | B | 15 | In | Off | | | |
| 2098 | 7 | 1238 | R4 | S | U | 13 | Brownes Point | WA | | | | | | | | B | 15 | In | Off | | | |
| 2099 | 7 | 1240 | B1 | S | U | Unk | Tacoma | WA | 20 | 1 | No Trip | 1984 | Other | | No | | | | | | | |
| 2100 | 7 | 1241 | R4 | S | U | 93 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2101 | 7 | 1242 | R4 | S | S | Unk | Graham | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2102 | 7 | 1242 | R5 | S | S | Unk | Graham | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2103 | 7 | 1242 | R6 | S | S | Unk | Graham | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2104 | 7 | 1242 | R7 | S | S | Unk | Graham | WA | | | | | | | | B | 15 | In | Off | | | |
| 2105 | 7 | 1243 | R4 | S | S | 3 | Kent | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2106 | 7 | 1243 | R5 | S | S | 3 | Kent | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2107 | 7 | 1243 | R6 | S | S | 3 | Kent | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2108 | 7 | 1243 | R7 | S | S | 3 | Kent | WA | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2109 | 7 | 1243 | R8 | S | S | 3 | Kent | WA | | | | | | | | Base | 15 | In | Off | | | |
| 2110 | 7 | 1244 | R4 | Unk | Unk | Unk | Unk | WA | | | | | | | | G | 15 | In | Off | | | |
| 2111 | 7 | 1244 | R5 | Unk | Unk | Unk | Unk | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2112 | 7 | 1244 | R6 | Unk | Unk | Unk | Unk | WA | | | | | | | | B | 15 | In | Off | | | |
| 2113 | 7 | 1245 | R4 | S | S | 12 | Kent | WA | | | | | | | | Kit | 15 | Out | Off | | | |
| 2114 | 7 | 1245 | R5 | S | S | 12 | Kent | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2115 | 7 | 1246 | R4 | S | S | Unk | Puyallup | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2116 | 7 | 1246 | R5 | S | S | Unk | Puyallup | WA | | | | | | | | B | 15 | In | Off | | | |
| 2117 | 7 | 1246 | R6 | S | S | Unk | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2118 | 7 | 1246 | R7 | S | S | Unk | Puyallup | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2119 | 7 | 1247 | R4 | S | U | Unk | Lakewood | WA | | | | | | | | B | 15 | In | Off | | | |
| 2120 | 7 | 1247 | R5 | S | U | Unk | Lakewood | WA | | | | | | | | B | 15 | In | Off | | | |
| 2121 | 7 | 1752 | R4 | S | S | 25 | Westbrook | ME | | | | | | | | G | 15 | Out | Off | | | |
| 2122 | 7 | 1752 | R5 | S | S | 25 | Westbrook | ME | | | | | | | | B | 15 | In | Off | | | |
| 2123 | 7 | 1752 | R6 | S | S | 25 | Westbrook | ME | | | | | | | | Kit | 15 | Out | Off | | | |
| 2124 | 7 | 1753 | R4 | S | S | 13 | Yarmouth | ME | | | | | | | | G | 15 | In | Off | | | |
| 2125 | 7 | 1753 | R5 | S | S | 13 | Yarmouth | ME | | | | | | | | B | 15 | In | Off | | | |
| 2126 | 7 | 1753 | R6 | S | S | 13 | Yarmouth | ME | | | | | | | | B | 15 | In | Off | | | |
| 2127 | 7 | 1754 | B1 | S | U | 130 | Portland | ME | 20 | 2 | Trip | 1996 | Base | | | | | | | | | |
| 2128 | 7 | 1754 | R4 | S | U | 130 | Portland | ME | | | | | | | | B | 15 | In | Off | | | |
| 2129 | 7 | 1754 | R5 | S | U | 130 | Portland | ME | | | | | | | | B | 15 | In | Off | | | |
| 2130 | 7 | 1754 | R6 | S | U | 130 | Portland | ME | | | | | | | | Kit | 15 | In | Off | | | |
| 2131 | 7 | 1754 | R7 | S | U | 130 | Portland | ME | | | | | | | | B | 15 | In | Off | | | |
| 2132 | 7 | 1755 | R4 | S | R | 30 | Unk | ME | | | | | | | | Out | 15 | | Off | | | |
| 2133 | 7 | 1755 | R5 | S | R | 30 | Unk | ME | | | | | | | | Kit | 15 | Out | Off | | | |
| 2134 | 7 | 1755 | R6 | S | R | 30 | Unk | ME | | | | | | | | B | 20 | In | Off | | | |
| 2135 | 7 | 1757 | R4 | M | U | 50 | Old Orchard Bh | ME | | | | | | | | B | 15 | In | Off | | | |
| 2136 | 7 | 1757 | R5 | M | U | 50 | Old Orchard Bh | ME | | | | | | | | B | 15 | In | Off | | | |
| 2137 | 7 | 1760 | R4 | S | S | 27 | Scarborough | ME | | | | | | | | G | 15 | Out | Off | | | |
| 2138 | 7 | 1761 | R4 | S | S | Unk | Cumberland | ME | | | | | | | No | G | 15 | Out | No Reset | | | |
| 2139 | 7 | 1762 | R4 | S | U | 48 | Lewiston | ME | | | | | | | | B | 15 | In | Off | | | |
| 2140 | 7 | 1766 | R4 | S | U | 48 | Portland | ME | | | | | | | | Kit | 20 | In | Off | | | |
| 2141 | 7 | 1766 | R5 | S | U | 48 | Portland | ME | | | | | | | | B | 20 | In | Off | | | |
| 2142 | 7 | 2501 | R4 | S | S | 4 | Orting | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2143 | 7 | 2501 | R5 | S | S | 4 | Orting | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2144 | 7 | 2501 | R6 | S | S | 4 | Orting | WA | | | | | | | | B | 15 | In | Off | | | |
| 2145 | 7 | 2501 | R7 | S | S | 4 | Orting | WA | | | | | | | | G | 15 | Out | Off | | | |
| 2146 | 7 | 2502 | R4 | M | S | 20 | Rendon | WA | | | | | | Yes | Yes | B | 15 | Out | No Trip | | | |
| 2147 | 7 | 2502 | R5 | M | S | 20 | Rendon | WA | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 2148 | 7 | 2503 | R4 | S | S | 32 | Barlem | WA | | | | | | | No | B | 15 | In | No Trip | | | |
| 2149 | 7 | 2503 | R5 | S | S | 32 | Barlem | WA | | | | | | | No | B | 15 | In | No Trip | | | |
| 2150 | 7 | 2521 | R4 | Unk | S | 15 | Seattle | WA | | | | | | | | B | 15 | In | Off | | | |
| 2151 | 7 | 2522 | R4 | S | S | 14 | Kent | WA | | | | | | | | B | 15 | In | Off | | | |
| 2152 | 7 | 2522 | R5 | S | S | 14 | Kent | WA | | | | | | | | G | 15 | In | Off | | | |
| 2153 | 7 | 2523 | R4 | S | U | New | Renton | WA* | | | | | | | | B | 15 | In | Off | | | |
| 2154 | 7 | 2523 | R5 | S | U | New | Renton | WA* | | | | | | | | G | 15 | In | Off | | | |
| 2155 | 7 | 2523 | R6 | S | U | New | Renton | WA* | | | | | | | | Kit | 15 | In | Off | | | |
| 2156 | 7 | 2523 | R7 | S | U | New | Renton | WA* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2157 | 7 | 2524 | R4 | S | U | 10 | Tacoma | WA | | | | | | Yes | Yes | Kit | 15 | In | Unk | | | |
| 2158 | 7 | 2524 | R5 | S | U | 10 | Tacoma | WA | | | | | | | | Kit | 15 | In | Off | | | |
| 2159 | 7 | 2524 | R6 | S | U | 10 | Tacoma | WA | | | | | | | | B | 15 | In | Off | | | |
| 2160 | 8 | 253 | R4 | S | U | 50 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2161 | 8 | 253 | R5 | S | U | 50 | Minneapolis | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2162 | 8 | 253 | R6 | S | U | 50 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2163 | 8 | 254 | R4 | S | S | 1 | Plymouth | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2164 | 8 | 254 | R5 | S | S | 1 | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2165 | 8 | 254 | R6 | S | S | 1 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2166 | 8 | 254 | R7 | S | S | 1 | Plymouth | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2167 | 8 | 254 | R8 | S | S | 1 | Plymouth | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2168 | 8 | 255 | R4 | S | U | 40 | Eding | MN | | | | | | | | Out | 15 | | Off | | | |
| 2169 | 8 | 255 | R5 | S | U | 40 | Eding | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2170 | 8 | 255 | R6 | S | U | 40 | Eding | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2171 | 8 | 255 | R7 | S | U | 40 | Eding | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2172 | 8 | 255 | R8 | S | U | 40 | Eding | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2173 | 8 | 256 | R4 | S | S | 7 | Bloomington | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2174 | 8 | 256 | R5 | S | S | 7 | Bloomington | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2175 | 8 | 256 | R6 | S | S | 7 | Bloomington | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2176 | 8 | 256 | R7 | S | S | 7 | Bloomington | MN | | | | | | | | Out | 15 | | Off | | | |
| 2177 | 8 | 256 | R8 | S | S | 7 | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2178 | 8 | 256 | R9 | S | S | 7 | Bloomington | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2179 | 8 | 257 | R4 | Unk | S | 4 | Casper Wood | MN | | | | | | | | Out | 15 | | Off | | | |
| 2180 | 8 | 257 | R5 | Unk | S | 4 | Casper Wood | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2181 | 8 | 257 | R6 | Unk | S | 4 | Casper Wood | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2182 | 8 | 257 | R7 | Unk | S | 4 | Casper Wood | MN | | | | | | | | Out | 15 | | Off | | | |
| 2183 | 8 | 257 | R8 | Unk | S | 4 | Casper Wood | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2184 | 8 | 257 | R9 | Unk | S | 4 | Casper Wood | MN | | | | | | | | B | 15 | In | Off | | | |
| 2185 | 8 | 261 | R4 | S | S | 4 | Greenwood | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2186 | 8 | 261 | R5 | S | S | 4 | Greenwood | MN | | | | | | | | Kit | 15 | Unk | Off | | | |
| 2187 | 8 | 261 | R6 | S | S | 4 | Greenwood | MN | | | | | | | | Kit | 15 | Unk | Off | | | |
| 2188 | 8 | 261 | R7 | S | S | 4 | Greenwood | MN | | | | | | | | Kit | 15 | In | Unk | | | |
| 2189 | 8 | 261 | R8 | S | S | 4 | Greenwood | MN | | | | | | | | Out | 15 | | Off | | | |
| 2190 | 8 | 262 | R4 | S | S | 4 | Andover | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2191 | 8 | 262 | R5 | S | S | 4 | Andover | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2192 | 8 | 262 | R6 | S | S | 4 | Andover | MN | | | | | | | | B | 15 | In | Off | | | |
| 2193 | 8 | 262 | R7 | S | S | 4 | Andover | MN | | | | | | | | B | 15 | In | Off | | | |
| 2194 | 8 | 262 | R8 | S | S | 4 | Andover | MN | | | | | | | | G | 15 | In | Off | | | |
| 2195 | 8 | 262 | R9 | S | S | 4 | Andover | MN | | | | | | Yes | Yes | B | 20 | In | No Reset | | | |
| 2196 | 8 | 263 | R4 | S | S | 35 | Minneapolis | MN | | | | | | | | Kit | 20 | In | Off | | | |
| 2197 | 8 | 263 | R5 | S | S | 35 | Minneapolis | MN | | | | | | | | Kit | 20 | Out | Off | | | |
| 2198 | 8 | 263 | R6 | S | S | 35 | Minneapolis | MN | | | | | | | | B | 20 | In | Off | | | |
| 2199 | 8 | 263 | R7 | S | S | 35 | Minneapolis | MN | | | | | | | | B | 20 | In | Off | | | |
| 2200 | 8 | 278 | R4 | S | S | 20 | Minnetonka | MN | | | | | | | | B | 15 | In | Off | | | |
| 2201 | 8 | 278 | R5 | S | S | 15 | Minnetonka | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2202 | 8 | 280 | B1 | S | S | 10 | Rockford | MN | 20 | 1 | Trip | 1990 | G | | | | | | | | | |
| 2203 | 8 | 280 | R4 | S | S | 10 | Rockford | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2204 | 8 | 301 | R4 | S | S | 7 | Andover | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2205 | 8 | 301 | R5 | S | S | 7 | Andover | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2206 | 8 | 301 | R6 | S | S | 7 | Andover | MN | | | | | | Yes | Yes | Base | 15 | In | No Trip | | | |
| 2207 | 8 | 301 | R7 | S | S | 7 | Andover | MN | | | | | | | | B | 15 | In | Off | | | |
| 2208 | 8 | 302 | B1 | S | S | 5 | Eden Prairie | MN | 20 | 1 | Trip | 1995 | Base | | | | | | | | | |
| 2209 | 8 | 302 | R4 | S | S | 5 | Eden Prairie | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2210 | 8 | 302 | R5 | S | S | 5 | Eden Prairie | MN | | | | | | | | B | 15 | In | Off | | | |
| 2211 | 8 | 303 | R4 | S | U | 48 | Golden Valley | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2212 | 8 | 304 | R4 | S | S | 2 | Chanhasson | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2213 | 8 | 304 | R5 | S | S | 2 | Chanhasson | MN | | | | | | | | Kit | 15 | Unk | Off | | | |
| 2214 | 8 | 304 | R6 | S | S | 2 | Chanhasson | MN | | | | | | | | G | 15 | In | Off | | | |
| 2215 | 8 | 304 | R7 | S | S | 2 | Chanhasson | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2216 | 8 | 304 | R8 | S | S | 2 | Chanhasson | MN | | | | | | | | Base | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2217 | 8 | 304 | R9 | S | S | 2 | Chanhasson | MN | | | | | | | | B | Unk | Unk | Off | | | |
| 2218 | 8 | 305 | R4 | S | Unk | 23 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2219 | 8 | 306 | R4 | S | Unk | 30 | St. Paul | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2220 | 8 | 306 | R5 | S | Unk | 30 | St. Paul | MN | | | | | | Yes | Yes | Out | 15 | | No Trip | | | |
| 2221 | 8 | 306 | R6 | S | Unk | 30 | St. Paul | MN | | | | | | | | Out | 15 | | Off | | | |
| 2222 | 8 | 306 | R7 | S | Unk | 30 | St. Paul | MN | | | | | | | | Out | 15 | | Off | | | |
| 2223 | 8 | 306 | R8 | S | Unk | 30 | St. Paul | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2224 | 8 | 306 | R9 | S | Unk | 30 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2225 | 8 | 307 | R4 | Unk | S | 30 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2226 | 8 | 307 | R5 | Unk | S | 30 | St. Paul | MN | | | | | | No | Yes | B | 15 | In | No Trip | Yes | No | Yes |
| 2227 | 8 | 307 | R6 | Unk | S | 30 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2228 | 8 | 308 | R4 | Unk | U | 34 | Minnepolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2229 | 8 | 308 | R5 | Unk | U | 34 | Minnepolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2230 | 8 | 308 | R6 | Unk | U | 34 | Minnepolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2231 | 8 | 309 | R4 | S | S | 23 | Robinsdale | MN | | | | | | No | Yes | G | 15 | Unk | On | | | |
| 2232 | 8 | 309 | R5 | S | S | 23 | Robinsdale | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2233 | 8 | 309 | R6 | S | S | 23 | Robinsdale | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2234 | 8 | 310 | R4 | S | S | 28 | Egan | MN | | | | | | | | B | Unk | In | Off | | | |
| 2235 | 8 | 311 | R4 | S | S | 38 | Fridley | MN | | | | | | | | B | 15 | In | Off | | | |
| 2236 | 8 | 311 | R5 | S | S | 38 | Fridley | MN | | | | | | | | B | 15 | In | Off | | | |
| 2237 | 8 | 312 | R4 | S | S | 9 | Andover | MN | | | | | | Yes | Yes | B | 20 | Unk | No Reset | | | |
| 2238 | 8 | 312 | R5 | S | S | 9 | Andover | MN | | | | | | Yes | Yes | B | 20 | Unk | No Reset | | | |
| 2239 | 8 | 313 | R4 | S | S | 18 | Bloomington | MN | | | | | | | | G | 15 | In | Off | | | |
| 2240 | 8 | 313 | R5 | S | S | 18 | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2241 | 8 | 314 | B1 | S | S | 6 | Eden Prairie | MN | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 2242 | 8 | 314 | R4 | S | S | 6 | Eden Prairie | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2243 | 8 | 314 | R5 | S | S | 6 | Eden Prairie | MN | | | | | | | | B | 15 | In | Off | | | |
| 2244 | 8 | 314 | R6 | S | S | 6 | Eden Prairie | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2245 | 8 | 314 | R7 | S | S | 6 | Eden Prairie | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2246 | 8 | 315 | R4 | S | U | 57 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2247 | 8 | 316 | B1 | M | S | 12 | Bloomington | MN | 15 | 1 | Trip | | G | | | | | | | | | |
| 2248 | 8 | 316 | R4 | M | S | 12 | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2249 | 8 | 317 | R4 | M | S | 6 mo | Plymouth | MN* | | | | | | | | G | 15 | In | Off | | | |
| 2250 | 8 | 317 | R5 | M | S | 6 mo | Plymouth | MN* | | | | | | | | B | 15 | In | Off | | | |
| 2251 | 8 | 317 | R6 | M | S | 6 mo | Plymouth | MN* | | | | | | | | Kit | 15 | In | Off | | | |
| 2252 | 8 | 317 | R7 | M | S | 6 mo | Plymouth | MN* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2253 | 8 | 318 | B1 | S | U | 70 | Minneapolis | MN | 15 | 1 | Trip | | Base | | | | | | | | | |
| 2254 | 8 | 319 | R4 | M | S | 10 | Plymouth | MN | | | | | | | | G | 15 | In | Off | | | |
| 2255 | 8 | 319 | R5 | M | S | 10 | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2256 | 8 | 320 | R4 | S | S | 40 | Fridley | MN | | | | | | | No | B | 15 | In | On | | | |
| 2257 | 8 | 321 | R4 | S | S | 20 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2258 | 8 | 321 | R5 | S | S | 20 | Coon Rapids | MN | | | | | | | No | B | 15 | In | On | | | |
| 2259 | 8 | 322 | R4 | S | S | 22 | Unk | MN | | | | | | | | G | 15 | In | Off | | | |
| 2260 | 8 | 322 | R5 | S | S | 22 | Unk | MN | | | | | | | | B | 15 | In | Off | | | |
| 2261 | 8 | 323 | R4 | S | S | 50 | Robbinsdale | MN | | | | | | | No | G | 15 | Out | No Trip | | | |
| 2262 | 8 | 324 | R4 | S | S | 1 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2263 | 8 | 324 | R5 | S | S | 1 | Maple Grove | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2264 | 8 | 324 | R6 | S | S | 1 | Maple Grove | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2265 | 8 | 324 | R7 | S | S | 1 | Maple Grove | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2266 | 8 | 325 | R4 | s | u | 80 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2267 | 8 | 326 | R4 | S | S | 50 | Golden Valley | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2268 | 8 | 327 | R4 | Unk | U | 80 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2269 | 8 | 327 | R5 | Unk | U | 80 | Minneapolis | MN | | | | | | No | Yes | B | 15 | In | No Trip | | | |
| 2270 | 8 | 328 | R4 | S | S | 14 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2271 | 8 | 328 | R5 | S | S | 14 | Plymouth | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2272 | 8 | 329 | R4 | S | U | 70 | Minneapolis | MN | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 2273 | 8 | 329 | R5 | S | U | 70 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2274 | 8 | 331 | B1 | M | S | 20 | Minnetonka | MN | 15 | 1 | Trip | | G | | No | | | | | | | |
| 2275 | 8 | 332 | R4 | M | S | 25 | Maplewood | MN | | | | | | | | B | 15 | In | Off | | | |
| 2276 | 8 | 333 | R4 | S | S | 21 | Brooklyn Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2277 | 8 | 334 | R4 | S | S | New | Robbinsdale | MN* | | | | | | | | B | 15 | In | Off | | | |
| 2278 | 8 | 334 | R5 | S | S | New | Robbinsdale | MN* | | | | | | | | G | 15 | Out | Off | | | |
| 2279 | 8 | 334 | R6 | S | S | New | Robbinsdale | MN* | | | | | | | | Kit | 15 | In | Off | | | |
| 2280 | 8 | 334 | R7 | S | S | New | Robbinsdale | MN* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2281 | 8 | 335 | R4 | S | S | Unk | Crystal | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2282 | 8 | 336 | R4 | M | S | 2 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2283 | 8 | 336 | R5 | M | S | 2 | Maple Grove | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2284 | 8 | 336 | R6 | M | S | 2 | Maple Grove | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2285 | 8 | 337 | R4 | S | S | 50 | Orno | MN | | | | | | | | B | 15 | In | Off | | | |
| 2286 | 8 | 338 | R4 | S | U | 100 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2287 | 8 | 338 | R5 | S | U | 100 | St. Paul | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2288 | 8 | 338 | R6 | S | U | 100 | St. Paul | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2289 | 8 | 338 | R7 | S | U | 100 | St. Paul | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2290 | 8 | 339 | R4 | S | S | 12 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2291 | 8 | 339 | R5 | S | S | 12 | Maple Grove | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2292 | 8 | 339 | R6 | S | S | 12 | Maple Grove | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2293 | 8 | 340 | R4 | S | S | 11 | Minnetonka | MN | | | | | | | | G | 15 | In | Off | | | |
| 2294 | 8 | 340 | R5 | S | S | 11 | Minnetonka | MN | | | | | | | | B | 15 | In | Off | | | |
| 2295 | 8 | 340 | R6 | S | S | 11 | Minnetonka | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2296 | 8 | 341 | R4 | S | S | 2 | Plymouth | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2297 | 8 | 341 | R5 | S | S | 2 | Plymouth | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2298 | 8 | 341 | R6 | S | S | 2 | Plymouth | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2299 | 8 | 341 | R7 | S | S | 2 | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2300 | 8 | 341 | R8 | S | S | 2 | Plymouth | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2301 | 8 | 341 | R9 | S | S | 2 | Plymouth | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2302 | 8 | 342 | R4 | S | S | 40 | New Hope | MN | | | | | | | | B | 15 | In | Off | | | |
| 2303 | 8 | 342 | R5 | S | S | 40 | New Hope | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2304 | 8 | 343 | R4 | S | S | 40 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2305 | 8 | 344 | R4 | S | U | 70 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2306 | 8 | 344 | R5 | S | U | 70 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2307 | 8 | 345 | R4 | M | S | 17 | Blaine | MN | | | | | | | | B | 15 | In | Off | | | |
| 2308 | 8 | 346 | R4 | S | R | 8 | Burns Township | MN | | | | | | | | B | 15 | In | Off | | | |
| 2309 | 8 | 346 | R5 | S | R | 8 | Burns Township | MN | | | | | | | | Base | 15 | Unk | Off | | | |
| 2310 | 8 | 346 | R6 | S | R | 8 | Burns Township | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2311 | 8 | 346 | R7 | S | R | 8 | Burns Township | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2312 | 8 | 347 | R4 | S | U | 70 | St. Paul | MN | | | | | | Yes | Yes | B | 15 | In | On | | | |
| 2313 | 8 | 348 | R4 | S | U | 23 | Chaska | MN | | | | | | | | B | 15 | In | Off | | | |
| 2314 | 8 | 348 | R5 | S | U | 23 | Chaska | MN | | | | | | | | B | 15 | In | Off | | | |
| 2315 | 8 | 349 | R4 | S | U | 52 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2316 | 8 | 350 | B1 | S | Unk | 25 | Maple Grove | MN | 40 | 2 | Trip | 1993 | Unk | | | | | | | | | |
| 2317 | 8 | 351 | R4 | S | U | 100 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2318 | 8 | 351 | R5 | S | U | 100 | St. Paul | MN | | | | | | | | Unk | 15 | In | Off | | | |
| 2319 | 8 | 353 | B1 | S | S | 12 | Shorewood | MN | 50 | 2 | Trip | Unk | Unk | | | | | | | | | |
| 2320 | 8 | 353 | R4 | S | S | 12 | Shorewood | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2321 | 8 | 353 | R5 | S | S | 12 | Shorewood | MN | | | | | | | | B | 15 | In | Off | | | |
| 2322 | 8 | 353 | R6 | S | S | 12 | Shorewood | MN | | | | | | | | B | 15 | In | Off | | | |
| 2323 | 8 | 353 | R7 | S | S | 12 | Shorewood | MN | | | | | | | | G | 15 | In | Off | | | |
| 2324 | 8 | 354 | R4 | S | U | 65 | Minneapolis | MN | | | | | | | | B | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2325 | 8 | 354 | R5 | S | U | 65 | Minneapolis | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2326 | 8 | 355 | R4 | S | U | 80 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2327 | 8 | 355 | R5 | S | U | 80 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2328 | 8 | 355 | R6 | S | U | 80 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2329 | 8 | 355 | R7 | S | U | 80 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2330 | 8 | 355 | R8 | S | U | 80 | Minneapolis | MN | | | | | | | | Kit | 15 | Unk | Off | | | |
| 2331 | 8 | 355 | R9 | S | U | 80 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2332 | 8 | 356 | R4 | S | U | 90 | Minneapolis | MN | | | | | | | No | Out | 15 | | No Trip | | | |
| 2333 | 8 | 356 | R5 | S | U | 90 | Minneapolis | MN | | | | | | | | G | 15 | Unk | Off | | | |
| 2334 | 8 | 356 | R6 | S | U | 90 | Minneapolis | MN | | | | | | | No | Out | 15 | | No Trip | | | |
| 2335 | 8 | 356 | R7 | S | U | 90 | Minneapolis | MN | | | | | | | No | B | 15 | Unk | No Trip | | | |
| 2336 | 8 | 356 | R8 | S | U | 90 | Minneapolis | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2337 | 8 | 356 | R9 | S | U | 90 | Minneapolis | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2338 | 8 | 357 | R4 | S | S | 50 | St. Paul | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2339 | 8 | 357 | R5 | S | S | 50 | St. Paul | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2340 | 8 | 357 | R6 | S | S | 50 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2341 | 8 | 358 | R4 | S | S | 48 | Mounds View | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2342 | 8 | 358 | R5 | S | S | 48 | Mounds View | MN | | | | | | Yes | Yes | B | 15 | Out | No Trip | | | |
| 2343 | 8 | 358 | R6 | S | S | 48 | Mounds View | MN | | | | | | | | B | 15 | In | Off | | | |
| 2344 | 8 | 359 | B1 | S | U | 15 | Minneapolis | MN | 15 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 2345 | 8 | 359 | B2 | S | U | 15 | Minneapolis | MN | 20 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 2346 | 8 | 359 | R4 | S | U | 15 | Minneapolis | MN | | | | | | | No | B | 15 | Out | No Trip | | | |
| 2347 | 8 | 360 | R4 | S | U | 11 | Coon Rapids | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2348 | 8 | 360 | R5 | S | U | 11 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2349 | 8 | 361 | R4 | S | U | 100 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2350 | 8 | 361 | R5 | S | U | 100 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2351 | 8 | 361 | R6 | S | U | 100 | Minneapolis | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2352 | 8 | 361 | R7 | S | U | 100 | Minneapolis | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2353 | 8 | 361 | R8 | S | U | 100 | Minneapolis | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2354 | 8 | 362 | R4 | S | U | 90 | Minneapolis | MN | | | | | | | | Out | 15 | | Off | | | |
| 2355 | 8 | 362 | R5 | S | U | 90 | Minneapolis | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2356 | 8 | 363 | R4 | Unk | S | Unk | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2357 | 8 | 364 | R4 | S | S | Unk | Plymouth | MN | | | | | | | | Out | 15 | | Off | | | |
| 2358 | 8 | 364 | R5 | S | S | Unk | Plymouth | MN | | | | | | | | Out | 15 | | Off | | | |
| 2359 | 8 | 364 | R6 | S | S | Unk | Plymouth | MN | | | | | | | | Out | 15 | | Off | | | |
| 2360 | 8 | 364 | R7 | S | S | Unk | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2361 | 8 | 364 | R8 | S | S | Unk | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2362 | 8 | 364 | R9 | S | S | Unk | Plymouth | MN | | | | | | | | G | 15 | In | Off | | | |
| 2363 | 8 | 365 | B1 | S | S | 10 | Plymouth | MN | 20 | Unk | Trip | 1990 | Unk | | | | | | | | | |
| 2364 | 8 | 365 | R4 | S | S | 10 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2365 | 8 | 365 | R5 | S | S | 10 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2366 | 8 | 366 | B1 | S | U | 10 | Belle Plaine | MN | 15 | 1 | Trip | Unk | G | | | | | | | | | |
| 2367 | 8 | 366 | R4 | S | U | 10 | Belle Plaine | MN | | | | | | | No | G | 15 | Out | No Trip | | | |
| 2368 | 8 | 367 | R4 | S | U | 80 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2369 | 8 | 367 | R5 | S | U | 80 | Minneapolis | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2370 | 8 | 368 | R4 | M | U | 40 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2371 | 8 | 369 | R4 | S | S | 44 | Ridfield | MN | | | | | | | | B | 15 | In | Off | | | |
| 2372 | 8 | 369 | R4 | S | R | 26 | St. Michael | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2373 | 8 | 369 | R5 | S | S | 44 | Ridfield | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2374 | 8 | 371 | R4 | S | S | 5 | Robbinsdale | MN | | | | | | | | B | 15 | In | Off | | | |
| 2375 | 8 | 371 | R5 | S | S | 5 | Robbinsdale | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2376 | 8 | 372 | R4 | S | S | 48 | Lino Lakes | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2377 | 8 | 372 | R5 | S | S | 48 | Lino Lakes | MN | | | | | | | | B | 15 | In | Off | | | |
| 2378 | 8 | 372 | R6 | S | S | 48 | Lino Lakes | MN | | | | | | | | Base | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2379 | 8 | 373 | R4 | S | U | 22 | Delano | MN | | | | | | | | B | 15 | In | Off | | | |
| 2380 | 8 | 374 | R4 | S | S | 48 | Crystal | MN | | | | | | | | B | 15 | In | Off | | | |
| 2381 | 8 | 375 | B1 | S | U | 100 | Princeton | MN | 15 | 1 | No Trip | Unk | G | | No | | | | | | | |
| 2382 | 8 | 376 | R4 | S | S | 22 | Maple Grove | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2383 | 8 | 376 | R5 | S | S | 22 | Maple Grove | MN | | | | | | | | Out | 15 | | Off | | | |
| 2384 | 8 | 377 | R4 | S | S | 43 | Crystal | MN | | | | | | | | B | 15 | In | Off | | | |
| 2385 | 8 | 392 | R4 | S | S | 11 | Eden Prairie | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2386 | 8 | 392 | R5 | S | S | 11 | Eden Prairie | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2387 | 8 | 392 | R6 | S | S | 11 | Eden Prairie | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2388 | 8 | 392 | R7 | S | S | 11 | Eden Prairie | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2389 | 8 | 392 | R8 | S | S | 11 | Eden Prairie | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2390 | 8 | 393 | R4 | Unk | U | 70 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2391 | 8 | 394 | R4 | S | S | 9 | Anclover | MN | | | | | | | No | Out | 15 | | No Trip | | | |
| 2392 | 8 | 394 | R5 | S | S | 9 | Anclover | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2393 | 8 | 394 | R6 | S | S | 9 | Anclover | MN | | | | | | | | B | 15 | Unk | Off | | | |
| 2394 | 8 | 394 | R7 | S | S | 9 | Anclover | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2395 | 8 | 394 | R8 | S | S | 9 | Anclover | MN | | | | | | | | Base | 15 | Unk | Unk | | | |
| 2396 | 8 | 395 | R4 | S | U | 59 | Unk | MN | | | | | | | | G | 20 | Out | Off | | | |
| 2397 | 8 | 395 | R5 | S | U | 59 | Unk | MN | | | | | | | | Out | 15 | | Off | | | |
| 2398 | 8 | 395 | R6 | S | U | 59 | Unk | MN | | | | | | | | B | 15 | In | Off | | | |
| 2399 | 8 | 395 | R7 | S | U | 59 | Unk | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2400 | 8 | 395 | R8 | S | U | 59 | Unk | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2401 | 8 | 396 | B1 | S | S | 5 | Shoreview | MN | 20 | 1 | Trip | 1995 | Unk | | | | | | | | | |
| 2402 | 8 | 396 | B2 | S | S | 5 | Shoreview | MN | 20 | 1 | Trip | 1995 | Unk | | | | | | | | | |
| 2403 | 8 | 396 | R4 | S | S | 5 | Shoreview | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2404 | 8 | 396 | R5 | S | S | 5 | Shoreview | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2405 | 8 | 396 | R6 | S | S | 5 | Shoreview | MN | | | | | | | | B | 15 | In | Off | | | |
| 2406 | 8 | 396 | R7 | S | S | 5 | Shoreview | MN | | | | | | | | B | 15 | In | Off | | | |
| 2407 | 8 | 396 | R8 | S | S | 5 | Shoreview | MN | | | | | | | | B | 15 | In | Off | | | |
| 2408 | 8 | 396 | R9 | S | S | 5 | Shoreview | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2409 | 8 | 398 | R4 | S | S | 12 | Eden Prairie | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2410 | 8 | 398 | R5 | S | S | 12 | Eden Prairie | MN | | | | | | | | B | 15 | In | Off | | | |
| 2411 | 8 | 399 | R4 | M | S | 7 | St. Paul | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2412 | 8 | 399 | R5 | M | S | 7 | St. Paul | MN | | | | | | | | B | 15 | In | Off | | | |
| 2413 | 8 | 402 | R4 | S | S | 12 | Farmington | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2414 | 8 | 402 | R5 | S | S | 12 | Farmington | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2415 | 8 | 402 | R6 | S | S | 12 | Farmington | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2416 | 8 | 402 | R7 | S | S | 12 | Farmington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2417 | 8 | 402 | R8 | S | S | 12 | Farmington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2418 | 8 | 403 | R4 | Unk | R | 13 | Victoria | MN | | | | | | | | B | 15 | In | Off | | | |
| 2419 | 8 | 403 | R5 | Unk | R | 13 | Victoria | MN | | | | | | | | B | 15 | In | Off | | | |
| 2420 | 8 | 403 | R6 | Unk | R | 13 | Victoria | MN | | | | | | | | G | 15 | In | Off | | | |
| 2421 | 8 | 403 | R7 | Unk | R | 13 | Victoria | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2422 | 8 | 403 | R8 | Unk | R | 13 | Victoria | MN | | | | | | | | B | 15 | In | Off | | | |
| 2423 | 8 | 403 | R9 | Unk | R | 13 | Victoria | MN | | | | | | | | B | 15 | In | Off | | | |
| 2424 | 8 | 404 | R4 | S | S | 9 | Bloomington | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2425 | 8 | 404 | R5 | S | S | 9 | Bloomington | MN | | | | | | | | Kit | 15 | Unk | Off | | | |
| 2426 | 8 | 404 | R6 | S | S | 9 | Bloomington | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2427 | 8 | 404 | R7 | S | S | 9 | Bloomington | MN | | | | | | | | G | 15 | In | Off | | | |
| 2428 | 8 | 404 | R8 | S | S | 9 | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2429 | 8 | 404 | R9 | S | S | 9 | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2430 | 8 | 405 | R4 | S | S | Unk | Chanhassen | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2431 | 8 | 405 | R5 | S | S | Unk | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2432 | 8 | 405 | R6 | S | S | Unk | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2433 | 8 | 406 | R4 | S | U | 70 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2434 | 8 | 406 | R5 | S | U | 70 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2435 | 8 | 406 | R6 | S | U | 70 | Minneapolis | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2436 | 8 | 406 | R7 | S | U | 70 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2437 | 8 | 407 | R4 | S | S | 14 | Minneapolis | MN | | | | | | | No | G | 15 | Out | No Trip | | | |
| 2438 | 8 | 407 | R5 | S | S | 14 | Minneapolis | MN | | | | | | | | G | 15 | In | Off | | | |
| 2439 | 8 | 407 | R6 | S | S | 14 | Minneapolis | MN | | | | | | | | B | 20 | In | Off | | | |
| 2440 | 8 | 407 | R7 | S | S | 14 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2441 | 8 | 408 | R4 | S | S | Unk | Bloomington | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2442 | 8 | 408 | R5 | S | S | Unk | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2443 | 8 | 408 | R6 | S | S | Unk | Bloomington | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2444 | 8 | 409 | B1 | S | S | 42 | Eding | MN | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 2445 | 8 | 409 | R4 | S | S | 42 | Eding | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2446 | 8 | 409 | R5 | S | S | 42 | Eding | MN | | | | | | Yes | Yes | Kit | 15 | Out | No Trip | | | |
| 2447 | 8 | 409 | R6 | S | S | 42 | Eding | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2448 | 8 | 409 | R7 | S | S | 42 | Eding | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2449 | 8 | 409 | R8 | S | S | 42 | Eding | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2450 | 8 | 409 | R9 | S | S | 42 | Eding | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2451 | 8 | 410 | R4 | S | S | 42 | Edina | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2452 | 8 | 410 | R5 | S | S | 42 | Edina | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2453 | 8 | 410 | R6 | S | S | 42 | Edina | MN | | | | | | Yes | Yes | B | 15 | In | No Trip | | | |
| 2454 | 8 | 410 | R7 | S | S | 42 | Edina | MN | | | | | | | | B | 15 | In | Off | | | |
| 2455 | 8 | 411 | R4 | S | S | 28 | Burnsville | MN | | | | | | | | B | 15 | In | Off | | | |
| 2456 | 8 | 411 | R5 | S | S | 28 | Burnsville | MN | | | | | | | | B | 15 | In | Off | | | |
| 2457 | 8 | 412 | R4 | S | S | 10 | Mound | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2458 | 8 | 412 | R5 | S | S | 10 | Mound | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2459 | 8 | 412 | R6 | S | S | 10 | Mound | MN | | | | | | | | B | 15 | In | Off | | | |
| 2460 | 8 | 412 | R7 | S | S | 10 | Mound | MN | | | | | | | | B | 15 | In | Off | | | |
| 2461 | 8 | 412 | R8 | S | S | 10 | Mound | MN | | | | | | | | B | 15 | In | Off | | | |
| 2462 | 8 | 412 | R9 | S | S | 10 | Mound | MN | | | | | | | | B | 15 | In | Off | | | |
| 2463 | 8 | 413 | R4 | S | S | 23 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2464 | 8 | 414 | R4 | S | R | 9 | Ramsey | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2465 | 8 | 414 | R5 | S | R | 9 | Ramsey | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2466 | 8 | 414 | R6 | S | R | 9 | Ramsey | MN | | | | | | | | B | 15 | In | Off | | | |
| 2467 | 8 | 414 | R7 | S | R | 9 | Ramsey | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2468 | 8 | 414 | R8 | S | R | 9 | Ramsey | MN | | | | | | | | B | 15 | In | Off | | | |
| 2469 | 8 | 415 | B1 | S | S | 6 | Maple Grove | MN | 20 | 1 | Trip | 1994 | | | | | | | | | | |
| 2470 | 8 | 415 | R4 | S | S | 6 | Maple Grove | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2471 | 8 | 415 | R5 | S | S | 6 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2472 | 8 | 416 | R4 | S | S | Unk | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2473 | 8 | 416 | R5 | S | S | Unk | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2474 | 8 | 417 | R4 | S | U | 43 | Minneapolis | MN | | | | | | | No | Out | 15 | | No Trip | | | |
| 2475 | 8 | 417 | R5 | S | U | 43 | Minneapolis | MN | | | | | | | | Out | 15 | | Off | | | |
| 2476 | 8 | 417 | R6 | S | U | 43 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2477 | 8 | 417 | R7 | S | U | 43 | Minneapolis | MN | | | | | | | | G | 15 | In | Off | | | |
| 2478 | 8 | 419 | B1 | S | S | 37 | Wayzata | MN | 15 | 1 | Trip | Unk | | | | | | | | | | |
| 2479 | 8 | 419 | R4 | S | S | 37 | Wayzata | MN | | | | | | | | Out | 15 | | Off | | | |
| 2480 | 8 | 419 | R5 | S | S | 37 | Wayzata | MN | | | | | | | | B | 15 | In | Off | | | |
| 2481 | 8 | 419 | R6 | S | S | 37 | Wayzata | MN | | | | | | | | B | 15 | In | Off | | | |
| 2482 | 8 | 419 | R7 | S | S | 37 | Wayzata | MN | | | | | | | | B | 15 | In | Off | | | |
| 2483 | 8 | 419 | R8 | S | S | 37 | Wayzata | MN | | | | | | | | Out | 15 | | No Trip | | | |
| 2484 | 8 | 420 | R4 | S | U | 50 | St. Louis Park | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2485 | 8 | 420 | R5 | S | U | 50 | St. Louis Park | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2486 | 8 | 420 | R6 | S | U | 50 | St. Louis Park | MN | | | | | | | | Base | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2487 | 8 | 420 | R7 | S | U | 50 | St. Louis Park | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2488 | 8 | 420 | R8 | S | U | 50 | St. Louis Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2489 | 8 | 420 | R9 | S | U | 50 | St. Louis Park | MN | | | | | | | | Out | 15 | | Off | | | |
| 2490 | 8 | 421 | R4 | S | S | 11 | Coon Rapids | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2491 | 8 | 421 | R5 | S | S | 11 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2492 | 8 | 422 | R4 | S | S | 15 | Minnetonka | MN | | | | | | | | B | 15 | In | Off | | | |
| 2493 | 8 | 422 | R5 | S | S | 15 | Minnetonka | MN | | | | | | | | B | 15 | In | Off | | | |
| 2494 | 8 | 422 | R6 | S | S | 15 | Minnetonka | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2495 | 8 | 423 | R4 | S | U | 7 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2496 | 8 | 423 | R5 | S | U | 7 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2497 | 8 | 423 | R6 | S | U | 7 | Minneapolis | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2498 | 8 | 423 | R7 | S | U | 7 | Minneapolis | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2499 | 8 | 424 | R4 | S | S | 11 | Coon Rapids | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2500 | 8 | 424 | R5 | S | S | 11 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2501 | 8 | 424 | R6 | S | S | 11 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2502 | 8 | 424 | R7 | S | S | 11 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2503 | 8 | 426 | B1 | S | S | 1 | Chaska | MN | 50 | 2 | Trip | 1999 | Base | | | | | | | | | |
| 2504 | 8 | 426 | B2 | S | S | 1 | Chaska | MN | 15 | 1 | Trip | 1999 | Base | | | | | | | | | |
| 2505 | 8 | 426 | R4 | S | S | 1 | Chaska | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2506 | 8 | 426 | R5 | S | S | 1 | Chaska | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2507 | 8 | 426 | R6 | S | S | 1 | Chaska | MN | | | | | | | | B | 15 | In | Off | | | |
| 2508 | 8 | 426 | R7 | S | S | 1 | Chaska | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2509 | 8 | 427 | R4 | S | S | 65 | Minnetonka | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2510 | 8 | 427 | R5 | S | S | 65 | Minnetonka | MN | | | | | | | | B | 15 | In | Off | | | |
| 2511 | 8 | 428 | R4 | S | U | 70 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2512 | 8 | 428 | R5 | S | U | 70 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2513 | 8 | 428 | R6 | S | U | 70 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2514 | 8 | 429 | R4 | S | S | 3 | Egan | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2515 | 8 | 429 | R5 | S | S | 3 | Egan | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2516 | 8 | 429 | R6 | S | S | 3 | Egan | MN | | | | | | | | B | 15 | In | Off | | | |
| 2517 | 8 | 429 | R7 | S | S | 3 | Egan | MN | | | | | | | | B | 15 | In | Off | | | |
| 2518 | 8 | 430 | R4 | S | S | 6 | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2519 | 8 | 430 | R5 | S | S | 6 | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2520 | 8 | 431 | R4 | S | S | 12 | Coon Rapids | MN | | | | | | | | B | 15 | In | Off | | | |
| 2521 | 8 | 433 | R4 | S | S | 42 | Exscelsior | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2522 | 8 | 433 | R5 | S | S | 42 | Exscelsior | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2523 | 8 | 434 | R4 | S | U | 51 | St. Paul | MN | | | | | | | No | G | 15 | Out | No Trip | | | |
| 2524 | 8 | 435 | B1 | S | S | 16 | Eden Prairie | MN | 15 | 1 | Trip | 1984 | U | | | | | | | | | |
| 2525 | 8 | 436 | R4 | S | S | 16 | Bloomington | MN | | | | | | | | B | 15 | In | Off | | | |
| 2526 | 8 | 436 | R5 | S | S | 16 | Bloomington | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2527 | 8 | 437 | R4 | S | S | 10 | Chanhassen | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2528 | 8 | 437 | R5 | S | S | 10 | Chanhassen | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2529 | 8 | 437 | R6 | S | S | 10 | Chanhassen | MN | | | | | | | | B | Unk | In | Off | | | |
| 2530 | 8 | 437 | R7 | S | S | 10 | Chanhassen | MN | | | | | | | | B | 15 | In | Off | | | |
| 2531 | 8 | 446 | R4 | S | U | 2 | Maple Grove | MN | | | | | | | | Out | 15 | | Off | | | |
| 2532 | 8 | 446 | R5 | S | U | 2 | Maple Grove | MN | | | | | | | | Out | 15 | | Off | | | |
| 2533 | 8 | 446 | R6 | S | U | 2 | Maple Grove | MN | | | | | | | | Out | 15 | | Off | | | |
| 2534 | 8 | 447 | R4 | S | S | 50 | Bloomington | MN | | | | | | | | Out | 15 | | Off | | | |
| 2535 | 8 | 448 | R4 | S | S | 20 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2536 | 8 | 449 | R4 | M | S | Unk | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2537 | 8 | 449 | R5 | M | S | Unk | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2538 | 8 | 449 | R6 | M | S | Unk | Plymouth | MN | | | | | | | | G | 15 | In | Off | | | |
| 2539 | 8 | 449 | R7 | M | S | Unk | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2540 | 8 | 450 | R4 | S | S | 41 | Crystal | MN | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2541 | 8 | 451 | R4 | S | S | 29 | Minnetonka | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2542 | 8 | 452 | R4 | M | S | 14 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2543 | 8 | 453 | R4 | M | S | 5 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2544 | 8 | 453 | R5 | M | S | 5 | Plymouth | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2545 | 8 | 453 | R6 | M | S | 5 | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2546 | 8 | 454 | R4 | S | S | 5 | Fridley | MN | | | | | | | | B | 15 | In | Off | | | |
| 2547 | 8 | 454 | R5 | S | S | 5 | Fridley | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2548 | 8 | 455 | R4 | S | S | 50 | St. Louis Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2549 | 8 | 455 | R5 | S | S | 50 | St. Louis Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2550 | 8 | 456 | B1 | S | S | 24 | Plymouth | MN | 15 | 1 | Trip | Unk | Base | | | | | | | | | |
| 2551 | 8 | 456 | R4 | M | S | 23 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2552 | 8 | 456 | R4 | S | S | 24 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2553 | 8 | 458 | R4 | S | S | 10 | Dayton | MN | | | | | | | | G | 15 | In | Off | | | |
| 2554 | 8 | 458 | R5 | S | S | 10 | Dayton | MN | | | | | | | | B | 15 | In | Off | | | |
| 2555 | 8 | 458 | R6 | S | S | 10 | Dayton | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2556 | 8 | 458 | R7 | S | S | 10 | Dayton | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2557 | 8 | 459 | R4 | M | S | 2 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2558 | 8 | 459 | R5 | M | S | 2 | Maple Grove | MN | | | | | | | | G | 15 | In | Off | | | |
| 2559 | 8 | 460 | R4 | S | S | 51 | Edina | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2560 | 8 | 461 | R4 | S | S | 44 | Crystal | MN | | | | | | | | B | 15 | In | Off | | | |
| 2561 | 8 | 462 | R4 | S | S | 10 | Lakeville | MN | | | | | | | | B | 15 | In | Off | | | |
| 2562 | 8 | 462 | R5 | S | S | 10 | Lakeville | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2563 | 8 | 462 | R6 | S | S | 10 | Lakeville | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2564 | 8 | 463 | R4 | S | S | 47 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2565 | 8 | 464 | B1 | S | U | 50 | Minneapolis | MN | 15 | 1 | Trip | 1994 | Base | | | | | | | | | |
| 2566 | 8 | 464 | R4 | S | U | 50 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2567 | 8 | 465 | R4 | S | S | 58 | St. Paul | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2568 | 8 | 465 | R5 | S | S | 58 | St. Paul | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2569 | 8 | 466 | B1 | S | S | 33 | Brooklyn Park | MN | 15 | 1 | Trip | Unk | G | | | | | | | | | |
| 2570 | 8 | 466 | R4 | S | S | 33 | Brooklyn Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2571 | 8 | 467 | R4 | S | S | 44 | Robinsdale | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2572 | 8 | 468 | R4 | S | S | 40 | Moundsview | MN | | | | | | | | B | 15 | In | Off | | | |
| 2573 | 8 | 469 | B1 | S | S | 19 | Maple Grove | MN | 15 | 1 | Unk | Unk | G | | | | | | | | | |
| 2574 | 8 | 470 | B1 | S | S | 41 | Richfield | MN | 15 | 1 | Trip | Unk | Base | | | | | | | | | |
| 2575 | 8 | 471 | B1 | S | S | 22 | Michael | MN | 15 | 1 | Trip | Unk | G | | | | | | | | | |
| 2576 | 8 | 471 | R4 | S | S | 22 | Michael | MN | | | | | | | | B | 15 | In | Off | | | |
| 2577 | 8 | 472 | R4 | S | S | 54 | Golden Valley | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2578 | 8 | 472 | R5 | S | S | 54 | Golden Valley | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2579 | 8 | 473 | R4 | S | S | 19 | Minnetonka | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2580 | 8 | 473 | R5 | S | S | 19 | Minnetonka | MN | | | | | | | | B | 15 | In | Off | | | |
| 2581 | 8 | 473 | R6 | S | S | 19 | Minnetonka | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2582 | 8 | 474 | R4 | S | S | 13 | Champline | MN | | | | | | | | B | 15 | In | Off | | | |
| 2583 | 8 | 474 | R5 | S | S | 13 | Champline | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2584 | 8 | 474 | R6 | S | S | 13 | Champline | MN | | | | | | | No | Kit | 15 | In | No Trip | | | |
| 2585 | 8 | 474 | R7 | S | S | 13 | Champline | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2586 | 8 | 475 | R4 | S | S | 15 | Lino Lakes | MN | | | | | | | | B | 15 | In | Off | | | |
| 2587 | 8 | 476 | R4 | S | S | 80 | Columbia Hts. | MN | | | | | | | | B | 15 | In | Off | | | |
| 2588 | 8 | 476 | R5 | S | S | 80 | Columbia Hts. | MN | | | | | | | | B | 15 | In | Off | | | |
| 2589 | 8 | 477 | B1 | S | S | 11 | Andover | MN | 15 | 1 | Unk | 1989 | Base | | | | | | | | | |
| 2590 | 8 | 477 | R4 | S | S | 11 | Andover | MN | | | | | | | | B | 15 | In | Off | | | |
| 2591 | 8 | 477 | R5 | S | S | 11 | Andover | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2592 | 8 | 478 | R4 | M | S | 16 | Woodbury | MN | | | | | | | | B | 15 | In | Off | | | |
| 2593 | 8 | 478 | R5 | M | S | 16 | Woodbury | MN | | | | | | | | G | 15 | In | Off | | | |
| 2594 | 8 | 480 | R4 | S | S | 14 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2595 | 8 | 481 | R4 | S | S | 14 | B Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2596 | 8 | 482 | R4 | S | S | 44 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2597 | 8 | 482 | R5 | S | S | 44 | Minneapolis | MN | | | | | | | No | Out | 15 | | No Trip | | | |
| 2598 | 8 | 483 | R4 | S | U | 80 | Minneapolis | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2599 | 8 | 483 | R5 | S | U | 80 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2600 | 8 | 484 | B1 | S | S | 13 | Eden Prairie | MN | 20 | 1 | No Trip | Unk | Base | | No | | | | | | | |
| 2601 | 8 | 484 | R4 | S | S | 13 | Eden Prairie | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2602 | 8 | 484 | R5 | S | S | 13 | Eden Prairie | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2603 | 8 | 484 | R6 | S | S | 13 | Eden Prairie | MN | | | | | | | | B | 15 | In | Off | | | |
| 2604 | 8 | 485 | R4 | S | S | 9 | Rogers | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2605 | 8 | 485 | R5 | S | S | 9 | Rogers | MN | | | | | | | | B | 15 | In | Off | | | |
| 2606 | 8 | 485 | R6 | S | S | 9 | Rogers | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2607 | 8 | 486 | R4 | S | U | 65 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2608 | 8 | 487 | R4 | S | S | 32 | Maple Grove | MN | | | | | | | | B | 15 | In | Off | | | |
| 2609 | 8 | 488 | R4 | S | S | 15 | Champlain | MN | | | | | | | | B | 15 | In | Off | | | |
| 2610 | 8 | 488 | R5 | S | S | 15 | Champlain | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2611 | 8 | 488 | R6 | S | S | 15 | Champlain | MN | | | | | | | | G | 15 | In | Off | | | |
| 2612 | 8 | 489 | R4 | S | S | 68 | Minneapolis | MN | | | | | | | | G | 15 | In | Off | | | |
| 2613 | 8 | 490 | R4 | S | S | 33 | Minnetonka | MN | | | | | | | | B | 20 | In | Off | | | |
| 2614 | 8 | 490 | R5 | S | S | 33 | Minnetonka | MN | | | | | | | | B | 20 | In | Off | | | |
| 2615 | 8 | 492 | R4 | S | S | 16 | Chaska | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2616 | 8 | 492 | R5 | S | S | 16 | Chaska | MN | | | | | | | | Out | 15 | | Off | | | |
| 2617 | 8 | 492 | R6 | S | S | 16 | Chaska | MN | | | | | | | | Out | 15 | | Off | | | |
| 2618 | 8 | 492 | R7 | S | S | 16 | Chaska | MN | | | | | | | | B | 15 | In | Off | | | |
| 2619 | 8 | 493 | R4 | Unk | S | 48 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2620 | 8 | 493 | R5 | Unk | S | 48 | Minneapolis | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2621 | 8 | 494 | R4 | Unk | S | 2 | Lake Elmo | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2622 | 8 | 494 | R5 | Unk | S | 2 | Lake Elmo | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2623 | 8 | 494 | R6 | Unk | S | 2 | Lake Elmo | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2624 | 8 | 494 | R7 | Unk | S | 2 | Lake Elmo | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2625 | 8 | 494 | R8 | Unk | S | 2 | Lake Elmo | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2626 | 8 | 494 | R9 | Unk | S | 2 | Lake Elmo | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2627 | 8 | 496 | B1 | S | S | Unk | Lino Lakes | MN | 15 | 1 | Trip | 1978 | U | | | | | | | | | |
| 2628 | 8 | 496 | B2 | S | S | Unk | Lino Lakes | MN | 15 | 1 | Trip | 1978 | U | | | | | | | | | |
| 2629 | 8 | 496 | R4 | S | S | Unk | Lino Lakes | MN | | | | | | | | B | 15 | In | Off | | | |
| 2630 | 8 | 497 | R4 | M | U | 49 | St. Louis Park | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2631 | 8 | 497 | R5 | M | U | 49 | St. Louis Park | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2632 | 8 | 497 | R6 | M | U | 49 | St. Louis Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2633 | 8 | 497 | R7 | M | U | 49 | St. Louis Park | MN | | | | | | | | B | 15 | In | Off | | | |
| 2634 | 8 | 498 | R4 | Unk | U | 75 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2635 | 8 | 498 | R5 | Unk | U | 75 | Minneapolis | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2636 | 8 | 498 | R6 | Unk | U | 75 | Minneapolis | MN | | | | | | | | G | 15 | In | Off | | | |
| 2637 | 8 | 498 | R7 | Unk | U | 75 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2638 | 8 | 500 | B1 | S | S | 38 | Apple Valley | MN | 50 | 2 | Trip | 1990 | Unk | | | | | | | | | |
| 2639 | 8 | 500 | B2 | S | S | 38 | Apple Valley | MN | 15 | 1 | Trip | Unk | Unk | | | | | | | | | |
| 2640 | 8 | 500 | R4 | S | S | 38 | Apple Valley | MN | | | | | | | | Out | 15 | | Off | | | |
| 2641 | 8 | 500 | R5 | S | S | 38 | Apple Valley | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2642 | 8 | 500 | R6 | S | S | 38 | Apple Valley | MN | | | | | | | | B | 15 | In | Off | | | |
| 2643 | 8 | 500 | R7 | S | S | 38 | Apple Valley | MN | | | | | | | | Base | 15 | In | Off | | | |
| 2644 | 8 | 500 | R8 | S | S | 38 | Apple Valley | MN | | | | | | | | Out | 15 | | Off | | | |
| 2645 | 8 | 500 | R9 | S | S | 38 | Apple Valley | MN | | | | | | | | B | 15 | In | Off | | | |
| 2646 | 8 | 1489 | R4 | Unk | S | New | Denver | CO* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2647 | 8 | 1489 | R5 | Unk | S | New | Denver | CO* | | | | | | | | Kit | 15 | In | Off | | | |
| 2648 | 8 | 1489 | R6 | Unk | S | New | Denver | CO* | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2649 | 8 | 1493 | R4 | S | S | 7 | Apple Valley | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2650 | 8 | 1493 | R5 | S | S | 7 | Apple Valley | MN | | | | | | | | Kit | 15 | Out | Off | | | |
| 2651 | 8 | 1493 | R6 | S | S | 7 | Apple Valley | MN | | | | | | | | B | 15 | In | Off | | | |
| 2652 | 8 | 1503 | R4 | M | S | Unk | Lakewood | CO | | | | | | | | B | 15 | In | Off | | | |
| 2653 | 8 | 1504 | R4 | S | S | Unk | Lakewood | CO | | | | | | | | B | 15 | In | Off | | | |
| 2654 | 8 | 1504 | R5 | S | S | Unk | Lakewood | CO | | | | | | | | B | 15 | In | Off | | | |
| 2655 | 8 | 1504 | R6 | S | S | Unk | Lakewood | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2656 | 8 | 1504 | R7 | S | S | Unk | Lakewood | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2657 | 8 | 1505 | R4 | S | S | 4 | Littleton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2658 | 8 | 1505 | R5 | S | S | 4 | Littleton | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2659 | 8 | 1505 | R6 | S | S | 4 | Littleton | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2660 | 8 | 1505 | R7 | S | S | 4 | Littleton | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2661 | 8 | 1505 | R8 | S | S | 4 | Littleton | CO | | | | | | | | Base | 15 | Out | Off | | | |
| 2662 | 8 | 1505 | R9 | S | S | 4 | Littleton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2663 | 8 | 1506 | R4 | S | R | 37 | Morrison | CO | | | | | | | | B | 15 | In | Off | | | |
| 2664 | 8 | 1506 | R5 | S | R | 37 | Morrison | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2665 | 8 | 1506 | R6 | S | R | 37 | Morrison | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2666 | 8 | 1507 | B1 | S | R | 15 | Brownfield | CO | 20 | 1 | No Trip | | Out | | No | | | | | | | |
| 2667 | 8 | 1507 | R4 | S | R | 15 | Brownfield | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2668 | 8 | 1507 | R5 | S | R | 15 | Brownfield | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2669 | 8 | 1507 | R6 | S | R | 15 | Brownfield | CO | | | | | | | | B | 15 | Out | Off | | | |
| 2670 | 8 | 1507 | R7 | S | R | 15 | Brownfield | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2671 | 8 | 1508 | B1 | S | S | 15 | Thornton | CO | 15 | 1 | No Trip | Unk | Out | | | | | | | | | |
| 2672 | 8 | 1508 | R4 | S | S | 15 | Thornton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2673 | 8 | 1509 | R4 | M | S | 14 | Denver | CO | | | | | | | | B | 15 | In | Off | | | |
| 2674 | 8 | 1512 | R4 | S | S | Unk | Littleton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2675 | 8 | 1512 | R5 | S | S | Unk | Littleton | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2676 | 8 | 1512 | R6 | S | S | Unk | Littleton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2677 | 8 | 1512 | R7 | S | S | Unk | Littleton | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2678 | 8 | 1544 | R4 | M | S | 15 | Aurora | CO | | | | | | | | Kit | 20 | Out | Off | | | |
| 2679 | 8 | 1544 | R5 | M | S | 15 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2680 | 8 | 1545 | R4 | S | S | New | Aurora | CO* | | | | | | | | Kit | 20 | Out | Off | | | |
| 2681 | 8 | 1545 | R5 | S | S | New | Aurora | CO* | | | | | | | | Kit | 20 | Out | Off | | | |
| 2682 | 8 | 1545 | R6 | S | S | New | Aurora | CO* | | | | | | | | B | 15 | In | Off | | | |
| 2683 | 8 | 1545 | R7 | S | S | New | Aurora | CO* | | | | | | | | G | 15 | In | Off | | | |
| 2684 | 8 | 1546 | R4 | S | U | Unk | Denver | CO | | | | | | | | Kit | 20 | Out | Off | | | |
| 2685 | 8 | 1546 | R5 | S | U | Unk | Denver | CO | | | | | | | | B | 15 | In | Off | | | |
| 2686 | 8 | 1546 | R6 | S | U | Unk | Denver | CO | | | | | | | | B | 15 | In | Off | | | |
| 2687 | 8 | 1547 | R4 | S | U | 88 | Unk | CO | | | | | | | | Kit | 20 | Out | Off | | | |
| 2688 | 8 | 1547 | R5 | S | U | 88 | Unk | CO | | | | | | | | Kit | 20 | Out | Off | | | |
| 2689 | 8 | 1547 | R6 | S | U | 88 | Unk | CO | | | | | | | | Kit | 20 | In | Off | | | |
| 2690 | 8 | 1547 | R7 | S | U | 88 | Unk | CO | | | | | | | No | B | 20 | In | No Trip | | | |
| 2691 | 8 | 1547 | R8 | S | U | 88 | Unk | CO | | | | | | | | B | 20 | In | Off | | | |
| 2692 | 8 | 1549 | B1 | S | S | 21 | Aurora | CO | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 2693 | 8 | 1549 | B2 | S | S | 21 | Aurora | CO | 20 | 1 | Trip | Unk | Base | | | | | | | | | |
| 2694 | 8 | 1549 | R4 | S | S | 21 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2695 | 8 | 1549 | R5 | S | S | 21 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2696 | 8 | 1549 | R6 | S | S | 21 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2697 | 8 | 1549 | R7 | S | S | 21 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2698 | 8 | 1549 | R8 | S | S | 21 | Aurora | CO | | | | | | | | G | 15 | In | Off | | | |
| 2699 | 8 | 1549 | R9 | S | S | 21 | Aurora | CO | | | | | | | | Out | 15 | | Off | | | |
| 2700 | 8 | 1550 | R4 | S | S | Unk | Aurora | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2701 | 8 | 1550 | R5 | S | S | Unk | Aurora | CO | | | | | | | | Out | 15 | | Off | | | |
| 2702 | 8 | 1550 | R6 | S | S | Unk | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2703 | 8 | 1550 | R7 | S | S | Unk | Aurora | CO | | | | | | | No | Kit | 15 | In | No Trip | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2704 | 8 | 1551 | R4 | S | S | 9 | Aurora | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2705 | 8 | 1551 | R5 | S | S | 9 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2706 | 8 | 1552 | B1 | S | R | 88 | Louviers | CO | 20 | 1 | Trip | Unk | Out | | | | | | | | | |
| 2707 | 8 | 1553 | R4 | S | S | Unk | Lakewood | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2708 | 8 | 1553 | R5 | S | S | Unk | Lakewood | CO | | | | | | | | B | 15 | In | Off | | | |
| 2709 | 8 | 1553 | R6 | S | S | Unk | Lakewood | CO | | | | | | | | B | 15 | Out | Off | | | |
| 2710 | 8 | 1553 | R7 | S | S | Unk | Lakewood | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2711 | 8 | 1554 | B1 | S | R | 20 | Elizabeth | CO | 15 | 1 | No Trip | Unk | Out | | No | | | | | | | |
| 2712 | 8 | 1555 | R4 | S | Unk | 7 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2713 | 8 | 1555 | R5 | S | Unk | 7 | Longmont | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2714 | 8 | 1555 | R6 | S | Unk | 7 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2715 | 8 | 1556 | R4 | S | S | 9 | Niwot | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2716 | 8 | 1556 | R5 | S | S | 9 | Niwot | CO | | | | | | No | Yes | B | 15 | In | On | | | |
| 2717 | 8 | 1556 | R6 | S | S | 9 | Niwot | CO | | | | | | | | B | 15 | In | Off | | | |
| 2718 | 8 | 1557 | R4 | M | Unk | Unk | Denver | CO | | | | | | | | B | 15 | In | Off | | | |
| 2719 | 8 | 1558 | R4 | S | S | 25 | Greeley | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2720 | 8 | 1558 | R5 | S | S | 25 | Greeley | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2721 | 8 | 1558 | R6 | S | S | 25 | Greeley | CO | | | | | | | | Out | 15 | | Off | | | |
| 2722 | 8 | 1559 | R4 | M | U | New | Denver | CO* | | | | | | | | B | 15 | In | Off | | | |
| 2723 | 8 | 1559 | R5 | M | U | New | Denver | CO* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2724 | 8 | 1559 | R6 | M | U | New | Denver | CO* | | | | | | | | Kit | 15 | Out | Off | | | |
| 2725 | 8 | 1560 | R4 | S | S | 14 | Littleton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2726 | 8 | 1561 | B1 | S | U | 68 | Denver | CO | 50 | 2 | Trip | Unk | Other | | | | | | | | | |
| 2727 | 8 | 1561 | R4 | S | U | 68 | Denver | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2728 | 8 | 1561 | R5 | S | S | 68 | Denver | CO | | | | | | | | Out | 15 | | Off | | | |
| 2729 | 8 | 1562 | B1 | S | S | 16 | Arvada | CO | 15 | 1 | Trip | 1984 | Out | | | | | | | | | |
| 2730 | 8 | 1563 | R4 | S | S | 90 | Denver | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2731 | 8 | 1564 | R4 | S | S | 45 | Denver | CO | | | | | | | | B | 15 | In | Off | | | |
| 2732 | 8 | 1564 | R5 | S | S | 45 | Denver | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2733 | 8 | 1565 | R4 | S | U | Unk | Denver | CO | | | | | | | | B | 15 | In | Off | | | |
| 2734 | 8 | 1587 | R4 | S | S | 20 | Littleton | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2735 | 8 | 1587 | R5 | S | S | 20 | Littleton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2736 | 8 | 1588 | R4 | M | S | 28 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2737 | 8 | 1594 | R4 | S | Unk | 18 | Lafayette | CO | | | | | | Yes | Yes | G | 15 | Out | No Trip | | | |
| 2738 | 8 | 1594 | R5 | S | Unk | 18 | Lafayette | CO | | | | | | | | B | 15 | In | Off | | | |
| 2739 | 8 | 1595 | B1 | S | Unk | 21 | Inglewood | CO | 15 | 2 | Trip | 1978 | Out | | | | | | | | | |
| 2740 | 8 | 1596 | B1 | S | R | 30 | Nederland | CO | 20 | 2 | Trip | Unk | Base | | | | | | | | | |
| 2741 | 8 | 1596 | B2 | S | R | 30 | Nederland | CO | 15 | 2 | Trip | Unk | Base | | | | | | | | | |
| 2742 | 8 | 1596 | R4 | S | R | 30 | Nederland | CO | | | | | | | | B | 15 | In | Off | | | |
| 2743 | 8 | 1596 | R5 | S | R | 30 | Nederland | CO | | | | | | | | B | 15 | In | Off | | | |
| 2744 | 8 | 1596 | R6 | S | R | 30 | Nederland | CO | | | | | | | | Other | 15 | In | Off | | | |
| 2745 | 8 | 1597 | R4 | S | S | 18 | Lafayette | CO | | | | | | | | B | 15 | In | Off | | | |
| 2746 | 8 | 1597 | R5 | S | S | 18 | Lafayette | CO | | | | | | | | B | 15 | In | Off | | | |
| 2747 | 8 | 1598 | R4 | S | U | 14 | Longmont | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2748 | 8 | 1598 | R5 | S | U | 14 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2749 | 8 | 1601 | R4 | M | S | 3 | Boulder | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2750 | 8 | 1601 | R5 | M | S | 3 | Boulder | CO | | | | | | | | G | 15 | In | Off | | | |
| 2751 | 8 | 1601 | R6 | M | S | 3 | Boulder | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2752 | 8 | 1601 | R7 | M | S | 3 | Boulder | CO | | | | | | | | B | 15 | In | Off | | | |
| 2753 | 8 | 1602 | R4 | S | S | 10 | Lakewood | CO | | | | | | | | Kit | 15 | Out | No Reset | | | |
| 2754 | 8 | 1602 | R5 | S | S | 10 | Lakewood | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2755 | 8 | 1602 | R6 | S | S | 10 | Lakewood | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2756 | 8 | 1602 | R7 | S | S | 10 | Lakewood | CO | | | | | | | | B | 15 | In | Off | | | |
| 2757 | 8 | 1602 | R8 | S | S | 10 | Lakewood | CO | | | | | | | | B | 15 | In | Off | | | |
| 2758 | 8 | 1607 | R4 | S | S | 3 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2759 | 8 | 1607 | R5 | S | S | 3 | Longmont | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2760 | 8 | 1607 | R6 | S | S | 3 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Miscellaneous Information | | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2761 | 8 | 1607 | R7 | S | S | 3 | Longmont | CO | | | | | | | | G | 15 | Out | Off | | | |
| 2762 | 8 | 1607 | R8 | S | S | 3 | Longmont | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2763 | 8 | 1616 | R4 | S | S | 6 | Erie | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2764 | 8 | 1616 | R5 | S | S | 6 | Erie | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2765 | 8 | 1616 | R6 | S | S | 6 | Erie | CO | | | | | | | | B | 15 | In | Off | | | |
| 2766 | 8 | 1622 | R4 | S | S | 13 | Broomfield | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2767 | 8 | 1622 | R5 | S | S | 13 | Broomfield | CO | | | | | | | | B | 15 | In | Off | | | |
| 2768 | 8 | 1624 | R4 | S | S | 33 | Boulder | CO | | | | | | | | B | 15 | In | Off | | | |
| 2769 | 8 | 2931 | B1 | S | S | 25 | Egan | MN | 20 | 1 | Trip | 1979 | Unk | | | | | | | | | |
| 2770 | 8 | 2931 | R4 | S | S | 25 | Egan | MN | | | | | | | | B | 15 | In | Off | | | |
| 2771 | 8 | 2931 | R5 | S | S | 25 | Egan | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2772 | 8 | 2932 | R4 | S | U | 75 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2773 | 8 | 2932 | R5 | S | U | 75 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2774 | 8 | 2932 | R6 | S | U | 75 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2775 | 8 | 2933 | R4 | S | S | 24 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2776 | 8 | 2934 | B1 | S | S | 16 | Plymouth | MN | 20 | 1 | Trip | Unk | G | | | | | | | | | |
| 2777 | 8 | 2934 | R4 | S | S | 16 | Plymouth | MN | | | | | | | | Out | 15 | | Off | | | |
| 2778 | 8 | 2934 | R5 | S | S | 16 | Plymouth | MN | | | | | | | | G | 15 | In | Off | | | |
| 2779 | 8 | 2934 | R6 | S | S | 16 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2780 | 8 | 2934 | R7 | S | S | 16 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2781 | 8 | 2935 | R4 | S | U | Unk | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2782 | 8 | 2935 | R5 | S | U | Unk | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2783 | 8 | 2935 | R6 | S | U | Unk | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2784 | 8 | 2935 | R7 | S | U | Unk | Minneapolis | MN | | | | | | | No | B | 15 | In | No Trip | | | |
| 2785 | 8 | 2936 | R4 | S | U | Unk | Minneapolis | MN | | | | | | | | Out | 15 | | Off | | | |
| 2786 | 8 | 2936 | R5 | S | U | Unk | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2787 | 8 | 2936 | R6 | S | U | Unk | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2788 | 8 | 2936 | R7 | S | U | Unk | Minneapolis | MN | | | | | | | | B | 15 | Out | Off | | | |
| 2789 | 8 | 2942 | R4 | S | Unk | 72 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2790 | 8 | 2942 | R5 | S | Unk | 72 | Minneapolis | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2791 | 8 | 2943 | R4 | S | S | 9 | Plymouth | MN | | | | | | | | B | 15 | In | Off | | | |
| 2792 | 8 | 2943 | R5 | S | S | 9 | Plymouth | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2793 | 8 | 2943 | R6 | S | S | 9 | Plymouth | MN | | | | | | | | Base | 15 | Out | Off | | | |
| 2794 | 8 | 2943 | R7 | S | S | 9 | Plymouth | MN | | | | | | | | Kit | 15 | In | Off | | | |
| 2795 | 8 | 2944 | R4 | S | U | 44 | Minneapolis | MN | | | | | | | | G | 15 | Out | Off | | | |
| 2796 | 8 | 2944 | R5 | S | U | 44 | Minneapolis | MN | | | | | | | | B | 15 | In | Off | | | |
| 2797 | 8 | 3667 | R4 | S | U | 2 | Highlands Ranch | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2798 | 8 | 3667 | R5 | S | U | 2 | Highlands Ranch | CO | | | | | | | | B | 15 | In | Off | | | |
| 2799 | 8 | 3667 | R6 | S | U | 2 | Highlands Ranch | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2800 | 8 | 3668 | R4 | S | U | 1 | Aurora | CO | | | | | | | | B | 15 | In | Off | | | |
| 2801 | 8 | 3668 | R5 | S | U | 1 | Aurora | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2802 | 8 | 3668 | R6 | S | U | 1 | Aurora | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2803 | 8 | 3668 | R7 | S | U | 1 | Aurora | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2804 | 8 | 3669 | R4 | S | R | 3 | Evergreen | CO | | | | | | | | G | 15 | In | Off | | | |
| 2805 | 8 | 3669 | R5 | S | R | 3 | Evergreen | CO | | | | | | | | B | 15 | In | Off | | | |
| 2806 | 8 | 3669 | R6 | S | R | 3 | Evergreen | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2807 | 8 | 3669 | R7 | S | R | 3 | Evergreen | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2808 | 8 | 3670 | R4 | S | U | 35 | Denver | CO | | | | | | | | B | Unk | In | Off | | | |
| 2809 | 8 | 3670 | R5 | S | U | 35 | Denver | CO | | | | | | | | B | Unk | In | Off | | | |
| 2810 | 8 | 3672 | R4 | S | U | 5 | Broomfield | CO | | | | | | | | G | 15 | In | Off | | | |
| 2811 | 8 | 3672 | R5 | S | U | 5 | Broomfield | CO | | | | | | | | B | 15 | In | Off | | | |
| 2812 | 8 | 3672 | R6 | S | U | 5 | Broomfield | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2813 | 8 | 3672 | R7 | S | U | 5 | Broomfield | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2814 | 8 | 3677 | R4 | S | R | 2 | Longmont | CO | | | | | | | | G | 15 | Out | Off | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | Miscellaneous Information | | | | | | | Circuit Breakers | | | | | Receptacles | | | | | | | | |
| 3 | Perm. | Control | GFCI | Property | Property | Approx. Age | City | State | Rating | Poles | Test | Date Installed | PanelBoard | Wiring | Samples | Location | Rating | Installed | Test | Weather | Cover | Cover |
| 4 | Number | Number | Type | Description | Location | of Bldg. | | | | | Results | Approx. | Location | Correct | Recovered | (GFCI) | | In | Results | Proof Cover | Damaged | Sealed |
| 2815 | 8 | 3677 | R5 | S | R | 2 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2816 | 8 | 3677 | R6 | S | R | 2 | Longmont | CO | | | | | | | | Base | 15 | Out | Off | | | |
| 2817 | 8 | 3677 | R7 | S | R | 2 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2818 | 8 | 3677 | R8 | S | R | 2 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2819 | 8 | 3677 | R9 | S | R | 2 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2820 | 8 | 3678 | R4 | S | S | 8 | Golden | CO | | | | | | | | Kit | 15 | Out | On | | | |
| 2821 | 8 | 3678 | R5 | S | S | 8 | Golden | CO | | | | | | | | B | 15 | In | Off | | | |
| 2822 | 8 | 3679 | R4 | S | R | 2 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2823 | 8 | 3679 | R5 | S | R | 2 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2824 | 8 | 3679 | R6 | S | R | 2 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2825 | 8 | 3679 | R7 | S | R | 2 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2826 | 8 | 3679 | R8 | S | R | 2 | Longmont | CO | | | | | | | | Base | 15 | Out | Off | | | |
| 2827 | 8 | 3679 | R9 | S | R | 2 | Longmont | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2828 | 8 | 3680 | B1 | S | R | 2 | Longmont | CO | Unk | Unk | Trip | 1998 | Base | | | | | | | | | |
| 2829 | 8 | 3680 | R4 | S | R | 2 | Longmont | CO | | | | | | | No | Out | 15 | | No Reset | | | |
| 2830 | 8 | 3680 | R5 | S | R | 2 | Longmont | CO | | | | | | | | Base | Unk | In | Off | | | |
| 2831 | 8 | 3688 | R4 | S | R | 2 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2832 | 8 | 3688 | R5 | S | R | 2 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2833 | 8 | 3688 | R6 | S | R | 2 | Longmont | CO | | | | | | | | Kit | 15 | In | Off | | | |
| 2834 | 8 | 3688 | R7 | S | R | 2 | Longmont | CO | | | | | | | | Kit | 15 | Out | Off | | | |
| 2835 | 8 | 3688 | R8 | S | R | 2 | Longmont | CO | | | | | | | | Base | 15 | In | Off | | | |
| 2836 | 8 | 3689 | R4 | S | S | 29 | Longmont | CO | | | | | | | | B | 15 | In | Off | | | |
| 2837 | 8 | 3690 | R4 | S | S | 30 | Evergreen | CO | | | | | | | | B | 15 | In | Off | | | |
| 2838 | 8 | 3690 | R5 | S | S | 30 | Evergreen | CO | | | | | | | | B | 15 | Out | Off | | | |
| 2839 | 8 | 3691 | R4 | S | S | 5 | Thornton | CO | | | | | | | | B | 15 | In | Off | | | |
| 2840 | 8 | 3691 | R5 | S | S | 5 | Thornton | CO | | | | | | | | Other | 15 | In | Off | | | |
| 2841 | 8 | 3691 | R6 | S | S | 5 | Thornton | CO | | | | | | | | B | 15 | Out | Off | | | |
| 2842 | 8 | 3691 | R7 | S | S | 5 | Thornton | CO | | | | | | | | Kit | Unk | In | Off | | | |
| 2843 | 8 | 3691 | R8 | S | S | 5 | Thornton | CO | | | | | | | | Kit | Unk | Out | Off | | | |
| 2844 | 8 | 3691 | R9 | S | S | 5 | Thornton | CO | | | | | | | | Base | Unk | In | Off | | | |
| 2845 | | | | | | | | | | | | | | | | | | | | | | |

## APPENDIX G - Column Codes for Appendix F

| Column | Title | Description | Information |
|---|---|---|---|
| A | Permutation Number | | |
| B | Control Number | Control Number (sample series) | x x x x |
| C | GFCI Type | Breaker or Receptacle | B1, B2, B3 or R4, R5, R6, R7, R8 etc. |
| D | Property Description | Property Description | Single family residential [S], Multi-family[M], Unknown [Unk] |
| E | Property Location | Property Location | Urban [U], Suburban [S], Rural [R], Unknown [Unk] |
| F | Bldg. Age | Approximate Age of Building | Leave blank if no data |
| G | City | | |
| H | State | | |
| I | Rating | Breaker Current Rating | 15, 20 |
| J | Poles | Number of Breaker Poles | 1, 2, Leave blank if no data |
| K | Test Results | Will the Breaker Trip? | [Trip], [No trip], [No Reset], Unknown [Unk] |
| L | Installed Date | Approximate Date of Installation | Leave blank if no data |
| M | PanelBoard Location | Location of the Panel Board | Basement [Base], Garage [G], Utility room [U], Outdoor [Out], Other [O], Unknown [Unk] |
| N | Wiring Correct | GFCI Receptacle Wiring Correct | Yes, No, Unknown [Unk], Leave blank if no data |
| O | Samples Recovered | Were the Samples Returned to Mfgr.? | Yes, No, Leave blank if no data |
| P | Location | Room Location of Receptacles | Basement/crawl [Base], Bathroom [B], Garage [G], Kitchen [Kit], Outdoor [Out], [Other], Unknown [Unk] |
| Q | Rating | Receptacle Current Rating | 15, 20 |
| R | Installed In | Receptacle Wall Installation | Interior Inside wall [In], Interior Outside wall [Out], Unknown [Unk], Blank if “Installed In” Outdoor |
| S | Test Results | Will the Receptacle Trip? | Tripped indicator OFF [Off], tripped indicator ON [On], [No trip], [No Reset], Unknown [Unk] |
| T | Weather Proof | Outdoor Weather Proof Cover Installed? | Yes, No, Leave blank if no data |
| U | Cover Damaged | Outdoor Weather Proof Cover Damaged? | Yes, No, Leave blank if no data |
| V | Cover Sealed | Outdoor Cover Properly Sealed/Caulked? | Yes, No, Leave blank if no data |

# SHOCK alert®

## DETECTS ELECTRICAL VOLTAGE GRADIENTS IN WATER

PROTECT YOUR FAMILY FROM DANGEROUS AND POTENTIALLY FATAL ELECTRICAL SHOCK

# OWNER'S MANUAL



SHOCK alert®

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Thank you for purchasing the Shock Alert® electrical voltage detection/warning system. Prior to using your device, read this manual carefully to understand how to properly operate your device. Failure to read this manual in its entirety could result in damage to the Shock Alert device or injury to your person. The serial number for your Shock Alert device may be found inside the battery compartment. Accurately record this number on Page 15 of this Product Manual in order to help us better serve you in the case of a service or warranty inquiry. **DO NOT DISCARD THIS MANUAL.** File your Product Manual with the recorded serial number in a safe place. This Shock Alert device is guaranteed against faulty materials or workmanship for a period of one year from date of purchase. Please see Page 15 for complete warranty information.

## INTRODUCTION:

Shock Alert is a device used to detect the presence of electrical voltage gradients in water that may be hazardous to a swimmer or a person coming into contact with that body of water. Electrical voltage could be the result of a number of things, including faulty electrical connection, frayed wire or improperly grounded wire on a light, boat, fountain, pump, dock, etc. Ground fault circuit interrupters (GFCI) and other electric safety equipment can become impaired or fail and may not protect against electricity present in water. When a swimmer is in or enters into electrified water, the electricity present will typically take the path of least electrical resistance- through the swimmer's body. If the voltage differential is sufficiently high, the current flowing through the swimmer's body can electrocute the swimmer and could result in temporary paralysis and the inability to swim. This phenomenon is known as Electric Shock Drowning (ESD). Each year, in the United States there are reported cases of electrical shock in water, several which lead to death or serious injury. Unfortunately many of these incidents are incorrectly recorded as a drowning rather than an Electric Shock Drowning.

Shock Alert has three probes on the base of the device designed to detect this potentially dangerous voltage gradient(s) in water. It provides a visual and audible alert to the existence of potentially hazardous voltage conditions in the body of water. Note that Shock Alert is a sensitive detection device that will detect small voltage gradients in water. Shock Alert can be used in fresh or chlorinated water. It may also be used in salt water pools. Shock Alert will detect voltage gradients in concrete, gunite and vinyl lined pools. **DUE TO THE INSULATING EFFECTS, SHOCK ALERT IS NOT FOR USE IN FIBERGLASS POOLS AND HOT TUBS.**

## BEFORE YOU BEGIN:

Immediately upon receiving your Shock Alert device, carefully unpack and check the carton contents to ensure that all parts are present and in good condition. Carefully inspect the device according to Shock Alert device image (Page 4).

Every care is taken in the choice of packing material to ensure that your device will reach you in perfect condition. If the device has been subject to excessive handling in transit, there may be visible external damage to the shipping carton. Notify the shipper immediately and retain packing material for inspection if any parts appear damaged or the carton itself shows signs of mishandling. Save the carton and all packing materials. In the event that the device must be returned to the factory, it is important that the device be returned in the original factory box. Please see parts list (Page 4) for box contents.

## PARTS LIST:

1. Shock Alert Device (1)
2. 12ft. Rope Tether (1)

NOTE: Three (3) AA batteries are required for operation of this device. Batteries are NOT included.



### WARNING

**Electricity is used to perform many useful functions, but it can also cause personal injuries and property damage. This product has been engineered and manufactured with the highest priority on safety. To ensure your safety and prolong the service life of your Shock Alert please read the following precautions carefully before using the device. Improper use can prevent voltage detection in water.**

- If you have any doubts about your ability to properly operate this device, do not attempt use.
- To avoid possible personal injury, carefully read and follow all guidelines as noted in this Product Manual.
- Use Shock Alert only as specified in this manual or the detection provided might be impaired.
- Shock Alert detects only AC voltage. Device is to be used only in water.
- This device is designed to detect electrical voltage gradients in water. It is not designed to detect any other dangerous condition.
- This device is designed to detect electrical voltage gradients in water. It is not designed to, and will not, absorb electrical voltage from the water.
- Shock Alert will NOT detect the presence of voltage in water held in a fiberglass structure (ie: fiberglass pool, fiberglass hot tub, etc.)
- Never swim near or in a marina.
- Keep Shock Alert device out of reach of children. This device is not a toy. Children under the age of sixteen (16) years should not operate this device.
- Use only AA batteries to power the Shock Alert.
- Keep batteries out of reach of children. In the event a battery is swallowed, immediately contact your poison control center, your physician, or the National Battery Ingestion Hotline at (202) 625-3333 as serious injury may occur.



- Assure top of Shock Alert device is fully visible and not covered with debris.
- Assure door of battery compartment is secured before operating Shock Alert (See Getting Started, Page 7-8).
- Assure red and green indicator lights are visible during start-up self-test (See Operation Instructions, Page 9-12).
- Assure you hear audible alarm during start-up self-test.
- If this device ever fails to test properly, replace it immediately. Products under warranty may be returned to the manufacturer for replacement. See Limited Warranty (Page 15) for additional details.
- **Power on all sources of electricity to the pool or dock prior to using Shock Alert** (See Getting Started, Page 7-8).
- Do not work alone when operating device.
- Prior to each use, assure device is not indicating low battery. See Troubleshooting (Page 13) to avoid false readings which could lead to possible electric shock or personal injury.
- Replace the battery as soon as the battery indicator begins to chirp.
- Prior to each use, inspect silver metal probes on bottom of unit to assure they are not contaminated. See Proper Care and Maintenance (Page 14) for cleaning instructions.
- Use only the rope tether provided.
- Do not use the tether for anything other than pulling the Shock Alert device through water.
- Strangulation hazard; practice caution when using tether.
- Avoid dropping the Shock Alert device. Dropping the device, especially on a hard surface, can potentially cause damage.
- If device is dropped on hard surface assure it is still functioning. If device is showing a green LED light, turn off device and re-start to conduct self-test.
- **Assure the device is turned on prior to placing it into the water (See Operation Instructions, Page 9-12).**
- Use caution when placing the device into the water. Use extreme caution if retrieving a device which is indicating voltage in water.
- Shock Alert must be floating in water to operate effectively. Assure nothing is obstructing metal probes on the bottom of device.
- Use caution so you do not come in contact with or fall into the water during the process of operating this device.
- This device will only indicate the presence of electrical voltage gradients at the sensor. **Electrical voltage may be present in other areas of the water.**
- **Measure all accessible water locations to assure no presence of voltage. Due to obstructions or natural flow of electricity in the water, measuring multiple locations is required.**
- Any area of a body of water will need to be measured with the Shock Alert device to assure no voltage is present prior to a swimmer entering that area. The swimmer should not enter areas not previously measured by Shock Alert.
- **Device only indicates when voltage is present in the water at that moment and does NOT tell you if voltage enters the water at a later time when the device is not in the water and not powered on.**
- An individual diving into or swimming below the surface of water may encounter an area of energized water, despite the Shock Alert floating on the surface indicating no voltage present.
- Shock Alert may not detect voltage in highly contaminated water.
- Metal objects such as ladders, railings and dock frames could be electrified. The Shock Alert will NOT detect the presence of voltage on metal objects unless those metal objects are in direct contact with the water.

- Caution should be taken to verify metal structures or objects not in contact with the water are not electrified and are properly grounded and bonded.
- Do not place ear up to grill where audible alert is located.
- Do not look directly at flashing LED lights for a prolonged period of time.
- Do not poke objects into the grill area covering the audible alarm.
- The Shock Alert device is equipped with both visual and audible indicators, however this device is NOT recommended for use by individuals that are sight or hearing impaired.
- Activation of the alarm on this device indicates the presence of electrical voltage, which can kill you. When the alarm sounds, you must not ignore it.
- Do not disregard visual and audible warnings. The Shock Alert measures voltage in the water that may not be felt by the human body. In addition, the Shock Alert device measures voltage that may be some distance away from a swimmer; in this case the effect may not be felt until that person swims in to the electrified area.
- If the alarm on this device sounds while it is in water, DO NOT enter the water. Contact a trained electrical professional immediately to address the problem.
- Do not use Shock Alert if it operates abnormally, as device detection capabilities may be impaired.
- Do not enter water until the instructions outlined in Before You Begin (Page 3), Getting Started (Page 7-8) and Operation Instructions (Page 9-12) have been completed.
- Electrical gradients in water can create risks of electrocution and Electric Shock Drowning if an individual enters water in which a sufficiently strong voltage gradient is present.
- This device does not protect against electrical shock to persons already in the water at the time of voltage detection or at the time voltage is introduced to the body of water.
- Do not use Shock Alert if voltage is known to be greater than 120V AC.
- **Do not leave Shock Alert in water for long periods. Remove device from water after use.**
- Do not disassemble or otherwise attempt to change the form of the Shock Alert device.
- Do not paint the Shock Alert device. This can prevent proper operation.
- Do not place Shock Alert device on or near a heat source.
- Do not attempt to dry the Shock Alert device in a microwave.
- Do not use harsh chemicals or cleaning solvents, insect sprays, or sunscreen on or near this device. Doing so may cause permanent damage.
- This device is not a suitable substitute for frequent electrical inspections by a trained professional.
- Follow all requirements outlined in the National Electrical Code.
- Routine inspection of GFCI devices is recommended.
- This device is not a substitute for regular electrical maintenance.
- Never attempt to introduce voltage into water to test the device operation or for any reason.
- Do not attempt to operate the device while under the influence of alcohol or drugs.
- Do not completely submerge the device for prolonged periods of time.
- Do not use device as a water toy.
- The Shock Alert is not intended for use as a life preserver. Do not use it as a flotation or rescue device.
- Do not use the Shock Alert as a weapon.



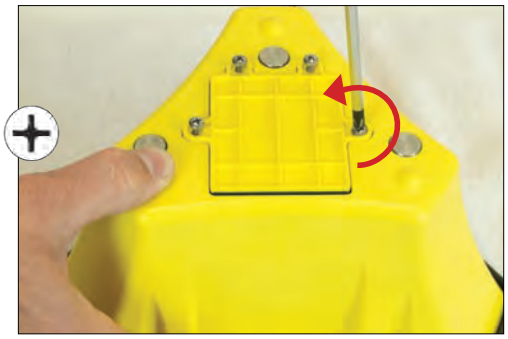
## GETTING STARTED:

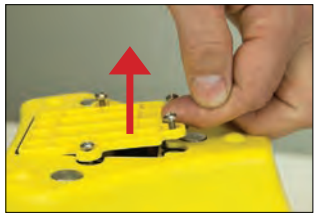
NOTE: To conserve battery life the device must be shut off when not in use.

### Battery Installation

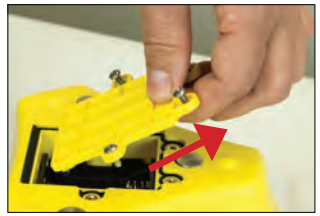
Shock Alert requires three (3) AA batteries (not included).

1. Place Shock Alert device on its side.
2. Using a cross tip screwdriver, remove the battery cover by turning each screw counterclockwise.
3. Carefully remove battery cover/ screws by pulling forward. Place cover/screws to the side. DO NOT DISCARD COVER AND SCREWS.







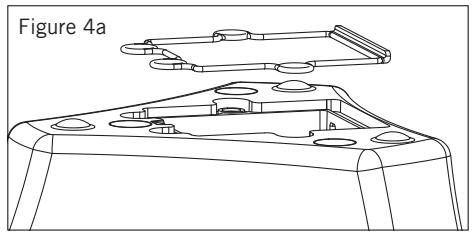


4. Insert three (3) AA batteries following the correct polarity (+/-) shown on the black battery compartment. Follow instructions on the battery packaging.

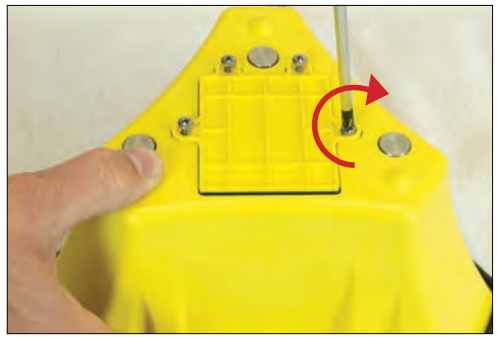


NOTE: If the black outer seal becomes unseated during battery installation return it to the appropriate position (see figure 4a) prior to replacing battery cover.

Figure 4a



5. Replace cover by inserting the bottom of the cover into the housing and rotating forward.
6. Insert a screw into each location and tighten until each is snug. Go back to the first screw and turn until tight (approximately another 1/4 turn of the screw).
7. Turn unit upright and continue to Operation Instructions (Page 9-12).



## Battery Warning

- Do not ingest the batteries.
- Battery is to be inserted with correct polarity. Failure to insert batteries in the correct polarity as indicated in the battery compartment may result in a failure of the Shock Alert device to function properly.
- Do not mix old and new batteries. Install only new batteries of the same type.
- Exhausted battery is to be removed immediately from device.
- Use only AA batteries.
- Do not take the battery apart, do not heat the battery, do not throw the battery into a fire.
- Keep batteries away from children and pets.
- When not using the device for an extended period of time, remove the batteries and store in a cool dry place at room temperature.

## Battery Disposal

Please always dispose of batteries at a suitable recycling point. Batteries should be recycled or disposed of as per provincial and local guidelines.

## Attaching Tether

Use the loop on either end of the provided 12' tether to attach the tether to the opening on the Shock Alert device. See images below.





**WARNING**

**Strangulation hazard. Keep tether out of the reach of children. Tether may become tangled around throat and prevent breathing.**

## Preparing the Area

**WARNING**

**Power on all sources of electricity to the pool or dock prior to using Shock Alert. (See Note Page 10)**

It is imperative to turn on any and all power in the area surrounding the pool, dock PRIOR to placing the Shock Alert device in the water.

Turn on and/or plug in all filters, pumps, motors, lights, etc.



# OPERATION INSTRUCTIONS:

**NOTE - TURNING ON SHOCK ALERT: Be aware that immediately after the Shock Alert device is powered on it will begin to flash and beep. This is called the "self-test" mode. Self-test is assuring the device is functioning and the current batteries have sufficient power to operate the device.**

**WARNING**

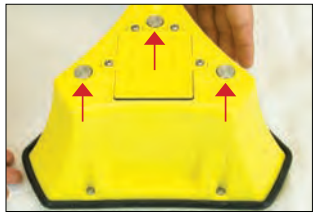
**Do not turn on Shock Alert while the device is floating in the water. Self-Test must be completed prior to being placed in the water.**

## Powering On the Device



Hold Shock Alert or place on a flat surface without touching the silver measurement probes on the bottom of the device. Press once on the circular black button located at the top center of the Shock Alert. You will feel a discernible click indicating the device has been powered on. Immediately after powering on, the device will go into self-test mode.

## Self-Test Mode



After the Shock Alert device is powered on it will begin to flash and beep. This is called the self-test mode. Self-test is assuring the device is functioning and the current batteries have sufficient voltage to operate the device. **NOTE: If you are holding the device during self-test mode it is recommended that you do not touch the silver probes on the bottom of the unit. There are no safety issues associated with touching the silver probes; however, not touching the probes during self-test will allow the device to perform the test more accurately. Do not place Shock Alert in the water until Self-Test is completed.**



Self-test mode will last for approximately five (5) seconds. During this time the Shock Alert will flash green and red LED lights and will produce an audible beeping sound. Once the self-test is complete the device will display green flashing LED's.

NOTE: If the device does not display flashing LED's following self-check mode the device is not on, the device failed the self-test, or the batteries need to be replaced.

NOTE: If the device flashes a red LED and is producing an audible beeping sound following self-check mode, there may be electrical interference in the area. Using the tether to place the Shock Alert in the water will eliminate this interference and the device will begin to flash green. If the device continues to flash red LED light and is producing an audible beeping sound once placed in the water, the water contains electrical voltage. Refer to Locating Voltage Source (Page 11).

## Water Testing

**WARNING**

**Use extreme caution and avoid contact with water when operating the device.**

**NOTE: Power on all sources of electricity to the pool or dock prior to using Shock Alert.**



Using the provided rope tether, lower the Shock Alert into the water. The device will flash a green LED if there is no voltage present around the sensor. NOTE: If the device immediately flashes red and then switches to green, no voltage is present at the device location.

Using the provided rope tether, **slowly pull the Shock Alert around the perimeter of the pool, dock, fountain, etc.** Focus carefully on areas surrounding under water lights, ladders, boat lifts, etc. **Note that Shock Alert will only detect voltage in the area surrounding the probes. It is necessary to test all areas around the pool, dock, etc.** Detection distance will vary due to amount of voltage in the water, conductivity of the water, depth of the water, pool/dock configuration, etc**. Take care to move the device to all areas of the water.** If the device continues to flash green, there is no voltage present.

If the Shock Alert begins to flash red and produce an audible beeping sound as you pull it around the perimeter, you have entered an area where voltage is present in the water. Note that Shock Alert is a sensitive detection device that will detect small voltage gradients in water. As the voltage gradient in the water increases, the red flashes and beeps will become more frequent. This may provide an aid in locating the voltage source.





## What To Do When Shock Alert Detects Voltage

**WARNING**

**Voltage in water is a dangerous and potentially life threatening situation. When the Shock Alert device sounds and flashes red, exercise extreme caution. Do not come in to contact with water or objects near water (ladders, railings, dock frames, lights, etc.).**

If the Shock Alert device detects voltage in water, carefully follow the steps outlined below.

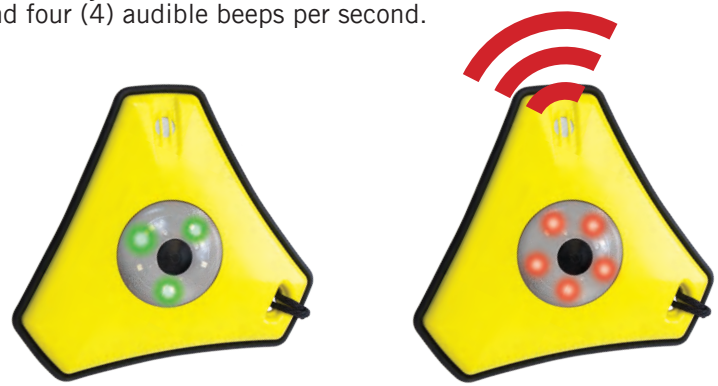
1. Do not panic.
2. Do not come into contact with water or objects in or near water.
3. If possible turn off power to the area. It is important that you are aware of power shut off areas surrounding your pool, dock, marina, etc.
4. If a person or animal is in the water call 911 immediately for emergency assistance. Do not attempt to enter water.
5. Contact a Certified Electrician.

## Locating Voltage Source

**WARNING**

**Use extreme caution and avoid contact with water when attempting to locate a voltage source. Contact a Certified Electrician immediately if voltage is detected in water.**

Continue to use the rope tether to pull the Shock Alert device around the perimeter of the pool, dock, fountain, etc. As you move closer in proximity to the source of electricity, the number of red flashes and audible beeping sounds will increase until they reach the maximum number of indicators: Four (4) red LED flashes and four (4) audible beeps per second.



Example: You place the Shock Alert device into the body of water and the device flashes green twice every two seconds. This indicates there is no voltage present around the sensor. As you begin to pull the device around the perimeter, the device produces one (1) red flash and one (1) audible beep per second. This indicates you have begun to enter a space where voltage is present. As you continue to pull the device around the perimeter, the red flashes and audible beeps increase to two (2) per second, then to three (3) per second. This indicates that the voltage level in the water is increasing. When you reach four (4) red flashes and four (4) audible beeps per second, you have reached the maximum amount of indicators. In some cases, this method will assist in locating the source of fault in a body of water.

## DEVICE INDICATORS:

| Visible/Audible Indicator | Battery | Voltage Detection |
|---|---|---|
| 2 green flashes every 2 seconds | Battery Good | No Voltage Detected |
| 1 green flash per second,<br>2 beeps per 4 seconds | **Battery Not Good** | No Voltage Detected |

| Visible/Audible Indicator | Battery | Voltage Detection |
|---|---|---|
| 1 red flash per second,<br>1 beep per second | Battery Good | **Level 1 Voltage Detected- 20mV/Foot** |
| 2 red flashes per second,<br>2 beeps per second | Battery Good | **Level 2 Voltage Detected- 42mV/Foot** |
| 3 red flashes per second,<br>3 beeps per second | Battery Good | **Level 3 Voltage Detected- 91mV/Foot** |
| 4 red flashes per second,<br>4 beeps per second | Battery Good | **Level 4 Voltage Detected- 200mV/Foot** |
| 4 red flashes per second,<br>2 beeps per second | **Battery Not Good** | **Voltage Detected** |

## UPON COMPLETION OF WATER TESTING:

Press once on circular black button located at the top center of the Shock Alert to turn off the device when not in use. This is to preserve battery life. Do not leave the Shock Alert device in water for extended periods. Remove device from water following use. **If voltage is detected in water, carefully remove Shock Alert from water using the provided tether. Do not reach into water to retrieve device.**

## DEVICE SPECIFICATIONS:

| | |
|---|---|
| Size (HxWxL) | 5.25 in x 8.5 in x 9.5 in<br>(13.3 cm x 21.6 cm x 24 cm) |
| Weight | 1.9 lbs (862 grams) |
| Battery Type | Three (3) AA Batteries (Batteries Not Included) |
| Max Electricity Withstand in Water | 120V AC (Measurement Category II) |
| UL Listing | UL 61010-1,3rd Edition;<br>CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition |

## TROUBLESHOOTING:

**WARNING**

**If the Shock Alert device is not functioning properly, DO NOT attempt use. The ability of the device to detect voltage in water may be compromised.**

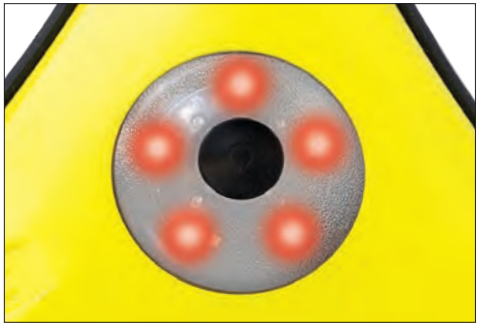
If the Shock Alert device will not turn on, replace all three (3) AA batteries (See Getting Started, Page 7-8).

If the Shock Alert device is not functioning properly, check for low battery signals:

| Visible/Audible Indicator | Battery | Voltage Detection |
|---|---|---|
| 1 green flash per second,<br>2 beeps per 4 seconds | **Battery Not Good** | No Voltage Detected |
| 4 red flashes per second,<br>2 beeps per second | **Battery Not Good** | **Voltage Detected** |

If device is indicating low battery, replace all three (3) AA batteries (See Getting Started, Page 7-8).





After all three (3) AA batteries have been replaced per the instructions in Getting Started (Page 7-8) and the Shock Alert device continues to not function properly, DO NOT ATTEMPT TO USE DEVICE. DO NOT ATTEMPT TO DISASSEMBLE OR ALTER the device; doing so could result in personal injury, and will void the limited warranty (See Limited Warranty, Page 15). Contact manufacturer immediately at 1-844-667-4625 or customerservice@shockalert.com. Products under warranty may be returned to the manufacturer for replacement. See Limited Warranty (Page 15) for full warranty details.

## PROPER CARE AND MAINTENANCE:

Dirt or debris on probes can affect the Shock Alert device's ability to make proper readings. Periodically clean the Shock Alert device and metal probes on the bottom by wiping with a dry cloth or a damp cloth with mild detergent. Do not use harsh chemicals, abrasives or solvents. Using these materials may damage the device and result in improper readings.

When not using the device for an extended period of time, remove the batteries and store in a cool dry place at room temperature.





## LIMITED WARRANTY OF MANUFACTURER:

**SHOCK ALERT® LLC PRODUCTS ARE WARRANTED AGAINST DEFECTIVE MATERIALS OR WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM DATE OF PURCHASE.** Any part returned to us within this warranty period showing defects in material or workmanship will be renewed or replaced F.O.B. factory without charge. **WE LIMIT THE DURATION AND REMEDIES OF ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE TO THE DURATION OF THIS EXPRESS LIMITED WARRANTY. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.** This warranty, which is given expressly and in lieu of all other expressed warranties, constitutes the only warranty made by the Company. This limited warranty does not cover any damage due to: (a) transportation; (b) storage; (c) improper use; (d) failure to follow the product instructions or to perform any preventive maintenance; (e) modifications; (f) unauthorized repair; (g) normal wear and tear; or (h) external causes such as accidents, abuse, or other actions or events beyond our reasonable control. **THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.** In order to obtain warranty service, you must call the Company's service department at 1-844-NO-SHOCK (1-844-667-4625) within one year from the date of purchase.

**THE LIABILITY OF THE COMPANY IS LIMITED TO THE REPAIR OR REPLACEMENT OF THE DEFECTIVE PARTS. IN NO CASE WILL THE COMPANY BE LIABLE FOR DAMAGE OR LOSS INCURRED BECAUSE OF INTERRUPTION OF SERVICE OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, LABOR, OR EXPENSE REQUIRED TO REPAIR OR REPLACE DEFECTIVE UNITS.** Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

**NOTE: WARRANTY IS VOID IF THE TOP COVER OF THE DEVICE HAS BEEN REMOVED.**

**RECORD DEVICE SERIAL NUMBER:**

_____

The serial number for your shock alert device may be found inside the battery compartment.

US Patents: 9,285,396 8,643,360 8,686,713 and additional patents pending.

**Distributed By:**
Shock Alert® LLC
50 N. Central Drive
O'Fallon, MO 63366

**Phone:** 1-844-NO-SHOCK (1-844-667-4625)
**Direct General Inquiries To:** customerservice@shockalert.com
**Direct Technical Inquiries To:** support@shockalert.com

www.shockalert.com

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TESTING EQUIPMENT
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# WHAT IS SHOCK ALERT?

Shock Alert® is a device used to detect the presence of electrical voltage gradients in water that may be hazardous to a swimmer or a person coming into contact with that body of water. Electrical voltage could be the result of a number of things, including faulty electrical connection, frayed wire or improperly grounded wire on a light, boat, fountain, pump, dock, etc. Ground fault circuit interrupters (GFCI) and other electric safety equipment can become impaired or fail and may not protect against electricity present in water. When a swimmer is in or enters into electrified water, the electricity present will typically take the path of least electrical resistance - through the swimmer's body. If the voltage differential is sufficiently high, the current flowing through the swimmer's body can electrocute the swimmer and could result in temporary paralysis and the inability to swim.

Shock Alert has three probes on the base of the device designed to detect this potentially dangerous voltage gradient(s) in water. It provides a visual and audible alert to the existence of potentially hazardous voltage conditions in the body of water. Shock Alert can be used in fresh or chlorinated water. It may also be used in salt water pools. Shock Alert will detect voltage gradients in concrete, gunite and vinyl lined pools. **DUE TO THE INSULATING EFFECTS, SHOCK ALERT IS NOT FOR USE IN FIBERGLASS POOLS AND FIBERGLASS HOT TUBS.**

## PREVENT ELECTRIC SHOCK DROWNING

1. Upgrade your pool or dock to current electrical code requirements
2. Have pools or docks inspected
3. Leave all the electrical work to the professionals
4. Never swim in or near a marina
5. Use Shock Alert in all bodies of water before entry




**1-844-NO-SHOCK**
**www.shockalert.com**

SHOCK ALERT, LLC.
50 N. CENTRAL DRIVE, O'FALLON, MO 63366

U.S. PAT. #9,285,396, #8,643,360, #8,686,713 and additional patents pending.

# Stray voltage common around docks

By Jason Dunovant | jason.dunovant@smithmountainlaker.com 721-4675 (ext. 407)

Jan 16, 2018

In the past few months, Neil Harrington has provided free checks around lake docks for stray voltage. Almost every dock he has visited, so far, has shown some levels of electricity in the water.

Harrington, a member of the Smith Mountain Lake Marine Volunteer Fire Department, has checked nearly 200 home and community docks since he began offering the checks last September. In that time, Harrington said he has only found seven docks with no stray voltage.

At least twice a week Harrington visits docks around the lake. At each one, he places a voltage detector in the water and checks the readings.

Two other members of the department have been helping Harrington with the dock checks as there now is a backlog of requests. Harrington said 78 people have signed up to have their docks checked and he expects most of them will have the same results.

While Harrington's readings have been in the millivolts range, he said as few as 2 volts could result in death from drowning. Electric shock drowning occurs when an electrical current passes through an individual in the water. A person can become paralyzed and unable to swim away or stay afloat.

"There shouldn't be any voltage in the water," Harrington said.

Since he first suspected there was a problem, Harrington said he is working to find what's causing it. Based on his checks, Harrington said a majority of docks are wired according to code, but continue to give off stray voltage in the water.

In some cases, Harrington has seen ground wires for boat lift motors that are too thin. When that happens, he said the path of least resistance for electricity is to go into the water instead of into the ground wire.

In other instances, Harrington found electrical panels are not wired differently than in homes. Electrical panels at docks should be wired with the neutral wires isolated, he said.

Huddleston resident Jim Erler contacted Harrington last October to have his dock checked during which Harrington found stray voltage coming from Erler's boat lift.

Erler said he hired an electrician to fix the problem, but after the work was done, voltage spread to a larger area around the dock. "The electrician thought he fixed it, but didn't know how to fix it," Erler said.

Unable to find a solution, Erler, who has a master's degree in electrical engineering, decided to look into the issue himself. He has a few ideas on what the problem could be, as well as how to resolve it, but said he wants to consult with other electrical engineers before releasing that information.

Once the problem and resolution are confirmed, Erler said he and Harrington plan to provide the information to Bedford, Franklin and Pittsylvainia counties as well as to state officials to assure that the issue is addressed and can be fixed in the future.

# Teen injured after shock at dock

By Jason Dunovant | jason.dunovant@smithmountainlaker.com 721-4675

Jun 12, 2018

Local officials are warning residents to be careful following the electric shock of a 17-year-old while on a dock in Gills Creek.

The incident happened June 2 shortly after 3 p.m. The 17-year-old female from Franklin County fell into the lake after being shocked as she held onto a boat lift cable with her hand and had her foot in the water, according to Sgt. Karl Martin of Virginia Department of Game and Inland Fisheries.

An 18-year-old, also from Franklin County, was on the dock when the victim fell into the water and pulled her out. “It could have ended in a catastrophe,” Martin said.

The teen was first taken to VelocityCare at Westlake and later to Carilion Roanoke Memorial Hospital with injuries that were not life-threatening, Martin said. She was released two days later.

Martin said he has been in contact with area dock builders and public safety officials asking them to be aware of the possibility of electric shock at docks. Dock owners also should contact an electrician if they suspect something is wrong with the electrical wiring on a dock.

Neil Harrington of the Smith Mountain Lake Marine Volunteer Fire Department, said he was asked by doctors at Carilion Roanoke Memorial

Hospital to inspect the dock June 3. Since September, Harrington has been conducting checks for stray voltage around docks.

Using a device he places in the water, Harrington said he found 90 millivolts of stray voltage near the dock's boat lift. He said the 17-year-old likely was holding onto the boat lift cable and when she placed her foot in the water, she "competed the circuit," which resulted in a shock.

As few as 2 volts could result in death from drowning, Harrington said. Electric shock drowning occurs when an electrical current passes through an individual in the water. A person can become paralyzed and unable to swim away or stay afloat.

So far, Harrington said he has checked more than 200 docks, old and new, around Smith Mountain Lake and almost all of them have at least a small amount of stray voltage.

From what he has seen, Harrington said many docks are built according to current building codes. He said changes to those building codes may be necessary to prevent stray voltage from continuing.

Sometime later this year, Harrington said he would like to organize a community meeting to inform residents on some of the issues he and other members of the community have found with dock wiring. The meeting should provide dock owners with information on how to avoid the chance of more electric shocks in the future.

Anyone interested in scheduling a member of the Smith Mountain Lake Marine Volunteer Fire Department to check their home can visit smlmfr.com and click on the Dock Check tab to schedule an appointment.

# Teen recovers after shock at dock

Laker Weekly

Jun 6, 2018

A Franklin County teenager was treated and released from Carilion Roanoke Memorial Hospital on June 4 after being shocked at a residential dock in the Gills Creek area of Smith Mountain Lake.

The incident happened June 2 shortly after 3 p.m. The 17-year-old female fell into the lake after being shocked as she held onto a boat lift cable with her hand and had her foot in the water, according to Sgt. Karl Martin of Virginia Department of Game and Inland Fisheries.

An 18-year-old, also from Franklin County, was on the dock when the victim fell into the water and pulled her out. "It could have ended in a catastrophe," Martin said.

The teen was first taken to VelocityCare at Westlake and later to Carilion Roanoke Memorial Hospital with injuries that were not life-threatening, Martin said. She was released two days later.

Both VDGIF and the Smith Mountain Lake Marine Volunteer Fire Department are investigating the cause of the incident.

# Research: Dock shock from home ground wire

Through his research, Jim Erler has found that the source of his dock's stray electricity comes from the ground wire of his lake home.

**By Jason Dunovant**
jason.dunovant@smithmountainlaker.com
721-4675

When Jim Erler discovered small amounts of stray voltage in the water around his Huddleston dock late last year, he contacted an electrician to fix it. After spending $2,000 on work that didn't solve the problem, he decided to find a solution on his own.

Erler, an electrical engineer and physicist, investigated the issue like any scientist would. He began taking measurements around his dock to find the exact cause — even connecting an oscilloscope to the electrical panel to track the varying voltages entering his home.

"I just became very curious," Erler said.

Through his research, Erler said he has found that the source of his dock's stray electricity comes from its ground wire from the house. It's a problem with newer, as well as older, docks, and electricity can still be present in the water even if all the power to the house and dock is turned off.

The purpose of a ground wire is to provide an alternative pathway for electric current to travel if there is a problem. While the ground wire is required for safety, Erler said voltage can still be induced on the ground wire from several sources.

The voltage on the ground wire could come from normal power company operations or may be induced by something as

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enters the water through boat lifts. He said an underwater irrigation pump, extension cords, loose wires or any other metal in the water also can be a source for stray voltage.

While the stray voltage Erler has measured around his dock is usually fairly low, he has recorded intermittent levels of higher voltage on his oscilloscope that have concerned him.

"We have measured events that we know are lethal," he said.

Harrington has spoken with local building inspectors about the issue. Erler said he has even spoken with a senior building inspector in Richmond in an effort to make changes to current electric code.

The issue, Erler said, extends far beyond Smith Mountain Lake. "There is a national problem here. We initially thought it was just a minor thing."

During his research, Erler also contacted Underwater Labratories, an independent safety science company. He said experts there told him that they would never allow their families to swim from an electrically powered dock.

One fix Erler has found to stop a source of stray voltage is to disconnect the ground wire between the house and dock; however, he doesn't recommend that since it currently is mandatory in building codes.

"It's a complicated issue, and we are absolutely concerned about it," said Will Goodwin, senior building inspector for Bedford County. All counties follow a statewide building code and inspectors are bound to enforce that code.

Goodwin said Virginia adopts its building code from the National Electric Code, and counties don't have the ability to make changes.

While inspectors are bound by the state's building code, Goodwin said they are still willing to help out if there is a problem. "If there is an issue, we will certainly go investigate it," he said.

Erler said one way to protect individuals from some lethal levels of stray voltage around a dock is to make sure all dock breakers include a ground fault circuit interrupter or GFCI. They protect against ground faults by automatically shutting off the power when a leak of electric current is detected.

Current code requires that all breakers at docks include a GFCI at the power box, Erler said. Residents should test their GFCIs often to make sure it will turn the power off in case of a ground fault.

One of the best protections against electrical shock at a dock is to convert the power source to 12 volts DC. He said 12-volts could power almost anything used at a dock, including a boat lift.

Direct current at 12 volts is safer than 110 volts of alternating current that comes out of a normal power outlet, Erler said. A dock can be converted to run on a direct current for around $3,000, he said.

"All new docks should have direct current," Erler said.

While Erler has found a major source of stray voltage around his dock, he is still researching to find out more. He said he would like to perform in-depth testing at other homes around the lake in an effort to better understand the problem.

He and Harrington would like to hold a public meeting in the future to discuss their findings.

# Stray voltage found around lake docks

By Jason Dunovant | jason.dunovant@ smithmountainlaker.com | 721-4675 (ext. 407)

Oct 6, 2017

Shock drowning is a real concern for Neil Harrington. As a diver with the Smith Mountain Lake Marine Volunteer Fire/Rescue Department, he makes sure to check for any possible electrical current before going into the water near docks.

Last month, Harrington began providing free dock checks for homeowners. So far, he said he has found a majority of docks have some stray voltage in the water.

Harrington has visited 20 docks with another 38 on his schedule. Out of those, he said, only two have not shown any signs of stray voltage. “Most of the docks have had stray voltage in the water,” he said.

When doing a check, Harrington places a water voltage detector in different locations around a dock. The majority of them have stray voltage coming from the boat lifts. Harrington said he often finds a small amount voltage coming off the boat lifts, usually not farther than 3 feet from the lift.

“It’s not a lot of voltage, but it is enough to be concerning,” Harrington said.

Most of Harrington’s readings have been in the millivolts range, but he said as few as two volts could result in death from drowning. Electric shock drowning occurs when an electrical current passes through an individual in the water. The person can become paralyzed and unable to swim away or stay afloat.

The docks Harrington said he has checked vary in age, size and shape.

SMLMVFR recently purchased its own water voltage detector and several department members have their own detectors. Members of the Smith Mountain Lake Water Safety Council recently approved the purchase of a water voltage detector for Scruggs Volunteer Fire and Rescue Department. The department will use the detector for dock checks and to assist its Scruggs Dive Team.

Harrington said he plans to speak with building inspectors in both Bedford and Franklin counties to discuss stray voltage around docks. He questioned if there should be checks for stray voltage in the water before a dock passes inspection.

“To me, that would make sense,” Harrington said.

Lake homeowners interested in having their docks checked can visit smlmfr.com (select the Dock Check — Stray Voltage tab).

# Use these tips to avoid shocks at docks

Laker Weekly

Jun 19, 2018

Last fall, the Smith Mountain Lake Marine Volunteer Fire Department began offering free checks for stray voltage in and around homeowners' docks. So far, the department has found that 96 percent of the docks have stray voltage around them.

The most common cause of stray voltage is a home's electrical ground wire connected to a dock's electrical ground wire, according to a news release from Neil Harrington who conducts the checks for the department.

In most homes the electrical service from the power company is grounded and connected to a home's electrical equipment ground, Harrington said. He said he has found that a dock should be "independently" grounded and not connected to a home's ground wire.

Harrington said to fix the issue, homeowners should disconnect the ground wire on the circuit running from their house to their dock. The National Electric Code provides conflicting guidance when it comes to wiring docks, and Harrington said disconnecting the ground wire could be a violation of local electrical codes.

Until this issue is resolved and clarifying language is available, the Smith Mountain Lake Marine Volunteer Fire Department has provided the following safety precautions for homeowners with docks:

- Upgrade a dock's electrical service to be compliant with the latest electric code.
- Insure ground fault circuit interrupter technology is installed on dock circuits.
- Make sure all metal parts of boat and personal watercraft lifts are out of the water when there are swimmers near the dock.
- Never allow people to swim near a boat or PWC lift.
- Do not touch a boat or PWC lift and the water at the same time.
- Never allow swimmers around slips at a marina or a community dock.
- Special attention is required if there are metal pilings supporting a dock.

Anyone interested in scheduling a dock check can visit smlmfr.com and click on the Dock Check tab to schedule an appointment.




Photos by JASON DUNOVANT | Laker Weekly

Neil Harrington points to the metal bars commonly found on boat lifts. The metal is often the source of stray voltage in the water around docks.

# Boat lifts a common source of stray voltage in water

SML Marine Volunteer Fire Department member warns to stay clear of boat lifts while swimming around docks.

**By Jason Dunovant**
jason.dunovant@smithmountainlaker.com
721-4675



Neil Harrington points to the ground wire in his dock's electrical circuit panel that connects from his home. He said stray voltage can reach the dock through that ground wire.

For nearly two years, Neil Harrington has provided free checks for stray voltage around docks on the lake. In that time, he has found some level of electricity in the water around nearly every dock he has visited.

Harrington, a member of the Smith Mountain Lake Marine Volunteer Fire Department, discovered the stray electricity almost always came from one common device at lakefront homes. Since the issue is so prevalent, he has decided to stop doing checks and start working to inform the public about ways to mitigate the problem.

"If you have your boat lift in the water, you have stray voltage in the water," Harrington said.

The source of the electricity, Harrington has found, is the metal portions of a boat lift or personal watercraft lift when it is lowered into the water. If electrical wiring is up to code, he said the water around the docks was almost always free of stray electricity when a lift is out of the water.

Harrington said stray voltage results from electricity traveling from the power lines on the street to the dock. The electricity reaches the dock from a ground wire that is connected

See **DOCK SHOCK, 2**

# DOCK SHOCK

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from the home to the dock.

The ground wire is connected at the dock's electrical circuit panel with all other electric devices at the dock — including the boat lift. When the boat lift is out of the water, Harrington said any stray voltage goes to the dock's ground rod. When the boat lift is in the water, the water becomes the path of least resistance for electricity and it no longer goes to the ground rod.

"As soon as the boat lift would touch the water, we would get readings," Harrington said of his stray voltage checks at lakefront homes.

The electricity found when a boat lift is in the water was usually a very small amount, but Harrington warned that any electricity found in the water can be dangerous. There could also be surges in the power lines that could result in much higher levels of electricity in the water for a brief time.

Electric shock drowning occurs when an electrical current passes through an individual in the water. A person can become paralyzed and unable to swim away or stay afloat.

Keeping lifts out of the water is the easiest way to prevent stray electricity, Harrington said. If someone takes a boat out while people are swimming nearby, they should raise the boat lift back out of the water after leaving.

Even when a lift is out of the water, Harrington said people should use caution. Swimmers should also stay at least 10 feet away from a boat lift at all times and should avoid climbing onto a boat lift.

Last year a 17-year-old girl was shocked while on a dock in Gills Creek. According to reports, the girl was holding onto a boat lift cable while she had her foot in the water. Harrington said she became the path of least resistance for the electricity running through the boat lift when she placed her foot in the water. When there was a surge of electricity, it went through her instead of the dock's ground rod.

While boat lifts are most often the cause of stray voltage, Harrington said underwater irrigation pumps, extension cords, loose wires or any other metal in the water also can be a source for stray voltage. He warned that some older docks were wired with the ground wire connected to a metal piling which can be dangerous for swimmers.

Harrington said one way to eliminate any possibility of stray voltage to a boat lift would be to disconnect the ground wire between the home and dock. While it would fix the issue, it also goes against current electrical code.

Harrington has spoken with local building inspectors about the problem. He said they are required to follow the National Electric Code. In the code, the ground wire must be connected from a home to the dock.

Harrington has also worked with Huddleston resident Jim Erler, an electrical engineer and physicist, to investigate the issue and try to find ways to change the current code. So far, he said their efforts have been unsuccessful.

"Until there are enough deaths attributed to stray voltage in the water, I don't know if it is going to change," Harrington said.

# WSC to combat stray voltage

**By SHERESE GORE**
Eagle Staff Writer

The Smith Mountain Lake Water Safety Council is forming a committee to investigate ways to combat stray voltage, such as through legislative action and education.

The most common cause of stray voltage in the water results from a home's ground wire being connected to the dock's electrical ground wire, according to a 2018 press release from the Smith Mountain Lake Marine Volunteer Fire/Rescue (SMLMVFR),

"The electrical service from the power company is grounded and connected to the home's electrical equipment ground," the release states. "However, the dock should be 'independently' grounded. That means it should NOT be connected to the home's ground wire."

According to the release, a simple fix would be to disconnect the ground wire on the circuit running from the house to the dock. However, the National Electric Code (NEC) "provides conflicting guidance when it comes to wiring docks and disconnecting that ground could be a violation of local electrical codes."

SMLMVFR member Neil Harrington said at last Wednesday's Water Safety Council meeting that he has reached out to inspectors in Bedford and Franklin counties about stray voltage.

Area localities look to the state for guidance, and Virginia adheres to the National Electric Code.

"Somehow we need to get attention to get the National Electric Code clarified so that we can stop putting stray voltage into the water," Harrington said.

In 2017, SMLMVFR began offering free checks for stray voltage in the waters around docks.

"We found that we were getting positive hits on pretty much every dock we hit," Harrington said.

Harrington said the free dock checks have since ended. Shutting down electricity to the dock, meanwhile, doesn't stop stray voltage from entering the water as anomalies in the electrical system follow a ground path, Harrington noted.

In June 2018, a 17-year-old girl was shocked at a dock at Gills Creek as she held onto a boat lift cable with her hand and had her foot in the water.

"I want to get it on as many dockets as I can," Harrington said. "I don't know how to get the attention other than to wait for people to get hurt, and I think that's stupid."

Water Safety Council Chairman Pat Massa asked Harrington to get a small group together to figure out how to move forward on the issue.

"We need to be an advocate for these things," Massa said.

SMLA President Lorie Smith, who is a candidate for the Gills Creek seat on the Franklin County Board of Supervisors, said the two lake-area representatives on the boards of supervisors of Bedford and Franklin counties need to commit to work with legislators on the issue.

"I just think this can be fixed," Smith said. "It's just going to take some rolling up the sleeves and connecting the dots."

The SMLMVFR press release from 2018 provided several safety precautions:

- Upgrade your dock's electrical service to be compliant with the latest electric code.
- Ensure ground fault circuit interrupter technology is installed on dock circuits.
- Make sure all metal parts of the boat and jet ski lifts are out of the water when people are swimming off docks.
- Never allow people to swim near your boat or jet ski lift.
- Do not touch the boat or jet ski lift and the water at the same time.
- Never allow swimming around the slips in a marina or community dock.
- Special attention is required if you have metal pilings supporting your dock.

If a homeowner has any concerns, they should contact a licensed electrician, Harrington said.

# TM1101.2-18

**Proponents:** Julius Ballanco (JBENGINEER@aol.com)

## 2015 Virginia Mechanical Code

**1101.2 Factory-built equipment and appliances.** *Listed* and *labeled* self-contained, factory-built *equipment* and appliances shall be tested in accordance with UL 207, 412, 471 or ~~1995.~~ 1995 or UL/CSA 60335-2-40. Such *equipment* and appliances are deemed to meet the design, manufacture and factory test requirements of this code if installed in accordance with their listing and the manufacturer's instructions.

**1104.3.2 Nonindustrial occupancies.** Group A2 and B2 refrigerants shall not be used in high-probability systems where the quantity of refrigerant in any independent refrigerant circuit exceeds the amount shown in Table 1104.3.2. Refrigerant systems using Group A2L refrigerants in high-probability systems shall comply with ASHRAE 15. Group A3 and B3 refrigerants shall not be used except where *approved*.

**Exception:** This section does not apply to laboratories where the floor area per occupant is not less than 100 square feet (9.3 $m^2$).

# ASHRAE

ASHRAE
1791 Tullie Circle, NE
Atlanta GA 30329

**~~15—2013~~ 15—2019: Safety Standard for Refrigeration Systems**

# ASHRAE

ASHRAE
1791 Tullie Circle, NE
Atlanta GA 30329

**~~34—2013~~ 34—2019: Designation and Safety Classification of Refrigerants**

# UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062-2096

**Add new text as follows:**

**1 Chapter 15 New Code Section UL/CSA** UL LLC, 333 Pfingsten Road, Northbrook, IL 60062-2096

CSA Group, 8501 East Pleasant Valley Road, Cleveland, OH 44131-5516

UL/CSA 60335-2-40-2019 Standard for Household and Similar Electrical Appliances, Part 2 Appliances - Safety - Part 2-40: Particular Requirements for Motor-compressors, Electrical Heat Pumps, Air Conditioners and Dehumidifiers (found in Section 1101.2)

**Reason Statement:** With the change to Low Global Warming Potential (GWP) Refrigerants, the Mechanical Code needs to be updated to address the use of Group A2L refrigerants in high probability (direct) systems. All of the commonly used Low GWP replacement refrigerants for direct systems fall into the category of Group A2L in the 2019 edition of ASHRAE 34. ASHRAE 15-2019 has added specific requirements for the use of Group A2L refrigerants. The safety requirements in ASHRAE 15 address the concerns regarding the use of a low flammable refrigerants. There are provisions for listing of equipment, installation of refrigerant detectors, and ventilation to mitigate any leak of refrigerant. By referencing ASHRAE 15 directly, the requirements become an enforceable part of the code.
ASHRAE 15 requires an A2L appliance or equipment to be listed. The standard for listing to Group A2L appliances is UL/CSA 60335-2-40-2019. This standard will sunset a number of other UL standards including UL 1995. The new standard is based on the International Standard with the same number. There are North American country deviations added to the standard for use in the United States and Canada. These country deviation significantly impact the use of Group A2L refrigerants with more conservative safety requirements. It is important to reference the standard that will be used by manufacturers to list all refrigerant equipment. It should be noted that UL/CSA 60335-2-40 also regulates refrigerant equipment using Group A1, B1, A2, and A3 refrigerants.

With the addition of many new refrigerants that fall into the category of Low GWP refrigerant, it is important to reference the latest edition of ASHRAE 34. The 2019 edition has many new refrigerants added. The standard also updated the category of refrigerants by making Group 2L a full category. It was previously listed as a subcategory of Group 2.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This section is an optional requirement. It is anticipated that initially equipment using Group A2L refrigerant will have a higher cost. However, there is no requirement in this proposal mandating the use of Group A2L equipment. High-probability refrigerant equipment using Group A1 refrigerants are still available. As a result, there is no impact to cost.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

This change only impacts the use of refrigerant in equipment. The resiliency of the equipment remains the same when there is a change in refrigerant.

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Consensus Disapproval

**Workgroup 4 - Final Reason:**

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# Public Comments for: TM1101.2-18

**Discussion by Andrew Klein**
May 26, 2020 16:14 UTC

Proposal # 362

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# EB502.1.1-18

**Proponents:** Stephen Szoke, American Concrete Institute (steve.szoke@concrete.org); Keith Kesner (kkesner3006@gmail.com); William Gaspar (wgaspar@moseleyarchitects.com); David Whitmore (davidw@vector-corrosion.com); Jeff Jezzard (jeffj@vector-construction.com); Matt Miltenberger (mattm@vcservices.com); Bill Horne (bhorne@ndtcorporation.com); Mark LeMay (mlemay@jqeng.com)

## 2015 Virginia Existing Building Code

**Revise as follows:**

**502.1 General.** Structural repairs shall be in compliance with this section and Section 501.2. Regardless of the scope of repair, new structural members and connections used for repair or rehabilitation shall comply with the detailing provisions of the VCC for new *buildings* of similar *structure*, purpose and location.

**502.1.1 Repairs to structural concrete** . Repairs to structural concrete elements shall comply with ACI 562 and this code.

**Exception** : Where seismic design governs, ACI 562 shall not be used for evaluation and design.

**Add new text as follows:**

**Chapter 16 ACI American Concrete Institute 38800 Country Club Drive, Farmington Hills, MI 48331** 562-19 Code Requirements for Assessment, Repair, and
Rehabilitation of Existing Concrete Structures

502.1

**Reason Statement: Concept** – This code change proposal adds ACI 562: Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures, to establish minimum requirements for the design, construction, repair, and rehabilitation of concrete structural elements in buildings for various levels of desired performance as deemed appropriate for the project. In addition to improved life safety, the requirements clearly define objectives and anticipated performance for the code official, owners, designers, contractors and installers. This proposal is not intended to supersede the building official approval of alternative means and methods.
Further concrete repairs are often required where there are deficiencies in design or construction that could result in failures. ACI 562 clearly defines these conditions as well as conditions related to maintenance or damage or dangerous conditions as defined in the VEBC. This is important for evaluation and design or structural concrete elements.

**Background**

– In 2006, the repair industry approached ACI asking for a concrete repair and rehabilitation code that would improve the overall quality of concrete repairs by establishing common requirements and establishing clear responsibilities between owners, designers, and contractors. This code would also provide building code officials with a reference by which to evaluate rehabilitated concrete structures. ACI, following its rigorous American National Standards Institute accredited standards development process assembled a code committee with balanced representation and produced the first official code in 2012. The committee members reviewed and considered numerous reports and publications related to concrete repair and rehabilitation to identify and develop requirements consistent with current industry practice. The committee has received feedback from users of the code and are now completing their third version of this code, ACI 562-19.Scope – ACI 562-19 complements the VEBC by providing specific direction on how to design concrete repairs and how to handle the unique construction problems associated with repair. This standard helps the designer assess the existing structure in accordance with the VEBC. The standard then provides the requirements that bridge the inconsistencies and gaps in acceptable criteria that occur from the two following situations that a designer must solve: one, repairing a structure according to the original building code used at the time it was built using today's construction methods and materials; or, repairing a structure built according to an older building code but repaired according to the latest building code. Note that ACI 562 does not directly address the evaluation of lateral-force resisting systems in high seismic areas. ASCE 41 is the appropriate standard for this situation as stated in the VEBC and ACI 562.

**Benefits** – There are many benefits that ACI 562 provides for the designer, owner, contractor, materials providers, building code official and the public. A few of these benefits are:

- Provides a level of expectation of life safety to the public in buildings where repairs or rehabilitation is performed on concrete structural elements.
- Provides clearly defined, uniform requirements aimed at extending the service life of existing structures.
- Provides minimum requirements for safety and quality of concrete repair.
- Establishes clear responsibilities between owners, designers, and contractors.
- Provides building code officials with a means to evaluate rehabilitation designs.
- Provides specific repair requirements that often result in less costly repairs compared to repairs required to meet only new construction requirements.

**Flexibility** – ACI 562 permits flexibility in evaluation, design, construction and repair materials to provide economieswhile establishing expected

performance for the service-life of the rehabilitation or repairs.

- Resources – Also, there many resources that complement ACI 562. Among these are:
- Concrete Repair Manual: Fourth Edition 2013
- ACI 563-18, Specifications for Repair of Structural Concrete in Buildings
- MNL-3(16) Guide to the Code for Assessment, Repair, and Rehabilitation of Existing Concrete Structures

These resources are readily available to provide greater understanding of assessment, repair and rehabilitation of concrete structural elements. ACI MNL-3 provides case studies demonstrating the ease of use of ACI 562. Numerous technical notes, reports, guides, and specifications that provide background information and technical support are available through other organizations, such as American Society of Civil Engineers, British Research Establishment, Concrete Society, International Concrete Repair Institute, National Association of Corrosion Engineers, Post-Tensioning Institute, Society for Protective Coatings, and US Army Corps of Engineers. Many of these organizations publications related to concrete repair can be found in the Concrete Repair Manual.

**Sustainability** - Reference of ACI 562 in the VEBC will help improve the confidence of owners, builders, and developers regarding effective repairs, upgrades, and reuse of existing buildings in lieu of demolition and replacement. Typically, extending the life of existing buildings is substantially more sustainable than demolition and new construction. Adoption of ACI 562 by reference is needed to help facilitate efforts that conserve energy and resources while maintaining a minimum level of requirements to ensure reasonable levels of life safety, and welfare are afforded to the public.

**Recommendation** – ACI, a professional technical society, has developed this ACI 562 in response to industry needs and to help assure minimum levels of life safety, health, and welfare for the public. For this reason and the other benefits identified in this reason statement, ACI recommends this code change proposal for committee approval as submitted.

**Support**: The proponent is in possession of emails form the following indicating they would like to be identified as co-proponents to this proposal:

- Mark LeMay, JQ Engineering, representing International Concrete Repair Institute, mlemay@jqeng.com 1000 Westgate Dr., Suite 252 St. Paul, MN 55114
- Keith Kesner CVM Professionals representing kkesner3006@gmail.com 5 Rockland Cir. Wayne, PA 19087
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- Bill Horne NDT Corporation representing NDT Corporation bhorne@ndtcorporation.com 153 Clinton Road, Sterling, MA 01564

**Cost Impact:** The code change proposal will decrease the cost of construction
The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptance criteria that is amicable to both the owner and the building code official. The result is the determination that the repair must meet the latest building code requirements for new construction. This standard increases the options available for repair and provides the acceptance criteria necessary to permit these options. A case study that illustrates this point: "ACI 562 has been referenced in expert reports for litigation cases, resulting in significantly reduced financial settlements. Denver-based J. R. Harris & Company recently used the code as a standard in several litigation reports assessing damages in existing concrete structures. As an approved consensus standard, according to American National Standards Institute (ANSI) procedures, ACI 562-13 has been accepted as the source standard to use for damage assessment and repair on individual projects by Greenwood Village and Pikes Peak Regional Building Departments in Colorado. Based on this acceptance, the consulting engineer was able to cite the code in their recommendation for structural remediation and determination of damages. In one case involving rehabilitation work on four buildings with faulty construction, J.R. Harris was able to reduce the repair costs from $12 million to $3 million, with a repair plan based on the lesser of the demand-capacity ratio based on either the original or current building code per ACI 562."

**Resiliency Impact Statement:** This proposal will increase Resiliency
Use of the ACI 562 standard helps ensure that repairs are properly performed and will satisfy an acceptance service life. Without minimum standards, repairs may not satisfy the intent or the code or the expectations of the owners or public. Proper evaluation and repairs will improve the resiliency of the building.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Consensus Disapproval

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB502.1.1-18

**Discussion by Kenney Payne**
Jun 24, 2020 13:19 UTC

AIA VA opposes locating the change under 502.1 - General as it could potentially conflict with repairs under 502.2.1, which allows for just restoring it to their predamage state, and under 502.2.2 which allows evaluations to comply with 502.2.2.1 and repairs under 502.2.2.3.

However, the change could be applicable whenever NEW structural elements are required as part of a repair. So, while we believe the VEBC already requires any new elements to comply with the VCC, we could support this change if it were limited to such NEW structural elements.

As an alternative, consider revising the VCC and therefore, any reference in the VEBC to the VCC would automatically include the new reference.

Proposal # 442

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An ACI Standard

# Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures (ACI 562-19) and Commentary

Reported by ACI Committee 562

ACI 562-19

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Always advancing

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First Printing
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**Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures and Commentary**

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# ACI 562-19

# Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures (ACI 562-19) and Commentary

An ACI Standard

Reported by ACI Committee 562


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*ACI 562-19, "Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures," was developed to provide design professionals a code for the assessment of the damage and deterioration, and the design of appropriate repair and rehabilitation strategies. The code provides minimum requirements for assessment, repair, and rehabilitation of existing structural concrete buildings, members, systems and where applicable, nonbuilding structures. ACI 562-19 was developed to work with the International Existing Building Code (IEBC) or to be adopted as a stand-alone code.*



**Keywords:** assessment; bond; corrosion; damage; durability; evaluation; existing structure; -reinforced polymer (FRP); interface bond; licensed design professional; maintenance; rehabilitation; reliability; repair; strengthening.


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## PREFACE

This code provides minimum requirements for assessment, repair, and rehabilitation of existing structural concrete buildings, members, systems and where applicable, nonbuilding structures. This code was developed by an ANSI-approved consensus process. This code can supplement the International Existing Building Code (IEBC), supplement the code governing existing structures of an authority having jurisdiction, or act as a stand-alone code in a locality that has not adopted an existing-building code. When this code is adopted as a stand-alone code, Appendix A should be used in place of Chapter 4.

The Code is written for use by a licensed design professional. This code provides minimum requirements for assessment, design and construction, or implementation of repairs and rehabilitation, including quality assurance requirements, for structural concrete in service. This code has no legal status unless it is adopted by the authority having jurisdiction. Where the code has not been adopted, it serves as a standard to provide minimum requirements for assessment, and design and construction of repair and rehabilitation of existing structural concrete. ACI 318 provides minimum requirements for the materials, design, and detailing of structural concrete buildings and, where applicable, nonbuilding structures, and for new construction within existing structures where noted herein.

Key changes from ACI 562-16 to ACI 562-19 include:

(a) Text was added to simplify use of new materials that have the equivalent of an ICC-ES evaluation report in Chapter 1.

(b)

(d) The commentary in Chapter 8 .


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## CODE

## CHAPTER 1—GENERAL REQUIREMENTS

### 1.1—General

**1.1.1** ACI 562, "Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures," is hereafter referred to as "this Code."

**1.1.2** *Scope*—This code shall apply to assessment, repair, and rehabilitation of existing concrete structures as:

1. A code supplementing the International Existing Building Code (IEBC)
2. As part of a locally adopted code governing existing buildings or structures
3. Or as a stand-alone code for existing concrete structures

**1.1.3** The intent of this Code is to safeguard the public by providing minimum structural requirements for existing structural concrete members, systems, and buildings.

**1.1.4** All references in this code to the licensed design professional shall be understood to mean persons who possess the knowledge, judgment, and skills to interpret and properly use this code and are licensed in the jurisdiction where this code is being used. The licensed design professional for the project is responsible for, and in charge of, the assessment or rehabilitation design, or both.

## COMMENTARY

## R1—GENERAL REQUIREMENTS

### R1.1—General

**R1.1.2** This code assessment, design, construction and durability requirements for repair and rehabilitation of existing concrete structures. Throughout this code, the term "structure" means an existing building, member, system, and, where applicable, nonbuilding structures where the construction is concrete or mixed construction with concrete and other materials.

Chapter 4 provides assessment, repair, and rehabilitation criteria if this code is used as a supplement to the International Existing Building Code (IEBC) for concrete members and systems.

Appendix A provides assessment, repair, and rehabilitation criteria when this Code is adopted, including Appendix A, as a stand-alone code for repair of existing concrete structures.

**R1.1.3** The intent of this code is to address the safety of existing structures through assessment requirements that demonstrate an approximation of the structural reliability using demand-capacity ratio limits of Chapter 4 or Appendix A and, if necessary as determined by the assessment, increase the structural capacity by repair or rehabilitation.

Unless prohibited by the authority having jurisdiction, if an existing structure is shown to be potentially dangerous in accordance with 4.3 or A.3, the structure should be rehabilitated using 4.3 or A.3.

Using the demand-capacity ratio limits of 4.5.1 or A.5.1, repair of the existing structural concrete to its predeteriorated state is permitted based on material properties in the original construction (per Chapter 6), and substantiated engineering principles of the original design. Where requirements of the original building code are appreciably changed in the current building code, the licensed design professional may consider using 4.5.2 or A.5.2.

Beyond the restoration assessment requirements of 4.5.1 and 4.5.3 or A.5.1 and A.5.3, the structural reliability principles of 4.5.2 or A.5.2 are permitted. These alternative requirements provide acceptable safety if the current building code demand exceeds the original building code demand or if the regulations of the original building code provide an unacceptable level of structural reliability.


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## CODE

**1.1.5** The requirements of this code are provided using strength design provisions for demands and capacities, unless otherwise noted.

### 1.2—Criteria for the assessment and design of repair and rehabilitation of existing concrete structures

**1.2.1** The "existing building code" refers to the code adopted by a jurisdiction that regulates existing buildings or structures.

**1.2.2** The "current building code" refers to the general building code adopted by a jurisdiction that regulates new building design and construction.

**1.2.3** The "original building code" refers to the general building code applied by the authority having jurisdiction to the structure in question at the time the existing structure was permitted for construction.

## COMMENTARY

**R1.1.5** When this code permits the original building code regulations to be used and that code uses allowable stress design, the following should be considered: those provisions should be substituted for strength design as noted in 4.5.3 or A.5.3; the licensed design professional is not required to use, but should consider using strength design provisions of this code as a check in the assessment of existing structures originally designed with allowable stress methods.

### R1.2—Criteria for the assessment and design of repair and rehabilitation of existing concrete structures

**R1.2.1** The code governing existing buildings in the United States is commonly the IEBC developed by the International Code Council (ICC). The IEBC provides regulations for evaluations of damage and the limit for damage to be repaired using the original building code.

**R1.2.2** The current building code establishes the design and construction regulations for new construction. Strength design regulations of the current building code include:

(a) Required strengths computed using combinations of factored loads (strength design demands)

(b) Design strengths (capacities) based on testing of materials, members, and systems

(c) Analytical methods used to calculate member and system capacity

(d) Strength reduction factors, which have been established to be consistent with reliability indices used with the strength design demands

The load factors and strength reduction factors in the current building code are obtained through rational design code calibration procedures to achieve the targeted reliability indices which produce historically acceptable structural safety for new structures. The targeted reliability indices are generally based on past structural behavior, engineering experiences, costs and consequences of loss, among other criteria. The resulting demand-capacity ratios for new structures provide the limits that are not to be exceeded if designing new construction, but these demand-capacity ratio limits need not to be the same as those for existing structures as noted in sections 4.5.2 and A.5.2.

The general building code in the United States is usually based on the International Building Code (IBC) published by the ICC. Prior to 2015, Chapter 34 of the IBC included provisions for existing structures. For the design and construction of new concrete structures, the IBC and most other older general building codes often reference ACI 318, Building Code Requirements for Structural Concrete and Commentary, with exceptions and additions.

**R1.2.3** This of "original building code" is consistent with the building code in at the time of original permitted construction per the IEBC. In assessing existing structures, the licensed design professional may need to consider changes in the codes enforced by the local authority


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## CODE

## COMMENTARY

having jurisdiction for the structure from the time of the original design through the time of the completion of construction. For buildings with major alterations or additions, the original building code should refer to the code in when the subject portion of the building was permitted, and portions of a building may have original building codes.

Reference to design requirements of the original building code should include: demands determined using either nominal loads, load factors, and load combinations of the original building code, or using allowable design loads and load combinations of the original building code; capacities determined using either strength design and reinforcement detailing provisions, and strength reduction factors of the original building code or using allowable stress design provisions of the original building code; and construction materials. Requirements for concrete design and construction include previous versions of ACI 318, concrete codes predating ACI 318, or concrete provisions within the original building code. A structural assessment using allowable stress design provisions of the original building code should be coupled with an evaluation using current standards or the strength design and reinforcement detailing provisions of this code to increase the understanding of structural behavior.

For a structure constructed prior to the adoption of a building code, the licensed design professional should research available standards and practices in at the time of construction. The Historic American Engineering Record, a program of the United States Park Service, has information on construction and preservation of historic structures (https://www.nps.gov/hdp/haer/).

**1.2.4** *Design-basis code criteria*

**1.2.4.1** The design-basis code criteria in this Code shall be used to assess and design repairs of existing members, systems, and structures.

**R1.2.4** *Design-basis code criteria*

**R1.2.4.1** The design-basis code criteria include requirements for assessment of the existing structure and for design when repairs are required based upon assessment results.

If a jurisdiction has adopted the IEBC and ACI 562 is used, then the design-basis code criteria are based on the IEBC with supplemental requirements of this code for potentially dangerous structural conditions, damage less than substantial structural damage, deterioration of concrete and reinforcement, faulty construction, serviceability issues, and durability of existing concrete.

For substantial structural damage, additions, alterations, and changes in occupancy, the IEBC establishes limits to which an assessment and design of repair and rehabilitation can occur in accordance with the original building code. Above these limits, an assessment and design of the repair and rehabilitation is in accordance with the current building code. Current and original building code provisions are supplemented by this code to address existing concrete members, systems, and structures.

Appendix A applies if a jurisdiction has not adopted the IEBC and has adopted this code. Appendix A of this code can provide design-basis code criteria for potentially dangerous


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| CODE | COMMENTARY |
|---|---|
| | structural conditions, substantial structural damage, damage less than substantial structural damage, deterioration of concrete and reinforcement, faulty construction, additions, alternations, changes in occupancy, serviceability issues, and durability of existing concrete. |
| **1.2.4.2** Assessment and design-basis criteria and the requirements for applying these criteria are provided in Chapter 4 and Appendix A. Chapter 4 applies if a jurisdiction has adopted the International Existing Building Code (IEBC) as the existing building code. Appendix A applies if a jurisdiction has not adopted the IEBC or if a jurisdiction has adopted this code. | **R1.2.4.2** Classifying the work category using criteria and requirements of Chapter 4 or Appendix A the design-basis criteria, which is used to design the repair or rehabilitation work. |
| **1.2.4.3** Assessment criteria shall be used to classify the work and to establish the design-basis criteria. | |
| **1.2.4.3.1** It shall be permitted to use the current building code as the assessment criteria for all existing structures. | **R1.2.4.3.1** Use of the current building code for assessment criteria may result in a conservative assessment of an older structure. The design professional should review use of the current building code with the Owner at the start of the project (refer to R1.3.1). |
| **1.2.4.4** Design-basis criteria shall be used to establish the applicable building code for repair and rehabilitation design. | |
| **1.2.4.5** The current building code shall be the design-basis code for new members and for connection of new members to existing structures. | |
| **1.2.4.5.1** The exceptions to 1.2.4.5 occur for the following: 1) when seismic are designed using the alternate design criteria of ASCE 41, or 2) when new members are added within the work area using the original building code as the design-basis code criteria for the repair. | **R1.2.4.5.1** The performance-based criteria in ASCE 41 may result in new member design that will not satisfy current code requirements for strength, or detailing. New concrete members and reinforcement may be designed by the original building code if integrated with the work area repair construction of the existing structure when the repair design-basis criteria for the existing structure is the original building code. The detailing of these new members and the connection of these members to the existing concrete should be according to the current building code. |
| **1.3—Applicability of this code** | **R1.3—Applicability of this code** |
| **1.3.1** This code provides minimum requirements when performing an assessment, repair or rehabilitation design and remedial construction of the structural components of existing concrete structures, including buildings and nonbuilding structures. | **R1.3.1** In typical U.S. practice, Owners are required to maintain existing structures to prevent unsafe conditions from occurring, or repair an existing structure when unsafe conditions are present. The minimum level of repair for an existing building will typically address these unsafe and potentially unsafe conditions.<br>The licensed design professional is permitted to perform assessment, design, and quality assurance activities that exceed the minimum requirements of this Code. Considerations beyond the minimum requirements of this Code, such as those for progressive collapse resistance, redundancy, or integrity provisions are permitted. Exceeding the code minimum requirements is not a violation of this Code. |
| **1.3.1.1** Regulations of the current building code need not be exceeded when assessing, designing repair and rehabilitation work, or installing remedial work of existing structures. | |


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## CODE

## COMMENTARY

The Owner and the design professional should agree on the intent of the repair and rehabilitation program and desired outcome at the onset of the project. The desired repair outcome may include consideration of the design service life of the repairs, structural reliability, serviceability considerations, and other factors. Due to the uncertain remaining service life of existing structures and the technical requirements of repair construction, quality assurance and construction observations in excess of that required by general building code is commonly required. The desired outcome of the repair and rehabilitation program, quality assurance, and construction observation requirements should be documented in the basis of design (Section 1.5.3).

**1.3.2** This Code is applicable to existing nonbuilding concrete structures.

**R1.3.2** Nonbuilding concrete structures can include, but are not limited to arches, tanks, reservoirs, bins and silos, blast- and impact-resistant structures, and chimneys.

**1.3.3** *Foundations*

**R1.3.3** *Foundations*

**1.3.3.1** This code shall apply to the assessment and repair or rehabilitation of existing structural concrete foundation members.

**R1.3.3.1** Foundation members and systems should include those constructed using plain or reinforced concrete including but not limited to spread footings, mat foundations, concrete piles, drilled piers, grade beams, pile and pier caps, and caissons embedded in the ground. The design and installation of new pilings fully embedded in the ground are regulated by the current building code. For repair of existing foundation members and systems, the provisions of this code apply if not in with the code governing existing building. For the portions of concrete piling in air or water, or in soil not capable of providing adequate lateral restraint throughout the piling to prevent buckling, the provisions of this code govern.

**1.3.4** *Soil-supported slabs*

**1.3.4.1** This code shall apply to the assessment and repair or rehabilitation of soil-supported structural slabs that transmit vertical loads or lateral forces from the structure to the soil.

**1.3.5** *Composite members*

**1.3.5.1** This code shall apply to the assessment and repair or rehabilitation of the concrete portions of composite members.

**1.3.6** *Precast and prestressed concrete*

**1.3.6.1** The code shall apply to the assessment and repair or rehabilitation of structural precast and prestressed concrete members, systems, and connections. The code shall apply to cladding transmitting vertical loads to supporting members or lateral loads to diaphragms or bracing members.

**1.3.7** *Nonstructural concrete*

**R1.3.7** *Nonstructural concrete*


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**1.3.7.1** This code is not intended for repair of nonstructural concrete or for aesthetic improvements, except if failure of such repairs would result in an potentially dangerous condition.

**1.3.8** *Seismic resistance*

**1.3.8.1** Evaluation of seismic resistance and design of shall be in accordance with the code governing existing buildings if one has been adopted or this code if a code governing existing buildings has not been adopted. If using this code for evaluation of seismic resistance and ASCE/SEI 41 shall apply.

**1.3.8.2** If for seismic resistance is not required by the code governing existing buildings or by this code, volun-

**1.3.8.2.1** When this code is used without the IEBC, the licensed design professional shall use the current building code supplemented by ASCE/SEI 41 and ASCE/SEI 7 to

## COMMENTARY

**R1.3.7.1** Where nonstructural concrete requires repair, that repair is not required to comply with or satisfy the requirements of this code. The licensed design professional designing repairs to nonstructural concrete should consider the consequence of repair failure to determine if there are provisions of this code that are applicable.

**R1.3.8** *Seismic resistance*

**R1.3.8.1** Provisions in Chapter 10 of ASCE/SEI 41 are based on ACI 369.1-17, which provides guidance on evaluation, repair and rehabilitation for existing concrete structures.

**R1.3.8.2** Conditions for evaluation of seismic resistance and design of are provided in Chapter 3 of ACI 369R, Chapter A2 of Appendix A of IEBC, and ASCE/SEI 41.

Critical conditions requiring engineering review include, but are not limited to: irregular building nonductile or strong-beam-weak-column frames; and anchorage of walls to diaphragms. improvements to the seismic resistance of a building can be made using repair techniques that provide less than those detailing and reinforcement methods required for new construction. As an example, providing additional reinforcement to concrete in hinging regions will increase the energy dissipation and seismic performance even though the amount of reinforcement may not satisfy the requirements for new structures (Kahn 1980; Priestley et al. 1996; Harris and Stevens 1991). Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook (FEMA P-154), Mitigation of Nonductile Concrete Buildings (ATC-78 Project), Seismic Performance Assessment of Buildings (ATC-58), of Building Seismic Performance Factors (FEMA P-695 Report), and and Mitigation of Nonductile Concrete Buildings (ATC-78-1) address seismic assessment and resistance in existing concrete structures.

Components of the seismic-force-resisting system that require strength and ductility should be Force-controlled (nonductile) action is acceptable for some classi- of components of the seismic-force-resisting system (ASCE/SEI 41). The strength requirement of this code, Section 7.1 is applicable to these force-controlled components. ASCE/SEI 41 and ACI 369R provide information on rehabilitation for seismic resistance. Seismic-resisting components requiring energy-dissipating capability should maintain the ability to dissipate energy after repair. Design and detailing requirements for seismic resistance of cast-in-place or precast concrete structures are addressed in ACI 318 and ACI 369R.

### 1.4—Administration

**1.4.1** Whenever this code is in with the regulations of the authority having jurisdiction or code governing

### R1.4—Administration


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existing buildings, the authority having jurisdiction or code governing existing buildings shall govern.

**1.4.2** Whenever this code is in with requirements in other referenced standards, this code shall govern.

**1.4.3** *Approval of special systems of design or construction*—Systems that are approved by the authority having jurisdiction through alternative means and methods clauses in the building design-basis code shall be permitted.

**1.4.4** Materials that are evaluated in a process equivalent to the requirements of the IBC shall be used in accordance with the requirements of the written evaluation report for the material. Material use shall satisfy requirements of this code.

### 1.5—Responsibilities of the licensed design professional

**1.5.1** The licensed design professional for the project is responsible for 1) assessing; 2) designing, detailing, and specifying the work proposed and material requirements; 3) consideration of load paths for the work proposed; and 4) preparing construction documents of the work proposed and specifying a quality assurance program. Construction documents shall indicate the location, nature, and extent of the work proposed.

**1.5.2** *Potentially dangerous structural conditions*—The licensed design professional for the project shall report observations of exposed structural defects in the existing construction within the work area representing visible potentially dangerous structural conditions requiring evaluation and possible mitigation to the Owner.

**1.5.2.1** When required by the authority having jurisdiction, visible potentially dangerous conditions shall be reported by the licensed design professional to the authority having jurisdiction.

## COMMENTARY

**R1.4.3** New methods of design, new materials, and new uses of materials for repair and rehabilitation usually undergo a period of development before being covered in a code. Hence, good systems or components might be excluded from use by implication if means are not available to obtain acceptance. For systems considered under this section, tests, load factors, strength reduction factors, n limits, and other pertinent requirements should be set by the authority having jurisdiction and should be consistent with the intent of this code. Provisions of this section do not apply to model analysis used to supplement calculations or to strength evaluation of existing structures.

**R1.4.4** The IBC (Section 1703 in IBC 2018) includes provisions for approval of alternate materials in new construction. The approval process requires the evaluation to be completed by an approved agency, and the material properties and use requirements be summarized in a written evaluation report. The same process may be used for materials in repair applications, provided the materials satisfy the provisions of this code. This process is intended to allow for use of new materials and new classes of materials that do not have approved design or material standards.

### R1.5—Responsibilities of the licensed design professional

**R1.5.1** During the assessment part of the investigation, the licensed design professional should request that the Owner provide all available information regarding the condition of the building, construction documents, previous engineering reports, disclose the presence of any known hazardous materials in the work area, and any other pertinent information to the parties involved in the work. This information may require that remedial measures be taken before or during the construction process and should be considered in the scope of work.

**R1.5.2** During investigation or repair construction, potentially dangerous structural conditions in the work area may be revealed. To protect the public safety, an observed potentially dangerous structural condition should be reported to the contractor and Owner to initiate mitigation of the condition. Mitigation may include temporary shoring or construction as part of the remedial work


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**1.5.3** The licensed design professional for the project shall document the basis of design. The basis of design shall address work categories and repair construction within the work area for each structural element and include:

(a) A description of the building

(b) s such as additions, alterations, or changes in occupancy

(c) Elements of existing structure to be shored

(d) Quality assurance and quality control (QA/QC) requirements

(e) Conditions and details of the proposed rehabilitation work

(f)

(g) Repair material requirements

(h) Known history of repairs and rehabilitation

## COMMENTARY

**R1.5.3** The basis of design provides a summary of the assessment of the existing structure, and a summary of the construction documents from original construction or prior rehabilitation used in developing the basis of design. The basis of design can be documented in a written report or included in construction documents. Information on some structures may be unavailable or unnecessary if strengthening is not required and should be so documented in the basis of design. The licensed design professional should review requirements of the authority having jurisdiction to determine the information to include in the basis of design documentation and requirements for the basis of design.

Additional materials that may be documented in the basis of design include:

(a) Detailed building description, including age of construction, structural systems, original building code, and past and current uses

(b) Documentation of potentially dangerous structural conditions in the work area of the structure determined in the assessment

(c) Documentation of substantial structural damage in the work area

(d) Members and systems of the work area requiring increase in capacity beyond the demand of the original building code

(e) Conditions and details of the proposed rehabilitation work

(f)

(g) Design-basis code criteria and basis of rehabilitation design

(h) Shoring requirements such as loads and spacing of shoring members

(i) Quality assurance and quality control (QA/QC) requirements

(j) Types and frequency of future inspection

(k) Types and frequency of future maintenance

(l) Recommendations to address serviceability conditions as discussed in Section 6.6

A maintenance protocol that addresses conditions provides the most method to ensure durability and should be established as part of the repair or rehabilitation design that includes inspections and period of time between inspections, after completion of the repair installation. Maintenance and frequent preventative approaches that occur early in the service life of the structure generally result in improved service life with less interruption and a lower life-cycle cost (Tuutti 1980; ACI 365.1R). Recommendations should be provided to the Owner on inspection and maintenance to be undertaken during the remaining design service life of the repair material or the repaired part of the structure.

A maintenance protocol should be provided in the basis of design, or in as-built or close-out documents. Maintenance of the repair can be incorporated in the instruction manuals from the licensed design professional, contractor, or product manufacturers. Documents and records of observations,


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inspections and tests should be provided to the Owner as necessary for future work.

### 1.6—Construction documents

**1.6.1** The construction documents for rehabilitation work proposed shall provide detail and clarity to convey the location, nature and extent of the work, and the necessary information to perform the work in conformance with the requirements of this code and the local authority having jurisdiction. shall require that materials used for repair and rehabilitation construction satisfy this code and governing regulatory requirements at the time the work is implemented.

### R1.6—Construction documents

**R1.6.1** As necessary, the construction documents should indicate:

(a) Name and date of issue of the building code and supplements to which the assessment, repairs, or rehabilitation conforms

(b) Design-basis code criteria used for conditions addressed by the documents

(c) Design assumptions and construction requirements including properties of existing and remedial materials used for the project and the strength requirements at stated ages or stages of the construction

(d) Details, locations and notes indicating the size, - uration, reinforcement, anchors, repair materials, preparation requirements, and other pertinent information to implement the repairs, strengthening, or rehabilitation of the structure

(e) Magnitude and location of prestressing forces

(f) Anchorage details for prestressing reinforcement

(g) Development length of reinforcement and length of lap splices

(h) Type and location of mechanical or welded splices of reinforcement

(i) Shoring or bracing criteria necessary before, during, and at completion of the assessment, repair, or rehabilitation projects

(j) Quality assurance program including inspections and testing requirements

ACI 563 is a reference that is written to be consistent with the requirements of this Code.

**1.6.2** Calculations pertinent to design shall be submitted with the construction documents if required by the authority having jurisdiction. Scale-model testing and analysis shall be permitted to supplement calculations.

**R1.6.2** Analyses and designs should include calculations, evaluation and design assumptions. If computer-based analyses and designs, such as element methods are used, they should include input, and computer-generated output.

**1.6.3** To the extent required by the contract between the licensed design professional and Owner, the licensed design professional shall provide the Owner with copies of the basis of design report, assessment reports, project documents, reports, locations of completed repairs, and other project documents.

**R1.6.3** Documentation of the project and repairs that have been carried out, including structural observations, inspection reports by others, test results, and recommendations on inspection and maintenance to be undertaken during the remaining design service life of the repaired part of the concrete structure, should be provided to the Owner. The extent and type of quality assurance records should include those required in the construction documents. It is good practice for the Owner to keep documentation of repairs, inspections, testing, monitoring, and investigations for future reference.

### 1.7—Preliminary assessment

**1.7.1** Preliminary assessment of an existing structure shall include investigation and review of the structure, construction documents, reports, local jurisdictional codes, and other available documents of the existing structure. Existing in-place conditions shall be visually or otherwise investigated to verify existing geometry and structural conditions.

### R1.7—Preliminary assessment

**R1.7.1** The goal of the preliminary assessment is to examine available information about the structure within the work area, and to make an initial determination of its adequacy to withstand in-place environmental conditions and design loads. The results of the preliminary assessment should be used to make decisions regarding the current


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in-place condition, need for additional information, work items necessary as part of the assessment, possible rehabilitation design and construction work to consider, and if there is a need for temporary shoring for safety of the existing structure. The preliminary assessment results should be updated as additional data regarding the examined structure become available.

The licensed design professional may determine that 4.6 or A.6 applies in a preliminary assessment based on engineering judgment and without analysis if all of the following

(a) Historical performance of the structure and visual observation of the structural condition of members and systems indicate acceptable behavior precluding assessment by 4.3 or A.3

(b) Review of construction documents and observation of current structural conditions indicate damage or deterioration of the structure below the level requiring assessment by 4.4 and 4.5 or A.4 and A.5

(c) s for additions, alterations, and changes in occupancy are not planned.

Repairs are permitted that address durability and serviceability of 4.6 or A.6 without analyzing members and systems and checking the demand-capacity ratio limits of 4.3 through 4.5 or A.3 through A.5 if the structure is determined to be structurally acceptable. Structural performance should be considered acceptable if past and present performance has been satisfactory and observations do not indicate structural distress beyond levels expected.

The extent of damage or deterioration should be limited and the licensed design professional should not have a concern about the capacity of the structure if repairs are completed using the provisions of 4.6 with verifying the demand to capacity limits of 4.4 and 4.5 or A.4 and A.5.

**1.7.2** The preliminary assessment shall determine if visibly potentially dangerous structural conditions are present. If present, they shall be reported in accordance with 1.5.2.

**R1.7.2** Potentially dangerous structural conditions may require the Owner to install shoring, limit access, or take other measures to mitigate these conditions.

**1.7.3** For the purpose of performing a preliminary assessment, it is permitted to use the criteria of the original or current building code for assessment criteria of Chapter 4 or Appendix A.

**R1.7.3** The assumed preliminary assessment criteria should be substantiated or in accordance with the assessment details of Chapter 6.

**1.7.4** The in-place strength of the existing structure shall be determined considering in-place geometric dimensions and material properties including of material deterioration

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ately available, a preliminary assessment is permitted to be completed using material properties as described in Section 6.3.2.

**R1.7.4** When required as a part of the preliminary assessment, strength calculations should be based on in-place conditions and should include an assessment of the loss of strength due to deterioration mechanisms. Guidelines for assessing in-place conditions include ACI 201.2R, ACI 214.4R, ACI 228.1R, ACI 228.2R, ACI 364.1R, ACI 437.1R, FEMA P-58, FEMA P-154, FEMA 306, FEMA 307, ASCE/SEI 11, ASCE/SEI 41, ATC-20, ATC-45, and ATC-78 as well as The Concrete Society *Technical Report 68* (2008). When material test results are initially unavailable, historical properties based on typical values used at the time of


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construction can be used in preliminary evaluation. If available, material properties from construction documents can also be used in a preliminary evaluation.

The assessment of existing structures should initially focus on critical gravity-load-resisting members such as columns, walls, and members that are expected to have limited ductility, followed by an assessment of the lateral-load-resisting system.

Assessing damage and other deterioration mechanisms that result in a change in material properties (such as compressive strength or modulus of elasticity) should include an evaluation of the of the damage on the material properties and the impact of the damage on the performance of the existing structure. Examples of deterioration mechanisms that result in possible changes in material properties include corrosion of steel reinforcement, thermal damage, concrete reactions such as alkali-aggregate, and freezing and thawing.

Conditions to be documented include cracking, spalls, member cross-section dimensions than on the original construction drawings, and construction deviating from tolerances permitted under the original design criteria.

**1.7.5** A structural assessment in accordance with Chapter 6 shall be performed when a member or structure exhibits damage, displacements, deterioration, or structural - cies, or behavior is observed during the preliminary assessment that is unexpected or inconsistent with available design and construction documents or code requirements in at the time of construction.

**R1.7.5** The preliminary assessment is generally the portion of the work necessary to determine the rehabilitation category. Based upon preliminary assessment results, a structural assessment may be required to determine the extent of damage or if potentially dangerous structural conditions are present. However, in some cases the licensed design professional may deem that a structural assessment is not required based on judgement in accordance with 1.7.1 and R1.7.1.


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## CHAPTER 2—NOTATION AND DEFINITIONS

### 2.1—Notation

This chapter notation and terminology used in this code.

$c$ = depth of neutral axis, in.
$D$ = dead load acting on the structure
$d_t$ = distance from extreme compression to centroid of extreme tension reinforcement, in.
$\overline{f_c}$ = average core strength to account for the diameter and moisture condition of the core, psi
$f_c'$ =
$f_{ceq}$ = equivalent concrete strength used for evaluation, psi
$f_y$ =
$\overline{f_y}$ = average yield strength value for steel reinforcement, psi
$f_{yeq}$ = equivalent yield strength of steel reinforcement used for evaluation, psi
$k_c$ = of variation factor for concrete testing sample sizes
$k_s$ = of variation factor for steel testing sample sizes
$L$ = live load acting on the structure
$\ell_t$ = span of member under load test and taken as the smaller of: (a) distance between centers of supports; and (b) clear distance between supports plus thickness h of member; for a cantilever, it shall be taken as twice the distance from face of support to cantilever end, in.
$n$ = number of sample tests
$R_a$ = service load capacity of structural member, system, or connection including of damage, deterioration of concrete and reinforcement, and faulty construction determined using allowable stresses according to the original building code.
$R_{cn}$ = current in-place nominal capacity of structural member, system, or connection including the of damage, deterioration of concrete and reinforcement, and faulty construction
$R_{ex}$ = nominal resistance of the structure during an extraordinary (that is, low-probability) event computed using the probable material properties
$R_n$ = nominal capacity of structural member, system, or connection excluding the of damage, deterioration of concrete and reinforcement, and faulty construction
$S$ = snow load acting on the structure
$T_g$ = glass transition temperature, °F
$U$ = demand using nominal loads and factored load combinations for strength design provisions (LRFD)
$U_c$ = demand using nominal loads of the current building code and factored load combinations of ASCE/SEI 7 for strength design provisions (LRFD)

## COMMENTARY

## R2—NOTATION AND DEFINITIONS


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$U_o$ = demand using nominal loads and factored load combinations of the original building code for strength design provisions (LRFD)

$U_o^*$ = demand using nominal loads of the original building code and factored load combinations of ASCE/SEI 7 for strength design provisions (LRFD)

$U_s$ = demand using service loads of the original building code and load combinations of the original building code

$V$ = of variation (a dimensionless quantity equal to the sample standard deviation divided by the mean) determined from testing of concrete or steel samples from structures

$v_{ni}$ = nominal interface shear stress capacity

$v_u$ = resultant interface stress demand from the transfer of tension and shear

$\varepsilon_t$ = net tensile strain in the extreme tension reinforcement at nominal strength

$\varepsilon_y$ = yield strain of steel reinforcement

$\phi$ = strength reduction factor

$\phi_{ex}$ = strength reduction factor used to check strength of the structure without external reinforcement after an extraordinary event

$\phi_o$ = strength reduction factor from the original building code used in the design of an existing structure

### 2.2—Definitions

ACI provides a comprehensive list of through an online resource, "ACI Concrete Terminology." - tions provided here complement that resource.

**assessment—**refer to **structural assessment**.

**assessment criteria**—codes, standards, loads, demands, capacities, strength reduction factors, materials, material properties, connections, details, and protections used in the evaluation.

**authority having jurisdiction**—person or entity that has legal control over the applicable building code and permitting procedures for a structure.

**bond**—(1) adhesion of applied materials to reinforcement or other surfaces against which they are placed, including friction due to shrinkage and longitudinal shear in the concrete and repair materials engaged by the bar deformations; (2) adhesion or cohesion between layers of a repair area or between a repair material and a substrate produced by adhesive or cohesive properties of the repair material or other supplemental materials throughout the service life of the repair.

**bond-critical application**—strengthening or repair system that relies on load transfer from the substrate to the system material achieved through shear and tension transfer at the interface, where bond rather than mechanical attachment is used as the primary load transfer mechanism.

**capacity**—the strength, ductility, energy dissipation and durability, of a material, member or system as determined by analysis or testing.

## COMMENTARY

### R2.2—Definitions

Additional repair-related are provided by "ICRI Concrete Repair Terminology".

An example of an authority having jurisdiction is the local

This has been expanded from "ACI Concrete Terminology" for this code.


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**compatible**—the ability of two or more materials to be placed in contact or in y close proximity to interact with no detrimental results with respect to the intended service life.

**connector steel**—steel elements, such as reinforcing bars, shapes, or plates, embedded in concrete or connected to embedded elements to transfer load, restrain movement, or provide stability.

**contact-critical application**—strengthening or repair system that relies on load transfer from the substrate to the system material achieved through bearing perpendicular to the interface.

**construction documents**—written and graphic documents and prepared or assembled that describe the location, design, materials, and physical characteristics of the elements of a project necessary for obtaining a building permit and for construction of the project.

**damage**—a decrease in the capacity of an existing member or structure resulting from events, such as loads and displacements, or as a result of deterioration of the structure.

**dangerous**—any building, structure, or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved its foundation, or lacks the necessary support of the ground.

2. There exists a risk of collapse, detachment or dislodgement of any portion, member, appurtenance, or ornamentation of the concrete building or structure under service loads.

**demand**—the force, deformation, energy input, and chemical or physical attack imposed on a material, member, or system which is to be resisted.

**design-basis code**—legally adopted code requirements under which the assessments, repairs, and rehabilitations are designed and constructed.

**design-basis criteria—**codes, standards, loads, displacement limits, material properties, connections, details, and protections used in the design of mandated or voluntary work.

**design service life (of a building, component, or material)**—the period of time after installation or repair during which the performance the requirements if routinely maintained but without being subjected to an overload or extreme event.

**deterioration**—(1) physical manifestation of failure of a material (for example, cracking, delamination, pitting, scaling, spalling, and staining) caused by environmental or internal autogenous on rock and hardened concrete as well as other materials; (2) decomposition of material during either testing or exposure to service. (See also **disintegration** and **weathering** in ACI CT.)

**durability**—ability of a material or structure to resist weathering action, chemical attack, abrasion, and other conditions of service and maintain serviceability over a

## COMMENTARY

An example of a contact-critical application is the addition

This has been adopted from the IEBC. Potentially dangerous conditions of an existing concrete member, system, or structure may include those as dangerous from the IEBC. Circumstances may render some conditions as dangerous to be potentially dangerous within a limited period of time or may be concluded to be less of an imminent hazard.


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**equivalent cover**—a system to supplement concrete cover to improve durability or protection to that equivalent to the minimum cover in the design-basis code.

**evaluation**—refer to **structural evaluation**.

**existing structure**—structure for which a legal of occupancy has been issued. For structures that are not covered by a of occupancy, existing structures are those that are complete and permitted for use or otherwise

**factored load**—product of the nominal load and load factor.

**faulty construction** construction resulting from errors or omissions in design or improper construction causing displacement of supporting portions of the structure or resulting in materials, geometry, size or location of concrete members, reinforcement or connections that result in a decrease in the capacity of an existing structure or an adverse impact on the long-term durability or serviceability of the structure.

**in-place condition**—current condition of an existing structure, system, member, connection including component sizes and geometry, material properties, faulty construction, deterioration, and damage from an event.

**interface reinforcement**—(1) existing or supplemental reinforcement that is properly anchored on both sides of an interface; (2) post-installed reinforcement such as adhesive anchors or mechanical anchors, or other mechanical connections providing a method of force transfer across an interface.

**interface shear stress**—shear stress resulting from transfer of forces at bonded interfaces between repair material and existing substrate used to achieve composite behavior.

**licensed design professional**—(1) an engineer or architect who is licensed to practice structural design as by the statutory requirements of the professional licensing laws of a state or jurisdiction; (2) the engineer or architect, licensed as described, who is responsible for the structural design of a particular project (also historically engineer of record).

**nominal load**—magnitude of load by the design-basis code before application of any load factor.

**nonstructural concrete**—any element or portion thereof made of plain or reinforced concrete that is not required to transfer gravity load, lateral load, or both, along a load path of a structural system to the ground.

**Owner—**corporation, association, partnership, individual, or public body or authority with whom the contractor enters into an agreement and for whom the work is provided. The Owner is the party in legal possession of the structure.

**potentially dangerous**—(1) structural state of existing concrete within a work area for an individual structural member, structural system, or structure meets the of dangerous or unsafe, is unstable, has potential of collapse of overhead components or pieces (falling hazards), has

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The is from the IEBC of an existing building. The IEBC is "A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued." When using this code with the IEBC, use of the IEBC is appropriate.

This is adopted from "ACI Concrete Terminology."

Potentially dangerous conditions of an existing concrete member, system, or structure include conditions that may be as dangerous or unsafe in the IEBC. These conditions may be overtly hazardous, dangerous, or unsafe depending


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been determined to have demand/capacity ratio exceeding the limit of Section 4.3.2.2 or has potentially hazardous resistance for seismic events. (2) A limit state of unacceptably low margin of safety against collapse without supplemental resistance.

**rehabilitation**—repairing or modifying an existing structure to a desired useful condition.

**repair**—the reconstruction or renewal of concrete parts of an existing structure for the purpose of its maintenance or to correct deterioration, damage, or faulty construction of members or systems of a structure.

**repair reinforcement**—reinforcement used to provide additional strength, ductility, or any combination of the three, to the repaired member.

**repair, structural**—restoring a damaged or deteriorated structure or increasing the capacity of a structure.

**repair system**—the combination of existing and new components, which may include existing reinforcement, repair materials, supplementary reinforcement and supplemental structural members.

**retr** of an existing member, system, or structure to increase its strength, ductility, or both as a means of improving the seismic performance of the structure.

**serviceability**—structural performance under service conditions.

**shoring**—props or posts of timber, steel, or other material used for the temporary support of excavations, formwork, members during repairs, or potentially dangerous structures; the process of erecting shores.

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on the circumstances or load probability between the time of determination and repair.

This is adapted from ACI Concrete Terminology – "the process of repairing or modifying a structure to a desired useful condition." The is for concrete rehabilitation and is inclusive of the IEBC - tion – "Any work, as described by the categories of work herein, undertaken in an existing building." Herein, concrete rehabilitations include: repair to restore original capacity; strengthening to increase the capacity to the current building code requirements; seismic per ASCE/SEI 41; and addressing additions, alterations, and change of occupancy.

The of repair from ACI Concrete Terminology is "to replace or correct deteriorated, damaged, or faulty materials, components, or elements of a structure." The of repair from IEBC is "The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage." The herein is adapted from the IEBC and is for repair of materials, components, or elements of existing concrete structures where structural repair or durability is addressed. Faulty materials, components, or elements of a structure are interpreted to be faulty construction resulting from errors or omissions in design or construction.

This is adapted from ACI Concrete Terminology – "increasing the load-carrying capacity of a structural component beyond its current capacity or restoring a damaged structural component to its original design capacity." Herein, the addresses increasing the capacity to include enhancements such as ductility of existing concrete members. Repairs to nonstructural members, whose failure would cause or result in potentially dangerous structural conditions are considered structural repairs.

Typically used to refer to seismic to increase resistance in an existing structure per ASCE/SEI 41. The is adapted from ASCE/SEI 41 – "Improving the seismic performance of structural or nonstructural components of a building."


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**specialty engineer**—a licensed design professional retained by a contractor to design a delegated portion of the project.

**stability, global**—stability of the overall existing structure with respect to vertical support, uplift, overturning, sway instability, or sliding failure.

**stability, local**—the stability of an individual member or part of an individual member.

**strengthening**—process of increasing the capacity of an existing structure or a portion thereof.

**structural analysis**—process of using engineering mechanics to determine internal demands on, and capacities of a structure, member, or system.

**structural assessment**—the process of investigating by systematically collecting information regarding the performance of an existing structure; and evaluating the collected information to make informed decisions regarding the need for repair or rehabilitation; and detailing of as conclusions and reporting recommendations for the examined structural concrete work area (member, system, or structure).

## COMMENTARY

The term "specialty engineer" is used in Chapter 9. In this code, the specialty engineer will typically be a licensed design professional that is retained by the contractor to design types of components such as precast concrete or shoring members.

This with details for existing concrete is adapted from ASCE/SEI 11 – "Systematic collection and analysis of data, evaluation, and recommendations regarding the portions of an existing structure which would be by its proposed use."

A structural assessment is the process of acquiring knowledge of the existing structure used for the purpose of judging the future performance. The results of the investigation and evaluation are used to make decisions on the appropriate course of action regarding the future use of the structure and the suitability of the structure to continue in service.

Herein, assessments should be limited to the work area and may include:

(a) Investigation of the in-place condition of the existing structure by:

i. Collection and review of data for the structure, such as geometry, material strengths, conditions, symptoms of distress, extent of damage, measurement of displacements, environmental factors and reinforcement sizes, and placement

ii. Collection of background data, such as construction plans, construction records, original, current, and code governing existing buildings, and historical events

(b) Evaluation of an existing structure, member or system of the work area (refer to commentary for structural evaluation)

(c) Findings and conclusions of the investigation and evaluation include:

i. the existing structure, member, or system rehabilitation category using the assessment criteria of this code

ii. Identify the work area, scope of work and likely cause or mechanism of damage, distress and deterioration

iii. Identify faulty construction limitations

iv. Evaluate test results to determine cause of failure and predict future performance.

(d) Determine repair and rehabilitation concepts, strategies, alternates and recommendations

i. Develop cost-impact or economic study as necessary to appraise remedial work and maintenance

ii. Describe repair and rehabilitation work recommendations


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## CODE

**structural concrete**—plain or reinforced concrete in a member that is part of a structural system required to transfer gravity loads, lateral loads, or both, along a load path to the ground.

**structural evaluation**—the process of determining and judging the structural adequacy of a structure, member, or system for its current intended use or performance objective.

## COMMENTARY

(e) Report conclusions and recommendations include:
i. Work area limits and limitations of information collected and evaluated
ii. Assessment criteria and work of the evaluation such as calculations, tests and analyses
iii. Details of (conclusions) and recommendations
iv. Safety issue requirements (for example, recommendation for any temporary shoring)

This is adapted from ASCE/SEI 11 – "The process of determining the structural adequacy of the structure or component for its intended use, performance, or both. Evaluation by its nature implies the use of personal and subjective judgment by those functioning in the capacity of experts." An evaluation should determine, to the best of the license design professional's knowledge, the level of quality (structural adequacy, serviceability, or durability) of an existing structure based upon a measured criteria and the judgment of the licensed design professional. An evaluation may require professional judgment to gage structural adequacy. Structural analyses may be required to determine possible ranges of existing structure capacities and variations in demands. The goal of the evaluation process is to appraise the in-place condition to determine adequacy for current or proposed future use. Structural evaluation requires determining capacity and demand, which may vary widely depending on the acquired information, tests, models, and analyses; determining the demand-capacity ratios; and judging structural reliability limits, which may be open to interpretation based on project requirements, structural experience, knowledge, and past performance.

Evaluation activities may include:

(a) Tests to reinforcement location, strength of material properties or structural capacity of existing members or systems or for presence of contaminants.

(b) Analysis of test results to establish reinforcement, statistical equivalent material properties, limits of faulty construction, and structural capacity

(c) Screening of observations and tests for mechanisms and causes of damage, distress, and deterioration

(d) Establishing the assessment criteria

(e) Calculating demand loadings, serviceability limits, lateral displacements, and durability requirements

(f) Analysis of the structure to determine the capacity of the structure to withstand current or future load demands and comply with serviceability limits

i. Determination of demand-capacity ratios to appraise structural adequacy, ascertain and judge the need for repair and rehabilitation
ii. determination of maintenance requirements necessary for the service life of the structure


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## CODE

**substantial structural damage**—except when using Appendix A, substantial structural damage shall be as

When using this code as a stand-alone code, substantial A.4.

**temporary bracing**—non-permanent supplemental members added to an existing structure to prevent local or global instability during assessment and repair construction.

**undercutting**—concrete removal around the reinforcement circumference to allow for existing reinforcement to be encapsulated in repair material.

## COMMENTARY

The of substantial structural damage is from the IEBC. The has been as noted in A.4, when using this code as a stand-alone code.


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## CODE

### CHAPTER 3—REFERENCED STANDARDS

*American Concrete Institute*

ACI 216.1-14—Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

ACI 318-19—Building Code Requirements for Structural Concrete and Commentary

ACI 369.1-17—Standard Requirements for Seismic Eval-

ACI 437.2-13—Code Requirements for Load Testing of Existing Concrete Structures and Commentary

ACI for Carbon and Glass Fiber-Reinforced Polymer Bar Materials for Concrete Reinforcement

ACI for Carbon and Glass Fiber-Reinforced Polymer (FRP) Materials Made by Wet Layup for External Strengthening of Concrete and Masonry Structures

*American Institute of Steel Construction*

ANSI/AISC for Structural Steel Buildings

*American Society of Civil Engineers*

ASCE/SEI 7—Minimum Design Loads for Buildings and Other Structures

ASCE/SEI 37—Design Loads on Structures during Construction

ASCE/SEI 41—Seismic Evaluation and of Existing Buildings

*American Welding Society*

AWS D1.4/D1.4M:2011—Structural Welding Code—Reinforcing Steel

*ASTM International*

ASTM for Billet-Steel Bars for Concrete Reinforcement (withdrawn 1969)

ASTM for Rail-Steel Bars of Concrete Reinforcement (withdrawn 1969)

ASTM for Deformed Rail Steel Bars for Concrete Reinforcement with 60,000 psi Minimum Yield Strength (withdrawn 1969)

ASTM for Axle-Steel Bars for Concrete Reinforcement (withdrawn 1969)

ASTM A185/A185M-18—Standard for Steel Welded Wire Reinforcement, Plain, for Concrete (withdrawn 2013)

ASTM A370-14—Standard Test Methods and for Mechanical Testing of Steel Products

ASTM for Special Large Size Deformed Billet-Steel Bars for Concrete Reinforcement (withdrawn 1968)

ASTM for High-Strength Deformed Billet-Steel Bars for Concrete Reinforcement with 75,000 psi Minimum Yield Strength (withdrawn 1968)

## COMMENTARY

### R3—REFERENCED STANDARDS

Both current and withdrawn standards are referenced. Standards that are referenced in the design-basis code are applicable for the assessment of existing structures. These standards may have been withdrawn by the developing organization; however, they provide information on the materials used at the time of original construction. Refer to 4.3.3 and Chapter 6.


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## COMMENTARY

ASTM for Deformed Billet Steel Bars for Concrete Reinforcement with 60,000 psi Minimum Yield Point (withdrawn 1968)

ASTM A497/A497M—Standard for Steel Welded Wire Reinforcement, Deformed, for Concrete (withdrawn 2013)

ASTM A615/A615M-14—Standard for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A616/A616M-96a—Standard for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement (withdrawn 1999)

ASTM A617/A617M-96a—Standard for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement (withdrawn 1999)

ASTM A706/A706M-14—Standard for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A955/A955M-15—Standard for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement

ASTM A1061/A1061M-09—Standard Test Methods for Testing Multi-Wire Steel Strand

ASTM C42/C42M-13—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C823/C823M-12—Standard Practice for Examination and Sampling of Hardened Concrete in Constructions

ASTM C1580-15—Standard Test Method for Water-Soluble Sulfate in Soil

ASTM C1583/C1583M-13—Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct T

ASTM D516-16—Standard Test Method for Sulfate Ion in Water

ASTM D4065-12—Standard Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures

ASTM D4130-15—Standard Test Method for Sulfate Ion in Brackish Water, Seawater, and Brines

ASTM E329-14a—Standard for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

*BSI Group*

BS EN 1504-10:2017—Products and systems for the protection and repair of concrete structures.
requirements, quality control and evaluation of conformity. Site application of products and systems and quality control of the works

*International Code Council*

IBC—International Building Code

IEBC—International Existing Building Code


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## CODE

## CHAPTER 4—CRITERIA WHEN USING THIS CODE WITH THE INTERNATIONAL EXISTING BUILDING CODE (IEBC)

### 4.1—General

**4.1.1** This chapter applies if a jurisdiction has adopted the International Existing Building Code (IEBC) as the existing building code. When this chapter is used, Appendix A does not apply.

**4.1.2** The design-basis code criteria of the project shall be determined based upon the results of the preliminary assessment (1.7) and the detailed assessment (Chapter 6), if performed, using the requirements set forth in this chapter.

**4.1.3** It shall be permitted to use the current building code in place of the original building code as the design-basis criteria for all damage states, deterioration, faulty design, or faulty construction.

**4.1.4** It shall be permitted to use this code in conjunction with the IEBC to determine the work category as shown in Table 4.1.4.

## COMMENTARY

## R4—CRITERIA WHEN USING THIS CODE WITH THE INTERNATIONAL EXISTING BUILDING CODE (IEBC)

### R4.1—General

**R4.1.1** Appendix A is used when this code is used for existing concrete structures as a stand-alone code without the IEBC and may be used to supplement provisions of Chapter 34 in 2012 and previous versions of the IBC.

**R4.1.2** Structures constructed under previously adopted codes or before the adoption of a building code may not satisfy all current building code requirements. This Code and the IEBC contain requirements that determine if existing structures should be repaired, rehabilitated, or to satisfy the requirements of the design-basis code. Local ordinances may also require that a structure be rehabilitated to satisfy the current codes. These requirements should be reviewed at the start of a project.

In the absence of mandatory local ordinances, the licensed design professional should determine if a seismic evaluation is necessary for potentially hazardous conditions using Section 4.3.3. Section 4.3.3 provides minimum assessment criteria for potentially hazardous seismic conditions. Provisions of ASCE/SEI 41 may be applicable to nonbuilding structures being assessed.

**R4.1.3** Refer to Section R1.2.4.3.1 for additional commentary on use of current building code as the design-basis criteria.

**R4.1.4** Unless the local jurisdiction provides more restrictive requirements, this chapter with the IEBC should be used to determine the assessment and design-basis criteria based on the work category of Table 4.1.4.


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## CODE

## COMMENTARY

**Table 4.1.4—Design-basis code criteria references for work categories**

| Work category | Design-basis code criteria reference |
|---|---|
| Potentially dangerous structural conditions for gravity and wind loads | 4.3.2 |
| Potentially hazardous structural conditions for seismic resistance in regions of high seismicity | 4.3.3 |
| | IEBC |
| Substantial structural damage to vertical elements of the lateral-force-resisting system | IEBC |
| Substantial structural damage to vertical elements of the gravity-load-resisting system | IEBC |
| Damage less than substantial structural damage with strengthening | 4.5 |
| Damage less than substantial structural damage without strengthening | 4.6 |
| Deterioration and faulty construction with strengthening | 4.5 |
| Deterioration and faulty construction without strengthening | 4.6 |
| Additions | IEBC |
| Alterations | IEBC |
| Changes in occupancy | IEBC |

**4.1.5** This code shall be used to assess and design repairs of existing structures. The current building code shall be used to detail new concrete members and connections between new concrete members and existing construction. When the original building code is used as the design-basis criteria for repairs and new concrete or reinforcing members are integrated with the repairs, the original building code shall be used for design; otherwise, these new members shall be designed using the current building code.

**R4.1.5** New member or reinforcement that is part of the work area repairs and built jointly with the existing structure should be designed using the same criteria as other repairs to the structure. However, the detailing of new members and detailing of added reinforcement, including connections to the existing structure, should comply with the current building code.

**4.1.6** In design of repair to existing structures using the original building code, detailing of the existing reinforcement within the work area need not comply with the current building code, if both of the following conditions are

(a) The damage or deterioration to the existing reinforcement is addressed

(b) The repaired work area of the structure has capacity equal to or greater than demand per 5.2.2 using the original building code requirements or the requirements of 4.5.3 when using allowable stress design

**R4.1.6** The licensed design professional should review the development of existing reinforcing steel, when cracking damage is evident near the ends of reinforcement, to determine if the cracking is indicative of potential development failure beyond the restrictions of this section. Research has shown that development length equations from previous versions of ACI 318 may be unconservative for top cast plain reinforcing steel bars (Feldman and Cairns 2017). - cant changes have occurred in the building code requirements increasing the development of reinforcing steel.

When the basis of design is the current building code, the licensed design professional should consider the following:

(a) Assessing demand/capacity ratios for the existing reinforcing steel with current development length provisions

(b) details of the reinforcement when assessing seismic resistance

The licensed design professional should determine if structural behavior indicates adequate performance. ACI


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### 4.2—Compliance method

**4.2.1** The compliance method selected and the design-basis criteria shall be used consistently for all assessment and rehabilitation design, excluding other options.

### 4.3—Potentially dangerous structural conditions

**4.3.1** A structural assessment shall be performed in the work area to determine if potentially dangerous structural conditions are present when there is a reason for the licensed design professional to question the capacity of the structure or when potentially dangerous structural conditions are observed as a part of the preliminary assessment.

**4.3.1.1** Potentially dangerous structural conditions shall be reported in accordance with 1.5.2.

**4.3.2** For gravity, soil, and wind loads, potentially dangerous structural conditions exist in members or structures where the demand/capacity ratio is greater than 1.5, as shown in Eq. (4.3.2).

$$U_c/\phi R_{cn} > 1.5 \qquad (4.3.2)$$

In Eq. (4.3.2), $U_c$ is the strength design demand determined by using the nominal loads in the current building code and the factored load combinations of ASCE/SEI 7, excluding seismic forces; and $\phi R_{cn}$ is the capacity adjusted by the strength reduction factor $\phi$ in Section 5.3 or 5.4 of this code.

**4.3.2.1** If the demand/capacity ratio exceeds 1.5 for the work area, the design-basis criteria shall be the current building code.

**4.3.2.2** For structures with no potentially dangerous conditions, Sections 4.4 through 4.9 shall be used to determine the design-basis criteria.

## COMMENTARY

224.1R, ACI 437R, and ACI 437.1R provide guidance in judging acceptable performance.

### R4.2—Compliance method

**R4.2.1** For all existing structures, only one of the compliance methods listed in the IEBC should be used and these should not be used in combination with each other.

### R4.3—Potentially dangerous structural conditions

**R4.3.1** Structural assessments are required when damage, deterioration, structural ies or behavior are observed during the preliminary assessment that are unexpected or inconsistent with available construction documents. The structural condition assessment will be performed in accordance with 1.7 or Chapter 6, or both. The commentary to 1.7.4 has information on methods to determine if there is a reason to question the capacity of the structure. Results of the condition assessment should also be reviewed to identify if potentially dangerous structural conditions are present. Potentially dangerous structural conditions include any instability, the potential for collapse of overhead components or pieces (falling hazards), or a risk of collapse exists under service load conditions.

**R4.3.2** Demand/capacity ratios are used to quantify the adequacy of the member or structure. The threshold demand/capacity ratios determine when levels of intervention may be required. For each demand/capacity ratio, this code provides direction on how the demand and capacity are determined. Demands may be determined based upon loads associated with current building codes ($U_c$ as above) or loads during the original design of the structure ($U_o$ as in Section 4.5.1). The calculated capacity of the structure will vary depending upon the condition of the structure and extent of evaluation used to as-built properties of the structure.

In assessing potentially dangerous structural conditions, the demand of Eq. (4.3.2) combines current building code nominal gravity loads (dead, live and snow) with lateral loads from soil and wind (excluding seismic forces), using the factored load combinations of ASCE/SEI 7. A demand/capacity ratio greater than 1.5, calculated using Eq. (4.3.2), represents a condition with limited to potentially no margin of safety against failure for ASCE/SEI 7 loads (Stevens and Kesner 2016).

In the assessment of potentially dangerous structural conditions, the licensed design professional should determine if it may be appropriate to include structural redundancies, alternate load paths, primary and secondary supporting elements, redistribution of loads, collapse mechanisms, reduced live loads, measured displacements (sagging, listing, leaning and tilting), second-order and other loads to the structure, such as drifting snow, self-straining loads, ice, and References for potentially dangerous structural conditions are Galambos et al. (1982), Ellingwood et al. (1982), and Ellingwood and Ang (1972). These references


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**4.3.3** Assessment criteria for potentially hazardous structural conditions of concrete structures for seismic loads, unless addressed by the authority having jurisdiction, are limited to potentially harzardous conditions associated with Structural Performance Level, Collapse Prevention of structures in Seismic Design Category D, E, and F of ASCE/SEI 7 using Earthquake Hazard Level, BSE-1E, and shall be determined using ASCE/SEI 41 and this Code. The design-basis criteria for design and construction to address potentially hazardous seismic conditions in concrete structures shall be this Code and ASCE/SEI 41.

### 4.4—Substantial structural damage

**4.4.1** Substantial structural damage shall be assessed and rehabilitated as referenced in Table 4.1.4.

### 4.5—Conditions of deterioration, faulty construction, or damage less than substantial structural damage with strengthening

If a work area of a structure has damage less than substantial structural damage, deterioration, or contains faulty construction, and there is a reason for the licensed design professional to question the capacity of the member, system, or structure of the work area, it shall be assessed by checking one of the criteria in sections 4.5.1, 4.5.2, or 4.5.3 as selected by the licensed design professional. Sections 4.5.1 through 4.5.3 shall not be applied in combination with each other.

**4.5.1** The demand/capacity ratio of the member, system, or structure of the work area shall be evaluated using the original building code demand ($U_o$) with nominal loads, factored load combinations, and capacities of the original building code to determine if the demand/capacity ratio exceeds 1.0, as shown in Eq. (4.5.1).

$$U_o/\phi_o R_{cn} > 1.0 \quad (4.5.1)$$

In Eq. (4.5.1), $U_o$ is the strength design demand determined by using the nominal loads and factored load combinations of the original building code. $\phi R_{cn}$ is the capacity adjusted by the reduction factor ($\phi_o$) of the original building code.

If $U_o/\phi_o R_{cn}$ is greater than 1.0, then strengthening repairs are required and shall be permitted to restore the structural capacity required by the original building code.

Repair of the existing concrete structure shall be permitted to restore a member, system, or structure of the work area to the capacity of the original building code based on the material properties of the original construction. New concrete members and connections to existing construction shall

## COMMENTARY

provide basic probability theory and concepts for an evaluation using the details of the demand as it relates to the capacity with the strength reduction factors of Section 5.3 for new concrete structures.

**R4.3.3** Compliance with ASCE/SEI 41 for Structural Performance Level, Collapse Prevention using an applicable Earthquake Hazard Level, BSE-1E should be reviewed and approved by the local authority having jurisdiction for the assessment of potentially harzardous seismic conditions of concrete structures. Assessment of potentially hazardous seismic conditions for concrete structures is not required for structures in regions of low or moderate seismicity. If no requirements for potentially hazardous seismic structural conditions are provided by the local authority having jurisdiction, the licensed design professional should refer to ATC-78, the IEBC and ASCE/SEI 41 appendices for guidance.

### R4.5—Conditions of deterioration, faulty construction, or damage less than substantial structural damage with strengthening

**R4.5.1** Concrete structures with damage less than substantial structural damage, deterioration, or containing faulty construction have historically been restored to the strength of the original building code.

The demand/capacity ratio limit of 1.0 as provided in this section allows strengthening repair that restores the structural reliability of the existing structure to the level prior to damage and deterioration when that repair is greater than that intended in the original building code.

Historical performance is often an acceptable indicator of adequate safety if the structure has been subjected to known loads even if the demand in the original building code was

If the capacity of the structure is not in question, such as indicated by the commentary provisions of R1.7, assessment checks are not required.


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comply with provisions of 4.1.5. If $U_o/\phi_o R_{cn}$ is 1.0 or less, then strengthening repairs are not required.

**4.5.2** An alternative assessment criteria shall be permitted when approved by authority having jurisdiction using engineering principles for the member, system, or structure of the work area of the existing structure.

## COMMENTARY

**R4.5.2** An assessment criterion other than the current building code or ASCE/SEI 41 may be used. The references of R4.3.2 should be considered in the selection of applicable assessment criterion. Beyond using the current building code, the assessment criteria should address if the demand or capacity of the original structure or member is inconsistent with current standards resulting in unacceptable structural safety. An increase in load intensity; added loads; changes in load factors, strength reduction factors, or load combinations; of analytical procedures; or changes in the determined capacity between the original and current building code (such as a change from allowable stress design [ASD] to strength design) should lead the licensed design professional to question the applicability of using the original building code for the assessment of an existing structure. Engineering principles used to determine acceptable structural safety are to use either a probabilistic evaluation of loads and capacities to show adequate structural reliability indices or an evaluation procedure using demand/capacity ratios that are derived from the basic engineering principles as presented in current standards.

An assessment criterion for a structure that has damage less than substantial structural damage, deterioration, or faulty construction that is based on the demand/capacity ratio threshold of 1.05 using the original building code or 1.1 using the current building code is the following:

a) If the current building code demand ($U_c$) exceeds the original building code demand ($U_o^*$) increased by 5 percent ($U_c > 1.05U_o^*$), check the demand/capacity ratio using the current building code demand ($U_c$) to determine if it exceeds 1.1, as shown in Eq. (R4.5.2a).

$$U_c/\phi R_{cn} > 1.1 \qquad \text{(R4.5.2a)}$$

If the demand/capacity ratio exceeds 1.1, then that system or member should be strengthened using the current building code demand. If the demand/capacity ratio does not exceed 1.1, then no strengthening is required.

b) If the current building code demand ($U_c$) does not exceed the original building code demand ($U_o^*$) increased by 5 percent ($U_c \le 1.05U_o^*$), check the demand/capacity ratio using the original building code demand ($U_o^*$) to determine if it exceeds 1.05, as shown in Eq. (R4.5.2b).

$$U_o^*/\phi R_{cn} > 1.05 \qquad \text{(R4.5.2b)}$$

If the demand/capacity ratio exceeds 1.05, then that system or member strength should be restored using the original building code demand. If the demand/capacity ratio does not exceed 1.05, then strengthening is not required.

In this assessment criterion, the strength reduction factors ($\phi$) of Section 5.3 or 5.4 shall be applied in both Eq. (R4.5.2a) and (R4.5.2b).


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**4.5.3** If the concrete design criteria of the original building code only used allowable stress design, an alternate to using 4.5.2 strength design criteria is to evaluate the demand/capacity ratio of the member, system, or structure of the work area based on allowable stress design load combinations for demand ($U_s$) and resistance calculated using allowable stresses ($R_a$) as shown in Eq. (4.5.3).

$$U_s/R_a > 1.0 \qquad (4.5.3)$$

If the demand/capacity ratio exceeds 1.0, then strengthening repairs are required and shall be permitted to restore the structural capacity as required by the original building code. If the demand/capacity ratio is 1.0 or less, then strengthening repairs are not required.

Repair of the existing concrete structure shall be permitted to restore a member or system of the work area to the capacity of the original building code based on the material properties of the original construction. New concrete members and connections to existing construction are part of the repair and shall comply with provisions of 4.1.5.

**4.5.4** Existing structures other than those to be strengthened per 4.3 through 4.5 shall use 4.6 through 4.9 to determine the design-basis criteria.

### 4.6—Conditions of deterioration, faulty construction, or damage less than substantial structural damage without strengthening

**4.6.1** If less-than-substantial structural damage is present, structures damaged, deteriorated, or containing faulty construction that do not require strengthening in accordance

## COMMENTARY

The current building code strength design demand ($U_c$) combines current building code nominal gravity loads (dead, live, and snow) with lateral loads from soil, wind, and seismic using the factored load combinations of ASCE/SEI 7. The original building code strength design demand ($U_o^*$) combines original building code nominal gravity loads (dead, live, and snow) and lateral loads from soil, wind, and seismic using the factored load combinations of ASCE/SEI 7.

It may be appropriate to consider detailing requirements for ductility when considering seismic resistance, redistribution of internal member forces, reduced live loads, measured displacements (sagging, listing, leaning, and tilting), second-order and other loads to the work area of the structure, such as drifting snow, lateral earth and pres-

The use of data is acceptable, if substantiated by the licensed design professional. For these assessment criteria, the demand/capacity ratio provisions in R4.5.2a may be used in the assessment, whether the current building code demand does or does not exceed the original building code demand increased by 5 percent.

**R4.5.3** Before the "Building Code Requirements for Reinforced Concrete (ACI 318-63)" in 1963, the design of reinforced concrete structures was based upon allowable stress or working stress design principles. Original building code demands should include nominal gravity loads (dead, live, and snow) and lateral wind forces or seismic forces using the load combinations of original building code. Displacements (sagging, listing, leaning, and tilting), second-order and other loads to the work area of the structure, such as drifting snow, lateral earth pressures, self-straining

Using allowable stress design is inconsistent with the reliability principles of current strength design provisions. To adequately address current safety levels, consideration should be given to using strength design provisions of 4.5.2. It may be appropriate to consider detailing requirements for ductility when considering seismic resistance.

### R4.6—Conditions of deterioration, faulty construction, or damage less than substantial structural damage without strengthening

**R4.6.1** Serviceability requirements including limits and crack control reinforcement in the current building code are not requirements of this code, but should be considered in the assessment and repair of existing structures.


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## CODE

with 4.5 shall use Chapters 7 through 10 of this code as the design-basis criteria.

### 4.7—Additions

**4.7.1** The existing structure shall be assessed and rehabilitated in accordance with structural requirements of the IEBC per Table 4.1.4 for Additions.

### 4.8—Alterations

**4.8.1** The existing structure shall be assessed and rehabilitated in accordance with structural requirements of the IEBC per Table 4.1.4 according to Alteration level 1, 2, or 3.

### 4.9—Change of occupancy

**4.9.1** The existing structure shall be assessed and rehabilitated in accordance with structural requirements of the IEBC per Table 4.1.4 for changes of occupancy.

## COMMENTARY

### R4.8—Alterations

**R4.8.1** Alterations in this section exclude the remedial work of 4.3 through 4.6.


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## CHAPTER 5—LOADS, FACTORED LOAD COMBINATIONS, AND STRENGTH REDUCTION FACTORS

### 5.1—General

**5.1.1** If this code is part of the design-basis code, the load factors, load combinations, and strength reduction factors in this chapter shall be used for the assessment of the existing structure and the design of rehabilitation.

**5.1.2** It shall not be permitted to use load factors and load combinations from the original building code with strength reduction factors from this chapter. It shall not be permitted to use load factors and load combinations from this chapter with strength reduction factors from the original building code.

**5.1.3** For work areas subjected only to construction activity and not subjected to design occupancies, it shall be permitted to determine factored loads on only those areas in accordance with ASCE/SEI 37.

**5.1.4** When assessing an existing structure, consideration shall be given to caused by loads or imposed deformations that the structure is subjected to, if required by the authority having jurisdiction, even if such may not

### 5.2—Load factors and load combinations

**5.2.1** Design of rehabilitation shall account for existing loads and imposed deformations of the structure; the of load redistribution due to damage, deterioration, or load removal; and the sequencing of load application, including construction and shoring loads, during the rehabilitation process.

**5.2.2** Structural assessment shall consider whether the design strengths of members and connections in the work area are to resist the factored load combinations required by this Code. In the rehabilitation design, the structural members and connections shall have design strengths at least equal to the required strengths calculated for the factored load combinations as required by this Code.

**5.2.3** Required strength $U$ shall be at least equal to the of factored load combinations as in the design-basis code.

**5.2.4** Required strength $U$ shall include internal load due to reactions induced by prestressing with a load factor of 1.0.

## COMMENTARY

## R5—LOADS, FACTORED LOAD COMBINATIONS, AND STRENGTH REDUCTION FACTORS

### R5.1—General

**R5.1.1** Load factors, load combinations, and strength reduction factors are intended to achieve consistent acceptable levels of safety among all the structural elements in a system. They are obtained through rational design code calibration procedures that consider the accuracy of the strength prediction models and on the expected loads during the design service life of the structure.

**R5.1.2** Mixing of load factors and load combinations from one code with strength reduction factors from a code may result in an inconsistent level of safety.

**R5.1.3** This provision permits the less stringent loads and load factors in ASCE/SEI 37 to be applied for areas designated for construction activity and not subjected to design occupancies.

**R5.1.4** Examples of such loads include vibration or impact loads. Examples of such imposed deformations include unequal settlement of supports, sagging, and listing, leaning and tilting, and those due to prestressing, shrinkage, temperature changes, and creep.

### R5.2—Load factors and load combinations

**R5.2.2** The basic requirement for strength design or assessment is expressed as:

design strength (for example, capacity) ≥ required strength (for example, demand)

$$\phi(R_n) \geq U$$

The design strength is the nominal strength multiplied by the strength reduction factor $\phi$.

**R5.2.3** The required strength $U$ is expressed in terms of factored loads, which are the product of nominal loads multiplied by load factors.


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**5.2.5** For post-tensioned anchorage zone design or evaluation, a load factor of 1.2 shall be applied to the maximum prestressing reinforcement jacking force.

### 5.3—Strength reduction factors for rehabilitation design

**5.3.1** Design strength provided by a member, its connections to other members, and its cross sections, in terms of axial load, shear, and torsion, shall be taken as the nominal strength calculated in accordance with requirements and assumptions of this code, multiplied by the strength reduction factors ϕ in 5.3.2 and 5.3.4.

**5.3.2** The strength reduction factor ϕ shall be shown in Table 5.3.2.

**Table 5.3.2—Maximum strength reduction factors for rehabilitation design**

| Strength | | Transverse reinforcement | ϕ |
|---|---|---|---|
| Flexure, axial, or both | Tension-controlled* | | 0.90 |
| | Compression-controlled† | Spirals‡ | 0.75 |
| | | Other | 0.65 |
| Shear, torsion, or both | | | 0.75 |
| Interface shear | | | 0.75 |
| Bearing on concrete§ | | | 0.65 |
| Post-tensioned anchorage zones | | | 0.85 |
| Struts, ties, nodal zones and bearing areas in strut-and-tie models | | | 0.75 |

*Applies when the steel tensile strain at member failure exceeds $2.5\varepsilon_y$, where $\varepsilon_y$ is the yield strain of the tensile reinforcement.

†Applies when the steel tensile strain at member failure does not exceed $\varepsilon_y$. For sections in which the net tensile strain in the extreme tension steel at nominal strength is between the limits for compression-controlled and tension-controlled sections, linear interpolations of ϕ shall be permitted.

‡Spirals shall satisfy 10.7.6.3, 20.2.2, and 25.7.3 of ACI 318-14.

§Does not apply to post-tensioned anchorage zones or elements of strut-and-tie models.

**5.3.3** Computation of development lengths do not require a ϕ-factor.

**5.3.4** For compression, shear, and bearing of structural plain concrete, ϕ shall be 0.60.

### 5.4—Strength reduction factors for assessment

**5.4.1** If the required structural element dimensions and location of reinforcement are determined in accordance with

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**R5.2.5** The load factor of 1.2 applied to the maximum tendon jacking force results in a design load that exceeds the typical prestressing yield strength. This compares well with the maximum attainable jacking force. For jacking loads less than the maximum tendon jacking force, or for jacking loads applied to nonmetallic prestressing tendons, design of the anchorage for 1.2 times the anticipated jacking force is appropriate given that the jacking load is controlled better than typical dead loads.

### R5.3—Strength reduction factors for rehabilitation design

**R5.3.2** For a steel yield strength of 60 ksi, the steel tensile strains corresponding to the tension- and compression-controlled limits are 0.005 and 0.002, respectively. Because the compressive strain in the concrete at nominal strength is typically assumed to be 0.003, the net tensile strain limits for compression-controlled members may also be stated in terms of the ratio $c/d_t$, where $c$ is the depth of the neutral axis at nominal strength, and $d_t$ is the distance from the extreme compression to the centroid of extreme tension reinforcement. The $c/d_t$ limits for tension- and compression-controlled sections are 0.375 and 0.6, respectively. The 0.6 limit for compression-controlled sections applies to sections reinforced with Grade 60 steel and to prestressed sections. For other grades of steel reinforcement, the term $c/d_t$ is a function of the yield strain of the steel reinforcement ($\varepsilon_y$). The $c/d_t$ ratio is calculated as $c/d_t = 0.003/(0.003 + \varepsilon_y)$.

### R5.4—Strength reduction factors for assessment

**R5.4.1** Strength reduction factors given in 5.4.1 are larger than those in 5.3.1. These increased values are by the


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Chapter 6, and material properties are determined in accordance with 6.4, it shall be permitted to increase $\phi$ from those in 5.3, but $\phi$ shall not exceed the values shown in Table 5.4.1.

**Table 5.4.1—Maximum strength reduction factors for assessment**

| Strength | | Transverse reinforcement | $\phi$ |
|---|---|---|---|
| Flexure, axial, or both | Tension-controlled* | | 1.00 |
| | Compression-controlled† | Spirals‡ | 0.90 |
| | | Other | 0.80 |
| Shear, torsion, or both | | | 0.80 |
| Interface shear | | | 0.80 |
| Bearing on concrete§ | | | 0.80 |
| Struts, ties, nodal zones, and bearing areas in strut-and-tie models | | | 0.80 |

*Applies when the steel tensile strain at member failure exceeds $2.5\varepsilon_y$, where $\varepsilon_y$ is the yield strain of the tensile reinforcement.

†Applies when the steel tensile strain at member failure does not exceed $\varepsilon_y$. For sections in which the net tensile strain in the extreme tension steel at nominal strength is between the limits for compression-controlled and tension-controlled sections, linear interpolations of $\phi$ shall be permitted.

‡Spirals shall satisfy 10.7.6.3, 20.2.2, and 25.7.3 of ACI 318-14.

§Does not apply to post-tensioned anchorage zones or elements of strut-and-tie models.

**5.4.2** If an evaluation of members is based on historical material properties as given in Tables 6.3.2a through 6.3.2c, the $\phi$-factors not exceeding those in 5.3 shall apply.

**5.4.3** For compression, shear, and bearing of structural plain concrete, $\phi$ shall be 0.60.

### 5.5—Additional load combinations for structures rehabilitated with external reinforcing systems

**5.5.1** For rehabilitation achieved with external reinforcing systems that are susceptible to damage by vandalism or impact, the required strength of the structure without rehabilitation shall equal or exceed the of the load combinations in 5.5.2. The performance of externally reinforced elements subjected to shall be evaluated using

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improved reliability due to the use of accurate material properties, and actual in-place dimensions. They have been deemed appropriate for use in ACI 318 and have had a lengthy history of satisfactory performance.

**R5.4.3** The resistance factor for assessment of plain concrete is the same as that for design in 5.3.4. Material properties for plain concrete determined in accordance with 6.3.5 may increase its nominal resistance, but the strength reduction factor remains unchanged because plain concrete failures are usually brittle.

### R5.5—Additional load combinations for structures rehabilitated with external reinforcing systems

**R5.5.1** The additional load combinations in this section are intended to ensure adequate strength should the external reinforcing system be damaged to become ive. External reinforcing systems should be evaluated to determine if they are susceptible to damage from accidental vehicular impact or vandalism. Alternately, the rehabilitation measures may include physical design features that protect the external reinforcing system from these types of damage. The requirements of this section are not intended for the assessment of the of blast loadings, blast or a generalized assessment of extraordinary events on structures.

The requirements of this section are not intended for the design of structures that are exposed to elevated tempera-


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**5.5.2** For external reinforcing systems susceptible to damage, the required strength of the structure without such external reinforcement shall satisfy Eq. (5.5.2a) and (5.5.2b)

$$\phi R_n \geq 1.1D + 0.5L + 0.2S \quad (5.5.2a)$$

$$\phi R_n \geq 1.1D + 0.75L \quad (5.5.2b)$$

where $D$, $L$ and $S$ are the due to the dead, live, and snow loads, respectively, calculated for the rehabilitated structure; $\phi$ is the strength reduction factor in 5.3 or 5.4, as applicable; and $R_n$ is the nominal strength of the structural member computed using the material properties determined from Chapter 6, without the contribution of the external reinforcing system.

**5.5.2.1** If the live load has a high likelihood of being a sustained load, the live load factor in Eq. (5.5.2a) and (5.5.2b) shall be increased to 1.0.

**5.5.3** Structural members with external reinforcement shall satisfy Eq. (5.5.3)

$$\phi_{ex} R \geq (0.9 \text{ or } 1.2)D + 0.5L + 0.2S \quad (5.5.3)$$

where $\phi_{ex}$ = 1.0; $R$ is the nominal resistance of the structural member, computed using the probable material properties during the event and considering the contribution of external reinforcement in accordance with Section 5.5.3.3; and $S$ is the snow load. The dead load factor of 0.9 shall be applied when the dead load counteracts the

**5.5.3.1** Additional live loads incurred during a shall be considered, with a load factor of 1.0.

**5.5.3.2** Internal forces and imposed deformations due to thermal expansion during the event shall be considered, with a load factor of 1.0, in determining the demands on the structural system.

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tures during routine service, such as manufacturing facilities and other industrial environments. Refer to Section 7.9.4.

**R5.5.2** These load combinations are intended to minimize the risk of failure of the strengthened structural member in the case where, during normal operating conditions, the external reinforcement is damaged. Such damage may not be detected immediately and so the structure (or structural component) may remain in service until the damage is identified and addressed. The load factors for live and snow loads in Eq. (5.5.2a) correspond to the arbitrary point-in-time loadings in ASCE/SEI 7. Equation (5.5.2b) is compatible with ACI 440.2R.

**R5.5.2.1** Examples include library stack areas, heavy storage areas, warehouses, and other storage occupancies with a live load exceeding 100 lb/ft$^2$.

**R5.5.3** Equation (5.5.3) is intended to ensure that the repaired element will maintain strength, accounting for its probable reduced material properties due to elevated temperatures, during a event. If protection is applied to the repaired element, its on the external reinforcement and existing elements should be considered.

The design-basis code and ACI 216.1 should be reviewed

Equation (5.5.3) was developed from Eq. (2.5.1) of ASCE/SEI 7-10 and is limited to the evaluation of on structures with external reinforcement. Guidance on computing the structural caused by the event is provided in 5.5.3.1 and R5.5.3.1.

Strength of the portion of the structure during a event should be based on reduced steel and concrete strengths. Guidance concerning probable material properties ACI 216.1.

**R5.5.3.1** Live loads associated with operations may include wetting of the building contents, which can be idealized as a live load of 20 lb/ft$^2$.

**R5.5.3.2** Thermal expansion of a member during a event will generate internal thrust forces if that expansion is restrained. The generated thrust force, while potentially large, is considerably less than that computed using conventional elastic properties and thermal expansion

This thrust may increase the moment capacity and the corre-

.

Procedures for calculating thermal induced thrust forces can be found in NIST (2010) and Buchanan (2001). PCI (2010) provides methods for determining (a) the magnitude and location of the thrust generated by a given tempera-


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|---|---|
| | ture and duration, and (b) the increase in moment capacity caused by a known thrust force. |
| **5.5.3.3** Any contribution of external reinforcement that is not protected using a system shall be neglected during a event. The contribution of any adhesively bonded external reinforcement to the strength of a member | **R5.5.3.3** Section 7.9 gives member strength requirements for protected and unprotected external reinforcing systems |
| **5.5.3.4** When the live load acting on the member to be strengthened has a high likelihood of being a sustained load, a live load factor of 1.0 shall be used in Eq. (5.5.3). | **R5.5.3.4** Refer to R5.5.2.1. |


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## CHAPTER 6—ASSESSMENT, EVALUATION, AND ANALYSIS

### 6.1—Structural assessment

**6.1.1** A structural assessment shall be performed if required per 1.7.5. The structural assessment shall comprise 1) an investigation to establish the in-place condition of the structure in the work area, including environment, geometry, material strengths, reinforcing-steel sizes and placement, and signs of distress; 2) an evaluation to the causes of distress and criteria for selection of rehabilitation solution(s); and 3) development of appropriate rehabilitation strategies.

### 6.2—Investigation and structural evaluation

**6.2.1** An investigation and structural evaluation shall be performed when there is a reason to question the capacity of the structure in the work area and information is available to determine if an existing structure is capable of resisting design demands.

**6.2.2** Where repairs are required to an individual member or connection in a structure, determine if similar conditions exist beyond the work area also require evaluation.

**6.2.3** An investigation shall document conditions as necessary to perform an evaluation of the structure in the work area.

## COMMENTARY

## R6—ASSESSMENT, EVALUATION, AND ANALYSIS

### R6.1—Structural assessment

**R6.1.1** Field investigations in support of the structural assessment may include visual observations, destructive testing, and nondestructive testing (NDT). Areas of known deterioration and distress in the structural members should be inspected, and recorded as to the type, location, and degree of severity. Investigation procedures are referenced in ACI 201.1R, ACI 228.1R, ACI 228.2R, ACI 364.1R, ACI 437R, ASCE/SEI 11, ASCE/SEI 41, and FEMA P-154. The structural members are not only members with obvious signs of distress but also contiguous members and connections in the structural system.

The data gathered to determine the existing capacity should include the following:

(1) The of material deterioration, such as loss of concrete strength from chemical attack; freezing and thawing

(2) Loss of steel area due to corrosion or other causes

(3) Missing or misplaced reinforcement

The of deterioration on the ductility of the member should be considered in the evaluation. The strength or serviceability of a member or structure may be compromised by spalling, excessive cracking, large or other forms of damage or deterioration. Seismic evaluation references for undamaged buildings include FEMA P-58, FEMA P-154 and ASCE/SEI 41 and for damaged buildings include FEMA 306 and FEMA 307.

Where the as-built conditions and properties of historical buildings require evaluation and rehabilitation, care should be taken to minimize the impact of repair design and investigation procedures (U.S. Department of the Interior 1995).

### R6.2—Investigation and structural evaluation

**R6.2.2** If there is no evidence of damage, distress or deterioration of similar members or connections elsewhere in the work area that required repair, there is no need to perform an evaluation of similar members unless potentially dangerous conditions are present. Such conditions may be a concern if there are variances from the original design intent such as lower-strength concrete or reinforcement. In addition, if the similar members are in an environment that could foster deterioration, then evaluation of these members may be necessary to determine if strengthening or durability enhancements may be required.

**R6.2.3** Conditions which may need to be documented include (a) through (g):


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(a) The physical condition of the structural members to examine the extent and location of deterioration or distress

(b) The adequacy of continuous load paths through the primary and secondary structural members to provide for life safety and structural integrity

(c) As-built information required to determine appropriate strength reduction factors in accordance with Chapter 5

(d) Structural members' orientation, displacements, construction deviations, and physical dimensions

(e) Properties of materials and components from available drawings, and other documents; or by testing of existing materials

(f) Additional considerations, such as proximity to adjacent buildings, load-bearing partition walls, and other limitations for rehabilitation

(g) Information needed to assess lateral-force-resisting systems, span lengths, support conditions, building use and type, and architectural features

The construction documents may not represent as-built conditions. Therefore, the licensed design professional is encouraged to research and verify that the material properties obtained from record documents are accurate. Material testing may be required to verify these values.

**6.2.4** When an analysis is required, the analysis shall be performed in accordance with Section 6.5 and the structural evaluation shall consider the following items.

(a) As-measured structural member dimensions including

(b) The presence and of alterations to the structural system

(c) Loads, occupancy, or usage from the original design

(d) In-place material properties in accordance with 6.3

**R6.2.4** The size, number, and location of the reinforcement may be needed to determine member strength. Nondestructive testing methods, including but not limited to ground-penetrating radar (GPR) and ferromagnetic testing, may be used to determine the location and spacing of reinforcement. These methods may require destructive Additional guidance is provided in ACI 228.2R.

### 6.3—Material properties

**6.3.1** Concrete compressive strength and steel reinforcement yield strength shall be determined for the structure if a structural evaluation is required. Nominal material properties shall be determined by (a), (b) or (c):

(a) Available drawings, and previous testing documentation

(b) Historical material properties in accordance with 6.3.2

(c) Physical testing in accordance with 6.4

### R6.3—Material properties

**R6.3.1** The construction documents may not represent as-built conditions. Therefore, the evaluation of material properties may require tion by material testing to that the material properties obtained from record documents are representative.

Additional factors and characteristics materials that may be required to be evaluated include:

(a) Ductility based on the mechanical characteristics of the component materials.

(b) Presence of corrosion of embedded steel reinforcement, including carbonation, chloride intrusion, corrosion-induced spalling

(c) Presence of other deterioration, such as alkali-silica reaction, sulfate attack, delayed ettringite formation, or other chemical attack

(d) Deterioration due to cyclic freezing and thawing

(e) Deterioration of and strength due to bar slip in cracked sections and joints damaged in seismic events

Other tests for material properties, including petrographic examination, are used.


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**6.3.2** If available drawings, or other documents do not provide information to characterize the material properties, it shall be permitted to determine such properties without physical testing from the historical data provided in Tables 6.3.2a through 6.3.2c.

**Table 6.3.2a—Default compressive strength of structural concrete, psi**

| Time frame | Footings | Beams | Slabs | Columns | Walls |
|---|---|---|---|---|---|
| 1900-1919 | 1000 | 2000 | 1500 | 1500 | 1000 |
| 1920-1949 | 1500 | 2000 | 2000 | 2000 | 2000 |
| 1950-1969 | 2500 | 3000 | 3000 | 3000 | 2500 |
| 1970-present | 3000 | 3000 | 3000 | 3000 | 3000 |

Note: Adopted from ASCE/SEI 41.

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The choice of tests depends on the structure, member type(s), and distress mechanism.

**R6.3.2** Material properties required for seismic evaluation and rehabilitation are discussed in ASCE/SEI 41. The required material properties may include necessary physical and chemical properties of the concrete and reinforcement, and should include the required references to ASTM standards and other methods of determining physical and chemical properties.

**Table 6.3.2b—Default tensile and yield strength properties for steel reinforcing bars for various periods***

| | | Structural† | Intermediate† | Hard† | | | | |
|---|---|---|---|---|---|---|---|---|
| | Grade | 33 | 40 | 50 | 60 | 65 | 70 | 75 |
| | Minimum yield, psi | 33,000 | 40,000 | 50,000 | 60,000 | 65,000 | 70,000 | 75,000 |
| Year | Minimum tensile, psi | 55,000 | 70,000 | 80,000 | 90,000 | 75,000 | 80,000 | 100,000 |
| 1911-1959 | | X | X | X | — | X | — | — |
| 1959-1966 | | X | X | X | X | X | X | X |
| 1966-1972 | | — | X | X | X | X | X | — |
| 1972-1974 | | — | X | X | X | X | X | — |
| 1974-1987 | | — | X | X | X | X | X | — |
| 1987-Present | | — | X | X | X | X | X | — |

Note: Adopted from ASCE/SEI 41.

*An entry of "X" indicates the grade was available in those years.

†The terms "structural," "intermediate," and "hard" became obsolete in 1968. Hard grade does not correspond to metallurgical hardness.


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**Table 6.3.2c—Default tensile and yield strength properties of steel reinforcement for various ASTM specifications and periods***

| | | | | Structural† | Intermediate† | Hard † | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grade | 33 | 40 | 50 | 60 | 65 | 70 | 75 |
| | | | Minimum yield, psi | 33,000 | 40,000 | 50,000 | 60,000 | 65,000 | 70,000 | 75,000 |
| ASTM designation‡ | Steel type | Year range | Minimum tensile, psi | 55,000 | 70,000 | 80,000 | 90,000 | 75,000 | 80,000 | 100,000 |
| A15 | Billet | 1911-1966 | | X | X | X | — | — | | |
| A16 | Rail§ | 1913-1966 | | — | — | X | — | — | | |
| A61 | Rail | 1963-1966 | | — | — | — | X | — | | |
| A160 | Axle | 1936-1964 | | X | X | X | — | — | | |
| A160 | Axle | 1965-1966 | | X | X | X | X | — | | |
| A185 | WWF | 1936-present | | — | — | — | — | X | | |
| A408 | Billet | 1957-1966 | | X | X | X | — | — | | |
| A431 | Billet | 1959-1966 | | — | — | — | — | — | | X |
| A432 | Billet | 1959-1966 | | — | — | — | X | — | | — |
| A497 | WWF | 1964-present | | — | — | — | — | — | X | — |
| A615 | Billet | 1968-1972 | | — | X | — | | — | — | X |
| A615 | Billet | 1974-1986 | | — | X | — | X | — | | — |
| A615 | Billet | 1987-present | | — | X | — | X | — | | X |
| A616-96‖ | Rail | 1968-present | | — | — | — | X | — | | — |
| A617 | Axle | 1968-present | | — | X | — | — | — | | — |
| A706# | Low-alloy | 1974-present | | — | — | — | X | — | X | — |
| A955 | Stainless | 1996-present | | — | X | — | X | — | | X |

Note: Adopted from ASCE/SEI 41.

*An entry of "X" indicates the grade was available in those years.

†The terms structural, intermediate, and hard became obsolete in 1968. Hard grade does not correspond to metallurgical hardness.

‡ASTM steel is marked with the letter W.

§Rail bars are marked with the letter R.

‖Bars marked with "s!" (ASTM A616-96) have supplementary requirements for bend tests.

#ASTM A706 has a minimum tensile strength of 80 ksi, but not less than 1.25 times the actual yield strength.

**6.3.3** It shall be permitted to determine material properties through testing in accordance with 6.4.

**6.3.4** The material properties provided in the original construction documents or material test reports shall be permitted to be used unless known deterioration that can

**R6.3.4** If the results of material testing from original construction are available, these results may be used in the analysis. Additional testing could be required to these material test results if deterioration has occurred.

**6.3.5** If historic data are not given in either Table 6.3.2b or 6.3.2c, the historic default value for yield strength $f_y$ shall be taken as 33,000 psi.

**R6.3.5** Additional guidance regarding the use of the historic lower bound default value is given in R6.4.4.1.

## 6.4—Test methods to quantify material and member properties

### 6.4.1 *General*

**6.4.1.1** Destructive and nondestructive test methods used to obtain in-place mechanical properties of materials and member properties shall be in accordance with this section. Compressive strength of sound concrete shall be determined

## R6.4—Test methods to quantify material and member properties

### R6.4.1 *General*


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by taking and testing core samples or by a combination of cores and by the use of site nondestructive testing. Steel reinforcement properties shall be determined by removal of reinforcement samples and destructive testing.

**6.4.1.2** The locations and numbers of material samples shall be to the material properties of the structural element of concern. The number of samples shall be determined during evaluation.

**6.4.2** *Core sampling of concrete for testing*

**6.4.2.1** It shall be permitted to determine the compressive strength of sound concrete by taking cores from the members being evaluated. Steel reinforcement shall be located before locating the cores to be extracted.

**6.4.3** *Concrete*

**6.4.3.1** The cores shall be selected, removed, and tested in accordance with ASTM C42 and ASTM C823. The equiva- $f_{ceq}$ shall be calculated by:

$$f_{ceq} = 0.9\overline{f}_c\left[1-1.28\sqrt{\frac{(k_cV)^2}{n}+0.0015}\right] \quad (6.4.3.1)$$

where $\overline{f}_c$ is the average core strength, as to account for the diameter, length to diameter ratio and moisture condition of the core (following ASTM C42 procedures); $V$ is the of variation of the core strengths (a dimensionless quantity equal to the sample standard deviation divided

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**R6.4.1.2** Review of available records from the original construction may be used to guide testing. Evaluation, historical research, and documentation of the geometry, material properties, and detailing used in the construction are invaluable and may be used to reduce the amount of required in-place testing. The data gathered to determine strength should include any of material deterioration, such as loss of concrete strength from chemical attack and loss of steel area due to corrosion. The impact of deterioration on the expected strength and ductility of the section also should be considered in the evaluation.

The minimum number of tests is by the data available from the original construction, the type of structural system, the desired accuracy, and the quality and condition of the in-place materials. The focus of the prescribed material testing should be on the principal structural members and properties needed for analysis. The licensed design professional should determine the appropriate number and type of testing needed to evaluate the existing conditions.

Care should be taken in selecting the location for sampling concrete. Core drilling should minimize damage of the existing reinforcement and should generally occur at loca-

**R6.4.2** *Core sampling of concrete for testing*

**R6.4.2.1** NDT may be used to locate existing reinforcement and to avoid damage to reinforcement during coring. Guidelines for core sampling and evaluating core strength data are given in ACI 214.4R. The presence of reinforcement or other foreign material, such as conduit or wood, may adversely the test strength of the concrete and cores containing such foreign material should not be used for strength determination. See ASTM C42/C42M Section 5.1.3 and Note 8 for additional information.

**R6.4.3** *Concrete*

**R6.4.3.1** The equivalent strength determined using this procedure can be used in strength equations with the strength reduction factors from Chapter 5. This approach is in the Canadian Highway Bridge Design Code (CAN/CSA S6-14) and is based on the approach proposed by Bartlett and MacGregor (1995). Equation (6.4.3.1) is a simpli of criteria given in ACI 214.4R that gives similar results because it includes the strength correction factors for length-to-diameter ratio, core diameter, and drilling damage. The strength value obtained using this procedure is an estimate of the 13 percent fractile of the in-place concrete strength at a interval of 90 percent, based on the data collected by Bartlett and


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by the mean); $n$ is the number of cores taken; and $k_c$ is the of variation ion factor, as obtained from Table 6.4.3.1.

**Table 6.4.3.1—Concrete coefficient of variation modification factor $k_c$**

| $n$ | $k_c$ |
|---|---|
| 2 | 2.4 |
| 3 | 1.47 |
| 4 | 1.28 |
| 5 | 1.20 |
| 6 | 1.15 |
| 8 | 1.10 |
| 10 | 1.08 |
| 12 | 1.06 |
| 16 | 1.05 |
| 20 | 1.03 |
| 25 or more | 1.02 |

**6.4.3.2** Nondestructive strength testing to evaluate in-place strength of concrete shall be permitted if a valid correlation is established with core sample compressive strength test results and nondestructive test results. of concrete compressive strength by NDT alone shall not be permitted as a substitute for core sampling and testing.

**6.4.4** *Steel reinforcement*

**6.4.4.1** If the original construction documents are not available and if the properties of the reinforcing bars are unknown, historical values provided in 6.3.2b and 6.3.2c shall be permitted in place of testing. If the grade of material is unknown, the lowest grade provided in Table 6.3.2b for a given historic period shall be used.

**6.4.5** *Reinforcement sampling and testing*

**6.4.5.1** Coupon samples used for the determination of the yield and tensile strength for steel reinforcement shall be obtained in accordance with ASTM A370. A minimum of three sample coupons, taken from segments of reinforcement shall be obtained from the members being evaluated.

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MacGregor (1995). When a strength fractile or interval is required, the methods presented in ACI 214.4R may be applicable.

The core samples, tested per ASTM C42/42M, are expected to be moisture conditioned following the procedure in the ASTM standard. The correction factors in ASTM C42/42M were developed for lightweight and normal weight concrete with a compressive strength between 2,000 and 6,000 psi (14 MPa to 42 MPa). Core samples are assumed to have a maximum length-to-diameter ratio of 2.1. Bartlett and MacGregor (1994a) discuss the of higher compressive strengths on the length-to-diameter ratio.

ASTM C42/42M procedures require a minimum core diameter of 3.70 in. (94 mm), smaller diameter cores are likely to have more variability and a lower strength (Bartlett and MacGregor 1994b).

When the testing requirements of ASTM C42/42M are not met, the user should consult ACI 214.4R.

**R6.4.3.2** ACI 228.1R provides information on NDT methods for evaluation of concrete compressive strength and development of statistical correlations between NDT and core test results.

**R6.4.4** *Steel reinforcement*

**R6.4.4.1** The age of the structure may be known but the grade of reinforcement may not be known. In this case, the lowest grade of reinforcement corresponding to the structure's age should be used. If the date of original construction is unknown, the lower bound value of $f_y$ equal to 33,000 psi may be used instead of testing, provided it is conservative. In some instances, assuming higher yield strengths may be more conservative. Where the demand on one member is governed by the capacity of a connected member, it is appropriate to assign higher yield strengths to the connected member. For example, in seismic analysis at beam column joints, the moment strength of the columns should exceed the moment strength of the beams. When assessing this requirement it is more conservative to assume a higher yield strength for the beam reinforcement than for the column reinforcement.

**R6.4.5** *Reinforcement sampling and testing*

**R6.4.5.1** Often, the steel reinforcement in a structure is of a common grade and strength. Occasionally, more than one grade of steel is used, for example, smaller diameter (No. 3 and 4) stirrups and other complex bent bars were often fabricated with lower strength material than the longitudinal bars.


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**6.4.6** The equivalent yield strength $f_{yeq}$ of reinforcement used for analysis shall be calculated by

$$f_{yeq} = (\bar{f}_y - 3500)e^{(-1.3k_s V)} \quad (6.4.6)$$

where $\bar{f}_y$ is the average yield strength value from the tests, in psi; $V$ is the of variation determined from testing; $n$ is the number of strength tests; and $k_s$ is the steel - cient of variation factor, as obtained from Table 6.4.6.

**Table 6.4.6—Steel coefficient of variation modification factor $k_s$**

| $n$ | $k_s$ |
|---|---|
| 3 | 3.46 |
| 4 | 2.34 |
| 5 | 1.92 |
| 6 | 1.69 |
| 8 | 1.45 |
| 10 | 1.32 |
| 12 | 1.24 |
| 16 | 1.14 |
| 20 | 1.08 |
| 25 | 1.03 |
| 30 or more | 1.00 |

**6.4.7** If the properties of the connector steel are unknown, strength shall be determined by (a), (b), or (c):

(a) Testing of coupons taken from the connector steel.

(b) Documentation giving connector steel properties in the original construction documents.

(c) Use of historic default values in accordance with 6.3.6.

**6.4.8** Coupon specimens for the determination of yield and tensile strengths of structural steel shall be tested in accordance with ASTM A370. A minimum of three specimens shall be taken from representative elements.

The equivalent yield strength $f_{yeq}$ of each specimen shall be its reported yield strength. The $f_{yeq}$ used for analysis shall be calculated by

$$f_{yeq} = (\bar{f}_y - 4000)e^{(-1.3k_s V)} \quad (6.4.8)$$

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CRSI (2014): "Vintage Reinforcement in Concrete Structures," contains supplemental information on mechanical prop-

Steel reinforcement information includes square, rectangular, and round bars with and without deformations, prestressing wire, bars, multi-wire strands, and structural shapes. Historically, wire rope and chain have also been used as reinforcement.

**R6.4.6** The equivalent yield strength determined using this procedure can be used in strength equations with the strength reduction factors from Chapter 5. The yield strength value obtained using this procedure is an estimate of the 10 percent fractile of the static steel strength. It is assumed that the yield strength measured during a coupon test exceeds the static yield strength by 3500 psi. This approach is in the Canadian Highway Bridge Design Code (CAN/CSA S6-14).

The factors in Table 6.4.6 the uncertainty of the sample standard deviation for a small sample size. They are the 95 percent one-sided tolerance limits on the 10 percent fractile, and they have been reduced by a constant factor to be equal to 1.0 for $n = 30$ specimens.

**R6.4.7** The historic default value is obtained from ASCE/SEI 41.


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where $\bar{f}_y$ is the average yield strength value from tests, in psi; $V$ is the of variation determined from testing; $n$ is the number of strength tests; and $k_s$ is the steel of , as obtained from Table 6.4.6.

**6.4.9** The sampling of prestressing steel reinforcement for strength testing shall be required if strength and historical data are not available. Testing of the prestressing reinforcement shall be in accordance with ASTM A1061/1061M.

**6.4.10** If welding of existing reinforcement is required, carbon equivalent shall be determined in accordance with AWS D1.4/D1.4M.

### 6.5—Structural analysis of existing structures

**6.5.1** The gravity and lateral-force-resisting structural systems shall be analyzed when required using loads and load combinations determined in accordance with this code that produce the maximum on the existing members being evaluated.

**6.5.2** Analysis of the structure shall use accepted engineering principles that satisfy force equilibrium and the principles of compatibility of deformations and strains.

**6.5.3** Analysis shall consider material properties, member geometry and deformation, lateral drift, duration of loads, shrinkage and creep, and interaction with the supporting foundation.

**6.5.4**
material deterioration, bond loss, and the redistribution of forces in members and in the structural system as a whole.

**6.5.5** Analysis shall consider the load path from the load application through the structure to the foundation. Three-dimensional distribution of loads and forces in the complete structural system shall be considered unless a two-dimen-

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### R6.5—Structural analysis of existing structures

**R6.5.1** Structural evaluation and analyses are conducted to verify strength and serviceability. The analytical methods of 6.5 are used with factored loads to determine strength requirements for a combination of shear, torsion, and axial loads of pertinent structural members. A service-load analysis may be required to evaluate serviceability

**R6.5.3** The licensed design professional is responsible for determining the appropriate method of analysis. Appropriate methods include linear elastic analysis, nonlinear analysis, and other traditionally accepted engineering analysis methods. If a linear elastic analysis method is used, the of cracking, second-order and other nonlinear should be included in the analysis.

The analysis may include the of the size and member geometry to determine the forces on individual members of a structure. The analysis should consider external including prestressing, material volume changes, tempera-

**R6.5.4** Member deterioration and damage may result in distribution of internal forces than the distribution of forces of the original structural design. The strength and integrity of prestressed structures with damaged prestressing reinforcement requires careful consideration to assess the impact of the damage. The state of the structure should be accurately modeled to determine the distribution of forces. Redistribution of forces may be determined using material nonlinear analysis, by load tests described in ACI 437.2, or by linear analysis, which bounds the limits of redistributed forces.

**R6.5.5** The evaluation of load requires consideration of both the load paths through the structure and how the forces are distributed in members.


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sional analysis adequately represents the part of the structure being evaluated.

**6.5.6** Analysis shall consider the of previous repairs and of any previous structural on the behavior of the structure.

**6.5.7** The analysis shall be based on available documentation, as-built dimensions, and the in-place properties of the structure including section loss. The determination of in-place material properties shall be in accordance with 6.3.

### 6.6—Structural serviceability

**6.6.1** If serviceability problems are during the preliminary evaluation or the structural assessment, the licensed design professional shall perform a serviceability evaluation based on the existing geometry and properties of the structure.

**6.6.2** The serviceability evaluation shall evaluate the structure for the intended use considering the existing geometry and properties of the structure, and shall consider such as existing levelness, support displacements,

### 6.7—Structural analysis for repair design

**6.7.1** The structural analysis used for repair design shall consider the structural repair process. The analysis shall consider the of the sequence of load application and material removal during the anticipated phases of the evaluation and repair process.

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**R6.5.6** to structures in the form of repairs, alterations, or additions may the force distribution and load path in a structure.

**R6.5.7** Available documentation may include original drawings, shop drawings, structural assessments, testing, and geotechnical reports. Deviations between the existing construction and construction documents are to be and recorded. If section loss has occurred, a more accurate analysis may be developed by direct measurement of the section, and by calculation of section properties based on actual conditions. Additional information may be obtained in ACI 364.10T.

### R6.6—Structural serviceability

**R6.6.1** Structural serviceability problems may include levelness, vibrations, leakage, or cracking. The data gathered to determine serviceability should include the of material deterioration, such as loss of concrete strength from sulfate attack or loss of steel area due to corrosion. Reference ACI 224.1R for additional information on cracking, including causation and repair.

**R6.6.2** When concerns are raised regarding the serviceability of the structure, the of levelness, vibrations, and on the structural performance should be investigated by the licensed design professional. The levelness, vibrations, and should indicate (or be assessed to determine) if the performance of the structure is acceptable. Acceptable performance criteria will need to be established for an individual structure based upon the intended use of the structure.

The performance criteria and the intended function of the structure should be considered. Floor criteria for new structures can be found in ACI 318. Vibration criteria are given in Fanella and Mota (2014).

Information on construction tolerances for new concrete construction is presented in ACI 117.1R; however, some of the tolerances only apply to measurement made during construction and therefore may not be appropriate to be used for existing completed construction. Refer to ATC Design Guide 1 (1999), Fanella and Mota (2014), and Wilford and Young (2006) for information on evaluation of vibration problems in concrete structures.

### R6.7—Structural analysis for repair design

**R6.7.1** The construction process may involve the application, removal and replacement of loads. The analysis needs to consider the of the application and removal of construction loads to determine the maximum loading during anticipated construction phases. The additional applied loads may be due to prestressing, vibration, material volume changes (such as creep and shrinkage, or tempera-


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**6.7.2** Structural analysis shall account for variations in material properties through member sections.

**6.7.3** Section analysis shall use principles of mechanics and shall assume either (a), (b), or (c) as deemed appropriate by the licensed design professional:

(a) Full composite action with no slip at interfaces between repair materials and existing materials

(b) Separate action with full slip between repair and existing materials

(c) Partial composite action with friction at interfaces between repair and existing materials

**6.7.4** *Seismic analysis of repaired structure*

**6.7.4.1** The interaction of structural members and nonstructural components that the response of the structure to seismic motions shall be considered in the analysis.

**6.7.4.2** Existing, repaired, and added supplementary members assumed not to be a part of the seismic-force-resisting system shall be permitted, provided there is no

**6.7.4.3** The analysis shall consider the structural - ration and material properties after repair.

### 6.8—Strength evaluation by load testing

**6.8.1** Load testing in accordance with ACI 437.2 shall be permitted to supplement an analysis or to demonstrate the strength of the original or repaired structure.

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ture changes), of shoring, and unequal deformation of supports.

**R6.7.2** The intent of this section is to address in between repair material and existing substrate. In these situations, localized deformation may occur in the material with the lower modulus of elasticity, the force distribution in the repaired structure.

**R6.7.3** Depending on the repair construction process and the selection of repair materials, the repair materials and the existing concrete or reinforcement may not act compositely. The analysis should model the anticipated degree of composite action of the repaired structure. An example of partial composite behavior are beams that contain shear studs to develop nominal strength, yet lack bond between the overlay and substrate. In this situation, the overlay and substrate do not maintain strain compatibility.

**R6.7.4** *Seismic analysis of repaired structure*

**R6.7.4.3** Procedures for seismic rehabilitation of concrete buildings, including analysis, are provided in ASCE/SEI 41, which incorporates ACI 369R. These references provide details for forces, rehabilitation methods, analysis and modeling procedures, and seismic rehabilitation design. Additional references for repair of building damage by a seismic event and rehabilitation of concrete buildings include FEMA 308, FEMA 395 through FEMA 400, and FEMA 547.

### R6.8—Strength evaluation by load testing

**R6.8.1** Information obtained during a structural assess- - ability of deteriorated or repaired structural members. Structural condition assessments, including destructive testing, can provide some of the information required, but the costs for these assessments can be Further, the results of a structural evaluation may still be inconclusive due to

repair. In such cases, load testing may provide the most - tive means of verifying the strength of a structure or member. Load testing can also be a valuable tool for evaluating the of structural repairs. For example, load testing, as in ACI 437.2, can be performed to determine if the


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**6.8.2** Load tests shall be conducted in accordance with the monotonic or cyclic procedures in ACI 437.2.

**6.8.3** The design professional is permitted to waive the $\ell_t$ criteria in ACI 437.2.

**6.8.4** If a member fails a cyclic load test, it shall be permitted to retest the member or structure in accordance with ACI 437.2. It shall be permitted to waive the maximum limit ($\ell_t$/180) in ACI 437.2 that precludes a retest.

**6.8.5** Model analysis shall be permitted to supplement calculations.

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**R6.8.2** If the strength of the structure being evaluated is limited by the strength of concrete, or the expected failure of the structure is controlled by shear or development of the reinforcement, the sustained load applied using the monotonic test allows greater time for widening and propagation of cracks, creep, and slip of reinforcement compared with the cyclic procedure.

**R6.8.3** The $\ell_t$/180 limit was included to provide an upper limit on the of a member during a load test. The limit may be waived by the design professional when the tested member is not damaged by large or when the residual criteria is

**R6.8.4** ACI 437.2 precludes a retest if the member exceeds a maximum limit of $\ell_t$/180 (Section 6.4.4.2 in ACI 437.2). For consistency with the monotonic testing protocol, this $\ell_t$/180 limit is waived.

**R6.8.5** This code permits model analysis to be used to supplement structural analysis and design calculations. Model analysis involves the construction and experimental testing of full or scale models of structure components, assemblages, or systems. Documentation of the model tests and subsequent interpretation should be provided with the related calculations. Model analysis should be performed by an individual having experience in this technique. References are provided in Harris and Sabnis (1999) and White (1970).


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## CHAPTER 7—DESIGN OF STRUCTURAL REPAIRS

### 7.1—General

**7.1.1** Repaired structural elements and connections within the work area shall have design strengths at all sections at least equal to the required strengths calculated using the applied factored loads and internal forces in such combinations as required by this code.

### 7.2—Strength and serviceability

**7.2.1** Repaired structures shall be designed to meet the strength requirements of the design-basis code.

**7.2.2** Repair design and construction procedures shall consider loading, internal forces, and deformations in both the existing and repaired structure during the repair process.

**7.2.3** When serviceability issues are consistent with Section 6.6, repairs to address serviceability issues shall be considered.

### 7.3—Behavior of repaired systems

**7.3.1** Repairs to sections, components, reinforcement, connections of members, or systems shall be designed to be integrated with the existing structure, creating a structural system capable of resisting the design loads by sharing and transferring loads between repaired and existing elements.

**7.3.1.1** Repairs incorporating new members shall be designed to be integrated with the existing structure, creating

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## R7—DESIGN OF STRUCTURAL REPAIRS

### R7.1—General

Repair and rehabilitation, as in Chapter 2, are processes in which and damage in a structure or member are corrected. The methods used to correct - ciencies and damage in structures will be the same for both repair and rehabilitation projects. For the purposes of this chapter, design requirements for repair and rehabilitation can be considered to be equivalent.

Durability requirements for repairs are in Chapter 8.

**R7.1.1** Internal forces include those from externally applied loads and those from imposed deformations, from such actions as prestressing, shrinkage of repair materials, temperature changes, creep, unequal settlement of supports, and listing, leaning and tilting displacements.

### R7.2—Strength and serviceability

**R7.2.2** During the repair process, it may not be possible or practical to relieve existing stresses or deformations. Consideration should be given to the in-place internal forces and deformations present in the structure during the repair and the subsequent internal forces from the design loads that the repaired section will resist. Internal forces and deformations caused by existing loads may be locked in by the repair.

Analysis to evaluate the of structural - tions should verify that the strength is adequate and that serviceability conditions are met. As an example, creating a large opening in structural slabs may necessitate cutting reinforcement, which can the global behavior of the structure. Supplementary strengthening may be required to address force redistribution that can exceed the existing strength of the elements. Slab punching shear strength should be evaluated for openings at the intersection of column strips to verify that the slab is adequate. This is especially critical near corner and edge columns where the slab shear stress is typically highest.

**R7.2.3** Adequate needs to be determined on a basis and is a function of the structure type, the desired performance of the structure, and loading conditions and use.

### R7.3—Behavior of repaired systems

**R7.3.1.1** Repair of a structure may be achieved by improving the global behavior of the structure by adding


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a structural system capable of resisting the design loads by sharing and transferring loads between new members and existing elements.The of the new members on the structure shall be evaluated according to the design-basis code.

**7.3.2** Repairs to members shall account for force transfer at the interface between the member and the repair material or repair system. It shall be permitted to use ACI 318 to design the force transfer mechanism between new and existing concrete.

**7.3.3** Structural repairs required for strength or shall maintain composite behavior under service load. The repaired system shall be designed to mitigate potentially dangerous conditions if bond between the repair and the substrate is lost.

### 7.4—Interface bond of cementitious repair materials

**7.4.1** Repair design shall include an analysis to determine the interface shear and tension stresses across bonded interfaces between cementitious repair materials and the existing substrate. The interface analysis shall use factored loads in

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new structural members that act integrally with the existing structural system or improving the behavior of the existing members. The design of the repair should consider connections of new members to the structure. Connections of new members should be designed to transfer design forces between new members and the structure.

Load sharing and load transfer should exist between the structure and the new members so that the assumed load path and force distribution can occur. The of adding new members on the global and force distribution should be considered.

New members may need to be separated from adjacent members to prevent or minimize interaction that may result in damage to adjacent portions of the structure. Transfer of forces between new and existing members should not compromise the performance of the structural system.

**R7.3.2** Induced forces on the repaired member are shared between the existing member and the repair material or system. The repair should be designed to allow for transfer of forces between the two components.

The requirements for composite behavior between the repair and the member may vary depending on the type of repair (structural or nonstructural), the performance criteria at service, and the required strength at the ultimate limit states. While certain designs require composite behavior up to an ultimate limit state, others may be limited to service conditions. Composite behavior can be achieved by chemical bonding, mechanical means, or a combination thereof. The design should specify the repair materials and techniques that will develop the level of composite behavior to achieve the intended performance of the repaired member. reference is made to ACI 318-14, Sections 16.4 and 22.9, for force transfer requirements between new and existing concrete. Techniques other than shear-friction may be acceptable.

Design guidelines for bond of -reinforced polymer (FRP) are provided in ACI 440.1R and 440.2R. Design provisions to achieve composite behavior with structural steel sections are provided in the for Structural Steel Buildings" (ANSI/AISC 360-16, Chapter I).

**R7.3.3** Nonstructural repairs intended to improve durability or aesthetics may not require composite behavior under service loads. To prevent potentially dangerous conditions in the event of bond failure in a repair, the repair should encapsulate existing steel reinforcement. Alternately, the repair systems should be designed to provide redundant attachment of the repair material to the existing structure.

### R7.4—Interface bond of cementitious repair materials

**R7.4.1** The forces acting on the interface between cementitious repair materials and existing substrate can include tension, shear, or a combination of tension and shear depending on repair geometry and the applied loads. The


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addition to internal forces resulting from restrained volume change to calculate the resultant interface stress demand ($v_u$) from the transfer of tension and shear.

**7.4.1.1** Interface shear stress shall be designed based on

$$v_u \le \phi v_{ni} \qquad (7.4.1.1)$$

where $v_{ni}$ is nominal interface shear stress capacity and $\phi$ is the strength reduction factor determined in accordance with 5.3.2.

**7.4.1.2** Testing requirements for interface bond shall be in accordance with Table 7.4.1.2.

**Table 7.4.1.2—Testing requirements where $v_u$ is partially or totally resisted by the concrete**

| $v_u$ | Testing requirements |
|---|---|
| Less than or equal to 30 psi | Bond integrity testing |
| Greater than 30 psi | Quantitative bond strength testing |

**7.4.2** If $v_u$ does not exceed 30 psi, interface reinforcement shall not be required. Bond integrity testing as in the construction documents shall be performed.

**7.4.3** If $v_u$ is between 30 psi and 60 psi, interface reinforcement is not required. Quantitative bond strength testing shall be performed to verify performance. Direct tension tests (ASTM C1583/C1583M) or other similar quantitative test methods shall be The frequency of tests and acceptance criteria shall be but the number of tests on a project shall be at least three (3).

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tensile and shear demand at an interface between a cementitious repair material and the substrate from applied loads and from volume changes that occur as a result of shrinkage or thermal movement can be calculated using principles of structural mechanics, but these calculations can be complex. Guidance on designing the interface for horizontal shear can be found in Chapter 16 of ACI 318-14, Chapter I of ANSI/AISC 360-16, and Bakhsh (2010).

Where the required nominal interface shear stress is lower than 80 psi, and where good surface preparation, placement, repair materials, and curing techniques are employed, satisfactory composite behavior will likely be achieved without interface reinforcement.

**R7.4.2** The 30 psi bond stress by this code is based on half of a nominal shear stress of 80 psi multiplied by the strength reduction factor in 5.3.2.

A properly prepared substrate is achieved by removing existing deteriorated, damaged, or contaminated concrete. The exposed sound concrete is then roughened and cleaned to allow for adequate bond of a repair material. ICRI Guideline No. 210.3 presents a discussion of achievable tensile bond strengths, suggests a minimum value of 100 psi for less critical applications, and indicates that tensile bond test values less than 175 psi that fail at the bond interface or within the existing concrete substrate may indicate a partially damaged, contaminated, or otherwise inadequate bond surface. BS EN 1504-10 suggests minimum direct tension strengths of 100 psi for nonstructural repair and 175 to 215 psi for structural repairs. Interface reinforcement may be needed if interface capacity cannot be achieved through bond.

Bond integrity testing can consist of various nondestructive qualitative test methods such as sounding in accordance with ASTM D4580/D4580M, ground-penetrating radar or impact-echo described in ACI 228.2R or ICRI Guideline No. 210.4.

**R7.4.3** The 60-psi bond stress is based on a nominal shear stress of 80 psi multiplied by the strength reduction in 5.3.2

On most concrete repair projects, testing to verify the bond of cementitious repair materials to the substrate is recommended as part of a quality assurance program. Quantitative bond strength testing is required when the bond stress exceeds 30 psi and interface reinforcement is not provided. ICRI Guideline No. 210.3 provides guidance on the number


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of tests that should be performed based upon the repair area and acceptance criteria.

Bond capacity has primarily been evaluated using direct tension tests, as in ASTM C1583/C1583M and as described in ICRI Guideline No. 210.3. In some instances, laboratory slant shear tests in accordance with ASTM C882/C882M of cores made in the lab or cores taken from mockups in the have been used to assist the licensed design professional to make informed design decisions. Slant shear test results typically exceed direct tension test results, but the slant shear strength is greatly by the compressive stress the test setup introduces across the interface and may not be directly comparable to conditions. Typically direct shear strengths are larger than direct tension strengths. Comparisons of these tests and other tests, for the purpose of achieving adequate bond is discussed in Bakhsh (2010). It generally is adequate to assume that the repair to substrate bond will resist an interfacial shear equal to the direct tensile test result.

If failure during direct testing occurs at the bond line, it may indicate inadequate surface preparation of the concrete substrate or the substrate surface was damaged by the surface preparation method (bruising of the substrate). to the surface preparation procedures may improve the tensile bond strength. Discussion of proper methods for surface preparation can be found in ACI 546R and ICRI Guideline No. 310.2R.

**7.4.4** If $v_u$ exceeds 60 psi, interface reinforcement shall be provided.

**7.4.5** If $v_u$ is completely resisted by interface reinforcement, quantitative bond strength testing is not required.

**R7.4.5** This provision provides an alternative to bond strength testing.

**7.4.6** Interface reinforcement shall be designed in accordance with ACI 318.

**R7.4.6** ACI 318 provides design provisions for horizontal shear transfer in composite concrete members. Minimum reinforcement is required between horizontal shear stress of 60 and 375 psi (500 psi multiplied by strength reduction factor of 0.75). Where the required design horizontal shear stress is greater than 375 psi, Section 16.4.4.1 of ACI 318-14 requires design per Section 22.9 of ACI 318-14. For cases where there is a net factored tension across the interface, reinforcement should be provided and designed in accordance with ACI 318.

**7.4.7** Construction documents shall specify testing requirements for interface reinforcement in the repair applications.

**R7.4.7** Testing to verify the performance of the interface reinforcement to transfer horizontal shear can be performed in accordance with the recommendations contained in ACI 355.2 and 355.4. requirements for testing of ties should be included in a quality assurance plan.

Direct tension testing of post-installed interface reinforcement is recommended to provide of the installation. Guidance for determining the number of tests and acceptance criteria of the direct tension testing is similar to principles used in developing direct tension testing requirements described in ICRI Guideline No. 210.3.


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### 7.5—Materials

**7.5.1** Materials in a structure shall be permitted to remain if such materials are performing satisfactorily.

**7.5.2** Except as permitted by this code, materials permitted by the current building code for new construction shall be used. Like materials shall be permitted, provided they do not contain hazardous materials or other materials not permitted by the code for new construction.

**7.5.3** Alternate materials shall be permitted following approval in accordance with 1.4.

**7.5.4** Design of the repair system shall consider the properties and installation of the repair materials and systems. These include, but are not limited to: physical properties of the repair materials, type of application, adhesion, volume stability, thermal movement, durability, corrosion resistance, installation methods, curing requirements, and environmental conditions.

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### R7.5—Materials

**R7.5.2** Hazardous materials include asbestos or other mate-

**R7.5.4** Physical properties of repair materials include mechanical, chemical, and electrical properties. Documentation should be obtained for properties of each repair material. The stated properties should be that they satisfy the project requirements. ACI and ICRI provide guidelines for the selection of repair materials (ACI 301, ACI 318, ACI 503R, ACI 503.5R, ACI 503.6R, ACI 506R, ACI 546.3R, ACI 549.1R, ICRI Guideline No. 320.2R, ICRI Guideline No. 320.3R, ICRI Guideline No. 330.1, and ICRI Guideline No. 340.1).

The design of a repair should consider the compatibility of the repair materials with the materials of the existing structure. Compatibility of repair materials and systems include volume stability, bond compatibility and durability, mechanical compatibility, and electrochemical and permeability compatibility. Generally, the intent is to use a repair material or repair system that has physical, mechanical, and other properties that are as close as possible to those of the parent material to provide long-term performance.

Individual repair materials may have properties yet will perform satisfactorily when combined in a repair system. An example of this is where materials with thermal ents of expansion may be used, provided that the overall performance of the system is not by thermal changes.

Volume stability is often estimated as a change in the linear dimensions of the repair and should be considered in the design of a repair system. Autogenous shrinkage, chemical shrinkage, degree of restraint, environmental conditions, drying shrinkage, creep, thermal changes, moisture absorption, and other factors all volume stability. Experience has shown that volume change of repair materials has often been the cause of poor performance of repairs. Properties of repair materials should be selected considering volume stability relative to the volume stability of the existing concrete in order to reduce the probability of cracking caused by relative volume changes.

Volume stability is discussed in ACI 209R, ACI 209.1R, ACI 546.3R, and ICRI Guideline No. 320.2R.

Repair materials such as portland-cement concrete, portland-cement mortar, polymer-cement concrete, polymer concrete, shotcrete, -reinforced concrete, resin-based materials, and similar products are commonly used. Repair


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materials might not necessarily contain portland cement, but should be selected to achieve the necessary service, strength, and durability requirements.

The selection of reinforcement material should consider the durability, performance at elevated temperatures, and ductility. Electrical and chemical reactivity between the reinforcement, the repair material, and the existing reinforcement should also be considered.

Refer to ACI 440.1R for internal FRP reinforcement, ACI 440.2R for externally bonded FRP reinforcement, and ICRI Guideline No. 330.1 and ACI SP-66 for steel reinforcement.

Required properties of the repair reinforcement should be in the construction documents. reinforcement properties are dependent on the requirements of the repair and may include physio-chemical (for example, glass transition temperature, and of thermal expansion) as well as mechanical properties (for example, ultimate strength, tensile modulus, and ultimate elongation).

### 7.6—Design and detailing considerations

**7.6.1** Repair design shall be based upon the member conditions in Chapter 6.

### R7.6—Design and detailing considerations

**7.6.2** *Concrete*—The in-place properties of the concrete, in accordance with Chapter 6, shall be used in the repair design.

**R7.6.2** The extent and cause of deterioration and the concrete strength and quality should be assessed, including compressive strength, chlorides, carbonation, sulfate attack, alkali-silica reaction, physical damage, corrosion-induced spalling, and cracking.

Chloride penetration can cause corrosion that can lead to cracking and spalling. The depth of a spall reduces the - tive area of concrete section. Degradation of the concrete

**7.6.3** *Reinforcement*

**R7.6.3** *Reinforcement*

**7.6.3.1** Reinforcement that is damaged or corroded shall be permitted to remain. The of remaining reinforcement shall be permitted to be used in the repair design in accordance with the design-basis code. The of corrosion damage on development of steel reinforcement shall be considered. Where original deformations are no longer reinforcing bars shall be considered as smooth bars.

**R7.6.3.1** Repair design should consider the in-place condition of the reinforcement, including the cross-sectional area of the reinforcing bars. The area is calculated using the remaining diameter of the reinforcing bar accounting for the loss of section due to corrosion. Further considerations may also include the location of the corroded areas, loss of the loss of bond, and the of corrosion on member strength. If the structure is damaged, steel reinforcement may be annealed, and the yield strength reduced. Refer to ACI 216.1 for additional guidance. Durability requirements related to corroded reinforcement are addressed in 8.4 and ACI 364.1R. CRSI (2014) provides information on older reinforcement systems.

**7.6.3.2** Repair design shall consider the location and detailing of the reinforcement in accordance with the assessment requirements of Chapter 6.

**R7.6.3.2** The location and detailing includes the horizontal and vertical positions, orientation, geometry of the reinforcement, development of reinforcement, and the presence of hooks and crossties. Field examination to locate reinforcement may be required. Guidance on evaluation techniques for reinforcement location is provided in Chapter 6.


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**7.6.3.3** Both existing and new reinforcement shall be adequately developed. Development length shall be permitted to be calculated based upon development in both the existing concrete and new materials and in accordance with the design-basis code.

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**R7.6.3.3** Reinforcement development may be inadequate due to corrosion, mechanical damage, or loss of concrete cover, delaminated concrete, concrete strength, or other conditions. Equations to calculate the development length have also changed over time and current equations may require longer development lengths than earlier equations. The design of the repair should evaluate the required development length. Detailing of the repair should include the proper development of new reinforcement to achieve the design force. ACI 318 provides development equations and requirements for detailing of steel reinforcement. ACI 369.1 (or ASCE/SEI 41) provides an equation when development length of existing reinforcement does not meet ACI 318. ACI 440.1R and ACI 440.2R provide detailing guidance for internal FRP reinforcement and externally bonded FRP reinforcement, respectively. Additional information can be found in Bulletin No. 10.

**7.6.4** *Prestressed structures*

**R7.6.4** *Prestressed structures*

**7.6.4.1** The of prestressing shall be considered in the repair design.

**R7.6.4.1** Requirements for repair of structures with bonded and unbonded prestressing are Post-tensioned structures (with bonded and unbonded tendons) are often cast-in-place monolithic structures, whereas pretensioned structures (with bonded strands) are often single-span precast structures. Each system is unique and should be individually considered. The repair of prestressed structures requires a condition assessment of the existing tendons. Repair of unbonded tendons may require tendon detensioning. Guidance for analysis, evaluation methods and repair techniques of unbonded post-tensioned structures is provided in ACI 423.4R, ACI 222.2R, ICRI Guideline No. 210.2, PTI DC80.2-10, and PTI DC 80.3/ICRI 320.6.

**7.6.4.2** The of ions to existing structure geometry, damage conditions, loss of prestressing force, and repair sequence shall be considered in the repair design.

**R7.6.4.2** Analysis to evaluate the of structural should verify that strength is adequate and that all serviceability conditions (for example, limits)

Analysis of prestressed structures is required to evaluate the of damaged or severed prestressing reinforcement on structural strength and performance. The of a severed bonded tendon is typically localized because the severed tendon is after a development length is achieved and the full strength of the tendon is reestablished. For structures with bonded tendons, shoring, if necessary, may only be required locally at the repair area.

Review of grouting quality assurance and supervision documents should be performed to evaluate grouted tendons in advance of any repair or rehabilitation of bonded post-tensioning systems. The presence of voids, moisture in ducts, chlorides and the extent of carbonation in the existing grout need to be Methods for evaluation of chloride-ion content are listed in ASTM C1152M, ASTM C1218, and AASHTO T260. Field evaluation of grout may be required even if documentation of the original construction is available.


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Unbonded tendons are designed to be permanently debonded from the member and often extend over multiple spans. As a result, damage or discontinuity of a tendon at one location will reduce the strength for the entire length of the tendon.

If unbonded tendons are severed, the prestressing force is assumed to be lost for the full length of the tendon. Releasing or cutting tendons may multiple spans and may require shoring beyond the area where cutting or releasing of tendons occurs. Adjacent spans may require temporary shoring depending on the number of tendons severed at one time and the applied loads. Analysis based on actual loading at the time

.

Repair and structural may require detensioning of prestressing tendons. Unbonded tendons should be detensioned in a controlled manner to ensure performance and safety. Unless not needed based on analysis, unbonded tendons should be reanchored and restressed to restore required structural strength. Cut or damaged unbonded tendons can be restored by splicing or by installing new tendons with anchors at intermediate locations, at the end of the structural member or the edge of any new openings.

The stressing force in a repaired tendon depends on the condition and type of the repaired post-tensioned system and in certain cases this force can be less than the original force if determined to be acceptable by structural analysis. Further discussion of this topic can be found in PTI DC 80.3/ICRI 320.6.

Corrosion on prestressing strands for bonded and unbonded post-tensioned systems may have an on strand integrity and strength. Prestressing strands require examination for conditions such as corrosion pitting and hydrogen embrittlement (refer to ICRI Guideline No. 210.2 and ACI 222.2R).

If repairs to prestressed slabs or beams result in increased concrete tensile stress (that is, changing the of the prestressed member as in ACI 318), impacts of the repair scheme on serviceability should be evaluated.

**7.6.4.3** Stresses in remaining section after concrete removal during repair shall not exceed the limits established in the design-basis code.

**R7.6.4.3** Removing surface concrete from a prestressed member may cause excessive compressive and tensile stress in the remaining concrete section and may alter secondary forces and moments due to prestressing in indeterminate structures. This condition is more critical for prestressed joists and girders that have a relatively small section and large prestressing force. Slabs are less critical due to the relatively small initial precompression. This change is acceptable as long as durability and strength are addressed as part of the repair design. The impact of removing concrete from a post-tensioned structure is addressed in Scollard and Bartlett (2004). PTI DC 80.3/ICRI 320.6 provides guidance for removing concrete around anchors and splices to prevent catastrophic anchorage failure.

**7.6.5** *Anchoring to concrete*—Post-installed anchors shall be designed in accordance with ACI 318 to transfer design

**R7.6.5** The design of post-installed anchors requires careful consideration of the loads to be resisted. Anchors


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forces to the substrate considering possible anchor failure modes and the condition of the substrate into which the anchor is installed.

**7.6.6** *Repair geometry* of repairs shall consider the potential for stress concentrations and cracking in both the existing structure and the repair area.

**7.6.7** *Expansion joint materials*—Selection of expansion joint materials shall consider the anticipated movement of the structure and facility maintenance procedures.

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should have adequate strength to transfer design forces across all interfaces and into the existing member. All possible anchor failure modes should be considered to determine the design strength. Anchors should be selected considering the expected concrete substrate cracking condition. For example, post-installed anchors used in the tension zone of concrete members and in structures located in regions of moderate or high seismic hazard should be able to transfer the design seismic forces assuming a cracked concrete condition.

Design of post-installed anchors is provided in ACI 318, which includes provisions that require performance of post-installed anchors in both cracked and uncracked concrete. ACI 355.2 and 355.4 provide the standard required for qualifying post-installed anchors in cracked and uncracked concrete. for post-installed anchors should include installation, testing, and inspection procedures.

For post-installed expansion or undercut anchors, manufacturer's installation instructions specify procedures for drilling, hole cleaning, installation, torque magnitude, and procedures to engage the anchor.

For adhesive anchors and dowels, hole cleaning and moisture conditions are critically important. Manufacturer's printed installation instructions should specify procedures for drilling, hole cleaning, installation, and the care to be taken until the adhesive has cured.

Testing and inspection of post-installed anchors should be in the construction documents. Many building codes require that adhesive anchors be installed under special inspection procedures to ensure that the installation is correctly performed in accordance with the design and manufacturer's procedure. Refer to ACI 318 for inspection requirements for post-installed anchors.

**R7.6.6** Repair shapes with sharp reentrant corners can cause stress concentrations that may result in cracking. Long, slender (high aspect ratio) repair areas also may result in transverse cracking. The shape of the repair should be considered to reduce stress concentrations and possible cracking. Methods discussed in ICRI Guideline No. 310.1R provide guidance to reduce cracking in concrete repairs including providing a uniform depth of edges and substrate, repair geometry, surface preparation, concrete removal below reinforcement (undercutting) and elimination of feather edge repairs.

**R7.6.7** Repairs to expansion joint materials are common, particularly those subjected to snow removal operations.

Design and selection of the expansion joints should consider the total anticipated movement of the expansion joint. Typically, expansion joint capacities listed in manufacturer's literature are based on total movement from minimum installation width to maximum installation width and assume the joint will be installed when the joint is at the midpoint of this movement range. Joints installed in the summer or winter months will experience movement


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primarily in one direction only, and so may require a larger capacity. Additional guidance can be found in the Parking Facility Maintenance Manual published by the National Parking Association (2016).

### 7.7—Repair using supplemental post-tensioning

**7.7.1** Supplemental post-tensioning shall be permitted for repair of structures.

**7.7.2** The of the supplemental post-tensioning on the behavior of the structure shall be considered in the repair design.

**7.7.2.1** Stresses due to supplemental post-tensioning shall be combined with existing stresses and the total shall not exceed the limits in the design-basis code.

**7.7.2.2** Design of supplemental post-tensioning shall provide for the transfer of post-tensioning forces between the post-tensioning system and the structure. Design of concrete supplemental post-tensioning anchor zones shall be in accordance with ACI 318. Design of steel brackets and supplementary structural steel shall be in accordance with ANSI/AISC 360.

**7.7.3** Provisions shall be made for of post-tensioning, temperature, and shrinkage on adjoining construction, including immediate and long-term deformations, changes in length, and rotations due to prestressing.

**7.7.4** Post-tensioning losses shall be included in the design of supplemental post-tensioning systems.

**7.7.5** Construction documents shall specify the repair sequence, including tendon placement, anchors, and stressing of the post-tensioned system.

### R7.7—Repair using supplemental post-tensioning

**R7.7.1** Supplemental post-tensioning can be applied to the structure externally, internally, or both.

**R7.7.2** Supplemental post-tensioning can introduce moment, shear, and axial forces within the structure that should be considered in the design and detailing of the repair. The internal forces induced by the supplemental post-tensioning can be For statically indeterminate structures, restraint to post-tensioning deformations can result in - cant internal forces. Refer to ICRI Guideline No. 330.1 for selecting strengthening systems for concrete structures.

**R7.7.2.1** Adding supplemental post-tensioning to a prestressed member may cause excessive compressive and tensile stress and may alter secondary forces and moments. External post-tensioning may result in changing the - cation of prestressed members as in ACI 318 Section 24.5.2. This change is acceptable as long as durability and strength are addressed as part of the repair design.

**R7.7.2.2** Anchors for new post-tensioned reinforcement should be designed and detailed for the transfer of post-tensioning forces to the existing structure. Bearing, spalling, and bursting forces created at anchor zones should be considered. Strut-and-tie modeling, as given in ACI 318, may be used to design post-tensioning anchor zones.

**R7.7.3** The post-tensioning forces may be restrained by adjacent members such as walls, and reduce the of the prestressing on the intended member or have unintended

**R7.7.4** Losses include wedge seating in the anchor; elastic shortening; creep of original concrete; shrinkage of original concrete following installation of the supplemental prestressing; creep of repair material; shrinkage of repair material; prestressing relaxation; and friction and wobble between the post-tensioning reinforcement and ducts, bearings, or deviators. Assessment of losses of supplemental post-tensioning force should consider the existing conditions of the repaired elements, as the members may have already experienced time-dependent creep and shrinkage.

**R7.7.5** Repair design using supplemental post-tensioning systems should include construction documents for installation sequence including shoring, removal of concrete, placement of new material and reinforcement, additional anchor requirements, horizontal shear transfer requirements, curing, and stressing. Installation of supplementary post-tensioning


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**7.7.6** Structural members repaired or with externally installed unprotected post-tensioning shall have adequate unrepaired strength, in accordance with 5.5.

### 7.8—Repair using fiber-reinforced polymer (FRP) composites

**7.8.1** Fiber-reinforced polymer composites in conformance with ACI 440.6 and ACI 440.8 shall be permitted to repair concrete structures.

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involves application of forces, which may require project safety and protection procedures by the installer. Refer to 8.4.1 for corrosion protection requirements.

**R7.7.6** Unless protection of the post-tensioning strengthening system is provided to prevent sudden failure of the member in case the external post tensioning reinforcement is damaged or becomes (such as or impact), the structural member should have adequate strength without the post-tensioning reinforcement to support factored loads,

### R7.8—Repair using fiber-reinforced polymer (FRP) composites

**R7.8.1** Fiber-reinforced polymer fabrics, bars, or shapes can be used as externally bonded reinforcement, internal reinforcement, and as internal or external prestressed reinforcement. FRP shapes may be used as additional standalone structural members. Design and detailing of externally bonded FRP systems should be consistent with ACI 440.2R. Particular attention should be given to strength increase limits, service limits, and determination of FRP material design properties.

Design and detailing of internal FRP reinforcement should be consistent with ACI 440.1R. Particular attention should be given to service limits and determination of FRP material design properties.

If internal prestressed FRP reinforcement is used, the design and detailing should be consistent with ACI 440.4R.

FRP systems should only be installed in or on sound concrete. Concrete distress, deterioration, and corrosion of reinforcement should be evaluated and addressed before the application of the FRP system. Surface preparation requirements should be based on the intended application of the FRP system. FRP applications can be categorized as bond-critical or contact-critical. Bond-critical applications, such as or shear strengthening of beams, slabs, columns, or walls, require an adhesive bond between the FRP system and the concrete. Contact-critical applications, such as - ment of columns, only require intimate contact between the FRP system and the concrete. Contact-critical applications do not require an adhesive bond between the FRP system and the concrete substrate, although one is often provided to facilitate installation. ACI 440.2R provides descriptions of FRP applications and surface preparation and repair requirements.

For bond-critical applications, the concrete substrate should possess the necessary strength to develop the design forces of the FRP system through bond. The substrate, including all bond surfaces between repaired areas and the original concrete, should have direct tensile and shear strength to transfer force between the existing substrate and FRP system. The tensile strength of the substrate should be at least 200 psi as determined by a type adhesion test per ASTM D7522/D7522M. Contact-critical applications are not required to meet this minimum bond value as


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the design forces of the FRP are developed by deformation or dilation of the concrete section.

For bond-critical applications, the concrete surface should be prepared to a minimum concrete surface (CSP) 3 as by the ICRI Guideline No. 310.2R. In contact-critical applications, surface preparation should promote continuous intimate contact between the concrete surface and the FRP system. Surfaces to be wrapped should, at a minimum, be or convex to promote proper loading of the FRP system.

FRP systems should not be applied to damp or wet surfaces unless the epoxies are formulated by the manufacturer for such applications. Moisture content of the concrete substrate should be evaluated before application of the FRP system as it may inhibit bonding between the concrete substrate and epoxy polymer. Surface moisture should not exceed the limits established by the manufacturer. Testing for presence of moisture should be done in accordance with manufacturer's written recommendations or one of the following: ASTM D4263 – "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method;" AASHTO FRPS-1-UL – "Guide tions for Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements," edition; ACI 548.1R; ASTM F1869 – "Standard Test Method for Measuring Moisture Vapor Emission Rate (MVER) of Concrete Using Anhydrous Calcium Chloride;" ASTM F2170 – "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes;" or ASTM F2420 – "Standard Test Method for Determining Relative Humidity on the Surface of Concrete Floor Slabs Using Relative Humidity Probe Measurements and Insulated Hood."

The surfaces to receive moisture testing and the testing equipment should be acclimated near the relative humidity levels and temperatures that the design is anticipated to have in service. Variation between testing and in-service conditions may provide inaccurate or misleading testing results.

**7.8.2** Structural members repaired or with externally-applied FRP composites shall have adequate unrepaired strength, in accordance with 5.5.

### 7.9—Performance under fire and elevated temperatures

**7.9.1** Design of the repair system shall consider elevated temperature performance and shall comply with the resistance ratings of the structural members and other safety requirements in accordance with the design-basis code.

### R7.9—Performance under fire and elevated temperatures

**R7.9.1** Regardless of the repair system used, performance of the repaired element under and elevated temperatures should be evaluated and the system should be detailed and materials selected to provide adequate performance. The repaired elements should comply with applicable building code requirements and relevant regulations valid at the project location. Structures renovated for use or strengthened to support higher loads may require a more stringent rating than the original structure. Other requirements such as spread and smoke density should also be considered in accordance with the general existing building code and ASTM E84.


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**7.9.2** It shall be permitted to design a repair without supplemental protection if the unrepaired member has adequate strength during a event considering the reduced material properties due to exposure in accordance with 5.5.3.

**7.9.3** The properties of the repair materials at elevated temperatures shall be considered.

**7.9.4** Repairs using adhesives shall consider their performance at elevated temperatures.

**7.9.5** Supplemental protection to improve the rating of repaired systems shall be permitted.

**7.9.6** Fire rating of repaired systems, based on ACI 216.1, shall be permitted.

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**R7.9.2** A repair system can be selected without additional protection provided that the existing unrepaired member has adequate strength during a event to support the loads, as in 5.5.3. Fire performance requirements and evaluation procedures for a structure during a event are outlined in ACI 216.1, ASCE/SEI/SFPE 29, and AISC Design Guide 19.

**R7.9.3** Repair material should comply with the requirements of relevant regulations valid at the project location. If there is a between the properties of products or systems and regulations, alternative repair principles or methods should be used to avoid such a In general, polymer mortar and polymer concrete have higher of thermal expansion and higher resistance to water vapor transmission and lower resistance to and elevated temperatures compared to cementitious alternatives.

**R7.9.4** ACI 440.2R reports that the physical and mechanical properties of the resin components of FRP systems are by temperature and can degrade at temperatures close to and above their glass-transition temperature $T_g$. An acceptable service temperature for FRP is established by ACI 440.2R as $T_g$ – 27°F. This value accounts for typical variation in test data for dry environment exposures. Adhesive-bonded FRP reinforcement should not be used if the maximum service temperature exceeds $T_g$ – 27°F. A service temperature exceeding this limit temperature should be addressed using an adhesive system with a higher $T_g$ value, using heat protection or insulation systems or using alternate repair systems. Similar service temperature considerations apply to adhesive-bonded steel reinforcement.

Adhesive-based repair systems can be considered - tive during a event if a protection system with an established rating is used that maintains the temperature of the adhesive-based system below its glass transition temperature. In the absence of an established rating, detailed analysis may be used to establish a rating of the repaired system.

**R7.9.5** Standard protection systems can be used to increase the rating of repaired systems. National codes and professional organizations list generic ratings for concrete structural members, giving the minimum thickness of concrete cover needed to protect the main steel reinforcement from (IBC; NFPA 5000 2015; PCA 1985, 1994). In addition to increasing the cover thickness, performance of reinforced and prestressed concrete members may be enhanced by protection systems as proven by testing or analytical methods (ACI 216.1). Concrete cover for nonmetallic reinforcement may need to exceed cover for steel reinforcement

**R7.9.6** The rating of a repaired system or assembly can be determined in accordance with ACI 216.1, which requires


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the use of reduced material strength due to exposure and

The criteria for evaluating a structure for safety are than those for strength design and typically incorporate lower material strengths and required strength, and may not require the use of strength reduction factors (refer to Section 5.5.3). The licensed design professional should verify that the strength of the member exceeds the force demand due to expected service loads during the event. The strength should be based on reduced material strengths for the maximum expected temperature in a event, which can be determined in accordance with ASTM E119 and ACI 216.1.

Section 1.2 of ACI 216.1 allows alternative methods to assess the resistance of assemblies. The reduced strength as well as the of protection system on the overall performance and rating of an existing and repaired element can also be determined utilizing available design models and element numerical procedures. Descriptions of the detailed analytical methods can be found in Buchanan (2001) and *Technical Report 68* (2008) by the Concrete Society.

The resistance or rating of a repaired system or assembly can be determined through full scale testing in accordance with ASTM E119, which requires the application of the expected service load to the test specimen during


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## CHAPTER 8—DURABILITY

### 8.1—General

**8.1.1** Durability of individual repairs, the repaired structure, and the interaction between the repaired areas and the remaining structure shall be considered.

**8.1.2** Cause(s) of current conditions, defects, and potential future deterioration of repairs shall be assessed as part of the repair design.

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## R8—DURABILITY

### R8.1—General

**R8.1.1** The durability of materials incorporated into a repair depends on the ability of the materials to withstand the environment where they are installed. A repaired section is considered to be the combination of the installed repair material(s) and the substrate material(s). The durability of repairs is dependent on the compatibility between repair materials, the structure, and the surrounding environment. To achieve compatibility, the repair and structure need to interact on several levels without detriment, including chemical, electrochemical, and physical behavior.

For repair durability design, the design service life is the time frame for which durability should be considered. The design service life requirements for a repaired structure are established by the licensed design professional in consultation with the Owner to achieve a repair that project requirements including strength, safety and serviceability. Such design service life should be in the repair design and maintenance requirements, as well as incorporated into the construction documents. Design service life may be achieved through satisfactory repair construction practices, including the material selection, surface preparation and application of the repair materials. The design service life of the structure and repaired members, including maintenance requirements, may be estimated by considering the durability of the repair materials and their interaction with the structure. Service life and the parameters to be considered, the limitations, and methods available for conducting a service life prediction are presented in ACI 365.1R. Some examples of end of service life where durability parameters are not met include:

(a) Unacceptable reduction in structural performance

(b) Unacceptable frequency of maintenance cycles and associated activities

(c) Exceeding maximum crack width or crack frequency from corrosion, shear

(d) Exceeding maximum permissible chloride level at the interface of the steel in the repair area, or in adjacent areas

(e) Depth of carbonation leading to corrosion of reinforcement

(f) Unacceptable reinforcement section loss due to corrosion

(g) Exceeding maximum concrete deterioration level, mass loss or unacceptable surface conditions due to deterioration mechanisms, such as corrosion, freeze-thaw, chemical attack, abrasion, sulfate attack, alkali-silica reaction (ACI 221.1R, ACI 364.11T), or delayed ettringite formation

(h) Loss of watertightness or excessive/unacceptable leakage

**R8.1.2** The presence of deterioration and its cause(s) should be determined as a step in repair durability design. Causes of deterioration include:


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(a) Mechanical (abrasion, cavitation, fatigue, impact, overload, settlement, explosion, vibration, excessive displacement, loads, or ground motion from a seismic event)
(b) Chemical (alkali-aggregate reaction, sulfate attack, acid dissolution, soft water leaching, or biological action)
(c) Physical (freezing and thawing cycles, scaling, humidity gradients, temperature gradients, coef- of thermal expansion, salt crystallization, radiation exposure, ultraviolet light, or in permeability between materials)
(d) Reinforcement corrosion (carbonation, corrosive contaminants, dissimilar metals, stray currents, or stress corrosion cracking, location of reinforcement)
(e) Defects

**8.1.3** Repair materials and methods shall be selected to be compatible with the structure, and within the service environment. Anticipated maintenance shall be considered in the selection of repair materials and methods.

**R8.1.3** Compatibility in concrete repair systems can be as the balance of physical, chemical and electrochemical properties, as well as volume changes between the repair, the reinforcement, and the existing substrate. This balance ensures that the composite repair system withstands stresses induced by loads, chemical and electrochemical and restrained volume changes without distress and deterioration over a designed period of time (Vaysburd and Emmons 2006).

Repaired sections should be resistant to expected service conditions that can result in deterioration during the design service life, including the causes of deterioration listed previously, and combinations of these causes.

Repaired sections should be resistant to:

(a) The ingress of chlorides and other corrosive contaminants that are present in the remaining concrete or the ingressof corrosive contaminants into the concrete that lead to corrosion of reinforcement or other embedments (8.4).

(b)

(c) Freezing-and-thawing damage if critically saturated and subject to a freezing-and-thawing environment.

(d) Scaling if exposed to salts.

(e) Deterioration due to exposure to ultraviolet or other radiation deterioration within the repair environment unless other means are provided to address such deterioration.

(f) Fatigue deterioration resulting from loading cycles and load reversal. For example, fatigue resistance may be needed in repair areas subject to many cycles of repeated loading.

(g) Impact, erosion, and vibration if exposed to conditions causing deterioration by these mechanisms.

(h) Abrasion due to heavy impingement of abrasive particles, or similar conditions.

(i) Chemical deterioration which may result from sulfate attack, acids, alkalis, solvents, leaching of cementitious materials due to soft water, salt crystallization, and other factors that are known to attack or deteriorate the repair material or concrete substrate. Water penetration into concrete is associated with many types of chemical attack and other deterioration mechanisms.

(j) Carbonation-induced corrosion. Carbonation of concrete and repair materials reduces their pH and dimin-


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ishes the passivation which may lead to corrosion of embedded reinforcement (refer to 8.4).

(k) Deterioration resulting from deleterious aggregate, alkali-aggregate reactions or other aggregate durability concerns.

(l) Deterioration due to trapped moisture as a result of permeability between the repair and existing concrete, leading to freezing-and-thawing damage of critically saturated concrete, corrosion of embedded steel reinforcement, alkali-aggregate reaction, or sulfate attack of either the repair concrete or existing concrete.

Appropriate materials selection for concrete repair is discussed in ACI 546.3R.

Environmental classes that may durability performance are shown in Table R8.1.3.

**Table R8.1.3—Exposure categories and classes (adopted from ACI 318-14)**

| Category | Class | Condition | |
|---|---|---|---|
| Freezing and thawing (F) | F0 | Concrete not exposed to freezing-and-thawing cycles | |
| | F1 | Concrete exposed to freezing-and-thawing cycles with limited exposure to water | |
| | F2 | Concrete exposed to freezing-and-thawing cycles with frequent exposure to water | |
| | F3 | Concrete exposed to freezing-and-thawing cycles with frequent exposure to water and exposure to deicing chemicals | |
| Sulfate (S) | | Water-soluble sulfate ($SO_4^{2-}$) in soil, percent by mass [1] | Dissolved sulfate ($SO_4^{2-}$) in water, ppm[2] |
| | S0 | $SO_4^{2-} < 0.10$ | $SO_4^{2-} < 150$ |
| | S1 | $0.10 \le SO_4^{2-} < 0.20$ | $150 \le SO_4^{2-} < 1500$ or seawater |
| | S2 | $0.20 \le SO_4^{2-} \le 2.00$ | $1500 \le SO_4^{2-} \le 10{,}000$ |
| | S3 | $SO_4^{2-} > 2.00$ | $SO_4^{2-} > 10{,}000$ |
| In contact with water (W) | W0 | Concrete dry in service, concrete in contact with water and low permeability is not required | |
| | W1 | Concrete in contact with water and low permeability is required | |
| Corrosion protection of reinforcement (C) | C0 | Concrete dry or protected from moisture | |
| | C1 | Concrete exposed to moisture but not to an external source of chlorides | |
| | C2 | Concrete exposed to moisture and an external source of chlorides from deicing chemicals, salt, brackish water, seawater or spray from these sources | |

[1]Percent sulfate by mass in soil shall be determined by ASTM C1580.

[2]Concentration of dissolved sulfates in water, in ppm, shall be determined by ASTM D516 or ASTM D4130.

### 8.2—Cover

**8.2.1** Concrete cover shall be in accordance with the design-basis code, or an equivalent cover shall be used. An equivalent cover using alternative materials and methods shall be approved in accordance with 1.4.2.

### R8.2—Cover

**8.2.2** Concrete cover over remaining and new reinforcement shall meet minimum requirements to provide - cient (i) corrosion protection; (ii) protection; and (iii) anchorage and development.

**R8.2.2** Concrete cover protects reinforcement in concrete construction from corrosion until the concrete cover becomes contaminated, cracks or is compromised. The protection provided by the concrete cover is important in determining the service life of the structure. The minimum cover is typically required by the design-basis code. The of concrete cover on reinforcement corrosion, chloride contamination, and carbonation should be considered


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when evaluating the maintenance requirements and design service life of alternative methods for corrosion protection.

Adequate protection may be provided by increased section thickness, the appropriate coatings, such as sealers, or both; or electrochemical corrosion protection methods. Alternative means of protecting reinforcement include the application of waterproof membranes (ACI 515.2R), and various forms of cathodic protection. Active corrosion may create distress and deterioration beyond the limits of the repair area. The design service life should consider the existing conditions and potential distress in repairs areas and areas adjacent to the repair.

Concrete cover also provides protection. Fire protection requirements can be met by techniques such as increasing cover

### 8.3—Cracks

**8.3.1** The cause(s) of cracks shall be assessed, and mitigation of cracking shall be considered in the repair design. As part of a repair design, cracking mitigation methods shall consider the causes, movement, size, orientation, width, and pattern of cracks. The characteristics of the substrate, location, and evidence of water transmission shall be determined to assess the appropriate method of repair. Active water - tration shall be corrected as required for the durability of the structure.

**8.3.2** The design of repairs shall consider the of cracks on the expected durability, performance, and design service life of the repair and structure as a whole.

### R8.3—Cracks

**R8.3.1** Cracks can reduce the protection provided by the cover over steel reinforcement and lead to water and deleterious material ingress, which accelerates the deterioration of embedded reinforcement and can cause other concrete deterioration issues such as freezing-and-thawing deterioration, alkali-aggregate deterioration, and chemical attack. of their cause(s) and evaluation of their impact on a structure or a concrete component is described in ACI 224.1R. Guidance for the assessment of cracking caused by earthquakes is provided in FEMA 306.

**R8.3.2** Not all cracks need to be repaired, however, all cracks have the potential to become active cracks. Cracks in concrete structures can be detrimental to the long-term performance of a structure if the cracks are of size to allow for the ingress of deleterious materials into the structure, and guidance for critical crack sizes is provided in ACI 224R, Table 4.1.

Consideration should be given to post-repair cracking and the need for protection of the existing concrete and repair material from the ingress of deleterious materials. ACI 224.1R provides guidance for the prevention and control of cracks.

There are a variety of materials that have been used for crack repair, and the correct for a given application will the design service life of the repair. For cracks that are essentially acting as a joint or are active, one type of repair is to seal the crack with an elastomeric sealant at the concrete surface(s). Crack injection can be another repair approach. For repair by crack injection, the process and material should be appropriate to the site conditions. Dormant cracks can be repaired by injection using materials such as epoxy, polyurethane, latex in a cement matrix, cement, and polymethacrylate. Crack injection should not be used to repair cracks caused by corrosion of steel reinforcement and alkali aggregate reaction unless supplemental means are employed to mitigate the cause of the cracks.


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### 8.4—Corrosion and deterioration of reinforcement and metallic embedments

**8.4.1** The corrosion and deterioration of reinforcement and embedded components shall be considered in the durability design. Repairs shall not contain intentionally-added constituents that are corrosive to reinforcement within the repair area.

**8.4.2** The impact on the design service life of the repaired structure shall be considered if it is anticipated that corrosion products cannot be removed from the reinforcement during repair.

**8.4.3** The quality of existing concrete and its ability to protect reinforcement from corrosion, and other forms of damage and deterioration shall be considered.

**8.4.4** Galvanic corrosion between electrochemically dissimilar materials shall be considered.

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### R8.4—Corrosion and deterioration of reinforcement and metallic embedments

**R8.4.1** Untreated reinforcement corrosion limits the life expectancy of repair areas, repair materials, and repaired structures. ICRI No. 310.1R provides guidelines on removal of damaged concrete and cleaning of reinforcement. Repairs that do not address reinforcement corrosion may negatively impact the design service life and require more intensive monitoring. The structural design considerations for corroding reinforcement on repairs are described in 7.6.3.1.

**R8.4.2** Ideally corrosion products should be removed from reinforcement in repairs. In some situations, due to congestion of reinforcement, access limitations, load considerations, or other factors, it is not possible to remove corrosion products from the steel reinforcement. Situations exist where corroding reinforcement that cannot be adequately cleaned or repaired will remain in the repaired structure. The of uncleaned reinforcement on the long-term durability of the repaired structure should be considered in these situations. Supplemental corrosion mitigation strategies may be needed in these situations.

**R8.4.3** Water and chemical penetration into the concrete can cause corrosion of metallic embedments and damage to nonmetallic reinforcement.

The corrosion of embedded metals adjacent to the repair may be accelerated due to electrical potential between electrically continuous reinforcement in the repair area and external to the repair area. This form of corrosion is commonly referred to as the “anodic ring” or “halo and is discussed in ACI 364.3T, ACI 546R, and “ACI RAP Bulletin 8” (ACI Committee E706 2005). The rate of anodic ring corrosion depends upon the chloride content, internal relative humidity, and temperature.

The anodic ring which may be induced by certain repairs, should be addressed by incorporating appropriate corrosion mitigation strategies such as cathodic protection or corrosion inhibitors. ACI 222R, ACI 222.3R, ACI 364.3T, ACI 546R, and *Technical Report 50* (The Concrete Society 1997) and FAQ sections from Concrete International (2002a,b,c) provide guidance for corrosion prevention, mitigation and inhibition. Both carbonation and chloride contamination may require consideration and are discussed in ACI 546R.

Aesthetics may be by means of protection and may also require consideration. Damage due to 7.9.

**R8.4.4** Reinforcement or metallic embedments in the repair area with electrochemical potentials, environments, or both, should be isolated from the existing reinforcement, or the existing reinforcement and metal embedments should be protected to minimize galvanic corrosion. For example, rail or post-pocket repairs that use dissimilar


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metals from conventional steel reinforcement could accelerate the deterioration of the installation (refer to ACI 222R).

**8.4.5** Corrosion protection of bonded and unbonded prestressing materials and prestressing system components shall be addressed during the repair design.

**R8.4.5** The presence of prestressing force in the steel and the need to transfer the prestressing force into the concrete makes corrosion damage in prestressed concrete members more critical than traditionally reinforced structures (refer to ACI 423.4R). Section 7.6.4 addresses the structural requirements for the repair.

The bonded or unbonded nature of the prestressing steel, the condition of the steel at the repair area, the attachment of the steel to the structure, the as-designed corrosion protection measures, the existing corrosion condition, the prestressing steel sheathing type and its risk for gaps and breaches that provide transmission pathways for contaminants, and the continuity of the prestressing steel need to be considered to address corrosion protection of the structure. Refer to PTI DC80.3-12/ICRI 320.6 and ACI 222.2R.

Hydrodemolition and other types of material removal methods should be used cautiously if the structure contains unbonded prestressing steel reinforcement. In these situations, water can be introduced into the sheathing surrounding the steel (refer to ICRI No. 310.3), the long-term durability of the prestressing steel reinforcement.

**8.4.6** If electrochemical protection systems are used to protect steel reinforcement in repair areas and structures, the interaction of the protection system with the repaired elements, the entire structure, and environment shall be considered.

**R8.4.6** Structures using impressed current electrochemical protection or mitigation systems should have continuous reinforcement, separate zones, or provisions should be made to make the steel electrically continuous. Impressed current electrochemical protection systems should be designed and maintained to not promote an alkali-aggregate reaction (AAR) and to avoid embrittlement of prestressing steel.

Impressed current electrochemical protection systems should include a monitoring and maintenance plan developed by a licensed design professional specializing in the design of corrosion protection systems (refer to NACE 01101, NACE 01102, NACE 01104, NACE 01105, NACE SP0107, NACE SP0290, and NACE SP0390).

**8.4.7** Repair materials and reinforcement shall be selected and detailed to be compatible such that the characteristics of each material do not adversely the durability of the other materials or of the existing concrete and reinforcement.

**R8.4.7** Incompatibilities can arise from the use of inappropriate materials or components, or dissimilar electrochemical characteristics or physical properties, which can negatively impact the concrete and reinforcement. Some examples include:

(a) In certain situations such as exposure to high temperatures, polyvinyl chloride (PVC) and other polymer-based materials can deteriorate, releasing decomposition products found to cause corrosion.

(b) Even if the conventional steel reinforcement becomes more noble in electrical contact with a dissimilar metal (for example, embedded aluminum conduit in the presence of chlorides), considerable concrete damage can arise (Monfore and Ost 1965).

(c) Fiber-reinforced polymer (FRP) wrapping should not be used as a corrosion repair strategy on members experiencing corrosion of embedded reinforcement, unless the concrete is


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repaired and corrosion mitigated. Appropriate sections within this code and referenced documents concerning FRP repairs should be consulted (refer to ACI 440.2R).

### 8.5—Surface treatments and coatings

**8.5.1** Moisture transmission through the structure and the of the surface treatment on the durability of the structure shall be considered.

### R8.5—Surface treatments and coatings

**R8.5.1** Surface treatments, coatings, sealers, or membranes are commonly used to limit the ingress of deleterious materials and moisture into the structure to reduce future deterioration of the structure. Surface treatments, coatings, sealers, and membranes may have a shorter service life than the concrete and can be considered as consumable or requiring periodic replacement or repair to maintain protection of the concrete (ACI 515.1R).

In some situations, encapsulation of moisture and deleterious materials by a surface treatment has been found to cause or accelerate deterioration. The condition of the concrete should be appropriate to receive a surface treatment, coating, or membrane (ICRI No. 310.2R).

**8.5.2** The selection of surface treatments applied to concrete surfaces shall consider the impact of abrasion, concrete cracks and their anticipated expansion and contraction, and anticipated movement of the structure on the repair system durability, the surface treatment, and the anticipated design service life of the structure.

**R8.5.2** Crack development and propagation provide an accelerated mechanism for ingress of moisture and deleterious materials and may also cause a surface treatment to


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## CHAPTER 9—CONSTRUCTION

### 9.1—General

Construction documents shall specify that:

(a) The contractor has the responsibility to construct the project in accordance with the construction documents and with appropriate standards.

(b) The contractor has the responsibility to provide the necessary resources and access for inspection, testing, observations, and quality control of the work.

(c) temporary shoring and bracing requirements in accordance with Section 9.2.

(e) Project-spec inspection, testing, and construction observation requirements of Chapter 10.

### 9.2—Stability and temporary shoring requirements

**9.2.1** Construction documents shall specify:

(a) Portions of the work that require temporary shoring and bracing during the period before the repair implementation for safety purposes and during construction

(b) Design loads and necessary spacing limitations for design of temporary shoring and bracing

(c) Contractor responsibilities to install, provide quality control, and properly maintain the temporary shoring and bracing

**9.2.2** Temporary shoring and bracing design shall consider:

(a) Accommodation for in-place conditions and changes in conditions over the period of the repair phases, per 9.2.7

(b) from measured lateral and vertical displacements, tilting or listing, secondary and superimposed loads

(c) Impact of the temporary shoring and bracing on the structure

(d) of deformation compatibility of the shoring system with the supported and supporting structural members and systems, in accordance with 9.2.6

(e) Structural stability of members, systems, and the structure in accordance with 9.2.5 and 9.2.6

(f) of damage or deterioration of existing members and systems in accordance with 9.2.8

**9.2.3** Shoring and bracing design shall be performed by a licensed design professional.

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## R9—CONSTRUCTION

### R9.1—General

The information to be presented in construction documents is described in 1.6.1. to the construction process, the construction documents should indicate that the contractor is responsible for construction consistent with the project plans and and convey project shoring, bracing and jacking requirements. During the work, the contractor should make the work available for inspection and observations by the licensed design professional, repair inspectors, and other quality assurance personnel.

### R9.2—Stability and temporary shoring requirements

**R9.2.1** design criteria for the temporary shoring and bracing in the construction documents should include requirements for loading, displacement limits, spacing, placement, and quality control during construction. ACI 563

**R9.2.2** Temporary shoring and bracing members should be designed to consider changes in bracing and shoring conditions during repair construction and as required to support construction operations. Design of temporary shoring and bracing members should be based on the in-place loads on the structure, deformations of the structure, and anticipated superimposed loads during construction. Secondary that may need to be examined in shoring and bracing design include geometric and material nonlinear response, member and foundation displacement, and internal member forces developed due to placement and alignment of shoring and bracing elements.

Anticipated loads, such as snow, seismic, wind, and construction and occupancy live loads, should be considered in the design criteria of the temporary shoring and bracing. Design requirements for shoring are contained in ASCE/SEI 37. Shoring design guidelines are contained in AISC Steel Design Guide Series 10 (Fisher and West 2003) and ACI SP-4.

**R9.2.3** Shoring and bracing design is not usually performed by the licensed design professional of record for the repair design. The contractor will usually retain a specialty engineer to prepare the temporary shoring design details and shoring-plans, showing loads, member type, spacing, and placement sequence for temporary shores and braces at the phases of planned repairs.


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**9.2.4** The licensed design professional for the repair design shall review temporary shoring and bracing design and details for compliance with the requirements of the project repair design and the temporary shoring and bracing criteria.

**9.2.5** The shoring and bracing shall maintain the global structural stability of the structure before remedial construction and during the repair phases.

**9.2.6** The shoring and temporary bracing shall maintain the structural stability of members and systems before construction and during the repair phases.

The lateral forces for temporary bracing design shall be determined using generally accepted engineering principles or as required by the design-basis code. Temporary shoring and bracing shall be designed to provide to prevent vertical and lateral displacement of the shored or braced members in excess of limits by the licensed design professional for the repair in the construction documents.

**9.2.7** The design of shoring and bracing members shall accommodate in-place conditions and changes in conditions during construction. The design shall, at a minimum, include consideration of (a) the changes in load paths, (b) construction loads, (c) unbraced lengths, and (d) the redistribution of loads and internal forces that result from removal of existing adjacent framing or changes in applied loads on structural members.

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**R9.2.4** Temporary shoring and bracing design and installation details should be reviewed by the licensed design professional for the repair project to assess the impact of the shoring on the structure, and to verify conformance of the proposed shoring with requirements. Refer to 5.1.4 for load requirements associated with shoring and temporary construction. Review of the shoring design by the licensed design professional for the repair design does not normally include a comprehensive review of the shoring design prepared by the specialty engineer and should not be considered a validation of the specialty engineer's design.

**R9.2.5** The assessment of global structural stability includes the overall structure, members and systems by repair, and temporary lateral bracing elements that contribute to overall stability. Stability of these elements should be considered during the phases of the repair process. Temporary measures may be needed to provide lateral bracing and shoring of members and systems. If necessary, the criteria to temporarily preload members should be included in the construction documents. Review and redesign for variations in the construction proposed by the contractor with changes in temporary shoring and bracing design and detailing should be addressed in the construction documents.

The licensed design professional should be aware that compression-controlled columns with high axial loads in a structure with substantial structural damage may behave in a brittle manner, with little warning prior to localized failure or possible progressive collapse. Therefore, caution should be taken in the design and installation sequence for stabilization measures in these situations.

**R9.2.6** Supplemental bracing for compression members may be required if the cross section or unbraced length of a compression member is during the repair process. Compression members include columns, walls, beam and other members, such as chords or diaphragms that resist compressive loads. The design of bracing members is described in various publications (AISC 2006; ANSI/AF&PA NDS 2014). The design load for a bracing member should be based on the existing dead and live loads, construction loads, and other loads that may be resisted by the compression member. A lateral force of 2 percent of the axial load in the member being braced is commonly used as a minimum load in the design of bracing members (ANSI/AISC 360-10).

**R9.2.7** Removal of column, beam, wall, and slab elements or parts thereof during repair construction and the placement of shoring and bracing can result in the redistribution of loads and internal forces within the building structure. The removal of framing members, diaphragms, or slabs can also the unbraced length of the framing members in the removal area. of the removal of elements should be considered in assessing the structure and shoring and bracing design.


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**9.2.8** Where structural members are required to support the structure and superimposed loads before repair and during construction, the structural capacity of damaged or deteriorated members shall be evaluated. The evaluation shall consider the actual cross section of the member and reinforcing at the time of the repair including losses of capacity due to damage and deterioration. Structural members that require temporary shoring and bracing to be installed and maintained in place during construction until the member

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**R9.2.8** Design of shoring and bracing members and the evaluation of members should be based on the member cross sections before and during the time of repair implementation. To account for unknown conditions, the evaluation by the licensed design professional should consider the importance of the member to the overall stability of the structure.

### 9.3—Temporary conditions

**9.3.1** Load and load factors used during the assessment and construction processes shall be in accordance with 5.1.4.

### R9.3—Temporary conditions

**R9.3.1** During the assessment and repair process, a temporary reduction in design load may be allowed, except if prohibited by authorities having jurisdiction or local building codes. Reduction in the design load intensity should be determined using the in-place condition of the structure and the time required for the completion of stabilization measures or repairs. ASCE/SEI 37 provides information on reductions in loads based upon the duration of a project. If a change in the length of the project or a delay occurs, the reduced design loads may no longer be appropriate.

### 9.4—Environmental issues

**9.4.1** Construction documents shall specify the contractor or other designated party is responsible for implementing environmental remediation measures, reporting new conditions encountered, and controlling construction debris, including environmentally hazardous materials and conditions.

### R9.4—Environmental issues

**R9.4.1** Assessment and repair of a structure can result in the exposure of workers and the public to potentially hazardous materials and conditions. Hazardous materials may be exposed, dislodged, carried into the air, or discharged as into surface drainage during the assessment and repair process. Hazardous conditions include noise, nuisance dust, misdirected drainage, and falling debris. The Owner should have an environmental assessment performed during the structural assessment and repair process in the areas to be repaired before any work to identify hazardous materials with the potential to present health issues to the workers and public, unless the Owner can attest that the structure is free of hazardous materials.

During the repair project, the contractor normally is responsible for the implementation of repairs and, accordingly, the control of construction debris, dust, and other materials. Any new conditions uncovered during the repair process should be reported to the Owner and licensed design professional.


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## CHAPTER 10—QUALITY ASSURANCE

### 10.1—General

**10.1.1** Quality assurance requirements of this chapter supplement the current and existing-building code provisions and shall be used for repair and rehabilitation construction.

### 10.2—Inspection

**10.2.1** Concrete repair and rehabilitation construction shall be inspected as required by the building code and construction documents.

**10.2.2** The construction documents shall include testing and inspection requirements applicable to the project.

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## R10—QUALITY ASSURANCE

### R10.1—General

**R10.1.1** The construction documents for repair and rehabilitation projects should include a quality assurance and inspection program. The quality assurance program should include:

(a) Review of the contractor's quality assurance program

(b) Quality control procedures during the repair process

(c) Review of conditions during the project

(d) Testing of materials used and material installation procedures

Usually, the quality control requirements are in the construction documents and the Owner retains the quality control personnel. The contractor is responsible for the work quality, including the quality of materials and workmanship.

### R10.2—Inspection

**R10.2.1** The quality of concrete repairs is largely dependent upon the workmanship during construction. Inspection is necessary to verify repairs and rehabilitation work are completed in accordance with construction documents. Most general building codes require special inspections for construction, which were developed for new construction. Typical repair construction is from new construction in scope, and new construction testing requirements may not be for repair construction. Construction documents should specify inspection requirements for concrete repair and rehabilitation construction during the various work stages. The licensed design professional should recommend that the Owner retain a licensed design professional, a inspector, a individual, or some combination thereof for the necessary inspections.

**R10.2.2** Required testing and inspections may include (a) through (j):

(a) Delivery, placement, and testing reports documenting the identity, quantity, location of placement, repair materials tests, and other tests as required

(b) Construction and removal of forms and reshoring

(c) Concrete removal and surface preparation of the concrete and reinforcement

(d) Placing of reinforcement and anchors

(e) Mixing, placing, and curing of repair materials

(f) Sequence of erection and connection of new members

(g) Tensioning of tendons

(h) Review and reporting of construction loads on beams, columns, and walls

(i) General progress of work

(j) Installation and testing of post-installed anchors

Inspection and test results should be submitted to the licensed design professional and the Owner.

Repair construction should be inspected to verify the quality of materials, quality of workmanship, and for compliance with the intent of the construction documents. Inspection should be provided by either repair inspectors,


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the licensed design professional, or a combination of repair inspectors and the licensed design professional. Responsibilities for performing the inspections should be clearly delineated at the start of a project.

Repair inspector for inspection of concrete repairs should be demonstrated by or previous work history and as required by the authority having jurisdiction before being retained. An individual who has been as an ICRI Concrete Surface Repair Testing Technician (ICRI CRST) or as an ACI Construction Inspector (ACI C630) are examples of inspectors. The licensed design professional may provide inspection services.

Inspection of concrete repair construction as in the construction documents should include review of the work in the review of construction documents, comparison of the work with construction documents, documentation and report of the work inspected as conforming or nonconforming, and whether corrections were made and or are still needed. Inspection and testing of post-installed anchor installation should be performed as required by the construction documents and in accordance with Chapters 17 and 26 of ACI 318-14.

Repair inspections should determine compliance with the intent of the contract documents, document the inspection, and report the inspection results. If the inspection shows conformance with the contract documents and no corrections are necessary, then the inspected work should be documented as conforming and reported to the licensed design professional and contractor, noting no corrections. If the inspection shows readily correctable issues and the issues are corrected by the contractor, then the inspected work should be documented as conforming and reported to the licensed design professional, Owner, and contractor with corrections noted and as completed. Nonconforming or components, processes, and procedures including the parts of the repairs not passing inspection should be reported to the licensed design professional for review. Actions should be made to correct the process before resuming the repair construction and inspection process. Nonconforming repair construction may include:

(a) Existing construction that from the repair documents

(b) Deterioration, distress, or levels of distress beyond those anticipated in the design of repairs

Material data sheets indicate the manufacturer's stated material properties that should satisfy the required properties of each repair. The manufacturing date and shelf life of the repair material provide information that the material is within the manufacturer's recommended time limits for installation.

Existing conditions describe the nature and extent of damage or deterioration, and size and condition of the members. Those conditions need to be for confor-


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mance to the design assumptions. The following are some

(a) Location of repairs
(b) Surface preparation of existing concrete and reinforcement
(c) Placement of reinforcement and anchors

(e) Delivery, placement, and testing reports documenting the quantity and location of placement, repair material tests, strength, and other tests of all repair materials
(f) Construction and removal of forms and shoring
(g) Mixing, placing, and curing of repair materials
(h) Sequence of repair construction
(i) Tensioning of tendons
(j) Construction loads
(k) General progresses of the repair work

**10.2.3** The construction documents shall establish inspection requirements of existing conditions and reinforcement that need to occur before concealing with materials that obscure visual inspection.

**R10.2.3** Removal of deteriorated concrete and reinforcement often uncovers unanticipated conditions that should be examined. Visual inspection and of existing conditions may require review of project conditions before continuing the construction process and thus require pauses in the construction processes so as not to conceal components of the work before completing necessary inspections and If unanticipated conditions are by the repair inspector, the licensed design professional should be informed. The licensed design professional should examine these conditions and determine what measures are to be implemented before placement of new repair materials. The construction documents should specify the locations where inspection is necessary before concealment and provide for possible changes in these locations due to unforeseen conditions. In some projects, all locations will not need to be inspected and representative locations will provide suitable inspection.

### 10.3—Testing of repair materials

**10.3.1** Repair material tests and test frequencies shall be in the construction documents. Results of tests shall be reported as required by the construction documents and the design-basis code. Test records shall be retained by the testing agency as required by the design-basis code.

### R10.3—Testing of repair materials

**R10.3.1** Tests of repair materials should comply with testing and test frequency of new concrete construction, unless otherwise in the contract documents and approved by the authority having jurisdiction. It is generally not practical to verify all manufacturers' listed properties of proprietary materials, such as shrinkage, compressive and tensile creep, thermal expansion and modulus of elasticity. In such cases, the licensed design professional should seek independent testing data from the manufacturer or others to verify manufacturer's listed properties that are critical to the application for the lots (or batches) of material to be used. The licensed design professional should evaluate the data and, if necessary, have manufacturers perform testing to that their material achieves the published values that they provided for the project. Refer to ACI 546.3R and ICRI No. 320.2R for guidance. Tests of repair materials' bond to existing materials should comply with requirements of the contract documents.


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Concrete repair materials testing personnel should be by demonstrating competence to the satisfaction of the licensed design professional and building code for testing types required of concrete repair and rehabilitation work.

As a minimum level of record keeping, the testing agency should maintain a record of the tests performed and the results consistent with the requirements for records in ASTM E329.

### 10.4—Construction observations

**10.4.1** Construction observation shall be performed as required by the authority having jurisdiction and construction documents.

### R10.4—Construction observations

**R10.4.1** A primary purpose of construction observation of rehabilitation work is to verify that the exposed existing construction is as assumed in the design and that the work detailed in the contract documents will the design intent. Construction observations are in addition to the inspection requirements described in 10.2. Construction observations should be performed by the licensed design professional that designed the work or other designated representative to provide these services.

If the existing construction from the design assumptions, requiring of the design, changes should be documented and the work as necessary. The licensed design professional or designated person responsible for construction observations should report design changes in writing to the Owner, rehabilitation inspector, contractor, and authority having jurisdiction resulting from existing construction, nonconforming rehabilitation work, and observed construction When construction observations are made by a party designated by the licensed design professional, design changes (construction deviations from the repair design) should also be reported to the licensed design professional. Revised design or construction work necessary to correct these and the construction corrections, should also be observed.


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## CHAPTER 11—COMMENTARY REFERENCES

*American Association of State Highway Transportation*

AASHTO FRPS-1-UL—Guide for Design of Bonded FRP Systems for Repair and Strengthening of

AASHTO T 260-97 (2011)—Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

*American Concrete Institute*

ACI 117.1R-14—Guide for Tolerance Compatibility in Concrete Construction

ACI 201.1R-08—Guide for Conducting a Visual Inspection of Concrete in Service

ACI 201.2R-08—Guide to Durable Concrete

ACI 209R-92—Prediction of Creep, Shrinkage, and T

ACI 209.1R-05—Report on Factors Shrinkage and Creep of Hardened Concrete

ACI 214.4R-10—Guide for Obtaining Cores and Interpreting Compressive Strength Results

ACI 216.1-14—Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

ACI 221.1R-98—Report on Alkali-Aggregate Reactivity

ACI 222R-01—Protection of Metals in Concrete against Corrosion

ACI 222.2R-14—Corrosion of Prestressing Steels

ACI 222.3R-11—Design and Construction Practices to Mitigate Corrosion of Reinforcement in Concrete Structures

ACI 224R-01—Control of Cracking in Concrete Structures

ACI 224.1R-07—Causes, Evaluation, and Repair of Cracks in Concrete Structures

ACI 228.1R-03—In-Place Methods to Estimate Concrete Strength

ACI 228.2R-98—Nondestructive Test Methods for Evaluation of Concrete in Structures

ACI 318-63—Building Code Requirements for Reinforced Concrete

ACI 318-14—Building Code Requirements for Structural Concrete and Commentary

ACI 318-19—Building Code Requirements for Structural Concrete and Commentary

ACI of Post-Installed Mechanical Anchors in Concrete and Commentary

ACI 355.4-1 of Post-Installed Adhesive Anchors in Concrete and Commentary

ACI 364.1R-07—Guide for Evaluation of Concrete Structures before Rehabilitation

ACI 364.3T-14—Treatment of Exposed Epoxy-Coated Reinforcement in Repair

ACI 364.10T-14—Rehabilitation of Structure with Reinforcement Section Loss (TechNote)


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ACI 364.11T-15—Managing Alkali-Aggregate Reaction Expansion in Mass Concrete
ACI 365.1R-00—Service-Life Prediction
ACI 369R-11—Guide for Seismic Rehabilitation of Existing Concrete Frame Buildings and Commentary
ACI 423.4R-14—Corrosion and Repair of Unbonded Single-Strand Tendons
ACI 437R-03—Strength Evaluation of Existing Concrete Buildings
ACI 437.1R-07—Load Tests of Concrete Structures: Methods, Magnitude, Protocols, and Acceptance Criteria
ACI 437.2-13—Code Requirements for Load Testing of Existing Concrete Structures and Commentary
ACI 440R-07—Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures
ACI 440.1R-15—Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars.
ACI 440.2R-08—Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
ACI 440.4R-04—Prestressing Concrete Structures with FRP Tendons
ACI 440.7R-10—Guide for the Design and Construction of Externally Bonded Fiber-Reinforced Polymer Systems for Strengthening Unreinforced Masonry Structures
ACI 503R-93—Use of Epoxy Compounds with Concrete
ACI 503.5R-92—Guide for the Selection of Polymer Adhesives in Concrete
ACI 503.6R-97—Guide for Application of Epoxy and Latex Adhesives for Bonding Freshly Mixed and Hardened Concrete
ACI for Crack Repair by Epoxy Injection
ACI 506R-16—Guide to Shotcrete
ACI 515.1R-79 (Revised 1985)—A Guide to the Use of W Protective, and Decorative Barrier Systems for Concrete
ACI 515.2R-13—Guide to Selecting Protective Treatments for Concrete
ACI 546R-14—Concrete Repair Guide
ACI 546.3R-14—Guide for the Selection of Materials for the Repair of Concrete
ACI 548.1R-09—Guide to the Use of Polymers in Concrete
ACI 549.1R-13—Guide to Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix Systems

ACI SP-4—Formwork for Concrete, eighth edition
ACI SP-66-04—ACI Detailing Manual
Concrete Construction Special Inspector

*American Institute of Steel Construction*
AISC 2006—Standard for Steel Building Structures


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ANSI/AISC for Structural Steel Buildings

*American Society of Civil Engineers*

ASCE/SEI 7-05—Minimum Design Loads for Buildings and Other Structures

ASCE/SEI 7-10—Minimum Design Loads for Buildings and Other Structures

ASCE/SEI 7-16—Minimum Design Loads for Buildings and Other Structures

ASCE/SEI 11-99—Guideline for Structural Condition Assessment of Existing Buildings

ASCE/SEI 37-14—Design Loads on Structures during Construction

ASCE/SEI 41-17—Seismic Evaluation and of Existing Buildings

ASCE/SEI/SFPE 29-05—Standard Calculation Methods for Structural Fire Protection ANSI/AF&PA NDS-2014—National Design (NDS) for Wood Construction

*Applied Technology Council*

ATC-20-19—Field Manual: Post-Earthquake Safety Evaluation of Buildings

ATC-45-04—Field Manual: Safety Evaluation of Buildings after Windstorms and Floods

ATC-58—Seismic Performance Assessment of Buildings

ATC-78—Project Mitigation of Nonductile Concrete Buildings

ATC-78-1—Evaluation of the Methodology to Select and Prioritize Collapse Indicators in Older Concrete Buildings

*ASTM International*

ASTM C42/C42M-13—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C882/C882M-13—Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear

ASTM C1152/C1152M-04(2012)—Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete

ASTM C1218/C1218M-99(2008)—Standard Test Method for Water-Soluble Chloride in Mortar and Concrete

ASTM C1583/C1583M-13—Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct T

ASTM D4263-83(2012)—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D4580/D4580M-12(2018)—Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding

ASTM D7522/D7522M-09—Standard Test Method for Bonded to Concrete Substrate

ASTM E84-15—Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E119-14a—Standard Test Methods for Fire Tests of Building Construction and Materials


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ASTM E329-13a—Standard for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

ASTM F1869-11—Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Using Anhydrous Calcium Chloride

ASTM F2170-11—Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

ASTM F2420-05—Standard Test Method for Determining Relative Humidity on the Surface of Concrete Floor Slabs Using Relative Probe Measurement and Insulated Hood

*CSA Group*

CAN/CSA S6-14—Canadian Highway Bridge Design Code and Commentary

*Concrete Reinforcing Steel Institute*

CRSI:2014—Vintage Steel Reinforcement in Concrete Structures

*Federal Emergency Management Agency*

FEMA P-58—Seismic Performance Assessment of Buildings: Volume 1 & 2

FEMA of Building Seismic Performance Factors

FEMA 306—Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings: Basic Procedures Manual

FEMA 307—Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings: Technical Resources

FEMA 308—Repair of Earthquake Damaged Concrete and Masonry Wall Buildings

FEMA 395—FEMA Risk Assessment Database

FEMA 396—Risk Management Series: Incremental Seismic Rehabilitation of Hospital Buildings

FEMA 397—Risk Management Series: Incremental

FEMA 398—Risk Management Series: Incremental Seismic Rehabilitation of Multifamily Apartment Buildings: Providing Protection to People and Buildings

FEMA 399—Risk Management Series: Incremental Seismic Rehabilitation of Retail Buildings: Providing Protection to People and Buildings

FEMA 400—Risk Management Series: Incremental Seismic Rehabilitation of Hotel and Motel Buildings

FEMA 547—Techniques for the Seismic Rehabilitation of Existing Buildings

FEMA P-154—Rapid Visual Screen of Buildings for Potential Seismic Hazards: A Handbook, third edition

Bulletin 10—Bond of Reinforcement in Concrete

*International Code Council*

IBC—International Building Code

IEBC—International Existing Building Code



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*International Concrete Repair Institute*

ICRI No. 210.2-02—Guideline for the Evaluation of Unbonded Post-Tensioned Concrete Structures

ICRI No. 210.3-13—Guide for Using In-Situ Tensile Pull-Tests to Evaluate Bond of Concrete Surface Materials

ICRI No. 210.4-09—Guide for Nondestructive Evaluation Methods for Condition Assessment, Repair, and Performance Monitoring of Concrete Structures

ICRI No. 310.1R-08—Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion

ICRI No. 310.2R-13—Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

ICRI No. 310.3-14—Guide for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods

ICRI No. 320.2R-09—Guide for Selecting and Specifying Materials for Repair of Concrete Surfaces

ICRI No. 320.3R-12—Guideline for Inorganic Repair Material Data Sheet Protocol

ICRI No. 330.1-06—Guideline for the Selection of Strengthening Systems for Concrete Structures

ICRI No. 340.1-06—Guideline for the Selection of Grouts to Control Leakage in Concrete Structures

ICRI Concrete Surface Repair Technician

*NACE International*

NACE 01101—Electrochemical Chloride Extraction from Steel-Reinforced Concrete—A State-of-the-Art Report

NACE 01102-02—State-of-the-Art Report: Criteria for Cathodic Protection of Prestressed Concrete Structures

NACE 01104—Electrochemical Realkalization of Steel-Reinforced Concrete—A State-of-the-Art Report

NACE 01 Cathodic Protection of Reinforced Concrete Elements—A State-of-the-Art Report

NACE SP0107-07—Electrochemical Realkalization and Chloride Extraction for Reinforced Concrete

NACE SP0290-2007—Standard Recommended Practice—Cathodic Protection of Reinforcing Steel in Atmospherically Exposed Concrete Structures.

NACE SP0390-09 (formerly RP0390)—Maintenance and Rehabilitation Considerations for Corrosion Control of Atmospherically Exposed Existing Steel-Reinforced Concrete Structures

*National Parking Association*

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*Post-Tensioning Institute*

PTI DC80.2-10—Guide for Creating Openings and Penetrations in Existing Slabs with Unbonded Post-Tensioning

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## APPENDIX A—CRITERIA AS A STAND-ALONE CODE

### A.1—General

**A.1.1** This Appendix shall apply if a jurisdiction has adopted this code including this Appendix by reference, but has not been adopted by the IEBC. When this Appendix is used, Chapter 4 shall not apply.

### A.2—Design-basis code criteria

**A.2.1** Unless prohibited by the authority having jurisdiction, the design-basis code criteria of the project shall be based on requirements set forth in this Appendix.

**A.2.2** The design-basis code criteria of the project shall be determined based upon the results of the preliminary assessment (1.7) and the detailed assessment (Chapter 6), if performed, using the requirements set forth in this Appendix. The design-basis code criteria shall be used consistently for all assessment and repair, rehabilitation, and design in the work area or areas of the structure, excluding other options.

**A.2.2.1** It shall be permitted to use the current building code in lieu of the orginal building code as the design-basis code for all damage states, deterioration, and faulty construction.

**A.2.3** It shall be permitted to use this Appendix to determine the work category as shown in Table A.2.3.

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## RA—CRITERIA AS A STAND-ALONE CODE

### RA.1—General

**RA.1.1** This Appendix is used when this code including this Appendix has been adopted for existing concrete structures as a stand-alone code without the use of the IEBC. This Appendix may be used to supplement provisions of Chapter 34 in 2012 and previous versions of the IBC. This Appendix provides provisions that are similar to those found in Chapter 4. The Appendix A text, compared to Chapter 4, has been to allow use independent of the IEBC.

### RA.2—Design-basis code criteria

**RA.2.2** Structures constructed under previously adopted codes or before the adoption of a building code may not satisfy all current building code requirements. This Appendix contains requirements that determine if existing structures should be repaired, rehabilitated, or retro- to satisfy the requirements of the original or the current building code as the design-basis code. Local ordinances may also require that a structure be rehabilitated to satisfy the current codes. Throughout an existing structure, the design-basis code should not change. These requirements should be reviewed at the start of a project.

In the absence of mandatory local ordinances, the licensed design professional should determine if assessment of seismic resistance and repairs or strengthening of the member, system, or structure of the work area in an existing concrete structure are necessary using this Appendix. Section A.3.3 provides minimum assessment criteria for potentially hazardous seismic conditions. Provisions of ASCE/SEI 41 may not be applicable to nonbuilding structures being assessed.

**RA.2.2.1** Most current building codes, such as those based on the IBC, provide acceptable safety based on consistent statistical probabilities. When using the current building code the resulting demand/capacity ratios provide the limits that should not be exceeded if assessing and designing remedial construction. Refer to Section R1.2.4.3.1 for additional commentary on the use of current building code as the design-basis code.

**RA.2.3** Unless the local jurisdiction provides more restrictive requirements, this Appendix should be used to determine the assessment and design-basis criteria for the work categories of A.3 through A.9 and as summarized in Table A.2.3.


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**Table A.2.3—Assessment and design-basis criteria for rehabilitation categories**

| Work category | Sections of this code to use for the assessment criteria | Primary code of the design-basis criteria used with this code |
|---|---|---|
| Potentially dangerous structural conditions for gravity and wind loads | A.3.2 | For potentially dangerous structures, current building code* |
| Potentially dangerous structural conditions for seismic resistance in regions of high seismicity (Seismic Design Category D [per ASCE/SEI 7] or higher) | A.3.3 | For potentially hazardous structures for seismic resistance, current building code* supplemented by ASCE/SEI 41 if the structure is Seismic Design Category D (per ASCE/SEI 7) or higher |
| Substantial structural damage to vertical members of the lateral-force-resisting system | A.4 | Current building code* for substantial structural damage |
| Substantial structural damage to vertical members of the gravity-load-resisting system | A.4 | Current building code* for substantial structural damage |
| Damage less than substantial structural damage, deterioration and faulty construction with capacity increase | A.5 | Current building code* unless compliant with Sections A.5.1, A.5.2 or A5.3 for the original building code† |
| Damage less than substantial structural damage, deterioration and faulty construction without capacity increase | A.6 | This code, Chapters 7 through 10 |
| Additions | A.7 | Current building code* unless compliant with Section A.7 for the original building code† |
| Alterations | A.8 | Current building code* unless compliant with Section A.8 for the original building code† |
| Changes in occupancy | A.9 | If rehabilitation is required then use the current building code* |

*Current building code is as per 1.2.2.
†Original building code is as per 1.2.3.

**A.2.4** This code shall be used to assess and design repairs in the work area of existing structures. The current building code shall be used to detail new concrete members and connections between new concrete members and existing construction. When the original building code is used as the design-basis criteria for repairs, new concrete or reinforcing members built integrally with the existing concrete structure shall be designed using the original building code. Alternately, the new members shall be designed using the current building code.

**A.2.5** In design of repairs to existing structures, detailing of the existing reinforcement within the work area need not comply with the current building code when using the original building code, if both of the following conditions are

(a) The damage or deterioration to the existing reinforcement is addressed

(b) The repaired work area of the structure has capacity equal to or greater than demand per 5.2.2 using the original building code requirements or the requirements of A.5.3 when using allowable stress design

**RA.2.5** The licensed design professional should review the development of existing reinforcing steel, when cracking damage is evident near the ends of the reinforcement to determine if the cracking is indicative of potential development failure beyond the restrictions of this section. Research has shown that development length equations from previous versions of ACI 318 may be unconservative for top reinforcing steel bars (Feldman and Cairns 2017).
changes have occurred in the building code requirements increasing development length of reinforcing steel.

When the basis of design is the current building code, the licensed design professional should consider the following:

(a) Assessing demand/capacity ratios for the existing reinforcing steel with current development length provisions

(b) details of the reinforcement when assessing seismic resistance

The licensed design professional should determine if structural behavior indicates adequate performance. ACI


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224.1R, ACI 437R, and ACI 437.1R provide guidance in judging acceptable performance.

### A.3—Potentially dangerous structural conditions

**A.3.1** A structural assessment shall be performed in the work area to determine if potentially dangerous structural conditions are present, when there is a reason for the licensed design professional to question the capacity of the structure or when potentially dangerous structural conditions are observed as a part of the preliminary assessment.

**A.3.1.1** Potentially dangerous structural conditions shall be reported in accordance with 1.5.2.

### RA.3—Potentially dangerous structural conditions

**RA.3.1** Structural assessments are required when damage, deterioration, structural or behavior are observed during the preliminary assessment that are unexpected or inconsistent with available construction documents. The structural condition assessment should be performed in accordance with 1.7 or Chapter 6, or both. The commentary to 1.7.4 has information on means and methods to determine if there is a reason to question the capacity of the structure. Results of the condition assessment should also be reviewed to identify if potentially dangerous conditions are present. Potentially dangerous structural conditions include any instability, the potential for collapse of overhead components or pieces (falling hazards), or a risk of collapse exists under service load conditions.

**A.3.2** For gravity, soil, and wind loads, potentially dangerous structural conditions exist in members or structures where the demand/capacity ratio is greater than 1.5 as shown in Eq. (A.3.2).

$$U_c/\phi R_{cn} > 1.5 \qquad \text{(A.3.2)}$$

In Eq. (A.3.2), $U_c$ is the strength design demand determined by using the nominal gravity, soil, and wind loads in the current building code and the factored load combinations of ASCE/SEI 7, excluding seismic forces; and $\phi R_{cn}$ is the capacity adjusted by the strength reduction factor ($\phi$) in Section 5.3 or 5.4 of this code.

**A.3.2.1** If the demand/capacity ratio exceeds 1.5 for the work areas, the design-basis criteria shall be the current building code.

**A.3.2.2** For structure with no risk of collapse under service load conditions, Sections A.4 through A.9 shall be used to determine the design-basis criteria.

**RA.3.2** Demand/capacity ratios are used to quantify the adequacy of the member or structure. The threshold demand/capacity ratios determine when levels of intervention may be required. For each demand/capacity ratio, this code provides direction on how the demand and capacity are determined. Demands may be determined based upon loads associated with current building codes ($U_c$ as above) or loads during the original design ($U_o$ as in Section 4.5.1) of the structure. The calculated capacity of the structure will vary depending upon the condition of the structure and extent of evaluation used to as-built properties of the structure.

In assessing potentially dangerous structural conditions the strength design demand of Eq. (A.3.2.2) combines current building code nominal gravity loads (dead, live, and snow) with lateral loads from soil and wind (excluding seismic forces) using factored load combinations of ASCE/SEI 7. A demand/capacity ratio greater than 1.5, calculated using Equation (A.3.2.2), represents a condition with limited to no margin of safety against failure for ASCE/SEI 7 loads (Stevens and Kesner 2016).

In the assessment of potentially dangerous structural conditions, the licensed design professional should determine if it may be appropriate to include: structural redundancies, alternate load paths, primary and secondary supporting elements, redistribution of loads, collapse mechanisms, reduced live loads, measured displacements (sagging, listing, leaning, and tilting), second-order and other loads to the structure, such as drifting snow, lateral earth and pressures, self-straining loads, ice, and References for potentially dangerous structural conditions include: commentary to Chapter 1 of ASCE/SEI 7-10, Galambos et al. (1982), Ellingwood et al. (1982), and Ellingwood and Ang (1972). These references provide target reliability indexes, basic probability theory and concepts for an evaluation using the details of the demand as it


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**A.3.3** Assessment criteria for potentially hazardous structural conditions of concrete structures for seismic resistance, unless addressed by the authority having jurisdiction are limited to potentially hazardous conditions associated with Structural Performance Level, Collapse Prevention of structures in Seismic Design Category D, E, and F of ASCE/SEI 7 using Earthquake Hazard Level, BSE-1E and shall be determined using ASCE/SEI 41 and this Code. The design-basis criteria to address potentially hazardous seismic conditions in concrete structures shall be this Code and ASCE/SEI 41.

**A.3.4** The design-basis criteria for structures without potentially dangerous conditions shall be determined in accordance with A.4 through A.9.

### A.4—Substantial structural damage

**A.4.1** Substantial structural damage shall be assessed using current building code demands. Substantial structural damage to vertical members of the lateral-force-resisting system shall be where in any story, the shear walls or columns of the lateral-force-resisting system are damaged such that the lateral-load-resisting nominal capacity of the structure ($\sum R_{cn}$) in any horizontal direction is reduced more than 33 percent from its predamage condition ($\sum R_n$). This relationship is given by Eq. (A.4.1a).

$$\frac{\sum R_n}{\sum R_{cn}} \geq 1.5 \qquad \text{(A.4.1a)}$$

Substantial structural damage to vertical elements of the gravity-load-resisting system shall be where for any wall or column or group of vertical members of the gravity-load-resisting system whose tributary area is more than 30 percent of the total area of the structure's and roof(s) are damaged such that the total vertical nominal capacity ($\sum R_{cn}$) is reduced more than 20 percent from its predamage condition ($\sum R_n$) as by Eq. (A.4.1b) and concurrently where the current building code factored gravity (dead, live, and snow) load demand to in-place vertical design capacity ratio of the damaged members is more than 1.33, as shown in Eq. (A.4.1c). These relationships are given by Eq. (A.4.1b) and (A.4.1c).

$$\frac{\sum R_n}{\sum R_{cn}} \geq 1.25 \qquad \text{(A.4.1b)}$$

$$\sum U_c / \sum \phi R_{cn} \geq 1.33 \qquad \text{(A.4.1c)}$$

Capacities according to Chapter 6 and strength reduction factors per 5.3 or 5.4 shall be used in Eq. (A.4.1a) through (A.4.1c). The design-basis criteria shall be the current building code demands, supplemented by requirements of

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relates to the capacity with the strength reduction factors of Section 5.3 for new concrete structures.

**RA.3.3** Compliance with ASCE/SEI 41 for Structural Performance Level, Collapse Prevention using an applicable Earthquake Hazard Level, BSE-1E should be reviewed and approved by the authority having jurisdiction for the assessment of potentially hazardous seismic conditions of concrete structures. Assessment of potentially hazardous seismic conditions for concrete structures is not required, but may be used, for structures in regions of low or moderate seismicity. If no requirements for potentially hazardous seismic structural conditions are provided by the authority having jurisdiction, the licensed design professional should reference ATC-78, the IEBC and ASCE/SEI 41 appendices for guidance.

### RA.4—Substantial structural damage

**RA.4.1** The assessment criteria for substantial structural damage are to existing concrete structures, which were adapted from the IEBC.

In Eq. (A.4.1c), the demand load is the current building code loads and load combinations and should include all current building code gravity loads judged to be applicable to the structure, such as drifting snow.

Supplemental requirements of this Code for the design-basis criteria include strength reduction factors per Section 5.3 or 5.4, capacities according to Chapter 6, repairs per Chapter 7, durability per Chapter 8, repair construction per Chapter 9, and quality assurance per Chapter 10 for existing structures. The referenced seismic design provisions of


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this code for the existing structure and ASCE/SEI 41 for seismic design provisions for the following:

(a) Lateral-force-resisting system in both directions for the case of substantial structural damage in either direction from lateral forces; or

(b) Vertical members of the gravity-load-resisting system for the case of substantial structural damage from gravity loads.

Structures with substantial structural damage caused by earthquake shall be assessed or rehabilitated for load combinations that include earthquake The seismic design provisions of ASCE/SEI 41 shall be Earthquake Hazard Level, BSE-1E with the Basic Performance Objective of "Life Safety" for Risk Category I, II, or III (ASCE/SEI 7) and of "Immediate Occupancy" for Risk Category IV and Earthquake Hazard Level, BSE-2E with the Basic Performance Objective of "Collapse Prevention" for Risk Category I, II (ASCE/SEI 7), "Life Safety" for Risk Category III and IV (ASCE/SEI 7).

Structures with substantial structural damage caused by wind shall be assessed or rehabilitated for load combinations that include the current building code gravity and wind loads.

The design of new structural members and connections to members supporting load from vertical members of the gravity-load-resisting system that have substantial structural damage from gravity loads shall be in accordance with provisions of the current building code.

**A.4.2** The design-basis criteria for structures without substantial structural damage shall be determined in accordance with A.5 through A.9.

### A.5—Conditions of deterioration, faulty construction, or damage less than substantial structural damage with strengthening

If a work area of a structure has damage less than substantial structural damage, deterioration, or contains faulty construction and there is a reason for the licensed design professional to question the capacity of the member, system, or structure of the work area, it shall be assessed by checking one of the criteria in sections A.5.1, A.5.2, or A.5.3 as selected by the licensed design professional. Sections A.5.1 through A.5.3 shall not be applied in combination with each other.

**A.5.1** The demand/capacity ratio of the member, system, or structure of the work area shall be evaluated using the original building code demand ($U_o$) with nominal loads, load combinations, and capacities of the original building code to determine if the demand/capacity ratio exceeds 1.0, as shown in Eq. (A.5.1).

$$U_o/\phi_o R_{cn} > 1.0 \qquad (A.5.1)$$

In Eq. (A.5.1a), $U_o$ is the strength design demand determined by using the nominal loads and factored load combinations of the original building code. $\phi_o R_{cn}$ is the capacity

## COMMENTARY

### RA.5—Conditions of deterioration, faulty construction, or damage less than substantial structural damage with strengthening

**RA.5.1** Concrete structures with damage less than substantial structural damage, deterioration, or containing faulty construction have historically been restored to the strength of the original building code.

The demand/capacity ratio of limit of 1.0 as provided in this section allows strengthening repair that restores the structural reliability of the existing structure to the level prior to damage and deterioration.

Historical performance is often an acceptable indicator of adequate safety if the structure has been subjected to known loads even if the strength design demand or capacity of the structure based on the requirements of the original building code is from the current building code.


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adjusted by the strength reduction factor ($\phi_o$) of the original building code.

If $U_o/\phi_o R_{cn}$ is greater than 1.0, then strengthening repairs are required and shall be permitted to restore the structural capacity required by the original building code.

Repair of the existing concrete structure shall be permitted to restore a member, system, or structure of the work area to the capacity of the original building code based on the material properties of the original construction. New concrete members and connections to existing construction that are part of the repairs shall comply with provisions of A.2.4. If $U_o/\phi_o R_{cn}$ is 1.0 or less, then strengthening repairs are not required.

If the demand/capacity ratio does not exceed 1.0, strengthening is not required.

**A.5.2** Alternative assessment criteria shall be permitted, when approved by authority having jurisdiction using engineering principles for the member, system of structure of the work area of existing structures.

## COMMENTARY

If the capacity of the structure is not in question, such as indicated by the commentary provisions of R1.7, assessment checks are not required.

**RA.5.2** Assessment criterion other than the current building code or ASCE/SEI 41 may be used. The references of RA.3.2 should be considered in the selection of applicable assessment criterion.

Beyond using the current building code, the assessment criteria should address if the demand or capacity of the original structure or member is inconsistent with current standards resulting in unacceptable structural safety. An increase in load intensity; added loads; changes in load factors, strength reduction factors, or load combinations; of analytical procedures; or changes in the determined capacity between the original and current building code (such as a change from allowable stress design [ASD] to strength design) should lead the licensed design professional to question the applicability of using the original building code for the assessment of an existing structure. Engineering principles used to determine acceptable structural safety are to use either a probabilistic evaluation of loads and capacities to show adequate structural reliability indices or an evaluation procedure using demand/capacity ratios that are derived from the basic engineering principles as presented in current standards.

An assessment criterion for a structure that has damage less than substantial structural damage, deterioration, or faulty construction that is based on the demand/capacity ratio threshold of 1.05 using the original building code or 1.1 using the current building code is:

(a) If the current building code demand ($U_c$) exceeds the original building code demand ($U_o^*$) increased by more than 5 percent ($U_c > 1.05U_o^*$), check the demand/capacity ratio using the current building code demand ($U_c$) to determine if it exceeds 1.1, as shown in Eq. (RA.5.2a).

$$U_c/\phi R_{cn} > 1.1 \qquad \text{(RA.5.2a)}$$

If the demand/capacity ratio exceeds 1.1, then that system or member should be strengthened using the current building code demand. If the demand/capacity ratio does not exceed 1.1, then no strengthening is required.


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## COMMENTARY

(b) If the current building code demand ($U_c$) does not exceed the original building code demand ($U_o^*$) by 5 percent ($U_c \leq 1.05U_o^*$), check the demand/capacity ratio using the original building code demand ($U_o^*$) to determine if it exceeds 1.05, as shown in Eq. (RA.5.2b).

$$U_o^*/\phi R_{cn} > 1.05 \qquad \text{(RA.5.2b)}$$

If the demand/capacity ratio exceeds 1.05, then that system or member strength should be restored using the original building code demand ($U_o^*$). If the demand/capacity ratio does not exceed 1.05, then strengthening is not required.

In this assessment criterion, the strength reduction factors ($\phi$) of Section 5.3 or 5.4 shall be applied in both Eq. (RA.5.2a) and (RA.5.2b).

The current building code strength design demand ($U_c$) combines current building code nominal gravity loads (dead, live, soil, and snow) and lateral loads from soil and wind (excluding seismic) using the factored load combinations of ASCE/SEI 7. The original building code strength design demand ($U_o^*$) combines the original building code nominal gravity loads (dead, live, and snow) and lateral loads from soil and wind (excluding seismic) using the factored load combinations of ASCE/SEI 7.

It may be appropriate to consider detailing requirements for ductility when considering seismic resistance, redistribution of internal member forces, reduced live loads, measured displacements (listing, leaning, and tilting), second-order and other loads to the structure, such as drifting snow, lateral earth and pressures, self-straining

The use of data is acceptable, if substantiated by the licensed design professional. For these assessment criteria, the demand/capacity ratio provisions of RA.5.2a may be used in the assessment, whether the current building code demand does or does not exceed the original building code demand increased by 5 percent.

**A.5.3** If the concrete design criteria of the original building code used only allowable stress design, an alternate to using A.5.2 strength design criteria is to evaluate the demand/capacity ratio of the member, system, or structure of the work area based on allowable stress design load combinations and design service loads, and the demand/capacity ratio based on allowable stress design load combinations for demand ($U_s$) and resistance calculated using allowable stresses ($R_a$) as shown in Eq. (A.5.3)

$$U_s/R_a > 1.0 \qquad \text{(A.5.3)}$$

If the demand/capacity ratio exceeds 1.0, then strengthening repairs are required and shall be permitted to be restored to the structural capacity as required by the original building code. If the demand/capacity ratio is 1.0 or less, then strengthening shall not be required.

**RA.5.3** Before 1963 and the "Building Code Requirements for Reinforced Concrete (ACI 318-63)," the design of reinforced concrete structures was based upon allowable stress or working stress design principles. Original building code demands should include nominal gravity loads (dead, live, and snow) and lateral wind forces or seismic forces using the load combinations of original building code. Consideration should be given to inclusion of measured displacements (sagging, listing, leaning, and tilting), second-order and other loads to the work area of the structure, such as drifting snow, lateral earth pressures, self-straining loads, ice, and Using allowable stress design is inconsistent with the reliability principles of strength design. To adequately address current safety levels, consideration should be given to using strength design provisions of A.5.2. It may be appropriate to consider detailing requirements for ductility when considering seismic resistance.


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Repair of the existing concrete structure shall be permitted to restore a member or system of the work area to the capacity of the original building code based on the material properties of the original construction. New concrete members and connections to existing construction that are part of the repair shall comply with provisions of A.2.4.

**A.5.4** Existing structures other than those to be strengthened per A.3 through A.5 shall use A.6 through A.9 to determine the design-basis code criteria.

### A.6—Conditions of deterioration, faulty construction, or damage less than substantial structural damage without strengthening

**A.6.1** If less-than-substantial structural damage is present, structures damaged, deteriorated, or containing faulty construction that do not require strengthening in accordance with A.5 shall use the provisions of Chapters 7 through 10 of this code as the design-basis code criteria.

### A.7—Additions

**A.7.1** Where additions are made that change the gravity load demands on the member, system, or structure of the work area of the existing structure, the demand shall be determined for the prior to the addition using the original building code loads and load combinations and the - ration with the addition using the current building code loads and load combinations. For the existing elements of the work area required to support gravity loads of the addition where the gravity load demands of the current building code with the addition are more than the original building code without the addition increased by 5 percent, the design-basis code shall be the current building code, with this code for the existing member, system, or structure of the work area and the current building code for the addition.

For the member, system, or structure of the work area of the existing structure supporting gravity loads whose calculated capacity using this code is to be decreased as part of an addition, the elements of the work area shall be shown to have or be rehabilitated to have a demand/capacity ratio equal to or less than 1.0 for the current building code demand.

If the addition is not independent of the existing building for lateral-force resistance, the design-basis code criteria for the existing lateral-force-resisting system with the addition shall be the current building code for seismic assessment and design.

*Exception:* The licensed design professional shall be permitted to use the original building code load demands and capacities where the demand/capacity ratio for each lateral-force-resisting member, with the addition using the current building code, does not exceed the demand/capacity ratio without the addition using the original building code increased by 10 percent.

### A.8—Alterations

**A.8.1** Where alterations are made that change the gravity load demands on the member, system, or structure of the work area of the existing structure, the demand shall be determined

## COMMENTARY

### RA.6—Conditions of deterioration, faulty construction, or damage less than substantial structural damage without strengthening

**RA.6.1** Serviceability requirements including limits and reinforcement for cracking of the current building code are not requirements of this code, but should be considered in the assessment and repair of existing structures.

### RA.7—Additions

**RA.7.1** The exception permits the licensed design professional to use the original building code for the assessment and design-basis criteria of existing lateral-force-resisting members when the members of the existing lateral-force-resisting system comply with Eq. (RA.7.1).

$$U_c/R_n \text{ (with addition)} \le 1.1\,U_o/R_n \text{ (without addition)} \quad \text{(RA.7.1)}$$

### RA.8—Alterations

**RA.8.1** The exception permits the licensed design professional to use the original building code for the assessment and design-basis code criteria of existing lateral-force-


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## CODE

for the prior to the alterations using the original building code loads and load combinations and the - tion with the alterations using the current building code loads and load combinations. For the existing elements of the work area required to support gravity loads of the addition where the gravity load demands of the current building code with the alterations are more than the original building code without the alterations increased by 5 percent, the design-basis code criteria shall be the current building code, with this code for the existing member, system, or structure of the work area and the current building code for the alterations.

When the capacity of the member, system, or structure of the work area of the existing structure supporting gravity loads is to be reduced as part of an alteration, the reduced capacity shall not be less than the current building code demand.

If the alteration increases design lateral loads, results in a structural irregularity per ASCE/SEI 7, or decreases the lateral capacity, the design-basis code criteria for elements of the work area shall be the current building code for seismic assessment and design.

*Exception:* The licensed design professional shall be permitted to use as an alternative the original building code load demands and capacities for any lateral-force-resisting member, system, or structure of the work area where the demand/capacity ratio with alterations using the current building code is not more than the demand/capacity ratio without alterations using the original building code increased by 10 percent.

### A.9—Change of occupancy

**A.9.1** Where the use or occupancy change demand on the member, system, or structure of the work area of the existing structure, the demand shall be determined using the original building code loads and load combinations and using the current building code loads and load combinations. For the existing elements of the work area when demand based on the current building code is greater than the demand on those elements based on the original building code criteria, the elements shall be rehabilitated using the current building code demands and the capacities based on this code and the lateral-force-resisting system shall be evaluated and rehabilitated if necessary to meet the Basic Performance Objective for Existing Buildings, as in ASCE/SEI 41. New concrete members and connections to existing construction that are part of the rehabilitation shall comply with provisions of A.2.4.

## COMMENTARY

resisting members when the members of the existing lateral-force-resisting system comply with Eq. (RA.8.1).

$$U_c/R_n \text{ (with alterations)} \le 1.1\,U_o/R_n \text{ (without alterations)} \quad \text{(RA.8.1)}$$

Alterations in this section exclude the remedial work of A.3 through A.6.


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## KEY CHANGES FROM ACI 562-16 TO ACI 562-19: SUMMARY OF REVISIONS

gely based upon comments received informally after the publication of ACI 562-16.

### Major revisions

The major changes are as follows:

(a) Text was added to simplify use of new materials that have the equivalent of an ICC-ES evaluation report in Chapter 1.

(b)

(d) .

### Minor revisions

The minor revisions were aimed at improving the current text to improve readability and integration with other documents. ASCE and other organizations.


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# A113.8(2)-18

**Proponents:** Haywood Kines (hkines@pwcgov.org)

## 2015 Virginia Construction Code

**113.8 Final inspection.** Upon completion of a *building* or *structure* and before the issuance of a certificate of occupancy, a final inspection shall be conducted to ensure that any defective work has been corrected and that all work complies with the USBC and has been approved, including any work associated with modifications under Section 106.3. The building official shall ~~be permitted to~~ require the electrical service to a *building* or *structure* to be energized for inspections of all Electrical, Plumbing and Mechanical systems prior to conducting the final inspection. The approval of a final inspection shall be permitted to serve as the new certificate of occupancy required by Section 116.1 in the case of additions or alterations to existing *buildings* or *structures* that already have a certificate of occupancy.

Exception; Permanent power Shall not be required when temporary power is provided to test all Electrical, Plumbing and Mechanical systems for Final inspection approval.

**Reason Statement:** Life Safety systems such as Fire Alarm, Smoke Alarms, GFCI Devices, AFCI Devices HVAC equipment, Plumbing equipment, Emergency lighting, and Exit Signs cannot be inspected for proper operation without power.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This will not impact the cost of construction

**Resiliency Impact Statement:** This proposal will increase Resiliency
This change will improve the final inspection process for the evaluation of all systems within the Building or structure.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Non-Consensus

**Workgroup 1 - Final Reason:**

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# Public Comments for: A113.8(2)-18

This proposal doesn't have any public comments.

Proposal # 297

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**A113.8(2)** Requirement to energize during final inspection.

**Proponent:** Haywood Kines of VA International Association of Electrical Inspectors

**Comments:**

- Mr. Holland (NEMA) speaks in support of this proposal and mentions that the energy codes require some discussion of the systems.
- Mr. Payne of AIA Virginia suggests NOT capitalizing all trade names in the final version.
- Mr. Catlett of Catlett Code Consulting also speaks in support of this proposal.
- Mr. Beahm represents himself and the Admin committee; says Admin committee disapproved of this proposal. He agrees, but raises the issue of plumbing and electrical.
- Mr. Kines clarifies that he included plumbing due to the structures that are not on public utilities and instead use wells (even in Prince William County), and they still need power.
- Mr. Fields of VBCOA Admin Committee is opposed to the proposal because they believe the existing language is sufficient and requires no change.
- Mr. Kines reiterates that it is absolutely necessary to test things in the field and that he stands by his proposed change.
- Mr. Toalson of HBAV opposes this change, believing the existing language is sufficient.
- Mr. Witt representing himself suggests adding an exception to be able to use temporary power; this allows the existing language to provide a compromise to try and reach consensus.
- Mr. Kines disagrees with the compromise, because it doesn't provide wholesale safety.
- Ms. Davis of DHCD brings up the concern that this proposal borders on policing how the building officials do their jobs, which is not in our purview.

**Results:** Non-consensus

Decided at June 23, 2020 Workgroup 1 Meeting

# B713.8-18

**Proponents:** Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov); Richard Grace (richard.grace@fairfaxcounty.gov)

## 2015 Virginia Construction Code

**Revise as follows:**

**713.8 Penetrations.** Penetrations in a shaft enclosure shall be protected in accordance with Section 714 as required for *fire barriers or horizontal assemblies*. Structural elements, such as beams or joists, where protected in accordance with Section 714 shall be permitted to penetrate a shaft enclosure.

**Reason Statement:** Section 713.2 states that a shaft shall be constructed as fire barriers or horizontal assemblies or both. In the 2006 code, "horizontal assembles" was added to this section but was not also reflected in the penetrations section. This change coordinates the penetrations requirements with the current language for shaft construction.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B713.8-18

This proposal doesn't have any public comments.

Proposal # 374

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## B713.8 Penetrations in Shaft Enclosures

**Proponent(s):** Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov); Richard Grace VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

**Summation of Proposal:** This change coordinates the penetration's requirements with the current language for shaft construction.

**Other Pertinent Information:** This proposed change was carried over from the June 2020 Workgroup 2 meeting to give the VBCOA IBC Committee an opportunity to review.

**Comments:**

- Mr. Grace provides context, gives history to what providing shafts means according to previous codes (2006 and 2009), and how it relates to the current code.
- Mr. Willham representing the VBCOA Building Code Committee opposes this change on the basis that the current language is sufficient as-is.
- Mr. Snidow suggests leaving out "vertical" and "horizontal" language, and just refer to them as penetrations.

**Results:** Non-consensus

Decided at the June 30, 2020 Workgroup 2 Meeting and
at the August 11, 2020 Combined Workgroup Meeting

# B713.11-18

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

## 2018 International Building Code

**Revise as follows:**

**713.11 Enclosure at the bottom.** Shafts that do not extend to the bottom of the building or structure shall comply with one of the following:

1. They shall be enclosed at the lowest level with construction of the same *fire-resistance rating* as the lowest floor through which the shaft passes, but not less than the rating required for the shaft enclosure.
2. They shall terminate in a room having a use related to the purpose of the shaft. The room shall be separated from the remainder of the building by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire-resistance rating* and opening protectives shall be not less than the protection required for the shaft enclosure.

~~3. They shall be protected by *approved fire dampers* installed in accordance with their listing at the lowest floor level within the shaft enclosure.~~

**Exceptions:**

1. The fire-resistance-rated room separation is not required, provided that the only openings in or penetrations of the shaft enclosure to the interior of the building occur at the bottom. The bottom of the shaft shall be closed off around the penetrating items with materials permitted by Section 718.3.1 for draftstopping, or the room shall be provided with an *approved automatic sprinkler system*.
2. A shaft enclosure containing a waste or linen chute shall not be used for any other purpose and shall discharge in a room protected in accordance with Section 713.13.4.
3. The fire-resistance-rated room separation and the protection at the bottom of the shaft are not required provided that there are no combustibles in the shaft and there are no openings or other penetrations through the shaft enclosure to the interior of the building.

## 2018 International Mechanical Code

**Revise as follows:**

**[BF] 607.5.5.1 Enclosure at the bottom.** Shaft enclosures that ~~do not extend~~ terminate in a room having a use related to the ~~bottom~~ purpose of the ~~building or structure~~ shaft shall be permitted to be protected in accordance with Section 713.11, Item 2 of the ~~International Building~~ Virginia Construction Code.

**Reason Statement:** VCC 713.11 states that where a shaft doesn't extend to the bottom of the structure, **one** of the following shall apply. If you apply Item 1, does Item 3 not apply or vice versa? It is written in such a way. Item 3 is also confusing in that it states the fire damper shall be installed "at the lowest floor level within the shaft enclosure." If the floor isn't rated and the shaft passes through the floor (as permitted by Item 1), why should the fire damper be installed at the floor level inside the shaft? Penetrations of a shaft by ducts and air transfer openings are already covered by 713.10, which sends you to Section 717. Section 717.5.3 provides provisions for duct penetrations into shaft enclosures, whether that be a penetration into the side, the top or the bottom of the shaft enclosure. Lastly, Item 3 requires only a fire damper whereas VCC 717.5.3 requires a fire damper and a smoke damper. This Item 3 conflict eliminates the smoke damper requirement.
VMC 706.5.5.1 - This companion change will align the two code sections and still permit a duct contained within a shaft to terminate in a room having a use related to the purpose of the shaft without requiring the installation of a fire damper.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 4 - Final Committee Action:** Non-Consensus

**Workgroup 4 - Final Reason:**

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# Public Comments for: B713.11-18

This proposal doesn't have any public comments.

Proposal # 369

## B713.11 Enclosures at the Bottom

**Proponent(s):** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

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**Summation of Proposal:** This companion change to B713.8 will align the two code sections and still permit a duct contained within a shaft to terminate in a room having a use related to the purpose of the shaft without requiring the installation of a fire damper

**Comments:**

- This is a companion piece to B713.8; Mr. Grace provides background information on the proposal.
- Dan Willham of VBCOA building code committee opposes; the committee believes the current code language suffices.
- Mr. Beahm (IBC Committee) asserts that the construction code should stay with the construction code. They are opposed to this proposal, arguing that it takes options away instead of providing additional measures for construction. He believes this is a philosophical difference between the two committees involved.
- Mr. Grace maintains they aren't taking away a viable option - the option remains in Chapter 7.

**Results:** Non-consensus

Decided at the June 30, 2020 Workgroup 2 Meeting and
August 11, 2020 Combined Workgroup Meeting

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# B905.5.3-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2018 International Building Code

**[F] 905.5.3 Class II system 1-inch hose.** A minimum 1-inch (25 mm) hose shall be allowed to be used for hose stations in light-hazard occupancies where investigated and *listed* for this ~~service and where *approved* by the fire code official.~~ service.

**[F] 909.7 Airflow design method.** ~~Where *approved* by the fire code official, smoke~~ Smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects. Smoke control systems using the airflow method shall be designed in accordance with NFPA 92.

**[F] 909.8 Exhaust method.** ~~Where *approved* by the fire code official, mechanical~~ Mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92.

**909.12.1 Verification.** Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, equipment and components used for smoke control.

> **Exception:** Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the preprogrammed weekly testing, ~~where *approved* by the building official and in~~ when in accordance with both of the following:
>
> 1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a listed control unit.
> 2. Testing of all components bypassed from the preprogrammed weekly test shall be in accordance with Section 909.20.6 of the International Fire Code.

**[F] 912.2.1 Visible location.** Fire department connections shall be located on the street side of buildings or facing approved fire apparatus access roads, fully visible and recognizable from the street, fire apparatus access road or nearest point of fire department vehicle access or as otherwise *approved* by the *fire code official*~~.~~ . **[<--APPROPRIATE USE]**

**Delete without substitution:**

~~**[F] 912.2.2 Existing buildings.** On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an *approved* sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be subject to the approval of the *fire code official.*~~

**[F] 912.4 Access.** Immediate access to fire department connections shall be ~~maintained at all times and without~~ provided without obstruction by fences, bushes, trees, walls or any other fixed or moveable ~~object. Access to fire department connections shall be *approved* by the *fire code official.*~~ object.

> **Exception:** Fences, where provided with an access gate equipped with a sign complying with the legend requirements of this section and a means of emergency ~~operation. The gate and the means of emergency operation shall be *approved* by the *fire code official* and maintained operational at all times.~~ operation.

**[F] 912.4.2 Clear space around connections.** A working space of not less than 36 inches (762 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be ~~provided and maintained in~~ provided in front of and to the sides of wall-mounted fire department connections and around the circumference of free-standing fire department ~~connections, except as otherwise required or *approved* by the *fire code official.*~~ connections.

**1004.5 Areas without fixed seating.** The number of occupants shall be computed at the rate of one occupant per unit of area as prescribed in Table 1004.5. For areas without *fixed seating*, the *occupant load* shall be not less than that number determined by dividing the floor area under consideration by the *occupant load* factor assigned to the function of the space as set forth in Table 1004.5. Where an intended function is not *listed* in Table 1004.5, the *building official* shall establish a function based on a *listed* function that most nearly resembles the intended function.

> **Exception:** ~~Where *approved* by the *building official*, the~~ The actual number of occupants for whom each occupied space, floor or building is designed, although less than those determined by calculation, shall be permitted to be used in the determination of the design *occupant load*.

**1004.7 Outdoor areas.** *Yards*, patios, occupied roofs, *courts* and similar outdoor areas accessible to and usable by the building occupants shall be

provided with *means of egress* as required by this chapter. The *occupant load* of such outdoor areas shall be ~~assigned by the *building official*~~ determined in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, *means of egress* requirements for the building shall be based on the sum of the *occupant loads* of the building plus the outdoor areas.

**Exceptions:**

1. Outdoor areas used exclusively for service of the building need only have one *means of egress*.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2.

**1004.8 Concentrated business use areas.** The occupant load factor for concentrated business use shall be applied to telephone call centers, trading floors, electronic data processing centers and similar business use areas with a higher density of occupants than would normally be expected in a typical business occupancy environment. ~~Where approved by the *building official*, the~~ The actual occupant load for concentrated business use areas shall be ~~the actual *occupant load*~~ permitted, but not less than one occupant per 50 square feet (4.65 $m^2$) of gross occupiable floor space.

**1013.1 Where required.** Exits and *exit access* doors shall be marked by an *approved* exit sign readily visible from any direction of egress travel. The path of egress travel to *exits* and within *exits* shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening *means of egress* doors within *exits* shall be marked by exit signs. Exit sign placement shall be such that any point in an *exit access corridor* or *exit passageway* is within 100 feet (30 480 mm) or the *listed* viewing distance of the sign, whichever is less, from the nearest visible exit sign.

**Exceptions:**

1. Exit signs are not required in rooms or areas that require only one exit or *exit access*.
2. Main exterior exit doors or gates that are obviously and clearly identifiable as *exits* need not have exit ~~signs where *approved* by the building official.~~ signs.
3. Exit signs are not required in occupancies in Group U and individual *sleeping units* or *dwelling units* in Group R-1, R-2 or R-3.
4. Exit signs are not required in dayrooms, sleeping rooms or dormitories in occupancies in Group I-3.
5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.

**Reason Statement:**
Unless specifically addressed in Chapter 1 or by state amendment, all exceptions, exemptions, allowances, options, etc. are available to the owner or its representative(s). If such language was left in, we would no longer have a "Uniform" "Statewide" building code because every code/fire official could either allow its use or not.

The below was provided by Vernon Hodge trying to address the subject where the code says "Subject to the approval of the code official, " or similar language:

- *Anyway, all administrative language in a model code or standard used as part of our state codes is superseded to the extent that it is different from our state administrative language. That's set out in Section 101.7 of the VCC. The phrase "subject to the approval of the building official" used the way it is used is administrative language that permits a building official to say that you cannot use the exception. For that to be valid administrative language, there has to be authorization in Chapter 1 of the VCC allowing a building official to exclude the use of a part of the code. There is no such language in Chapter 1. All provisions of the code, exceptions, exemptions, allowances, etc. are perfectly valid and may be used. There is no authorization for a building official to decide that a code provision may not be used.* ***Therefore, language such as "subject to the approval of the building official" in a model code or standard is unenforceable under the VCC and VRC.***

  *However, if that language is used in a state amendment to the model codes or standards, then Section 101.7 of the VCC permits it to be enforceable. Therefore, to get final resolution to the issue, the Board of Housing and Community Development could decide whether they want to use the model code idea that* [such provisions] *should be controlled by whether a building official will permit it. There is a special section in Chapter 1 of the VCC (Section 103.9) where the board authorizes the use of certain administrative provisions of the model codes and standards. They could authorize the use of the language "subject to the approval of the building official" there, although I believe they would be very reluctant to do that, as it* ***would lead to non-uniform enforcement of the codes****.*

912.2.2 belongs in the VEBC. Addressed in a separate code proposal.

912.4 and 912.4.2: References to maintenance belongs in the Virginia Maintenance Code.

1004.7: Building official should not be the entity to "determine" the occupant load - they have the authority to "approve" (or not) the occupant load

established by the owner or its representative(s).

1004.8: Revised to similar language used in 1004.5, Exception - "permitted."

**Cost Impact:**
In most cases, where the "actual" occupant load could be used in lieu of the table, it would result in a DECREASE in the cost of construction, depending on the situation and comparison between complying with the exception or not.

For example, take a typical classroom of 800 SF. Per the Table, that would result in 40 occupants. However, most school districts limit the number of students by policy to 20-30. Now, say this was a high school wit 100 classrooms. Per the Table, that would result in **4,000 occupants** for just the classrooms (not counting the gym, auditorium, cafeteria, media center, etc.) compared to say **3,000 occupants** (using 30 as the cap). The reduction in plumbing fixtures alone would amount to a lot of savings.

The same could be said about the other code provisions if a code/fire official requires something MORE than is required by code.

**Resiliency Impact Statement:**
Will not increase or decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B905.5.3-18

This proposal doesn't have any public comments.

Proposal # 335

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## B905.5.3-18 Subject to the Approval of the Building Code Official

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:**

- Mr. Beahm wishes to clarify who else would have to approve -- the building official? The code official?
- Mr. Payne and Mr. Beahm engage in a discussion regarding who would be able to enforce that this code is followed -- what is the allowable interpretation, and who else would need to approve the code itself?
- Mr. Milliken (representing the Fire Services Board) does not support this proposal.
- Mr. Little also does not support.
- Mr. Payne clarifies that this, in response to Mr. Milliken's assertion that this allows "choices," it's not about what you like and what you don't like.
- Mr. Pharr says that AOBA/VAMA support this proposal.

**Results:** Non-consensus

Decided at the June 30, 2020 Workgroup 2 Meeting

# B916-18

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)

## 2015 Virginia Construction Code

### SECTION 916
### IN-BUILDING EMERGENCY
### COMMUNICATIONS COVERAGE

**916.1 General.** For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building *emergency communication equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new buildings and structures in accordance with this section.

**Exceptions:**

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area buildings in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 $m^2$).
4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide *emergency communication equipment* for *emergency public safety personnel*.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.

**916.1.1 Installation.** ~~The building *owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The~~ Buildings shall have approved radio coverage for emergency responders within the building based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems. Where an emergency responder radio communication enhancement system is provided, installation shall be in accordance with NFPA 1221, NFPA 72 and this section.The *locality* shall be responsible for the installation of any additional communication *equipment* ~~required for the operation of the system.~~ beyond these minimum requirements.

**916.1.2 ~~Operations.~~ System Monitoring.** ~~The *locality* will assume all responsibilities for the operation and maintenance of the *emergency communication equipment*. The building *owner* shall provide sufficient operational space within the building to allow the *locality* access to and the ability to operate in-building *emergency communication equipment.*~~

Where provided, the emergency responder radio enhancement system shall be monitored by a listed fire alarm control unit and supervisory signals shall include the following:

1. Loss of normal AC power supply.

2. System battery charger(s) failure.

3. Malfunction of the donor antenna(s).

4. Failure of active RF-emitting device(s).

5. Low-battery capacity at 70-percent reduction of operating capacity.

6. Failure of critical system components.

7. The communications link between the fire alarm system and the emergency responder radio enhancement system.

**916.1.3 Inspection.** In accordance with Section 113.3, all installations shall be inspected prior to concealment.

**916.2 Acceptance test.** ~~Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner*. Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.~~

Where an emergency responder radio coverage system is provided, the system shall be tested and approved in accordance with NFPA 1221 and NFPA 72.

**Revise as follows:**

**916.2.1 Critical Areas.** Critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage prior to occupancy approval.

## 2018 International Building Code

**Revise as follows:**

# NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy MA 02169-7471

**1: NFPA 1221: Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, 2019 Edition**

**Reason Statement:** The effectiveness and reliability of emergency responder communication is one of if not the most important aspect of successful emergency response and protection of public safety. In fact, as wireless technologies advance and community hazards expand, these public safety communication tools quickly become the backbone of incident response for not only fire and rescue personnel but also law enforcement and other first responders. Just as the water provided in building standpipes is critical to firefighting operations in large buildings, clear and dependable communications is vital to the safety of first responders in these buildings. This is in keeping with the philosophy inherent in the model codes that, when a facility grows too large or complex for effective fire response, fire protection features must be provided within the building. Building construction features and materials can absorb or block the radio frequency energy used to carry the signals inside or outside the building. Blockage or absorption of the radio frequency signal can prevent a critical message from an emergency responder from being received and acknowledged. Depending on the incident, this loss of information can place other emergency responders in greater danger or may prevent an injured or disoriented emergency responder from communicating for assistance.
The current VCC language requires the use of out-dated technology and in some cases the installation of equipment that may never be used. Unless meeting one of the exemption requirements, building owners are required to route hundreds of feet of likely disconnected cabling throughout the building including in areas where existing coverage may already be adequate. This proposal does NOT remove or modify any of the many exemptions currently indicated by the current code (VCC 916.1) so as to maintain consistency throughout Virginia. In addition, the current VCC language provides no recognition as to the current level of public safety communication strength currently on site. Without additional guidance, this could suggest that a building owner is responsible for providing a higher level of radio coverage than what currently is present in reality - a cost that is not fair to be burdened by the building owner or developer. The proposed language (ICC and NFPA model code language) ensures that the building is only required to maintain the existing level of public safety radio communication coverage available at the exterior of the building. Furthermore, just as building standpipe systems, fire hydrant systems, fire alarm systems and other fire protection systems are required to be provided as part of the building infrastructure for emergency responder use, the reliability and dependability of emergency radio enhancement systems demand that they be similarly connected to and monitored by the building fire alarm system. Finally, the current VCC language does not provide any reference standard for the installation or testing of such systems. This proposal includes a reference to NFPA 1221 for these details to ensure that they are capable, compatible and interoperable for emergency response at any time or location.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
Since this proposal does not remove or modify any of the current exemptions from providing in-building communication infrastructure, this proposal only applies to the same buildings where infrastructure is already required to be provided. In fact, this proposal provides the ability of building owners and developers to utilize cost-effective technology to accomplish the requirement with less labor and materials. Moreover, it also works to ensure that such technology is only provided where it is found to be needed and only to the level at which the public safety system currently provides at the exterior of the building. These cost-saving efforts are expected to equal or exceed any added cost to monitor such system by the building fire alarm system. Also, since the proposal is based on national and international standards that have been in place for years, most large construction projects already anticipate these costs for construction around the country.

**Resiliency Impact Statement:** This proposal will increase Resiliency
As compared to the ineffective and in some cases unnecessarily burdensome code language currently present in the VCC, this proposal represents a tremendous increase in building and public safety resiliency. Ensuring that first responders are able to effectively communicate is invaluable to the successful outcome of emergency response incidents and the protection of lives and property. The assurance for emergency responder radio coverage that this proposal provides does so not only for the major, or once-in-a-lifetime catastrophes but also many times over in the daily smaller "routine" emergencies that occur throughout buildings.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B916-18

**Discussion by Kenney Payne**
Apr 17, 2020 17:03 UTC

This could increase the potential liability on RDPs (and I imagine building owners as well) as such system's functionality is oftentimes based on "line of sight" when can be affected by numerous "future" events, such as another building being constructed. There are also potential bandwidth and/or broadcast issues. Virginia chose to revise these sections from the IBC version for these and other reasons. We do not see how this proposal addresses those reasons for the initial changes. Also, these systems cannot be tested until AFTER substantial completion of the building and any changes that must be made to address issues end up costing the owner who then points the finger at the RDP - who most oftentimes, had no control over the signals that may or may not be obtained throughout the entire building.

**Comment by Kenney Payne**
Jun 29, 2020 20:41 UTC

Proposal # 324

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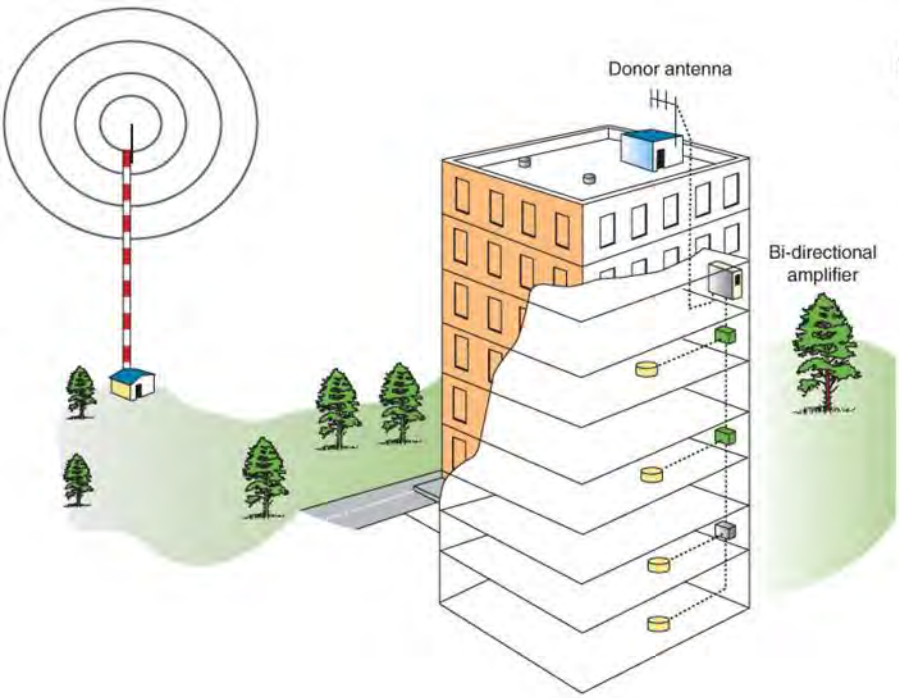


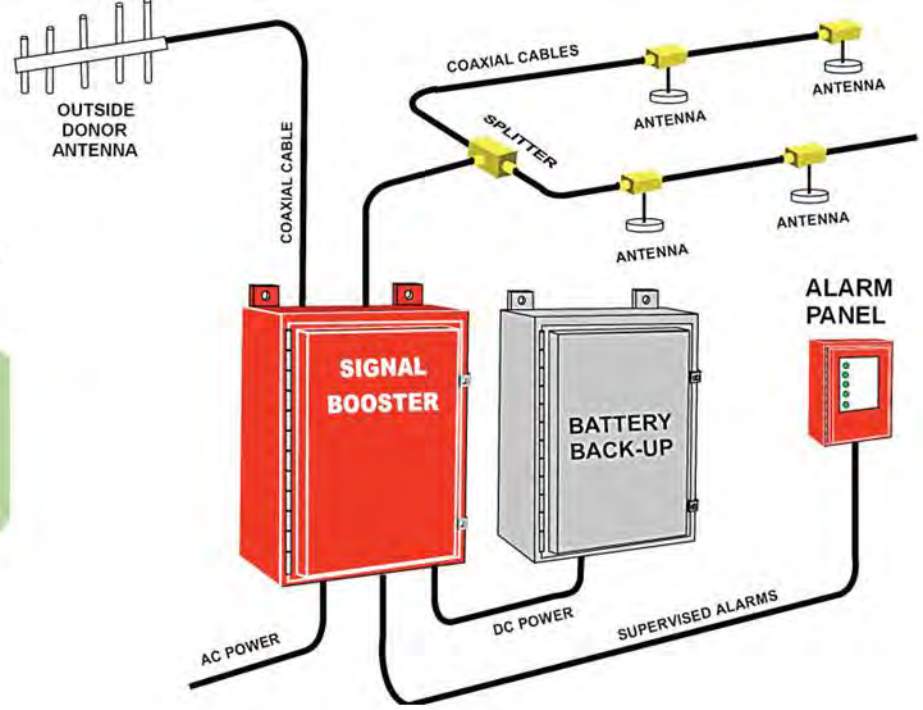




NFPA 72, Bi-Directional Amplifier System. (Source: Copyright © Jack Daniel Company, Victorville, CA)

## B916-18 Emergency Responder Communication

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)
--Public Comments for: B916-18
Discussion by Kenney Payne Apr 17, 2020 17:03 UTC -
**Comments:**

- Mr. Payne expounds on this in verbal discussion regarding repeated attempts to change the code language over multiple cycles. He opposes this change on behalf of AIA Virginia.
- Mr. Pharr and Mr. Milliken provide discussion with a move for non-consensus.

**Results:** Non-consensus

Decided at the June 30, 2020 Workgroup 2 Meeting

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# B918.1-18

**Proponents:** Linda Hale (Linda.Hale@Loudoun.gov); Andrew Milliken (amilliken@staffordcountyva.gov)

## 2018 International Building Code

### CHAPTER 9
### FIRE PROTECTION AND LIFE SAFETY SYSTEMS

### SECTION 918
### EMERGENCY RESPONDER RADIO COVERAGE

**Revise as follows:**

**[F] 918.1 General.** Emergency responder radio coverage shall be provided in all new buildings in accordance with Section 510 of the International Fire Code ~~Code.~~ .

## 2015 Virginia Construction Code

**Revise as follows:**

~~**916.1 General.** For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building *emergency communication equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new buildings and structures in accordance with this section.~~

**Exceptions:**

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area buildings in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 $m^2$).
4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide *emergency communication equipment* for *emergency public safety personnel*.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.

~~**916.1.1 Installation.** The building *owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The *locality* shall be responsible for the installation of any additional communication *equipment* required for the operation of the system.~~

~~**916.1.2 Operations.** The *locality* will assume all responsibilities for the operation and maintenance of the *emergency communication equipment*. The building *owner* shall provide sufficient operational space within the building to allow the *locality* access to and the ability to operate in-building *emergency communication equipment*.~~

**916.1.3 Inspection.** In accordance with Section 113.3, all installations shall be inspected prior to concealment.

**Revise as follows:**

~~**916.2 Acceptance test.** Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner*. Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.~~

**Reason Statement:** The provisions of Section 510 are concerned with the reliability of portable radios used by emergency responders inside buildings. This is in keeping with the philosophy inherent in the I-Codes that, when a facility grows too large or complex for effective fire response, fire protection features must be provided within the building.
Emergency responders use portable radios to communicate with other emergency responders, the incident commander and the public safety communications center. Building construction features and materials can absorb or block the radio frequency energy used to carry the signals inside or outside the building. Blockage or absorption of the radio frequency signal can prevent a critical message from an emergency responder from being received and acknowledged. Depending on the incident, this loss of information can place other emergency responders in greater danger, or may prevent an injured or disoriented emergency responder from communicating for assistance. The requirements apply to analog or digital radio systems and are applicable to all buildings. This section requires that all buildings have approved radio coverage for emergency

responders within the building. Approved radio coverage is based on the ability of the existing public safety communications system to transmit a signal inside and outside the building.

The existing radiating or “leaky cable” that is currently required in the code is approximately 15% more expensive than a non-radiating cable. A radiating cable that is then placed in a conduit or raceway that shields the cable eliminates the sole purpose of a radiating cable. A radiating cable (that is not shielded) does have a very specific application, but it is a limited application.

Passing off the costs of this critical communication system to a jurisdiction equates to passing off the expense to the citizens of that jurisdiction, as most fire departments are funded predominantly by local tax dollars and or donations. This is unconscionable that the citizens of a jurisdiction should bear the financial burden of a private building that is being built in a locality. And is tantamount to placing career and volunteer firefighters, who are willing risk their lives to save another, in harm’s way without the most basic of abilities to call a MayDay (e.g. help) or for an incident commander to call for an evacuation prior to firefighters becoming trapped. How many firefighters must perish before we appreciate their un-waiver dedication and provide the rudimentary tools in which to save lives?

**Cost Impact:**
The cost will not increase in all buildings, as not all buildings will have impaired emergency radio communications. The impairment degree of those that are compromised will not be the same as it is based on building construction features, existing buildings, and the signal strengths in a jurisdiction. The off set of price from a radiating cable to a metal shielded coaxial cable will also assist with some of the price difference. The cost increased to compromised structures will vary from 40 cents/sq ft to $1.00/sq ft., and is hardly worth a life.

**Resiliency Impact Statement:** This proposal will increase Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B918.1-18

**Discussion by Kenney Payne**
Jul 30, 2020 19:35 UTC

This could increase the potential liability on RDPs (and I imagine building owners as well) as such system's functionality is oftentimes based on "line of sight" which can be affected by numerous "future" issues, such as another building being constructed. There are also potential bandwidth and/or broadcast issues. Virginia chose to revise these sections from the IBC version for these and other reasons. We do not see how this proposal addresses those reasons for the initial changes. Also, these systems cannot be tested until AFTER substantial completion of the building and any changes that must be made to address issues end up costing the owner who then points the finger at the RDP - who most oftentimes, had no control over the signals that may or may not be obtained throughout the entire building.

But perhaps more importantly, Virginia amended this section as a result of numerous stakeholders' input and to make such a wholesale change at this late stage in the process without being vetted through a subworkgroup and/or allow such stakeholders ample time to provide input and/or compromise language could lead to unintended consequences as far as Virginia is concerned.

We would encourage this be carried over to the next code cycle and a subworkgroup be formed of various stakeholders to continue the discussion.
**Comment by Kenney Payne**
Aug 4, 2020 12:27 UTC

Let me begin by saying AIA does not oppose in-building emergency communications. We understand its critical nature and life-saving functions it serves for both emergency responders and those they are responding to. Sometimes, one needs to look for a balance between code requirements and how such codes ultimately affect staying in business. No sooner than this requirement first showed up in the codes, I heard from three (3) architectural firms complaining that owners were suing them because their tests had failed. In all fairness, I attributed that to just a lack of understanding on how to actually achieve the results needed and the technology was lagging. I believe A/Es do a much better job at designing infrastructure that leads to passing tests or pretty darn close - and technology has made tremendous strides in making this happen.

I sought someone who is way better at this than I am - below are his comments from June 2017 (so, that was during the last/2015 code cycle) - but they still apply today!

*Looks like someone got together with a radio engineering firm who sees big money in this and worked out all the technical details. All this upfront engineering and all the constant maintenance and testing because the locality did not put in a better system originally – usually for cost reasons.*

*Have they submitted costs to design, purchase and install? And reoccurring costs to maintain? Especially in an existing building? And their statement Cost Impact: No impact is a lie. It is costing the building owner both up front and continuous. Recent studies and designs for school size buildings are running in the $5-6,000 range. And we are being told to use pricing of $0.30 to $0.50 per square foot for a cable only passive system without amplification or repeaters. You may have other numbers from your office. We did a recent school, went through the design process that indicated a cable system would be required in some areas of the school. We had the emergency services agree to test the building when it was nearly complete before installing a system. They did and determined they could work with the building without adding a system - saving the owner the material and installation costs but not the study costs.*

*I will point out in the cited 47 CFR 90.219, subsection (b), (1) (i) that consent is required from the service licensee, in writing. In most localities that is not the Fire Department. So it is not their right to grant permission for such equipment installation by a building owner. What if the service licensee says no?*

*I have fought this for years because the proposals kept asking for what was technically impossible. This time, they have brought to the table the technical requirements that work – at a price. I cannot fight the details other than to point out fire departments are trying to give away permissions they do not actually own in most, if not all, localities in Virginia.*

*I would point out that it would allow a licensee to put in a full repeater system if they wanted to expand coverage in the area in addition to inside the building. With this proposed building owner system, that is expressly prohibited.*

Below were his comments from October 2013 - so this is for the 2012 code cycle) - but they still apply today!

*The 2009 requirement for In-Building Emergency Communications Coverage is better than the 2006 version, but still flawed and, in most cases unnecessary. Being a licensed ham radio operator and radio license test administrator plus years of knowing many Motorola and Ericson engineers and installers, I have learned a lot about the public service radio systems and how they work. Also how they are bid and sold to localities. What they can and cannot do.*

*As to our current building code, there are several problems in 915.1. Line 915.1.1 requires "The building owner shall install radiating cable, such as coaxial cable or equivalent." It should be noted traditional coaxial cable does not radiate – and is specifically designed not to. Radiating cable is a very specific cable designed with millimeter sized openings that are intended to pass only specific frequencies in and out. It is custom to the radio frequencies. In small town areas where police, fire and rescue could all be on different radio frequencies, someone has to decide which one gets coverage.*

*The next problem is the line "Radiating cable shall be installed in dedicated conduits,…". Radiating cable does not work in conduit. Conduit blocks the signal getting in and out.*

*2009 got it correct about the additional equipment. It is illegal for the owner to run amplifiers, etc on these FCC designated frequencies. Only the designated licensee can do such.*

*915.1.2 Comes closer to what I would like to see and I think would be more workable solution. This is a requirement for the owner to provide sufficient operational space in the building. I will come back to this in a moment.*

*915.2 Acceptance Test. Is this a requirement for a building permit? What if a properly designed radiating system does not provide "required level of radio coverage"? What is that level? I don't know of a public service radio system in Virginia that is guaranteed to provide more than 95% coverage of a locality for 95% of the time. Yes, that is the purchased standard from most of the major radio system manufacturers that local governments are willing to pay for and part of the problem in the first place. We are trying to ask the owner to compensate for the other 5% of the locality the local government was not willing to pay to cover. But, back to the acceptance test, a designed system is installed. For whatever reason, and it could just as easily be improper operation of their equipment by the public safety personnel, the system does not provide the coverage they want, when does it become the localities to install their amplification system?*

*And finally, I can design a passive radiating system for use in the building, but that does not mean it will necessarily connect with the outside police radio system without providing exterior antennas – a requirement not addressed in the code.*

*Getting back to 915.1.2 and what I would prefer to see. The 2009 Virginia Statewide Fire Prevention Code in section 510.2 hits what I would like to see. And that is, the building owner shall provide appropriate space in the building for the locality to install the additional necessary equipment. Let's take the requirement out for a radiating cable system. Let's do a survey to determine what types of buildings do require this type of coverage and the trigger area or narrow the categories. And if there are typically or traditional building sizes or types that may have problems, let's provide a space designed to accommodate equipment should the locality find the need but can be used by the owner for other things in the meantime. In reality, it is not a building type or size that is the problem, but the site specific issue of how close is the building to the public service radio tower.*

*So, what would we provide? I would recommend a closet size space with duplex receptacle on an emergency power circuit, if available – otherwise a dedicated line. The space should be vented. And it should provide 2" or so conduit to a location above the corridor ceiling on each floor and to the roof where it is capped for future use with antennas. Then, if not required by the local public service, the owner can use it as a closet. If it is required, the locality can install the appropriate licensed equipment and cabling required to solve it.*

*Bottom line, the trigger requirements are not realistic. Typical 21,000 sf buildings or larger – say schools do not require this. A strip shopping mall does not require this. Aspect ratio. These buildings typically are not deep enough to restrict signals and have lots of wall surfaces (ie: windows) that do not restrict signals.*

*The rest are my comments concern statements that continue to crop up or be repeated without documenting a source. Many relate back to the original proposal submitted to Virginia to include an in-building communications system which, at that time, cited specific cases that could be reviewed. Actual review, which I did, found many were incomplete statements or did not include the determined cause of the problem. Just the problem. I was able to verify almost all of the reported cases and none of them that I found would have been helped with an in-building system. Consistently, it turned out to be improper or lack of training, improper maintenance of equipment, or battery failure.The initial proposal was based on duplicating language used by Schaumburg, Illinois in their code to get a system installed in the new convention center they were planning to build. I got the following from their building office and the Mayor's office. Note, Schaumburg is the home of Motorola and their radio division that makes most of the police and fire systems in the US. The initial request from the Mayor was for a requirement that would require cell phone coverage throughout the convention center. That was it. During preparation, somebody came up with the idea to change it from cell phones to police/fire radios. It never got built. In the city with some of the best radio minds, no one could figure out how.*

*I keep seeing reports of people being able to see each other but not communicate by radio. Line of sight communications. The only reported case from the original proposal that at the time claimed this to be one reason for in-building systems did not note the final conclusion that determined bad batteries and lack or training on how to maintain the equipment was the problem.*

*I am unaware of in-building communications problems at Virginia Tech. I do know that all the different services responding were not on the same type of radio and could not communicate to each other. This is a recognized problem the federal govt. is trying to resolve by getting all public service radios to change to a common set of frequencies. This is why TV station frequencies were moved so your old TV sets and antennas no longer work without a converter box! That is not a building construction problem nor would it be resolved with an in-building communications system. It there is a report to the contrary, I would like to read it.*

*And use of cell phones are an entirely different matter controlled by the cell phone companies, their licensed provision of coverage, and a localities' restriction on cell phone towers.*

*The World Trade Center is another cited example. The following came out in the Senate hearings I read. Yes, there was a problem communicating inside the buildings and this was previously discovered following the bombing in the basement parking a year or so before the towers collapsed. And it was fixed at that time by installation of a special police/fire repeater system in an ADJACENT building. Unfortunately, it had to be turned on by key at the site. It was turned on and successfully used before the collapse of the towers. And due to lack of training and understanding, every time police or fire started to use the frequency, the dispatchers moved them off the good frequency to the non-working overcrowded frequencies already in use.*

*Yes, there can be a problem. But it is equipment driven. Systems are being purchased with a guarantee of 95% coverage, 95% of the time. That is actually pretty good for an acceptable price. Key here is how much local government wants to spend. One of our Northern Virginia fire departments pushing the original legislation (may have been Arlington) included their report of tests conducted in some of their large shopping malls. No, they could not communicate with the dispatcher or each other through the police/radio tower systems on their $800 handhelds. But, if you read down in the report, you see where they went out and bought a bunch of $30.00 family radio service handhelds any one can buy to coordinate their testing. Because the cheap stuff worked in the buildings. There are multiple reasons why, not the least of which is frequency of the radios. Bottom line is, this is one of those 5% areas not covered by the system bought.*

*Passive and active radiating cables do work. It actually dates back to the early steam days when the first radios were put on trains. Passive radiating systems allowed signals to be received inside tunnels. Versions of this are still used today. They just need to be custom designed to the radio system and location.*

*Repeaters and amplifiers are illegal for the owner to install and maintain. Must be property of and maintained by licensee. The FCC regulates and the courts have consistently upheld that states and localities cannot.*

*A little lengthy, but I hope you can get some ideas from this you think worthwhile. I just happen to be passionate about radio and know just enough to be dangerous. And where to look for a lot of the rest. I do believe we should do the best to protect the owners and occupants of the buildings we design and, in particular, the public service people trying to protect us. I get riled up though when I see a miscarriage of power to cover up for someone's decision to provide only so much coverage and put the responsibility for the rest on individual owners whether it is needed or not.*

**One of his major concerns with ALL of this was about "broadcast rights, bandwidths, over-the-air signals, etc." and how can we**

**design something THAT WORKS when we don't know how all the signal stuff will ultimately play out - which is one HUGE reason the VCC approached it the way they did. Let the localities work it out among themselves and the owner is just basically letting the locality install equipment into their building and providing infrastructure and a few spaces throughout.**

Then, I sent the below out to VBCOA in October 2013 - which still applies today!

*There appears to be a conflict when one provision (915.1) says we (RDP/owner) are to provide infrastructure so the jurisdiction can provide the equipment, and where equipment is defined to include radiating cables, but then 915.1.1 requires radiating cable to be provided by the owner, not the jurisdiction. Therefore, hopefully we can bring clarification to the intent when it comes to the radiating cable system*

*We have been told that owners should be advised at construction regarding the need for infrastructure to accommodate the locality's requirements – however, we propose owners (ergo, architects) should be advised during design – not construction. If done during construction, it is oftentimes too late, or very costly to remedy. Thus, we suggest some form of a preliminary meeting. The USBC already codifies such a preliminary meeting when dealing with existing buildings (2012 VRC 103.1.2) . If any such meeting is held, we believe the fire official should be required to attend, especially if they are the ones that we are trying to accommodate.*

*Our main concern involves broadcasting procedures and the ability of owners to actually obtain broadcast licenses to operate such equipment (and our ability to design such a system with so many variables). Do we really want thousands of owners to have to acquire thousands of broadcast channels/bandwidths throughout the Commonwealth?*

*Infrastructure (i.e., oftentimes understood to mean empty conduits, empty cable trays, empty raceways, empty spaces, etc.) by its nature cannot "perpetuate" the operations of any system. It can "accommodate," but not perpetuate the in-building emergency communications (IBEC). The equipment can perpetuate the system, not the infrastructure. Therefore, 915.1 should utilize the appropriate term.*

*To ensure this section is not applied in a retrofit manner, we suggest language that mimics 2012 IFC Section 510.1 be included.*

*We also suggest we add language mimicking 2012 IFC Section 510.1, Exception 1.*

*We also believe we need to clarify that these requirements do not apply to existing buildings undergoing any type of rehabilitation, other than a complete change of occupancy. The term "new" is being interpreted by a number of building officials as including an existing building undergoing alterations or a partial change of occupancy.*

*Section 915.1.1 (Installation) should be modified to clarify that only an empty infrastructure is required to be provided by the owner. Also, as currently proposed for 2012, a conflict exists. Other portions of this Section imply that the emergency communication equipment will be provided by the locality. The 2012 definition of emergency communication equipment includes radiating cable systems. However, as currently written, Section 915.1.1 (Installation) requires the owner to provide the radiating cable (or equivalent). So, who is responsible for providing the cable?*

*[definition] Emergency communication equipment. Emergency communication equipment, includes but is not limited to, two-way radio communications, signal booster, bi-directional amplifiers, radiating cable systems or internal multiple antenna, or a combination of the foregoing.*

*We suggest we include a requirement for the infrastructure to be provided in such a way that would allow for modifications without destructive demolition, which should lessen the potential for increased remedial costs.*

*Currently, Section 915.2 (Acceptance test) required compliance with "the required level of radio coverage;" however, there is no criteria established in the building code for what "level of radio coverage" is required. Therefore, we believe the code should establish requirements for a minimum level of coverage, we cannot design to an unknown, owners cannot pay for unknowns, and contractors cannot build to unknowns.*

*However, if we codified a preliminary meeting (like what has been done in 2012 VRC 103.1.2), it should go a long way in assisting the owner and RDP during their design process to confirm the infrastructure will comply with this section and allow for the equipment, operation, and maintenance provided by the locality. Currently, the level of radio coverage is an "open book" that oftentimes does not get verified until after the owner occupies the building, or just before a Certificate of Occupancy is applied for – and by then, it is too late to implement cost-effective changes.*

*We should clarify that the "no cost" of 915.2 relates to the locality's field tests, not the level of radio coverage – which may actually end up costing additional money if the signal strength and/or coverage are not sufficient.*

*We suggest mimicking the requirements in 2012 IFC Section 510.4.1.*

*There should be a mechanism to prevent the locality from denying occupancy due the result of noted deficiencies, provided those deficiencies are remedied within some time frame (e.g., 60 days). If the locality did not want to issue a certificate of occupancy, they could issue a temporary certificate of occupancy until such time the deficiencies are remedied.*

**So, this should provide a basis for my/AIA VA's concerns. While what we have now is not perfect, we have adapted to endeavor to make it workable. We definitely would have the same if not more concerns if we start expanding and even introducing new requirements onto the RDP and/or owner's responsibilities.**
**Comment by W Shaun Pharr**
Aug 3, 2020 7:17 UTC

AOBA/VAMA are opposed to B918.1

In a regrettable reversion to prior form, the Fire Services proponents of this code change feel compelled to make scurrilous, slanderous allegations against the Board of Housing and Community Development (BHCD) which first adopted code provisions addressing in-building emergency communications, and against each successive Board which has reaffirmed those provisions.

The proponents assert in their reason statement that the code provisions adopted by these Board members are "unconscionable… and tantamount to placing career and volunteer firefighters… in harm's way without the most basic of abilities to call a MayDay… or for an incident commander to call for an evacuation…"

And, of course, anyone who does not share the Fire Services world view on such matters—specifically, the BHCD members, past and present over the last fourteen years, who have adopted the current provisions-- is subjected to the shopworn trope of "How many firefighters must perish before we appreciate their un-waiver (sp) dedication and provide the rudimentary tools in which to save lives?"

How respectful of these citizen Board members. How tactful.

Work Group members are urged to reject this dishonest and misplaced litmus test of whether one supports firefighters and effective fire prevention, or not.

The USBC's current provisions are the result of an extensive process initiated by the General Assembly in 2003. It created a 45-member task force with State and local members from the Commonwealth, as well as local and national stakeholders and experts in the field. The Task Force met several times over the next year and produced a 71-page report, to assist the Board of Housing and Community Development in developing building code regulations. DHCD then convened extensive deliberations, over many months, in the next code development cycle to come up with what the Board ultimately adopted, and has largely reaffirmed in subsequent code cycles.

Those provisions make clear what the obligations of building owners are, and what the obligations of localities are:

· Building owners are NOT required to provide a system—they are to provide space in the building—conduits, plenums, etc.—and, in that space, "radiating cable, such as coaxial cable, or equivalent." (916.1.1).

· The same section states that "The locality shall be responsible for the installation of any additional communication equipment required for the operation of the system."

· Sec. 916.1.2 Operations clearly states that: "The locality will assume all responsibilities for the operation and maintenance of the emergency communication equipment.

· The building owner shall provide sufficient operational space within the building to allow the locality access to and the ability to operate in-building emergency communication equipment.

BHCD had ample reason for choosing the path that it did regarding the allocation of responsibilities and costs between building owners and localities. It noted that there is wide variation in the reasons for, and sources of, radio signal attenuation in buildings. Many of these reasons are beyond the control of the building owner—the natural terrain, the later erection of a new building nearby that causes signal inadequacy, or the latest cell tower to spring up, to name a few.

Moreover, it took note of similarly wide variations in the emergency communications capabilities of the many career, volunteer and combination fire departments across the Commonwealth. How many jurisdictions still have only a single radio channel to handle all functions (e.g dispatching apparatus, fireground operations, recalling off-duty personnel, EMT calls)? How many use dual function police/fire services dispatchers? How many departments assign portable radios to every firefighter? How do staffing, tactics, equipment and training differences among departments affect emergency communications? Should individual building owners be saddled with the costs of overcoming these wide disparities in municipal emergency communications capacities (or desires)?

The Board ultimately concluded that the most equitable way of addressing these wide variations in both property characteristics and fire department

needs was the same way that localities for centuries have addressed their needs for complex services that are deemed essential, e.g., roads, education and police and fire services: a jurisdiction's general tax revenues. All building owners are to be held to the same obligation—that of uniformly providing basic infrastructure at their own cost, and subsequent access to that infrastructure. All localities are, in turn, obliged to determine the communication systems they desire, and to then deploy, test and maintain them in the spaces provided by building owners.

B918.1 would turn this well-considered allocation of responsibilities and costs on its head, with no meaningful deliberation, and should be rejected. If a fire department feels that its in-building emergency communications capacity is inadequate in some buildings or geographic areas, it should ascertain the specific causes for any such shortcomings, then identify the means and costs of remedying those shortcomings, and request the necessary budget authority to do so.

Proposal # 456

## B918.1 Emergency Responder radio coverage

**Proponent(s):** Linda Hale, Loudoun County Fire Marshal's Office (Linda.Hale@Loudoun.gov); Andrew Milliken, Stafford County Fire Marshal's Office (amilliken@staffordcountyva.gov)

**Summary:** This proposal defines how emergency radio coverage should be installed in certain buildings. It mandates the use of specific technology.

**Comments:**

- Ms. Hale provides reasoning - it shouldn't be on taxpayers to pay for radio coverage
- Mr. Pharr of AOBA and VAMA opposes - they say it is entirely appropriate to use tax revenue to fund local essential safety measures. Further, we shouldn't saddle building owners with these costs. Nobody is arguing that these safety measures aren't critical to safety.
- Mr. Witt (VBCOA Fire Code Committee) opposes; he suggests we carry to the next code cycle, acknowledges the need for an update but believes the stakeholders all need to come together to make some decisions that are mutually acceptable.
- Mr. Willham (VBCOA Committee) also opposes for the reasons stated above.
- Mr. Milliken (Fire Services Board) is in support. He believes that due to the technologies that have come out since this code was originally penned, an update is warranted, but he wants to at least get the discussion going.
- Mr. Dyer (SFMO) is in support for the reasons already stated.
- Public comment by Mr. Payne of AIA Virginia cites that he is concerned about functionality and longevity of this proposal's suggested changes due to "line-of-sight" language (just in case another building is constructed later).
- Mr. Pharr (AOBA/VAMA) points out that the current language makes suggestions as opposed to outlining requirements. There is most likely "latitude that has not been explored" to enact some of these infrastructure ideas. He would not be opposed to a committee that explores how to update these ideas and the language to describe them; he is however vehemently opposed to using this proposal to "turn existing code on its head."
- Ms. Hale maintains it is a small dollar amount that would make the difference between the model code and the code with these changes in place and that she was not attempting to recreate anything through this proposal; she is not sure a workgroup would allow any sort of consensus.
- Mr. Pharr disagrees, and clarifies that what he meant was that there may be equivalent, different approaches to the problems laid out by this proposal, other than those that have been suggested. He wishes to note that AOBA/VAMA also submitted a comment on cdpVA.

**Results:** Non-consensus

Decided at the August 11, 2020 Combined Workgroup Meeting

# B1004.3(2)-18

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)

## 2015 Virginia Construction Code

**Revise as follows:**

**1004.3 Posting of occupant load.** Every room or space that is an assembly or merchantile occupancy and where the *occupant load* of that room or space is 50 or more shall have the *occupant load* of the room or space posted in a conspicuous place, near the main *exit* or *exit access doorway* from the room or space. Posted signs shall be of an *approved* legible permanent design and shall be maintained by the *owner* or the *owner's* authorized agent.

## 2015 Virginia Statewide Prevention Fire Code

**Revise as follows:**

**(N) 1004.3 Posting of occupant load.** Every room or space that is an assembly or mercantile occupancy and where the *occupant load* of that room or space is 50 or more shall have the occupant load of the room or space posted in a conspicuous place near the main *exit* or *exit access* doorway from the room or space. Posted signs shall be of an *approved* legible permanent design and shall be *maintained* by the owner or the owner's authorized agent.

**403.1.1 Maintaining occupant load posting.** ~~Occupant load postings required by the building code are required to be *maintained*.~~

Every room or space that is an assembly or mercantile occupancy, and where the occupant load of that room or space is 50 or more, shall have the occupant load of the room or space as determined by the building official posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or owner's authorized agent.

## 2015 Virginia Existing Building Code

**Revise as follows:**

**1101.15 Posting of occupant load.** Every room or space that is an assembly or mercantile occupancy, and where the occupant load of that room or space is 50 or more, shall have the occupant load of the room or space as determined by the building official posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or owner's authorized agent.

## 2015 Virginia Maintenance Code

**Revise as follows:**

**[F] 702.1 General.** A safe, continuous and unobstructed path of travel shall be provided from any point in a building or structure to the *public way*. Means of egress shall comply with the ~~*International*~~ *Virginia Statewide Fire Prevention Code and the applicable building code*.

**Reason Statement:** Similar to proposal 329 - B1004.3-18 but adds correction to VMC 702.1

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
None

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1004.3(2)-18

This proposal doesn't have any public comments.

## B1004.3(2) Posting occupant load for mercantile use

**Proponent(s):** Andrew Milliken (representing himself), (amilliken@staffordcountyva.gov)
**Summation of Proposal:** Similar to proposal 329 - B1004.3-18 but adds correction to VMC 702.1
**Comments:**

- Mr. Milliken explains that this first proposal is one that was submitted before, but that B1004.3 and B1004.3(2) are companion proposals with similar ideas, they only plan to try and get one of the two to consensus.
- Mr. Willham (VBCOA Building Code Committee) opposes.
- Mr. Beahm (IBC Committee) does not believe this is a change that is drastically needed. He is opposed.
- Ms. Hale (Virginia Fire Prevention Association) disagrees; she believes that this list should be "proactive" rather than "reactive," and this change is something that is necessary. She is in support.
- Mr. Snidow claims they can reference the C.O.
- Ms. Eggerton (Alexandria) thinks that posting the occupancy load will help with COVID, which limits the occupant loads in retail. But she also acknowledges that there is a cost to getting the signs up.
- Mr. Milliken suggests moving companion proposal B1004.3(2) to non-consensus.
- Mr. Willham (VBCOA Building Code Committee) opposes.

**Results:** Non-Consensus

Decided at the August 11, 2020 Combined Workgroup Meeting

# B1612.2.1-18

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; City of Newport News; AIA Virginia

## 2018 International Building Code

**1612.2 Design and construction.** The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

**Revise as follows:**

**1612.2.1 Modification of ASCE 24: Elevation requirements.** The minimum elevation requirements shall be as specified in ASCE 24 or the base flood elevation plus 2 feet, whichever is higher.

## 2018 International Residential Code

**R322.2.1 Elevation requirements.**

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus ~~1 foot (305 mm)~~ 2 feet (610 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus ~~1 foot (305 mm)~~ 2 feet (610 mm), or the design flood elevation, whichever is higher.

**Exception:** Enclosed areas below the design flood elevation, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

**Revise as follows:**

**R322.3.2 Elevation requirements.**

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus ~~1 foot (305 mm)~~ 2 feet (610 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
5. Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.5 and R322.3.6.

**Reason Statement:** This item increases the minimum required elevations (lowest floor, bottom of lowest horizontal structural member, dry floodproofing) from BFE +1 ft to to BFE +2 feet. Still needs to be considered by the full workgroup.

**Cost Impact:** The code change proposal will increase the cost of construction
The additional height in construction will increase costs but are offset by damage avoided during floods and lower flood insurance annual premium costs.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This will increase resilience to flood damage by elevating construction an additional foot above the base flood elevation.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1612.2.1-18

This proposal doesn't have any public comments.

Proposal # 352

## B1612.2.1-18 Elevation Requirement

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region II; Terrazia; City of Newport News; AIA Virginia
**Comments:** Discussion among Ms. Quinn of FEMA, Ms. Cook of Arlington County, Mr. Payne and others revolves around this being a potentially cost-prohibitive action.
**Results:** Non-consensus

## Sub-Workgroup Summary:

**B1612.2.1 – Consensus Approved (BFE+2)**
**Mr. Brown summarized that this set of proposals are not in code change format and are, instead, a guide that can be used to determine what's the best flood elevation height for a particular flood hazard area.**

**Mr. Homewood proposed the BFE plus 3 is desirable but that he would be OK with BFE plus 2. The rest of the room was in agreement that plus 2 was better but with the reservation that the Homebuilders of Virginia may not be in agreement**

**Mr. Homewood answered a question about the cost of one foot of elevation versus two feet. In Norfolk, they studied it and it's under $10,000. Mr. Payne pointed out that there is a concern for ADA compliance as only single family homes are exempt and other elevated buildings would require a ramp, and with three feet of elevation it would be a large ramp.**

**Mr. Brown summarized that as the group was in agreement, that staff would pull out all the Base Flood Elevation sections in flood hazard sections, coastal high hazard areas and A zones, as well as ASCE 24, and create a proposal.**

Decided at the June 30, 2020 Workgroup Meeting

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# B1612.4-18

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; City of Newport News

## 2018 International Building Code

**1612.4 Flood hazard documentation.** The following documentation shall be prepared and sealed by a *registered design professional* and submitted to the *building official*:

1. For construction in *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*:

1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.11.1.

1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, *construction documents* shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

1.3. For dry floodproofed nonresidential buildings, *construction documents* shall include a statement that the dry floodproofing is designed in accordance with ASCE 24, and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.

2. For construction in *coastal high hazard areas* and *coastal A zones*:

2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.11.1.

2.2. *Construction documents* shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.

2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/$m^2$) determined using *allowable stress design*, *construction documents* shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

2.4. For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

**Reason Statement:** Adds additional documentation for construction in flood hazard and coastal high hazard areas. This includes a flood emergency plan as specified in Chapter 6 of ASCE 24 and a requirement to meet engineered flood opening requirements of Section 2.7.2.2 of ASCE 24 where flood openings in breakaway walls do not meet the non-engineered opening provisions of Section 2.7.2.1 of ASCE 24. Still needs to be considered by full workgroup.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The emergency plan is already required in ASCE 24 and certification of engineered openings added in 2.4 is the same as item 1.2

**Resiliency Impact Statement:** This proposal will increase Resiliency
Additional compliance with ASCE 24 will increase resiliency by requiring additional documentation for flood hazard prevention

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1612.4-18

**Discussion by Kenney Payne**
Jun 19, 2020 20:36 UTC

Our concern is with the **last portion of Item 1.3** - there is no “flood emergency plan” that I could find in Chapter 6 as it relates to dry floodproofing. It speaks to an “emergency escape and rescue opening” (EERO) but that is not a “plan.” And if I have complied with Section 6.2, then I have already

complied with such “emergency” requirements.

Are you speaking to Section 6.2.3? If so, then those terms should be used and the reference should be to the section rather than the entire chapter (which also includes wet floodproofing).

Is such a “plan” found elsewhere in ASCE 24? The referenced version in 2018 IRC is the 2014 edition of ASCE 24. Is there a newer version of ASCE 24 that has such a “plan” in Chapter 6?

So, unless properly referenced, it should be deleted (which gets us back to what it was to begin with).

1.3 For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24~~, and shall include the flood emergency plan specified in Chapter 6 of ASCE 24~~.

**Comment by Kenney Payne**
Jun 24, 2020 12:40 UTC

My issue is not against a “plan” - it is bringing to light that Chapter 6 of ASCE 24 does not actually advise what such a “plan” would look like.

6.2.3 mentions a “flood emergency plan” but a what if I design something that doesn’t require human intervention - what then? 6.2.3 only applies if human intervention is required.

6.2.3, Item 1 is a “community” plan - not specific to the building itself, so I’m not sure how this gets enforced or complied with by an RDP or owner.

6.2.3, Item 3 only applies if removable shields are used - it doesn’t say what the “plan” is if no shields are used.

If I have to provide a statement that I designed it in accordance with Chapter 6 of ASCE 24, then I also designed it per 6.2.3 - yes?

Should the "plan" requirements reference FEMA 83?

However, if it is intended to mean 6.2.3, then could we say . . .

1.3 For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24, and if removable shields are used, shall include ~~the~~ a flood emergency plan ~~specified~~ in accordance with ~~Chapter 6~~ Section 6.2.3, Item 3 of ASCE 24.

Owners and RDPs cannot “state” or be held responsible for compliance with 6.2.3, Item 1 since that is a “community” requirement - the community might have it one day, but not the next.

So, until this is addressed, we remain OPPOSED.

Proposal # 349

## B1612.4-18 Flood Hazard Documentation

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region II; Terrazia; City of Newport News
**Public Comments:** Discussion by Kenney Payne Jun 19, 2020 20:36 UTC
**Comments:** Mr. Brown of DHCD lends context for this proposal on behalf of the Resiliency SWG.

- Mr. Payne (AIA Virginia) voices concern for lack of specificity and problematic language.
- Ms. Quinn with FEMA (Charles City County region) asserts that floodproofing shield maintenance is dependent on the efficacy of floodproofing design and that this proposal is insufficient to provide proper design planning.
- Mr. Payne rebuts that "just because this planning has been around since 1998, doesn't mean we have been responsible for implementation or plan creation" - just design - for that amount of time.
- Mr. Beahm clarifies that regardless of what the plan is, they review every 3 years.
- Mr. Brown of DHCD clarifies that he does have some concerns regarding AHJ in terms of building officials, that they may not have the authority to properly review.

**Results:** Non-consensus

## Subworkgroup Summary

B1612.4-18 – Consensus Approved
Mrs. Quinn said it is FEMA's position that they want uniformity on the type of documentation being required and so this proposal captures that. Mr. Shapiro pointed out that all the 2021 items up for discussion were reviewed by engineers and professionals at the national level as well as the OGCV process and are, therefore, well vetted proposals. Mr. Homewood noted that breakaway walls are part of FEMAs "higher standards" provisions and some localities in Coastal A and VE zones have banned breakaway walls already.
Mr. Brown pointed out the process for proposals approved here, that they will go to the full Workgroup Committee and Mr. Potts pointed out the deadlines for submission of items to be considered.

Decided at the June 30, 2020 Workgroup Meeting

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# B1804.8-18

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; AIA Virginia

## 2018 International Building Code

**Add new text as follows:**

**HIGHEST ADJACENT GRADE**

Highest elevation of the finished ground surface next to the foundation of a *structure* .

## 2018 International Residential Code

**Add new text as follows:**

**HIGHEST ADJACENT GRADE**

Highest elevation of the finished ground surface next to the foundation of a *structure.*

## 2018 International Building Code

**Add new text as follows:**

**1804.8 Protection from local drainage.** The top surface of floor systems and concrete floors shall be elevated to a minimum of one foot (305 mm) above the highest adjacent grade unless otherwise approved.

## 2018 International Residential Code

**Add new text as follows:**

**R501.3 Protection from local drainage.** The top surface of floor systems and concrete floors shall be elevated to a minimum of one foot (305 mm) above the highest adjacent grade unless otherwise approved.

**Reason Statement:** This proposal incorporates ASCE 24-14 definition for Highest Adjacent Grade but modified to specify above the "finished grade". This proposal will protect structures that are outside of designated flood hazard areas from damage from stormwater runoff related flooding on a site by requiring all floors to be elevated to a minimum of 1 foot above the adjacent finished grade. Still needs to be considered by the full workgroup.

**Cost Impact:** The code change proposal will increase the cost of construction
This change proposal will increase the cost by requiring all buildings to be elevated one foot above the adjacent grade. This will not impact all buildings (mostly slab on grade structures) as many are already designed to be elevated one foot or more above finished grade.

**Resiliency Impact Statement:** This proposal will increase Resiliency
This proposal increases resiliency by reducing flood risk to buildings outside of designated flood hazard areas and adding additional requirements for elevations adjacent to higher grade unfinished surfaces.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: B1804.8-18

This proposal doesn't have any public comments.

Proposal # 353

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## B1804.8-18 Highest Adjacent Grade Definition

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region II; Terrazia; AIA Virginia

**Comments:**

- Mr. Payne of AIA Virginia lends context to this proposal.
- Mr. Wallace labels the language as "extremely arbitrary" - could render a lot of properties "un-buildable". Brings up issues with grades, with age-in-place facilities, ADA-accessible structures, and how these would be affected.
- Ms. Quinn clarifies the levels of planes that would be required to remain in compliance.
- Homebuilders are opposed.

**Results:** Non-consensus

## Subworkgroup Summary

**B1804.8 – Approved As Amended**

**Mr. Shapiro said that 1804.8 should be changed to "AHJ" or "as approved" instead of engineer. Mr. Homewood questioned how this would work in cities that aren't as flat a Norfolk. Mr. Homewood argued for banning slab on grade adjacent to roads and suggested we should promote raised slab construction in these regions. Mr. Payne asked if this would supersede the change to BFE+2 from above.**

**Mrs. Quinn explained how it would work like the rest of the code where the higher standard takes precedent. The group argued that this provision should not be tied to an adjacent road and should instead be structured to the "highest adjacent grade unless otherwise approved." The group agreed to strike the new definition and Mr. Shapiro said that ASCE 24 has a definition for "highest adjacent grade" that we can reference or pull into our code.**

Decided at the June 30, 2020 Workgroup Meeting

# ERB101-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Energy Conservation Code

**Revise as follows:**

**R407.2 Zero Energy and Zero Energy Ready Construction** Any new single family, townhouse or multifamily residential construction that is advertised or otherwise held out to the public, including potential buyers, as being "Zero Energy" or "Zero Net Energy" or "Zero Energy Ready" or "Zero Net Energy Ready" or equivalent phrases, shall satisfy the standards set forth in Appendix RB (IRC Appendix Q).

**Add new text as follows:**

**Appendix RB (IRC Appendix Q) Zero Energy Residential Building Standards RB101 Applicability.**

This appendix is mandatory for all new single family, townhouse or multifamily residential construction that is advertised or otherwise held out to the public, including potential buyers, as being "Zero Energy" or "Zero Net Energy" or "Zero Energy Ready" or "Zero Net Energy Ready" or equivalent phrases, and that does not expressly identify as the basis for its design and construction an established alternative system of building standards, such as Passive House, which sets standards for zero energy or zero net energy housing. The objective is a dwelling that is highly efficient and supplies all its energy needs with zero carbon energy.

**RB 102 Zero Energy Residential Buildings** To qualify as a Zero Energy or Net Zero Energy residential building, the following criteria for energy efficiency and qualfiying energy must be met:

1. the rated design must be shown to have the values in Table RB102 when compared to the ERI reference design determined in accordance with RESNET/ICC 301 for each of the following:
   a. ERI value not including net onsite or other power production (Column 1) calculated in accordance with RESNET/ICC 301, and
   b. ERI value including qualifying net onsite energy production (Column 2) calculated in accordance with RESNET/ICC 301; and

2. the building must meet the mandatory requirements of Section 406.2 in the 2018 International Energy Conservation Code (IECC); its thermal envelope must have a thermal efficiency that meets or exceeds the levels of efficiency and SHGC required by the 2018 IECC; and its onsite energy supply must be electricity or solar thermal without onsite combustion.

**Table RB 102 (IRC AQ 102.2) MAXIMUM ENERGY RATING INDEX**

| (1) Energy Rating Index not including onsite power | (2) Energy Rating Index including onsite power |
|---|---|
| 47 | 0 |

**Revise as follows:**

**RB 103 Zero Energy Ready** In order to qualify as "Zero Energy Ready" or "Zero Net Energy Ready", a residential building must (a) satisfy all the requirements of RB 102 except for having insufficient Onsite Power Production to achieve 0 of Column 2 of Table RB 102, (b) meet the 2018 IECC standards to be "Solar Ready" to meet the building energy needs (IECC Appendices CA and RA), and (c) provide documentation demonstrating that the building has sufficient "Solar Ready" space and sunlight to achieve an ERI of zero in Column 2 of Table RB102 if the potential solar facilities were installed.

**Reason Statement:** The purpose of this new section and Appendix is to encourage builders to construct "Zero Energy" (sometimes called "Zero Net Energy") dwellings by establishing basic standards that can be understood by both builders and the public and that also achieve net zero carbon emissions. Clarity of standards may also encourage potential buyers to communicate their interest in a Zero Energy dwelling. It does not require any builder to construct Zero Energy housing, but if a builder chooses to do so and to claim that the result is a Zero Energy building, then this Appendix becomes mandatory. A building may be labeled "Zero Energy Ready" (of "Zero Net Energy Ready") if it meets the standards prescribed, including having Solar Ready construction and an initial long-term contract for a zero-carbon renewable energy source. A builder would be able to construct highly efficient buildings using other systems such as Passive House without making the zero energy claim. The proposal is modeled on language in the pending 2021 IECC.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
No builder is required to construct a Zero Energy residential building. However, if a builder chooses to do so, it must conform to the standards set forth in the proposed appendix. The standards provide clarity to builders and the public about what Zero Energy means. That clarity will help to assure buyers that they are getting what they are paying for and thereby encourage builders and buyers to pursue this option. The Energy Rating Index system provides flexibility to builders in how to achieve the ambitious goals. The Zero Energy Ready option is designed to move toward the goals through a combination of high energy efficiency and solar-readiness, empowering the buyer to achieve zero-energy levels by adding onsite

zero-carbon renewable energy.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Zero Energy buildings will greatly increase resiliency by (a) eliminating carbon emissions, (b) saving energy and energy costs, (c) providing highly efficient housing that will preserve comfort during periods of outages, (d) incorporating clean, on-site energy production that can support overall energy reliability, and (e) reducing risks of defaulting on mortgages and utility bills. Zero Energy Ready buildings will also benefit the welfare of all Virginians by saving energy with highly efficient construction and reducing overall carbon emissions and other pollutants.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: ERB101-18

**Discussion by Kenney Payne**
Aug 4, 2020 12:54 UTC

While AIA VA is taking a NEUTRAL position on the proposal itself, we do believe that if it were to be approved by the BHCD we believe in code language that is understandable and enforceable. This proposal has numerous language that fails those tests, in our opinion - our comments are in *italics*:

- Any new single family, townhouse or multifamily residential construction that is advertised or otherwise held out to the public, including potential buyers, as being "Zero Energy" or "Zero Net Energy" or "Zero Energy Ready" or "Zero Net Energy Ready" or equivalent phrases, shall satisfy the standards set forth in Appendix RB (IRC Appendix Q).
  - *How does one enforce "advertised?" Must code enforcement officials now read every builder's marketing brochures?*
  - *Terms like"including" are vague and creates a potential for a non-uniform application of the codes - whereas Virginia is a UNIFORM statewide building code. Also, how does one enforce for "potential" buyers - couldn't that be every citizen of Virginia?*
  - *Why an appendix and not in the body of the VRC?*
- RB101 Applicability. This appendix is mandatory for all new single family, townhouse or multifamily residential construction that is advertised or otherwise held out to the public, including potential buyers, as being "Zero Energy" or "Zero Net Energy" or "Zero Energy Ready" or "Zero Net Energy Ready" or equivalent phrases, and that does not expressly identify as the basis for its design and construction an established alternative system of building standards, such as Passive House, which sets standards for zero energy or zero net energy housing. The objective is a dwelling that is highly efficient and supplies all its energy needs with zero carbon energy.RB 102 Zero Energy Residential Buildings.
  - *Refer to our comments above for the terms "advertised" and "potential."*
  - *How doe sone "expressly' identify something vs. just identifying something?*
  - *Terms like "such as" are vague and actually serves no purpose from an enforcement standpoint.*
  - *The code usually avoids promoting a certain "brand" and tries to utilize as many published, adopted, and accepted standards or regulations. "Passive House" is a concept - not a code, regulation, or recognized standard.*
  - *Codes should not be in the business of establishing "objectives" but "requirements." The term objective is similar to "intent" in this context.*
  - *Code-wise what is the difference between "efficient" and "highly efficient?" If just efficient, it fails?*
- To qualify as a Zero Energy or Net Zero Energy residential building, the following criteria for energy efficiency and qualfiying energy must be met:
- 1. the rated design must be shown to have the values in Table RB102 when compared to the ERI reference design determined in accordance with RESNET/ICC 301 for each of the following:
- a. ERI value not including net onsite or other power production (Column 1) calculated in accordance with RESNET/ICC 301, and
- b. ERI value including qualifying net onsite energy production (Column 2) calculated in accordance with RESNET/ICC 301; and
- 2. the building must meet the mandatory requirements of Section 406.2 in the 2018 International Energy Conservation Code (IECC); its thermal envelope must have a thermal efficiency that meets or exceeds the levels of efficiency and SHGC required by the 2018 IECC; and its onsite energy supply must be electricity or solar thermal without onsite combustion.
  - *Typo on "qualifying"*
  - *The term "must" should be "shall"*

- *The code doe snot define the year edition at every reference - it just refers to that particular iCode and the year is handled in Chapter 1.*
- *The phrase "meets or exceeds" is unnecessary - just say "complies with"*

- RB 103 Zero Energy Ready. In order to qualify as "Zero Energy Ready" or "Zero Net Energy Ready", a residential building must (a) satisfy all the requirements of RB 102 except for having insufficient Onsite Power Production to achieve 0 of Column 2 of Table RB 102, (b) meet the 2018 IECC standards to be "Solar Ready" to meet the building energy needs (IECC Appendices CA and RA), and (c) provide documentation demonstrating that the building has sufficient "Solar Ready" space and sunlight to achieve an ERI of zero in Column 2 of Table RB102 if the potential solar facilities were installed.
  - *Refer above for comments addressing the use of "must" and "2018"*
  - *The codes should avoid the use of terms like "potential" and "were" - it implies a future design that would nearly impossible to enforce since no one knows the future. Just say provide X and Y - with the understanding that X and Y will ultimately accommodate whatever future installations are required or will be provided.*

**Comment by William Penniman**
Aug 10, 2020 18:55 UTC

I would be willing to work with the DHCD staff and others if the language can be improved. However, I respond to the comments as follows:

· If the staff or commenter would prefer that the details be incorporated into the main body, rather than an appendix, I would not object. My understanding is that mandatory language in the text of Virginia USBC can incorporate an Appendix, which is what this proposal does.

· I agree that typos should be corrected. Also, the words “must” and “shall” have similar meanings and I have no objection to substituting “shall” unless the context dictates otherwise.

· Zero-energy construction is important and should be encouraged by, at least, providing clear standards for the meaning of the label in order to protect consumers. Rather than mandating zero-energy construction, the proposed code provision is designed to prevent false or misleading claims about the energy efficiency of a new dwelling. Both buyers and sellers can have a clear understanding of the meaning of the terms.

· The provision can be enforced through a simple question in the permit application: is the building to be marketed or sold as “zero-energy” or “zero-energy-ready” or “net-zero-energy” or “net-zero-energy ready” or equivalent terms? If the answer is yes, then the builder will need to provide documentation supporting compliance with ERI and solar-related standards set forth in the section. The builder would be in violation of its permit application and resulting permit if it answered “no” but later attempted to sell the dwelling as “zero-energy” etc.

· There is nothing vague about the phrase “advertised or otherwise held out to the public, including potential buyers”. It clearly captures both statements to the general public and to individuals who might buy the structure.

· Referencing the 2018 IECC was intended to assure that the building envelope meets at least those standards even if opponents of envelope efficiency standards succeed in watering down the envelope efficiency requirements in Virginia. I have no objection to spelling out the specific standards or substituting the phrase “the current IECC” for “2018 IECC” in order to anticipate the evolution of the code. The point is to assure that achieving the specified ERI score is accomplished with fundamental structural measures, not just appliances that may be replaced at a future date.

The proposal is modeled on a zero-energy appendix RB that is being considered in the 2021 IECC process. It has been modified to make it easier for builders to meet the standards, including by adding a “zero-energy ready” option. The proposal does not prohibit marketing other highly efficient energy models as long as they are expressly identified to buyers and not by a vague zero-energy claim that is not expressly supported by this section or a recognized above-code program. I thought that such flexibility would be appreciated, but it can be removed if desired.

Proposal # 453

## Workgroup 3
## ERB101 - Zero energy building standards appendix

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club

**Comments:**

- Ms. Shutler of Virginia Grassroots Coalition is in support, but believes there should be mandatory language for what constitutes as "zero energy."
- Ms. Loving (CAAV) is in support
- Mr. Shearer (representing himself) is in support.
- Mr. Beahm representing himself, opposes on the grounds that this does not need to be brought in until 2021.
- Mr. Payne of AIA Virginia wonders why this is in the appendix and not the BODY of the code.
- Mr. Clark of HBAV is opposed.
- Mr. Lacey of RECA speaks in support, in that it may be helpful for consumers and builders.
- Mr. Clements of Chesterfield County opposes, based on lack of enforceability.

**Results:** Non-Consensus

## Combined Workgroup
## ERB101 Net Zero Energy Appendix

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)

**Summation of Proposal:** This provides an appendix to encourage builders to construct "Zero Energy" dwellings by establishing basic standards.

**Comments:**

- Mr. Bikoff (VA Democracy Forward) supports.
- Mr. Willham (Fairfax County) supports RE407.1.1-18
- Susan Stillman is in support of the zero net energy proposal. This is for consumer protection.
- Ms. Najarian supports this on behalf of VA Democracy Forward and as an individual. Standardizing terminology puts transparency into the process for owners. Always critical in the buying and selling process.
- Ms. Lang supports on behalf of myself.
- Ms. Eggerton (City of Alexandria) supports this definition and criteria net zero proposal and assures consistent metrics according to the standards as improved efficiency options that align with adopted Environmental Action Plan 2040
- Ms. Shutler is in support. This does not require builders to construct buildings with these requirements, but they can choose to implement if they wish.
- Mr. Shearer is in support. He mentions that this proposal is crucial to consumer protection.
- Mr. Witt opposes ERB101-18, because code officials are not in the business of verifying marketing terms as it is not a code regulatory issue
- Mr. Clark (Home Builders Association of VA) is opposed to this measure - is there a Virginia-specific issue? Are there reports of builders using this marketing term?
- Ms. Nawaz supports this proposal. Clarifying the language of what is meant by "zero energy" or "net zero energy". The definition has evolved over time (NREL has publications on this) and clarity allows all parties involved in a home transaction to be clear on expectations. Standardization doesn't raise costs, just helps participants.
- Mr. Beahm agrees with Mr. Witt.

**Results:** Non-consensus

# E404.2-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Energy Conservation Code

**Add new text as follows:**

**R404.2 Solar-Ready Zone (Mandatory).** New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m2) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Sections R404.2.1 through R404.2.7.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.

2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

**R404.2.1 Construction document requirements for solar-ready zone.** Construction documents shall indicate the solar-ready zone.

**R404.2.2 Solar-ready zone area.** The total solar-ready zone area shall be not less than 300 square feet (27.87 m2) exclusive of mandatory access or set back areas as required by the International Fire Code. New townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m2). The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m2) exclusive of access or set back areas as required by the International Fire Code.

**404.2.3 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

**404.2.4 Roof load documentation.** The structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

**R404.2.5 Interconnection pathway.** Construction documents shall indicate pathways for routing of conduit or plumbing from the solar-ready zone to the electrical service panel or service hot water system.

**R404.2.6 Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled “For Future Solar Electric.” The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

**R404.2.7 Construction documentation certificate.** A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

### CHAPTER 2 [RE]
### DEFINITIONS

**Revise as follows:**

**SECTION R201 GENERAL**

**SOLAR-READY ZONE.** A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

## 2015 Virginia Residential Code

**Add new text as follows:**

**N1104.2 Solar-Ready Zone (Mandatory)** New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m2) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Sections N1104.2.1 through N1104.2.7.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.

2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

**N1104.2.1 Construction document requirements for solar-ready zone.** Construction documents shall indicate the solar-ready zone.

**N1104.2.2 Solar-ready zone area.** The total solar-ready zone area shall be not less than 300 square feet (27.87 m2) exclusive of mandatory access or set back areas as required by the International Fire Code. New townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m2). The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m2) exclusive of access or set back areas as required by the International Fire Code.

**N1104.2.3 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

**N1102.2.4 Roof load documentation.** The structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

**N1102.2.5 Interconnection pathway.** Construction documents shall indicate pathways for routing of conduit or plumbing from the solar-ready zone to the electrical service panel or service hot water system.

**N1102.2.6 Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled “For Future Solar Electric.” The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

## CHAPTER 2
## DEFINITIONS

**Add new text as follows:**

**N1102.2.7 Construction documentation certificate.** A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

**Revise as follows:**

**SECTION R201 GENERAL**

**SOLAR-READY ZONE.** A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

# 2015 Virginia Energy Conservation Code

**Add new text as follows:**

**C405.10 Solar-Ready Zone (Mandatory).** A solar-ready zone shall be located on the roof of buildings that are five stories or less in height above grade plane, and are oriented between 110 degrees and 270 degrees of true north or have low-slope roofs. Solar-ready zones shall comply with Sections C405.10.1 through C405.10.7.

Exceptions:

1. A building with a permanently installed, on-site renewable energy system.

2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

3. A building where the licensed design professional certifies that the incident solar radiation available to the building is not suitable for a solar-ready zone.

4. A building where the licensed design professional certifies that the solar zone area required by Section C405.10.2 cannot be met because of extensive rooftop equipment, skylights, vegetative roof areas or other obstructions.

**C405.10.1 Construction document requirements for a solar-ready zone.** Construction documents shall indicate the solar-ready zone.

**C405.10.2 Solar-ready zone area.** The total solar-ready zone area shall be not less than 40 percent of the roof area calculated as the horizontally projected gross roof area less the area covered by skylights, occupied roof decks, vegetative roof areas and mandatory access or set back areas as required by the International Fire Code. The solar-ready zone shall be a single area or smaller, separated sub-zone areas. Each sub-zone shall be not less than 5 feet (1524 mm) in width in the narrowest dimension.

**C405.10.3 Obstructions.** Solar-ready zones shall be free from obstructions, including pipes, vents, ducts, HVAC equipment, skylights and roof-mounted equipment.

**C405.10.4 Roof loads and documentation.** A collateral dead load of not less than 5 pounds per square foot (5 psf) (24.41 kg/m2) shall be included in the gravity and lateral design calculations for the solar-ready zone. The structural design loads for roof dead load and roof live load shall be indicated on the construction documents.

**C405.10.5 Interconnection pathway.** Construction documents shall indicate pathways for routing of conduit or piping from the solar-ready zone to the electrical service panel or service hot water system.

**C405.10.6 Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric installation and shall be labeled “For Future Solar Electric.” The reserved space shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

## CHAPTER 2 [CE]
## DEFINITIONS

**Add new text as follows:**

**C405.10.7 Construction documentation certificate.** A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

**Revise as follows:**

**SECTION C202 GENERAL DEFINITIONS**

**SOLAR-READY ZONE** . A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

**Reason Statement:** Distributed solar energy production, including rooftop solar energy production, is important to reducing carbon emissions which are the primary driver of climate change that is increasingly threatening the health, safety and welfare. Rooftop solar energy production will also reduce occupants' utility bills by reducing the quantity of energy they need to purchase for heating, lighting and other purposes. Further, this distributed generation will reduce the quantity of energy that utilities need to generate or sell and the line losses that would result from transmitting energy to markets from central power stations.
These proposed provisions are designed to require builders to make new buildings "solar ready", subject to certain limited exceptions. They do not require builders to install solar, but enable buyers to arrange to install solar generating or water heating if they choose to do so in the future. It will also lower the cost of adding solar at a later date. The proposal is based up on the Solar Ready appendix in the IECC.

**Cost Impact:** The code change proposal will increase the cost of construction
Modest cost increases will result from requiring solar readiness for buildings subject to the provisions. However, the costs should be limited and they will reduce the costs of adding solar in the future. The proposal requires creating a path for electrical or water lines from rooftop facilities. Some roof strengthening might be required, but adequate roof strength will probably result from normal construction since solar is often added to roofs even today. Requirements pertaining to the solar area will require some planning, but may reduce or increase actual construction costs.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Distributed energy generation will increase resiliency by supplementing utility generation with locally generated electricity which would potentially be available in the event of power outages in other parts of the utility's system. Rooftop solar can also help to support local "microgrids" that planners foresee developing in the future to help keep power flowing locally in the event of outages.

Rooftop solar water heating will be available regardless of power outages affecting a utility.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: E404.2-18

**Discussion by Kenney Payne**
Aug 4, 2020 13:26 UTC

R404.2.2: Is this language copied from a recognized standard or code? If not, how were the numbers determined?

R404.2.3: Missing the 'R'. Also, codes should not use terms or phrases such as "but not limited to"

R404.2.4: Missing the 'R'.

R404.2.5: When using the term "or", it can be interpreted that once I comply with one, I do not need to comply with the other. So, once I provide the pathway for say, "plumbing" I am done and can forget about the "conduit." Is that your intention? If not, consider using "and" or "both, as applicable."

R404.2.6: The code should avoid using terms such as "future." If you want a spare - just require the spare and the label. You can delete "for future solar electric installation" as the label requirement achieves the same result.

Definition: Terms like "future" are problematic and should be avoided in code. Could you just delete "the future installation of" and achieve the same result?

**Comment by William Penniman**
Aug 10, 2020 17:24 UTC

This solar readiness proposal is designed to prepare housing for solar energy where reasonably possible. Obviously, I agree to fix my typographical errors of the missing “R”.

The language is drawn from the Appendix RA of the 2018 IECC. https://codes.iccsafe.org/content/iecc2018/appendix-ra-solar-ready-provisions-detached-one-and-two-family-dwellings-and-townhouses

Appendix RA states that these provisions shall be applicable where solar-ready provisions are required. Accordingly, this proposal would make the provisions mandatory in Virginia for housing meeting the criteria in R404.2. This would serve the health and welfare of residents of the Commonwealth--both the dwelling occupants and the public generally.

Regarding the question concerning R404.2.5, both pathways should be installed and identified in the construction documents, which would allow the owner to choose use either or both at a later time. An extra conduit would not add significantly to the construction costs when a building is being constructed and walls are open. That would increase the owner’s options. At a minimum, a builder claiming “Zero-Energy Ready” or “Net-Zero Energy Ready” should be required to install the path to the electric panel. Use of the word “future” is appropriate since the point is to empower the owner to add solar energy easily at a later time.

Proposal # 468

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## E404.2 Solar readiness

**Proponent(s):** William Penniman (Sierra Club), wpenniman@aol.com

**Summation of Proposal:** This proposal specifies a requirement for rooftops to be overbuilt in preparation for installation of solar panels, but does not mandate the installation of solar panels. The proposal has exceptions for when solar panels would be ineffective and therefore does not require overbuilding of the roof.

**Comments:**

- Mr. Penniman provides context for all the energy proposals, including this one.
- Ms. Nawaz is in support - she discusses how she hopes homeowners of all means will be able to install solar, and if not, figure out why.
- Ms. Loving (CAAV) is in support. She mentions the urgency for Virginia to adopt these energy-efficient measures.
- Ms. Hoekstra is in support - that it is great to have a backup energy source.
- Ms. Stillman (Sierra Club) is in support; she claims it will indeed be a cost-saving measure.
- Mr. Clark (Virginia Homebuilders' Association) is opposed; he acknowledges that solar would be good for the environment, but the upfront costs provide issues.
- Mr. Beahm (self) is opposed to the change. He believes this should be up to the homeowner, not something that is forced upon them through regulation.
- Bryan Holland (NEMA) fully endorses and supports Proposal E404.2-18 as a means to further improve the effective use and conservation of energy on dwellings.
- Ms. Main (self) is in support.
- Ms. Najarian (Virginia Democracy Forward) is in support. She mentions that there is real consumer demand for residential solar energy, especially among younger homeowners/homebuyers.
- Mr. Pharr (AOBA/VAMA) mentions that whatever expenditures there are could also be irrelevant if the solar isn't being used.
- Mr. Witt suggests making this a non-mandatory appendix.
- Mr. Goplerud mentions that this is focused on residential structures only, not commercial.
- Ms. Namaz mentions that nobody is discussing the cost-savings measures that occur over the lifetime of solar panels. She suggests postponing this proposal for later consideration so that we can take a closer look at the numeric breakdown.
- Mr. Pharr describes how the construction code outlines "5 stories or less". He mentions how some localities use incentives as opposed to mandates to increase the chances that consumers will adopt solar.
- Mr. Beahm claims that oftentimes consumers are literally saving every dollar, so even if a $100 figure may be objectively low for some, it could still be cost-prohibitive for others, especially those who are trying to buy their first homes.
- Ms. Nawaz maintains that there is documentation to suggest that the costs are not slated to be prohibitive.
- Mr. Witt questions who is going to verify the solar readiness: how would this be enforced?
- Mr. O'Connor represents Virginia-based businesses in the propane and heating oil industries. Any equipment they install in a residence is self funded not the result of a state subsidy or mandate. He opposes this process as it puts the governments' foot on the scale for one supplier of home energy while discriminating against others.

**Results:** Non-consensus

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# E405.10-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Energy Conservation Code

**Revise as follows:**

**SECTION C202 GENERAL DEFINITIONS**

**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

**EV CAPABLE SPACE.** Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the EVSE.

**EV READY SPACE** . A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an EVSE, and be located in close proximity to the proposed location of the EV parking spaces.

**Add new text as follows:**

**C405.10 Electric Vehicle (EV) charging for new construction.** New construction shall facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the NFPA 70.

**C405.10.1 New commercial buildings.** EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table C405.10.1. Where the calculation of percent served results in a fractional parking space, it shall be shall rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as “EV Capable” or “EV Ready”. The raceway location shall be permanently and visibly marked as “EV Capable”.

**C405.10.2 Identification.** Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

**Table C405.10.1 EV Ready Space and EV Capable Space Requirements**

**TABLE C405.10.1.**
**EV READY SPACE AND EV CAPABLE SPACE REQUIREMENTS**

| Total Number of Parking Spaces | Minimum number of EV Ready Spaces | Minimum number of EV Capable Spaces |
|---|---|---|
| 1 | 1 | - |
| 2 – 10 | 2 | - |
| 11 – 15 | 2 | 3 |
| 16 – 19 | 2 | 4 |
| 21 - 25 | 2 | 5 |
| 26+ | 2 | 20% of total parking spaces |

**Revise as follows:**

**SECTION R202 GENERAL DEFINITIONS**

**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

**EV CAPABLE SPACE.** Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the EVSE.

**EV READY SPACE.** A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an EVSE, and be located in close proximity to the proposed location of the EV parking spaces.

**Add new text as follows:**

**R404.2 (N1104.2) Electric Vehicle (EV) charging for new construction.** New construction shall facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70).

**R404.2.1 (N1104.2.1) One- and two-family dwellings and townhouses.** For each dwelling unit, provide at least one EV Ready Space. The branch circuit shall be identified as "EV Ready" in the service panel or subpanel directory, and the termination location shall be marked as "EV Ready".

**Exception:** EV Ready Spaces are not required where no parking spaces are provided.

**R404.2.2 (N1104.2.2) Multifamily dwellings (three or more units).** EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table R404.2.2. Where the calculation of percent served results in a fractional parking space, it shall round up to the next whole number. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

**R404.2.3 (N1104.2.3) Identification** Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

**Table R404.2.2 EV Ready Space and EV Capable Space Requirements.**

**Table R404.2.2 (IRC N1104.2.2)**
**EV Ready Space and EV Capable Space requirements.**

| Total Number of Parking Spaces | Minimum number of EV Ready Spaces | Minimum number of EV Capable Spaces |
|---|---|---|
| 1 | 1 | - |
| 2 – 10 | 2 | - |
| 11 – 15 | 2 | 3 |
| 16 – 19 | 2 | 4 |
| 21 - 25 | 2 | 5 |
| 26+ | 2 | 20% of total parking spaces |

## 2015 Virginia Residential Code

**Revise as follows:**

**SECTION R202 DEFINITIONS**

**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

**EV CAPABLE SPACE.** Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the EVSE.

**EV READY SPACE.** A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an EVSE, and be located in close proximity to the proposed location of the EV parking spaces.

**Add new text as follows:**

**N1104.2 Electric Vehicle (EV) charging for new construction.** New construction shall facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70).

**N1104.2.1 One- and two-family dwellings and townhouses.** For each dwelling unit, provide at least one EV Ready Space. The branch circuit shall be identified as "EV Ready" in the service panel or subpanel directory, and the termination location shall be marked as "EV Ready".

**Exception:** EV Ready Spaces are not required where no parking spaces are provided.

**N1104.2.2 Multifamily dwellings (three or more units).** EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table R404.2.2. Where the calculation of percent served results in a fractional parking space, it shall round up to the next whole number. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

**N1104.2.3 Identification.** Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

**Table N1104.2.2 EV Ready Space and EV Capable Space Requirements.**

**Table N1104.2.2**
**EV Ready Space and EV Capable Space requirements.**

| Total Number of Parking Spaces | Minimum number of EV Ready Spaces | Minimum number of EV Capable Spaces |
|---|---|---|
| 1 | 1 | - |
| 2 – 10 | 2 | - |
| 11 – 15 | 2 | 3 |
| 16 – 19 | 2 | 4 |
| 21 - 25 | 2 | 5 |
| 26+ | 2 | 20% of total parking spaces |

**Reason Statement:** This proposal is modeled on a provision we expect will be the 2021 IECC. Electric vehicles (EVs) are growing in importance and will continue to grow in importance as climate risks compel shifting to vehicles that do not emit pollution. Vehicles are Virginia's largest source of carbon-dioxide emissions from fossil fuel combustion.[1] Even based on today's mix of generation in Virginia, DOE estimates that EVs would reduce CO2 emissions by roughly two-thirds compared to vehicles combusting gasoline.[2] Emissions from generation that supplies EVs will decline more as utilities' zero-carbon renewable energy replaces fossil-fuel generation. EVs' direct emissions are non-existent, which also has health and pollution benefits compared to gasoline or diesel vehicles. Furthermore, in addition to the EV user's savings on annual operating costs (energy and maintenance), EV charging during off-peak periods can lead to a reduction of electric rates to all utility customers.[3]
Forecasts of EV growth are substantial over the next 10 years and beyond and major vehicle manufacturers have committed to expanding their production of EVs. The Edison Electric Industry estimates that more than 20% of new vehicle sales will be EVs by 2030, and other estimates go as high as 33% by 2030.[4]
At-home charging in conjunction with single or multifamily parking is particularly important to meeting the needs of EV owners and to encourage charging during utilities' off-peak periods.[5] The capability for at-home charging will substantially reduce barriers to EV adoption that arise from the inconveniences that EV charging is slower than pumping gasoline, the public infrastructure for charging is still limited, and drivers have limited ability to take advantage of off-peak rates without home-charging. Going forward, utilities may get the added benefit of being able to draw on the batteries of parked electric vehicles in order meet peak demands and balance fluctuating loads.

Experience shows that installing a simple 220V/40 Ampere outlet (comparable to a dryer outlet) for "Level 2" EV charging, in a garage or outside close to parking spaces (e.g., on a wall near a single family driveway), will enable an EV owner to reliably charge an EV at home, scheduling it at night or otherwise outside the utilities peak demand period for the lowest rates. The presence of the wiring from the beginning would permit low-cost installation of a different charging system preferred by the EV owner. In the case of commercial and large multifamily construction, the proposal requires 2 initial EV Ready spaces and the infrastructure (panel space and raceways) to reach up to 20% of parking spaces as demand arises. That infrastructure will save money as growing EV needs are met.

[1] https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf
[2] DOE estimates that an EV in Virginia emits (via electric generation) less than a third as much CO2 as a gasoline-driven vehicle. https://afdc.energy.gov/vehicles/electric_emissions.html ; https://evtool.ucsusa.org/

[3] See June 23 Comments of the Sierra Club to the State Corporation Commission in SCC Docket PUR-2020-00051, Electrification of Motor Vehicles. As the comments explain, with managed off-peak charging and efficient rate structures, rising EV loads can drive down rates to all customers. Regarding operating costs, an EV has very little maintenance costs and EV's electricity cost equivalent to a gallon of gasoline, in Virginia, was $1.16 versus $1.96 for gasoline earlier this year. https://www.energy.gov/maps/egallon
[4] https://www.edisonfoundation.net/-/media/Files/IEI/publications/IEI_EEI-EV-Forecast-Report_Nov2018.ashx ; June 23 Comments of the Sierra Club, See June 23 Comments of the Sierra Club to the State Corporation Commission in SCC Docket PUR-2020-00051, supra. That statement of reasons accompanying the Proposal in the 2021 IECC process also documented the large increases projected for the number of EVs expected to be on the road, rising nationally from 1 million at the end of 2018 to 18.7 million by 2030. Every major carmaker has announced plans for significant EV production increases over then next 5 years.

[5] Utilities' energy sales are lowest and cheapest in off-peak hours, particularly at night. A common utility strategy is to offer time-of-use rates with low night-time prices to encourage off-peak EV charging. For EV customers to make use of such incentives, they will need access to overnight charging at home where they spend the night.

**Cost Impact:** The code change proposal will increase the cost of construction
The incremental cost of installing the electric equipment will be low when a residence is constructed. It is easy to install the wires, panel capacity and conduits for electric vehicle charging--along with the rest of a dwelling's wiring--when a single or multifamily dwelling is built. It is much harder and much more expensive to do so as a retrofit.

In a single family garage or carport, for example, wires would need to be run from the circuit breaker, which is simple when other outlets are being installed during construction. However, as a retrofit, this basic wiring could require much higher costs from complicated feeding of a line and possible wall damage.

In a large multifamily building the cost would be greater than a single-family dwelling due the larger garage or parking lot size and possibly their

design. However, the costs of the infrastructure required by the proposal are still low compared to the overall building, to potential retrofit costs, and to harm from impeding tenants ability to reduce carbon and other pollutants while enjoying EV's lower operating costs. The proposed requirements are staged to begin with 2 EV Ready Spaces and the infrastructure (panel capacity and raceways) for 20% of parking spaces, so that the remaining electrical costs would only be incurred as occupant need grows. In submissions to the IECC as part of the 2021 IECC review process, data indicated that the cost of retrofitting commercial parking to EV ready status would be 3-8 times higher than doing to work at the time of building construction. See IECC Proposal CE217-19 Part 1(Cost Impact discussion). Such high retrofit costs will deter future retrofits and act as a barrier to EV access by residents of multifamily dwellings, potentially for decades.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Expanding EV utilization will enhance resiliency by reducing $CO_2$ and other harmful emissions from vehicles and from producing and delivering gasoline and diesel fuel for combustion in vehicles. This is important because those emissions compound the risks of climate change and adversely impact public health. As Virginia's electric grid shifts to zero-carbon generation, those emission reduction benefits will grow. Local air pollution harms caused by vehicle pollution will also be reduced which will particularly benefit high traffic areas, including low-income urban areas.

Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane associated with fossil fuel production and combustion). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that will worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage. Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution. Shifting to EVs is an important piece of the solution. Continuing to construct buildings that will not support use of clean EVs will make it harder to achieve climate goals, particularly since the buildings will likely remain in place for 70 years or more.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: E405.10-18

**Discussion by Kenney Payne**
Aug 4, 2020 13:58 UTC

Why is this in the building code? I believe the only other place for parking requirements is for accessibility. This should be a zoning issue.

However, if it were to move forward, please consider the following:

C405.10: Terms like "future" can be problematic from an enforcement standpoint. Also, by saying "new construction" that could be adding markerboards to one space or altering a bathroom to make it more accessible. Consider just saying something like: "Provide Electric Vehicle Supply Equipment (EVSE) in accordance with NFPA 70."

C405.10.1: Headings are not code - so the charging paragraph doesn't define that this provision is limited to commercial buildings. Has two "shall" in the 1st sentence - delete the 2nd one.

C405.10.2: Same comment as C405.10 above regarding the use of the term "future."

Same comments as above for the VECC residential and IRC provisions.
**Comment by William Penniman**
Sep 16, 2020 18:34 UTC

The building code contains requirements for electrical outlets in buildings, including garages and elsewhere and including with respect to locations and spacing. This is no different except that it addresses a new need for outlets.

**Comment by Kenney Payne**
Aug 20, 2020 21:41 UTC

Garages are either attached to a building, a building themselves, or a detached building - all which by their nature as being a building - would fall under the purview of the building code. We are talking about a painted stripe on the ground - that is not governed by the building code - except in the case of accessible parking and/or loading zones.

We opposed only on the grounds that we do not believe this should be in the building code. However, if it is determined that it does belong in the building code, then we still question the language and consideration should be given to revise it so it can be enforced.

**Comment by William Penniman**
Aug 10, 2020 19:11 UTC

I do not object to making wording changes that do not weaken the proposal. I would be happy to work with Mr. Payne or the DHCD staff if wording changes are needed.

Substantively, there is nothing strange about incorporating this proposal into the building code. Garage construction, garage electrical outlets, outdoor electrical outlets and handicapped parking, for example, are already the subject of the building code.

Building codes are supposed to evolve as technology and public needs evolve. Virginia's government is actively trying to expand charging availability for electric vehicles both because EVs reduce health and climate harms resulting from fossil fuel combustion and because EVs save owners money in "fuel" and maintenance – hundreds of dollars per year. EV demand is growing and EV prices are falling so that new EVs are expected to be as cheap or cheaper than gasoline cars between 2023 and 2025. Already, some are cheaper than the average gasoline vehicle sold in Virginia.

A major barrier is availability of adequate charging facilities, including at-home charging that can conveniently occur at night, during utilities' low-cost, off-peak periods. Off-peak charging will help utilities and hold down rates for all utility customers.

This proposal is important to advancing electric vehicle charging opportunities in a manner that will allow charging equipment and outlets to efficiently grow as user demand grows. Installing this infrastructure during construction is much cheaper than retrofitting, which can require reopening walls and creating electrical rooms. An electric circuit and outlet can be installed when building a new single-family garage for less than $100, but retrofits can be far more expensive. Failing to take these steps during the construction phase will lead to far higher costs and, thus, resistance by multi-family building owners to meet growing needs of tenants. That will delay pollution reductions and energy and cost savings, which would harm the health, safety and welfare of residents of the Commonwealth.

I am skeptical that the measure can be addressed as a zoning matter, but local governments should certainly be informed if that is the case. Even if it were an option, it would be better to include this in the USBC so that it applies consistently throughout the state.

**Discussion by Andrew Clark**
Aug 13, 2020 16:26 UTC

The Home Builders Association of Virginia (HBAV) opposes this proposal. As the EV market has emerged, multi-family builders and developers have increasingly become more attracted to incorporating EV Ready Spaces and EV Capable Spaces into their projects because they have seen a demonstrated demand for those amenities in the market. This proposal seeks to require that all new developments incorporate those amenities, regardless of whether or not there is actual demand for them. The development community is incredibly responsive to emerging trends and technology in the marketplace – efforts to expand the use of electric vehicles and EV charging stations in new developments should focus on educating builders, developers, and design professionals about the emerging EV market and ways to incorporate the technology into the developments in a cost effective manner. Those type of educational efforts have been successful in several markets in Virginia.

This proposal also wades into local zoning ordinances by requiring a portion of a development's total parking spaces be designated for EV Ready and EV Capable parking spaces – with the exception of accessibility accommodations, those types of requirements are outside the scope of the code and are typically determined by local zoning ordinances and planning departments. To our knowledge, local government officials, VACO, and VML have not been consulted on the concept of having the building code mandate provisions of their zoning ordinances.

Code proposals cannot be based solely on the projected increase in the cost of construction - however, it is an important factor to consider. The proponent stated that this proposal would increased the cost of construction for multi-family structures. Multi-family structures are an important part of addressing the rental housing affordability crisis that exists in the Commonwealth - and although the proponent states that the increase cost of infrastructure required by this proposal are still low compared to the overall building, the cost of potential retrofit costs, and low compared to the "harm from impeding tenants ability to reduce carbon and other pollutants while enjoying EV's lower operating costs", it would inevitably increase the rents of the units within the building and create yet another barrier to entry for many individuals and families who are seeking affordable rental housing.

**Comment by William Penniman**
Sep 15, 2020 18:32 UTC

Electric Vehicles are growing in popularity and are critical to achieving the net-zero carbon emission goals embodied in the Virginia energy objectives and policies, which were enacted in 2020 and signed by the Governor. Owners will save money with the lower "fuel" and maintenance costs electric vehicles and EVs will reduce by 2/3 or more the carbon emission from gasoline-vehicles.

Unfortunately, charging takes more time than pumping gas and convenient overnight charging is critical to EV owners. Overnight charging will reduce costs of charging to owners and to utilities as compared to daytime charging. This has the potential to benefit all electricity customers and the public generally, not just the owner.

In parking supplied with single family dwellings (e.g., garage or carport), the proposal only requires the wiring and panel capacity to be in place for ONE EV charger. That would cost $50 or less if the panel is in the garage. If it were located elsewhere, one only needs to add the cost of additional wiring at approximately $1.50/foot (i.e.. $45 for 30 feet). The stated objection does quarrel with single family EV readiness.

In the case of multifamily, the proposal is also modest. It only requires TWO EV ready spaces plus raceways from the location of future electric panels to parking spaces equal to 20% of the provided parking. This is not very expensive during construction, and it is much cheaper to install when a garage is being constructed. Later retrofitting is likely to cost 3-8 times more according to information presented to the IECC. Contrary to the commenter's claim, this cannot be left to the market. I have spent several years on the Reston Planning and Zoning Committee reviewing proposed multifamily projects in Reston, Virginia. No builder has ever volunteered or agreed to install more capacity than for 2% of the spaces. The problem with that is that the cost of retrofitting is 3-8 times higher and will be a barrier to expansion of charging capacity as demand grows. If they won't do it when the cost is low, they are unlikely to do it later. That barrier will depress future EV ownership by multifamily residents. EV purchase costs are falling and expected to be less than gasoline vehicles in the next few years, and annual operating costs are already more than $500-$600 below gasoline vehicles based on data from DOE and Carnegie Mellon. EVs will benefit low-income and middle-income buyers provided they can get convenient charging. EVs will also benefit non-owners with lower pollution that harms the health of people living near roads.

Until residents acquire EVs, there will be no need to add more EV charging facilities. But when they do, this will make expansion of EV charging easy and inexpensive.

Proposal # 462

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## E405.10 Electric vehicle readiness

**Proponent(s):** William Penniman (Sierra Club), wpenniman@aol.com
**Summation of Proposal:** This proposal is anticipated to be in the 2021 IECC and includes provisions for additional installations of EV-charging stations and EV-Ready structures.

**Comments:**

- Mr. Penniman provides background, including cost-savings benefits for implementation.
- Ms. Hoekstra is in support due to the fact that climate change is doing irreversible harm to the environment.
- Ms. Loving (CAAV) is in support.
- Ms. Nawaz underscores the differences between electric vehicles and gasoline-powered vehicles, and the benefits of EV. She is in support.
- Bryan Holland (NEMA) fully supports Proposal E405.10 adding EV Capable and EV Ready requirements into the VECC.
- Ms. Stillman speaks to the benefits of installing EV charging stations upfront so that we don't have to retrofit later.
- Mr. Gerena (Drive Electric RVA) is in support and discusses how Virginia is already behind neighboring states and that we need to adopt more stringent carbon regulations.
- Maggie Kelley (SEEA) supports Proposal E405.10 - adding EV Capable and EV Ready requirements into the VECC, on the basis that this assists in creating a more energy-efficient Virginia.
- Mr. O'Connor brings up that this proposal means that consumers will have one choice of EV charging supplier- all of which are regulated monopolies with a guaranteed rate of return. He brings up how today, there are 4,236 stations selling gasoline in VA, and that consumers need more options, not fewer. He also mentions how, on July 1, Virginia increased its gasoline tax to 28. cents per gallon. Electric vehicles pay less than a tenth of that amount annualized but drive the same roads.
- Mr. Pharr - AOBA/VAMA are opposed due to the fact that there are no data to support the cost savings.
- Mr. Clark (HBAV - also representing Phil Abraham with the Virginia Association of Real Estate) still has concerns about this proposal, and is not in support, but that educating stakeholders and consumers to empower them to make these greener choices independently would be great instead of mandating the changes.
- Sharon Shutler (The Virginia Grassroots Coalition) supports this proposal.
- Annette Lang mentions that as a homeowner in an HOA, she has no options...
- Eric Goplerud (Faith Alliance for Climate Solutions) supports this proposal.
- Ivy Main (self) supports the EV proposal. Putting a plug in the parking area is cheap and easy when done during construction. There is no good reason not to do it.
- Charles Gerena (Drive Electric RVA) brings up, in response to comments on using incentives to encourage actions that benefit the environment rather than mandates, such incentives are far less effective if the built space prevents those actions from taking place. For example, a homeowner may want to install an EV charger, but she may be unable to do so because the panel box is one side of the house and the driveway is on the other side.
- Mr. Oberg compares the costs of retro-fitting versus folding in EV-readiness into a 30-year mortgage and strongly supports.
- Ms. Lang (representing herself) said that building in an EV charging station would be a huge incentive to buy an electric vehicle.
- Mr. Penniman supports.

**Results:** Non-consensus

## E405.10 - Electric Vehicle Charging Stations

Proponent(s): William Penniman (wpenniman@aol.com), Sierra Club

**Comments:**

- Mr. Abraham of Virginia Association of Commercial Real Estate is opposed based on language.
- Mr. Holland of NEMA is strongly in support based on efficiency, affordability, and consistency of standards across localities in the state. He notes there is support at the national level as well during the 2021 code adoption process.
- Mr. Banashek representing himself discusses how we could solve many issues with EV charging stations. He is in support.
- Ms. Tamres representing herself speaks out in strong support of this proposal.
- Mr. Gordon of AOBA is opposed on the grounds that the one-size-fits-all solutions don't really apply here. The data don't support this, and this would be more appropriate at the local level.
- Mr. Statzer of VBCOA supports.
- Ms. Eggerton of Alexandria is in support, pointing out that EV charging stations are part of a larger environmental impact plan.
- Ms. Kelley of Southeastern Energy Efficiency Alliance is in full support of this proposal.
- Mr. Clark of VBCOA disagrees with Mr. Penniman on the grounds that if code doesn't force developers to include charging stations for single-family homes, then they just won't do it. He has seen evidence to the contrary.
- Ms. Loving representing CAAV supports this proposal. As a consumer, she also speaks in support.

**Results:** Non-consensus

**Decided at the July 15, 2020 Workgroup 3 Meeting**
**and the August 11, 2020 Combined Workgroup Meeting**

# E1301.1.1.1-18

**Proponents:** Andrew Grigsby (grigsby.ac@gmail.com)

## 2015 Virginia Construction Code

**Delete without substitution:**

~~**1301.1.1.1 Changes to the IECC.** The following changes shall be made to the IECC:~~

1. ~~Change Table C402.4 to read:~~

**TABLE C402.4**

**BUILDING ENVELOPE REQUIREMENTS: FENESTRATION**

| CLIMATE ZONE | 1 | 2 | 3 | 4 EXCEPT MARINE | 5 AND MARINE 4 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Vertical fenestration** | | | | | | | | |
| ***U*-factor** | | | | | | | | |
| Fixed fenestration | 0.50 | 0.50 | 0.46 | 0.38 | 0.38 | 0.36 | 0.29 | 0.29 |
| Operable fenestration | 0.65 | 0.65 | 0.60 | 0.45 | 0.45 | 0.43 | 0.37 | 0.37 |
| Entrance doors | 1.10 | 0.83 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| **SHGC** | | | | | | | | |
| SHGC | 0.25 | 0.25 | 0.25 | 0.40 | 0.40 | 0.40 | 0.45 | 0.45 |
| **Skylights** | | | | | | | | |
| ***U*-factor** | 0.75 | 0.65 | 0.55 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| **SHGC** | 0.35 | 0.35 | 0.35 | 0.40 | 0.40 | 0.40 | NR | NR |

NR = No requirement.

2. Change Section C402.4.3 to read:

**C402.4.3 Maximum U-factor and SHGC.** The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$$PF = A/B \qquad \textbf{(Equation 4-5)}$$

where:

*PF* = Projection factor (decimal).

*A* = Distance measured horizontally from the furthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.

*B* = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.20, the required maximum SHGC from Table C402.4 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.4.3 corresponding with the orientation of the fenestration product and the projection factor.

3. Add Table C402.4.3 to read:

4. Add an exception to the first paragraph of Section C403.2.4.3 to read:

**Exception:** Any grease duct serving a Type I hood installed in accordance with Section 506.3 of the International Mechanical Code shall not be required to have a motorized or gravity damper.

5. Add Section C403.2.6.3 to read:

**C403.2.6.3 Dwelling unit mechanical ventilation.** Mechanical ventilation shall be provided for dwelling units in accordance with the *International Mechanical Code.*

6. Change Section C405.5 to read:

**C405.5 Exterior lighting (Mandatory).** All exterior lighting, other than low-voltage landscape lighting, shall comply with Section C405.5.1.

**Exception:** Where approved because of historical, safety, signage, or emergency considerations.

7. Change Section R401.2 to read:

**R401.2 Compliance.** Projects shall comply with all provisions of Chapter 4 labeled "Mandatory" and one of the following:

1. Sections R401 through R404.
2. Section R405.
3. Section R406.
4. The most recent version of REScheck, keyed to the 2015 *International Energy Conservation Code.*

**Note:** See REScheck compliance guidance issued by DHCD, available at the Department's website.

8. Delete Section R401.3.

9. Change the ceiling *R*-value and wood frame wall *R*-value categories for Climate Zone "4 exception Marine" in Table R402.1.2 to read:

| **CEILING *R*-VALUE** | **WOOD FRAME WALL *R*-VALUE** |
|---|---|
| 38 | 15 or 13+1[h] |

10. Change the ceiling *U*-factor and frame wall *U*-factor categories for Climate Zone "4 except Marine" in Table R402.1.4 to read:

| **CEILING *U*-VALUE** | **FRAME WALL *U*-VALUE** |
|---|---|
| 0.030 | 0.079 |

11. Change Section R402.2.4 to read:

**R402.2.4 Access hatches and doors.** Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated in accordance with the following values:

1. Hinged vertical doors shall have a minimum overall R-5 insulation value;
2. Hatches and scuttle hole covers shall be insulated to a level equivalent to the insulation on the surrounding surfaces; and
3. Pull down stairs shall have a minimum of 75 percent of the panel area having R-5 rigid insulation.

Access shall be provided to all equipment that prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed *R*-value of the loose fill insulation.

12. Change Sections R402.4 and R402.4.1.1 to read:

**R402.4 Air leakage.** The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

**R402.4.1.1 Installation (Mandatory).** The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the code official, an approved third party shall inspect all components and verify compliance.

13. Change the title of the "Insulation Installation Criteria" category of Table R402.4.1.1; change the "Shower/tub on exterior wall" category of Table R402.4.1.1, and add footnotes "b" and "c" to Table R402.4.1.1 to read:

| COMPONENT | AIR BARRIER CRITERIA | INSULATION INSTALLATION CRITERIA[b] |
|---|---|---|
| Shower/tub on exterior wall[c] | The air barrier installed at exterior wall adjacent to showers and tubs shall be installed on the interior side and separate the exterior walls from the showers ortubs. | Exterior walls adjacent to showers and tubs shall be insulated. |

b. Structural integrity of headers shall be in accordance with the applicable building code.

c. Air barriers used behind showers and tubs on exterior walls shall be of a permeable material that does not cause the entrapment of moisture in the stud cavity.

14. Change Section R402.4.1.2 and add Sections R402.4.1.2.1, R402.4.1.2.2, and R402.4.1.3 to read:

**R402.4.1.2 Air sealing.** Building envelope air tightness shall be demonstrated to comply with either Section R402.4.1.2.1 or R402.4.1.2.2.

**R402.4.1.2.1 Testing option.** The building or dwelling unit shall be tested for air leakage. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

During testing:

1. Exterior windows and doors and fireplace and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures;
2. Dampers, including exhaust, intake, makeup air, backdraft and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open;
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

**R402.4.1.2.2 Visual inspection option.** Building envelope tightness shall be considered acceptable when the items listed in Table R402.4.1.1, applicable to the method of construction, are field verified. Where required by the building official, an approved party, independent from the installer, shall inspect the air barrier.

**R402.4.1.3 Leakage rate (Prescriptive).** The building or dwelling unit shall have an air leakage rate not exceeding 5 changes per hour as verified in accordance with Section R402.4.1.2.

15. Change Section R403.3.3 to read:

**R403.3.3 Duct testing (Mandatory).** Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

**Exception:** A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. The licensed mechanical contractor installing the mechanical system shall be permitted to perform the duct testing. The contractor shall have been trained on the equipment used to perform the test.

16. Change Section R403.7 to read:

**R403.7 Equipment and appliance sizing.** Heating and cooling equipment and appliances shall be sized in accordance with ACCA Manual S or other approved sizing methodologies based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

**Exception:** Heating and cooling equipment and appliance sizing shall not be limited to the capacities determined in accordance with Manual S or other approved sizing methodologies where any of the following conditions apply:

1. The specified equipment or appliance utilizes multistage technology or variable refrigerant flow technology and the loads calculated in accordance with the approved heating and cooling methodology fall within the range of the manufacturer's published capacities for that equipment or appliance.
2. The specified equipment or appliance manufacturer's published capacities cannot satisfy both the total and sensible heat gains calculated in accordance with the approved heating and cooling methodology and the next larger standard size unit is specified.
3. The specified equipment or appliance is the lowest capacity unit available from the specified manufacturer.

~~17. Change Table R406.4 to read:~~

~~18. Delete Section R503.1.1.1.~~

**Reason Statement:** Virginia should adopt the 2018 International Energy Conservation Code (IECC) without alteration (viewable at https://codes.iccsafe.org/content/iecc2018). The many efficiency reducing amendments to the 2012 IECC that were adopted into the 2012 USBC should be eliminated. Those amendments increased costs for new homebuyers and Virginia as a whole. Researchers at US Dept. of Energy national labs found that, on average, implementing the provisions of the 2012 IECC would have been cash positive for new homebuyers from the first month of occupation, which has caused a drain on our economy and human well-being ever since. Virginia routinely adopts the full IECC for commercial buildings but made a fairly radical departure from the residential IECC during the 2012 code update cycle. We have gradually incorporated aspects of the 2012 IECC since then (note that the 2018 Residential IECC has only minor changes relative to the 2012), and now is the time to finish the job and take full advantage of smart efficiency techniques in new homes of all kinds.
Rigorous energy codes are a win for

- energy policy (costs, grid stability, predictability)
- environmental policy (global warming, resource use)
- the construction industry (increase value and quality of their product, more jobs)

- the mortgage industry (32% less risk of default (IMT/UNC report))
- local jobs (framing and insulating don't happen overseas, testing is new work, quality takes time)
- housing affordability (increases predictability of monthly costs and lowers total cost of housing)
- home buyers/renters of all kinds (comfort, savings, predictability, indoor air quality)

Besides, people want it. A 2013 survey by the National Association of Homebuilders reports that 9 out of 10 homebuyers are willing to pay 2-3% more for a home that includes permanent energy efficiency features.

More on energy and affordability: The Federal Bureau of Labor Statistics and the US Census Bureau report that energy costs for low-income families may represent 10 percent of household income – or more. Rigorous energy codes like the 2018 International Energy Conservation Code (IECC) benefit these families tremendously by helping to create homes with low and predictable energy costs. While it does take a little more up-front capital to build in the provisions of the 2018 IECC, the reduced operating costs more than offset those costs. This benefits low-income and working-class households particularly – as energy costs represent a greater percentage of their income than wealthier folks.

In 2015, the Virginia Tech Center for Housing Research released a study of Earthcraft-certified affordable rental housing in Virginia. This study found that energy usage was approximately 30 percent less in these certified homes compared to similar homes built to the minimum standards of Virginia's building code. These lucky households were saving $54 per month on average—representing 1% to nearly 3% of gross income. That's a big deal for any family struggling to put food on the table.

The homes in the study were low-income projects funded by Virginia's Low Income Housing Tax Credit (LIHTC) program and included blower door testing, among other provisions that exceed Virginia's current code. The costs to implement the above-code elements and achieve Earthcraft certification were managed within the budgets of affordable housing developers. This research was updated in 2017, showing that the affordable housing developments were saving residents an average 45% on their annual energy costs compared to standard housing.

A the 2013 University of North Carolina Center for Community Capital report showed that owners of energy-efficient homes are 32 percent less likely to default on their mortgages. This is incredible, not just for those families, but also for community stability and the overall housing market.

This also highlights a point about other populations for whom energy efficiency is vitally important. Consider the lower middle class, the working class, the "aspirational" homebuyer – families who stretch their budget to get into the best possible new home when they really are one or two missed paychecks from disaster. These folks cannot afford to be surprised by a high energy bill. They are much better off when low energy costs are built into every new home they look at. Then they're much less likely – 32% less likely – to take on more total cost of ownership than they can afford.

The housing industry must consider the total cost of homeownership. With the rigorous efficiency provisions of the 2018 IECC, that cost is reduced – and with that all Virginians enjoy a stronger economy, more stable energy prices, and healthier, more comfortable homes.

SOURCES:

Utility costs as % of income:

- https://www.bls.gov/cex/
- http://www.americaspower.org/sites/default/files/Energy_Cost_Impacts_2012_FINAL.pdf

VT report:

- 2015: https://www.vchr.vt.edu/publications/impact-energy-efficient-design-and-construction-lihtc-housing-virginia
- 2017: https://www.viridiant.org/wp-content/uploads/2018/01/EEC-II-Energy-Cost-Final-Report-1.17.18-1.pdf

UNC report: http://www.imt.org/uploads/resources/files/IMT_UNC_HomeEEMortgageRisksfinal.pdf

cost-effectiveness analyses:

- https://www.mckinsey.com/~/media/McKinsey/dotcom/client_service/Sustainability/PDFs/Reducing%20US%20Greenhouse%20Gas%20Emissic
- http://bcapcodes.org/wp-content/uploads/2015/11/Virginia-2012-IECC-True-Cost.pdf
- http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1194.pdf
- http://bcap-energy.org/wp-content/uploads/2015/12/ICF-Comparison-of-Cost-effectiveness-Methodologies.pdf
- http://www.homeinnovation.com/~/media/Files/Reports/Percent%20Energy%20Savings%202012%20IECC%20Cost%20Effectiveness%20Analy
- US DOE's cost-effectiveness analysis of the 2012 IECC for Virginia: https://www.energycodes.gov/analysis-previous-residential-codes
- US DOE's cost-effectiveness analysis of the 2015 IECC for Virginia: https://www.energycodes.gov/residential-energy-cost-savings-analysis
- US DOE's cost-effectiveness analysis of the 2018 IECC: https://www.energycodes.gov/development/determinations

**Cost Impact:** The code change proposal will increase the cost of construction
It is irresponsible to focus exclusively on the cost of construction and ignore the cost of operation. This proposal will increase initial construction

costs but it will reduce the total cost of housing for occupants and society. If our concern about cost impact is based on the need to keep housing affordable for Virginians of all income levels, then we must consider operating as well as construction costs.

In 2012, the US DOE estimated the incremental cost of compliance with the 2012 IECC relative to the 2009 USBC as $2138 for a 2400sf home. In all, those energy improvements were calculated as saving an average of $388 per year in energy costs, relative to the 2009 USBC. DOE also calculated the net cost to new home occupants based on energy savings, mortgage cost increases, and other associated costs in the first year of ownership and found that consumers realized an average $272 in net savings annually by using the 2012 IECC. Life-cycle cost savings, averaged across building types, are $5,836 for the 2012 IECC. The 2015 and 2018 versions of the IECC were similarly determined to provide net annual savings for occupants of Virginia homes.

Based on this analysis, the advanced energy codes reduce the cost of housing for Virginians – especially for those in lower income brackets who pay a greater percentage of their income on mortgages, rents, and utilities.

Referenced documents:

- US DOE's cost-effectiveness analysis of the 2012 IECC for Virginia: https://www.energycodes.gov/analysis-previous-residential-codes
- US DOE's cost-effectiveness analysis of the 2015 IECC for Virginia: https://www.energycodes.gov/residential-energy-cost-savings-analysis
- US DOE's cost-effectiveness analysis of the 2018 IECC: https://www.energycodes.gov/development/determinations

**Resiliency Impact Statement:** This proposal will increase Resiliency
RESILIENCY IMPACT STATEMENT

Improving new homes' energy performance will have an enormously positive effect on resiliency in Virginia. The key concept for understanding the resiliency of homes is "passive survivability". When the power is out, a better insulated home will maintain temperature better. It will tend to track the average daily ambient temperature rather than swinging to extreme lows and highs. This helps keep homes habitable during natural disasters. As those disasters become more frequent and more severe, we need to have homes that are better equipped to enable residents to stay healthy through a power outage. And we need all homes to be more efficient in order to minimize the chance of power shortages.

The public health and economic shocks of the global Coronavirus pandemic provide yet another reminder that we must take resiliency and sustainability seriously. As people around the world shelter in place and many folks' incomes (especially the poor and working class) are slashed, passive survivability becomes as salient as during a hurricane or wildfire. We have the technology now to build homes that will better withstand disasters and provide better shelter during public health emergencies. What's more, if built smartly from the beginning, these homes provide lower total cost of ownership for occupants. And all of that smart building directs more economic activity to local builders, suppliers, and lenders. Yes, there is a learning curve for integrating high-performance design, but the benefits to the homebuilding industry and to their consumers and to society at large are well worth doing that learning sooner rather than later.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: E1301.1.1.1-18

**Discussion by William Penniman**
Sep 16, 2020 19:38 UTC

The Virginia Chapter of the Sierra Club and allied organizations have submitted comments to the Board strongly endorsing this proposal to update Virginia's code to incorporate the full 2018 IECC standards. It is long overdue and should be adopted without modification. Most importantly, the proposal would update building envelope insulation standards (for walls, ceilings and fenestration) and the standards for air leakage standards, as

well as related standards (e.g., UFactors) affected by those. These money-saving standards have been blocked by Virginia's builders since the standards were first adopted by the 2012 IECC. As a matter of law, this proposal to implement the 2018 IECC should be adopted because (a) it is manifestly "consistent with recognized standards of …energy conservation," and (b) the greater energy conservation would help "protect the health, safety and welfare of the residents of the Commonwealth," particularly in light of the Commonwealth's Energy Objectives and Policy. Written and oral public comments strongly supported full adoption of the 2018 IECC.

As explained by the proponent's proposal, implementation of the full 2018 IECC standards will save residents energy and money and increase resiliency, while also reducing harmful pollution from fossil-fuel combustion. DOE and others found that these would provide net savings for residents even after considering construction and mortgage costs (which are lower today).[i]

Reducing ongoing energy costs benefits all residents and reduces high energy burdens, particularly risks of evictions and utility shut-offs, for the most vulnerable residents.[ii] Full compliance with the IECC meets all statutory standards for Virginia's building code and would advance Virginia's Energy Objectives and Policy as amended by legislation in 2020. Retrofits—particularly of walls and windows and to locate and reduce air leakage—would be much more costly than during construction, when walls are open and workers are present. Efficient buildings are more resilient as they retain tolerable temperatures longer during power outages. Adopting the full 2018 IECC is manifestly "consistent with recognized standards for health, safety, energy conservation and water conservation" as required by Virginia Code Section 36-99.

According to an analysis by the Responsible Energy Codes Alliance (RECA) using Virginia-specific data and DOE's methodology,[iii] the incremental costs of complying with the higher wall and ceiling insulation levels in the 2012-2018 codes (compared to Virginia's current, outdated code) would be $614 (i.e., 0.002 of the average cost of a new home in Virginia) and be paid back in an average of 6 years. If these had been implemented back in 2012, they would have completely paid for themselves from savings by 2018. The Virginia-specific cost increases identified by RECA would reduce occupants' energy costs by approximately 6% annually, which would be particularly significant for low-income residents who are at greater risk of eviction or failing to pay utility bills. The standards can be met with either 2X4 or 2X6 construction (the latter permits wider spacing between studs) or met by other means, such as RESNET or Energy Rating Index.

Wall insulation is particularly important since it would save 7.5 times more money than ceiling insulation annually with a 4.4 year payback. Thus, residents would be poorly served by a compromise announced August 4 by some work group participants pursuant to which one participant withdrew its proposal to have wall insulation meet IECC standards in exchange for the builders finally agreeing to drop opposition to the participant's other proposal for IECC ceiling insulation levels. We were not a party to those negotiations or agreement. Although we obviously support adoption of IECC ceiling insulation standards and understand other participants' fears that nothing gets past builder opposition, we opposed that compromise and we continue to urge BHCD to implement the full IECC envelope standards. Failing to adopt the full 2018 IECC envelope insulation standards would harm every resident for the 70+ years the house is in use.

In addition to requiring blower door testing, this measure would require that blower door tests confirm that air leakage is at or below 3 air changes per hour (ACH), rather than the 5 air changes permitted by the existing USBC. The IECC has required 3 ACH since 2012, but Virginia has still not caught up. In December 2019, the Board proposed to require blower door tests but to leave air leakage standards at 5 ACH. The air leakage difference is substantial: 5 ACH is 67% worse (i.e., leakier) than 3 ACH. The higher leakage undercuts the value of insulation. Unsealed gaps can also increase access by insects and rodents. Materials (such as caulking) to repair leaks cost little when construction is undertaken, particularly when care is taken at the framing stage.[iv] Post-occupancy retrofitting to reduce leakage is much more difficult and costly since it may require reopening and repairing walls. It is unfair for builders to leave to future residents the problems of identifying and repairing air leakage/infiltration.

Our June 25, 2020 comments and our public hearing comments supported blower-door tests, but we opposed the proposal to remain at 5 ACH because it will raise residents' costs of heating, cooling and dehumidification and because air leakage is much more difficult to locate and fix as a retrofit. E1301.1.1.1-18 would correct that omission.

In short, the Board should adopt this proposal as part of its current update to Virginia's building codes.

[i] DOE, National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC, https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf

[ii] See Gov. Northam's Executive Order 43; https://codewatcher.us/codes/low-income-housing-and-the-iecc/

[iii] RECA's analysis was submitted its analysis in support of proposals (RE402.1.2(4)-18 and RE402.1.2(5)-18) to adopt 2018 IECC standards for walls and ceilings. The data shown in our table is drawn from that information. In connection with another proposal (RE402.1.2(1)-18), RECA used a DOE formula with national data and came out with slightly higher initial costs but greater lifecycle savings over 30 years. It does not alter the basic analysis.

[iv] https://codewatcher.us/building-science/when-is-the-best-time-to-air-seal/

## E1301.1.1.1 - Deletion of All State Amendments to the Energy Code

**Proponent(s):** Andrew Grigsby (grigsby.ac@gmail.com)
**Comments:**

- Mr. Penniman (Sierra Club) is in support.
- Mr. Goplerud (FACS) makes the point that Virginia as a state is behind many other states in terms of energy amendment adoptions. He supports.
- Mr. Shippee (self) fully supports this proposal.
- Mr. Clark of VBCOA opposes.
- Mr. Beahm (Warren County) opposes.
- Mr. Statzer (VBCOA Energy Committee) supports.
- Mr. Shearer representing himself supports.

**Results:** Non-Consensus

Decided at the June 30, 2020 Workgroup 2 Meeting and
at the July 15, 2020 Workgroup 3 Meeting

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# RE402.1.2(6)-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Energy Conservation Code

**R402.1.2 Insulation and fenestration criteria.** The *building thermal envelope* shall meet the requirements of Table R402.1.2, based on the climate zone specified in Chapter 3.

**Revise as follows:**

**TABLE R402.1.2**

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

| CLIMATE ZONE | FENESTRATION *U*-FACTOR[b] | SKYLIGHT[b] *U*-FACTOR | GLAZED FENESTRATION SHGC[b, e] | CEILING *R*-VALUE | WOOD FRAME WALL *R*-VALUE | MASS WALL *R*-VALUE[i] | FLOOR *R*-VALUE | BASEMENT[c] WALL *R*-VALUE | SLAB[d] *R*-VALUE& DEPTH | CRAWL SPACE[c]WALL *R*-VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NR | 0.75 | 0.25 | 30 | 13 | 3/4 | 13 | 0 | 0 | 0 |
| 2 | 0.40 | 0.65 | 0.25 | 38 | 13 | 4/6 | 13 | 0 | 0 | 0 |
| 3 | 0.35 | 0.55 | 0.25 | 38 | 20 or 13+5[h] | 8/13 | 19 | 5/13[f] | 0 | 5/13 |
| 4 except Marine | ~~0.35~~ 0.32 | 0.55 | 0.40 | ~~38~~ 49 | ~~15 or 13+1[h]~~ 20 or 13+5h | 8/13 | 19 | 10 /13 | 10, 2 ft | 10/13 |
| 5 and Marine 4 | 0.32 | 0.55 | NR | 49 | 20 or 13+5[h] | 13/17 | 30[g] | 15/19 | 10, 2 ft | 15/19 |
| 6 | 0.32 | 0.55 | NR | 49 | 20+5 or 13+10[h] | 15/20 | 30[g] | 15/19 | 10, 4 ft | 15/19 |
| 7 and 8 | 0.32 | 0.55 | NR | 49 | 20+5 or 13+10[h] | 19/21 | 38[g] | 15/19 | 10, 4 ft | 15/19 |

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. The first value is cavity insulation, the second value is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

**R402.1.4 U-factor alternative.** An assembly with a *U*-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative to the *R*-value in Table R402.1.2.

**Revise as follows:**

**TABLE R402.1.4**

EQUIVALENT U-FACTORS[a]

| CLIMATE ZONE | FENESTRATION *U*-FACTOR | SKYLIGHT *U*-FACTOR | CEILING *U*-FACTOR | FRAME WALL *U*-FACTOR | MASS WALL *U*-FACTOR[b] | FLOOR *U*-FACTOR | BASEMENT WALL *U*-FACTOR | CRAWL SPACE WALL *U*-FACTOR |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.50 | 0.75 | 0.035 | 0.084 | 0.197 | 0.064 | 0.360 | 0.477 |
| 2 | 0.40 | 0.65 | 0.030 | 0.084 | 0.165 | 0.064 | 0.360 | 0.477 |
| 3 | 0.35 | 0.55 | 0.030 | 0.060 | 0.098 | 0.047 | 0.091[c] | 0.136 |
| 4 except Marine | ~~0.35~~ 0.32 | 0.55 | ~~0.030~~ 0.026 | ~~0.079~~ 0.060 | 0.098 | 0.047 | 0.059 | 0.065 |
| 5 and Marine 4 | 0.32 | 0.55 | 0.026 | 0.060 | 0.082 | 0.033 | 0.050 | 0.055 |
| 6 | 0.32 | 0.55 | 0.026 | 0.045 | 0.060 | 0.033 | 0.050 | 0.055 |
| 7 and 8 | 0.32 | 0.55 | 0.026 | 0.045 | 0.057 | 0.028 | 0.050 | 0.055 |

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure R301.1 and Table R301.1.

**Reason Statement:** The purpose of this proposal is to have Virginia adopt the full building envelope efficiency requirements of the 2018 IECC. Due to comments received, these changes are shown as strike-outs to the 2015 Virginia code (although they could be just as easily be shown as a positive adoption of the relevant provisions of the 2018 IECC). These proposed requirements for efficiency in walls, ceilings and fenestration would be new to Virginia but they are not new under the IECC. They date to the 2012 IECC, while Virginia still implements the 2009 IECC. The outdated provisions under the existing building code should be deleted and replaced with these provisions from the 2018 IECC.
Continuing to implement the 2009 IECC would be inconsistent with Virginia law governing building codes. Section 36-99A of the Virginia Code clearly states that the purposes of the USBC is to protect the public and adhere to recognized standards of energy conservation and water conservation: "The provisions of the Building Code and modifications thereof shall be such as *to protect the health, safety and welfare of the residents of the Commonwealth*, provided that buildings and structures should be permitted to be constructed, rehabilitated and maintained at the least possible cost *consistent with recognized standards of health, safety, energy conservation and water conservation*…."

Residents' welfare is harmed by failing to adopt the 2018/2015/2012 IECC efficiency standards. DOE found years ago that the 2012 IECC would save residents money every year even considering the impacts of construction costs on borrowing costs. More recently, the Responsible Energy Codes Alliance compared the cost in Virginia of complying with the 2018/2015/2012 wall and ceiling envelope standards with the 2009 standards in the current code. It found that residents would save money every year; achieve full payback in 6 years; and keep money in their pockets every year thereafter, which is a big deal in dwellings that have an expected life of 70 years or more.

Although, if finalized, the Board's December 2019 proposal would continue the 2009 standards once again, that needs to be reconsidered. Since then, the General Assembly (GA) passed and the Governor signed the Virginia Clean Economy Act (VCEA),[1] which committed Virginia to achieving zero-carbon emissions from electric generation by 2045, requires investor-owned utilities to implement programs to improve its customers' energy efficiency, and to shift increasingly to renewable energy sources. Virginia's GA and Governor also decided that Virginia should join the Regional Greenhouse Gas Initiative, which implements a regional carbon market for electric generators and will yield funds dedicated, in part, to improving energy efficiency in low-income dwellings.[2] To achieve the dramatic carbon and energy reductions called for by the VCEA, it is more critical than ever that energy efficiency be a cornerstone of building construction and rehabilitation.

The ongoing burden of inefficient construction harms everyone, but it particularly harms low-income and moderate-income residents. The high energy burden of inefficient construction makes it harder for residents to pay other bills, including mortgages, and it makes it harder to avoid utility cut-offs for failing to pay utility bills. Retrofitting dwellings insulation is extremely costly. (Virginia is on-course to spend over $1 billion on improving energy efficiency primarily in existing dwellings--vastly more than it would have cost to build the housing well in the first place.) Retrofitting insulation in walls is particularly difficult outside a building renovation since it requires removing and replacing walls. It makes no sense to continue an outdated building code standard that results in new construction and renovations that harm customers and Virginia's efforts to reduce energy usage and carbon emissions.

[1] https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+CHAP1193 .

[2] https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+CHAP1219+pdf

**Cost Impact:** The code change proposal will increase the cost of construction
Adopting these long-overdue energy saving measures will add marginally to construction costs. DOE found that the 2012 IECC would save money for customers from the first month even after considering incremental mortgage costs attributable to the stronger efficiency measures. According to research by the Responsible Energy Codes Alliance, meeting the 2012/2108 standards for walls and ceilings would add approximately $614 to the cost of construction, an investment that would be fully repaid through utility savings in approximately 6 years, with savings continuing for another 64 years based on the typical life of a residential building. Savings like these illustrate why the Virginia Code says that minimizing construction costs must remain consistent with nationally recognized code

**Resiliency Impact Statement:** This proposal will increase Resiliency
The proposed measures will help to enhance resiliency by reducing energy usage, helping to mitigate climate impacts and preparing Virginia's buildings and economy for a future that requires the least energy usage and related pollution possible. Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses, limits on economic activity, agriculture, fisheries, and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy savings and minimizing GHG pollution.

Improving envelope efficiency will help residents and communities will help residents to withstand periods of power outages from storms or other causes. All the options will reduce burdens on utilities which will help them cope with storms and other difficulties. Lowering energy consumption will also lower overall utility costs and benefit all Virginia utility customers.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:** Was carried over from July Meeting.

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# Public Comments for: RE402.1.2(6)-18

**Discussion by Kenney Payne**
Aug 4, 2020 14:35 UTC

While anyone can submit any proposal at any time within the established deadlines and criteria, we encourage the BHCD to vote "Consensus for Disapproval" based on the following understanding:

In previous workgroup meetings, it is our understanding that the homebuilders and energy folks came to a compromise/trade-off on accepting improvements to ductwork leakage in return for keeping the air changes as is. The BHCD has already approved that understanding during the "Proposed Phase."

Now, at the 11th hour, here comes "other" energy folks to propose changes that would contradict the previous "agreements." And because the deadlines have passed, the homebuilders do not have the ability to revise their position on the duct leakage.

Should the BHCD approve this (and numerous other energy-related proposals relating to residential construction) it will basically create the belief that the energy coalition cannot be trusted to stick to anything they agree to - at least during the Proposed Phase.

As a representative of AIA Virginia, I have personally been involved in numerous discussions to find common ground or a compromise - including with energy folks - and once the trust is gone, there most likely would be no more compromising.

It is our opinion that if Mr. Penniman wanted to submit this and all the other proposals, he should have submitted them during the Proposed Phase and/or been involved in the earlier workgroup meetings or subworkgroup meetings. To compare, both Eric Lacey and Andrew Grigsby (both associated with the energy coalition) have withdrawn their proposals once the compromise was obtained. Mr. Penniman should do the same.

This does not pass the smell test. It appears he (and others) waited until the Final Phase - and near the end of this Phase (not even at the beginning

of this Phase) - for the very reason to come in at the 11th hour to avoid in-depth vetting and/or discussions. While that is allowed, and I have done the same, the difference here is that it conflicts with previous compromises and agreements. I have not done that - and I never will. And if any of my members submitted something contrary to a previous agreement I made - I would do my best to convince them to withdraw their proposal(s). The energy folks should consider the same.

Therefore, regardless of our position on the code content itself (personally, I could support much of what they propose), strictly in principle, we must OPPOSE and encourage the BHCD to do the same.

**Comment by William Penniman**
Sep 16, 2020 17:54 UTC

See my reply to the comments of the Home Builders and AOBA, which address the points repeated by Mr. Payne. Let it be clear that I have been open and violated no agreement to which I was a party. My involvement and that of many other members of the public followed public notice of a proposed rule that is manifestly inconsistent with applicable law and with the interests of residents and the public generally. My proposals in the work group process were timely and followed applicable procedures. They offer lawful and publicly beneficial code updates, rather than keeping Virginia behind long-established IECC standards. As it has recognized in its 2020 update to its Energy Objectives and Policies, Virginia must swiftly reduce energy usage and reduce greenhouse gas emissions in order to protect the public and the economy. It cannot afford to keep building structures that will raise residents costs, waste energy and increase carbon emissions for many decades.

**Comment by Kenney Payne**
Aug 20, 2020 21:33 UTC

All good points and are not disputed. However, as noted in AOBA's opposition comments (as well as our own), Virginia has a process that is based on openness, inclusion, opportunities, and most of all - professionalism, respect, and **mutual trust**. The credo of compromise and "agreements" has been a tradition since I first became involved in this code-change process in the year 2000. As a representative of an organization that has benefited from such "agreements," I support the "process" even if we may oppose the change itself - and we oppose those who would try to "break" such "agreements" - especially at the absolute last stage of the process. It is bad for the trust factor and would only harm the process moving forward. Mr. Pharr in his comments for AOBA hit all the highlights as to the duty the BHCD has, so for the sanctity of the process, I would again just ask that the BHCD support the *original* compromise agreement achieved between HBAV and RECA (which given their relationship history, is amazing in itself - do we really want to jeopardize that?).

**Comment by William Penniman**
Aug 10, 2020 13:51 UTC

I am glad that the commenter indicates that he could support the proposal if there had not been a pre-existing deal struck by the home builders. However, at the time I submitted the proposal there was no agreement between “home builders and energy folks.” The absence of any deal on building envelopes was openly discussed at the July 15, 2020 meeting of Work Group 3. Consequently, I am hopeful that the Virginia AIA will support this proposal to finally implement envelope efficiency standards from the IECCs of 2012, 2015 and 2018.

Even if there had been a deal among other parties, neither I nor the Sierra Club was bound by it. The issue was published in a proposed rule that was open to public comment. The Sierra Club and many others commented and urged the BHCD to implement the full energy efficiency requirements contained in the 2018 IECC. We explained why the statute and the public interest require that result, notwithstanding any “agreement” among other parties.

The BHCD has an independent legal obligation to receive input and proposals from the public and to determine what proposed changes would best serve the “health, safety and welfare of the residents of the Commonwealth” and be “consistent with recognized standards of health, safety [and] energy conservation.” Since my proposal expressly adopts the IECC’s standards for building envelopes, it unquestionably meets those statutory tests, and the compromise alternatives do not. Further, since DOE and others have found that adopting the IECC’s envelope standards will save residents money and conserve energy for the multi-decadal lives of the building envelopes, my proposal—or that submitted by Mr. Grigsby (E1301.1.1.1)—should be adopted by the BHCD. Under the terms of the Virginia Code Section 36.99, the IECC’s envelope standards may not to be overridden based on builders’ desire to reduce their construction costs. Since behind-the-wall measures, like insulation, are invisible and not well understood, most buyers must depend upon strong building codes for effective energy savings in building construction.

**Discussion by W Shaun Pharr**
Aug 11, 2020 6:32 UTC

AOBA/VAMA join AIA Virginia in opposing the proposed code change.

The proponent is technically correct that, as long as a proposed section is still open for public comment, any interested party may submit comments and is not obliged to respect a negotiated agreement previously reached by key stakeholders, even when one or more of those stakeholders has modified its position in order to reach a compromise deemed acceptable.

That said, Virginia's famously deliberative and effective codes development process is premised on mutual trust and respect by its participants-- of and for each other, and for the process, including agreements reached in the spirit of compromise. Such an agreement was reached here, and should be adopted by the Board.

In regard to the Code of Virginia, the proponent, regrettably, cherry-picks. Specifically, CoVA 36-99B, conveniently not mentioned in his reason statement, reads:

"B. In formulating the Code provisions, the Board shall have due regard for (emphasis added) generally accepted standards as recommended by nationally recognized organizations, including, but not limited to, the standards of the International Code Council and the National Fire Protection Association."

"Due regard for" does not mean blind obeisance to the standards "recommended by" these or other organizations; nor does it require absolute consistency with the latest such standards.

Virginia's BHCD has a proud history of declining to adopt various provisions found in the latest editions of "model" codes and standards where, in its collective judgment, the Commonwealth would be better served by a different approach. Moreover, those departures from model code provisions have gone in both directions: after giving "due regard for" a model code provision, the Board has sometimes declined to adopt that version in favor of a modified version of it; or retained the then-current provision found in the USBC; or adopted a provision that mirrors a proposal being considered, but not yet adopted, by a nationally recognized organization.

The Board's overriding charge from CoVA 36-99A is to ensure that "The provisions of the Building Code and modifications thereof shall be such as to protect the health, safety and welfare of the residents of the Commonwealth..."

Would the proponents possibly assert that the current USBC/2009 IECC provisions fail to offer any protection of the health, safety and welfare of Virginians? Or can they only claim that adoption of the latest IECC standards would arguably "protect them more?"

The latter is not the standard which the General Assembly has placed on the Board. After giving the required "due regard for" the latest IECC, it has determined to adopt a different approach, a decision well within its discretion.

**Comment by William Penniman**
Sep 16, 2020 16:44 UTC

Mr. Pharr's arguments are not sustainable. He would wrongly elevate private compromises (a) over hundreds of public comments urging adoption of the full 2018 IECC, (b) over unrefuted evidence that the code updates dating back to the 2012 IECC save money and energy for residents and reduce pollution for the public; and (c) over the terms of the law applicable to building codes and Virginia energy policies generally.

(a) The whole point of publishing proposed rules and inviting public comments—in this case hundreds of comments--is to let the public weigh in on building code standards and on deals such as the one that would keep Virginia behind the IECC for the third straight cycle. It is more than "technically correct" to say that the public comment process is supposed to influence the BHCD's decision on matters as important as energy efficiency measures that will save money and reduce pollution for 70+ years beyond the time new homes are constructed. His "famously deliberative" code process has allowed builders to wield undue influence simply by withholding consent in work groups. That process must not be allowed to hold back Virginia from adopting energy-saving code measures that protect the health, safety and welfare of residents and that are consistent with recognized codes. Further delay will harm residents and Virginia for 70 years or more.

(b) Ample, uncontradicted evidence from DOE and others supports the conclusions that the IECC's efficiency standards will save residents money, improve their comfort and resiliency, and reduce pollution for the benefit of the Commonwealth.[1] DOE found that the 2012 IECC would save money from the beginning of home occupancy and payback initial costs within a few years. ACEEE, RECA and others have confirmed those conclusions. Better envelope efficiency will improve comfort and resiliency during power outages. And, by reducing energy usage, it will reduce air pollution, including climate and asthma-inducing pollution, from fossil fuel combustion by residences and utilities. Data submitted by RECA during the work group process shows that wall insulation is inexpensive (0.0013 of the cost of an average new home) and that wall insulation will save residents 8.5 times as much annually and payback 7.5 times faster than ceiling insulation.[2] These benefits will last for many decades—which means that failure to adopt them will harm residents and the public for decades. Upgrading wall insulation is extremely expensive since it would require opening and repairing exterior walls throughout a dwelling. Few residents and fewer landlords would undertake that project without financial assistance which shifts the costs to society.

(c) Virginia Code 36-99A is explicit that the building code is supposed to "protect the health, safety and welfare of residents of the Commonwealth" and reducing construction costs must not override the obligation to be "consistent with recognized standards of health, safety…[and] energy conservation." The reference in Virginia Code 36-99B to "due regard" for standards set by the International Code Council (which issues the IECC) emphasizes the importance of the IECC and other ICC codes as a primary source of "recognized standards." Departures must either (i) exceed or achieve the same end result in a better way, or (ii) be supported by another "recognized standard" such as LEED or Passive House. The phrase "due regard" does not imply that the BHCD can disregard Section 36-99A's standards, including compliance with "recognized standards" or stick to standards that were superseded years ago.

In addition to the terms of Section 36-99A and B, 2020 legislative actions (i.e., since the December 2019 proposal was issued) require BHCD to revise its December 2019 code proposals. As recognized by Section 67-100, "Swift decarbonization and a transition to clean energy are required to meet the urgency of the challenge [of climate change]," and "[t]he Commonwealth will benefit from being a leader in deploying a low-carbon energy economy." Section 67-101 sets forth specific "energy objectives" implementation of which "will advance the health, welfare and safety of the

residents of the Commonwealth" – the same legal standards that apply to building codes. These "energy objectives" and "Commonwealth energy policy" in Section 67-102, "provide guidance to the agencies…of the Commonwealth in taking discretionary action with regard to energy issues" within their authority. These energy policies and objectives include reducing energy usage and costs through energy efficiency, achieving net-zero greenhouse gas emissions by 2045 including in the electricity, building and transportation sectors, promoting carbon-free generation including rooftop solar, and mitigating climate impacts on disadvantaged communities.

Disadvantaged communities—as well as all other residents—will be harmed for 70+ years if Virginia continues to lag behind the IECC's "recognized standards" for energy conservation. As Executive Order 43 recognizes, high energy bills are one of the major problems facing low-income residents, and that should not be made worse by continuing to lag on building code efficiency.

[1] See statement and sources in support of E1301.1.1.1-18, as well as my submissions and comments by the Sierra Club, et al. See also DOE, National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC, https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf

[2] RECA's analysis was submitted its analysis in support of proposals (RE402.1.2(4)-18 and RE402.1.2(5)-18) to adopt 2018 IECC standards for walls and ceilings. The data shown in our table is drawn from that information. In connection with another proposal (RE402.1.2(1)-18), RECA used a DOE formula with national data and came out with slightly higher initial costs but greater lifecycle savings over 30 years. It does not alter the basic analysis.

**Discussion by Andrew Clark**
Aug 13, 2020 14:28 UTC

The Home Builders Association of Virginia (HBAV) opposes this proposal. Over the course of the 2018 Code Development Cycle, HBAV has worked with the Responsible Energy Codes Alliance (RECA) to find common ground on several energy efficiency proposals, including RECA's proposal to increase wall insulation requirements and their proposal to increase ceiling insulation requirements. Although we were not able to find consensus on the wall insulation proposal, both HBAV and RECA did reach consensus on the ceiling insulation proposal, which will help advance Virginia's energy efficiency goals. Proposal RE402.1.2(6) would increase both the wall and ceiling insulation requirements - while HBAV supports the increased ceiling insulation requirements, we believe that additional analysis should be conducted by the stakeholders before considering increased wall insulation requirements, given the potential for significant increases to the cost of construction, home design implications, and the pricing/availability of 2x6 lumber and framers with the experience in advance framing techniques. It's also important to note that the building code does not prohibit a home buyer, or builder, from voluntarily opting to increase their wall insulation or utilize 2x6 framing - but given the increased cost and design implications, that decision should be left to builder and home buyers. We urge the Board to disapprove of RE402.1.2(6) and support the consensus proposal (RE402.1.2(4)) to increase ceiling insulation.

**Comment by William Penniman**
Sep 16, 2020 14:46 UTC

According to an analysis by the Responsible Energy Codes Alliance (RECA) using Virginia-specific data,[i] the incremental costs of complying with the higher wall and ceiling insulation levels in the 2012-2018 codes (compared to Virginia's current, outdated code) are low and would be paid back in an average of 6 years. If these had been implemented back in 2012, they would have completely paid for themselves from savings by 2018. The Virginia-specific cost increases identified by RECA would be about 0.002 of the average cost of a new home in Virginia, but would reduce occupants' energy costs by approximately 6% annually, which would be particularly significant for low-income residents who are at greater risk of eviction or failing to pay utility bills.

Wall insulation costs are not high when undertaken during the construction phase. The standards can be met with either 2X4 or 2X6 construction (the latter permits wider spacing between studs, which would offset costs of the lumber) or met by other means, such as RESNET or Energy Rating Index.[ii]

The following summarizes the averages of RECA's Virginia-specific data:

Average Incremental cost / annual savings from adopting 2018 IECC (varies by location with faster payback in NoVa)
Walls 2018 IECC: Cost $399; Saves $78-103/yr; Payback Ave 4.4 years;
Ceiling 2018 IECC: Cost $215; Saves $10-14/yr; Payback Ave 17.9 years:
Total 2018 wall/ceiling insulation: Cost $614; Saves $88-117/yr; Ave $102.50/yr; Payback 6 years.
Net savings over 30/50years (savings - cost, not counting utility rate increases):
Walls: $2316/$4126; Ceilings: $145/385: Total: $2461/$4511

As shown in the table, the costs are low and total savings are large, with the biggest savings and most rapid paybacks being associated with wall insulation, which is also much more costly and difficult to retrofit since it requires opening and repairing walls. Annual savings from the 2018 wall insulation standards would be 7.5 times greater than for ceiling insulation. Thus, residents would be poorly served by a compromise by some work

group participants pursuant to which RECA withdrew its proposal to have wall insulation meet IECC standards in exchange for the builders finally agreeing to drop opposition to the participant's other proposal for IECC ceiling insulation levels. Although we obviously support adoption of IECC ceiling insulation standards and understand other participants' fears that nothing gets past builder opposition under past BHCD practices, we opposed that compromise and we continue to urge BHCD to implement the full IECC envelope standards. Failing to adopt the 2018 IECC wall insulation standards would be a life-of-the-dwelling mistake, harming every resident for the 70+ years the house is in use. Consequently, the BHCD should adopt the IECC's full envelope standards, including for walls, as we proposed here and in E1301.1.1.1-18.

There is no merit to Home Builder's Association assertion that "additional analysis should be conducted by the stakeholders before considering increased wall insulation requirements." DOE found, years ago, that the 2012/2018 IECC envelope standards would save money and payback expeditiously. RECA's analysis (above) shows that wall insulation upgrades are not costly (0.0013 of an average new home in Virginia) and pays back rapidly. Further delay is not justified.

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[i] RECA's analysis was submitted its analysis in support of proposals (RE402.1.2(4)-18 and RE402.1.2(5)-18) to adopt 2018 IECC standards for walls and ceilings. The data shown above is drawn from that information. In connection with another proposal (RE402.1.2(1)-18), RECA used a DOE formula with national data and came out with slightly higher initial costs but greater lifecycle savings over 30 years. It does not alter the basic analysis.

[ii] Alternatives to the specific wall standards include: The U-factor alternative table (R402.1.4); the Total UA Alternative (R402.1.5); U.S. DOE's REScheck software (www.energycodes.gov); the Simulated Performance Alternative (R405); The Energy Rating Index (R406). UFactors would need to be updated along with the wall and ceiling insulation updates, to reflect the 2018 IECC.

Proposal # 473

## RE402.1.2(6) - Insulation and fenestration criteria

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

- Mr. Payne (AIA Virginia) suggests that the proposal itself include what would be the end result. There seems to be a vague target with this proposal.
- Mr. Clark of VBCOA opposes.
- Mr. Shearer representing himself agrees with Mr. Payne.
- Mr. Lacey (RECA) is in support of this proposal, and is happy to work together to accomplish these goals as well as those related to his RECA proposals in WG2.
- Ms. Shutler of the Virginia Grassroots Coalition is in support.
- Mr. Gordon (AOBA) supports a carryover, but he is concerned based on the premise of the cost-benefit analysis that consumers or owners would not make the right decision on their own.
- Mr. Penniman wishes to clarify that the first priority is health and safety of residents, and cost-saving measures are helpful, but secondary.

**Results:** Carry over to August

## RE402.1.2(6) 2018 IECC Insulation tables

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)
**Summation of Proposal:** This proposal brings in the full 2018 IECC insulation tables
**Comments:**

● Mr. Clark (HBAV) opposes on the basis of cost as well as some serious design flaws.
● Mr. Shearer (self) supports this proposal; he believes it is indicative of Virginia going in the "right direction."
● Kathie Hoekstra (350 Alexandria and self) supports this proposal.
● Mr. Goplerud (FAAC) supports based on cost savings as a result of increased energy efficiency.
● Mr. Pharr (AOBA/VAMA) is opposed.
● Ms. Nawaz supports this proposal.
● Ms. Main (self) supports this proposal, citing that it will reduce utility bills for owners and tenants over the life of the home. These bills are unaffordable for low-income residents, so this is a very important part of making housing affordable.
● Ms. Stillman (self) supports the improvement in insulation for walls and ceilings, citing that it is easier and cheaper to do in construction than later.
● Sharon Shutler (Virginia Grassroots Coalition) supports this proposal.
● Ms. Lang underscores the need to bring Virginia's code up to "modern standards."
● Dr. Frederick Krimgold (VT) speaks in support of the proposal, citing the greenhouse gases' increase in recent years and how climate change is so detrimental to our environment, our safety, and our homes in the long-term.
● Mr. Clark (HBAV) wishes to clarify whether support for this proposal also indicates support for the previous proposal…
● Mr. Penniman (Sierra Club) is not opposed to compromise.
Results: Non-consensus

Decided at the July 15, 2020 Workgroup 3 Meeting and
at the August 11, 2020 Combined Workgroup Meeting

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# RE402.4.1.2(2)-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2018 International Energy Conservation Code

**Revise as follows:**

**R402.4.1.2 Testing.** The *building* or dwelling unit shall be tested and verified as having an air leakage rate not ~~exceeding five air changes per hour in *Climate Zones* 1 and 2, and~~ exceeding three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

[Note: To the extent necessary, other sections of the Code should be similarly incorporated and, as needed, amended in order to accomplish the purpose of limiting air infiltration to 3 air changes per hours across all residential buildings.]

**Reason Statement:** The purpose of this proposal is to bring the Virginia code up to date with the 2018/2012 IECC as it relates to blower door testing and 3 air changes per hour. The proposal is worded as a positive statement that should substitute for the 2015 version of this section in its entirety. Following promulgation of the 2012 IECC, DOE found that the changes from 2009 improved efficiency and was cost effective for occupants in that they saved money every year and quickly recouped the cost of construction.
Sections 36-99A and 36-99B of the Virginia Code make clear that building codes are required to "protect the health, safety and welfare of the residents of the Commonwealth"; that deviations to reduce construction costs must nevertheless be "consistent with recognized standards of health, safety, energy efficiency and water efficiency," and that codes promulgated by the ICC, including the IECC, are among the "recognized standards" to be followed.
Reducing the maximum air infiltration to 3 air changes per hour was technically and economically established when the 2012 IECC was promulgated, and the IECC requirement has remained at 3 air changes per hour in both the 2015 and 2018 IECC. There is no excuse for Virginia to continue to permit leaky houses that require additional heating and cooling in order to offset the infiltration of outside air. That drives up utility costs for occupants and air pollution for all of Virginia from avoidable fossil fuel combustion. To the extent lower cost construction is most likely to avoid sealing leaks, it is low and moderate income buyers or tenants who are most likely to be hurt. There is no reason why builders, informed by blower door tests and other techniques (infrared cameras, for example), should not be able to identify and seal leaks to reduce infiltration to 3 air changes per hour (ACH).

I understand that the Board's December 2019 proposal to finally implement a blower door test while retaining the 5 ACH emerged from negotiations. However, the Board should implement the statutory requirement to require building codes to "protect the health safety and welfare of the residents of the Commonwealth" in a manner "consistent with recognized standards" from organizations such as the ICC. The historic practice of having updates follow unanimous "consensus" of active participants in code negotiations subjugates the key issue of public welfare to asymmetric bargaining leverage.

Furthermore, since December, the GA and the Governor have recognized the importance of sharply cutting carbon dioxide emissions, maximizing energy efficiency, and trying to protect low-income and moderate-income residents from high energy bills attributable to inefficient housing and appliances. These developments require reconsideration of the proposal to extend the leaky-house standard of 5 air changes per hour.

**Cost Impact:** The code change proposal will increase the cost of construction
The cost of blower door tests and filling leaks is minimal. It may take some looking to find the gaps but it shouldn't be hard to block the leaks. On the other hand, residents will save money by reducing the volume of air changes that have to be reheated, recooled or dehumidified. Retrofitting after walls have been closed up could require going behind walls and would be much more costly.

**Resiliency Impact Statement:** This proposal will increase Resiliency

Improving building energy efficiency will increase resiliency, whereas the pending proposal to retain the outdated 5 air changes per hour will do the opposite.
The proposed measures will help to enhance resiliency in several ways. By reducing the volume of air that needs to be reheated or cooled every day, the proposal will reduce energy usage, help mitigate climate impacts and prepare Virginia's buildings and economy for a future that requires the least energy usage and related pollution possible. Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses, limits on economic activity, agriculture, fisheries, and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy savings and minimizing GHG pollution.

Furthermore, saving energy will reduce occupants' utility bills while increasing their comfort. Reducing energy cost burdens will improve the economic resiliency of all residents, but particularly low and moderate income customers most harmed by high bills. It will also reduce loan defaults and choices between paying energy bills and other basic family needs. Improving envelope efficiency will also help residents and communities withstand periods of power outages from storms or other causes. It will reduce burdens on utilities which will help them cope with storms and other difficulties. With buildings lasting 70 or more years, there is no excuse for not meeting standards established 8 years ago.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RE402.4.1.2(2)-18

**Discussion by W Shaun Pharr**
Aug 11, 2020 6:23 UTC

AOBA/VAMA join AIA Virginia in opposing the proposed code change.

The proponent is technically correct that, as long as a proposed section is still open for public comment, any interested party may submit comments and is not obliged to respect a negotiated agreement previously reached by key stakeholders, even when one or more of those stakeholders has modified its position in order to reach a compromise deemed acceptable.

That said, Virginia's famously deliberative and effective codes development process is premised on mutual trust and respect by its participants-- of and for each other, and for the process, including agreements reached in the spirit of compromise. Such an agreement was reached here, and should be adopted by the Board.

In regard to the Code of Virginia, the proponent, regrettably, cherry-picks. Specifically, CoVA 36-99B, conveniently not mentioned in his reason statement, reads:

"B. In formulating the Code provisions, the Board shall have ***due regard for*** (emphasis added) generally accepted standards as recommended by nationally recognized organizations, including, but not limited to, the standards of the International Code Council and the National Fire Protection Association."

"Due regard for" does not mean blind obeisance to the standards "recommended by" these or other organizations; nor does it require absolute consistency with the latest such standards.

Virginia's BHCD has a proud history of declining to adopt various provisions found in the latest editions of "model" codes and standards where, in its collective judgment, the Commonwealth would be better served by a different approach. Moreover, those departures from model code provisions have gone in both directions: after giving "due regard for" a model code provision, the Board has sometimes declined to adopt that version in favor of a modified version of it; or retained the then-current provision found in the USBC; or adopted a provision that mirrors a proposal being considered, but not yet adopted, by a nationally recognized organization.

The Board's overriding charge from CoVA 36-99A is to ensure that "The provisions of the Building Code and modifications thereof shall be such as

to protect the health, safety and welfare of the residents of the Commonwealth..."

Would the proponents possibly assert that the current USBC/2009 IECC provisions fail to offer any protection of the health, safety and welfare of Virginians? Or can they only claim that adoption of the latest IECC standards would arguably "protect them more?"

The latter is not the responsibility which the General Assembly has placed on the Board. After giving the required "due regard for" the latest IECC, it has determined to adopt a different approach, a decision well within its discretion.

**Comment by William Penniman**
Sep 16, 2020 18:25 UTC

The arguments by AOBA/VAMA are not sustainable. They would wrongly elevate private compromises (a) over hundreds of public comments urging adoption of the full 2018 IECC, (b) over evidence that the code updates dating back to the 2012 IECC save money and energy for residents and reduce pollution for the public; and (c) over the terms of the law applicable to building codes and Virginia energy policies generally.

(a) It is more than "technically correct" to say that the public comment process is supposed to influence the BHCD's decision on matters as important as energy efficiency measures that will save money and reduce pollution for 70+ years beyond the time new homes are constructed. The whole point of publishing proposed rules and inviting public comments—in this case hundreds of comments--is to let the public weigh in on building code standards and on deals such as the one that would keep Virginia behind the IECC for the third straight cycle. The "famously deliberative" code process has allowed builders to wield undue influence simply by withholding consent in work groups. That process must not be allowed to hold back Virginia from adopting energy-saving code measures that protect the health, safety and welfare of residents and that are consistent with recognized codes. Further delay will harm residents and Virginia for 70 years or more.

(b) Ample, uncontradicted evidence from DOE and others supports the conclusions that the IECC's 2012-2108 efficiency standards will save residents money, improve their comfort and resiliency, and reduce pollution for the benefit of the Commonwealth.[1] DOE found that the 2012 IECC would save money from the beginning of home occupancy and payback initial costs within a few years. The 3 ACH standard was part of the 2012 IECC and has been part of the IECC ever since. Air leakage/infiltration undermines the benefits of insulation. Allowing leakage at 5 ACH is 67% worse than 3 ACH. Reducing air leakage/infiltration is an important aspect of envelope efficiency, which will improve comfort and resiliency during power outages. And, by reducing energy usage, it will reduce air pollution, including climate and asthma-inducing pollution, from fossil fuel combustion by residences and utilities. This is an issue that can and should be addressed in the construction phase when gaps can more easily be located and fixed. The fix can involve better framing techniques and inexpensive caulk or foam. It is much harder to locate and fix gaps later, particularly if reopening and repairing walls is required. Builders should not walk away and leave this burden to residents.

(c) Virginia Code 36-99A is explicit that the building code is supposed to "protect the health, safety and welfare of residents of the Commonwealth" and reducing construction costs must not override the obligation to be "consistent with recognized standards of health, safety…[and] energy conservation." The reference in Virginia Code 36-99B to "due regard" for standards set by the International Code Council (which issues the IECC) emphasizes the importance of the IECC and other ICC codes as a primary source of "recognized standards." Departures must either (i) exceed or achieve the same end result in a better way, or (ii) be supported by another "recognized standard" such as LEED or Passive House. The phrase "due regard" does not imply that the BHCD can disregard Section 36-99A's standards, including compliance with "recognized standards" or stick to standards that were superseded years ago.

In addition to the terms of Section 36-99A and B, 2020 legislative actions (i.e., since the December 2019 proposal was issued) require BHCD to revise its December 2019 code proposals. As recognized by Section 67-100, as amended in 2020, "Swift decarbonization and a transition to clean energy are required to meet the urgency of the challenge [of climate change]," and "[t]he Commonwealth will benefit from being a leader in deploying a low-carbon energy economy." Section 67-101 sets forth specific "energy objectives" implementation of which "will advance the health, welfare and safety of the residents of the Commonwealth" – the same legal standards that apply to building codes. These "energy objectives" and "Commonwealth energy policy" in Section 67-102, "provide guidance to the agencies…of the Commonwealth in taking discretionary action with regard to energy issues" within their authority. These energy policies and objectives include reducing energy usage and costs through energy efficiency, achieving net-zero greenhouse gas emissions by 2045 including in the electricity, building and transportation sectors, promoting carbon-free generation including rooftop solar, and mitigating climate impacts on disadvantaged communities.

All residents--especially disadvantaged communities--will be harmed for 70+ years if Virginia continues to lag behind the IECC's "recognized standards" for energy conservation. As Executive Order 43 recognizes, high energy bills are one of the major problems facing low-income residents, and that should not be made worse by continuing to lag on building code efficiency.

[1] See my submission and comments by the Sierra Club, et al.; DOE, National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC, https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf

**Discussion by Andrew Clark**
Aug 14, 2020 13:25 UTC

The Home Builders Association of Virginia (HBAV) opposes this proposal because it is in conflict with a consensus proposal which was worked on

extensively by the Responsible Energy Codes Alliance (RECA) and HBAV during the first phase of the 2018 code development cycle. That proposal, which will move Virginia towards blower door testing while maintaining 5ACH, was sent to the Board of Housing and Community Development with full consensus and subsequently approved. HBAV also opposes the substance of this proposal: many builders, including many “green builders”, have concerns that 3ACH could create ventilation and mold/moisture issues in new homes.

Virginia’s code development process has received national recognition for its transparency and inclusiveness – all are invited to submit proposals and advocate for their position – and HBAV is a strong believer that this code cycle and future code cycles should maintain its commitment to those values. Despite claims by Mr. Penniman to the contrary, HBAV and others are not attempting to deny him or the Sierra Club of any “right” to submit input and proposals to the Board of Housing and Community Development. Far from it.

One of the purposes of having multiple phases in the code development process is that it gives all the stakeholders time to submit proposals, exchange perspectives and data, and make modifications to proposals (if necessary). A deliberate, thorough, and thoughtful process yields better results. This proposal was submitted during the final phase of the 2018 code development cycle and to our knowledge, the proponents of this proposal did not attempt to seek input from other stakeholders, including the home building industry or other energy-efficiency stakeholders involved in the code development process.

**Comment by William Penniman**
Sep 15, 2020 16:36 UTC

As discussed more fully in my reply to AIA's comments, BHCD has an independent legal responsibility to protect the health, safety and welfare of residents of the Commonwealth and to adopt regulations that are consistent with recognized standards for health, safety and energy conservation. The 2019 compromise proposal among certain groups does not meet those legal standards and must be rejected. Compliance with recognized building standards for energy conservation dating back to the 2012 IECC should finally be implemented.
Since that compromise was published, in December 2019, as a proposal, the General Assembly enacted and the Governor signed legislation that strongly contradicts the efficiency-weakening standard proposed by the compromise. Among other things, it adopted energy objectives and energy policies VA Code Sections 67-100 to 67-102) which call for agencies to implement policies that will increase energy efficiency, reduce greenhouse gas emissions and advance Virginia's policy to achieve net zero greenhouse gas emissions by 2045. It also adopted other legislation, including the Virginia Clean Economy Act and the Clean Energy and Community Flood Preparedness Act requiring reductions in carbon emissions and more investment by utilities and the state in energy efficiency.

When the compromise was published and opened to public comment, the public strongly objected to the continuation of weakening amendments to the IECC. Hundreds of written comments and numerous oral comments were submitted. Public opposition defeats the notion that this was a legitimate compromise that might conceivably serve the public interest. There is no legitimate basis in law or policy for the BHCD to defer to work group deals when the public and thousands of future homeowners will suffer the consequences of higher costs, less comfortable occupancy, less resliency and greater pollution.

**Discussion by Kenney Payne**
Aug 4, 2020 14:35 UTC

While anyone can submit any proposal at any time within the established deadlines and criteria, we encourage the BHCD to vote "Consensus for Disapproval" based on the following understanding:

In previous workgroup meetings, it is our understanding that the homebuilders and energy folks came to a compromise/trade-off on accepting improvements to ductwork leakage in return for keeping the air changes as is. The BHCD has already approved that understanding during the "Proposed Phase."

Now, at the 11th hour, here comes "other" energy folks to propose changes that would contradict the previous "agreements." And because the deadlines have passed, the homebuilders do not have the ability to revise their position on the duct leakage.

Should the BHCD approve this (and numerous other energy-related proposals relating to residential construction) it will basically create the belief that the energy coalition cannot be trusted to stick to anything they agree to - at least during the Proposed Phase.

As a representative of AIA Virginia, I have personally been involved in numerous discussions to find common ground or a compromise - including with energy folks - and once the trust is gone, there most likely would be no more compromising.

It is our opinion that if Mr. Penniman wanted to submit this and all the other proposals, he should have submitted them during the Proposed Phase and/or been involved in the earlier workgroup meetings or subworkgroup meetings. To compare, both Eric Lacey and Andrew Grigsby (both associated with the energy coalition) have withdrawn their proposals once the compromise was obtained. Mr. Penniman should do the same.

This does not pass the smell test. It appears he (and others) waited until the Final Phase - and near the end of this Phase (not even at the beginning of this Phase) - for the very reason to come in at the 11th hour to avoid in-depth vetting and/or discussions. While that is allowed, and I have done the same, the difference here is that it conflicts with previous compromises and agreements. I have not done that - and I never will. And if any of my members submitted something contrary to a previous agreement I made - I would do my best to convince them to withdraw their proposal(s). The energy folks should consider the same.

Therefore, regardless of our position on the code content itself (personally, I could support much of what they propose), strictly in principle, we must OPPOSE and encourage the BHCD to do the same.

**Comment by William Penniman**

Aug 10, 2020 14:31 UTC

The BHCD has an independent legal obligation to receive input and proposals from the public and to determine what proposed changes would best serve the "health, safety and welfare of the residents of the Commonwealth". When it sought public comments on a proposal to implement a blower door test but to continue to allow air infiltration at a rate of 5 air changes per hour (ACH), the Sierra Club (with nearly 20,000 members) and two other organizations jointly filed comments opposing the compromise proposal and explaining why failing to adopt the 3 ACH standard would be contrary to the "health, safety and welfare" of Virginia residents, contrary to the IECC's 2018, 2015 and 2012 building code standards, and contrary to statutory standards requiring building codes to be consistent with recognized standards for energy conservation. We also pointed out that DOE had previously found that the standards adopted in the 2012 IECC, which included the 3 ACH air leakage standards, would save residents money through lower utility bills and energy conservation, for decades.

Following the submission of rulemaking comments, I took steps to submit this proposal, in a timely manner, through the CDPVA process in order to assure that it is considered on the merits. I was no more bound than any other member of the public by a deal demanded by home builders who threatened to block any changes involving blower door tests and air leakage. Although there is a benefit from finally implementing blower door tests to replace "visual" examinations which had permitted ACH violations to continue, that so-called deal still falls far short of the most important part of the IECC's standard – actually reducing air leakage to 3 ACH. The ACH level is ultimately the key to energy savings, and 5 ACH is 67% higher than the 3 ACH level in the 2012-2018 IECC.

The BHCD is not bound by such a deal, and it should not countenance a "consensus" process that empowers builders to block implementation of IECC energy conservation standards without implementing alternative measures that achieve the same or greater energy savings. The so-called agreement is inconsistent with the standards in Virginia Code Section 36-99 because high levels of leakage harm the health, safety and welfare of Virginia residents and they are not consistent with the IECC's recognized building code standards for energy conservation.

Since my proposal expressly adopts the IECC's standards for limiting air leakage to 3 ACH, it is unquestionably "consistent with recognized standards of health, safety [and] energy conservation." The compromise favored by some builders does not satisfy the statutory standards and it would raise utility costs to residents for decades. Beyond that, I would observe that higher air leakage and infiltration also means unfilled gaps in walls, ceilings or floors which may also increase residents' exposure to insects and rodents getting into the house.

The 3 ACH standard has been around since 2012, and it can be met. Caulk and foam, among other sealing materials, are not expensive. It is mainly important that the issue be addressed carefully throughout construction, including when framing is going up. https://codewatcher.us/building-science/when-is-the-best-time-to-air-seal/

Buyers want more sustainable homes that will save them money, that they are willing to pay more to get them, and that builders have an economic opportunity in marketing lower energy consumption in new construction. That will not happen, particularly for lower-income residents, if inefficient construction is permitted by weak code standards developed in a process that favors compromises. When a builder says a house "meets code," it should assure buyers that the dwelling at least satisfies the IECC's nationally recognized standards, not some halfway compromise that is not consistent with recognized codes or the standards for code setting contained in Virginia Code Section 36-99.

Proposal # 474

## RE402.4.1.2(2) - Air Leakage Rate Testing/Limits

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

- Mr. Shippee (self) is in strong support of this proposal.
- Mr. Payne (AIA Virginia) opposes on principle of there being a compromise to allow 5 air changes/hour.
- Mr. Clark of VBCOA is not in support.
- Mr. Beahm (Warren County) opposes; he believes the language in place is sufficient and does not need to be changed as per this proposal.
- Ms. Stillman representing herself is in support in order to make houses more energy-efficient.
- Mr. Lacey (RECA) supports the compromise we achieved with HBAV and others (blower door testing at 5 ACH50. While our original position was 3 ACH50, we believe 5 ACH50 was a fair and productive improvement in the code.

**Results:** Non-Consensus

Decided at the August 11, 2020 Combined Workgroup Meeting

# RE403.1.2-18

**Proponents:** William Penniman

## 2015 Virginia Energy Conservation Code

### CHAPTER 4 [RE]
### RESIDENTIAL ENERGY EFFICIENCY

### SECTION R403
### SYSTEMS

**R403.1 Controls (Mandatory).** At least one thermostat shall be provided for each separate heating and cooling system.

**R403.1.1 Programmable thermostat.** The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).

**Revise as follows:**

**R403.1.2 Heat pump supplementary heat (Mandatory).** Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating ~~load.~~ load. Except in emergency heating mode, the supplementary electric-resistance heat in heat pump systems installed in new construction may not energize unless the outdoor temperature is below 40º F (4º C).

**R403.1.3 Primary Heat Source (Mandatory)** Electric resistance heat shall not be used as the primary heat source for space heating in new residential construction or as a replacement for a heat pump in existing dwelling units.

## 2015 Virginia Residential Code

### SECTION N1103 (R403)
### SYSTEMS

**N1103.1.1 (R403.1.1) Programmable thermostat.** The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).

**N1103.1 (R403.1) Controls (Mandatory).** At least one thermostat shall be provided for each separate heating and cooling system.

**Revise as follows:**

**N1103.1.2 (R403.1.2) Heat pump supplementary heat (Mandatory).** Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating ~~load.~~ load. Except in emergency heating mode, the supplementary electric-resistance heat in heat pump systems installed in new construction may not energize unless the outdoor temperature is below 40º F (4º C).

**N1103.1.3 (R403.1.3) Primary Heat Source (Mandatory)** Electric resistance heat shall not be used as the primary heat source for space heating in new residential construction or as a replacement for a heat pump in existing dwelling units.

**Reason Statement:** Electric resistance heat is a highly inefficient form of space heating. Heat pumps are much more energy efficient than resistance heating systems. Lower operating costs of heat pumps will substantially reduce a customer's heating bills--by 50% compared to resistance heat according to DOE. Heat pumps will also provide customers with the added benefit of air conditioning. The proposal is modeled on a Georgia building code provision (R403.1.2)

**Cost Impact:** The code change proposal will increase the cost of construction
Resistance space heating may be cheaper to install than a standard heat pump or mini-split heat pump. However, it does not provide air conditioning which is an inherent part of a heat pump, including a mini-split. Adding a stand-alone air conditioning unit to a resistance heating unit can make the total cost greater. Like baseboard electric heat, mini-splits do not require duct work, which would be required for either an electric furnace or heat pump. The additional upfront cost of a heat pump or mini-split compared to resistance heat will be recovered by the owner or tenant through energy cost savings attributable to a heat pump's much greater energy efficiency. As noted, DOE reports that heat pumps can reduce heating costs by 50% compared to resistance heat. https://www.energy.gov/energysaver/heat-and-cool/heat-pump-systems

Since a heat pump or mini-split provides air conditioning, it will also provide a form of seasonal comfort not produced by any form of electric resistance unit.

By reducing demands on utilities for expensive generation and by reducing air pollution emissions from power generation, heat pumps will also reduce energy costs and health impacts to Virginia residents beyond the owner or occupant of a specific dwelling.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Climate change poses an ever-greater resiliency threat the longer we fail to reduce greenhouse gas (GHG) emissions. The need to swiftly reduce carbon emissions is recognized in Governor Northam's Executive Order 43 (2019) and in 2020 legislation by the General Assembly, including The Virginia Clean Economy Act and the Clean Energy and Community Flood Preparedness Act. Improving the efficient use of energy is recognized as a critical measure to reduce GHG emissions and harmful climate impacts, and overall utility costs to consumers. This proposal will replace highly inefficient resistance heating with much more efficient heat pumps.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RE403.1.2-18

**Discussion by Kenney Payne**
Aug 4, 2020 15:22 UTC

R403.1.3: Language regarding existing dwelling units does not belong in the VECC (maybe VEBC 603.8?) and even so, would conflict with VEBC 302.2 and 601.1, Exception 4.

For those reasons, we would OPPOSE the portion addressing existing dwelling units in R403.1.3.

Since the VRC can be used for existing dwelling units in lieu of the VEBC, we do have the same concerns for N1103.1.3.
**Comment by William Penniman**
Sep 16, 2020 18:43 UTC

I have no objection to locating or repeating in the the language prohibiting replacement of heat pumps with resistance heat in existing dwellings. Had the suggestion been made prior to the August 4 meeting, I might have been able to do that. I would not object to working with Staff to make the change.
**Comment by Kenney Payne**
Aug 20, 2020 21:10 UTC

Our opposition is not to the concept itself, but where and how EXISTING dwelling units are addressed in the code. Our point was that if anything, it belongs in the VEBC - not the VECC - especially since we already agreed to moved everything dealing with existing buildings out of Chapter 5 of the VECC. Our other point is that it could be interpreted that whether in the VECC or VEBC, it conflicts with the provisions of the VEBC. And the VEBC supersedes the other codes.

Finally, we did not propose to "remove that concept from N1103.1.3" - read our comment again.
**Comment by William Penniman**
Aug 10, 2020 14:02 UTC

As I have previously explained in the statement of reasons and my presentation to Work Group 3, electric resistance heating is highly inefficient compared to electric heat pumps; it is much more costly to operate; it contributes more to air pollution and climate change; and it provides less year-round comfort than heat pumps, which helps residents year-round. As explained by DOE, a heat pump reduces energy costs by half or more compared to resistance heat. Resistance heat is extraordinarily expensive in cold periods (a problem that will be made worse if building envelopes are poorly insulated and sealed, which is the subject of other proposals). Energy cost savings and improved comfort from heat pumps will be particularly important to low-income residents.

As proposed, resistance heat should not be installed as a primary heat source in new construction or installed to replace a heat pump in an existing dwelling. Replacing a heat pump with resistance heat would be wasteful of energy and affirmatively harmful to residents. I would have no objection to writing into the VEBC language stating: “Electric resistance heat shall not be installed as a replacement for a heat pump in an existing dwelling.”

There is no reason to remove that concept from N1103.1.3. If, however, other proposals transfer efficiency measures to a single location for existing building codes, then this may be located there. It should not be dropped.

Proposal # 446

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## RE403.1.2 - Electric Resistance Heat Restrictions

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

- Ms. Eggerton of Alexandria is in support.
- Ms. Stillman representing herself is in support of this proposal.
- Ms. Main representing herself speaks in support as well, that it benefits the buyers.
- Mr. Payne (AIA Virginia) opposes; he believes this language should be in the existing building code.
- Mr. Beahm (Warren County) speaks in opposition.
- Mr. Gordon (AOBA) opposes.

**Results:** Non-Consensus **:**

## RE403.1.2 Electric resistance heat

**Proponent(s):** William Penniman (wpenniman@aol.com)
**Summation of Proposal**: This proposal restricts the use of electric resistance heat as a primary home heating method.
**Comments:**

- Ms. Lang (self) supports this proposal with regard for Mr. Penniman's explanation of benefits.
- Ms. Stillman supports, citing personal experience with both electric resistance heat and pump heat.
- Mr. Clark (HBAV) opposes.
- Mr. Beahm (representing self) does not support.
- Ms. Shutler (The Virginia Grassroots Coalition) supports this proposal
- Ms. Nawaz supports this proposal, mentioning that electric heat pumps are much more efficient than gas/fossil fuel sources.
- Ms. Eggerton (speaking for herself) supports this proposal.

Results: Non-Consensus

Decided at the July 15, 2020 Workgroup 3 Meeting and
at the August 11, 2020 Combined Workgroup Meeting

# RE403.1.4-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Energy Conservation Code

**Add new text as follows:**

**R403.1.4 Primary Space Heating Systems** New residential construction may not install HVAC systems that rely on combustion of gas or other fuels as the primary systems for space heating.

**N1103.1.4 Primary Space Heating Systems** New residential construction may not install HVAC systems that rely on combustion of gas or other fuels as the primary systems for space heating.

**Reason Statement:** The Board has authority, under 36-99.6.3, to regulate HVAC systems and an obligation under Section 36.99 to adopt building codes to protect the health, safety and welfare of residents of the Commonwealth. The Board should use those powers to adopt code provisions that prohibit future installations of combustion furnaces, as primary heating sources, in new, privately owned residential dwellings.
In-home combustion of gas or other fuels is less energy efficient than heating with electric heat pumps due to the higher coefficient of performance of heat pumps. In addition, installation of electric heat pumps will reduce emissions of carbon dioxide and other pollutants that result from fossil fuel combustion. Such pollutants are harmful to human health and the environment and can contribute to indoor air pollution that presents health issues beyond climate change (e.g., carbon monoxide and methane leakage). [1] All combustion (whether gas, oil, coal or other fuel) is dirtier and more harmful than using electric heat pumps. Electric heat pumps will only get better as Virginia increasingly generates electricity with zero-carbon technologies, which is required by the Virginia Clean Economy Act of 2020. Methane emissions associated with natural gas at every stage from production to consumption also increase climate change, particularly since methane is approximately 86 times more potent than carbon dioxide as a heat-trapping gas, over 20 years.[2]

In addition, combustion furnaces are more costly in Virginia's climate zone, so cost also favors electric heat pumps.[3]

In sum, the growing climate crisis and the importance of reducing indoor and outdoor air pollution warrant implementation of this limitation on using combustion heating as the primary heat source in new dwellings.

[1] Although combustion furnaces are generally designed to vent emissions outdoors, they still pose a risk of carbon monoxide, and installing a natural gas furnace will increase the probability that a gas stove will also be installed. Gas stoves are a particularly large source of indoor air pollution. https://rmi.org/insight/gas-stoves-pollution-health .
[2] “The drilling and extraction of the fuel from wells, as well as its processing, transmission, distribution, and storage, also result in the leakage of methane—a primary component of natural gas that is 34 times stronger than carbon dioxide at trapping heat over a 100-year period and 86 times stronger over 20 years (Myhre et al. 2013).” Union of Concerned Scientists, The Natural Gas Gamble: A Risky Bet on America’s Clean Energy Future (March 2015), p. 16. The report adds: “Although there is still uncertainty about the precise quantity of these so-called fugitive methane emissions, preliminary studies and field measurements range from 1 to 9 percent of total natural gas production.
[3]https://www.trane.com/residential/en/resources/heat-pump-vs-furnace-what-heating-system-is-right-for-you/

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The comparative costs of installing a combustion furnace or an electric heat pump depend on the assumptions made about the characteristics of the units (efficiency and other features) as well as whether a gas line or tank needs to be installed to supply the combustion unit. Beyond the start, efficiencies and operating costs favor electric heat pumps.

**Resiliency Impact Statement:** This proposal will increase Resiliency
The proposed measure will promote energy efficiency; increase reliance on zero-carbon energy sources to operate our buildings; help mitigate climate impacts; and prepare Virginia’s buildings and economy for a future that requires the least energy usage and related pollution possible. Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses, limits on economic activity, agriculture, fisheries, and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy savings and minimizing GHG pollution.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RE403.1.4-18

**Discussion by Kenney Payne**
Aug 4, 2020 15:01 UTC

The code should not be in the business of picking favorites and should allow as many options as possible, provided they are consistent with acceptable levels of health, safety, and welfare of the occupants. On a personal note, natural gas has served me well, including when the power was out for over a week after a hurricane blew through.

Mr. Penniman's reason statements used in other proposals tout "choice" (solar, EV, etc.) yet he wants to take choice away here.

His reason statement compares the energy efficiency of heat pumps (which I have on my house) to gas appliances, but when one analyzes "cradle-to-grave" costs and environmental impact, one cannot dismiss the impact producing such electric power has on the environment. While improving, there is still an impact. So, this argument is somewhat limited because it ignores how the electricity is produced and limits it positions to just between the appliances themselves.

Clearly, gas is dangerous. The code has established requirements to address such hazards. But, electricity has its hazards as well. And, the code has addressed those hazards as well (at least most of them - arc fault anyone?). as with anything, the code is a MINIMUM and can always be exceeded. Choice is a good thing - especially in the residential market. When codes start regulating favorites, it can be inherently become problematic and potentially create unintended consequences.

For these reasons, we OPPOSE and encourage the BHCD to do the same.
**Comment by William Penniman**
Sep 16, 2020 17:37 UTC

A house with a separate generator (which is not a primary space-heating source) or a solar-and-battery combination can keep essential appliances running even if they are electric.
**Comment by Kenney Payne**
Aug 20, 2020 21:17 UTC

My furnace works when the power is out because it is run by my generator - which is powered by natural gas. And, if I'm running natural gas to my house for my generator, why not go ahead and take advantage of it to serve other components in my house, such as my water heater, furnace, fireplaces, and range-top?

Gov. Newsom just this week (August 17) said he now questions their energy approach given all of the blackouts that they have had to endure this summer. And ex-Gov. Brown just told folks to just turn up their thermostats - during a heat wave. Such empathy!
**Comment by William Penniman**
Aug 10, 2020 19:34 UTC

On-site combustion of gas or other fuels is much less energy efficient than an electric heat pump. On-site combustion of fuels contributes more to climate change and to air pollution both indoor and out. The harms from fossil fuel combustion are even worse when one considers methane leakage at every stage from production to consumption, particularly since methane is 86 times more powerful than CO2 as a heat trapping gas over 20 years. Heating with gas furnaces are more costly than electric heat pumps. Even at the time of construction gas furnaces incur the additional costs of installing air conditioning and gas line extensions.

In order to tame climate change, electrification of uses and switching generation to zero-carbon sources is critical. Already, the combination of heat pump efficiencies and Virginia's mix of electric generation is cleaner than on-site combustion of gas or other fuels. By law, renewable energy will increase five-fold by 2030, and annually increase until it reaches 100% in 2050. The sum of renewable energy and existing nuclear will result in more than half of Virginia's electric generation being from zero-carbon sources before 2030.

Considering all the factors, shifting space heating from on-site combustion to electric heat pumps is consistent with the statutory goals (VA Code 36-99) of adopting building code standards that best serve the "health, safety and welfare" of the people of Virginia. Also, the BHCD has authority to set standards for HVAC systems, which is relevant to this proposal.

Contrary to the commenter's suggestion, my experience and understanding are that gas furnaces do not function when power is out. My proposal

only addresses primary space heating equipment, not back-up generators.

## RE403.1.4 - Primary Space Heating Systems

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

- Ms. Stillman (self) is in support.
- Mr. Shippee (self) is in support.
- Mr. Clark (HBAV) is opposed.
- Ms. Whayland of Virginia Natural Gas is opposed on a cost basis.
- Mr. Vaughan of Columbia Gas is opposed on the grounds that heat pumps won't be as effective for all types of homes throughout the state.
- Ms. Eggerton of Alexandria argues against this point; current heat pumps' technology heats from the lowest temperature of 7 degrees Fahrenheit.
- Mr. Payne of AIA Virginia is opposed.
- Ms. Phillips of Washington Gas is also opposed.
- Ms. Papageorge of Southern Company Gas opposes this proposal.
- Ms. Shutler of the Virginia Grassroots Coalition is in support of this proposal.

**Results:** Non-Consensus.

**RE403.1.4 Primary Space Heating Systems**
**Proponent(s): William Penniman - Sierra Club (wpenniman@aol.com)**
**Summation of Proposal:** This proposal prohibits the use of gas furnaces for primary heat sources.
Comments:
● Mr. Clark (HBAV) opposes.
● Mr. Beahm (self) stands by his comments from the last change (RE403.1.2) and opposes this proposal, RE403.1.4, as well.
● Ms. Lang (self) supports this proposal.
● Ms. Stillman (self) supports.
● Ms. Eggerton (Alexandria) says it is cheaper as a first cost to install a heat pump only over an air conditioner with a gas furnace. Modern heat pumps can perform down to 7 degrees so that no back up heat is needed.
● Ms. Nawaz supports this proposal.
● Ms. Najarian (Virginia Democracy Forward) supports this proposal.
● Ms. Shutler (Virginia Grassroots Coalition) supports this proposal
● Mr. Pharr (AOBA/VAMA) opposes RE403.1.4
●Ms. Whayland (Natural Gas) opposes.
●Ms. Main (self) supports.
●Mike O'Connor opposes.
●Alexandria Phillips (self and Washington Gas) opposes this proposal RE403.1.4
●Mr. Zaynow (Columbia Gas) opposes.
●Ms. Papageorge (Southern Company Gas) strongly opposes this proposal.
●Mr. Shearer (self): The code pertains to new construction, which should be movingtowards zero carbon. He is in support.
●Ms. Main (self) supports, citing that a new law makes it the policy of the Commonwealthto achieve a net-zero economy by 2045, which will necessitate all buildings goingelectric. There is no reason to install gas heat in buildings today, that will have to beconverted later.
Results: Non-consensus

# RE404.2-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Energy Conservation Code

**Add new text as follows:**

**R404.2 (N1104.2) Electric readiness (Mandatory)** Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 through R404.2.3. All water heating systems shall comply with the space requirements of Section R404.2.3 B.

**R404.2.1 (N1104.2.1) Household Ranges and Cooking Appliances** An individual branch circuit and outlet with a minimum rating of 250-volts, 40-amperes shall be installed within 3 feet from each gas or propane range or permanently installed cooking appliance. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 40-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane range or permanently installed cooking appliance. A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

**R404.2.2 (N1104.2.2) Household Clothes Dryers and Water Heaters** An individual branch circuit and outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane clothes dryer and water heater or any water heater using fuel oil. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 30-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane clothes dryer or water heater or any water heater using fuel oil. A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

**R404.2.3 (N1104.2.3) Electrification-ready circuits or raceways and water heater space.** A. The unused conductors required by Sections R404.2.1 or R404.2.2 shall be labeled with the word "spare" and be electrically isolated. The ends of unused raceways, if any, shall be visible or located behind a plate where the appliance outlet will go and shall be labeled with the intended use. Space shall be reserved in the electrical panel in which the branch circuit originates (or will originate if a raceway is initially installed) for the installation of an overcurrent device. Capacity for the circuits described by Sections R404.2.1 or R404.2.2 shall be included in the load calculations of the original installation.

B. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available within 3 feet of the water heater.

**Exception:** The water heater space requirement does not need to be met where a heat pump water heater is installed.

## 2015 Virginia Residential Code

**Add new text as follows:**

**N1104.2 Electric readiness (Mandatory)** Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections N1104.2.1 (R404.2.1) through N1104.2.3 A. All water heating systems shall comply with Section N1104.2.3 B (R404.2.3 B).

**N1104.2.1 Household Ranges and Cooking Appliances** An individual branch circuit and outlet with a minimum rating of 250-volts, 40-amperes shall be installed within three feet of each household range and permanently installed cooking appliance. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 40-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane clothes dryer or water heater. A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

**N1104.2.2 Household Clothes Dryers and Water Heaters** An individual branch circuit and outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane clothes dryer and water heater or any water heater using fuel oil. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 30-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane clothes dryer or water heater or any water heater using fuel oil . A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

**N1104.2.3 (R404.2.3) Electrification ready circuits and water heater space.** Electrification-ready circuits and water heater space.

A. The unused conductors required by Sections N1104.2.1 (R404.2.1) and N11.04.2.1 (R404.2.2) shall be labeled with the word "spare" and be electrically isolated. The ends of unused raceways, if any, shall be visible or located behind a plate where the appliance outlet will go and shall be labeled with the intended use. Space shall be reserved in the electrical panel in which the branch circuit originates (or will originate if a raceway is initially installed) for the installation of an overcurrent device. Capacity for the circuits described by Sections N1104.2.1 and N1104.2.2 shall be included in the load calculations of the original installation.

B. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available within 3 feet of the water heater.

Exception: The water heater space requirement does not need to be met where a heat pump water heater is installed.

**Reason Statement:** This proposal enhances customer choice by making it easy for property owners to choose either electric or gas appliances in the future. It is easy and inexpensive to installing wiring and equipment with appropriate capacities when a house is being built. Alternatively, a raceway and related equipment may be installed. At that time, walls are open, wiring is being routed, and tradesmen are present. Retrofitting would be much more costly and could require opening and repairing walls. By ensuring that a dwelling built with gas or propane can easily accommodate future electric appliances and equipment, this proposal protects homeowners from future conversion costs if a customer decides to switch to electric energy for any reason. In Virginia, an electric heat pump is already more cost effective than a gas furnace according to a manufacturer that sells both. https://www.trane.com/residential/en/resources/heat-pump-vs-furnace-what-heating-system-is-right-for-you/ A heat pump is also cleaner and will get progressively cleaner as electricity generation shifts to zero-carbon sources.

There are several potential reasons an occupant may wish to switch in the future. For example, gas prices fluctuate more than electric rates and could become less affordable. Electric heat pump technology has a high level of energy efficiency, moderates indoor humidity and incorporates air conditioning into a single system. Electric heat pumps offer pollution reduction benefits over onsite gas combustion, and those benefits will grow as the efficiency of electric heat pumps continues to rise and as Virginia's electricity generation transitions from fossil fuels to zero-carbon sources. Virginia's largest utilities are now required to steadily shift to zero-carbon generation, close coal plants, and achieve all zero-carbon generation by 2045.

Onsite gas combustion also poses a risk of indoor air pollution that is increasingly recognized. Indirectly, installing a natural gas furnace will increase the probability that a gas stove will be installed. Gas stoves are a particularly large source of indoor air pollution. https://rmi.org/insight/gas-stoves-pollution-health

Increasingly, customers are concerned about climate and health impacts from fossil fuel combustion, in addition to energy efficiency and bills. As a result, they may want to transition from natural gas to electric space and water heating and possibly to cooking to take advantage of the climate and efficiency benefits. Further, federal, state, and local environmental and public health policies may encourage, or even require the transition from fossil fuels in some areas over the life of the building. Although gas may be cleaner than coal, it is dirtier than zero-carbon electric generation or a mix including significant zero-carbon generation, and methane emissions which occur at every stage of the process, including in homes, are a much more powerful greenhouse gas than carbon dioxide per unit emitted. UCS, The Natural Gas Gamble: A Risky Bet on America’s Clean Energy Future (March 2015),

Thus, this electric-ready requirements will protect customers' options and pocketbooks. Transitioning to electricity for all forms of heating (space, water and cooking) is important to reducing climate impacts from fossil fuel combustion. Having wires in place will eliminate the retrofit cost barrier to doing so.
The proposal's language is modeled on concepts in the pending 2021 IECC.

**Cost Impact:** The code change proposal will increase the cost of construction
The cost of meeting these electric-ready requirements when the house is being built, walls are open, and the trades are already on-site, is marginal. Wiring will already be extended to gas or propane appliances and this merely requires also extending wires capable of handling a heavier load or, at least, raceways and equipment facilitating future branch circuit connections. In comparison, the cost of retrofitting a building for these requirements can be orders of magnitude higher, require opening and patching walls. Not making new buildings electric-ready would leave homeowners exposed to potentially high retrofit costs in the future and will greatly inhibit customer choice and act as a barrier to achieving the health, welfare and resiliency benefits of cleaner electricity and heat pump efficiencies.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Climate change poses an ever-greater resiliency threat the longer we fail to reduce greenhouse gas (GHG) emissions. The need to swiftly reduce carbon emissions is recognized in Governor Northam’s EO 43 and in recent legislation from the General Assembly. Electrification helps to address those risks by reducing GHG emissions, and the pollution-reduction benefits will grow as more electricity is generated by zero-carbon energy sources. Under the Virginia Clean Economy Act, which was enacted this year, the zero-carbon electricity generation by Virginia's largest utilities will increase every year, so they generate zero carbon emissions by 2045. Other forms of pollution will decline as well. That will steadily increase the already substantial health, welfare and resiliency benefits from switching to all-electric appliances.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:** Bryan Holland from NEMA had suggested revisions (See below)

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# Public Comments for: RE404.2-18

**Discussion by Bryan Holland**
Jul 16, 2020 12:09 UTC

**R404.2 (N1104.2) Electric readiness (Mandatory).** Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 through R404.2.3. All water heating systems shall comply with Section R404.2.4.

**R404.2.1 (N1104.2.1) Household Ranges and Cooking Appliances.** An individual branch circuit and outlet with a minimum rating of 250-volts, 40-amperes shall be installed within three feet of each gas or propane range or permanently installed cooking appliance.

**R404.2.2 (N1104.2.2) Household Clothes Dryers and Water Heaters.** An individual branch circuit and outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane household clothes dryer and water heater.

**R404.2.3 (N1104.2.3) Electrification-ready circuits.** The unused conductors required by Sections R404.2.1 or R404.2.2 shall be labeled with the word “spare.” Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections R404.2.1 or R404.2.2 shall be included in the load calculations of the original installation.

**R404.2.4 (IRC N1104.2.4) Water heater space.** An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available surrounding or within 3 feet of the installed water heater.

**Exception:** The water heater space requirement does not need to be met where a heat pump water heater or tankless water heater is installed.

**Comment by William Penniman**
Sep 16, 2020 18:38 UTC

These suggestions and those of another work group member were addressed by revisions prior to the August 4 work group meeting.

**Comment by William Penniman**
Jul 16, 2020 19:26 UTC

Bryan - Thanks for these. They look good on first reading, I will reread in the next couple of days. Were these from the suggested changes that you or one of the other speakers said were inadvertently left out of the 2021 IECC process?

Proposal # 447

## RE404.2 - Electric Readiness

Proponent(s): William Penniman (wpenniman@aol.com), Sierra Club
Comments:

- Mr. Holland (NEMA) speaks strongly in support of this proposal.
- Ms. Main, representing herself, is strongly in support.
- Mr. Banashek representing himself is strongly in support.
- Mr. Kines (Prince William County) agrees with the principle; however, he has some concerns with the specificity of language regarding electrical requirements.
- Mr. Statzer of VBCOA agrees with Mr. Kines: support in theory, opposes in practice.
- Mr. Holland acknowledges that modifications will still need to be made, but he still underscores the importance of this proposed change. He notes that this was what was put forward for the 2021 codes, and it would be better for this proposal to reflect more comprehensively what was eventually decided for the 2021 codes.
- Mr. Goplerud (Faith Alliance for Climate Solutions) supports.
- Ms. Eggerton (Alexandria) is in strong support on the grounds that this will help localities come up with environmental action plans.
- Mr. Clark of HBAV opposes on the grounds of cost.
- Mr. Vaughan of Columbia Gas opposes, citing gas still being a very important and affordable piece of the heating and cooling market.
- Ms. Papageorge of Southern Company Gas opposes.

**Results:** Carryover

**RE404.2 Electric readiness**
**Proponent(s): William Penniman - Sierra Club (wpenniman@aol.com)**

- Mr. Penniman provides background for this proposal.
- Ms. Clark mentions that if this proposal is the same as it was during the last workgroup meeting, HBAV is opposed. Phil Abraham on behalf of the Virginia Association of Commercial Real Estate asked Mr. Clark to pass along his opposition as well.
- Mr. O'Connor is opposed.
- Ms. Eggerton (The City of Alexandria) supports this as they have a goal of moving to electrification in the future as an action of the adopted Environmental Action Plan 2040. This proposal supports the goals to reduce carbon emissions by 50% by 2030 and 80-100% by 2050.
- Mr. Beahm (self) claims this change would create issues with different manufacturers' requirements, so he is opposed.
- Ms. Stillman (self) supports electric readiness.
- Ms. Papageorge (Southern Company Gas) is in opposition to this proposal. The proponent states that the proposal is based on language that will probably be in the 2021 IECC". It may not, as this provision from the 2021 edition of the IECC is currently being appealed to the Board of Directors of the International Code Council (ICC).
- Mr. Sargeant (OmegaFlex) says that unless this can be amended to require gas be piped to all electric appliances, they strongly oppose this proposal. This proposal seeks to force electrification.
- Ms. Stillman argues that this proposal just says you give customers choices by making the home electric ready. More choices.
- Alexandria Phillips, speaking on behalf of herself and Washington Gas, opposes this proposal RE404.2
- Bryan Holland (NEMA) strongly supports Proposal RE404.2. They worked with the proponent to address the comments made during the WG#3 meeting and feel the revised language is very workable and will enhance the effective use of energy in a dwelling.
- Jimmy Moss (self) opposes this proposal

- Ms. Najarian supports this proposal, claiming that it is apparent that Virginia, the country, and the world will convert to using electricity to combat climate change. Virginia is poised to finally be a frontrunner in the transition to use of renewable energy. The time to do this is when you are building. In addition, a very important aspect of environmental justice, is to make costs of utilities reduce. That includes cost of running energy efficient appliances. Let's do it at the front end.
- Ms. Main (self) is in support; let's not wait to convert to electric energy.
- Ms. Lang (self) supports.
- Ms. Shutler says The Virginia Grassroots Coalition supports this electric readiness proposal.
- Ms. Byer (self) supports this proposal.
- Ms. Eggerton (The City of Alexandria) supports this as we have a goal of moving to electrification in the future as an action of the adopted Environmental Action Plan 2040 and this proposal supports the goals to reduce carbon emissions by 50% by 2030 and 80-100% by 2050
- Mr. Clark (HBAV) is opposed, as is Phil Abraham on behalf of Virginia Association for Commercial Real-Estate.
- Ms. Main supports the electric readiness proposal. Again, it's Virginia policy to get off fossil fuels in the next 25 years, and we should not make it more expensive for homeowners to switch from gas to electric.
- Mr. Zaynow of Columbia Gas is opposed.

**Results:** Non-Consensus

Decided at the July 15, 2020 Workgroup 3 Meeting and
at the August 11, 2020 Combined Workgroup Meeting

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# RE407.1.1-18

**Proponents:** William Penniman (wpenniman@aol.com)

## 2015 Virginia Residential Code

**Add new text as follows:**

**(NEW) R407.1.1 Additional Energy Efficiency Requirements** In addition to all other mandatory efficiency measures, an additional measure shall be selected by the builder from the Additional Efficiency Package Options set forth in section R407.2, subject to the following constraints:

1. For buildings complying under Sections R401 through R404, one of the Additional Efficiency Package Options shall be installed in accordance with R407.2.

2. For buildings complying under the simulated performance alternative in R405, one of the Additional Efficiency Package Options in Section R407.2 shall be installed without including such measures in the proposed design under Section R405.

3. For buildings complying under the Energy Ratings Index alternative in R406, the energy rating index value shall be equal to or less than the ERI target specified in R407.2.2

**407.2 Additional Efficiency Package Options** At least one of the following options shall be selected pursuant to R407.1.

407.2.1 Better insulation. Meet the wall and ceiling insulation requirements equal to or better than R.20+5 or R13+10 for walls and R. 60 for ceilings;

407.2.2. Better ERI. Meet an ERI of 54;

407.2.3. More efficient HVAC. Install heating and cooling equipment that meets or exceeds one of the following:

a. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner

b. Greater than or equal to 10 HSPF / 16 SEER air source heat pump

c. Greater than or equal to 3.5 COP ground source heat pump.

For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100% of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100% of the heating design load.

407.2.4. Reduced energy service use in service water heating option. The hot water system shall meet or exceed one of the following efficiencies:

a. Greater than or equal to 82 EF fossil fuel service water heating system;

b. Greater than or equal to 2.0 EF electric service water heating system;

c. Greater than or equal to 0.4 Solar Fraction solar water heating system.

**Reason Statement:** The purpose of this code change is to improve energy efficiency in covered buildings by approximately 5-10% while giving code users flexibility to choose the measures that make the most sense for their project. Each of the options is feasible to implement and has been vetted in the 2021 ICC process, which will soon be completed.
In addition to paralleling an additional efficiency options requirement of the pending 2021 IECC, this proposal largely mirrors the format for Section C406 Additional Efficiency Package Options for new commercial buildings in the 2012 IECC.

The options in this proposal differ from the pending additional efficiency options in the 2021 IECC in that two of the four options in this proposal would be mandatory, not options, under the pending 2021 IECC.

- The option for a higher level of envelope insulation is part of the mandatory baseline for Climate Zone 4 in the soon-to-be finalized 2021 IECC.
- The better ERI option also tracks the new ERI baseline in the pending 2021 IECC.
- The option for high efficiency HVAC is part of the pending 2021 IECC's package of additional measures and is based on existing technology.
- The options for high efficiency water heating is part of the pending 2021 IECC's package of additional measures and is based on existing

technology.

Since the results of Virginia's current update cycle, including this proposal if adopted, will not take effect until sometime in 2021, there is no valid reason not to incorporate beneficial provisions from the 2021 IECC, such as this one, during this code cycle. Delay will harm Virginia or its residents, since the Board's actions will affect energy savings (or unnecessary energy usage) for many decades in buildings constructed before the next code-cycle is completed.

Adopting this proposal will increase energy savings and reduce occupancy costs for residential customers. It will also reduce air pollution emissions, including carbon emissions, that result directly or indirectly from residential energy usage. Achieving such results is clearly consistent with Virginia Code 36-99 which requires that the state's building codes protect "the health, safety and welfare of residents in the Commonwealth" and be "consistent with recognized standards of health, safety, energy conservation and water conservation". The welfare of all Virginians will benefit from the increased energy savings, lower aggregate energy costs and lower pollution levels.

This proposed requirement that builders select among additional energy-saving options is also consistent with, and supportive of, measures for improving efficiency and reducing carbon emissions established by the 2020 General Assembly and the Governor (e.g., in the Virginia Clean Economy Act, the Clean Energy and Community Flood Protection Act) and expressed in Governor Northam's EO 43 (Sept. 2019). Achieving those goals requires that new buildings be built to meet higher energy efficiency standards than are proposed by the BHCD's pending proposal, which does not even catch up to the 2018 IECC. That is much cheaper and more effective than having to retrofit at much higher costs in the future. This proposal will help to move forward on energy conservation.

**Cost Impact:** The code change proposal will increase the cost of construction
The proposal will increase construction costs. However, it will also reduce energy costs to occupants, and it will reduce health and environmental costs from generating energy to serve demands that could be reduced by energy efficiency measures that can be built into new buildings. Incorporating these measures into new buildings will save energy and costs for 70 years or more. Greater building energy efficiency is critical to reducing direct and indirect costs to residents and the community. Thus, the measures will both save money and help to protect "the health, safety and welfare of residents in the Commonwealth."

**Resiliency Impact Statement:** This proposal will increase Resiliency
The proposed measures will help to enhance resiliency in several ways.

All the options will reduce energy usage, help mitigate climate impacts and prepare Virginia's buildings and economy for a future that requires the least possible energy usage and related pollution. Climate change is already harming Virginia and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses and harms to economic activity, agriculture, fisheries and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy savings and minimizing GHG pollution.

Options to improve envelope efficiency or ERI will help residents and communities withstand periods of power outages from storms or other causes. All the options will reduce burdens on utilities which will help them cope with storms and other difficulties. Lower utility costs will benefit all customers as will lower pollution levels.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RE407.1.1-18

**Discussion by Kenney Payne**
Aug 4, 2020 15:17 UTC

While AIA Virginia is remaining NEUTRAL on this proposal, should it move forward, we believe the language could be improved. The code should be written in an active tense and direct the user as to what to do - not be written more like a commentary or story. It should use terms that are clear and enforceable and not vague, ambiguous, and unenforceable. For example, what does "better" mean? Is it necessary to get the point across? What's "more"? One (1) is more, but maybe two (2) is intended. When using "meet or exceed" does that mean as an RDP I can "meet" the requirement and comply, or does that mean a code official can require me to "exceed" the requirement?

Therefore, for your consideration:

407.2.1: ~~Better~~ Insulation. ~~Meet the~~ For wall and ceiling insulation ~~requirements equal to or better than~~ comply with R.20+5 or R13+10 for walls and R. 60 for ceilings;

407.2.2. ~~Better~~ ERI. ~~Meet~~ Provide an ERI of 54;

407.2.3. ~~More efficient~~ HVAC. ~~Install~~ Provide heating and cooling equipment that meets or exceeds one of the following:

For multiple cooling systems, all systems shall ~~meet or exceed~~ comply with the minimum efficiency requirements in this section and shall be sized to serve 100% of the cooling design load. For multiple heating systems, all systems shall ~~meet or exceed~~ comply with the minimum efficiency requirements in this section and shall be sized to serve 100% of the heating design load.

407.2.4. ~~Reduced~~ Energy service use in service water heating option. The hot water system shall ~~meet or exceed~~ comply with one of the following efficiencies:

**Comment by William Penniman**
Aug 10, 2020 14:06 UTC

If the DHCD Staff and BHCD prefer the requested language changes and do not believe that it alters the results, I have no objection to making the changes. The intent of the phrases “meets or exceeds” and “equal to or better than” was simply to convey that the standards are minimums for energy efficiency.

Proposal # 452

## RE407.1.1 ERI Options

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)
**Summation of Proposal:** This proposal gives additional options for trade-offs to accomplish the required energy rating.
**Comments:**

- Keith Oberg (self) supports.
- Ms. Shutler supports.
- Ms. Najarian (Virginia Democracy Forward) supports this measure as it gives builders and owners a choice, and also supports increased energy efficiency. This is significant because energy efficiency is a win win. No one loses, and giving people choices empowers them and helps with the buy in.
- Ms. Nawaz supports this proposal.
- Mr. Witt (speaking for himself) opposes this change as it requires additional requirements to other requirements of the code. The residential code is a prescriptive code and any requirement should stand alone
- Mr. Clark opposes based on substance but also on the proposal's structure itself.
- Mr. Lacey (RECA) is in support.
- Ms. Harnish (VAEEC): VA Energy Efficiency Council supports this proposal
- Mr. Beahm (representing himself) opposes RE407.1.1
- Ms. Eggerton (City of Alexandria) supports this as options for improved efficiency that aligns with the adopted Environmental Action Plan 2040
- Mr. Shearer (self) is in support.

**Results: Non-Consensus**

**RE407.1.1 -Additional Energy Requirements**
**Proponent(s):** William Penniman ( wpenniman@aol.com ), Sierra Club
**Comments:**
● Ms. Shutler of the Virginia Grassroots Coalition supports. She does not think this proposal is too ambitious.
● Mr. Clark with VBCOA HBAV is in opposition.
● Mr. Payne (AIA Virginia) is concerned about the subjectivity of the language of this proposal.
● Mr. Lacey (RECA) is in support based on the fact that the proposal is based largely on the 2021 code requirements, and that RECA certainly supports this.
● Ms. Eggerton of Alexandria clarifies that Virginia has used future model code language into code development for deck requirements many years ago and in other cases as well. She is in support.
● Mr. Shearer (representing himself) is also in support.
● Ms. Loving of CAAV is also in support and like Mr. Lacey, believes this change would provide greater options and flexibility; she would welcome further stringency as well.
● Mr. Gordon of AOBA is opposed to the proposal due to the vague language and cost concerns.
● Mr. Farrell of VBCOA is concerned about including "non-mandatory options" in the proposal because they would be difficult to enforce from a maintenance perspective.
**Results: Non-Consensus**

Decided at the July 15, 2020 Workgroup 3 Meeting and
August 11, 2020 Combined Workgroup Meeting

# RB302.3(2)-18

**Proponents:** Residential Uses Subworkgroup

## 2018 International Residential Code

**Revise as follows:**

**ACCESSORY DWELLING UNIT**

A *dwelling unit* in a *two-family dwelling* that is accessory to the primary *dwelling unit* . An *accessory dwelling unit* provides for separate living, sleeping, eating, cooking and sanitation facilities for one or more occupants, but may share living space, means of egress, utilities, or other components. An *accessory dwelling unit* fully complies with the requirements of this code for a *dwelling unit* except where specified otherwise.

**Add new text as follows:**

**TWO-FAMILY DWELLING**

A *dwelling* that includes two *dwelling units* or one *dwelling unit* and one *accessory dwelling unit* .

**Revise as follows:**

**[RB] DWELLING.**

Any building that contains one or two *dwelling units*, or one *dwelling unit* and one *accessory dwelling unit*,used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

**R302.3 Two-family dwellings.** *Dwelling units* in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code. Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the *exterior wall*, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

**Exceptions:**

1. A fire-resistance rating of $^1/_2$ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.
2. Wall assemblies need not extend through *attic* spaces where the ceiling is protected by not less than $^5/_8$-inch (15.9 mm) Type X gypsum board, an *attic* draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the *dwellings* and the structural framing supporting the ceiling is protected by not less than $^1/_2$-inch (12.7 mm) gypsum board or equivalent.
3. Fire resistant rated assemblies are not required to separate a *dwelling unit* and *accessory dwelling unit* , where both units are located on the same lot and comply with Sections R314.7 and R315.5.

**R311.1 Means of egress.** *Dwellings* , and each *dwelling unit* in a *two-family dwelling,* shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the *dwelling* to the required egress door without requiring travel through a garage. The required egress door shall open directly into a public way or to a *yard* or court that opens to a public way.

**R314.7 Fire alarm systems.** A fire alarm system complying with Section R314.7.1 through R314.7.4 shall be installed within a *two-family dwelling* that is constructed without fire separations in accordance with exception 3 of Section R302.3 and shall be installed in such a manner that the actuation of an alarm will activate all notification appliances within both *dwelling units*. Fire alarm systems shall be permitted to be used in other *dwelling units* in lieu of smoke alarms and shall comply with Sections R314.7.1 through R314.7.4.

**R315.5 Interconnectivity.** Where more than one carbon monoxide alarm is required to be installed within an individual *dwelling unit* in accordance with Section R315.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the ~~individual~~ *dwelling ~~unit~~*. Alarm devices within a *two-family dwelling* constructed wihout fire separations in accordance with Exception 3 of Section R302.3 shall be interconnected in such a manner that the actuation of one alarm within either unit will activate all alarms within both *dwelling units*. Physical interconnection of carbon monoxide alarms shall not be required where *listed* wireless alarms are installed and all alarms sound upon activation of one alarm.

**Exception:** Interconnection of carbon monoxide alarms in existing areas shall not be required where *alterations* or *repairs* do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an *attic*, crawl space or basement available that could provide access for interconnection without the removal of interior finishes.

**M1602.2 Return air openings.** Return air openings for heating, ventilation and air-conditioning systems shall comply with all of the following:

1. Openings shall not be located less than 10 feet (3048 mm) measured in any direction from an open combustion chamber or draft hood of another appliance located in the same room or space.
2. The amount of return air taken from any room or space shall be not greater than the flow rate of supply air delivered to such room or space.
3. Return and transfer openings shall be sized in accordance with the appliance or equipment manufacturer's installation instructions, Manual D or the design of the registered design professional.
4. Return air shall not be taken from a closet, bathroom, toilet room, kitchen, garage, mechanical room, boiler room, furnace room or unconditioned attic.

    **Exceptions:**

    1. Taking return air from a kitchen is not prohibited where such return air openings serve the kitchen only, and are located not less than 10 feet (3048 mm) from the cooking appliances.
    2. Dedicated forced-air systems serving only the garage shall not be prohibited from obtaining return air from the garage.

5. For other than dedicated HVAC systems, return air shall not be taken from indoor swimming pool enclosures and associated deck areas except where the air in such spaces is dehumidified,
6. Taking return air from an unconditioned crawl space shall not be accomplished through a direct connection to the return side of a forced-air furnace. Transfer openings in the crawl space enclosure shall not be prohibited.
7. Return air from one dwelling unit shall not be discharged into another dwelling unit.

    **Exception:** The return air within a *two-family dwelling* constructed without fire separations in accordance with Exception 3 of Section R302.3 shall be permitted to discharge into either *dwelling unit.*

**Reason Statement:** Provides an affordable housing option. Originally brought forward by Arlington County to allow part of existing dwelling units to be occupied by both transient lodgers or long-term renters that desire a degree of independence and privacy from an owner-occupied dwelling. This version was presented as "option d" during the Residential Subworkgroup meetings and agreed to by the group.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
0

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB302.3(2)-18

This proposal doesn't have any public comments.

Proposal # 458

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## RB302.3(2) Accessory dwelling unit

**Proponent(s):** Residential Use Subworkgroup
**Comments:**

- Mr. Kines of Prince William County is concerned about potential safety issues with this proposal - he is not in support.

**Results:** Non-consensus

Decided at the July 15, 2020 Workgroup 3 Meeting

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# RB313.1-18

**Proponents:** Glenn Dean (gad.pompier@gmail.com)

## 2015 Virginia Residential Code

### SECTION R313
### AUTOMATIC FIRE SPRINKLER SYSTEMS

**R313.1 Townhouse automatic fire sprinkler systems.** ~~Notwithstanding the requirements of Section 103.3, where installed, an~~ An automatic residential fire sprinkler system ~~for townhouses~~ shall be ~~designed and installed in accordance with NFPA 13D or Section P2904.~~ installed in *townhouses* .

**Exception:** An automatic residential fire sprinkler system shall not be required when additions or alterations are made to existing townhouses that do not have an automatic residential fire sprinkler system installed.

**R313.1.1 Design and installation.** Automatic residential fire sprinkler systems for *townhouses* shall be designed and installed in accordance with Section P2904 or NFPA 13D.

**R313.2 One- and two-family dwellings automatic fire sprinkler systems.** ~~Notwithstanding the requirements of Section 103.3, where installed, an~~ An automatic residential fire sprinkler system shall be ~~designed and~~ installed in ~~accordance with NFPA 13D or Section P2904.~~ one- and two-family *dwellings* .

**Exception:** An automatic residential fire sprinkler system shall not be required for additions or alterations to existing buildings that are not already provided with an automatic residential fire sprinkler system.

**R313.2.1 Design and installation.** Automatic residential fire sprinkler systems shall be designed and installed in accordance with Section P2904 or NFPA 13D.

**Reason Statement:** In part, the purpose of this proposal is to elevate Virginia's residential building code from one being sub-par to being equal to the national standard/model as it relates to fire safety and sustainability through preservation.T
he cost of residential sprinkler systems keeps dropping to where it may well be less than a typical kitchen counter upgrade. This statement is based on the attached 2017 study by the University of Nevada, Las Vegas. Beyond that, the facts supporting the requirement to install automatic fire sprinkler systems in townhouses and 1&2 family dwellings have not fundamentally changed over the past decade although they are stronger now than before. By the same token, the argument against requiring sprinklers is fundamentally the same, just somewhat weaker given the national expansion of them being required along with technical improvements, consumer, builder and local official's increased knowledge.

Attached is an article published online by Forbes dated August 3, 2019. It provides a concise overview of why fire sprinklers should be required in all newly constructed housing. (I've hi-lited a few important points.) In concert with the attachment, I urge watching a 10-minute video on YouTube (https://www.youtube.com/watch?v=OiHqRJVChlQ ) that expands the article's cited example of Scottsdale, AZ, a locality with one of the oldest ordinances in the country requiring fire sprinklers. (There are other localities with similar requirements for fire sprinklers but their requirement is younger and thus don't have the more reliant record as Scottsdale, AZ does --- yet.) A fire sprinkler opponent in Virginia might say that Arizona is not Virginia and Arizona's fire experience is not the same as Virginia's. Really, about the only significant difference between Arizona and Virginia is the climate. People are people. Fire is fire. Construction is construction. They essentially use the same materials in Arizona as are used in Virginia with the only difference being the appearance (architecture) once assembled.

One of the oldest arguments against fire sprinklers has been "cost". It's been repeatedly stated that to require fire sprinklers will increase the cost of housing; fire sprinklers will price people out housing; fire sprinklers will hurt the economy. These same tired arguments have been levied against other housing elements over the years. They've been used to argue against handrail geometry, stair geometry, GFIs, smoke detectors, window sizing, energy efficiencies, and the list goes on. To repeat - the cost of installing fire sprinklers is LESS than the cost of most kitchen counter upgrades. They do not require a "sprinkler contractor" to install them. Under current DPOR licensing requirements, a plumber can install them. The plumbing loops in the house are lengthened in order to have a sprinkler head high on a wall in the middle of a ceiling. Maintenance is less than the amount of maintenance given to replacing worn washers in a faucet. (Other than someone physically damaging a fire sprinkler head, there's no maintenance.) The "tap fee" is a non-issue used for distraction. The same is true for the meter size because it does not need to be different from what is currently required or needed. The same is for houses on wells. Nor is there a need for a "stand by fee". In the event of a fire, the amount of water flow (GPM) needed to operate a sprinkler head is no more than what would be needed to take a shower or refill a toilet. If there is sufficient potable water to supply the house for domestic use, then by default there is enough water to supply the fire sprinkler system.

Probably the most ludicrous statement ever made against fire sprinklers was, in a public forum no less, "only OLD houses burn". If that were true, the question becomes at what age does a newly construction house become "old"? **(Please return to the attached article wherein it states that there have been NO - I repeat - NO fire deaths in any house constructed in Scottsdale, AZ since 1986 - 34 years ago.)**

The technical merits and costs of requiring the installation of fire sprinklers in townhouses and 1&2 family dwellings are well known and have been for years. The argument against them hasn't changed much either. So it simply comes down to politics and which argument, for or against, do you wish to subscribe to. As quoted in the attached article, it can be, "A puddle of water or a pile of ashes." To that end, be mindful of the statutory

charge that the USBC and its provisions *"…**shall** be such as to protect the health, safety and welfare of the residents of the Commonwealth, provided that buildings and structures **should** be permitted to be constructed, rehabilitated and maintained at the least possible cost consistent with recognized standards of health, safety, energy conservation and water conservation, including provisions necessary to prevent overcrowding, rodent or insect infestation, and garbage accumulation; and barrier-free provisions for the physically handicapped and aged."* (§ 36-99 of the Code of Virginia) (Emphasis added to denote the order of placement and the importance of the words "shall" and "should".)

**Cost Impact:**
Not including the cost of land, I estimate the cost of incorporating fire sprinkler systems into newly constructed townhouses and 1 &2 family dwellings at 1% or less of the construction costs above the structure's foundation.

**Resiliency Impact Statement:**
COV Executive Order Twenty-four speaks to increasing Virginia's resilience to sea level rise and natural hazards. The Executive Order goes further in saying, "We must act now to protect lives and property from multiple threats and reduce taxpayer exposure through fiscally responsible planning." According to the Resilient Design Institute, resilient design is defined as "the intentional design of buildings, landscapes, communities, and regions in response to vulnerabilities to disaster and disruption of normal life". Fire is a natural hazard to a community whether it is a single house or an entire neighborhood. I submit this proposal proposal provides resilience but it is targeted only to the hazards of fire on a scale smaller than what may be intended or described in Executive Order 24.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB313.1-18

This proposal doesn't have any public comments.

Proposal # 337

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## RB313.1 Sprinkler systems in townhouses

**Proponent(s):** Glenn Dean (gad.pompier@gmail.com), representing himself
**Comments:**

- Mr. Dawson (NFPA) provides background on the proposal in Mr. Dean's absence.
- Ms. Hale of Loudoun County strongly supports.
- Mr. Clark of the Homebuilders' Association is not in support.
- Mr. Shapiro (National Fire Sprinkler Associates) gives an example of how this proposed change has worked well in other states, such as Washington

**Results:** Non-Consensus

Decided at the July 15, 2020 Workgroup 3 Meeting

# Residential Fire Sprinkler Cost Benefit Analysis

# For

# City of Las Vegas (NV) Fire and Rescue

## July 2017

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**Authors:**

**Sanford D. Mangold**
**(Adjunct Professor, Crisis & Emergency Mgt)**
**Chad Hofius**
**(Cost Analyst)**

# Residential Fire Sprinkler Study - 2017

**Executive Summary:**

This is a study commissioned by the Las Vegas Fire and Rescue Department, which provides a dispassionate and objective cost benefit analysis of residential fire suppression (sprinkler) systems, which could be mandated in all new home construction up to 5,000 square feet of livable space*. This study is in direct response of Nevada Revised Statue (NRS) 278.586, which specifies that any governing body considering such a mandate must perform a cost benefit analysis and hold a public hearing on the results of that analysis prior to enacting legislation requiring residential fire suppression systems in all new home construction.

UNLV performed a detailed study over the course of 3 months and determined that there is a definite cost benefit to both homeowners and home builders by installing fire suppression systems in all new residential homes up to 5,000 square feet of livable space.

The following pages detail the UNLV study, which also compares and contrasts the study results with those provided by Applied Analysis (a local Las Vegas analytical company), which was contracted to perform a similar study by the Southern Nevada Homebuilders Association in March 2015.

The UNLV study clearly shows that survival is the primary reason for mandating installation of residential fire sprinkler systems, as well as detailing the source of all cost savings back to homeowners and homebuilders, if such a mandate were enacted.

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***The scope of this report addresses new homes which are less than 5,000 square feet in total livable area to match the scope of the requirements of Section 278.586, added to Nevada Revised Statue as a result of the passage by of SB477. This statute requires that a cost cost-benefit analysis be performed whenever a residential sprinkler ordinance will be considered for residential dwelling structures which are less than 5000 sq. feet in livable area. Please see Attachment 1 of this report for the complete NRS 278.586.**

# Residential Fire Sprinkler Study - 2017

**Purpose:**

The purpose of this study is to present an independent, objective analysis regarding the possible installation of residential fire suppression systems (sprinkler systems) in all new single-family home construction within the city limits of Las Vegas, Nevada. As a starting point, the University of Nevada Las Vegas (UNLV) was asked to study, analyze, and document the different perspectives presented in two studies prepared by reputable organizations:

- The National Institute of Standards and Technology (NIST): Benefit-Cost Analysis of Residential Fire Sprinkler Systems (NISTIR-7451), September 2007.
- Applied Analysis: Benefit-Cost Analysis of Residential Fire Suppression Systems – A Review and Analysis in Unincorporated Clark County, March 2015.

**Background:**

The City of Las Vegas, through the Las Vegas Fire and Rescue, commissioned a cost-benefit analysis to determine the affordability of residential fire sprinklers in single family dwellings with usable living space equaling 5,000 square feet or less. This analysis is to determine the costs associated with a local mandate, as well as the benefits the homeowner and the community gain from residential fire sprinklers. This cost-benefit analysis is also required to satisfy Nevada Revised Statute 278 enacted during the 2015 Nevada legislative session through Senate Bill 477 (attachment 1). Embedded in the Senate language is a mandate requiring that a cost-benefit analysis be performed to demonstrate that the installation of a residential fire suppression system in a new home would be:

> to the benefit of the owners of the residential dwelling units to which the requirement would be applicable and that such benefit exceeds the costs related to the installation of automatic fire sprinkler systems in such residential dwelling units. (Reference: Nevada Senate Bill 477)

Further, the City may elect to issue a mandate requiring fire suppression systems in new residential homes with livable area of 5,000 square feet or less, if:

> the unique characteristics or the location of the residential dwelling unit, when compared to residential dwelling units of comparable size or location within the jurisdiction of the governing body, would cause an unreasonable delay in firefighter response time. (Reference: Nevada Senate Bill 477)

The Senate bill also specifies that the City may mandate residential fire suppression systems in new homes with livable area greater than 5,000 square feet without requiring either of the two criteria mentioned above.

Following the City of Las Vegas' decision to consider adopting this fire suppression system mandate, the Southern Nevada Home Builders Association commissioned a local analytical company, Applied Analysis, to perform a cost-benefit analysis in order to determine the financial feasibility of such a mandate.

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Applied Analysis used the 2007 NIST Study (referenced above) as a baseline document. Then, using only local Clark County (Nevada) data in the NIST-developed algorithms, Applied Analysis performed a study to determine if there was, indeed, a cost benefit to the homeowner derived from having a residential fire suppression system installed. Applied Analysis concluded:

> The National Study found that sprinkler systems are economical (i.e., the benefits outweigh the costs) based on national data; however, the utilization of local datasets leads to a different conclusion. Based on the cost-benefit analysis conducted and described herein, results indicate that in unincorporated Clark County, home fire sprinkler systems are not economical (i.e., the costs outweigh the benefits of installation) based on local fire probabilities and system installation costs. (Reference: Applied Analysis Study, page 3)

**Observations:**

It is important to note that the Applied Analysis study did not dispute the factual content of the NIST Study. Further, Applied Analysis did not suggest that the data used by NIST was flawed; the cost-benefit algorithms developed by NIST were incomplete; nor the conclusions reached by NIST were faulty. Rather, Applied Analysis simply stated that when local Clark County (Nevada) data is plugged into the NIST-developed algorithms, then the installation costs of a residential fire suppression system appear more expensive than any potential financial benefit for a homeowner.

Additionally, the Applied Analysis Study did not consider the potential economic benefits to the homebuilders nor the community, if residential fire suppression systems were mandated in all new residential home construction of 5,000 square feet or less. Without this information, any attempt to provide the City of Las Vegas with a comprehensive cost-benefit analysis is short-sighted and incomplete.

Following the action of the 2015 Legislative Session, the City of Las Vegas asked the University of Nevada Las Vegas (UNLV) to conduct an independent study in an attempt to, if possible, reconcile the differences between the two studies (NIST and Applied Analysis) and to determine if there was additional information, which could shed more light on the wisdom of adopting the legislation mandating the installation of fire suppression systems in all new residential home construction.

Armed with both studies, the UNLV researchers commenced their independent study.

**Approach:**

UNLV met with the Las Vegas Fire Rescue (LVFR) Fire Marshals with whom they conducted extensive interviews, took detailed notes, and obtained a wealth of background studies on residential fire suppression systems performed over the past 15 years. Further, UNLV met with several fire suppression installation contractors to determine the types of fire sprinkler systems available to home builders and the costs of installation based on current and projected residential home building trends with the Las Vegas city limits.

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The researchers also contacted fire marshals, insurance companies, and analytical companies from across the nation. Specifically, they contacted Verisk Analytics:

> Verisk Analytics, Inc. is an American data analytics and risk assessment firm based in Jersey City, New Jersey, United States, serving customers worldwide in insurance, natural resources, financial services, government, and risk management.

Each of the organizations and individuals provided the UNLV researchers with supplementary information. The information indicated that additional data (beyond simply just the cost of installation) needed to be factored into any thorough study on fire suppression systems. This new data coupled with realistic fire suppression system installation costs would provide Las Vegas City Council with comprehensive information upon which to make a final decision as to how to proceed with residential fire suppression system legislation.

**Findings:**

- **Cost:** UNLV performed an in-depth cost analysis, which refutes the cost figures generated by Applied Analysis and its subsequent conclusions (Attachment 2). As shown Attachment 3, UNLV discovered that a residential fire suppression system actually pays for itself in a matter of months after the new residential home is complete (For more detailed information, see Attachment 4). Further, the positive cost benefits to the homebuilder and community-in-general were studied and detailed in the following pages.

- **Smoke Alarms – A Case of Too Little, Too Late:** Smoke alarms without residential fire suppression systems do not appear to be enough to save lives and/or avert major home damage.
    - Smoke alarms do not provide sufficient warning to save all lives. In a typical residential house fire, they activate at about the 45 second point after a fire has started. Smoke becomes a visibility problem at 2 ½ minute point. Temperatures reach in excess of 1,000 degrees in about 4 minutes. Delays in notification (occupants waking up; assessing & identifying the problem; insuring humans and pets are alerted; then calling 911) means the Fire Department commences response at approximately the 5-minute point. It takes (on average) 10 minutes (total elapsed time) for the fire department to arrive. (Source: Power Point Presentation "Why Sprinklers?") By that time, the residence is fully involved in the fire.

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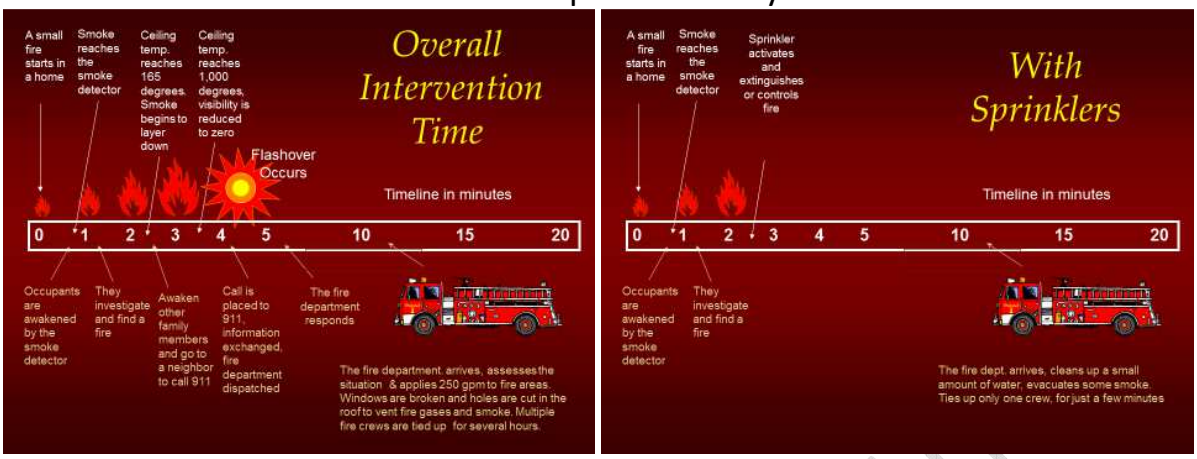


Fire Suppression in Homes with and without Sprinkler Systems
(Source: "Residential 1-2 WHY SPRINKLERS" Presentation by Roy Marshall)

- **Damage to Home:** Beyond fire and smoke damage, there is a significant amount of water and structural damage to a house that has experienced a fire.

  - Residential sprinkler systems are set to activate at 150 degrees F.
    - The average residential sprinkler system outputs water at an average of 13 gallons per minute (GPM).
    - Given average fire department response times, a residential sprinkler head may output less than 200 gallons of water before being shut off by a fire fighter.
  - Unprotected residential dwellings will require between 1,500 and 100,000 gallons of water to extinguish the blaze. (This figure does not include damage to doors, windows, and the roof as the fire department works to gain entry into the home.)

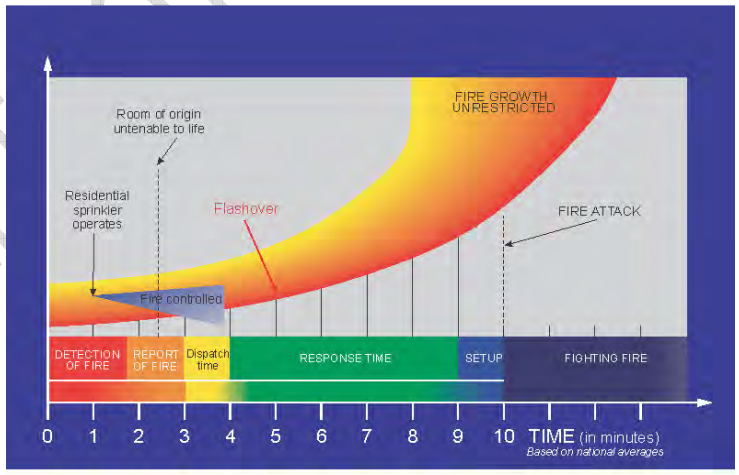


Figure 3: Positive Effects of Residential Sprinklers
(Source: "Why Sprinklers" Power Point Presentation by Pat Coughlin)

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- **The Danger in Synthetics:**
  When a house is on fire, many times It is not the structural fire that causes fire deaths, it is the synthetic composition of the residential contents. (Synthetics burn twice as hot and twice as fast.) **(Source: Power Point Presentation "Why Sprinklers?")** Additionally, synthetic materials will typically outgas extremely hazardous and toxic smoke clouds.

  - During a fire, temperatures in a house (without fire suppression systems) can reach 1200 degrees F in less than 5 minutes.
  - "Thermal burns and smoke inhalation were the primary symptoms leading to death, accounting for 90 percent of all fatalities in residential fires." **[Source: Topical Fire Report Series, Volume 16, Issue 2 / July 2015, *"Civilian Fire Fatalities in Residential Buildings (2011-2013)"*]**

- **Fatalities:**
  Residential Fire Suppression Systems save lives. According to an extensive study performed by the Medford (Oregon) Fire Department:

  - Home fire sprinklers are designed to ensure a tenable atmosphere for escape.
  - Fire sprinklers with smoke detectors increases chance of surviving a fire by over 97%.
  - Smoke detectors aren't enough.
    (Source: Power Point Presentation "The Case for Residential Sprinklers in Medford, Oregon.)

- **Modern Home Building Trends:**
  New trends in home building and modern furnishing are compressing the timelines between a fire starting, toxic smoke release, and flashover occurring. The Federal Emergency Management Agency (FEMA) and the US Fire Administration hosted a two-day workshop at the Maryland Fire & Rescue Institute (College Park, MD) on 11-12 Dec 2012. This workshop was attended by leading experts from the fire service and home fire research specialists, who gave compelling presentations on how the latest trends in homebuilding and residential furnishing are cause for concern. What they revealed is that there is not only increased concern for the residents, but substantially increased risks for the firefighters as they combat fires in newer residential homes. Their observations are summarized as follows:

  - Changes in the Design of New Homes
    - Larger home footprints.
    - Open concept floor plans.
    - More unventilated attics.
    - Increasingly airtight construction.
    - Increased concealed space.
    - Variety in plans and construction types.
    - Increased housing density.
    - Building at the wildland interface.

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- **Modern Home Building Trends (continued):**

  - Changes in Home Construction Materials and Techniques
    - Engineered wood assemblies.
    - Combustible exterior finishes.
    - Green building features.

  - Changes in Home Furnishings
    - New information on effectiveness and hazards of fire retardant chemicals in upholstered furnishings.
    - Overall increased plastic contents.
    - Energy-saving technologies.
    - Photovoltaics.
    - Electric vehicles.
    - Energy storage and distributed power solutions.

  - Changing Fire Service-related Risks
    - Shorter time available for size up due to reduced times to flashover.
    - Fire flow/Wind-driven fires phenomena.
    - Current fire ground procedures and firefighter training inadequate to address those new risks.
    - Less experience in fighting fires due to fewer fires.
    - Staffing reductions in selected jurisdictions independent of increased risks.
    - New firefighter gear/tools with varying performance levels.
    - Firefighter gear improvements increasing other personnel risks.
    - Exposure to carcinogens from contents and construction materials.

    (Source: "Changing Severity of Home Fires Workshop Report," US Fire Administration/National Fire Data Center, December 2012)

- **IRC 2012:** Las Vegas adheres to 2012 International Residential Code (IRC), which mandates fire sprinkler systems. However, during the adoption process, the City placed a qualifier on when residential fire sprinklers will be required. Las Vegas City Ordinance 6351 stipulates:

  The commencement date for residential sprinkler installation shall be the July 1st that follows the first calendar year, if any, during which the combined number of building permits issued by the Southern Nevada jurisdictions for single family dwellings reaches or exceeds 10,000.
  (Note: Southern Nevada jurisdictions include all of Clark County to include the cities of Las Vegas, North Las Vegas, and Henderson.)

  Although, special provisions are provided when fire sprinkler systems are installed (0-hour versus 1-hour fire resistance walls and decreased separation distances between homes), the lack of a mandate means that many new homes are built with the inherent issues identified in the bullet statement above.

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It is important to note that Residential occupancies are required by the IRC and International Energy Conservation Code (IECC) to limit air leakage to prevent conditioned air escaping the dwelling. This approach to energy savings has created a condition to limit the escape of smoke and fire gases in the case of a fire condition within the dwelling. The combination of fire gases from synthetic materials with limited ability to vent causes fires to reach flashover potential within three minutes of ignition.

- **Incentives or Trade-ups for Homebuilders and Developers.**

  - **Garages:**
    The base IRC, 2012 Edition, Section 302.6 and Table 302.6 requires fire rated separation from habitable rooms and garages when the habitable rooms are located above the garage. The City of Las Vegas may consider the installation of fire sprinklers in the garage space as an equivalent alternative to 5/8" Type X gypsum board. This may be proposed as a local code amendment.
    - As a result, homes and garages with sprinklers can use less expensive and fewer gypsum panels in the construction of garage walls and ceilings. Assuming a 22' by 22' garage with 8' ceilings, two walls adjacent to living space, and living space above, the estimated cost savings per house from this incentive was estimated to be $226.
    - Without sprinklers in the house and garage, the design is assumed to include two layers of 5/8'' Type X gypsum board on the ceiling and have two garage walls with 5/8" Type X panels on both the inside and outside of the wall. These specifications are based on 1-hour rated assemblies found in the Gypsum Association's "Fire Resistance Design Manual." With sprinklers used in the garage and the home, there would be only one layer of ½'' drywall on the ceiling and ½" gypsum panels on the walls dividing the garage from the home.
    - Approximate prices for the 5/8'' Type X and ½'' standard gypsum panels were based on a review of the cost of a 4' by 12' panel from several national retailers who supply the products. The cost for 5/8'' Type X panel was roughly $15.23 per panel while the standard ½'' panel was about $11.98. (These prices are only estimates.)

  - **Exterior Wall Elements:**
    - The IRC requires separation between homes to reduce the likelihood of fire spreading from one home to the next. If they are placed closer than outlined in Section R302.1 (Table R302.1(1)) then a 1-hour minimum fire resistance rating, as tested by approved standards, is required.

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- **Exterior Wall Elements (continued):**
  - Table R302.1(2) allows dwellings to be spaced two feet closer when fire sprinklers are installed versus Table R302.1(1) which is used for dwellings without fire sprinklers.
  - This provision allows a home builder to install fire sprinklers to decrease separation distance between houses without exterior walls being rated. The house can grow one foot wider on each side.

- **Increased Fire Hydrant Spacing:**

  The City of Las Vegas allows fire hydrants serving homes built under the IRC to be spaced every 500 feet, and if all homes served by the hydrant have fire sprinklers, then the spacing can be every 600 feet (CLV Fire Code - Section 507). The City of Las Vegas may consider larger spacing of fire hydrants, up to 900 foot intervals with master planned communities where all homes have fire sprinklers. This can be done as a code amendment, or as part of development agreement with a master developer. In considering the information gathered from jurisdictions for this incentive, it was determined that a 400 foot increase in hydrant spacing feet was representative, resulting in an "incentivized spacing" of roughly 900 feet. The more distance there is between hydrants, the lower the hydrant cost per building lot because one hydrant covers more lots. The value of the incentive is therefore presented as a reduced cost per building lot.
  - The value of this incentive was estimated to be $49 per building lot. In calculating this figure, the cost of a fire hydrant is estimated to be $4,000. This figure was obtained from a price sheet of a residential fire hydrant manufacturer (Kennedy). Also, it was necessary to assume that a standard sized lot would have 50 feet of frontage for tract home developments. This figure was sourced from a Tualatin Valley Fire and Rescue report on fire sprinkler incentives, and is a representative lot width in many residential developments nationwide. In considering both sides of the street, 20 building lots can be covered by a hydrant under standard spacing requirements. This results in a per-building lot hydrant cost of $110.
  - There can be 36 lots covered by a single hydrant under the incentivized spacing, reducing the per-building lot hydrant cost to about $122. This translates into an incentive value of $98 per building lot.
  - It is worth noting that the incentive's per-lot value may not hold under certain development scenarios. For example, a sub-division's layout might not allow for each hydrant to cover the maximum amount of building lots. Most hydrants may cover the full 36 lots, but others may cover fewer based on the layout of roads and buildable lots. (This would serve to increase the sub-division's hydrant cost per lot, and reduce the overall value of the incentive.)

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- **Increased Fire Hydrant Spacing (continued):**

  - One additional benefit is reducing the need for water district easements for each hydrant location and, if applicable, additional space for on street parking.
    ("Study of Cost Implications Associated with a Voluntary Residential Sprinkler System for New Construction," hydrants. This report provides a comparison between the cost of a sprinkler system and the total value of a number on and off-site tradeoffs, or incentives.)

- **Reduction of Road Width:**
  The City of Las Vegas currently does not allow a reduction of road through a code amendment, but can as a condition of a development agreement. The City of Las Vegas has a fire apparatus access road minimum width requirement of 24 feet. Of the jurisdictions that offer this type of incentive, several different road width reductions are noted.

  - In light of this, a 4' reduction provides a reasonable estimate. In order to present this incentive on a per-lot basis, the reduction in width is divided by two to account for lots being present on each side of the street. The frontage length of a building lot (50') is multiplied by ½ of the road width reduction (2') to determine the area of road, per building lot, which no longer needs to be paved. This area, 100 square feet (SF), is then multiplied by an estimated road development cost ($3.50/SF) to determine the savings from avoided excavation and paving costs ($350/lot). The estimated road development cost per SF of $3.50 was calculated by obtaining the paving cost per single-family lot from Public Works Sources. This cost was divided by one-half the total area of road in front of a building lot, assuming road frontage of 50' and road width of 24', to obtain the cost per SF.

  - The value of the raw land that is able to remain unpaved as a result of this incentive also serves as a component of the value determination, because this land becomes available to the developer for some other use. It is assumed that the developer is able to make some sort of productive use of the non-paved land, such as additional building lots, open spaces, etc. In calculating an estimate for the value of raw land, a raw lot cost of $48,769 was obtained from the NAHB's 2004 Construction Cost Survey while a median lot size of 9,114 for new single-family detached homes was obtained from the U.S. Census Bureau's Characteristics of New Housing for 2009. Relevant data was combined to arrive at a raw land cost of $5.35 per SF, which was in turn multiplied by 100 SF (per lot) to arrive at value of $535/lot for the value of the additional available land.

  - Combining these two components of the reduced road width incentive, the estimated value of the 4' width reduction is roughly $1,172 per building lot.

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- **Reduced Fire Flows:**

  Code required fire flow for one- and two-family dwelling currently is a minimum requirement of 1500 gallons per minute (GPM). The fire code as adopted will allow for a 50 percent reduction in fire flow as long as the 1500 gallons per minute is maintained. A reduced minimum fire flow requirement of 750 gallons per minute (GPM), down from a standard flow rate of 1,500 GPM could be implemented for dwellings less than 3000 square feet. The Las Vegas Valley Water District will maintain a minimum flow rate and pressure for residential tract areas, but a reduction in fire flow could reasonably result in the water main size being reduced from 8" to 6" in diameter.

  - The value of this incentive was found to be $50 per lot. For this calculation, it was assumed that the 2" reduction in water main diameter would result in a cost savings of $2 per linear foot of pipe.
  - To obtain the per-lot metric, a lot frontage of 50 feet was used. The water main was assumed to serve both sides of a street; therefore, lots across the street from each other "shared" the value of this incentive, essentially dividing the value by 2. Both the 50' lot frontage and the $2 cost savings/lineal foot pipe figures were obtained from the Tualatin Valley Fire and Rescue report referenced above.

- **Reduced Cul-De-Sac Width:**

  Based on information gathered from jurisdictions offering this incentive, the most common reduction of a cul-de-sac radius was found to be 2 feet. For instance, to allow developers to decrease the radius of a cul-de-sac 2 feet in exchange for including sprinkler systems in the project's homes.

  - Unlike some of the previous incentives which have been valued on a per-lot basis, this incentive is valued for a single cul-de-sac. With the three-foot reduction noted above, the estimated value was found to be $5,433 per cul-de-sac. This figure is based on the area of cul-de-sac which would not have to be paved in moving from a 52' radius to 50' radius, allowing for the fact that part of this area would still be paved where the road enters the cul-de-sac. Road paving cost per square foot was obtained using the same method as was applied in estimating the value of a reduced road width. (This will also require a code amendment if the City of Las Vegas and the homebuilding industry find value in using this approach.)
  - In addition to reduced excavation and paving costs, this figure is also based on the estimated value of raw land of $5.35 per SF that no longer needs to be paved and becomes available to the developer for some other use. Again, this component of the valuation assumes the developer can make some sort of productive use of the preserved land. The value for raw land was determined using the NAHB and U.S. Census Bureau sources noted above in the discussion on reduced road widths.

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- **Increased Dead-End Street Length:**
  The typical amount of extended dead-end street length found in the study was 125 feet.
  - Similar to the incentive for reduced radii of cul-de-sacs, this incentive is not valued on per-lot basis. Instead, the benefit of the incentive is stated in terms of how many lots can be added as a result of the increased street length. Under a scenario where 125 feet of street length can be added to a dead-end, an additional four lots can be included.
  - **T**his determination assumes that a standard size lot includes 50 feet of street frontage, and that lots are situated on both sides of the extended dead-end. It should be noted that the value of these additional lots would be partially offset by added land development costs, and that the application of this incentive could be limited by some development layouts.

- **Secondary Access Point:**
  The International Fire Code as adopted and amended though Section 503.1.2 requires a secondary access point for emergency services when a planned community has more than 100 dwelling units. The code allows this secondary access point to be eliminated until a planned community reaches 200 dwelling units with equipped throughout with residential fire sprinklers. This secondary access point may represent a buildable lot for an additional dwelling unit. The return on investment for the homebuilder and master developer will vary based on the street and lot configuration of the community.

**Conclusions:**

- **Cost is the wrong metric:**
  The cost of installation is not a core issue. In our opinion, the issue of cost appears to be a "red herring" issue. Certainly, while important, cost cannot be used as the sole criterion for accepting or rejecting the provisions contained in Senate Bill 477, NRS 278.576.
  - First, it does not matter whether fire suppression systems increase value of a Las Vegas home by $3,500 - $5,049 (NIST Study) or provide negative value by as much as $2,230 (Applied Analysis Study). (See Attachments 2 & 3) The real issues are: "Do fire suppression systems work and do they save lives and property?" The answer to both questions is: "Yes."
  - Second, the UNLV Cost Analysis (Attachment 4) demonstrates that having a fire suppression system installed in a new home (during construction, not retrofitting) amortizes to zero within the first 12-18 months of home ownership. What is important about this analysis, is that it used current Las Vegas area costing data.

  - Third, on page 4 of the Applied Analysis study, the following statement is made:
    "It is also noteworthy that to retrofit older, existing houses in unincorporated Clark County with a fire sprinkler system, assuming similar pricing, it would cost nearly $ 1 billion."

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Nowhere in Senate Bill 477, NRS 278.576, or any Las Vegas Fire Department proposal put in front of the City Council mention anything about retrofitting older homes. We view this statement as completely unnecessary and a distraction, which may be interpreted as an attempt to strengthen a very weak case against residential sprinkler systems.

- Finally, community developers and homebuilders can realize significant overall cost savings and increased profit margins by allowing residential fire suppression systems to be an integral part of new residential homes built in Las Vegas. These cost savings come in the form of reduced street widths; reduced cul-de-sac widths; less costly building materials in certain areas of the home; and more.

In the opinion of the UNLV researchers, cost is an ancillary issue. This study has essentially put the perception of increased cost of new home construction due to installation of fire suppression systems to rest. Fire suppression systems pay for themselves. So, if cost is not the main issue, what is? The core issue is Safety.

- **Survival is the Paramount Issue:** Abraham Maslow, noted American psychologist, developed a concept called the Hierarchy of Needs. The most fundamental human need is: Survival. While fire alarms provide some level of warning, they do not provide sufficient notification to the occupants of a burning home to allow the occupants to get to safety in a reliable manner. Residential sprinkler systems are designed to put water on the ignition source of a home fire, while allowing the resident to escape safely. Thus, residential fire sprinkler systems in new homes speaks to the most fundamental human need – Survival.

- **Mandated Residential Sprinklers do not "disincentize" home buyers:** The UNLV researchers took the extra step of reviewing new home permits for the Las Vegas area. What was discovered that the City of Henderson, NV (which mandates residential fire suppression systems in all new residential home construction) has surpassed the City of Las Vegas in new home permits. It would appear that mandating residential fire sprinkler systems will not adversely affect new home building in Las Vegas. (Attachment 5)

**Recommendation:**

In the opinion of the researchers from the University of Nevada Las Vegas, the Las Vegas City Council should immediately pass the ordinance mandating fire suppression systems for all new single family residential home construction.

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**Attachment 1**

**Adopted language as a result of Senate Bill 477**

**NRS 278.586 Adoption of building code or other action by local government requiring installation of automatic fire sprinkler system in new residential dwelling units and other structures.**

1. A governing body may adopt a building code or take any other action that requires the installation of an automatic fire sprinkler system in a new residential dwelling unit that has an area of livable space of 5,000 square feet or more.

2. Except as otherwise provided in subsection 3, a governing body may, on or after July 1, 2015, adopt a building code or take any other action that requires the installation of an automatic fire sprinkler system in a new residential dwelling unit that has an area of livable space of less than 5,000 square feet only if, before adopting the building code or taking the action, the governing body:

(a) Conducts an independent cost-benefit analysis of the adoption of a building code or the taking of any other action by the governing body that requires the installation of an automatic fire sprinkler system in a new residential dwelling unit that has an area of livable space of less than 5,000 square feet; and

(b) Makes a finding at a public hearing that, based on the independent cost-benefit analysis conducted pursuant to paragraph (a), adoption of the building code or the taking of any other action by the governing body that requires the installation of an automatic fire sprinkler system in a new residential dwelling unit that has an area of livable space of less than 5,000 square feet is to the benefit of the owners of the residential dwelling units to which the requirement would be applicable and that such benefit exceeds the costs related to the installation of automatic fire sprinkler systems in such residential dwelling units.

3. A governing body may require the installation of an automatic fire sprinkler system in a new residential dwelling unit that has an area of livable space of less than 5,000 square feet without conducting the analysis or making the findings required by subsection 2 if the governing body makes a determination at a public hearing that the unique characteristics or the location of the residential dwelling unit, when compared to residential dwelling units of comparable size or location within the jurisdiction of the governing body, would cause an unreasonable delay in firefighter response time. In making such a determination, the governing body may consider:

(a) The availability of water for use by firefighters in the area in which the residential dwelling unit is located;

(b) The availability to firefighters of access to the residential dwelling unit;

(c) The topography of the area in which the residential dwelling unit is located; and

(d) The availability of firefighting resources in the area in which the residential dwelling unit is located.

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4. A governing body shall not adopt a building code or take any other action that requires the installation of an automatic fire sprinkler system in a structure other than a residential dwelling unit or any portion of such a structure, whether located on public or private property:

(a) That is covered but not completely enclosed;

(b) That is used primarily for agricultural, livestock or equestrian activities;

(c) That has spectator seating situated around the perimeter of the structure or portion thereof; and

(d) Which is otherwise in compliance with all relevant building codes concerning exits and fire alarm systems.

5. The provisions of this section do not prohibit:

(a) A local government from enforcing an agreement for the development of land which requires the installation of an automatic fire sprinkler system in any residential dwelling unit; or

(b) A person from installing an automatic fire sprinkler system in a structure described in subsection 4 or any residential dwelling unit.

6. As used in this section:

(a) "Automatic fire sprinkler system" has the meaning ascribed to it in NRS 202.580.

(b) "Residential dwelling unit" does not include a condominium unit, an apartment unit or a townhouse unit that shares a common wall with more than one other such unit.

(Added to NRS by 2015, 1989)

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**Attachment 2**

## Summary of Benefit-Cost Analysis per Housing Unit: National Study vs. Unincorporated Clark County

**(Source: Applied Analysis Study: March 2015)**

| | National Study (2005 dollars) | National Study (2014 dollars) | Unincorporated Clark County (2014 dollars) |
|---|---|---|---|
| **Benefits** | | | |
| Fatalities Averted | $3,725.57 | $4,516.01 | $1,019.61 |
| Injuries Averted | $224.74 | $272.74 | $145.18 |
| Direct Uninsured Property Losses Averted | $79.64 | $96.54 | $36.95 |
| Indirect Costs Averted | $15.93 | $19.31 | $7.39 |
| Insurance Credit | $948.41 | $1,149.63 | $1,341.15 |
| Benefits Subtotal | $4,994.29 | $6,054.23 | $2,550.29 |
| **Cost** | $829-$2,075 | $1,005-$2,515 | $4,780.00 |

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**Attachment 3**

**Cost Benefit Comparison Analysis**

| | Cost of Sprinkler Installation | | |
|---|---|---|---|
| Newly Constructed Tract Home | AA Study (2014 Dollars) | National Study (2014 Dollars) | UNLV Study (2016 Dollars) |
| Per Square Foot | $2.00 | $1.02 | $0.95 |
| 2,000 Square foot Home | ($4,000) | ($2,040) | ($1,900) |

| | Benefit | | |
|---|---|---|---|
| Newly Constructed Tract Home | AA Study (2014 Dollars) | National Study (2014 Dollars) | UNLV Study (2016 Dollars) |
| Insurance Premium Credit | 12% | 8% | 15% |
| Annual Insurance savings | $71 | $48 | $89 |
| Appreciation in First Year | 2.80% | 6.80% | 2.80% |
| 2,000 Square foot Home | $6,384 | $15,504 | $6,384 |
| Total Benefit in first year | $6,455 | $15,552 | $6,473 |

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**Attachment 4**

The provided Cost Benefit Analysis (CBA) will compare the cost of the installation with a residential fire suppression system versus the monetary benefits. For the ease of a mathematical baseline, the square footage of 2,000 was used to represent a single family new construction tract home in Las Vegas, NV. Please note that number for any square footage of a home does not affect the formula used in the Cost Benefit Analysis.

The following dataset inputs were used in the CBA:

1. The estimate proposal of $.95 per ft² for the cost of installation in a new tract home.[1]
2. The average cost of $114 per ft² to build was used for the square footage of a new constructed tract home. [2]
3. The average home appreciation of 2.8% was applied for a ten-year projection. [3]
4. The discount rate used was the same 4.6% discount rate found in the Applied Analysis study.
5. The average insurance premium discount of 15% for a credit of $89 annually. [4]

The cost of a new 2,000 ft² tract home is $228,000 in today's dollars net a projected 10-year benefit of $64,032 bringing the potential value of the home to $292,032 in 2025. The investment cost of a $1,900 residential fire suppression system has a payback period in the first year of home ownership. See table 1 below.

Table 1

| **2000 SF Single Family Home** | **$228,000** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| Fire Sprinkler Cost | $(1,900) | | | | | | | | | |
| Home Appreciation | | $6,384 | $6,563 | $6,747 | $6,935 | $7,130 | $7,329 | $7,534 | $7,745 | $7,962 |
| Insurance Premium Credit | | $89 | $89 | $89 | $89 | $89 | $89 | $89 | $89 | $89 |
| Total Benefits Per Year/FCF | $(1,900) | $6,473 | $6,652 | $6,836 | $7,024 | $7,219 | $7,418 | $7,623 | $7,834 | $8,051 |
| Cumulative Benefits | $64,032 | | | | | | | | | |
| **Discount Factors** | | | | | | | | | | |
| Discount Rate | 4.6% | | | | | | | | | |
| Base Year | 2016 | | | | | | | | | |
| Year Index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Discount Factor | 1.0000 | 0.9560 | 0.9140 | 0.8738 | 0.8354 | 0.7986 | 0.7635 | 0.7299 | 0.6978 | 0.6671 |
| Discounted FCF | $(1,900) | $6,188 | $6,080 | $5,973 | $5,868 | $5,765 | $5,664 | $5,565 | $5,467 | $5,371 |
| Cumulative FCF | $(1,900) | $4,288 | $10,368 | $16,341 | $22,209 | $27,974 | $33,637 | $39,202 | $44,669 | $50,040 |
| **NPV** | $50,048 | | | | | | | | | |
| **IRR** | 343% | | | | | | | | | |

[1] The cost of the residential fire sprinkler system was based on an estimate from a local reputable installer.
[2] According to the Las Vegas Review-Journal, the average sale price of home in 2015 is $114 per square foot.
[3] Since 1990 the average appreciation rate for homes in Las Vegas is 2.8% (neighborhoodscout.com).
[4] The average insurance rate premium credit for an automatic sprinkler system to a home in Las Vegas is 15% annually (USAA underwriting, property and casualty).

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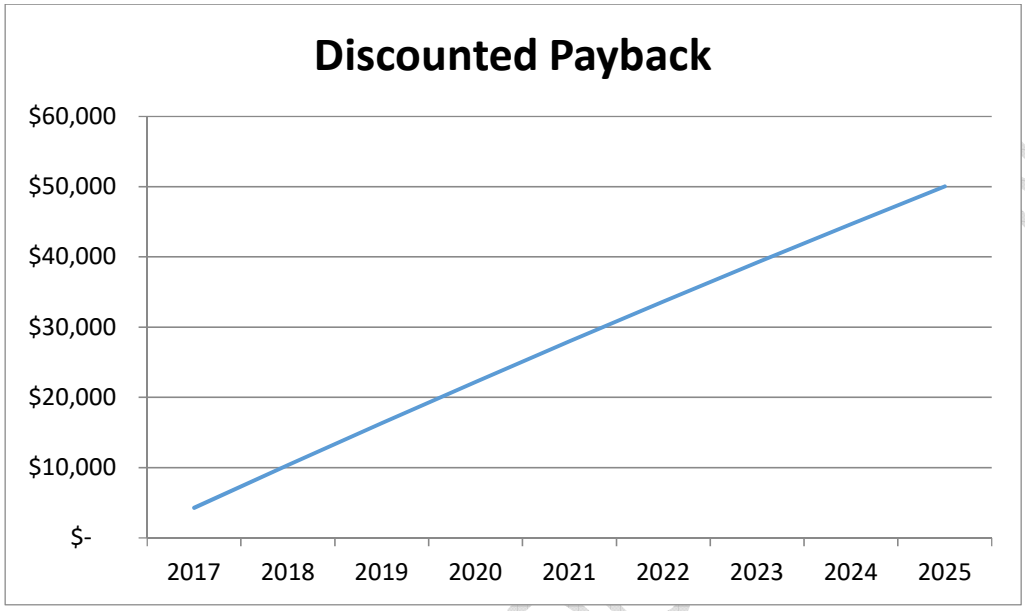
Discounted Payback
$60,000
$50,000
$40,000
$30,000
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2017
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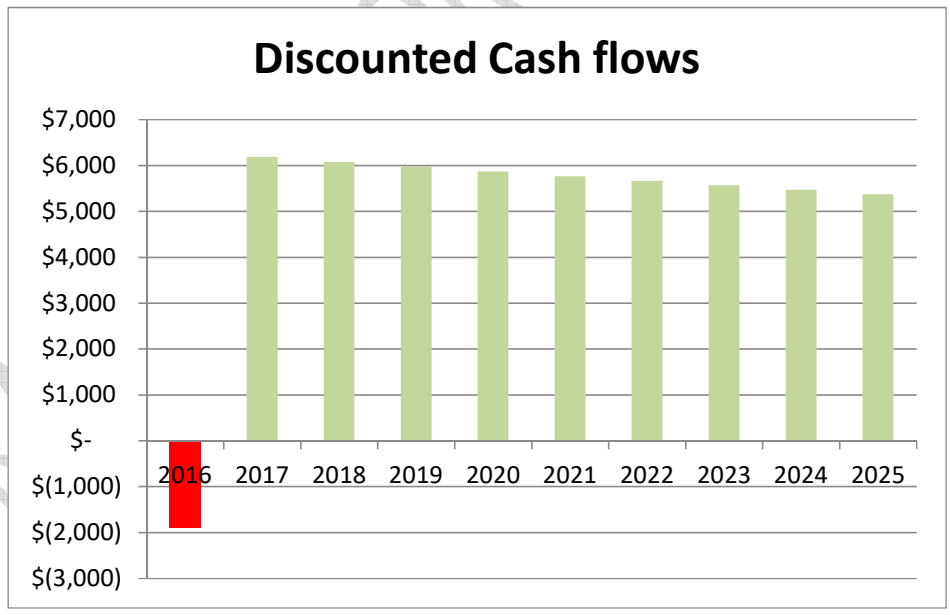
Discounted Cash flows
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$-
$(1,000)
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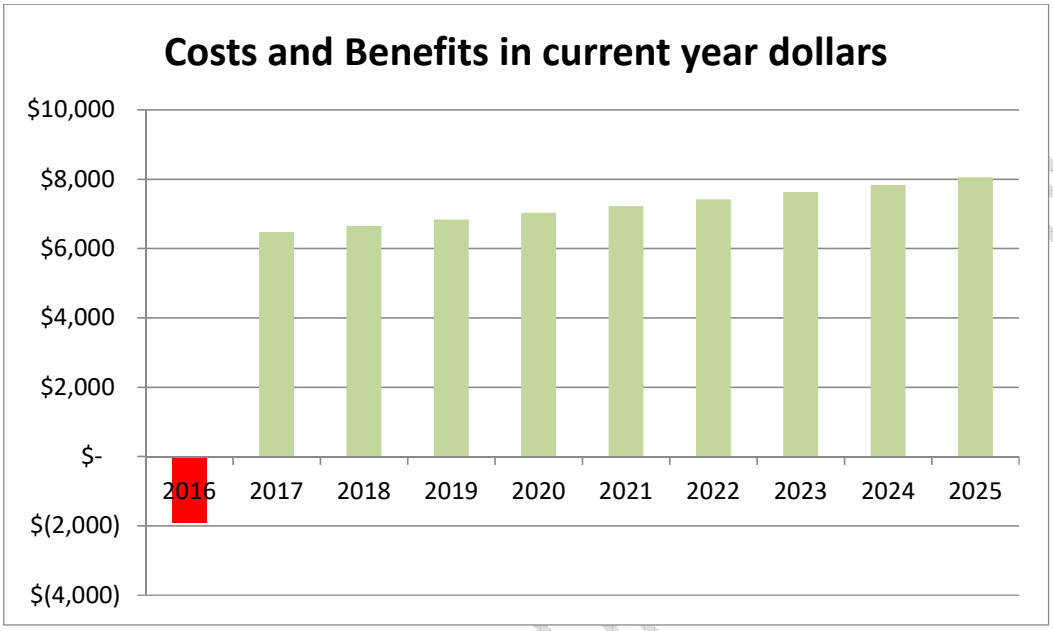


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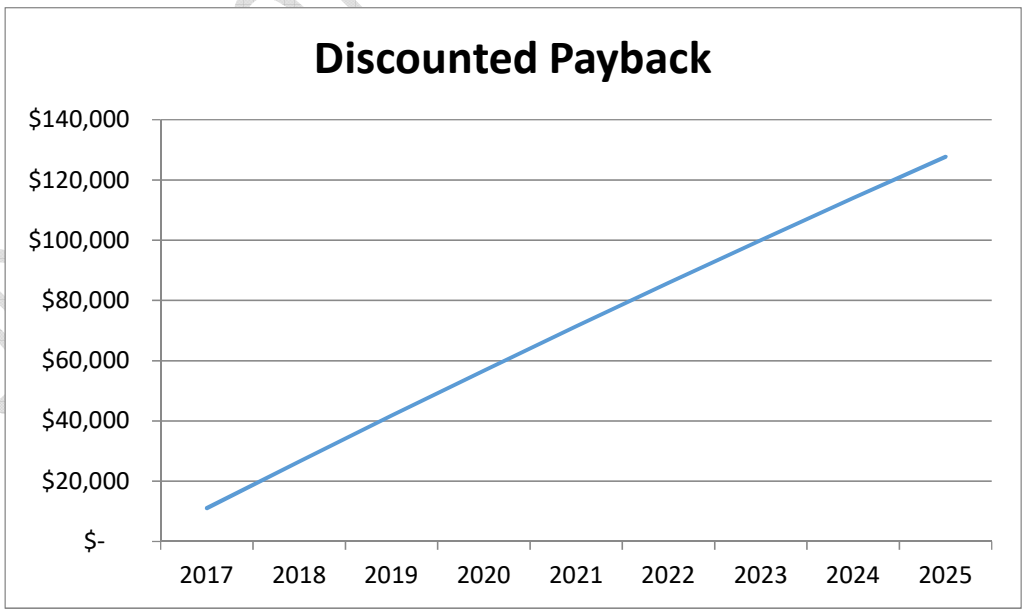
**5,000 Square Foot Example:**

The cost of a new 5,000 ft² tract home is $570,000 in today's dollars net a projected 10 year benefit of $162,180 bringing the potential value of the home to $732,180 in 2025. The investment cost of a $4,750 residential fire suppression system has a payback period in the first year of home ownership. See table 2 below.

Table 2

| **5000 SF Single Family Home** | $570,000 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| Fire Sprinkler Cost | $(4,750) | | | | | | | | | |
| Home Appreciation | | $16,407 | $16,866 | $17,339 | $17,824 | $18,323 | $18,836 | $19,364 | $19,906 | $20,263 |
| Insurance Premium Credit | | $89 | $89 | $89 | $89 | $89 | $89 | $89 | $89 | $89 |
| Total Benefits Per Year/FCF | $(4,750) | $16,496 | $16,955 | $17,238 | $17,913 | $18,412 | $18,925 | $19,453 | $19,955 | $20,552 |
| Cumulative Benefits | $162,180 | | | | | | | | | |
| **Discount Factors** | | | | | | | | | | |
| Discount Rate | 4.6% | | | | | | | | | |
| Base Year | 2016 | | | | | | | | | |
| Year Index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Discount Factor | 1.0000 | 0.9560 | 0.9140 | 0.8738 | 0.8354 | 0.7986 | 0.7635 | 0.7299 | 0.6978 | 0.6671 |
| Discounted FCF | $(4,750) | $15,771 | $15,497 | $15,228 | $14,964 | $14,704 | $14,449 | $14,199 | $13,953 | $13,711 |
| Cumulative FCF | $(4,750) | $11,021 | $26,517 | $41,745 | $56,709 | $71,413 | $85,863 | $100,062 | $114,015 | $127,726 |
| **NPV** | $127,734 | | | | | | | | | |
| **IRR** | 350% | | | | | | | | | |

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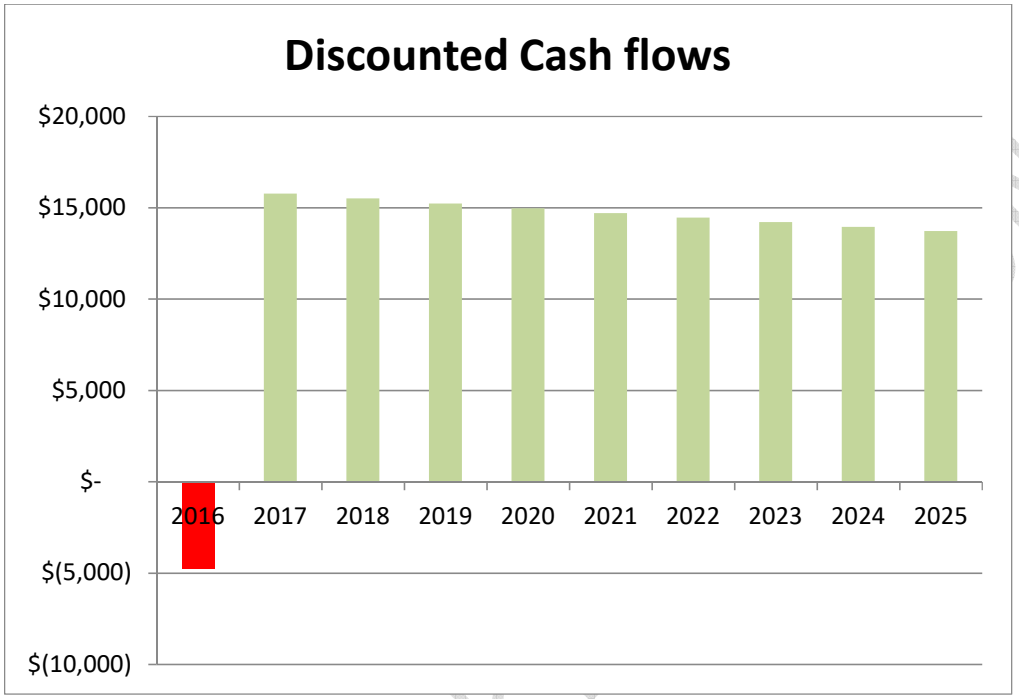
Discounted Cash flows
$20,000
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$(5,000)
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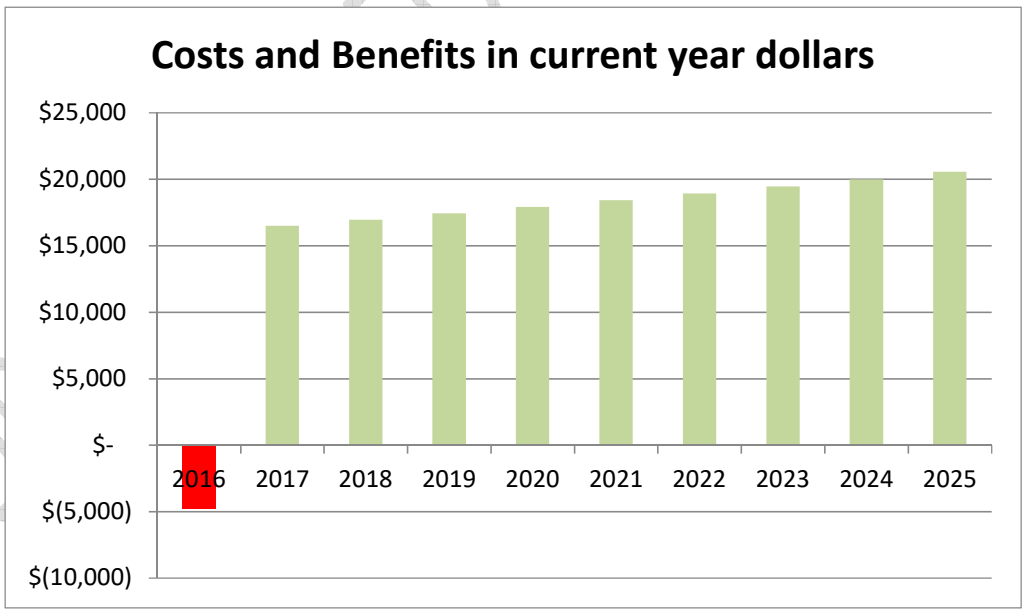
Costs and Benefits in current year dollars
$25,000
$20,000
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$10,000
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$-
$(5,000)
$(10,000)
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

**Attachment 5**

New Home Permits
Las Vegas Area
2001-2016

| New Home Permits | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boulder City | 3 | 22 | 15 | 10 | 9 | 3 | 11 | 7 | 9 | 19 | 13 | 26 | 45 | 52 | 46 | 69 |
| Clark County | 4085 | 3593 | 3410 | 3567 | 2966 | 1604 | 2137 | 1931 | 2470 | 5859 | 9765 | 13535 | 14367 | 11132 | 10644 | 10329 |
| Henderson | 2223 | 1689 | 1222 | 1274 | 1117 | 799 | 707 | 505 | 1097 | 2387 | 4249 | 4923 | 4595 | 4267 | 3980 | 4109 |
| Las Vegas | 1454 | 1662 | 1438 | 1517 | 1233 | 808 | 926 | 744 | 1085 | 2356 | 2998 | 4268 | 6200 | 6861 | 4451 | 4281 |
| Mesquite | 246 | 202 | 196 | 202 | 169 | 134 | 201 | 106 | 379 | 487 | 303 | 599 | 429 | 387 | 289 | 404 |
| North Las Vegas | 794 | 630 | 471 | 497 | 618 | 510 | 648 | 498 | 834 | 2365 | 4262 | 7007 | 6105 | 4599 | 2735 | 2665 |
| Totals | 8805 | 7798 | 6752 | 7067 | 6112 | 3858 | 4630 | 3791 | 5874 | 13473 | 21590 | 30358 | 31741 | 27298 | 22145 | 21857 |

http://socds.huduser.gov/permits/

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**We, the undersigned, have read the Residential Fire Sprinkler Study – Final Copy (July 2017). We monitored the research throughout the study. We have reviewed and agree with the finding, and find that analysis to be sound and thoughtful in its approach. Therefore, we endorse the conclusions reached. Please let us know if you have any questions or need any additional clarifications.**

Date: 7/27/17

**Christopher Stream, Ph.D.**
**Director**
**School of Public Policy and Leadership**
**Greenspun College of Urban Affairs**
**University of Nevada, Las Vegas (UNLV)**

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2,355 views | Aug 3, 2019, 05:29pm

# Why Fire Sprinkler Systems Should Be A Requirement In All Homes



**Sheri Koones** Contributor ⓘ
Real Estate



This diagram shows the cutaway of a house with a sprinkler system. DRAWING COURTESY OF THE HOME FIRE SPRINKLER COALITION

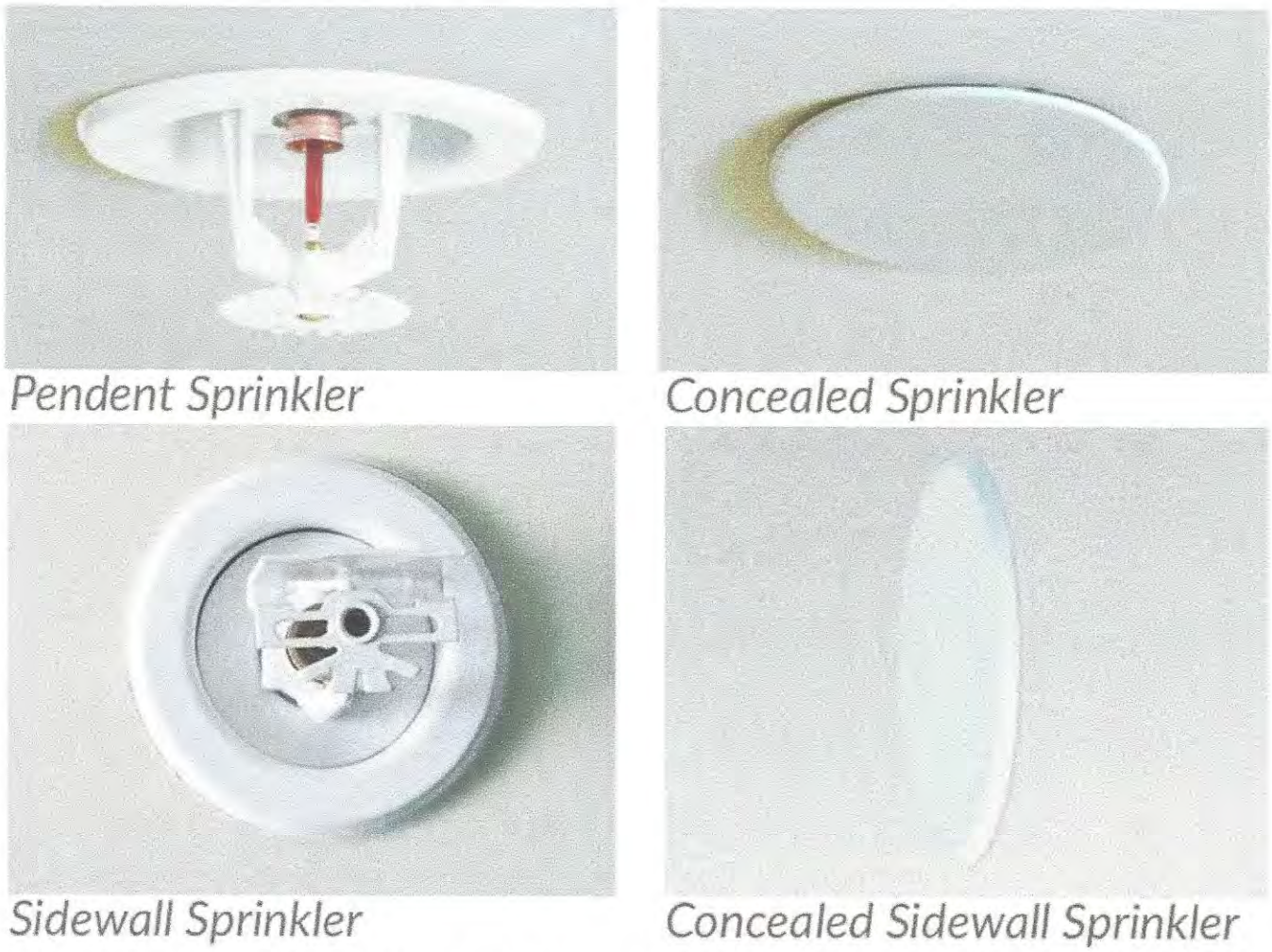
Every day on the news you see another house going up in flames. People's total belongs gone in a flash, lives lost.

One simple solution to this problem is the installation of fire sprinkler systems. More important than granite counter tops and other luxury items in the home is the safety of the occupants. I have long been an advocate for sprinkler systems because the best living conditions in any home are those that are safe first, then sustainable and energy efficient Beautiful is an added plus!

Many argue that fire sprinkler systems add an extra expense to the cost of construction. But when you are investing in building a house – safety should be a major priority.

It's every homeowner's nightmare — a house fire, caused by faulty wiring, a kitchen accident, an act of nature or simple carelessness. When most homeowners think of house fires, they probably first consider the resulting property damage, and the numbers are staggering. Fires in single- and two-family homes caused $6.1 billion in property loss, according to data compiled by the National Fire Protection Association (NFPA), based in Quincy, Mass.

But more sobering is the loss of life that often results from house fires. Every year, more than 2,300 people perish due to fires in their homes. If residential fire sprinkler systems had been installed in those houses, property damage could have been greatly reduced, and lives could have been saved.

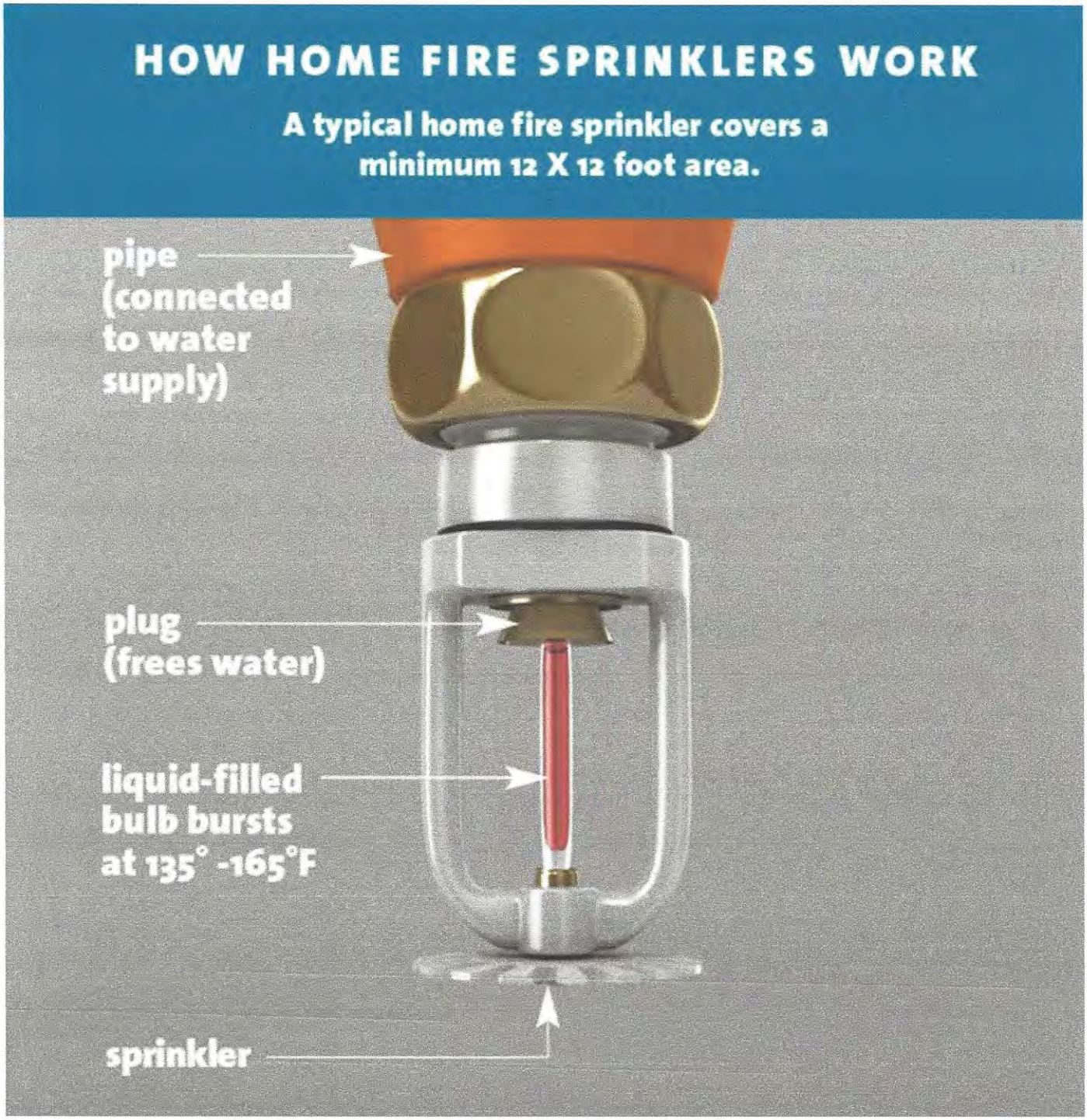



There are a variety of pendants available for use with a fire sprinkler system. Some of them can be nearly invisible.
PHOTO COURTESY OF THE HOME FIRE SPRINKLER COALITION

Despite this fact, many homeowners rarely consider installing a residential fire sprinkler system, for a variety of reasons. Swayed by common misconceptions, as well as what some perceive as an aesthetic issue, even safety-conscious homeowners steer away from home fire sprinkler systems. That's beginning to change, however, as more homeowners learn about the realities and benefits of these systems, as communities begin to mandate the installation of home fire sprinkler systems in new homes and as updated, less conspicuous systems become available.

In an ironic twist, many homeowners believe that sprinkler systems will cause more damage to a home than the fire itself. But that's faulty thinking. According to the Scottsdale Report, a 15-year study of sprinkler system effectiveness compiled by Deputy Chief and Fire Marshal Jim Ford of the Rural/Metro Fire Department in Scottsdale, Ariz. a fire sprinkler system delivers eight to 10 times less water than the hoses used by

firefighters to put out the flames, resulting in less water damage to a home. A fire hose dispenses up to 250 gallons of water per minute, while a typical residential sprinkler head will release just 25 gallons of water per minute. What's more, the fire department applies hose streams to a house fire in broad sweeps, while a sprinkler system is much more targeted. According to the Home Fire Sprinkler Coalition, 90 percent of all house fires are extinguished by a single sprinkler.




This is a simple diagram showing how a fire sprinkler works. PHOTO COURTESY OF THE HOME FIRE SPRINKLER COALITION

There's another important point to consider. When a house fire occurs, a sprinkler can respond almost immediately, reducing the amount of damage caused by the fire, whereas by the time the fire department arrives (usually in 5 to 10 minutes), the damage to the home can be far more substantial. In Scottsdale, according to the study, the average cost of fire damage in homes without sprinklers was $45,000, compared to just $2,166 for homes with a sprinkler system. Damage from smoke also was reduced in homes with sprinklers, because house fires were extinguished much more quickly.

Most importantly, in Scottsdale, where sprinklers have been required in all new homes built since 1986, there have been no deaths due to fire in homes with sprinklers. However there have been 13 deaths in homes without sprinklers.




VIDEO COURTESY OF THE HOME FIRE SPRINKLER COALITION

Some homeowners worry that sprinklers will activate accidentally, for no reason, or that all sprinklers will activate for a small, localized fire. However, automatic fire sprinklers are individually heat-activated and tied into a network of pipes with water under pressure. Only those sprinklers in the immediate area of the fire will operate, optimizing the use of the limited water they distribute.

Another contention about sprinkler systems is that they will detract from the aesthetics o the home. However, newer systems feature sprinklers, or pendents, can be concealed. Th sprinklers can be inconspicuously installed on a ceiling or wall and almost completely concealed by small plates that can be matched to a room's colors.

An advantage of sprinkler systems besides the obvious advantages of saving lives and property, some insurance companies offer discounts to homeowners with fire sprinkler systems installed. Savings vary by company, so homeowners need to shop around.

The cost of installing a system in a new construction is estimated to be 1 to 1.5 percent of the total construction cost. Retrofitting a system in an existing house can be about 50 percent higher. In addition, a few municipalities have policies that charge fees, generally called tap fees, for the initial connection of the water sprinkler system (connection fees) and for maintaining the availability of water (standby charge).

According to sprinkler industry humor, homeowners have a choice: "A puddle of water o a pile of ashes." It is clear that sprinkler systems can save lives and reduce property loss, and should be considered an important option when building or remodeling a home. For further information check the web site of the Home Fire Sprinkler Coalition or the National Fire Protection Association.

*Follow me on Twitter or LinkedIn. Check out some of my other work here.*



**Sheri Koones**

My next book coming out in October (Taunton Press) is titled – Downsize: Living Large In a Small House - profiles 33 exceptional houses that show how small can be comfo... **Read More**

# RB325.1-18

**Proponents:** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com)

## 2015 Virginia Residential Code

**Revise as follows:**

**ATTIC, HABITABLE.**

A finished or unfinished *habitable space* between the ceiling assembly and the roof assembly

~~unfinished area, not considered a story, complying with all of the following requirements:~~

1. ~~The occupiable floor area is at least 70 square feet (6.5 m$^2$), in accordance with Section R304,~~
2. ~~The occupiable floor area has a ceiling height in accordance with Section R305, and~~
3. ~~The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~

~~Habitable attics greater than two-thirds of the area of the story below or over 400 square feet (37.16 m$^2$) shall not be permitted in dwellings or townhouses that are three stories above grade plane in height.~~

## 2018 International Residential Code

**Revise as follows:**

### SECTION R325
### MEZZANINES, HABITABLE ATTICS, AND ROOFTOP DECKS

**R325.1 General.** Mezzanines shall comply with Sections ~~R325~~ R325.2 through R325.5. *Habitable attics* shall comply with Section R325.6. Rooftop decks shall comply with R325.7.

## 2015 Virginia Residential Code

**Add new text as follows:**

### 325.6
### Habitable attics.

**Revise as follows:**

**325.6.1 General.** Habitable attics shall comply with Sections R325.6.2 through R325.6.4.

**Add new text as follows:**

**R325.6.2 Minimum Dimensions** A habitable attic shall have a minimum floor area in accordance with Section R304 and a minimum ceiling height in accordance with Section R305.

**R325.6.3 Means of Escape and Means of Egress.** The means of escape for habitable attics shall comply with the applicable provisions of Section R310, and the means of egress for habitable attics shall comply with R311.

**R325.6.4 Story Above Grade Plane.** A habitable attic located above the third story shall comply with either R325.6.4.1 or R325.6.4.2.

**R325.6.4.1 Without Fire Sprinklers:** Habitable attics in dwelling units or townhouses that do not have an automatic fire sprinkler system complying with R325.6.4.2 shall comply with all of the following:

1. The occupiable space shall be enclosed by the roof assembly above, knee walls (if applicable) on the sides, and the floor-ceiling assembly below. A door opening from the habitable attic to a rooftop deck located at the same floor level as the habitable attic shall be permitted. Rooftop decks shall comply with R325.7.

2. The habitable attic shall not exceed two-thirds of the area of the story below or 400 square feet (37.16 m2), whichever is less.

3. The floor of the habitable attic shall not extend beyond the exterior walls of the floor below.

4. The sill height of required means of escape windows for the habitable attic or any sleeping room in the habitable attic shall not exceed 30 feet above the grade level beneath the window.

**R325.6.4.2 With Fire Sprinklers:** Habitable attics in dwelling units or townhouses that are equipped throughout with an automatic fire sprinkler system in accordance with NFPA 13D, 13, 13R or Section P2904 shall comply with all of the following:

1. The occupiable space shall be enclosed by the roof assembly above, knee walls (if applicable) and gable walls (if applicable) on the sides, and the floor-ceiling assembly below. A door opening from the habitable attic to a rooftop deck located at the same floor level as the habitable attic shall be permitted. Rooftop decks shall comply with R325.7.

2. The floor of the habitable attic shall not extend beyond the exterior walls of the floor below.

## R325.7
## Rooftop Decks.

**R325.7.1 General.** Rooftop decks located above the third story shall comply with Sections R325.7.2 through R325.7.6.

**R325.7.2 Means of Egress.** The means of egress for a rooftop deck shall comply with R311. The means of egress shall be through a habitable attic complying with R325.6 or directly to a stairway. A stairway enclosure not exceeding 70 square feet (6.5 m2) shall be permitted to project above the roof-ceiling assembly for the third story.

**R325.7.3 Materials of Construction.** Rooftop deck materials shall comply with the requirements for roof covering materials in R902.

**R325.7.4 Shade Structures.** Where provided, shade structures shall be unenclosed except for the horizontal overhead shade. Shade structures shall be constructed of noncombustible materials or fire retardant treated wood and shall be supported by noncombustible or fire retardant treated wood support posts, a habitable attic complying with R325.6 or a stairway enclosure complying with R325.7.2.

**R325.7.5 Enclosed Spaces.** Rooftop deck levels shall not include any enclosed space, other than habitable attics complying with R325.6 or a stairway enclosure complying with R325.7.2.

**R325.7.6 Floor Level.** The walking surface of a rooftop deck shall be located not more than 12 inches (304.8mm) above the top surface of the roof assembly above the third story.

**Reason Statement: Note (from DHCD Staff): A revised proposal was submitted by the proponent and discussed at the 9/1/2020 Combined Workgroup Meeting. The proposal was updated to match what was discussed at the meeting and the following revised statement was provided by the proponent after the meeting:**

This proposed change deletes the 2015 Virginia IRC amendment to the definition "attic, habitable" with the intent of better correlating with the 2018 IRC definition, which reads "A finished or unfinished habitable space within an attic." Per request of DHCD staff, the Virginia proposal has been slightly modified to read “A finished or unfinished habitable space between the ceiling assembly and the roof assembly,” which avoids the use of the term “attic” within its own definition but retains technical consistency with the model code. In prior model codes and the Virginia IRC, the technical requirements for habitable attics were embedded in the definition. ICC moved those requirements to Section R325.1 in the 2018 IRC and R326.1 in the 2021 IRC because, as a matter of policy, ICC prefers to avoid including technical regulations in definitions. These changes were made to comply with that policy, and there doesn't appear to be a reason for Virginia to not follow the model code in that regard.
The other revision initially proposed by this change is correlation with the 2021 ICC/IRC, and specifically the change made by Item RB152-19, which was approved for inclusion in the 2021 IRC. It was Approved as Modified by public comments 3 and 5 at the public comment hearing, and that action was sustained by the ICC membership. The changes clarified that habitable attics above the third story essentially create a fourth story, for which the IBC has always required fire sprinklers to offset the increased risk of additional height. Occupants located four stories above grade have a long way to go to escape against smoke and heat rising from a fire below that can block the interior stairs, and occupants four stories above grade cannot reasonably jump from escape windows or be readily rescued by fire department using ground ladders. However, the IRC allows NFPA 13D protection, a much more cost-effective approach for this application, versus NFPA 13R or NFPA 13 systems required by the IBC.

Feedback on the original proposal has led to a modified version for Virginia that differs from the model code. Rather than any habitable attic above the third story requiring fire sprinklers, the modified version bases fire protection on the height of required means of escape windows above grade, recognizing that this is a specific measure associated with emergency escape and rescue from a habitable attic using a ground ladder.

Additionally, two changes have been added as building industry incentives. The first is allowing what is essentially a full fourth story under the IRC using NFPA 13D protection and without requiring a fire-resistive structure. Currently, a fourth story would be directed to the IBC, which requires NFPA 13R or NFPA 13 protection, at significantly higher cost.

The second is providing a prescriptive allowance for rooftop decks and stairway penthouses above the third story. These have become highly

desirable features for home buyers that builders must currently negotiate on a case-by-case basis since they aren't currently addressed by the IRC. Given the relationship between habitable attics and stairway penthouses for rooftop access, it is a reasonable extension of the initial proposal to address both topics in the modified version of this proposal, ensuring that there are benefits to be gained by both the building industry and fire-safety stakeholder groups, should this change be approved.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
**Note (from DHCD Staff): A revised proposal was submitted by the proponent and discussed at the 9/1/2020 Combined Workgroup Meeting. The proposal was updated to match what was discussed at the meeting and the following revised statement was provided by the proponent after the meeting:**

The code change proposal could increase or decrease the cost of construction, depending on the design options selected. For smaller habitable attics, where the means of escape window is too high for safe egress, the cost of construction would increase. For large habitable attics that do not meet the current Virginia limits and would otherwise require compliance with the IBC, the proposal will reduce the cost of construction by allowing such dwellings to be built under the IRC rather than the IBC, with less expensive sprinkler protection.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:** Carryover to Sept

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## Board Decision

**PCH Action:** None

**Board Reason:** N/A

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## Board Decisions

- [ ] Approved
- [ ] Approved with Modifications
- [ ] Carryover
- [ ] Disapproved
- [ ] None

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# Public Comments for: RB325.1-18

This proposal doesn't have any public comments.

Proposal # 411

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## RB325.1 Habitable attics 2021 change

**Proponent(s):** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com) - Consultant, National Fire Sprinkler Associates
**Comments:**

- DHCD staff suggests carrying over to Combined Workgroup meeting.
- Mr. Brown (DHCD) suggests that Mr. Moldovan of DHCD meet with Mr. Shapiro and with Mr. Clark of the Homebuilders' Association to come up with an amended proposal.

**Results:** Carryover to August

## RB325.1 Habitable Attics

**Proponent(s):** Jeff Shapiro (jeff.shapiro@intlcodeconsultants.com)
**Summation of Proposal:** Deletes the state amendment and brings in the 2018 language for habitable attics.
**Comments:**
● Mr. Clark (HBAV) asserts that he would be glad to have a conversation with Mr. Shapiro offline to iron out this proposal.
● Mr. Witt suggests reaching out to some of the other stakeholders who could help workshop this proposal further, such as Mr. Clements (Chesterfield County).
● Ms. Davis mentions that DHCD staff is concerned about the language that is contained within the proposal; Mr. Shapiro agrees to work with these groups.
Results: Carry over to 9/1 meeting with the agreement to meet with DHCD staff and other stakeholders prior to the meeting - Andrew Clark, David Beahm, Dan Willham, Jason Laws, Ron Clements, Andrew Milliken.
**Results: Non-Consensus**

Decided at the July 15, 2020 Workgroup 3 Meeting and
at the August 11, 2020 Combined Workgroup Meeting

# RB332(2)-18

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; AIA Virginia

## 2018 International Residential Code

**Add new text as follows:**

**R332**
**STANDBY POWER SYSTEMS**

**332.1 General** Standby power systems shall comply with Section 332, Chapter 34 and NFPA 70

**332.2 Where required** Optional standby power systems shall be provided in accordance with this section.

**332.2.1 New construction** An optional standby power system shall be installed for dwellings in Group R-5 occupancies in accordance with the following:

1. The secondary power source for the optional standby power system required by this section can be permanently installed on-site alternate source or a portable alternate source.
2. Each individual dwelling unit must be provided with an independent secondary power supply or an independent connection for a portable power supply.
3. Load transfer to the standby power system shall be automatic or manual.
4. The optional standby power system must be capable of providing a minimum of 60 amperes of power to the dwelling unit's electrical system.
5. Where the secondary power source is not permanently installed on-site and connected to the dwelling unit's wiring system, a permanent connection to the dwelling unit's wiring system must be installed for connection of a portable power supply in the event of loss of primary power.

Exception: An emergency or standby power system, permanently installed in accordance with VCC Section 2702.1.2 that provides automatic power to the dwelling unit in accordance with VCC Sections 2702.1.3 and 2702.1.4 shall be an acceptable alternative to the optional standby power system required by this section.

**332.2.2 Alterations, repairs and additions.** When an alteration to a dwelling unit's electrical system includes upgrading the electric service to a higher ampere rating, an optional standby power system shall be provided in accordance with Section 332.2.1.

**Reason Statement:** Requires power inlet to be installed, for an optional (portable) generator, for all new one and two-family homes, and for existing one and two-family homes when the electric service is being upgraded to a higher ampere rating.

**Cost Impact:** The code change proposal will increase the cost of construction
The cost is estimated to be around $200 to install this hook up to feed the main panel in a home.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Gives owner an option to maintain power and livability after an event which causes a prolonged loss of power.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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# Public Comments for: RB332(2)-18

This proposal doesn't have any public comments.

Proposal # 365

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## RB332(2) Standby power systems

**Proponent(s):** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; AIA Virginia
**Comments:**

- Mr. Holland (NEMA) supports.
- Mr. Clark says the Homebuilders' Association opposes.

**Results:** Non-Consensus

Decided at the July 15, 2020 Workgroup 3 Meeting

# RB703.11.1-18

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; City of Newport News; AIA Virginia

## 2015 Virginia Residential Code

**Revise as follows:**

**R703.11.1 Installation.** Vinyl ~~siding, soffit and~~ siding and accessories shall be installed in accordance with the manufacturer's instructions.

~~**R703.11.1.4 Vinyl soffit panels.** Soffit panels shall be individually fastened to a supporting component such as a nailing strip, fascia or subfascia component or as specified by the manufacturer's instructions.~~

.

**Add new text as follows:**

## R704
## Soffits

**R704.1 General Wind Limitations** Where the design wind pressure is 30 psf or less, soffits shall comply with Section R704.2. Where the design wind pressure exceeds 30 psf, soffits shall comply with Section R704.3. The design wind pressure on soffits shall be determined using the component and cladding loads specified in Table R301.2(2) for walls with an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

**R704.2 Soffit installation where the design wind pressure is 30 psf and less.** Soffit installation shall comply with Section R704.2.1, Section R704.2.2, Section R704.2.3, or Section R704.2.4. Soffit materials not addressed in Sections R704.2.1 through R704.2.4 shall be in accordance with the manufacturer's installation instructions.

**R704.2.1 Vinyl soffit panels.** Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia or subfascia component in accordance with Figure R704.2.1. Where the unsupported span of soffit panels is greater than 16 inches, intermediate nailing strips shall be provided in accordance with Figure R704.2.2. Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

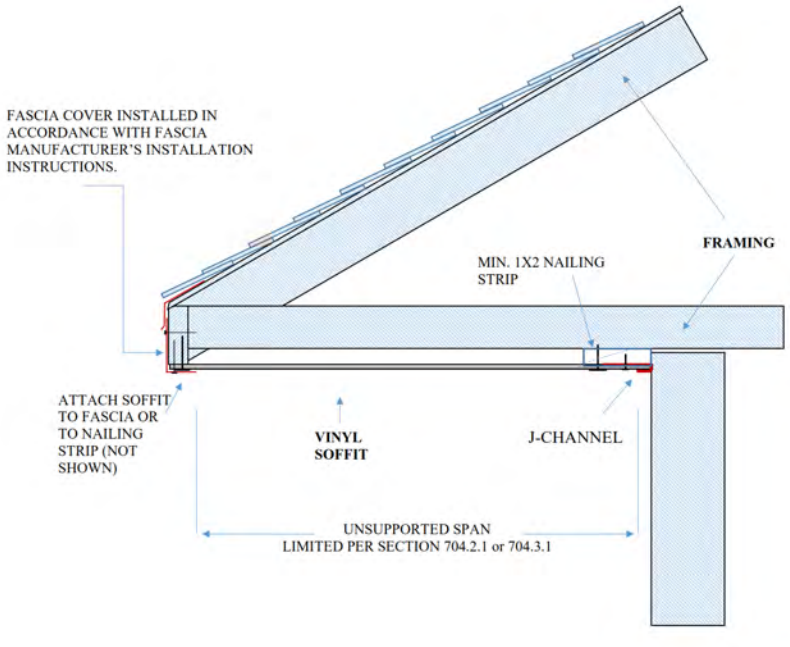


**Figure R704.2.1 Typical single span vinyl soffit panel support**

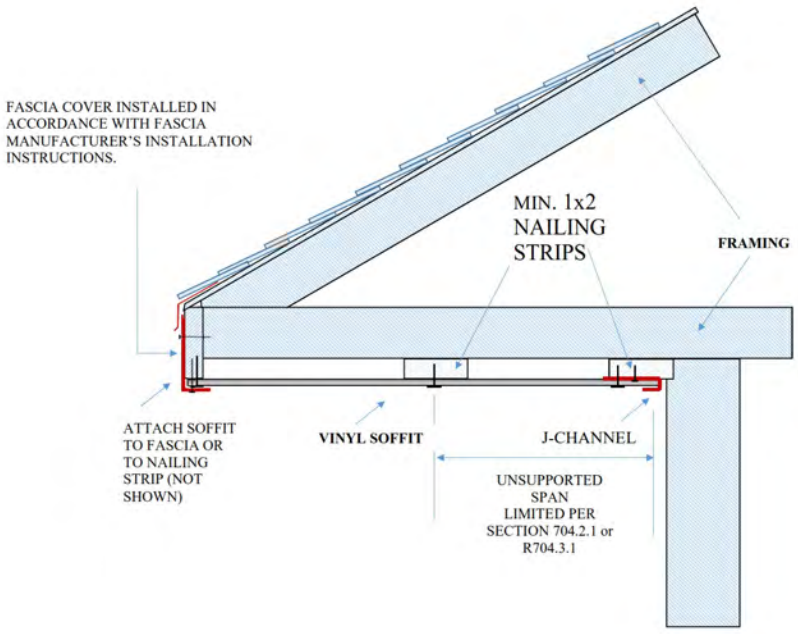


**Figure R704.2.2 Typical double span vinyl soffit panel support**

**R704.2.2 Fiber-cement soffit panels.** Fiber-cement soffit panels shall be a minimum of 1/4 inch in thickness and shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Panel joints shall occur over framing or over wood structural panel sheathing. Soffit panels shall be installed with spans and fasteners in accordance with the manufacturer's installation instructions.

**R704.2.3 Hardboard soffit panels.** Hardboard soffit panels shall be a minimum of 7/16 inch in thickness and shall be fastened to framing or nailing strips with 2 ½ " x 0.113" siding nails spaced not more than 6 inches on center at panel edges and 12 inches on center at intermediate supports.

**R704.2.4 Wood structural panel soffit.** The minimum nominal thickness for wood structural panel soffits shall be 3/8 inch (9.5 mm) and shall be fastened to framing or nailing strips with 2-inch by 0.099-inch (51 mm x 2.5 mm) nails. Fasteners shall be spaced not less than 6 inches (152 mm) on center at panel edges and 12 inches (305 mm) on center at intermediate supports.

**R704.3 Soffit installation where the design wind pressure exceeds 30 psf.** Soffit installation shall comply with Section R704.3.1, Section R704.3.2, Section R704.3.3, or Section R704.3.4. Soffit materials not addressed in Sections R704.3.1 through R704.3.4 shall be in accordance with the manufacturer's installation instructions.

**R704.3.1 Vinyl soffit panels.** Vinyl soffit panels and their attachments shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3). Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia, or subfascia component in accordance with Figure R704.2.1. Where the unsupported span of soffit panels is greater than 12 inches, intermediate nailing strips shall be provided in accordance with Figure R704.2.2. Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

**R704.3.2 Fiber-cement soffit panels.** Fiber-cement soffit panels shall comply with Section R704.2.2 and shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

**R704.3.3 Hardboard soffit panels.** Hardboard soffit panels shall comply with the manufacturer's installation instructions and shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

**R704.3.4 Wood structural panel soffits.** Wood structural panel soffits shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3). Alternatively, wood structural panel soffits shall be permitted to be installed in accordance with Table R704.3.4.

**Table R704.3.4 Prescriptive Alternative for Wood Structural Panel Soffit[b, c, d, e]**

| Maximum Design Pressure (+ or - psf) | Minimum Panel Span Rating | Minimum Panel Performance Category | Nail Type and Size | Fastener[a] Spacing Along Edges and Intermediate Supports | |
|---|---|---|---|---|---|
| | | | | Galvanized Steel | Stainless Steel |
| 30 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 6[f] | 4 |
| 40 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 6 | 4 |
| 50 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 4 | 4 |
| | | | 8d common (2½ x 0.131 x 0.281 head diameter) | 6 | 6 |
| 60 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 4 | 3 |
| | | | 8d common (2½ x 0.131 x 0.281 head diameter) | 6 | 4 |
| 70 | 24/16 | 7/16 | 8d common (2½ x 0.131 x 0.281 head diameter) | 4 | 4 |
| | | | 10d box (3 x 0.128 x 0.312 head diameter) | 6 | 4 |
| 80 | 24/16 | 7/16 | 8d common (2½ x 0.131 x 0.281 head diameter) | 4 | 4 |
| | | | 10d box (3 x 0.128 x 0.312 head diameter) | 6 | 4 |
| 90 | 32/16 | 15/32 | 8d common (2½ x 0.131 x 0.281 head diameter) | 4 | 3 |
| | | | 10d box (3 x 0.128 x 0.312 head diameter) | 6 | 4 |

a. Fasteners shall comply with Sections R703.3.2 and R703.3.3.
b. Maximum spacing of soffit framing members shall not exceed 24 inches.
c. Wood structural panels shall be of an exterior exposure grade.
d. Wood structural panels shall be installed with strength axis perpendicular to supports with a minimum of two continuous spans.
e. Wood structural panels shall be attached to soffit framing members with specific gravity of at least 0.42. Framing members shall be minimum 2x3 nominal with the larger dimension in the cross section aligning with the length of fasteners to provide sufficient embedment depths.
f. Spacing at intermediate supports shall not be greater than 12 inches on center

**Reason Statement:** The purpose of this code change proposal is to improve the wind performance of soffits by clarifying International Residential Code (IRC) installation requirements for the most common types of manufactured soffits and by providing a prescriptive alternative for wood structural panel soffits that complies with design wind pressures specified in the IRC and ASCE 7. The code change refines and further clarifies provisions that were adopted into the 2018 IRC and adds new provisions to address soffit installation in high wind regions. The proposal also moves the clarified soffit provisions to the new Section 704 to better distinguish from exterior wall covering provisions that make up nearly all of Section 703. In addition to separating the clarified soffit provisions to prevent them from being overlooked, new soffit provisions can easily be added as needed with this improved organization and simplified format.
As part of the response to Hurricane Harvey in Texas and Hurricane Irma in Florida, the Federal Emergency Management Agency (FEMA) deployed Mitigation Assessment Teams (MATs) composed of national and regional building science experts to assess the damage in both States. The primary purpose of a MAT is to improve the natural hazard resistance of buildings by evaluating the key causes of building damage, failure, and success, and developing strategic recommendations for improving short-term recovery and long-term disaster resilience from future natural hazard events. The following MAT-related information is included in the FEMA MAT Reports: Hurricane Irma in Florida (https://www.fema.gov/media-library/assets/documents/176315) and Hurricane Harvey in Texas (https://www.fema.gov/media-library/assets/documents/177700).

The FL MAT observed building envelope damage on both older and newer residential construction, and soffits were among the most frequently

observed damaged envelope components. Based on estimated wind speeds at the sites visited, failure occurred to soffit components at wind speeds well below design wind speeds for these areas. The FL MAT observed both vinyl and metal soffit loss, but vinyl soffit panels were the most common product observed, particularly in the Florida Keys where vinyl soffit damage was widespread.

In many cases, inadequate support and attachment at the ends of the soffit panel led to failure of the soffit. The Sugarloaf Key house shown below (FL MAT Report Figure 4-19) lost its vinyl soffit in several areas. The red oval shows where the soffit panel was stripped from the assembly's J-channel, which remains attached along the exterior wall (yellow arrows). The soffit appears to have been fastened to only a single nailing strip across the midpoint of the framing above. Section 704.2.1 (including Figure 704.2.1) of the proposal has been included to clarify that vinyl soffit panels are required to be fastened at each end and the unsupported span cannot exceed specified limits (16 or 12 inches) unless permitted by the manufacturer's product approval.

-image

In some cases, vinyl soffit failure appeared to have been associated with fascia cover loss as shown in the image below from Little Torch Key (FL MAT Report Figure 4-18). Loss of the fascia cover likely increases wind pressures on vinyl soffit where the edges of the soffit are exposed.

-image

The TX MAT observed similar wind damage to residential soffits as indicated below. The dwelling in Cape Valero shown on the left (TX MAT Figure 4-44) lost re-covered vinyl soffit panels (green arrow) to high winds, exposing the vent opening (red arrows) to wind driven rain. The photo on the right (TX MAT Figure 4-45) shows a soffit opening that was previously covered by a ventilating fiber-cement board. Red arrows indicate where the attic is exposed to wind driven rain. As with examples shown from Florida, estimated wind speeds for the sites were below design wind speeds.

-image

FL and TX MAT observations described above along with other examples detailed in the MAT Reports, led to the following conclusions and recommendations:

**Conclusion FL-10: The MAT observed evidence of inadequate resistance to wind pressures and improper installation of soffits on residential buildings.** Widespread loss of soffits was observed in residential construction, and wind-driven rain infiltrated some areas where soffits were displaced or lost.
**Recommendation FL-10a: Designers, contractors, and inspectors should place more emphasis on proper soffit installation to limit wind-driven rain.** Proper soffit installation should be emphasized by designers, contractors, and inspectors in order to limit wind-driven rain from entering building envelopes and damaging building interiors.
**Conclusion TX-18: Many soffits lacked adequate wind resistance, typically because the wrong material was used for the region or it was improperly installed.** The MAT observed widespread loss of soffits in residential and non-residential construction, generally due to improper materials, lack of fasteners, and/or inadequate framing, and wind-driven rain infiltrated some areas where soffits were displaced or lost. The loss of soffit vents can allow hurricane winds to drive large amounts of water through the openings and soak insulation, which can lead to mold growth and, in some cases, the collapse of ceilings.
**Recommendation TX-18: Designers, contractors, and inspectors should place more emphasis on proper soffit installation in high-wind regions.** Wind-driven rain should be limited from entering building envelopes and damaging building interiors through proper soffit installation.In summary, widespread residential soffit damage observed in the wake of the 2017 Hurricane Season indicates the need for clarified installation provisions in the IRC. The proposed provisions apply to design wind pressures realized across the US, but are clearly differentiated where 30 pounds per square foot (psf) or less or where greater than 30 psf, so that installation requirements are tailored for the site-specific pressures. Regardless the soffit design wind pressure, the new provisions will provide greater clarity for the builder to implement code-compliant soffit installation and for the building official to verify code-compliant soffit installation.

**Cost Impact:**
The code change proposal will not increase the cost of construction for buildings where design wind pressures are 30 psf or less because it only clarifies the existing requirements for soffit installation. The code change proposal may decrease costs for buildings where the design wind pressure exceeds 30 psf because it provides code compliant solutions in lieu of design.

**Resiliency Impact Statement:** This proposal will increase Resiliency
Will increase resiliency by clarifying installation requirements and improving the performance of soffits.

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## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

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## Public Comments for: RB703.11.1-18

This proposal doesn't have any public comments.

Proposal # 388

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## RB703.11.1: Faucet Attachment and Bracing Requirements

**Proponent(s):** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; City of Newport News; AIA Virginia

**Comments:**

- Mr. Stafford provides context for this proposal.
- This proposal includes 2021 language.
- Mr. Clark (Homebuilder's Association of Virginia) opposes.

**Results:** Non-Consensus

Decided at the July 15, 2020 Workgroup 3 Meeting

# EB103.2-18

**Proponents:** Gregory Revels (greg.revels@henrico.us)

## 2015 Virginia Existing Building Code

**Revise as follows:**

**103.2 Change of occupancy.** Prior to a *change of occupancy* of the *building* or *structure*, the owner or the owner's agent shall make written application to the local building department for a new certificate of occupancy and shall obtain the new certificate of occupancy.

When impractical to achieve compliance with this code for the new occupancy, the building official shall consider modifications upon application and as provided for in Section 106.3 of the VCC.

**Exception:** An existing Group R-5 dwelling unit utilized as a short-term rental, allowing transient occupancy, is permitted to remain classified as Group R-5, provided that smoke alarms are installed in compliance with Section R314 and fire extinguishers are installed in compliance with Section R330 of the VRC.

**Reason Statement:** Provides an exception from the change of occupancy requirement of section 103.2 for Group R-5 dwelling units used for short-term rentals. Allows these uses to remain Group R-5 given they are provided with smoke alarms in accordance with Section R314 and fire extinguishers in accordance with R330 of the VRC.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Non-Consensus

**Workgroup 1 - Final Reason:**

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# Public Comments for: EB103.2-18

**Discussion by Kenney Payne**
Aug 4, 2020 13:41 UTC

I could not find a definition of "short-term rental." Is there one? If not, should there be one? Is "short-term" considered no more than 30-days since "transient" is limited to 30 days? Would this address beach houses where folks rent them out for the entire summer (i.e., longer than 30 days)?

We do not oppose the proposal, but do believe some clarification may be needed - or not.

Proposal # 457

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## EB103.2 Short-term rentals

**Proponent(s):** Greg Revels, Henrico County (greg.revels@henrico.us)

**Summation of Proposal:** Provides clarification and exceptions for change of occupancy for R-5 units used as short term rentals.

**Other Pertinent Information:**

- Short-term rental has been a long-standing issue that's been discussed at the Residential Use Group meetings, including meetings on: May 31 2019, July 10 2019, August 9th and the final ADU meeting (split as a separate proposal) in June 2020. There has been disagreement within the building code community for use-group classification of beach rental homes with multiple sleeping units, and it has also been a sticking point for some of the ADU discussion where people are converting basements into rental units. This can create a fire hazard and life safety hazard since both these groups of structures are not designed for multiple occupancies, but effectively they're being converted into such.
- At the May 31, 2019 meeting, suggested added language regarding ADUs was brought forth; nothing was decided upon because the group believed it would be helpful to have Mr. Revels (not in attendance that day) to walk the group through the proposed changes. The discussion at that meeting yielded the following results: The workgroup felt there was no additional concerns from a code perspective regarding Air BnB and similar short-term rentals of dwelling units. There are no greater hazards associated with the use than found in time shares or lodging houses. However, current provisions do not allow the uses for anything other than the purposes of "complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation" which are called out in the definition of a dwelling unit. Uses for wedding venues or other similar uses would not be considered complying with the requirements and would need to be addressed within the requirements of the IBC. Local zoning and/or homeowner associations may be better geared to regulate the number of and requirements for parking, licensing, etc. than attempting to regulate them through the building code.

**Comments:**

- Proponent is not present.
- Ms. Davis (DHCD) gives background to this proposal in Mr. Revels' stead.
- Ms. Hale is concerned that it isn't inclusive enough - doesn't include fire code.
- Mr. Allen (Henrico County) speaks on behalf of Mr. Revels.
- Mr. Beahm (representing self) is opposed to the change, claiming this proposal would implement a solution for a locality's issue as opposed to a statewide issue.
- Mr. Milliken is also opposed, for the reasons outlined by Mr. Beahm. The Fire Services Board are concerned with it remaining an R-5. He questions how or whether this affects the residential subworkgroup.
- Mr. Brown of DHCD clarifies that this did not affect the subworkgroup, and that Mr. Revels did intend for it to be inclusive statewide, not merely just bound to help one locality.
- Mr. Allen is in support.

**Results:** Non-consensus

Decided at the August 11, 2020 Combined Workgroup Meeting

# EB202(2)-18

**Proponents:** Casey Littlefield (casey.littlefield@dhcd.virginia.gov); Michael Dellinger (mdellinger@albemarle.org)

## 2015 Virginia Existing Building Code

**[A] CHANGE OF OCCUPANCY.**

Either of the following shall be considered a *change of occupancy* where the current VCC requires a greater degree of accessibility, structural strength, fire protection, means of egress, electrical, ventilation or sanitation than is existing in the current *building* or *structure*:

1. 1.
   Any change in the occupancy classification of a *building* or *structure*.
2. 2.
   Any change in the purpose of, or a change in the level of activity within, a *building* or *structure*.

**Note:** The use and occupancy classification of a *building* or *structure*, shall be determined in accordance with Chapter 3 of the VCC.

**Reason Statement:** As currently written the only way to get to Chapter 7 Change of Occupancy is by definition. While the definition of Change of Occupancy indicates building systems that would trigger a Change of Occupancy electrical was not on the list. The problem occurs when a change of use stays the same but levels of personal safety increase such as going from an insurance office to a Physical Therapy office ( a B use to a B use). The Physical Therapy Office typically use machines and equipment that connect the patient to electrical shock. The receptacles that supply this equipment needs to have a redundant grounding system in place so the patient doesn't become a path to ground. By adding the word "electrical" to the definition the code official is able to require this NEC 517.13(A) and (B) required wiring.

**Cost Impact:**
While there will be a cost impact with this proposal the incurred costs wont be significant. If a 5 office Insurance office turns into a 5 office Physical Therapy office with one required health care receptacle in each room all sharing one circuit the cost would be around $125.00 per room to complete the installation.

**Resiliency Impact Statement:**
None

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB202(2)-18

**Discussion by Kenney Payne**
Apr 17, 2020 19:20 UTC

The example used under "Reason" would be addressed and resolved by VEBC 603.3, where all new construction, elements, components, systems, and spaces must comply with the VCC. VEBC 601.1 also says the building cannot be less safe after completion of the alterations.

**Discussion by Kenney Payne**
Feb 12, 2020 21:21 UTC

This may open up a can of worms we do not want. The term "electrical" is so broad, would having to revise one wire in a 300,000 SF building create a COO? Also, I'm not convinced the proposed change to the definition would fix the example used in the "Reason statement."

So let's say the wiring for the equipment would constitute a "greater degree" - that just means you have a COO. When I go to Section 708, tell me where I have to provide the type of wiring needed for the equipment. If it doesn't fall under the "special occupancies" described in 708.1, then that doesn't apply. Would this require a service upgrade? If not, then nothing to see here. 708.3 covers the "number" of outlets, not the "type" of outlets. And lighting would not apply.

While there may be a need to address the example given, I'm not sure this proposal does that while possibly opening up the potential for unintended consequences of declaring more projects as a COO that otherwise would not be.

## EB202(2)-18: Change of occupancy definition

**Proponents:** Casey Littlefield

Public Comments for: EB202(2)-18 Discussion by Kenney Payne

**Comments:**

- Mr. Payne (AIA Virginia) is concerned about the interpretation of the word “electrical” for Change of Occupancy. He also believes the VEBC already includes the language that would provide guidelines for what this proposal is supposed to cover.
- Mr. Kines (Prince William County) argues that there are several ways in which this proposal could be applied; he speaks in support of the proposal.
- Mr. Moss (VBCOA) agrees with Mr. Payne (AIA Virginia) and would not be in favor of this changeMr. Beahm (representing himself) agrees
- Ms. Cook (Arlington) and Ms. Eggerton (Alexandria) both assert that there are many reasons change of occupancy would require upgrades, including electrical
- Mr. Payne (AIA Virginia) suggests that this change is not necessary, supports punting this one to the next code cycle.

**Results:** Non-Consensus

Decided at the July 1, 2020 Workgroup 2 Meeting

# EB701.4-18

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

## 2015 Virginia Existing Building Code

**Add new text as follows:**

**OPTION A - 701.4 Energy Conservation** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with the Virginia Energy Conservation Code.

**701.4.1 Commercial Buildings** Where the use in a space changes from one use in Table C405.3.2(1) or C405.3.2(2) of the VECC to another use in Table C405.3.2(1) or C405.3.2(2) of the VECC, the installed lighting wattage shall comply with Section C405.3 of the VECC. Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.4.1 of the VECC, the space is exempt from Section C402.4.1 of the VECC provided that there is not an increase in fenestration area.

Exceptions:

1. Where the component performance alternative in Section C402.1.5 of the VECC is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.

2. Where the total building performance option in Section C407 of the VECC is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3 of the VECC.

**701.4.2 Residential Buildings** Any space that is converted to a dwelling unit or portion thereof from another use or occupancy shall comply with the VECC.

Exception: Where the simulated performance option in Section R405 of the VECC is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost allowed by Section R405.3 of the VECC.

## 2015 Virginia Energy Conservation Code

**Revise as follows:**

**C505.1 General.** Spaces undergoing a change in occupancy or use shall comply with Chapter 7 of the VEBC.~~that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.4.2(1) or C405.4.2(2) to another use in Table C405.4.2(1) or C405.4.2(2), the installed lighting wattage shall comply with Section C405.4.~~

**R505.1 General.** Spaces undergoing a change in occupancy or use shall comply with Chapter 7 of the VEBC.~~that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.~~

**Delete without substitution:**

~~**R505.2 General.** Any space that is converted to a dwelling unit or portion thereof from another use or occupancy shall comply with this code.~~

~~**Exception:** Where the simulated performance option in Section R405 is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost otherwise allowed by Section R405.3.~~

## 2015 Virginia Existing Building Code

**Revise as follows:**

**OPTION B - PROPOSED DESIGN** For the purposes of determining compliance with Section 713, a description of the proposed building, or portion thereof, used to estimate annual energy use for determining compliance based on total building performance.

**Add new text as follows:**

### SECTION 713
### ENERGY CONSERVATION

**713.1 Commercial buildings.** In commercial buildings, spaces undergoing a change in occupancy or any space that is converted to a dwelling unit or portion thereof that would result in an increase in energy demand shall comply with the applicable requirements of the VECC throughout the area where the change of occupancy occurs. Alterations undertaken in connection with such change of occupancy shall comply with Section 601.4.

Exceptions:

1. Where the component performance alternative in Section C402.1.5 of the VECC is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.

2. Where the total building performance alternative in Section C407 or R405 of the VECC is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost allowed by Section C407.3 or R405.3 of the VECC.

3. The costs to comply with the applicable requirements of the VECC are not required to exceed 20 percent of the costs of the alterations associated with the area where the change of occupancy occurs that are not separately required under Section 601.4.

4. The area where the change of occupancy occurs is less than 10 percent of the total floor area where such change occurs or where such area is no larger than 1,500 square feet, whichever is greater.

5. Where the change of occupancy was undertaken for the primary purpose of increasing the accessibility to the facility.

**713.2 Residential buildings.** In residential buildings, any non-conditioned or low energy space that is altered to become conditioned space shall comply with the applicable requirements of the VECC.

**Exception:** Where the simulated performance alternative in Section R405 of the VECC is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost allowed by Section R405.3 of the VECC.

**Reason Statement:** This proposal includes two options - Option A, which is the original proposal, and Option B, which is a revised proposal meant as a compromise on change of occupancy requirements. To be clear, we would either want the proposal in Sections 701.4 (Option A) OR Section 713 (Option B), NOT both.
This proposal aligns with other proposals to move the energy conservation requirements for existing buildings from the VECC to the VEBC. This proposal also provides a pointer in the VECC to the VEBC to assist code officials who may be used to looking at the VECC rather than the VEBC for existing building energy conservation requirements.

Option A brings the requirement of VECC Sections C505 and R505 into Chapter 7 of the VEBC.

Option B brings the requirements of VECC Section C505 into Chapter 7 of the VEBC but adds three additional exceptions for commercial building compliance which provide building owners, builders, and design professionals more flexibility in complying with the code. For residential buildings, the language of new 713.2 mirrors the language that is already in Section 1109.2 of the VRC for clarity.

**Cost Impact:** The code change proposal will increase the cost of construction
This proposal will increase the cost of construction in some cases. Because the current VECC and VEBC are not in perfect alignment on energy conservation requirements for existing buildings, the cost impact will vary based on which code is used as the basis for code compliance. To the extent that code officials have been enforcing Chapter R5/C5 of the VECC for existing buildings, this proposal will not increase the cost of construction and may reduce the cost of construction in some cases, since the requirements are drawn directly from VECC Chapter R5/C5. However, where code officials have been enforcing the VEBC for all requirements for existing buildings, these changes will apply new requirements and may result in increased initial cost of construction but may also results in reduced life cycle costs due to the anticipated energy savings.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal is administrative and will neither increase nor decrease resiliency.

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:** Was originally non-consensus at the WG2 meeting. Proponent requested to edit and bring back following the meeting to reach consensus. Changed status to carryover and released proposal. Carryover to sept 2020.
Option B is preferred.

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# Public Comments for: EB701.4-18

**Discussion by W Shaun Pharr**
Aug 10, 2020 20:36 UTC

AOBA/VAMA share the concerns identified by Kenney Payne for VA AIA.

Further, we believe that BHCD is legally preluded by the Code of Virginia from adopting code provisions applicable to existing buildings which will

increase the costs of compliance for such buildings.

Sec. 36-103 of the Code of Virginia reads, in part, as follows:

"[The] Board may adopt and promulgate as part of the Building Code, building regulations that facilitate the maintenance, rehabilitation, development and reuse of existing buildings ***at the least possible cost*** (emphasis added) to ensure the protection of the public health, safety and welfare."

In short, the General Assembly, as a policy matter, premised the Board's authority to develop and adopt an existing buildings code on the provisions of such a code representing the least possible costs while encouraging, rather than possibly discouraging, continued reinvestment in existing buildings. Code change proposals which would increase the costs of "development" of existing buildings are antithetical on their face to the policy prescribed by the General Assembly and, thus, cannot be validly adopted.

Moreover, it is sophistry to assume that, absent a regulatory mandate, property owners will just ignore the economic benefits that proponents claim will result, and will, instead, do what proponents consider to be "the wrong thing." If those benefits are there, then property owners who can manage the "first costs" required to meet higher energy standards will do so-- and much of the so-called "low hanging fruit" in existing buildings will be harvested, without a "shove it down their throats" mandate that violates the avowed purpose of the existing buildings code.

**Discussion by Kenney Payne**
Jun 24, 2020 13:41 UTC

Per VEBC 701.1, “compliance shall be only as necessary to meet the specific provisions of the applicable iCodes” (which includes the IECC) so there is no need to include the provisions where “the use in a space changes” like 701.4.1 and 701.4.2 or any other section that addresses “new” stuff.

If a COO involves *alterations*, then compliance with VEBC 601.4 is already required per VEBC 701.2.

Regarding the “Cost impact” statement that there would be no increase in costs. It should consider the 2015 VEBC as the baseline not the 2018 IECC - since the 2015 VEBC is the code being changed. Such proposals would ADD costs to an existing building when compared to the 2015 VEBC.

Proposal # 434

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**EB701.4: Moves VECC existing building provisions to VEBC**
**Proponents: Laura Baker, Eric Lacey of RECA**
**Comments:**

- Ms. Baker explains that this proposal is designed to move VECC existing building language over in the VEBC Change of Occupancy chapter.
- Mr. Payne of AIA Virginia voices concern about moving the language over; currently, energy conservation requirements are not triggered by a Change of Occupancy. Thi would be a complete reversal, to which he is opposed.
- Ms. Cook of Arlington County mentions that she doesn't think we will reach consensus on this proposal; due to the current economic climate. There would be heavy financial implications. Thus, she is not in support.
- Mr. Payne brings up that if there is an alteration to a structure related to a change of occupancy, that may trigger energy conservation requirements - but as it stands, for existing buildings with no alterations, he is not in support.
- Ms. Cook (Arlington County) wishes to see the cost statement; Ms. Baker claims there isn't any because it is already contained within the VEBC. Ms. Cook believes this is factually incorrect, and that it is contained within the body of the Virginia Energy Code, but that to add it to the VEBC would have a large financial impact.

**Results:** Non-Consensus

Decided at the September 1, 2020 Combined Workgroup Meeting

# EB704.1-18

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

## 2015 Virginia Existing Building Code

### SECTION 704
### FIRE PROTECTION

**704.1 Fire protection systems.** Fire protection systems shall be provided in accordance with Sections 704.2 and 704.3.

**Revise as follows:**

**704.2 Fire sprinkler system.** Where a *building* undergoes a *change of occupancy* that requires an automatic fire sprinkler system to be provided based on the new occupancy in accordance with ~~Chapter 9~~ Section 903 of the VCC, such automatic fire sprinkler system shall be provided throughout the area where the *change of occupancy* occurs.

**704.3 Fire alarm and detection system.** Where a *building* undergoes a *change of occupancy* that requires a fire alarm and detection system to be provided based on the new occupancy in accordance with ~~Chapter 9~~ Section 907 of the VCC, such fire alarm and detection system shall be provided throughout the area where the *change of occupancy* occurs. Existing alarm notification appliances shall be automatically activated throughout the *building*. Where the *building* is not equipped with a fire alarm system, alarm notification appliances shall be provided throughout the area where the *change of occupancy* occurs in accordance with Section 907 of the VCC as required for new construction.

**704.3 Standpipe system.** Where a building undergoes a change of occupancy that requires a standpipe system to be provided based on the new occupancy in accordance with Section 905 of the VCC, such standpipe system shall be provided to serve the area where the change of occupancy occurs.

**Reason Statement:** Clarification is needed to avoid misinterpretations of the intended requirements.
It appears a number of plan reviewers are interpreting that VEBC Section 704 requires compliance with the *entire* Chapter 9 of the VCC. This would also bring in standpipe systems, portable fire extinguishers, emergency alarm systems, smoke control systems, smoke and heat removal, etc. That is not the intent of VEBC Section 704.

When the VEBC sends one to another iCode (e.g., the VCC or VPC) it is only for that specific requirement and then you go back to the VEBC.
In this case, VEBC 704.2 requires you to go to VCC Chapter 9 to see if the new occupancy would require a sprinkler system. THAT'S IT! It is to get a 'yes' or 'no' answer. If the answer is 'yes' (that the new occupancy would require a sprinkler system per VCC 903), then you go back to the VEBC to see *where* it is located - only where the change of occupancy occurs.

It is the same process for 704.3 regarding fire alarms and detection systems.

It is not the intent of VEBC Section 704 to require you to comply with everything in VCC Chapter 9 - it requires only for you to see if a sprinkler system and/or fire alarm system would be required based on the new occupancy.

Example:

- Existing building (or portion thereof) is 'B'
- Change of occupancy to 'R-2' (or portion thereof)
- VEBC 704 says to go to VCC Chapter 9 to see if a sprinkler and/or fire alarm system is required for the new portions with the 'R-2' occupancy
  - You go to VCC 903.2.8 to see if a sprinkler system is required for 'R-2'
    - If you meet any of the exceptions - the answer is NO
    - If you do not meet the exceptions - the answer is YES
    - However, do not forget about VEBC 702.1 which requires you to also look at VCC Chapter 4 - specifically Section 420.5; but since it sends you back to the same 903.2.8, the exceptions would still apply for the 'R-2'
  - You go to VCC 907.2.9 to see if a fire alarm and detection system is required for 'R-2'
    - If you meet any of the exceptions - the answer is NO
    - If you do not meet any of the exceptions - the answer is most likely YES
    - However, do not forget about VEBC 702.1 which requires you to also look at VCC Chapter 4 - specifically Section 420.6; in which case you would need to evaluate each of those sections - and only those sections - to determine if you get a 'yes' or 'no'
- If the answers are YES for sprinklers and/or YES for fire alarms, you go back to VEBC 704 to find out *where* they are to be installed
  - In each case, it is only where the change of occupancy occurs
- There is nothing in that process that requires you to evaluate the other sections of VCC Chapter 9 - including Section 905 for standpipe systems

By deleting the reference to the entire Chapter 9 and substituting the specific section within Chapter 9; hopefully, this will clarify the intent and there will no longer be any misinterpretations as it relates to VEBC Section 704.

**Cost Impact:**
If code enforcement officials are requiring standpipes and/or any of the other systems that VCC Chapter 9 covers - this proposal would **DECREASE** the cost of construction, because there would be no need for such systems to be added based on Section 704.

If Section 704 is interpreted as intended, then this proposal would not affect the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 2 - Final Committee Action:** Non-Consensus

**Workgroup 2 - Final Reason:**

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# Public Comments for: EB704.1-18

This proposal doesn't have any public comments.

Proposal # 396

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## EB704.1-18 Fire protection

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)
**Comments:**

- Mr. Milliken (Fire Services Board Codes and Standards Committee) dissents in practice regarding sprinklers, on the basis of language that could be redefined as "fire areas"
- Mr. Payne (AIA Virginia) suggests that Mr. Milliken's interpretation of the code would be a "tremendous change" from how it has historically been interpreted
- Ms. Cook (Arlington) supports this code change proposal because it is clarifying
- Mr. Milliken (Fire Services Board Codes and Standards Committee) patently disagrees with Mr. Payne.

**Results:** Non-Consensus

Decided at the July 1, 2020 Workgroup 2 Meeting

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# RTE3902.16(1)-18

**Proponents:** Haywood Kines (hkines@pwcgov.org)

## 2015 Virginia Residential Code

**E3902.16 Arc-fault circuit-interrupter protection : ~~of bedroom outlets.~~Branch circuits that supply 120-volt, single phase, 15-ampere and 20-ampere outlets installed in kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, and similar rooms or areas shall be protected by any of the following: [210.12 (A)]** ~~Branch circuits that supply 120-volt, single phase, 15-ampere and 20-ampere outlets installed in bedrooms shall be protected by any of the following:1.~~

1. 1. A listed combination-type arc-fault circuit interrupterinstalled to provide protection of the entire branch circuit.
2. 2. A listed branch/feeder-type AFCI installed at the origin of the branch-circuit in combination with a listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.
3. 3. A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
   - 3.1. The branch-circuit wiring shall be continuousfrom the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   - 3.2. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 50 feet (15.2 m) for 14 AWG conductors and 70 feet (21.3 m) for 12 AWG conductors.
   - 3.3. The first outlet box on the branch circuit shall be marked to indicate that it is the first outlet on the circuit.
4. 4. A listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:
   - 4.1. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   - 4.2. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 50 feet (15.2 m) for 14 AWG conductors and 70 feet (21.3 m) for 12 AWG conductors.
   - 4.3. The first outlet box on the branch circuit shall be marked to indicate that it is the first outlet on the circuit.
   - 4.4. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and shall be listed as such.
5. 5. Where metal outlet boxes and junction boxes and RMC, IMC, EMT, Type MC or steel-armored Type AC cables meeting the requirements of Section E3908.8, metal wireways or metal auxiliary gutters are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, a listed branch-circuit type AFCI installed at the first outlet shall be considered as providing protection for the remaining portion of the branch circuit.
6. 6. Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 2 inches (50.8 mm) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, a listed outlet branch-circuit type AFCI installed at the first outlet shall be considered as providing protection for the remaining portion of the branch circuit.

**Exception:** AFCI protection is not required for an individual branch circuit supplying only a fire alarm system where the branch circuit is wired with metal outlet and junction boxes and RMC, IMC, EMT or steel-sheathed armored cable Type AC, or Type MC meeting the requirements of Section E3908.8.

**Reason Statement:** This type of protection has been in the code since the 1999 NEC and the 2000 IRC code, it has been used in all Dwelling units constructed under the VCC code such as Apartments and Condo's without state amendments and without any issues or problems. The Arc-fault protection adds additional protection for all dwelling units to prevent fires from low current arching, prevent lose of life, and property damage.

**Cost Impact:** The code change proposal will increase the cost of construction
This change will add some minimum cost to construction based on the product changes and availability for new methods to comply with code such as AFCI devices and the use of NM Cable methods. The additional level of safety provided to prevent fires and personnel injuries adds value to our homes.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

## Workgroup Recommendation

**Workgroup 3 - Final Committee Action:** Non-Consensus

**Workgroup 3 - Final Reason:**

**Workgroup 3 - Proposed Committee Action:** Non-Consensus

**Workgroup 3 - Proposed Reason:** Final WG recommendation NC 8/21.

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# Public Comments for: RTE3902.16(1)-18

**Discussion by Richard Potts**
Sep 10, 2019 12:46 UTC

Email support from Cheriene Sanderson.
Attachments: https://va.cdpaccess.com/proposal/178/discuss/49/file/download/111/Commonwealth%20of%20Virginia%20Mail%20-%20In%20support%20of%20RTE3902.16%20for%20Virginia%20Electrical%20Code.pdf

**Discussion by Thomas King**
Sep 6, 2019 14:43 UTC

Attaching an email received in support of the proposal.
Attachments: https://va.cdpaccess.com/proposal/178/discuss/48/file/download/110/Commonwealth%20of%20Virginia%20Mail%20-%20Fwd-%20PROPOSED%20VIRGINIA%20CODE%20AMENDMENT.pdf

**Discussion by Kevin Arnold**
Aug 13, 2019 15:33 UTC

Eaton fully supports proposal RTE3902.16-18 for restoring Arc-Fault Circuit-Interrupter (AFCI) protection to the VRC as required in the 2017 NEC® and 2018 IRC® without amendments. Any amendments that diminish the level of safety brought by the 2017 NEC® are strongly discouraged. This proposal would remove such amendments that decrease the level of protection afforded as a minimum by the 2017 NEC®. Since the adoption and expansion of AFCI protection in the NEC®, the US Fire Administration and the Federal Emergency Management Agency (FEMA) has recorded a 22% reduction in residential electrical fires along with a significant reduction to residential electrical fire damage and fire fatalities. We strongly encourage the BHCD to approve the proposal RTE3902.16-18 for the residential electrical safety for the people of the Commonwealth of Virginia.
Attachments: https://va.cdpaccess.com/proposal/178/discuss/31/file/download/88/US%20Fire%20Administration%20-%202014-2016%20Residential%20Building%20Electrical%20Fires.pdf

**Discussion by Brett Brenner**
Aug 12, 2019 16:25 UTC

The Electrical Safety Foundation International supports proposal RTE3902.16-18 expanding arc-fault circuit interrupter protection (AFCI).

AFCIs have been a part of the National Electrical Code (NEC) since 1999. In the current edition of the NEC, AFCI protection is required in all 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, and similar rooms or areas.

According to the National Fire Protection Association, between 2012 and 2016, 10% of all home fires were caused by electrical distribution and lighting equipment. During the same time period, electrical distribution and lighting equipment accounted for 19% of all civilian fire deaths, 10% of all civilian fire injuries, and 20% of all direct fire property damage. AFCIs provide fire prevention. Rather than detecting fires, they prevent the source of electrical fires. The Consumer Product Safety Commission estimates that AFCI technology can prevent 50% of residential wiring fires.

Reducing electrical fires and preventing fire related injuries, fatalities, and property loss is an important responsibility for the regulatory community. By increase AFCI protection in homes, Virginia can meet National Electrical Code requirements and protect its residents at home.

**Discussion by Bryan Holland**
Jun 26, 2019 15:53 UTC

The National Electrical Manufacturers Association (NEMA) fully supports proposal RTE3902.16-18 related to AFCI protection of branch circuits for dwellings under the scope of the VRC. We strongly urge the BHCD to approve the proposal and believe this action will enhance public health, safety, and the welfare of the citizens and visitors in the Commonwealth of Virginia.

Smoke alarms and fire extinguishers are examples of emergency equipment used in homes to take action when a fire occurs. However, an AFCI is a product that is designed to detect arcing faults in a circuit and turn off the electrical system before it becomes an ignition source. Conventional

overcurrent protective devices cannot detect these hazardous arcing currents that have the potential to initiate fires. Electrical fires take many lives, damage or destroy significant amounts of property, and often occur in areas of the home that are hidden from view or early detection.

Electric arcing creates intense heating that can ignite surrounding material, such as wood framing or insulation. The temperature of these arcs can exceed 10,000 °F. An AFCI device uses advanced electronic technology to monitor the circuit for the presence of these “hazardous” arcing conditions. A hazardous arc occurs for many reasons including damage to conductor insulation from nails, screws, sharp points, or even furniture placed on top of an appliance or lamp cord. When arcing occurs, the AFCI analyzes the characteristics of the event and determines if it is a normal or hazardous arc. AFCI manufacturers test for the hundreds of possible operating conditions and then program their devices to respond only to the hazardous arcing conditions. AFCI technology can be incorporated into circuit breakers, receptacles, appliances and appliance cords.

Research in the arc fault area began in the early 1990s when the U.S. Consumer Product Safety Commission (CPSC) identified a concern with the residential fires of electrical origin. A large number of these fires were determined to be in the branch-circuit premise wiring. It was these early studies that led to the first proposals requiring AFCIs, which were made during the development of the 1999 NEC. NEC Code-Making Panel 2 (CMP-2) reviewed many proposals and heard numerous presentations on the new technology. After much data analysis and discussion, CMP-2 concluded that AFCI protection should initially be required for branch circuits that supply receptacle outlets in bedrooms.

Subsequent editions of the NEC further expanded the requirements to now include all 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, and similar rooms or areas. This same rule can be found in Section E3902.16 of the 2018 IRC and what is being proposed by RTE3902.16-18.

The most current edition of the NEC (2017 edition) also requires AFCI protection in dormitory units, guest rooms, guest suites, where branch circuits are extended or modified, and for the replacement of certain receptacles in a dwelling or dormitory unit. Additional protection against arcing faults can be found in Sections 406.4(D), 382.6, 440.64, 550.25, 690.4, 691.10, and 712.57.

Reducing fires of electrical origin and saving lives is an important responsibility of the entire construction and regulatory community. Applying technology to improve the electrical safety of the home is a wise investment for both the homeowner and the community at large. Through extensive product testing and the proper application of the NEC requirements, AFCIs will provide superior protection against arcing faults and is the advanced technology to reduce electrical fires.

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## RTE3902.16(1): Arc-Fault Circuit Interrupters

**Proponent(s):** Haywood Kines (hkines@pwcgov.org), Prince William County
**Comments:**

- Mr. Holland (NEMA) claims we are missing the ability to more comprehensively protect people in preventing fires, and that this proposal fixes some of the discrepancies. He is in support.
- Mr. Clark of the Homebuilders' Association talks about incremental adoption of the GFCI technologies, as opposed to the full adoption this proposal outlines. He is in support of RTE3902.16(2) instead.
- Mr. Smith of Eaton supports this proposal.
- Mr. Farrell (VBCOA) is in full support of this proposal and RTE3902.16(2).

**Results:** Non-Consensus

Decided at the July 15, 2020 Workgroup 3 Meeting

Commonwealth of Virginia

**Potts, Richard <richard.potts@dhcd.virginia.gov>**

# In support of RTE3902.16 for Virginia Electrical Code

1 message

**Cheriene Sanderson** <ms_sanderson25@yahoo.com> Tue, Sep 10, 2019 at 7:36 AM
To: cindy.davis@dhcd.virginia.gov
Cc: jeff.brown@dhcd.virginia.gov

Dear DHCD Board members:

My name is Cheriene Sanderson and I live at 15 Riverlands Drive, Apt. E, Newport News, Virginia 23605. I am a burn survivor and I believe Virginia should do everything within its power to prevent electrical house fires at every level.

I am writing to you in strong support of the proposal before the DHCD (RTE3902.16(1)) to restore Arc Fault Circuit Interrupter (AFCI) protections in Virginia homes to the standard of the most current consensus on fire safety requirements, per the IRC. AFCIs and other fire protection and prevention devices are extremely important to public safety. To reduce, remove or in any way limit the use of these smart technology devices suggests the DHCD does not care about fire safety and maintaining strong electrical codes in our state. I believe you do though and will make the right decision.

The National Fire Protection Association indicates that annually 40,000 residential electrical fires occur resulting in numerous deaths and burn injuries. Fire prevention technology like AFCIs helps prevent these tragedies from occurring. Since their required use, along with other improved construction materials, fire safety technologies and more, the number of electrical fires nationally has continued to decline.

Strong electrical codes protect Virginia residents and these need to continue. Now is the time to bring Virginia up to date with the fire safety requirements, allowing these AFCI devices to protect the entire home.

We join others to support RTE3902.16(1) and call on you to continue to stand up for strong electrical codes and requirements in our state - including the use of AFCIs.

Thank you!

Commonwealth of Virginia

King, Thomas <thomas.king@dhcd.virginia.gov>

# Fwd: PROPOSED VIRGINIA CODE AMENDMENT

1 message

**Brown, Jeffrey** <jeff.brown@dhcd.virginia.gov> Fri, Sep 6, 2019 at 10:39 AM
To: "King, Thomas" <thomas.king@dhcd.virginia.gov>

FYI....as soon as we finish the book.

Sincerely,

**JEFF BROWN, MCP**
Director of State Building Codes Office
Division of Building and Fire Regulation
Va. Department of Housing and Community Development
600 E. Main Street – Suite 1100
Richmond, VA 23219
804-371-7161
Jeff.Brown@dhcd.virginia.gov

***Click and Follow: Code Connection Blog***

---------- Forwarded message ---------
From: **Acton** <acton@phoenix-society.org>
Date: Fri, Sep 6, 2019 at 10:35 AM
Subject: PROPOSED VIRGINIA CODE AMENDMENT
To: cindy.davis@dhcd.virginia.gov <cindy.davis@dhcd.virginia.gov>, jeff.brown@dhcd.virginia.gov <jeff.brown@dhcd.virginia.gov>, richard.potts@dhcd.virginia.gov <richard.potts@dhcd.virginia.gov>

Dear Cindy, Jeff and Richard,

My name is Amy Acton and I am the Executive Director of a national organization called the Phoenix Society for Burn Survivors. I represent thousands of men, women and children across the United States who are burn survivors as well as family members, caregivers, burn care

professionals, nurses, doctors, firefighters, fire chiefs and more who value fire safety.

On behalf of the Phoenix Society and its hundreds of Virginia members, I strongly support amendment **RTE3902.16(1)**, which increases arc-fault circuit interrupter (AFCI) protection in Virginia homes.

I join my organization in supporting programs and technologies that help prevent and protect against fires, including the 40,000+ electrical fires that occur annually causing injury and death. AFCIs are proven to protect residents from dangerous electrical arcing in a home's wiring, preventing devastating and deadly electrical fires. The effects of a burn injury are lifelong, and we support those who must walk that journey. The best treatment of a burn injury is preventing it in the first place, through fire prevention technology like AFCIs.

This proposed amendment will strengthen Virginia's electrical code and help protect the state's residents for years to come. With this in mind, our organization would respectfully ask that you accept this proposed modification and keep Virginia on the right path regarding proven fire prevention technology.

Sincerely,

Amy Acton

**Amy Acton**

Executive Director

Phoenix Society
for burn survivors

525 Ottawa Avenue NW, Front

Grand Rapids, MI 49503

616.458.2773 | acton@phoenix-society.org

616.208.1148 (direct line)

www.phoenix-society.org

Topical Fire Report Series

December 2018 | Volume 19, Issue 8

# Residential Building Electrical Fires (2014-2016)

These topical reports are designed to explore facets of the U.S. fire problem as depicted through data collected in the U.S. Fire Administration's National Fire Incident Reporting System. Each topical report briefly addresses the nature of the specific fire or fire-related topic, highlights important findings from the data, and may suggest other resources to consider for further information. Also included are recent examples of fire incidents that demonstrate some of the issues addressed in the report or that put the report topic in context.

## Findings

- From 2014 to 2016, an estimated 24,000 residential building electrical fires were reported to United States fire departments each year. These fires caused an estimated 310 deaths, 850 injuries and $871 million in property loss.
- Residential building electrical fires resulted in over twice the dollar loss per fire than residential building nonelectrical fires did.
- Residential building electrical fires occurred most often in one- and two-family dwellings (83 percent).
- Residential building electrical fires occurred most often in the winter month of January (12 percent).
- In only 17 percent of residential building electrical fires, the fire spread was limited to the object where the fire started.
- Residential building electrical fires most often started in bedrooms (15 percent) and attics or vacant crawl spaces (13 percent).
- The leading specific items most often first ignited in residential building electrical fires were electrical wire, cable insulation (31 percent) and structural member or framing (18 percent).
- The leading specific factors contributing to the ignition of residential building electrical fires were other electrical failure, malfunction (43 percent), unspecified short-circuit arc (23 percent), and short-circuit arc from defective, worn insulation (11 percent).
- Smoke alarms were present in 51 percent and automatic extinguishing systems (AESs) were present in 3 percent of electrical fires that occurred in occupied residential buildings.

Electricity is a basic part of life in the U.S. It provides the energy for most powered items in a home, from lights to heating systems to televisions. Today it is hard to imagine a home without electricity. It is a part of our homes and our activities that most of us take for granted. Yet, using electricity can have dangerous consequences.

Electrical fires occur frequently throughout the U.S., causing injury, claiming lives, and resulting in large losses of property.[1] From 2014 to 2016, an estimated 24,000 residential building electrical fires were reported by U.S. fire departments annually.[2,3] These fires caused an estimated 310 deaths, 850 injuries and $871 million in property loss.[4,5] Residential building electrical fires continued to be a part of the residential fire problem and accounted for 6 percent of all residential building fires.[6] The term "electrical fires" is defined as those fires that include electrical distribution, wiring, transformers, meter boxes, power switching gear, outlets, cords, plugs, surge protectors, electric fences, lighting fixtures, and electrical arcing as the source of heat.[7]

This topical report addresses the characteristics of electrical fires in residential buildings as reported to the National Fire Incident Reporting System (NFIRS) from 2014 to 2016, the most recent data available at the time of the analysis.[8] The NFIRS data are used for the analyses presented throughout the report. For the purpose of the report, the terms "residential fires," "electrical fires," and "nonelectrical fires" are synonymous with "residential building fires,"

FEMA | U.S. Fire Administration
Working for a fire-safe America

**National Fire Data Center**
16825 S. Seton Ave.
Emmitsburg, MD 21727
https://www.usfa.fema.gov/data/statistics/

"residential building electrical fires" and "residential building nonelectrical fires" respectively. "Electrical fires" is used throughout the body of this report; the findings, tables, charts, headings and endnotes reflect the full category, "residential building electrical fires."

## The residential building electrical fire problem

Although electrical fires declined by 22 percent from 2007 to 2016,[9] electrical malfunction was one of the top four leading causes of residential fires during each of these ten years. It has also been a leading cause of residential fire deaths, injuries and dollar loss during this time frame.[10] Electrical fires involve the flow of electric current or static electricity[11] and are caused by electrical system failures, appliance defects, incorrectly installed wiring, misuse and poor maintenance of electrical appliances, and overloaded circuits and extension cords.[12] These electrical fires can be unique. For example, electrical fires that start in walls can smolder for some time and cause smoke not to be seen immediately and detection to be delayed. By the time smoke is seen and fire is detected, the flames may have already spread behind and within walls.[13] As a result, electrical fires have the potential to spread farther and cause more damage and injuries. In addition, electrical fires can be particularly problematic to extinguish. Since they involve electricity, and water conducts electricity, using water to put out the fire can cause electrocution unless power is reliably disconnected.

Over the last 35 years, homes have been dramatically transformed by electrical devices. Today's electrical demands can overburden the electrical system in a home,[14] putting it at a higher risk of an electrical fire. This may be particularly true for homes more than 40 years old that have older wiring, electrical systems, and devices. There is also the likelihood that older homes may not comply with more modern electric code requirements, which puts them at an elevated risk of hazardous conditions that could lead to an electrical fire.[15] Eventually, given enough time, any home can be at risk of an electrical fire as wire insulation ages, connections loosen, receptacles and switches come loose or wear out, and oil and dirt cause electrical components to overheat.[16]

## Type of fire

Building fires are divided into two classes of severity in the NFIRS: "confined fires" and "nonconfined fires." Confined building fires are small fire incidents that are limited in extent to specific types of equipment or objects, staying within pots, fireplaces or certain other noncombustible containers.[17] Confined fires rarely result in serious injury or large content loss and are expected to have no significant accompanying property loss due to flame damage.[18] Nonconfined fires extend beyond certain types of equipment or objects. They are generally larger fires resulting in more serious injury and larger losses of property and content.

Of the two classes of severity, nonconfined fires accounted for almost all of the electrical fires (Table 1). Because there were so few confined electrical fires, the subsequent analyses in this report include all electrical fires and do not distinguish between confined and nonconfined fires.

**Table 1. Residential building electrical fires by type of incident (2014-2016)**

| Incident type | Percent |
|---|---|
| Nonconfined fires | 99.7 |
| Confined fires | 0.3 |
| Trash or rubbish, contained | 0.2 |
| Incinerator overload or malfunction, fire confined | 0.1 |
| Total | 100.0 |

Source: NFIRS 5.0.

## Loss measures

Table 2 presents losses of reported electrical and nonelectrical fires, averaged over the three-year period of 2014 to 2016.[19] Electrical fires resulted in a higher number of injuries per thousand fires than nonelectrical fires (Table 2). In addition, electrical fires resulted in almost twice as many fatalities per thousand fires and over twice as much dollar loss per fire than nonelectrical fires. This may ultimately be due to challenges in the detection and location of some electrical fires that can be hidden inside walls.

**Table 2. Loss measures for residential building electrical and nonelectrical fires (three-year average, 2014-2016)**

| Measure | Residential building electrical fires | Residential building nonelectrical fires |
|---|---|---|
| **Average loss:** | | |
| Fatalities/1,000 fires | 6.3 | 3.4 |
| Injuries/1,000 fires | 26.6 | 22.8 |
| Dollar loss/fire | $27,500 | $12,510 |

Source: NFIRS 5.0.
Notes: 1. Average loss for fatalities and injuries is computed per 1,000 fires. Average dollar loss is computed **per fire** and is rounded to the nearest $10.
2. The 2014 and 2015 dollar-loss values were adjusted to 2016 dollars.
3. The "Residential building nonelectrical fires" category does not include fires of unknown cause.

## Property use

Residential buildings are divided into three major property use categories: one- and two-family residential buildings, multifamily residential buildings, and other residential buildings. One- and two-family residential buildings include detached single-family residences, manufactured homes, mobile homes not in transit, and duplexes. Multifamily residential buildings include apartments, condominiums and town houses. Other residential buildings include all other types of residences, such as hotels or motels, long-term care facilities, dormitories and sorority or fraternity housing.

One- and two-family dwellings accounted for 83 percent of residential building electrical fires reported to NFIRS (Table 3). By comparison, one- and two-family residential buildings accounted for 60 percent of nonelectrical fires, more in line with the occurrence of one- and two-family residential building fires overall (64 percent).[20] Multifamily residential buildings accounted for only 12 percent of electrical fires while they accounted for 33 percent of nonelectrical fires. Finally, all other residential buildings accounted for 6 percent of electrical fires while they accounted for 7 percent of nonelectrical fires.[21] One explanation for the lower percentage of electrical fires in multifamily and other dwellings may be that more stringent building and fire codes requiring regular fire and safety inspections (which include the inspection of wiring and electrical components) are often imposed on these types of residential buildings. In addition, multifamily dwellings and other residential buildings may more often be professionally maintained.

**Table 3. Residential building electrical and nonelectrical fires by property use (2014-2016)**

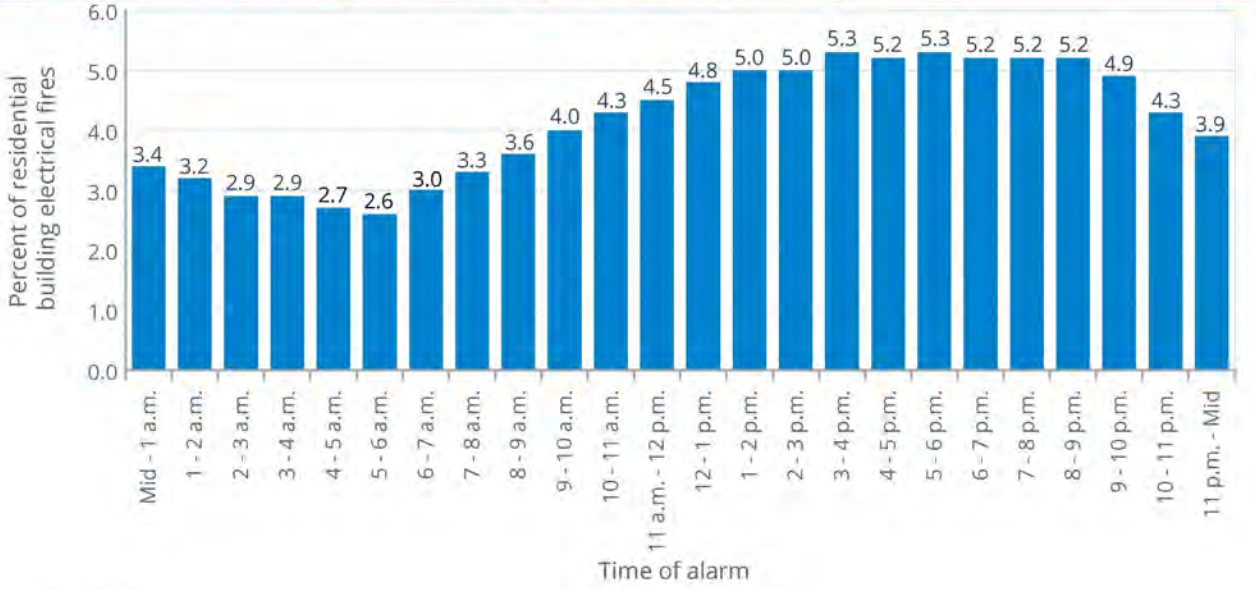
| Property use | Percent of residential building electrical fires | Percent of residential building nonelectrical fires |
|---|---|---|
| One- and two-family | 82.9 | 60.0 |
| Multifamily | 11.7 | 32.7 |
| Other | 5.5 | 7.4 |
| Total | 100.0 | 100.0 |

Source: NFIRS 5.0.
Notes: 1. Total percentages of residential building electrical fires and residential building nonelectrical fires do not add up to 100 percent due to rounding.
2. The "Percent of residential building nonelectrical fires" category does not include fires of unknown cause.

## When residential building electrical fires occur

As shown in Figure 1, electrical fires occurred most frequently in the late afternoon to early evening hours.[22] They gradually declined throughout the late evening and early morning hours reaching the lowest point from 5 to 6 a.m. Beginning at 6 a.m., fire incidence started to increase until the peak hours were reached.

**Figure 1. Residential building electrical fires by time of alarm (2014-2016)**




Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Figure 2 illustrates that electrical fire incidence was highest during the winter month of January at 12 percent. This is not surprising, as cooler weather in this month and surrounding months typically results in more indoor activities that lead to an increase in lighting, heating and appliance use. In addition, during the winter months, cold temperatures and heaters may lead to dry air with low humidity,[23] which could result in wood studs and framing drying out and being somewhat more easily ignited by an arcing current or electrical overheating. The lowest incidence of electrical fires occurred in September at 6 percent.

**Figure 2. Residential building electrical fires by month (2014-2016)**

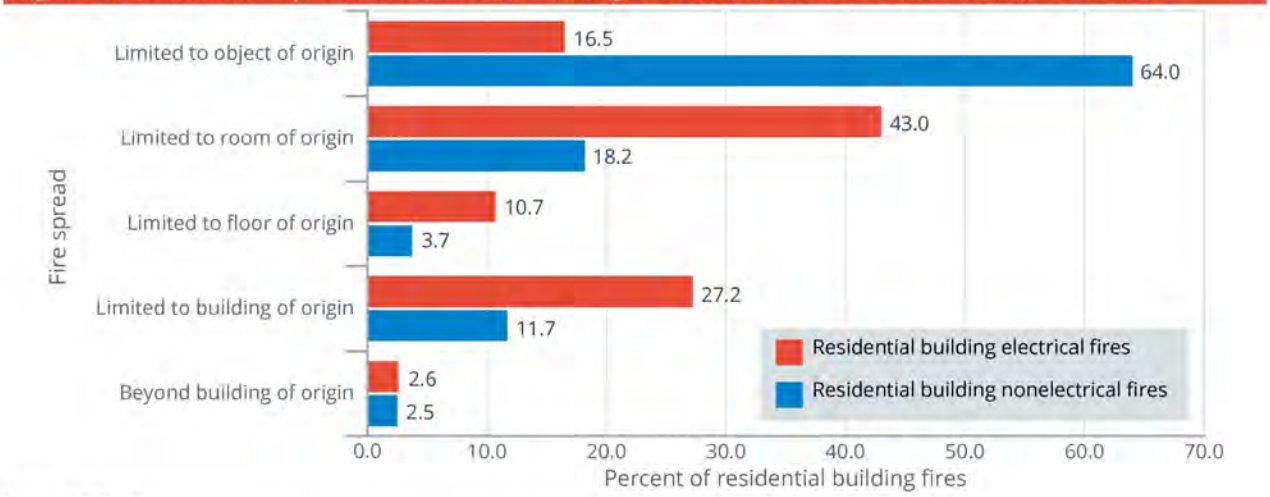



Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

## Fire spread in residential building electrical fires

While 64 percent of nonelectrical fires were limited to the object of origin, only 17 percent of electrical fires were limited to the object of origin (Figure 3). Of the remaining electrical fires that spread beyond the object of origin, 43 percent were limited to the room of origin, 11 percent were limited to the floor of origin, and 27 percent were limited to the building of origin. An additional 3 percent of electrical fires spread beyond the building of origin.[24] The larger fire spread may be partly due to challenges in the detection of some electrical fires (i.e., fires within walls) as previously discussed.

**Figure 3. Extent of fire spread in residential building electrical and nonelectrical fires (2014-2016)**




Source: NFIRS 5.0.
Notes: 1. Total percent of residential building nonelectrical fires does not add up to 100 percent due to rounding.
2. The "Residential building nonelectrical fires" category does not include fires of unknown cause.

## Where residential building electrical fires start (area of fire origin)

Five areas in the home — bedrooms (15 percent); attics or vacant crawl spaces (13 percent); walls or concealed wall spaces (9 percent); cooking areas and kitchens (7 percent); and common rooms or lounge areas (7 percent) — accounted for 51 percent of electrical fires (Table 4).

**Table 4. Leading areas of fire origin in residential building electrical fires (2014-2016)**

| Area of origin | Percent of residential building electrical fires (unknowns apportioned) |
|---|---|
| Bedrooms | 15.4 |
| Attic: vacant, crawl space above top story | 13.0 |
| Wall assembly, concealed wall space | 8.7 |
| Cooking area, kitchen | 7.4 |
| Common room, den, family room, living room, lounge | 6.7 |

Source: NFIRS 5.0.

## How residential building electrical fires start (heat source)

The "heat from powered equipment" category accounted for the majority (88 percent) of electrical fires (Table 5). Within this category, electrical arcing accounted for 74 percent; heat from other powered equipment accounted for 7 percent; radiated or conducted heat from operating equipment accounted for 5 percent; and sparks, embers or flames from operating equipment accounted for 2 percent of these electrical fires. The "hot or smoldering object" category accounted for an additional 6 percent of electrical fires, while the heat source for the remaining 6 percent of electrical fires fell into other categories.

**Table 5. Sources of heat in residential building electrical fires by major category (2014-2016)**

| Heat source category | Percent of residential building electrical fires (unknowns apportioned) |
|---|---|
| Heat from powered equipment | 87.8 |
| Hot or smoldering object | 6.3 |
| All other heat source categories | 5.8 |
| Total | 100.0 |

Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

## What ignites first in residential building electrical fires

Electrical wire, cable insulation (31 percent) and structural member or framing (18 percent) were the specific items most often first ignited in electrical fires (Table 6). Although less prominent, thermal, acoustical insulation (7 percent); exterior sidewall covering, surface, finish (6 percent); interior wall covering (6 percent); and other structural component or finish (5 percent) were also leading items first ignited.

**Table 6. Leading specific items first ignited in residential building electrical fires (2014-2016)**

| Item first ignited | Percent of residential building electrical fires (unknowns apportioned) |
|---|---|
| Electrical wire, cable insulation | 30.9 |
| Structural member or framing | 17.8 |
| Thermal, acoustical insulation within wall, partition, or floor/ceiling | 7.2 |
| Exterior sidewall covering, surface, finish | 6.2 |
| Interior wall covering | 5.5 |
| Other structural component or finish | 4.7 |

Source: NFIRS 5.0.

## Factors contributing to ignition in residential building electrical fires

Table 7 shows the categories of factors contributing to ignition in electrical fires. As expected, the leading category by far was "electrical failure, malfunction" (88 percent). In this category, other electrical failure, malfunction (43 percent); unspecified short-circuit arc (23 percent); and short-circuit arc from defective, worn insulation (11 percent) were the specific factors that accounted for 77 percent of electrical fires. The "misuse of material or product" (6 percent) and "mechanical failure, malfunction" (5 percent) categories combined were a contributing factor in 11 percent of electrical fires.

**Table 7. Factors contributing to ignition of residential building electrical fires by major category (where factors contributing to ignition were specified, 2014-2016)**

| Factors contributing to ignition category | Percent of residential building electrical fires |
|---|---|
| Electrical failure, malfunction | 87.8 |
| Misuse of material or product | 5.5 |
| Mechanical failure, malfunction | 5.1 |
| Operational deficiency | 4.0 |
| Design, manufacture, installation deficiency | 1.2 |
| Natural condition | 1.1 |
| Other factors contributing to ignition | 1.0 |
| Fire spread or control | 0.2 |

Source: NFIRS 5.0.

Notes: 1. Only includes incidents where factors that contributed to the ignition of the fire were specified. At least one factor contributing to the ignition was specified in 80 percent of reported residential building electrical fires.
2. Multiple factors contributing to fire ignition may be noted for each incident; total will exceed 100 percent.

## Equipment involved in ignition in residential building electrical fires

Three specific types of equipment played a leading role in the ignition of half of all residential electrical fires. These leading types of equipment involved in ignition, as shown in Table 8, were other electrical wiring (31 percent), outlets and receptacles (12 percent), and electrical branch circuits (8 percent).[25] Of interest, extension cords (5 percent), panel (fuse) boards (4 percent), and other lamps and lighting (4 percent) were also leading types of equipment involved in ignition.

**Table 8. Leading specific type of equipment involved in ignition of residential building electrical fires (2014-2016)**

| Equipment involved in ignition | Percent of residential building electrical fires |
|---|---|
| Electrical wiring, other | 30.5 |
| Outlet, receptacle | 12.0 |
| Electrical branch circuit | 7.6 |

Source: NFIRS 5.0.

## Alerting/Suppression systems in residential building electrical fires

Fire fatalities and injuries have declined over the last 35 years, partly due to new technologies to detect and extinguish fires. Smoke alarms are present in most homes. In addition, the use of residential sprinklers is widely supported by the fire service and is gaining support within residential communities.

Smoke alarm data presented in Tables 9 and 10 are the raw counts from the NFIRS dataset and are not scaled to national estimates of smoke alarms in residential buildings where electrical fires occurred. In addition, the NFIRS does not allow for the determination of the type of smoke alarm (i.e., photoelectric or ionization) or the location of the smoke alarm with respect to the area of fire origin. The data presented in Table 11 are also the raw counts from the NFIRS dataset and are not scaled to national estimates of AESs in residential buildings where electrical fires occurred.

### Smoke alarms in residential building electrical fires

Smoke alarms were reported as present in 50 percent of residences where electrical fires occurred. In 25 percent of electrical fires, no smoke alarms were present. In another 25 percent of these fires, firefighters were unable to determine if a smoke alarm was present (Table 9).

**Table 9. NFIRS smoke alarm presence in residential building electrical fires (2014-2016)**

| Presence of smoke alarms | Count | Percent |
|---|---|---|
| Present | 21,080 | 49.7 |
| None present | 10,782 | 25.4 |
| Undetermined | 10,505 | 24.7 |
| Null/Blank | 87 | 0.2 |
| Total incidents | 42,454 | 100.0 |

Source: NFIRS 5.0

While 7 percent of electrical fires occurred in residential buildings that are **not** currently or routinely occupied, these buildings — which are under construction, undergoing major renovations, vacant and the like — are unlikely to have alerting and suppression systems that are in place and, if in place, that are operational. In fact, only 15 percent of all electrical fires in unoccupied residential buildings were reported as having smoke alarms that operated. In addition, AESs were reported as present in only 2 percent of electrical fires in residential buildings that were not routinely occupied. As a result, the detailed analyses in the following sections focus on electrical fires in occupied residential buildings only.[26]

## Smoke alarms in occupied residential building electrical fires

Smoke alarms were reported as present in 51 percent of electrical fires in occupied residential buildings. In 24 percent of electrical fires in occupied residential buildings, there were no smoke alarms present. Lastly, in 25 percent of electrical fires in occupied residential buildings, firefighters were unable to determine if a smoke alarm was present (Table 10).

When smoke alarms were present (51 percent) and the alarm's operational status was considered, the percentage of smoke alarms reported as present consisted of:

- Present and operated — 26 percent.
- Present but did not operate — 17 percent (fire too small, 11 percent; alarm failed to operate, 7 percent).[27]
- Present but operational status unknown — 8 percent.

When the subset of incidents where smoke alarms were reported as present was analyzed separately as a whole, smoke alarms were reported to have operated in 51 percent of the incidents and failed to operate in 13 percent. In 21 percent of the subset, the fire was too small to activate the alarm. The operational status of the alarm was undetermined in an additional 16 percent of these incidents.[28]

**Table 10. NFIRS smoke alarm data for occupied residential building electrical fires (2014-2016)**

| Presence of smoke alarms | Smoke alarm operational status | Smoke alarm effectiveness | Count | Percent |
|---|---|---|---|---|
| Present | Fire too small to activate smoke alarm | | 4,182 | 10.6 |
| | Smoke alarm operated | Smoke alarm alerted occupants, occupants responded | 7,232 | 18.3 |
| | | Smoke alarm alerted occupants, occupants failed to respond | 258 | 0.7 |
| | | No occupants | 1,407 | 3.6 |
| | | Smoke alarm failed to alert occupants | 319 | 0.8 |
| | | Undetermined | 987 | 2.5 |
| | Smoke alarm failed to operate | | 2,644 | 6.7 |
| | Undetermined | | 3,161 | 8.0 |
| None present | | | 9,576 | 24.3 |
| Undetermined | | | 9,683 | 24.5 |
| Total incidents | | | 39,449 | 100.0 |

Source: NFIRS 5.0.
Note: The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2014 to 2016. They do not represent national estimates of smoke alarms in electrical fires in occupied residential buildings. They are presented for informational purposes.

If a fire occurs, properly installed and maintained smoke alarms provide an early warning signal to everyone in a home. Smoke alarms help save lives and property. The U.S. Fire Administration (USFA) continues to partner with other government agencies and fire service organizations to improve and develop new smoke alarm technologies. More information on smoke alarm technologies, performance, disposal and storage, training bulletins, and public education and outreach materials can be found at https://www.usfa.fema.gov/prevention/technology/smoke_fire_alarms.html. Additionally, the USFA's position statement on smoke alarms is available at https://www.usfa.fema.gov/about/smoke_alarms_position.html.

## Automatic extinguishing systems in residential building electrical fires

Overall, full or partial AESs — mainly sprinklers — were present in just 3 percent of occupied residential buildings where electrical fires occurred (Table 11). Residential sprinkler systems help to reduce the risk of deaths and injuries, homeowner insurance premiums, and uninsured property losses. Despite these advantages, many homes do not have AESs, although they are often found in hotels and businesses. Sprinklers are required by code in hotels and many multifamily residences. There are major movements in the U.S. fire service to require sprinklers in all new homes. At present, however, they are largely absent in residences nationwide.[29]

**Table 11. NFIRS automatic extinguishing system data for occupied residential building electrical fires (2014-2016)**

| Presence of automatic extinguishing systems | Count | Percent |
|---|---|---|
| AES present | 1,011 | 2.6 |
| Partial system present | 41 | 0.1 |
| AES not present | 36,357 | 92.2 |
| Unknown | 2,040 | 5.2 |
| Total incidents | 39,449 | 100.0 |

Source: NFIRS 5.0.
Notes: 1. The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2014 to 2016. They do not represent national estimates of AESs in electrical fires in occupied residential buildings. They are presented for informational purposes.
2. Total does not add up to 100 percent due to rounding.

USFA and fire service officials across the nation are working to promote and advance residential fire sprinklers. More information on costs and benefits, performance, training bulletins, and public education and outreach materials regarding residential sprinklers is available at http://www.usfa.fema.gov/prevention/technology/home_fire_sprinklers.html. Additionally, the USFA's position statement on residential sprinklers is available at https://www.usfa.fema.gov/about/sprinklers_position.html.

## Examples

The following are recent examples of electrical fires reported by the media:

- August 2018: An overheated electrical cord caused a fire in a bedroom of an apartment in Holyoke, Massachusetts. A neighbor in the apartment downstairs smelled smoke and called 911 around 6 p.m. Upon arrival, firefighters found heavy smoke and a small fire in the third-floor apartment bedroom, but were able to extinguish the fire quickly. No one was injured.[30]
- July 2018: Several residents of an apartment building in Austin, Minnesota, were displaced after an electrical fire damaged two units. Upon arrival to the early evening fire, firefighters extinguished the blaze, which appeared to have started as an electrical fire in the ceiling of the building's laundry room. Further investigation revealed that a resident felt warmth coming from the floor of her apartment and smelled burning over two hours prior to the emergency call. The resident then went to the laundry room beneath her apartment, but said the smell stopped. She later noticed the smell again and saw smoke, prompting her to make an emergency call. While no injuries were reported, the fire caused an estimated $10,000 in damage to the building and $2,500 in damage to contents.[31]
- April 2018: A fault in a duplex electrical receptacle caused a late-night fire at a group home in Severn, Maryland, which killed three people. Upon arrival, it took firefighters more than an hour to put out the blaze in the single-family dwelling. Two of the victims killed were male residents of the home, while the third victim was a female worker in the home. Investigators determined that the faulty receptacle was located in a rear bedroom of the home. All of the victims, however, were found at the front of the house. Investigators believe the worker was trying to save one of the residents as both were found dead inside the same room in the house. Paramedics tried to save the other resident when they found him inside the home, but were unsuccessful and declared him dead at the scene. The Office of the Chief Medical Examiner in Baltimore determined that the two victims who were found together both died of smoke inhalation and burns. The third victim died of smoke inhalation. The home was completely destroyed.[32]

## Electrical fire safety

To help keep your home fire safe, make sure all electrical work in your home is done by a qualified electrician and follow these electrical safety tips:

- Appliances:
  - Always plug major appliances, such as refrigerators, stoves, washers and dryers, directly into a wall outlet.
  - Never use an extension cord with a major appliance — it can easily overheat and start a fire.
  - Always plug small appliances directly into a wall outlet.
  - Unplug small appliances when you are not using them.
  - Keep lamps, light fixtures and light bulbs away from anything that can burn.
  - Use light bulbs that match the recommended wattage on the lamp or fixture.
  - Check electrical cords on appliances often. Replace cracked, damaged and loose electrical cords. Do not try to repair them.
- Outlets:
  - Do not overload wall outlets.
  - Insert plugs fully into sockets.
  - Never force a three-prong cord into a two-slot outlet.
  - Install tamper-resistant electrical outlets if you have young children.

- Extension cords, power strips and surge protectors:
  - Replace worn, old or damaged extension cords right away.
  - Use extension cords for temporary purposes only.
  - Avoid putting cords where they can be damaged or pinched, like under a carpet or rug.
  - Do not overload power strips.
  - Use power strips that have internal overload protection.

For additional electrical home fire prevention tips and information, please visit the USFA's electrical fire safety outreach materials webpage at https://www.usfa.fema.gov/prevention/outreach/electrical.html.

You can also find information on home electrical safety and work place electrical safety, as well as resources to educate communities, at the Electrical Safety Foundation International, www.esfi.org.

## NFIRS data specifications for residential building electrical fires

Data for this report were extracted from the NFIRS annual Public Data Release files for 2014, 2015 and 2016. Only version 5.0 data was extracted.

Residential building electrical fires were defined using the following criteria:

- Aid Types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid counting a single incident more than once.
- Incident Types 111 to 123 (excludes Incident Type 112):

| Incident Type | Description |
|---|---|
| 111 | Building fire |
| 113 | Cooking fire, confined to container |
| 114 | Chimney or flue fire, confined to chimney or flue |
| 115 | Incinerator overload or malfunction, fire confined |
| 116 | Fuel burner/boiler malfunction, fire confined |
| 117 | Commercial compactor fire, confined to rubbish |
| 118 | Trash or rubbish fire, contained |
| 120 | Fire in mobile property used as a fixed structure, other |
| 121 | Fire in mobile home used as fixed residence |
| 122 | Fire in motor home, camper, recreational vehicle |
| 123 | Fire in portable building, fixed location |

Note: Incident Types 113 to 118 do not specify if the structure is a building.

- Property Use Series 400, which consists of the following:

| Property Use | Description |
|---|---|
| 400 | Residential, other |
| 419 | One- or two-family dwelling, detached, manufactured home, mobile home not in transit, duplex |
| 429 | Multifamily dwelling |
| 439 | Boarding/Rooming house, residential hotels |
| 449 | Hotel/Motel, commercial |
| 459 | Residential board and care |
| 460 | Dormitory-type residence, other |
| 462 | Sorority house, fraternity house |
| 464 | Barracks, dormitory |

- Structure Type:
  - For Incident Types 113 to 118:
    - 1—Enclosed building, or
    - 2—Fixed portable or mobile structure, or
    - Structure Type not specified (null entry).
  - For Incident Types 111 and 120 to 123:
    - 1—Enclosed building, or
    - 2—Fixed portable or mobile structure.
- The USFA Structure Fire Cause Methodology was used to determine residential building electrical malfunction fire incidents (i.e., cause code = '06').[33]

The analyses contained in this report reflect the current methodologies used by the USFA. The USFA is committed to providing the best and most current information on the U.S. fire problem and continually examines its data and methodology to fulfill this goal. Because of this commitment, data collection strategies and methodological changes are possible and do occur. As a result, analyses and estimates of the fire problem may change slightly over time. Previous analyses and estimates on specific issues (or similar issues) may have used different methodologies or data definitions and may not be directly comparable to the current ones.

Information regarding the USFA's national estimates for residential building fires, as well as the data sources used to derive the estimates, can be found in the document "Data Sources and National Estimates Methodology Overview for the U.S. Fire Administration's Topical Fire Report Series (Volume 19)," https://www.usfa.fema.gov/downloads/pdf/statistics/data_sources_and_national_estimates_methodology_vol19.pdf. This document also addresses the specific NFIRS data elements analyzed in the topical reports, as well as "unknown" data entries and missing data.

To request additional information, visit https://www.usfa.fema.gov/contact.html. Provide feedback on this report.

## Notes:

[1]"Residential Building Electrical Fires (2009-2011)," Topical Fire Report Series, USFA, March 2014, Volume 14, Issue 13, https://www.usfa.fema.gov/downloads/pdf/statistics/v14i13.pdf.

[2]The term "residential buildings" includes what are commonly referred to as "homes," whether they are one- or two-family dwellings or multifamily buildings. It also includes manufactured housing, hotels and motels, residential hotels, dormitories, assisted living facilities, and halfway houses — residences for formerly institutionalized individuals (patients with mental disabilities, drug addictions, or those formerly incarcerated) that are designed to facilitate their readjustment to private life. The term "residential buildings" does not include institutions such as prisons, nursing homes, juvenile care facilities, or hospitals, even though people may reside in these facilities for short or long periods of time.

[3]In NFIRS Version 5.0, a structure is a constructed item of which a building is one type. In previous versions of the NFIRS, the term "residential structure" commonly referred to buildings where people live. To coincide with this concept, the definition of a residential structure fire for the NFIRS 5.0 includes only those fires where the NFIRS 5.0 Structure Type is 1 or 2 (enclosed building and fixed portable or mobile structure) with a residential property use. Such structures are referred to as "residential buildings" to distinguish these buildings from other structures on residential properties that may include fences, sheds and other uninhabitable structures. In addition, confined fire incidents that have a residential property use but do not have a structure type specified are presumed to occur in buildings. Nonconfined fire incidents that have a residential property use without a structure type specified are considered to be invalid incidents (Structure Type is a required field) and are not included.

[4]National estimates are based on 2014 to 2016 native Version 5.0 data from the NFIRS, residential structure fire loss estimates from the National Fire Protection Association's (NFPA) annual surveys of fire loss, and the USFA's residential building fire loss estimates: https://www.usfa.fema.gov/downloads/pdf/statistics/res_bldg_fire_estimates.pdf. Further information on the USFA's residential building fire loss estimates can be found in the "National Estimates Methodology for Building Fires and Losses," August 2012, https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf. For information on the NFPA's survey methodology, see the NFPA's report "Fire Loss in the United States During 2016," September 2017, https://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/overall-fire-problem/fire-loss-in-the-united-states. In this topical report, fires are rounded to the nearest 100, deaths to the nearest five, injuries to the nearest 25, and dollar loss to the nearest million. In this report, deaths and injuries refer to civilian casualties only and do not include firefighters who die or are injured as a result of a fire.

[5]The USFA Structure Fire Cause Methodology was used to identify fires for which the cause was electrical in nature. The cause methodology and definitions can be found in the document "National Fire Incident Reporting System Version 5.0 Fire Data Analysis Guidelines and Issues," July 2011, https://www.usfa.fema.gov/downloads/pdf/nfirs/nfirs_data_analysis_guidelines_issues.pdf.

[6]2014-2016 NFIRS data.
[7]The term "electrical fires" is an abbreviated form of the original term "electrical malfunction fires" as defined by USFA's Structure Fire Cause Methodology.
[8]Fire department participation in the NFIRS is voluntary; however, some states do require their departments to participate in the state system. Additionally, if a fire department is a recipient of a Fire Act Grant, participation is required. From 2014 to 2016, 68 percent of the NFPA's annual average estimated 1,328,500 fires to which fire departments responded were captured in the NFIRS. Thus, the NFIRS is not representative of all fire incidents in the U.S. and is not a "complete" census of fire incidents. Although the NFIRS does not represent 100 percent of the incidents reported to fire departments each year, the enormous dataset exhibits stability from one year to the next without radical changes. Results based on the full dataset are generally similar to those based on part of the data.
[9]"Residential Building Electrical Malfunction Fire Trends (2007-2016)," Fire Estimate Summary, USFA, May 2018, https://www.usfa.fema.gov/downloads/pdf/statistics/res_bldg_fire_estimates.pdf.
[10]"Residential Building Fire Causes (2007-2016)," "Residential Building Fire Death Causes (2007-2016)," "Residential Building Fire Injury Causes (2007-2016)," and "Residential Building Fire Dollar-Loss Causes (2007-2016)," Fire Estimate Summary, USFA, May 2018, https://www.usfa.fema.gov/downloads/pdf/statistics/res_bldg_fire_estimates.pdf.
[11]Vytenis Babrauskas. (2008). "Research on electrical fires: The state of the art." Fire Safety Science 9: 3-18. doi:10.3801/IAFSS.FSS.9-3, http://www.iafss.org/publications/fss/9/3# (accessed Sept. 12, 2018).
[12]"Common causes of home electrical fires," WireChief Electric LTD, Feb. 4, 2011, http://www.vancouverelectricianblog.com/common-home-electrical-fires/ (accessed Sept. 12, 2018).
[13]Mike Holmes, "Dangers of electrical fires: Ditch DIY when fixing faulty wiring," Postmedia News, Aug. 7, 2012, http://www.canada.com/news/Dangers+electrical+fires/7051750/story.html (accessed Sept. 12, 2018).
[14]"Know the dangers in your older home," Electrical Safety Foundation International, 2015, https://www.esfi.org/resource/know-the-dangers-in-your-older-home-217 (accessed Sept. 12, 2018).
[15]"Residential electrical system aging research project," The Code Authority, Underwriters Laboratories, Issue 2, 2008, https://www.ul.com/wp-content/uploads/2014/04/ul_ResidentialElectricalSystemResearch.pdf (accessed Sept. 12, 2018).
[16]Mike Holmes, "Dangers of electrical fires: Ditch DIY when fixing faulty wiring," Postmedia News, Aug. 7, 2012, http://www.canada.com/news/Dangers+electrical+fires/7051750/story.html (accessed Sept. 12, 2018).
[17]In the NFIRS, confined fires are defined by Incident Type Codes 113 to 118.
[18]The NFIRS distinguishes between "content" and "property" loss. Content loss includes losses to the contents of a structure due to damage by fire, smoke, water and overhaul. Property loss includes losses to the structure itself or to the property itself. Total loss is the sum of the content loss and the property loss. For confined fires, the expectation is that the fire did not spread beyond the container (or rubbish for Incident Type code 118), and hence, there was no property damage (damage to the structure itself) from the flames. However, there could be property damage as a result of smoke, water and overhaul.
[19]The average fire death and fire injury loss rates computed from the national estimates do not agree with average fire death and fire injury loss rates computed from NFIRS data alone. The fire death rate computed from national estimates is (1,000 x (310/24,000)) = 12.9 deaths per 1,000 residential building electrical fires, and the fire injury rate is (1,000 x (850/24,000)) = 35.4 injuries per 1,000 residential building electrical fires.
[20]2014-2016 NFIRS data.
[21]Total percentage of residential building electrical fires does not add up to 100 percent due to rounding.
[22]For the purposes of this report, the time of the fire alarm is used as an approximation for the general time at which the fire started. However, in the NFIRS, it is the time at which the fire was reported to the fire department.
[23]"Effects of low humidity on health," Mercola, https://articles.mercola.com/sites/articles/archive/2014/01/13/low-humidity-health-effects.aspx (accessed Sept. 13, 2018).
[24]Total percentage of residential building electrical fires does not add up to 100 percent due to rounding.
[25]The three leading specific types of equipment involved in ignition do not add up to 50 percent due to rounding.
[26]The term "occupied" implies that the building is operational or in normal use. This includes residences that are unoccupied for a brief period of time such as when household members are away at work, school or on vacation.
[27]Total percentage of smoke alarms that were present but did not operate does not equal 17 percent due to rounding.
[28]Total does not add up to 100 percent due to rounding.
[29]U.S. Department of Housing and Urban Development and U.S. Census Bureau, American Housing Survey for the United States: 2011, September 2013, "Health and Safety Characteristics-All Occupied Units (National)," Table S-01-AO, https://www.census.gov/content/dam/Census/programs-surveys/ahs/data/2011/h150-11.pdf (accessed Sept. 17, 2018).
[30]Jeanette DeForge, "Holyoke Fire in Apartment Building Caused by Electrical Issue," www.masslive.com, Aug. 6, 2018, https://www.masslive.com/news/index.ssf/2018/08/holyoke_fire_in_apartment_buil.html (accessed Sept. 17, 2018).
[31]Mike Stoll, "Apartment Building Damaged in Electrical Fire; Resident Said Floor Felt Warm on Her Feet," www.austindailyherald.com, July 17, 2018, https://www.austindailyherald.com/2018/07/apartment-building-damaged-in-electrical-fire-resident-said-floor-felt-warm-on-her-feet/ (accessed Sept. 17, 2018).
[32]Phil Davis and Chase Cook, "Fault in Electrical Outlet Caused Fatal Fire at Arundel Lodge Home," www.capitalgazette.com, May 8, 2018, http://www.capitalgazette.com/news/for_the_record/ac-cn-arundel-lodge-update-20180508-story.html (accessed Sept. 17, 2018).
[33]See endnote 5.

# TM607.6.2.2-18

**Proponents:** Clay Dalon (claydalon@gmail.com)

## 2015 Virginia Mechanical Code

**Revise as follows:**

**607.6.2.2 Equipment shutdown.** Where ceiling radiation dampers are listed as static dampers, the HVAC equipment shall be effectively shut down to stop the airflow prior to the damper closing using one of the following methods:

1. A duct detector installed in the return duct.
2. An area smoke detector interlocked with the HVAC equipment.
3. A listed heat sensor installed in the return air duct system.

**Reason Statement:** The current language of this code sections appears to limit the installation of the heat sensor to within the return duct only. Revising this paragraph to "return duct system" extends the allowable installation to within the air handling unit return section or mixing plenum. Keep in mind, many apartment unit wall hung air handlers do not have any return duct. See attached typical apartment unit wall hung air handling unit detail.

**Cost Impact:** The code change proposal will decrease the cost of construction
Allowing the installation of the heat sensor within the return duct system will decrease cost by giving contractor another option for hvac systems that do not have return ductwork.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
The operation of the heat sensor and air handling will be unchanged and will function in the same manner with no apparent difference.

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## Workgroup Recommendation

**Workgroup 4 - Final Committee Action:** Non-Consensus

**Workgroup 4 - Final Reason:**

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# Public Comments for: TM607.6.2.2-18

This proposal doesn't have any public comments.

Proposal # 417

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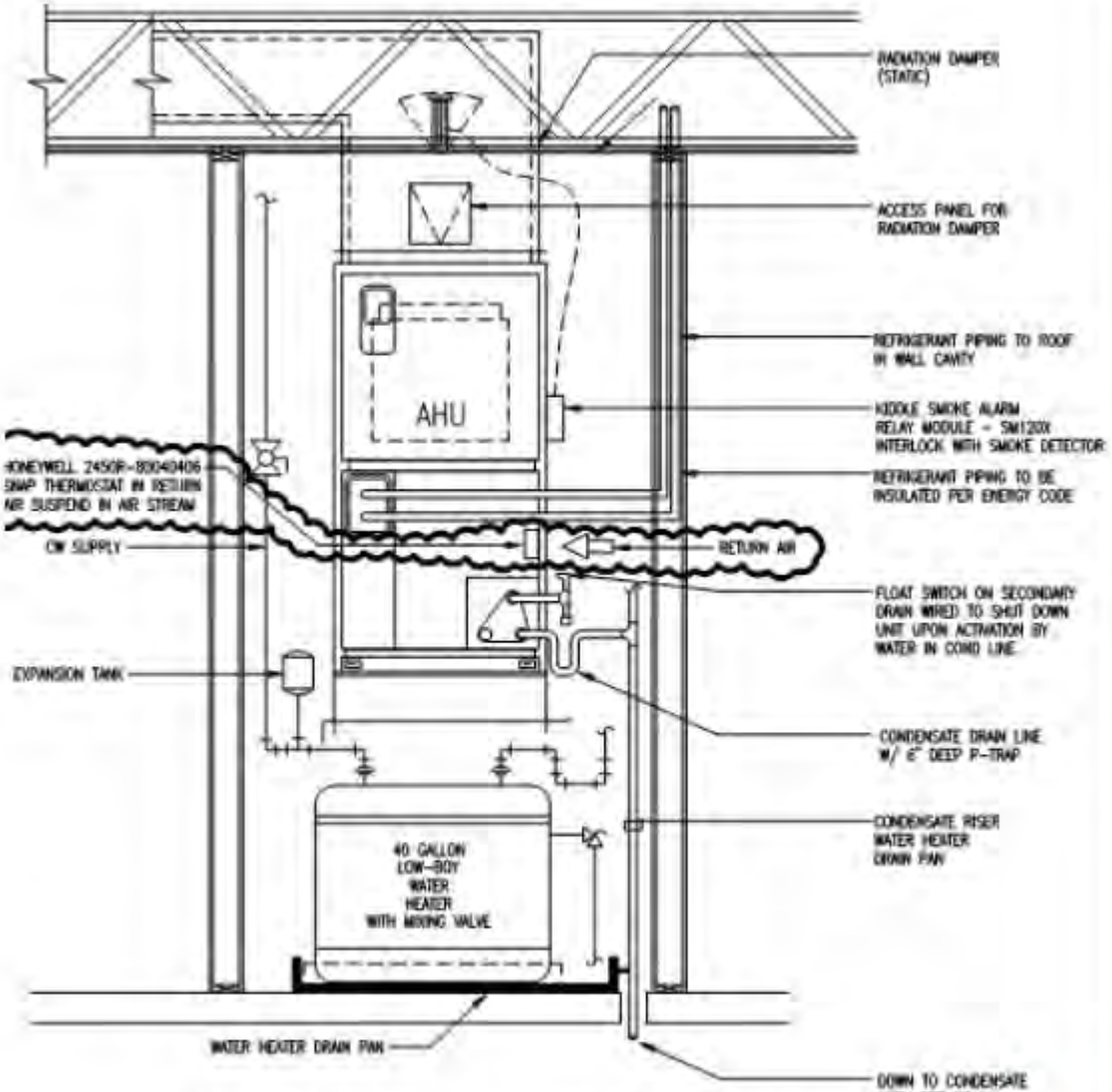


# MECHANICAL CLOSET DETAIL

NOT TO SCALE

**TM607.6.2.2 Equipment shutdown**
**Proponent(s): Clay Dalon (claydalon@gmail.com)**
**Comments:**

- **Mr. Grace speaking on behalf of himself suggests Mr. Dalon was just trying to clear things up. He is in support.**
- **Mr. Payne of AIA Virginia wants to know if the addition is for all three words concerned; AIA Virginia is in support due to the flexibility and options that this proposal would provide.**
- **Mr. Grace clarifies the language.**
- **Mr. Allen of Henrico County suggests this change may be unnecessary, that it's just additional wordsmithing of language that was already fine the way it was.**
- **Mr. Clements of Chesterfield County agrees with Mr. Allen of Henrico County.**
- **Mr. Grace concedes that it is "wordsmithing," but believes it ultimately helps.**

**Results: Non-consensus**

Decided at the July 22, 2020 Workgroup 4 Summary

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# AD40(2)-18

**Proponents:** ADTAC Committee

## 2015 Virginia Building and Fire Code Related Regulations

**A.** The following standards are hereby incorporated by reference for use as part of this chapter:

The standards referenced above may be procured from:

ANSI25 W 43rd StreetNew York, NY 10036

ASTM100 Barr Harbor Dr.West Conshohocken, PA 19428-2959

1. American National Standards Institute (ANSI) Standard No. B77.1-2011 for the regulation of passenger tramways; and
2. American Society for Testing and Materials (ASTM) Standard Nos. F747-15, F770-15, F1159-15b, F1193- 16, F1957-99 (2011), F2007-12, F2137-16, ~~F2291-15~~, F2291-19, ~~F2374-10~~ F2374-19, F2375-09, F2376-13, F2460-11, F2461-18, F2959-16, F2960-16, ~~and~~ F2974-15 and F3054-18 for the regulation of amusement devices.

**B.** The provisions of this chapter govern where they are in conflict with any provisions of the standards incorporated by reference in this chapter.

**C.** The following requirements supplement the provisions of the ASTM standards incorporated by reference in this chapter:

1. The operator of an amusement device shall be at least 16 years of age, except when the person is under the supervision of a parent or guardian and engaged in activities determined not to be hazardous by the Commissioner of the Virginia Department of Labor and Industry;
2. The amusement device shall be attended by an operator at all times during operation except that (i) one operator is permitted to operate two or more amusement devices provided they are within the sight of the operator and operated by a common control panel or station and (ii) one operator is permitted to operate two small mechanical rides with separate controls provided the distance between controls is no more than 35 feet and the controls are equipped with a positive pressure switch; and
3. The operator of an amusement device shall not be (i) under the influence of any drugs which may affect the operator's judgment or ability to assure the safety of the public or (ii) under the influence of alcohol.

**D.** Where an amusement device was manufactured under previous editions of the standards incorporated by reference in this chapter, the previous editions shall apply to the extent that they are different from the current standards.

**Reason Statement:** At their June24, 2019 meeting, the ADTAC recommended adding ASTM standards F2960-16 and F3054-18 as referenced standards in the VADR. Also, at their April 26,2019 meeting, the ADTAC approved updating references to ASTM standards F2291 and F2374 to the 2018 and 2017 edition respectively as these were the most current editions at that time. These updates are included in the VADR 2018 Base Document. ASTM has since updated both of these standards to the 2019 edition. This proposal adds ASTM standards F2960-16 and F3054-18, and also updates the VADR references to F2291 and F2374 to the 2019 edition.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
No cost impact.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
No impact on resiliency.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

**Workgroup 1 - Proposed Committee Action:** Consensus Approval

**Workgroup 1 - Proposed Reason:**

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# AD75(2)-18

**Proponents:** ADTAC Committee

## 2015 Virginia Building and Fire Code Related Regulations

**13VAC5-31-75. Local building department.**

**A.** In accordance with § 36-98.3 and § 36-105 of the Code of Virginia, the local building department shall be responsible for the enforcement ~~1.~~ of this chapter and may charge fees for such enforcement activity. The total amount charged for any one permit to operate an amusement device or devices or the renewal of such permit shall not exceed the following, except that when a private inspector is used, the fees shall be reduced by 75%:

1. ~~$35 for~~ $55 for each small mechanical ride or inflatable amusement device covered by the permit;
2. ~~$55 for~~ $75 for each circular ride or flat-ride less than 20 feet in height covered by the permit~~; $75 for~~, except concession go-karts. Concession go-kart fees shall not exceed $300 per track, for tracks with up to 20 karts. An additional fee of up to $10 may be charged for each additional kart in excess of 20; ~~3.~~
3. $100 for each spectacular ride covered by the permit that cannot be inspected as a circular ride or flat-ride in subdivision 2 of this subsection due to complexity or height, except zip lines. Zip line fees shall not exceed $150 for each zip line. For the purposes of this section, each portion from launch point to landing point shall be considered a separate zip line and each zip line between a launch point and landing point shall also be considered a separate zip line;
4. $200 for each coaster covered by the permit that exceeds 30 feet in height; and
5. $400 for each coaster covered by the permit that exceeds 60 feet in height,
6. The local building department may charge an additional fee for permits and inspections of generators and associated wiring for amusement device events. Generators subject to these fees are those used exclusively with amusement devices and that are inspected by the local building department. The fee per event shall not exceed $165 and shall not exceed the actual cost to perform the inspection or inspections.

**Exception:** Small portable generators serving only cord and plug connected equipment loads are not subject to the fee.

Notwithstanding the above, the local building department shall be permitted to increase the fees up to 50% when requested to perform weekend or after-hour inspections. The local building department shall also be permitted to increase fees up to 50% when a reinspection is required.

**B.** Notwithstanding the provisions of subsection A of this section, when an amusement device is constructed in whole or in part at a site for permanent operation at that site and is not intended to be disassembled and moved to another site, then the local building department may utilize permit and inspection fees established pursuant to the USBC to defray the cost of enforcement. This authorization does not apply to an amusement device that is only being reassembled, undergoing a major modification at a site or being moved to a site for operation.

**C.** A permit application shall be made to the local building department at least five days before the date in which the applicant intends to operate an amusement device. The application shall include the name of the owner, operator or other person assuming responsibility for the device, a general description of the device including any serial or identification numbers available, the location of the property on which the device will be operated, and the length of time of operation. The permit application shall indicate whether a private inspector will be used. If a private inspector is not used, the applicant shall give reasonable notice when an inspection is sought and may stipulate the day such inspection is requested provided it is during the normal operating hours of the local building department. In addition to the information required on the permit application, the applicant shall provide proof of liability insurance of an amount not less than $1 million per occurrence or proof of equivalent financial responsibility. The local building department shall be notified of any change in the liability insurance or financial responsibility during the period covered by the permit.

**D.** Notwithstanding the provisions of subsection C of this section, a permit application is not required for a small mechanical ride or an inflatable amusement device that has a certificate of inspection issued by any local building department in this Commonwealth either a six-month period for small mechanical rides or within a one-year period for inflatable amusement devices prior to the dates the small mechanical ride or inflatable amusement device is to be used, regardless of whether the device has been disassembled and moved to a new site. In such cases, the local building department shall be notified at least three days prior to the operation of the small mechanical ride or the inflatable amusement device and the information required on a permit application as listed in subsection C of this section shall be provided to the local building department. In addition, and notwithstanding the provisions of subsection A of this section, the local building department shall be permitted to charge a $50 inspection fee per event to the person notifying the local building department of an event where an inflatable amusement device is operating, if the local building department chooses to inspect any or all of the inflatable amusement devices operating at that event. An inspection report shall be provided to the person notifying the local building department of the event if such an inspection is conducted.

**E.** Local building department personnel shall examine the permit application within five days and issue the permit if all requirements are met. A certificate of inspection for each amusement device shall be issued when the device has been found to comply with this chapter by a private inspector or by an inspector from the local building department. It shall be the responsibility of the local building department to verify that the private inspector possesses a valid certificate of competence as an amusement device inspector from the Virginia Board of Housing and Community Development. In addition, local building department personnel shall be responsible for assuring that the certificate of inspection is posted or affixed on or in the vicinity of the device in a location visible to the public. Local building department personnel shall post or affix such certificates or permit the certificates to be posted or affixed by the private inspector. Permits shall indicate the length of time the device or devices will be operated at the site, clearly identify the device or devices to which it applies and the date of expiration of the permit. Permits shall not be valid for longer than one year, except that permits for small mechanical rides shall not be valid for longer than six months.

**F.** In addition to obtaining a certificate of inspection in conjunction with a permit application for amusement devices permanently fixed to a site, a new certificate of inspection shall also be obtained prior to the operation of an amusement device following a major modification, prior to each seasonal operation of a device, at least once during the operating season and prior to resuming the operation of a device following an order from a local building department to cease operation. This requirement shall not apply to small mechanical rides meeting the conditions outlined in subsection D of this section.

**G.** For amusement devices manufactured prior to 1978, the owner or operator shall have the information required by 10.1 through 10.6 of ASTM F1193 available at the time of inspection. In addition, the operator of any amusement device shall be responsible for obtaining all manufacturer's notifications, service bulletins and safety alerts issued pursuant to ASTM F770 and the operator shall comply with all recommendations and requirements set out in those documents. A copy of all such documents shall be made available during an inspection.

**H.** In the enforcement of this chapter, local building department personnel shall have authority to conduct inspections at any time an amusement device would normally be open for operation or at any other time if permission is granted by the owner or operator, to issue an order to temporarily cease operation of an amusement device upon the determination that the device may be unsafe or may otherwise endanger the public and to accept and approve or deny requests for modifications of the rules of this chapter in accordance with the modification provisions of the USBC.

**I.** In accordance with subdivision 7 of § 36-137 of the Code of Virginia, the local building department shall collect a 2.0% levy of fees charged for permits under this chapter and transmit it quarterly to DHCD to support training programs of the Virginia Building Code Academy. Localities that maintain individual or regional training academies accredited by DHCD shall retain such levy.

**J.** In accordance with § 36-98.3 of the Code of Virginia and 13VAC5-31-10 B, the procedures for violations of this chapter shall be as prescribed in the USBC.

**K.** In accordance with § 36-98.1 of the Code of Virginia, the Virginia Department of General Services (DGS) shall function as the local building department for the application of this chapter to amusement devices located on state-owned property. In accordance with § 36-98.2 and § 36-114 of the Code of Virginia, appeals of the application of this chapter by the DGS shall be made directly to the State Building Code Technical Review Board. Further, as a condition of this chapter, such appeals shall be filed within 14 calendar days after receipt of the decision of DGS.

**13VAC5-31-75. Local building department.**

**A.** In accordance with § 36-98.3 and § 36-105 of the Code of Virginia, the local building department shall be responsible for the enforcement of this chapter and may charge fees for such enforcement activity. The total amount charged for any one permit to operate an amusement device or devices or the renewal of such permit shall not exceed the following, except that when a private inspector is used, the fees shall be reduced by 75%:

1. $35 for each small mechanical ride or inflatable amusement device covered by the permit;
2. $55 for each circular ride or flat-ride less than 20 feet in height covered by the permit;
3. $75 for each spectacular ride covered by the permit that cannot be inspected as a circular ride or flat-ride in subdivision 2 of this subsection due to complexity or height;
4. $200 for each coaster covered by the permit that exceeds 30 feet in height; and
5. The local building department may charge an additional fee for permits and inspections of generators and associated wiring for amusement device events. Generators subject to these fees are those used exclusively with amusement devices and that are inspected by the local building department. The fee per event shall not exceed $165 and shall not exceed the actual cost to perform the inspection or inspections.

**Exception:** Small portable generators serving only cord and plug connected equipment loads are not subject to the fee.

Notwithstanding the above, the local building department shall be permitted to increase the fees up to 50% when requested to perform weekend or after-hour inspections.

**B.** Notwithstanding the provisions of subsection A of this section, when an amusement device is constructed in whole or in part at a site for permanent operation at that site and is not intended to be disassembled and moved to another site, then the local building department may utilize permit and inspection fees established pursuant to the USBC to defray the cost of enforcement. This authorization does not apply to an amusement device that is only being reassembled, undergoing a major modification at a site or being moved to a site for operation.

**C.** A permit application shall be made to the local building department at least five days before the date in which the applicant intends to operate an amusement device. The application shall include the name of the owner, operator or other person assuming responsibility for the device, a general description of the device including any serial or identification numbers available, the location of the property on which the device will be operated, and the length of time of operation. The permit application shall indicate whether a private inspector will be used. If a private inspector is not used, the applicant shall give reasonable notice when an inspection is sought and may stipulate the day such inspection is requested provided it is during the normal operating hours of the local building department. In addition to the information required on the permit application, the applicant shall provide proof of liability insurance of an amount not less than $1 million per occurrence or proof of equivalent financial responsibility. The local building department shall be notified of any change in the liability insurance or financial responsibility during the period covered by the permit.

**D.** Notwithstanding the provisions of subsection C of this section, a permit application is not required for a small mechanical ride or an inflatable amusement device that has a certificate of inspection issued by any local building department in this Commonwealth either a six-month period for small mechanical rides or within a one-year period for inflatable amusement devices prior to the dates the small mechanical ride or inflatable amusement device is to be used, regardless of whether the device has been disassembled and moved to a new site. In such cases, the local building department shall be notified at least three days prior to the operation of the small mechanical ride or the inflatable amusement device and the information required on a permit application as listed in subsection C of this section shall be provided to the local building department. In addition, and notwithstanding the provisions of subsection A of this section, the local building department shall be permitted to charge a $50 inspection fee per event to the person notifying the local building department of an event where an inflatable amusement device is operating, if the local building department chooses to inspect any or all of the inflatable amusement devices operating at that event. An inspection report shall be provided to the person notifying the local building department of the event if such an inspection is conducted.

**E.** Local building department personnel shall examine the permit application within five days and issue the permit if all requirements are met. A certificate of inspection for each amusement device shall be issued when the device has been found to comply with this chapter by a private inspector or by an inspector from the local building department. It shall be the responsibility of the local building department to verify that the private inspector possesses a valid certificate of competence as an amusement device inspector from the Virginia Board of Housing and Community Development. In addition, local building department personnel shall be responsible for assuring that the certificate of inspection is posted or affixed on or in the vicinity of the device in a location visible to the public. Local building department personnel shall post or affix such certificates or permit the certificates to be posted or affixed by the private inspector. Permits shall indicate the length of time the device or devices will be operated at the site, clearly identify the device or devices to which it applies and the date of expiration of the permit. Permits shall not be valid for longer than one year, except that permits for small mechanical rides shall not be valid for longer than six months.

**F.** In addition to obtaining a certificate of inspection in conjunction with a permit application for amusement devices permanently fixed to a site, a new certificate of inspection shall also be obtained prior to the operation of an amusement device following a major modification, prior to each seasonal operation of a device, at least once during the operating season and prior to resuming the operation of a device following an order from a local building department to cease operation. This requirement shall not apply to small mechanical rides meeting the conditions outlined in subsection D of this section.

**G.** For amusement devices manufactured prior to 1978, the owner or operator shall have the information required by 10.1 through 10.6 of ASTM F1193 available at the time of inspection. In addition, the operator of any amusement device shall be responsible for obtaining all manufacturer's notifications, service bulletins and safety alerts issued pursuant to ASTM F770 and the operator shall comply with all recommendations and requirements set out in those documents. A copy of all such documents shall be made available during an inspection.

**H.** In the enforcement of this chapter, local building department personnel shall have authority to conduct inspections at any time an amusement device would normally be open for operation or at any other time if permission is granted by the owner or operator, to issue an order to temporarily cease operation of an amusement device upon the determination that the device may be unsafe or may otherwise endanger the public and to accept and approve or deny requests for modifications of the rules of this chapter in accordance with the modification provisions of the USBC.

**I.** In accordance with subdivision 7 of § 36-137 of the Code of Virginia, the local building department shall collect a 2.0% levy of fees charged for permits under this chapter and transmit it quarterly to DHCD to support training programs of the Virginia Building Code Academy. Localities that maintain individual or regional training academies accredited by DHCD shall retain such levy.

**J.** In accordance with § 36-98.3 of the Code of Virginia and 13VAC5-31-10 B, the procedures for violations of this chapter shall be as prescribed in the USBC.

**K.** In accordance with § 36-98.1 of the Code of Virginia, the Virginia Department of General Services (DGS) shall function as the local building department for the application of this chapter to amusement devices located on state-owned property. In accordance with § 36-98.2 and § 36-114 of the Code of Virginia, appeals of the application of this chapter by the DGS shall be made directly to the State Building Code Technical Review Board. Further, as a condition of this chapter, such appeals shall be filed within 14 calendar days after receipt of the decision of DGS.

**Reason Statement:** ADTAC recommended changes to fees.  Proposal increases the fees a local building department may charge for a permit to operate an amusement device.

**Cost Impact:** The code change proposal will increase the cost of construction
Proposal increases the fees a local building department may charge for a permit to operate an amusement device.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: AD75(2)-18

This proposal doesn't have any public comments.

Proposal # 315

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# CS10-18

**Proponents:** BCAAC

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC521-10. Definitions.**

**A.** The following words and terms when used in this chapter shall have the following meanings unless the context clearly indicates otherwise:

"Active certificate" means a certificate that is not revoked, suspended, or inactive.
“Applicant” means a person seeking a certificate.
“BCAAC” means the Building Code Academy Advisory Committee appointed pursuant to subdivision 7 of §36-137 of the Code of Virginia.
“BHCD” means the Virginia Board of Housing and Community Development.
“Certificate” means a certificate of competence issued pursuant to subdivision 6 of §36-137 of the Code of Virginia concerning the content, application, and intent of specified subject areas of the building and fire prevention regulations promulgated by the BHCD and issued to present or prospective personnel of local governments and to any other persons seeking to become qualified to perform inspections pursuant to Chapter 6 (§36-97 et seq.) of Title 36 of the Code of Virginia, Chapter 9 (§27-94 et seq.) of Title 27 of the Code of Virginia, and any regulations adopted thereunder, who have completed training programs or in other ways demonstrated adequate knowledge.
“Certificate holder” means a person to whom a certificate has been issued.
“Code Academy” means the Virginia Building Code Academy established under subdivision 14 of §36-139 of the Code of Virginia or individual or regional training academies accredited by the Department pursuant to subdivision 7 of §36-137 of the Code of Virginia.
“DFP” means the Virginia Department of Fire Programs.
"Inactive certificate" means a certificate where the certificate holder has not attended the periodic training courses designated by the Department or has not met the continuing education requirements.
“Department” means the Virginia Department of Housing and Community Development.
~~"Nongovernmental employee" means any person not employed by a locality collecting and transmitting the fee levy to the department in accordance with subdivision 7 of § 36-137 of the Code of Virginia.~~
“Provisional certificate” means a temporary certificate issued to in accordance with Section 13VAC5-21-51 (C)
“SFPC” means the Virginia Statewide Fire Prevention Code (13VAC5-51).
“State Review Board” means the Virginia State Building Code Technical Review Board established under §36-108 of the Code of Virginia.
“USBC” means the Virginia Uniform Statewide Building Code (13VAC5-63).
“VADR” means the Virginia Amusement Device Regulations (13VAC5-31).

**B.** Words and terms used in this chapter that are defined in the USBC, VADR or SFPC and that are not defined in this chapter shall have the meaning ascribed to them in those regulations unless the context clearly indicates otherwise.

**Reason Statement:** Definitions were added for “active certificate”, “inactive”, and “provisional certificate”. These certificate statuses were mentioned and described in 13VAC5-21-51 in paragraph form, but for clarity purposes were brought to 13VAC5-21-10 as definitions. "Nongovernmental employee" has been removed to reflect proposed changes to 13VAC5-21-31

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: CS10-18

This proposal doesn't have any public comments.

Proposal # 370

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# CS31-18

**Proponents:** BCAAC

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC5-21-31. Qualification and examination requirements.**

~~**A.** An applicant for a certificate in categories associated with the USBC or the SFPC shall provide a written endorsement from the code official or the code official's supervisor in the locality in which they are employed certifying that the applicant complies with the qualification section in the USBC or the SFPC for each type of certificate sought. When the applicant for a certificate in categories associated with the USBC or the SFPC is a nongovernment employee, the applicant shall provide documentation that the applicant complies with the qualification section in the USBC or the SFPC as it would relate to the applicant's job responsibilities for each type of certificate sought.~~

~~**B.** An applicant for a certificate in categories associated with the VADR shall provide a written endorsement from the applicant's supervisor or a person having a similar relationship to the applicant certifying that the applicant is generally qualified to conduct activities related to the VADR.~~

~~**C.**~~ Applicants for all certificates shall provide proof of successful completion of approved examinations for each certificate sought, except as provided for in 13VAC5-21-45. The Department shall maintain a list of approved testing agencies and examinations that meet nationally accepted standards for each certificate offered. For information on approved testing agencies and examinations contact the Department's ~~Technical Assistance Services~~ Virginia Building Code Academy Office, ~~501 N. 2nd St.~~ 600 East Main St., Richmond, VA 23219, telephone (804) 371-7180.

**Reason Statement:** Paragraph A was removed after researching the historical precedent of certificate issuance and cross-referencing with state law. The function of a "certificate of competence" is established in the definition of "Certificate" and the determination of qualifications is a function of the employer.
Paragraph B was removed because qualification provisions are established through NAARSO certification standards.

"Training and Certification Office" was changed to "Virginia Building Code Academy".

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: CS31-18

This proposal doesn't have any public comments.

Proposal # 380

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# CS41-18

**Proponents:** BCAAC

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC5-21-41. Certification categories and training requirements.**

**A.** The Department maintains a list of all certificates offered and the list sets out the required training necessary to attend and complete to obtain a certificate. Alternatives to the training requirements set out in 13VAC5-21-45 shall be considered for all certificates offered except that no alternative shall be accepted for the code academy core module.

**B.** Applicants for certificates shall attend and complete the code academy core module. After the completion of the core module, applicants are required to attend and complete the code academy training as set out in a list maintained by the Department, except as provided for in 13VAC5-21-45. All required training must have been completed within no more than ~~six~~ four years prior to the date the application is submitted. ~~and~~ The requirements for training are based on those in effect at the time of application.

**Reason Statement:** Reduces the time training must have been completed prior to certificate application from six years to four years.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: CS41-18

This proposal doesn't have any public comments.

Proposal # 381

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# CS45-18

**Proponents:** BCAAC

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC5-21-45. Alternatives to training requirements.** Upon written request, alternative training or a combination of training, education, or experience to satisfy the training requirements of 13VAC5-21-41 may be approved, provided that such alternatives or combinations are determined to be equivalent to that required.

However, as provided in 13VAC5-21-41, no substitutions shall be approved for the code academy core module. The types of combinations of education and experience may include military training, college classes, technical schools or long-term work experiences, except that long-term work experiences shall not be approved as the sole substitute to satisfy the training requirements. BCAAC may be consulted ~~with~~ in any such consideration.

**Reason Statement:** Grammar

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: CS45-18

This proposal doesn't have any public comments.

Proposal # 384

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# CS61-18

**Proponents:** BCAAC

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC5-21-61. Board Sanctions.** When the BHCD determines a certificate holder has failed to (i) comply with an order issued by the State Review Board, (ii) meet the required training or testing requirements, or (iii) attend periodic maintenance training or continuing education, ~~or both,~~ a warning letter may be issued to the certificate holder or a certificate may be revoked or suspended by the BHCD. ~~In such cases, a noncompliance notice shall be issued to the certificate holder and notification shall be provided to the locality or company employing the certificate holder.~~

~~Exceptions to the issuance of a noncompliance notice for failing to comply with the continuing education requirements may be considered where there is a separation from employment by medical or military leave for 12 consecutive months or more during the continuing education period.~~ A record of any action taken pursuant to this section shall be permanently retained in the training record of the certificate holder.

**Reason Statement:** Noncompliance letters are a function of the Academy. Removing them from this section codifies the process on the Academy's administrative side.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal will neither increase nor decrease Resiliency.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: CS61-18

This proposal doesn't have any public comments.

Proposal # 391

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# MH20-18

**Proponents:** DHCD Staff (sbco@dhcd.virginia.gov)

## 2015 Virginia Building and Fire Code Related Regulations

**13VAC5-95-20. Application and enforcement.**

**A.** This chapter shall apply to manufactured homes as defined in 13VAC5-95-10 and as set out in this section.

**B.** Enforcement of this chapter shall be in accordance with the federal ~~regulations.~~ regulations 24 CFR §3285, 3286 and 3288.

**C.** Manufactured homes produced on or after June 15, 1976, shall conform to all the requirements of the federal standards, as amended.

**D.** DHCD is delegated all lawful authority for the enforcement of the federal standards pertaining to manufactured homes by the administrator according to § 36-85.5 of the Code of Virginia. The Division of Building and Fire Regulation of DHCD is designated as a state administrative agency in the HUD enforcement program, and shall act as an agent of HUD. The administrator is authorized to perform the activities required of an SAA by the HUD enforcement plan including, but not limited to, investigation, citation of violations, handling of complaints, conducting hearings, supervising remedial actions, monitoring, making such reports as may be required, and seeking enforcement of the civil and criminal penalties established by § 36-85.12 of the Code of Virginia.

**E.** In accordance with § 36-85.11 of the Code of Virginia, all local building officials are authorized to and shall enforce the provisions of this chapter within the limits of their jurisdiction and shall be responsible for the following:

1. Verify through inspection that a manufactured home displays the required HUD label and data plate;
2. Determine whether the manufactured home has been damaged during transit. If the manufactured home has been damaged, then the local building official is authorized to require tests, in accordance with the federal standards, for tightness of plumbing systems and gas piping and an operational test to ensure that all luminaries and receptacles are operable. If a manufactured home has sustained damage to the structural components, the local building official shall require the appropriate design approval primary inspection agency approval on any repairs or designs;
3. Prevent the use of a manufactured home that in the opinion of the local building official contains a serious defect or imminent safety hazard, and notify the administrator immediately;
4. Notify the administrator of any apparent violations of this chapter, to include defects and noncompliance that occurred during the manufacturing process and any alterations that occurred during installation; and
5. Verify through inspection that the installation is in accordance with the federal installation standards. Where the local building official finds that the installation of the manufactured home is not in accordance with the federal installation standards, the local building official shall order the home to be brought into compliance within a reasonable time. If the order is not complied with, then the local building official shall notify the administrator.

**F.** In accordance with § 36-85.11 of the Code of Virginia, site preparation, utility connection, and skirting installation for manufactured homes shall meet the requirements of the USBC. In addition, as a requirement of this chapter and the USBC, administrative provisions of the USBC, such as requirements for permits, inspections, and certificates of occupancy, and the specific requirements of § 425 of Part I of the USBC (13VAC5-63-220 L through 13VAC5-63-220 Q), shall also be applicable.

**Reason Statement:** This will ensure compliance with federal standards.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: MH20-18

This proposal doesn't have any public comments.

# MH20(2)-18

**Proponents:** DHCD Staff

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC5-95-20. Application and enforcement.**

**A.** This chapter shall apply to manufactured homes as defined in 13VAC5-95-10 and as set out in this section.

**B.** Enforcement of this chapter shall be in accordance with the federal regulations.

**C.** Manufactured homes produced on or after June 15, 1976, shall conform to all the requirements of the federal standards, as amended.

**D.** DHCD is delegated all lawful authority for the enforcement of the federal standards pertaining to manufactured homes by the administrator according to § 36-85.5 of the Code of Virginia. The Division of Building and Fire Regulation of DHCD is designated as a state administrative agency in the HUD enforcement program, and shall act as an agent of HUD. The administrator is authorized to perform the activities required of an SAA by the HUD enforcement plan including, but not limited to, investigation, citation of violations, handling of complaints, conducting hearings, supervising remedial actions, monitoring, making such reports as may be required, and seeking enforcement of the civil and criminal penalties established by § 36-85.12 of the Code of Virginia.

**E.** In accordance with § 36-85.11 of the Code of Virginia, all local building officials are authorized to and shall enforce the provisions of this chapter within the limits of their jurisdiction and shall be responsible for the following:

1. Verify through inspection that a manufactured home displays the required HUD label and data plate;
2. Determine whether the manufactured home has been damaged during transit. If the manufactured home has been damaged, then the local building official is authorized to require tests, in accordance with the federal standards, for tightness of plumbing systems and gas piping and an operational test to ensure that all luminaries and receptacles are operable. If a manufactured home has sustained damage to the structural components, the local building official shall require the appropriate design approval primary inspection agency approval on any repairs or designs;
3. Prevent the use of a manufactured home that in the opinion of the local building official contains a serious defect or imminent safety hazard, and notify the administrator immediately;
4. Notify the administrator of any apparent violations of this chapter, to include defects and noncompliance that occurred during the manufacturing process and any alterations that occurred during installation; and
5. Verify through inspection that the installation is in accordance with the federal installation standards. Where the local building official finds that the installation of the manufactured home is not in accordance with the federal installation standards, the local building official shall order the home to be brought into compliance within a reasonable time. If the order is not complied with, then the local building official shall notify the administrator.

**F.** In accordance with § 36-85.11 of the Code of Virginia, site preparation, utility connection, and skirting installation for manufactured homes shall meet the requirements of the USBC. In addition, as a requirement of this chapter and the USBC, administrative provisions of the USBC, such as requirements for permits, inspections, and certificates of occupancy, and the specific requirements of § ~~425~~ 429 of Part I of the USBC (13VAC5-63-220 L through 13VAC5-63-220 Q), shall also be applicable.

**Reason Statement:** Correlation only

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
Will not change cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Consensus Approval

**Workgroup 1 - Final Reason:**

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# Public Comments for: MH20(2)-18

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# AD20-18

**Proponents:** Scott Andrews (scott.andrews@acctinfo.org)

## 2015 Virginia Building and Fire Code Related Regulations

**Add new text as follows:**

**13VAC5-31-20 Definitions** "Aerial Adventure Course" means a guided or self-guided amusement structure open to the public on which a person travels under their own power or under the influence of gravity over elevated activities made of wood, steel, cable, rope and other materials and supported by trees, poles or other support structures. The access to the structure is controlled. The activities are supervised. Safety and essential equipment are provided by the operator. This does include zip lines and zip tours. This does include climbing walls and climbing towers both permanent and portable. Does not include Via Ferrata.
"Special Inspector" means an inspector of amusement devices authorized to inspect a limited number and type of activities. Examples include zip line and aerial adventure courses inspectors. Special inspectors may have activity specific training or qualification.

**13VAC5-31-30 Devices Covered and Exempt** A.3. Aerial Adventure Courses

**13VAC5-31-40 Incorporated Standards** A.2. American National Standards Institute (ANSI) Standards ANSI/ACCT 03-2019 for the regulation of Aerial Adventure Courses and Zip Lines.

ACCT

P.O. Box 19797

Boulder, CO 80308

**13VAC5-31-50 Certification of Amusement Device Inspectors** Special Inspectors for Aerial Adventure Courses or Zip Lines may also be qualified by possessing an Association for Challenge Course Technology (ACCT) Inspector Certification Level 2 Professional and complete required Virginia trainings as outlined in Virginia Certification Standards (13VAC5-21).

**Part VIII 13VAC5-31-217 General Requirements** A. In addition to other applicable requirements of this chapter, aerial adventure courses/parks and zip lines shall be operated, maintained, and inspected in accordance with ANSI/ACCT 03-2019 or ASTM F2959 as determined by the course designer.

**13VAC5-31 Documents Incorporated by Reference** Association for Challenge Course Technology (ACCT) P.O. Box 19797, Boulder, CO 80308 (http://www.acctinfo.org):

ANSI/ACCT 03-2019 Challenge Course and Canopy/Zip Line Tours Standards (Revision of ANSI/ACCT 03-2016 Standards)

**Reason Statement:** Reason Statement: The ANSI/ACCT standard is the most widely used standard for the challenge course, aerial adventure and zip line industry. The standards in purpose written for the industry and includes significant operational and training standards designed to support safe operations. Additionally, the industry already has a robust inspection structure in place that is supported my insurance companies in the United States. The inclusion of the ACCT Standard allows existing courses to continue under the effective standard those course were designed, built, inspected and operated to since they were constructed.

**Cost Impact:**
Cost Impact Statement: The code change proposal will not significantly increase the cost of operating a course. It will make inspections more available to owners. The code change proposal will have a small impact on the cost of new construction.

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Non-Consensus

**Workgroup 1 - Final Reason:**

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# Public Comments for: AD20-18

**Discussion by Richard Potts**
Apr 1, 2020 19:56 UTC

Attached is an email from the Chair of the ADTAC Committee with regards to their opposition to this proposal.
Attachments: https://va.cdpaccess.com/proposal/367/discuss/58/file/download/163/Commonwealth%20of%20Virginia%20Mail%20-%20Re_%20ACCT%20AD20-18%20Code%20change.pdf

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Proposal # 367

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Aug 3, 2020 12:30 UTC

Attached are the items not acted on during the SFPC swg meeting held on 7/30/20
Attachments:
https://va.cdpaccess.com/proposal/479/discuss/93/file/download/436/20200820%20SFPC%20Edit%20WG%20Meeting%20Results%20%20uncomplet
https://va.cdpaccess.com/proposal/479/discuss/93/file/download/375/20200730%20SFPC%20Edit%20Results%20-%20uncompleted%20items%20%281%29.xlsx

**Comment by Thomas King**
Aug 20, 2020 20:24 UTC

**Comment by Thomas King**
Aug 20, 2020 20:23 UTC

These items are the approved items from the August 20th 2020 meeting

Proposal # 479

**13VAC5-31-20. Definitions.**

A. The following words and terms when used in this chapter shall have the following meanings unless the context clearly indicates otherwise:

"Aerial Adventure Course" means a guided or self-guided amusement structure open to the public on which a person travels under their own power or under the influence of gravity over elevated activities made of wood, steel, cable, rope and other materials and supported by trees, poles or other support structures. The access to the structure is controlled. The activities are supervised. Safety and essential equipment are provided by the operator. This does include zip lines and zip tours. This does include climbing walls and climbing towers both permanent and portable. Does not include Via Ferrata.

"Amusement device" means (i) a device or structure open to the public by which persons are conveyed or moved in an unusual manner for diversion, but excluding snow tubing parks and rides, ski terrain parks, ski slopes, and ski trails, and (ii) passenger tramways. For the purpose of this definition, the phrase "open to the public" means that the public has full access to a device or structure at an event, irrespective of whether a fee is charged. The use of devices or structures at private events is not considered to be open to the public.

"Bungee cord" means the elastic rope to which the jumper is attached which lengthens and shortens to produce a bouncing action.

"Carabineer" means a shaped metal device with a gate used to connect sections of a bungee cord, jump rigging, equipment, or safety gear.

"Certificate of inspection" means the certificate or sticker for amusement devices distributed by DHCD.

"DHCD" means the Virginia Department of Housing and Community Development.

"Gravity ride" means a ride that is installed on an inclined surface, which depends on gravity for its operation to convey a passenger from the top of the incline to the bottom, and which conveys a passenger in or on a carrier tube, bag, bathing suit, or clothes.

"Ground operator" means a person who assists the jump master to prepare a jumper for jumping.

"Harness" means an assembly to be worn by a bungee jumper to be attached to a bungee cord. It is designed to prevent the wearer from becoming detached from the bungee system.

"Jump master" means a person who has responsibility for the bungee jumper and who takes the jumper through the final stages to the actual jump.

"Jump zone" means the space bounded by the maximum designed movements of the bungee jumper.

"Jumper" means the person who departs from a height attached to a bungee system.

"Landing area" means the surface area of ground or water directly under the jump zone, the area where the lowering device moves the bungee jumper to be landed away from the jump space and the area covered by the movement of the lowering device.

"Local building department" means the agency or agencies of the governing body of any city, county or town in this Commonwealth charged with the enforcement of the USBC.

"Operating manual" means the document that contains the procedures and forms for the operation of bungee jumping equipment and activity at a site.

"Passenger tramway" means a device used to transport passengers uphill, and suspended in the air by the use of steel cables, chains or belts, or ropes, and usually supported by trestles or towers with one or more spans.

"Platform" means the equipment attached to the structure from which the bungee jumper departs.

"Private inspector" means a person performing inspections who is independent of the company, individual or organization owning, operating or having any vested interest in an amusement device being inspected.

"Small mechanical ride" means an amusement device, other than an inflatable amusement device, where (i) the assembly time for the device is two hours or less, (ii) the revolutions per minute of any rotation of the components of the device is not greater than seven, (iii) the device has a footprint of less than 500 square feet, and (iv) the device does not invert a patron or lift a patron more than three feet in the air, measured from the ground to the bottom of the patron's feet when the device is operating.

"Special Inspector" means an inspector of amusement devices authorized to inspect a limited number and type of activities. Examples include zip line and aerial adventure courses inspectors. Special inspectors may have activity specific training or qualification.

"Ultimate tensile strength" means the greatest amount of load applied to a bungee cord prior to failure.

"USBC" means the Virginia Uniform Statewide Building Code (13VAC5-63 ).

B. Words and terms used in this chapter which are defined in the USBC shall have the meaning ascribed to them in that regulation unless the context clearly indicates otherwise.

C. Words and terms used in this chapter which are defined in the standards incorporated by reference in this chapter shall have the meaning ascribed to them in those standards unless the context clearly indicates otherwise.

**13VAC5-31-30. Devices Covered and Exempt.**

A. The following devices, identified by name or description, when open to the public shall be considered amusement devices subject to this chapter. The list is intended only to clarify questionable devices, while the definition of an "amusement device" in 13VAC5-31-20 is generally used to determine the applicability of this chapter.

1. Inflatable amusement devices; and

2. Zip lines.

3. Aerial Adventure Courses

B. The following equipment or devices shall not be considered amusement devices subject to this chapter:

1. Nonmechanized playground or recreational equipment such as swing sets, sliding boards, climbing bars, jungle gyms, skateboard ramps and similar equipment where no admission fee is charged for its use or for admittance to areas where the equipment is located;

2. Coin-operated rides designed to accommodate three or less passengers;

3. Water slides or similar equipment used in community association, community club or community organization swimming pools;

4. Mechanical bulls or similar devices;

5. Devices known as mall trains, shopping mall trains, or electric trackless trains for malls; and

6. Devices known as water walking balls, euro bubbles, or similar devices.

**13VAC5-31-40. Incorporated Standards.**

A. The following standards are hereby incorporated by reference for use as part of this chapter:

1. American National Standards Institute (ANSI) Standard ~~No. B77.1-2011~~ B77.1-2017 for the regulation of passenger tramways; and

2. American National Standards Institute (ANSI) Standards ANSI/ACCT 03-2019 for the regulation of Aerial Adventure Courses and Zip Lines

3. American Society for Testing and Materials (ASTM) Standard Nos. F747-15,~~-F770-15~~ F770-18, ~~F1159-15b~~ F1159-16, ~~F1193-16~~ F1193-18, F1957-99 (~~2011~~ 2017), ~~F2007-12~~ F2007-18, ~~F2137-16~~ F2137-18,-~~F2291-15~~ F2291-18, ~~F2374-10~~ F2374-17, F2375- 09 (2017), ~~F2376-13~~ F2376-17a, F2460-11, ~~F2959-16~~ F2959-18, and ~~F2974-15~~ F2974-19 for the regulation of amusement devices.

The standards referenced above may be procured from:

ACCT
P.O. Box 19797
Boulder, CO 80308

ANSI
25 W 43rd Street
New York, NY 10036

ASTM
100 Barr Harbor Dr.
West Conshohocken, PA 19428- 2959

B. The provisions of this chapter govern where they are in conflict with any provisions of the standards incorporated by reference in this chapter.

C. The following requirements supplement the provisions of the ASTM standards incorporated by reference in this chapter:

1. The operator of an amusement device shall be at least 16 years of age, except when the person is under the supervision of a parent or guardian and engaged in activities determined not to be hazardous by the Commissioner of the Virginia Department of Labor and Industry;

2. The amusement device shall be attended by an operator at all times during operation except that (i) one operator is permitted to operate two or more amusement devices provided they are within the sight of the operator and operated by a common control panel or station and (ii) one operator is permitted to operate two small mechanical rides with separate controls provided the distance between controls is no more than 35 feet and the controls are equipped with a positive pressure switch; and

3. The operator of an amusement device shall not be (i) under the influence of any drugs which may affect the operator's judgment or ability to assure the safety of the public or (ii) under the influence of alcohol.

D. Where an amusement device was manufactured under previous editions of the standards incorporated by reference in this chapter, the previous editions shall apply to the extent that they are different from the current standards.

**13VAC5-31-50. Certification of Amusement Device Inspectors.**

Any person, including local building department personnel, inspecting an amusement device relative to a certificate of inspection shall possess certification as an amusement device inspector in accordance with the Virginia Certification Standards (13VAC5-21).

Special Inspectors for Aerial Adventure Courses or Zip Lines may also be qualified by possessing an Association for Challenge Course Technology (ACCT) Inspector Certification Level 2 Professional and complete required Virginia trainings as outlined in Virginia Certification Standards (13VAC5-21).

Note: Continuing education and periodic training requirements for DHCD certifications are set out in the Virginia Certification Standards (13VAC5-21).

**Part VIII. Aerial Adventure Courses and Zip Lines**

**13VAC5-31-217. General Requirements.**

A. In addition to other applicable requirements of this chapter, aerial adventure courses/parks and zip lines shall be operated, maintained, and inspected in accordance with ANSI/ACCT 03-2019 or ASTM F2959 as determined by the course designer.

**Documents Incorporated by Reference (13VAC5-31)**

ANSI ~~B77.1-2011~~ B77.1-2017, Passenger Ropeways – Aerial Tramways, Aerial Lifts, Surface Lifts, Tows and Conveyors – Safety ~~Requirements~~ Standard, American National Standards Institute (ANSI), 25 West 43rd Street, 4th Floor, New York, NY 10036 (http://www.ansi.org/ )

Association for Challenge Course Technology (ACCT) P.O. Box 19797, Boulder, CO 80308 (http//www.acctinfo.org):

ANSI/ACCT 03-2019 Challenge Course and Canopy/Zip Line Tours Standards (Revision of ANSI/ACCT 03-2016 Standards)

American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959; (http://www.astm.org/ ):

ASTM F747-15, Standard Terminology Relating to Amusement Rides and Devices

ASTM ~~F770-15~~ F770-18, Standard Practice for Ownership, Operation, Maintenance, and Inspection of Amusement Rides and Devices

ASTM ~~F1159-15b~~ F1159-16, Standard Practice for Design of Amusement Rides and Devices that are Outside the Purview of Other F24 Design Standards

ASTM ~~F1193-16~~ F1193-18a, Standard Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices

ASTM F1957-99 (~~2011~~ 2017), Standard Test Method for Composite Foam Hardness-Durometer Hardness

ASTM ~~F2007-12~~ F2007-18, Standard Practice for Classification, Design, Manufacture, and Operation of Concession Go-Karts and Facilities

ASTM ~~F2137-16~~ F2137-18, Standard Practice for Measuring the Dynamic Characteristics of Amusement Rides and Devices

ASTM ~~F2291-15~~ F2291-18, Standard Practice for Design of Amusement Rides and Devices

ASTM ~~F2374-10~~ F2374-17, Standard Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices

ASTM F2375-09 (2017), Standard Practice for Design, Manufacture, Installation and Testing of Climbing Nets and Netting/Mesh used in Amusement Rides, Devices, Play Areas and Attractions

ASTM ~~F2376-13~~ F2376-17a, Standard Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems

ASTM F2460-11, Standard Practice for Special Requirements for Bumper Boats

ASTM ~~F2959-16~~ F2959-18, Standard Practice for Aerial Adventure Courses

ASTM ~~F2974-15~~ F2874-19, Standard Guide for Auditing Amusement Rides and Devices

**Reason Statement:** The ANSI/ACCT standard is the most widely used standard for the challenge course, aerial adventure and zip line industry. The standards in purpose written for the industry and includes significant operational and training standards designed to support safe operations. Additionally, the industry already has a robust inspection structure in place that is supported my insurance companies in the United States. The inclusion of the ACCT Standard allows existing courses to continue under the effective standard those course were designed, built, inspected and operated to since they were constructed.

**Cost Impact Statement:** The code change proposal will not significantly increase the cost of operating a course. It will make inspections more available to owners. The code change proposal will have a small impact on the cost of new construction.

# CS51-18

**Proponents:** BCAAC (bcaacdhcd@gmail.com)

## 2015 Virginia Building and Fire Code Related Regulations

**Revise as follows:**

**13VAC5-21-51. Issuance of certificates.**

**A.** Certificates will be issued when an applicant has complied with the applicable requirements of this chapter. Certificates ~~holders~~ will be classified as active or inactive. ~~An active certificate holder is a person who is certified and who has attended all periodic training courses designated by the Department subsequent to becoming certified. An inactive certificate holder is a person who is certified but has not attended all such training courses.~~ An inactive certificate will be considered out of compliance and a noncompliance notice will be issued to the certificate holder. In such cases, notification shall also be provided to the locality or company employing the certificate holder. Exceptions to the issuance of a noncompliance notice may be considered where there is a separation from employment by medical or military leave for 12 consecutive months or more during the continuing education period.

An inactive certificate ~~holder~~ may be ~~request reinstatement~~ reinstated as an active certificate ~~holder~~ after completing make-up training courses ~~authorized~~ designated by the Department. ~~Provisional certificates may also be issued in accordance with subsection C of this section~~.

~~Requirements for periodic training courses and continuing education requirements are set out in subsection D of this section.~~

**B.** All certificates issued since June 1978 are ~~considered to be~~ valid unless revoked or suspended, except that provisional certificates shall remain valid as set out under subsection C of this section.

**C.** A provisional certificate may be issued to (i) a person who has been directed by the Department to obtain a certificate; (ii) an applicant requesting a certificate under the alternative ~~examination or~~ training provisions of 13VAC5-21-45; (iii) an applicant when the required training has not been provided or offered; (iv) an inactive ~~or lapsed~~ certificate holder when the issuance of a provisional certificate is determined to be warranted by the Department; or (v) a person who, due to extenuating and warranting circumstances either on behalf of the code academy or beyond the person's control, has not fully complied with the eligibility requirements of training and competency established herein.

Such a provisional certificate may be issued when the applicant has ~~(i) provided the written endorsement or documentation required by 13VAC5-21-31, (ii)~~ satisfactorily completed the code academy core module and ~~(iii)~~ completed any training through the code academy or through other providers determined to warrant the issuance of the provisional certificate.

The provisional certificate is valid for a period of up to one year after the date of issuance and shall only be issued once to any individual, except that a provisional certificate shall remain valid when the required training has not been provided or offered.

**D.** All certificate holders shall attend periodic maintenance training as designated and approved by the Department and shall attend ~~16 hours of~~ continuing education every two years as designated and approved by the Department. ~~If a certificate holder possesses more than one certificate, the 16 hours shall satisfy the continuing education requirement for all certificates.~~

**Reason Statement:** Certificate statuses have been consolidated into two statuses to mitigate misunderstanding between the statuses: active and inactive. Active certificates reflect a certificate holder who has completed the required periodic training and met the continuing education requirements. Inactive certificates reflect a certificate holder who has not attended periodic training or met the continuing education requirements. Statements about the required number or hours for continuing education have been removed and placed back into the Department's CE policy. Removing it from the VCS provides the opportunity to adjust training hour requirements as needed and based on consensus of BCAAC without having to go through the legislative process.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency

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## Workgroup Recommendation

**Workgroup 1 - Final Committee Action:** Non-Consensus

**Workgroup 1 - Final Reason:**

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# Public Comments for: CS51-18

**Discussion by Richard Witt**
Jun 19, 2020 17:27 UTC

This code change is unnecessary and the current 2015 language should remain. CEU requirements should be approved by the Board of Housing and Commuity Development and not at the discression of the department. While there are a number of courses that can be obtained online 16 CEU's already created hardships on small localities that have multiple responsibilities besides code enforcement such as erosion and sediment control certifications that require 18 + hours of CEU's. These additional duties also are applicable to larger localities in order to meet state Chesapeake bay preservation requirements for inspection numbers. Also localities are cutting training budgets due to the COV-19 epidemic. Training requires time away from your primary function and responsibilities which dramatically affects both small and large localities from a logistical point of viewAdditionally, under current department  policies no CEU credit is given for code change training which can be 1 to 3 days of training based on your certifications. A previous proposed code change by staff or BCAAC would have  increased CEU requirments to 20 without any data driven reasoning. Please leave the current 16 CEU requirents and the language which would require Board approval for change

Proposal # 385

# Energy Subworkgroup

## Background – BHCD October 19, 2020

The energy subworkgroup was established and first met during the 2015 Code Update Cycle. The purpose of the committee was to review energy related proposals and see where consensus could be reached to increase energy provisions that provide a balance with affordability. This subworkgroup has continued their work throughout the current code update process.

The subworkgroup met on April 24th, 2019; July 18th, 2019 and March 31st, 2020. Participants included representatives from the Virginia Building Code Officials Association (VBCOA); American Institute of Architects (AIA Viginia); Responsible Energy Codes Alliance (RECA); Southeast Energy Efficiency Alliance (SEEA); Viridiant; Department of Mines Minerals and Energy (DMME); Apartment and Office Building Association of Metropolitan Washington/Virginia Apartment and Management Association (AOBA/VAMA); Virginia Energy Efficiency Council (VAEEC); the Home Builders' Association of Virginia (HBAV); Virginia Plumbing and Mechanical Inspectors Association (VPMIA); Jeff Mang of Hogan Lovells, and the International Association of Electrical Inspectors (IAEI).

These discussions yielded several proposals that were voted consensus for approval in the proposed phase. After some deliberation and hard work from the subworkgroup participants, the Board approved the following proposals during the proposed phase:

**RE402.4.1.2:** Requires blower door testing for residential buildings.

**RE401.3:** Certificate. The purpose of this proposal is to restore the IECC's requirement that a certificate listing key building efficiency information be posted in a permanent location.

**RE401.2:** This proposal does two things: First, it updates the reference to U.S. DOE's REScheck from the 2015 IECC to the 2018 IECC, consistent with the intent to base the Uniform Code on the 2018 IECC; Second, it eliminates a modification to the use of REScheck.

**E402.4:** This proposal improves the efficiency of commercial buildings by implementing a moderate improvement in fenestration SHGC that was adopted into the 2018 IECC and ASHRAE Standard 90.1-2016.

**E403.2.8:** Deletes conflict from energy code with the minimum life safety requirements outlined in the International Mechanical Code.

**Proposals -consensus for approval for the Final Phase include:**

**E402.1.4.2**: This proposal also clarifies how to calculate the U-factor contribution of tapered roof insulation; an important component of new and replacement roof systems.

**E402.4.2:** The Section C402.4.2 removes mandatory requirements for skylights in all buildings that will have an area greater than 2500 sq. ft with a ceiling height of 15 ft. This Code section lists building uses that by design is technically infeasible to install skylights to meet the minimum area requirements. Typically these roof areas are used for HVAC equipment, and PV systems as well as possible structural issues based on actual design of the buildings.

**E404.5:** Removes a plumbing provision for water lines in the IECC that is costly with little to no energy efficiency benefit.

**RE402.1.2(4):** Increases ceiling insulation from R38 to R49.

**Energy Subworkgroup Summary**
April 24, 2019

**Subworkgroup Members Present:**

| | |
|---|---|
| David Owen | HBAV/Boone Homes |
| Kenney Payne | AIAVA |
| Sean Evensen-Shanley | Viridiant |
| Steve Sunderman | Terrazia PC/Resilient VA |
| Jeff Mang | Hogan Lovells |
| Ron Clements | VBCOA (Existing Building Code) |
| Chelsea Harnish | VAEEC |
| Andrew Clark | HBAV |
| Shaun Pharr | AOBA/VAMA |
| Daniel Farrell | DMME |
| Andrew Grigsby | Self |
| Eric Lacy | RECA |
| Ellen Eggerton | City of Alexandria/VBCOA (Energy) |
| Mike Hamilton | Arlington County/VBCOA (Energy) |
| Linda Baskerville | Arlington County/VBCOA (Energy) |
| K.C. Bleile | Viridiant |

**Others in attendance:**

| | |
|---|---|
| Jim Jenkins | HEW |
| Ross Shearer | Self |
| Benjamin Knopp | Think Little |
| Laura Wynn | RECA |

Introductions were made and an overview of the process was given. All energy-related proposals were reviewed for the 2018 code update cycle.

**Code Changes Discussed:**

1. EB601.4-18, EB307.8(1),EB307.8(2) (Existing Building Code Proposals)
    - Tabled—An overview for each proposal was given. There was extensive discussion around the concept of moving all of the existing building provisions of the energy code to the Virginia Existing Building code. There was also conversation about incentivizing rehabilitation versus the opportunity to increase energy efficiency. Ellen Eggerton and the VBCOA Energy Committee will work with VBCOA Existing Building Committee and other interested committee members on this. Will report back during next meeting.

2. RE402.1.2 (Wall and Ceiling Insulation)
    - Non consensus—HBAV opposes this proposal due to the cost increase to single-family homes. They believe these measures should be optional. Supporters of this proposal argued that savings in utility costs more than offset the initial increase in construction costs.

3. RE402.4.1.2 (Air Leakage Testing)
    - Tabled—The proponent gave an overview and Sean Evensen-Shanley presented the preliminary findings of the Virginia Energy Code Field Study. The study looked at duct and air (envelope) leakage as well as other measures in newly constructed single-family homes. David Owen and Andrew Clark will discuss with their members and provide an update during the next meeting. In the meantime, the proponent will provide any additional information if necessary.

4. E402.4 (Commercial Fenestration SHGC)
    - Tabled—Shaun Pharr had concerns with the increased requirement for multi-family buildings. He will bring it up with his members and provide an update during the next meeting.

5. E503.1.1.1 (Replacement Fenestration)
    - Consensus for Approval (Energy Subworkgroup to be co-proponent)

6. RE401.2 (REScheck)
    - Tabled—First part of the proposal, updating the IECC year, appears to be editorial. The second part of this proposal removes the note for compliance guidance that shows how to comply with REScheck based on Virginia's amendments. The proposal assumes that proposals to remove existing state amendments will be approved. Further discussion will be necessary to determine the note's relevance.

7. RE401.3 (Certificate)
    - Tabled—There was discussion as to the importance and usefulness of the certificate. Concerns were raised that this could potentially open the door to additional requirements. Andrew Clark, Eric Lacey and Shaun Pharr to discuss prior to next meeting to see if there is any opportunity for consensus.

**Energy Subworkgroup Summary**

**July 18, 2019**

**Subworkgroup Members Present:**

| | |
|---|---|
| David Owen | HBAV/Boone Homes |
| Sean Evensen-Shanley | Viridiant |
| Jeff Mang | PIMA |
| Chelsea Harnish | VAEEC |
| Andrew Clark | HBAV |
| Shaun Pharr | AOBA/VAMA |
| Daniel Farrell | DMME |
| Eric Lacy | RECA |
| Ellen Eggerton | City of Alexandria/VBCOA (Energy) |
| Mike Hamilton | Arlington County/VBCOA (Energy) |
| Linda Baskerville | Arlington County/VBCOA (Energy) |
| K.C. Bleile | Viridiant |
| Bruce Cornwall | VBCOA (Energy) |
| Maggie Kelley | SEEA |

**Others in Attendance:**

| | |
|---|---|
| Benjamin Knopp | Think Little |
| Richard Grace | VPMIA/VBCOA |
| Terry Ganey | VPMIA |
| Thomas Clark | VPMIA |
| Ron Shearer | |

**Code Changes Discussed:**

1. RE402.1.2 (Wall and Ceiling Insulation)
    - Non-consensus—Proponent gave overview of their proposal and addressed the public comment submitted in cdpVA. A. Clark/HBAV was still in the process of evaluating the cost estimates and still did not have consensus among his members.

2. RE402.4.1.2 (Air Leakage Testing)
    - Non-consensus—Proponent gave overview of their proposal. As with RE402.1.2, A. Clark was still in the process of evaluating the cost estimates and still did not have consensus among his members. Also had issues with the cumulative cost of adding additional measures. Mr. Pharr had not received feedback from his organization since the last meeting and was not able to provide support.

3. RE503.1.1.1 (Replacement Fenestration)
    - Consensus—This was a consensus item from the previous meeting.

4. RE403.3.1 (Duct Insulation)

- Consensus—Proponent gave an overview of their proposal. A. Clark said that he didn't have an opportunity to review the proposal, but was okay with moving the proposal forward as consensus with the opportunity to address it at the full workgroup meeting, if necessary. The group agreed to support this proposal.

5. RE401.3 (Certificate)
    - Consensus as amended—Proponent gave an overview of their proposal. There was a question as to how the certificate is to be generated and maintained. There was also concern raised with the location of the certificate and the requirement to maintained onsite, specifically with multifamily. Consensus was achieved by revising the language to allow an off-site location for multifamily.

6. RE401.2 (REScheck)
    - Consensus—Proponent gave an overview of the proposal. Concern was raised with not approving this change and relying on updating the REScheck "workaround" memo. If using tradeoffs, need to use full version of REScheck. David Owen suggested using the 2015 IECC for REScheck, which is still more stringent than the 2015 VEBC. K.C. Bleile believes this positions Virginia for more resources as we continue to streamline the delivery of housing. Consensus was reached to support.

7. RE403.3.5 (Building Cavities)
    - Nonconsensus—Proponent was not in attendance. Background was given and the group acknowledged there was a conflict. No consensus was reached in terms of how to remedy this. Tom Clark doesn't believe this should be in the IECC, since the IMC governs duct design. Some believed the IMC needs to be revised to match the IECC.

8. E402.4 (Commercial Fenestration SHGC)
    - Consensus—Mr. Pharr still had not received feedback from his members. It was expressed that these windows are what is readily available. Given that there was no opposition or concern other than his, Mr. Pharr agreed to having the subworkgroup support with the opportunity to raise any concerns at the full workgroup should they arise.

9. E403.2.9 (Kitchen Exhaust Systems)
    - Consensus—This proposal was not included in the agenda, but the group agreed to review it and the proponent gave an overview. The subworkgroup agreed to support this proposal.

10. EB601.4 (Existing Building Code)
    - Tabled by proponent—Proponent gave an overview of their proposal. Mr. Pharr still did not support. Believed it went against the "Virginia way" of incentivizing improving buildings. Kenney Payne (AIA) also provided written opposition. There was still a fundamental difference with having existing building provisions in the IECC. A suggestion as made to duplicate the provisions in both the IECC and IEBC. VBCOA energy and existing building code committees still haven't met, but intend to do so. Proponent would like for this proposal to be included with the rest of the IEBC energy proposals that are being tabled to allow more time to work through.

11. EB307.8 (2) (Existing Building Code Reroofing)
    - Nonconsensus—Proponent gave an overview of their proposal. Was revised from the previous proposal to address comments from the prior meeting. Similar discussion as EB601.4, Mr. Pharr still had concerns with the additional requirements discouraging owners from repairing/improving their buildings. Kenney Payne (AIA) provided written opposition to this proposal as well. There was still a fundamental difference with having existing building provisions in the IECC. Dan Farrell expressed the State Energy Office's support for this change.

**Energy Subworkgroup**
**Remote Meeting – Adobe Connect**
**March 31, 2020**

| | |
|---|---|
| Andrew Grigsby | Richmond Region Energy Alliance |
| Andrew Clark | HBAV |
| David Owen | HBAV |
| Chelsea Harnish | VA EE Council |
| Daniel Farrell | State Energy Office |
| Eric Lacey | Responsible Energy Codes Alliance |
| Jeff Mang | Polyisocyanurate Insulation Manufacturers Association |
| Maggie Kelley | SEEA (Southeast Energy Efficiency Alliance) |
| Laura Baker | RECA |
| Christina Jackson | Region 8 IEBC Representative |
| Helen Hardiman | Board of Housing and Community Development |
| Shaun Pharr | AOBA and VAMA |
| Haywood Kines | IAEI |
| Ross Shearer | Self |
| Sean Evensen-Shanley | Viridiant |
| KC Bleile | Viridiant |
| Sean Farrell | VBCOA |
| Steve Sunderman | Resilient Virginia |
| Richard Gordon | Hanover County |
| Bruce Cornwall | Culpeper County |
| Ron Clements | Chesterfield County |
| Michael Hamilton | Arlington County |
| Allison Cook | Arlington |
| Linda Baskerville | Arlington |
| Ellen Eggerton | Alexandria |
| Richard Grace | Fairfax County |
| Jane Kim | Fairfax County |
| Dan Willham | Fairfax County |
| Rick Statzer | Abingdon |
| Kenney Payne | AIA Virginia |
| Paul Messplay | DHCD |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |
| Rajan Engh | DHCD |

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**Summary**

Mrs. Cook asked to move proposal A101.6, which was up last, to 4th on the agenda.

**E404.5 – Consensus Approval**

Mr. Payne presented on his proposal and explained how the plethora of restrictions and requirements actually use more energy, not less. Mrs. Eggerton asked if this removes the requirement for piping insulation in hot water lines. Mr. Hamilton said this restricts the distance from water heater to the end use. Mrs. Cook said there may be unintended consequences from handling this in the energy code rather than address this in the plumbing code. Mr. Sunderman agrees that it should be handled in the plumbing code.

**E1301.1.1.1-18 – Non-consensus**

Mr. Grigsby presents his proposal to remove Virginia amendments to the energy code and to adopt the 2018 IECC unamended. Mr. Lacey supports the proposal on behalf of RECA and desires to remove the weakening effects of Virginia's amendments. Mrs. Eggerton and Mrs. Baskerville support the proposal. Mr. Gordon supports having Virginia code professionals handling their energy amendments at the national level rather than amending the state code. Mr. Sunderman also supports this. Mr. Payne recommended splitting the C and R portions of the code to appease the homebuilders. Mr. Lacey said that most of the C portions are direct from the IECC but there are a few amendments that simplify the code.

Mr. Clark and Owens oppose a broad switch in standards in the Energy code which would increase the cost of construction.

**E402.4.2 – Consensus Approval**

Mr. Kines explained he discovered this issue while teaching the code academy the energy module. Mr. Kines explained he doesn't understand the minimum fenestration requirement for sky lights especially since the roof R-value is substantially higher than the U-factor from a skylight fenestration. Skylights are a big energy loser and need to be minimized to the greatest extent possible.

**A101.6 – Non-consensus**

Mr. Payne explained his proposal to resolve several of the conflicts in the code. Mrs. Baskerville disagrees with item 6, because it imposes all energy improvements through the respective trade's regulations, rather than in the VECC. Mr. Grace agreed that we should work between the codes to resolve conflicts. Mrs. Cook said she fundamentally disagrees. The code books should be coordinated between them and not have conflicts between them. Mrs. Baskerville worries this would serve to gut the energy code. Mrs. Baker said she would prefer we handle conflicts on an issue by issue basis rather than a blanket superseding provision like this. Mr. Pharr stated that professional should be able to rely on their code book. Plumbers the plumbing code, electricians the electrical code. They shouldn't have to resolve conflicts between the code and the energy code. Mr. Payne is going to split his proposal into 101.5 and 101.6 and submit them both. Proposal 101.6 is the one that is non-consensus.

**EB402.1.4.2 – Consensus Approval**

Mr. Mang presented on this proposal which clears up several areas of confusion and provides clarity on technical conflicts possible in the current code. Mrs. Eggerton and Mr. Lacey support this proposal for coming from a national consensus process for the energy code.

**EB601.4 (1) and EB601.4 (2)**

Proponent passed over in favor of EB601.4.(3). Will withdraw if EB601.4(3) is ultimately approved.

**EB601.4(3) – Consensus Approval**

Mr. Lacey presented on this variation first because it is his preferred approach for dealing with this issue. Broadly this proposal moves several items from the energy code to the Existing Building Code. Mr. Pharr questioned the cost impact statement which Mr. Lacey and Mr. Payne elaborated on and resolved Mr. Pharr's questions. Mr. Payne asked Mr. Farrell if the exception in EB601.4 could be retained even if the Board pulled this out for disapproval. Mr. Mang asked to include roof replacement language from EB601.4(4).

**EB601.4(4) – Consensus for Approval**

Mr. Mang presented on this proposal and how it works with energy conservation requirements of the roof replacement provisions and what that means for keeping and improving upon the home's energy efficiency requirements. Mr. Payne explained that he originally opposed this but came around to be a proponent due to the logic of such an improvement during that scale (75%) of replacement. Mr. Payne addressed the concern that this could present a financial hardship for a roof replacement and that the applicant or an RDP could look for ways to achieve a repair or keep it under 75% versus a full roof replacement.

**EB601.4(2) – Approved as Amended**

Mr. Payne states that the first part of his proposal would go away (601.4) and this proposal would be left with the CE and RE portions of Chapter 5. Mr. Lacey suggests a one line edit for Chapter C5 and R5 that they comply with EB601.4 and the group agrees to this. Mr. Payne agrees to take the proposal and edit it to match these changes.

Mrs. Cook asks that all of the EB601.4 proposals include that language for C5 and R5 and indicate that they should comply with EB601.4 so that whichever variant passes, that change is maintained.

**EB402.1.2(1)(2)(3) – Withdrawn**

**EB402.1.2(4)(5) - Carryover**

Mr. Lacey explained his proposal for insulation, taking ceiling up to 49 and walls up to 20 or 13+5. The proposal variant (4) only includes the ceiling R-value of 49. He asks to jump around between his variants to present. Mr. Clark says that all of the EB402.1.2 proposals are non-consensus from the homebuilders association. He has additional meetings this week with his constituents to see if they can pick any of the variants to be consensus on. Mrs. Baskerville points out that there are trade-offs that builders can do if they are unable to comply with specific sections due to the design of the home. Most members of the committee agree with the proposal or whichever proposal is approved of these variants. David Owen and Andrew Clark are in opposition. Mr. Lacey states that this proposal has been unchanged and out there since the Proposed Phase and nothing has changed, he hasn't seen movement or efforts at compromise on these proposals and is frustrated that there has not been more effort here.

Mr. Clark states there's room for continued discussion. Mr. Cornwall and Mrs. Eggerton said they believed these proposals had support from the HBAV in previous meetings. Mr. Clark and Owens both emphasized that this group of proposals was not one of the items the HBAV had consensus on when Mr.

Lacey and others met with the HBAV last December. The group agrees to withdraw Variants 1-3 and move forward with (4) and (5). Mr. Grigsby asks to combine the reason statements for the proposals and add them to the ones that are still moving forward.

**EB402.4.1.3 – Consensus for Disapproval (see note*)**

Mr. Grigsby explained that this was approved in 2012 and Virginia left this out of its energy code. It's a simple change that improves efficiency by reducing leakage in the building envelop to the National standard for air leakage.

Mr. Hamilton states he believed Andrew Clark is correct in claiming that we had agreed to 5 air changes in the last meeting and that the compromise was to move from a visual air leakage inspection to a blower door test. Mrs. Eggerton and Mrs. Kelley agreed that they had compromised on blower door testing if they keep the 5 air changes and they cannot support this proposal due to the previous compromise.

*After the meeting, Mr. Grigsby withdrew his proposal.

**EB503.1.1.1 – Non-consensus**

Mr. Lacey said that this restores language previously deleted and it is very straightforward. Mrs. Eggerton asked if this proposal is tied in with EB604.1(3). Mr. Lacey said if that proposal passes then this proposal is unnecessary. Mr. Pharr asks if the cost statement is accurate. He believes that like material replacement is not a guarantee of no cost increases. Mrs. Eggerton and Mr Willham agree that the proposal's cost statement needs work. Mr. Pharr is opposed to this proposal in its current format.

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# Residential Dock Safety Subworkgroup

**Background – BHCD October 19, 2020**

**Proposal T2701.1.1-18** was submitted during the proposed phase of the 2018 code development cycle. Mr. James Erler, who was concerned about electrical shock incidents that have occurred at some Smith Mountain Lake (SML) residential docks, submitted the proposal. The proposal generated a great deal of interest from various stakeholders including: the International Association of Electrical Inspectors (IAEI); Smith Mountain Lake Marine Fire Rescue; SML Citizens; The Virginia Building and Code Officials Association (VBCOA); the National Fire Prevention Association (NFPA); Underwriters Laboratories (UL); the National Electrical Manufacturers Association (NEMA); Electric Power Institute; Eaton, and the Appalachian Power Company (APCO), as well as Delegate Byron. As so many stakeholders with varied perspectives had an interest in the proposal, it was carried over to final phase to allow additional time for dedicated discussion on this issue via a sub-workgroup.

The sub-workgroup met to discuss the above proposal on November 25th, 2019 and January 28th, 2020. The proposal outlined measures intended to reduce electrical shock drowning deaths. There was general agreement among stakeholders that the issue was important. However, concerns were raised by some stakeholders that the proposed solution would create unintended consequences. Ultimately, the majority of stakeholders decided that the technical complexity and challenges associated with implementing a new electrical safety grid were beyond the scope of the sub-workgroup's abilities or capacity. The stakeholders suggested, based on information provided by NFPA, that the proponent submit his proposal to the appropriate NFPA 70 Code Making Panel along with a request for a study by the NFPA Research Foundation. The suggestion would allow national experts to study this issue further through the standard making process. It is unknown at this time if that is in process.

For the purposes of improvements to the 2018 Virginia code, a consensus proposal (T2701.1.1(2)) from members of the Virginia Chapter of the International Association of Electrical Inspectors brings forth dock safety provisions from the 2020 National Electrical Code (NEC). That proposal is on the consent agenda for the Board's consideration.

**Residential Dock Electrical Safety Sub-Workgroup**
**November 25, 2019**
**Varina Library- 1875 New Market Road, Henrico VA 23231**

## Attendees:

| | |
|---|---|
| Haywood Kines | I.A.E.I |
| Allen Turner | I.A.E.I |
| Neil Harrington | SML Marine Fire Rescue |
| David Trimble | SML Citizens ESD subgroup |
| John Broughton | VBCOA- Franklin County |
| Florin Moldovan | VBCOA- Spotsylvania County |
| Robby Dawson | NFPA |
| John Lane | Stakeholder |
| Jim Erler | Stakeholder-Bedford County |
| Guy Tomberlin | VL |
| Gordon Frost (phone & Adobe) | NFPA |
| Bryan Holland (phone & Adobe) | NEMA |
| Doug Dorr (Adobe) | Electric Power Institute |
| Frederick Reyes (Adobe) | |
| Gary Loftis (Adobe) | |
| Randy Holloway (Adobe) | Smith Mountain Lake |
| Kevin Arnold (phone) | EATON |
| Jimmy Moss | VBCOA- Grayson County |
| Kathy Byron (Adobe) | |
| Ronald Jefferson (Adobe) | APCO |
| Cindy Davis | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |
| Thomas King | DHCD |
| Nicole Donaldson | DHCD |

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Welcome/Introductions

The meeting began with those present providing positions and concerns related to the proposal.

Mr. Kines disagreed with Mr. Erler's proposal and questioned if he looked at the National guidelines for the operational marina requirements for compliance with the National code, electrical shock drowning association documentation (provided references about poor maintenance/equipment on boats and power to the shore and installation instructions). Mr.

Kines felt this proposal is very dangerous and deadly. He is in opposition to the proposal as written.

Mr. Turner agreed with Mr. Kines and added that eliminating one of the most critical components of the electrical system is dangerous. This proposal will go into direct conflict of the grounding principles of the shore grounding book of the National Electrical Code NFPA 303 which recommends ground integrity test. He indicated that there are nine marinas (as of 2014) that have ongoing around the clock ground system that detect ground faults.

Mr. Harrington wanted stray voltage stopped and wanted to prevent electrical shock drowning. The residential dock is still grounded and if we break bonding at the sub panel at the dock and the service panel at the house this would be a solution that he has been requesting for a year.

Mr. Broughton and colleagues had concerns but has an open mind.

Mr. Moss wanted to sort out the change and end up with a proposal that makes the docks safe.

Mr. Dawson and Mr. Tomberlin wanted to observe and see what resources NFPA and UL may have available.

Mr. Holland wanted to address the violation of the provisions with the National Electric Code and all the assumptions with the proposal that are not addressed. He pointed out that when we are modifying the later chapters of the NEC it is intended to supplement the mandatory requirements of Chapter 1-4. Article 250 “grounding and bonding” already mandates certain requirements for grounding and bonding. When we get to chapter 5 the rule is an enhancement safety to article 250 and to put this mandatory exception in it violates 110.10 /250.485, and violates all of part 6 of article 250. The exceptions now is assuming there is a feeder because were doing an exception to the main rule in 555.15 which is addressing feeders that supplied by a service out to a residential docking location. This proposal doesn’t address the circuits at residential locations and it assumes that there’s going to be a remote panel board and a grounded electrical system at the remote panel board. There is no requirement in the code for that. This proposal is putting a mandatory requirement on single family dwelling. It’s taking a stray voltage problem from the utility and trying to institute a rule into the NEC.

Mr. Holloway pointed out that the electrical safety grounds are not being removed. There are ground rods at the docks. What’s being disconnected is the ground at the service panel at the house.

Mr. Frost agreed with Mr. Holland and added that the tripping of the GFCI circuit is not a safe situation.

Mr. Dorr pointed out that if we continue to use the green wires all the way down to the dock or marina then that doesn’t eliminate the drownings but if we get rid of it then there is a challenge of decreasing the redundancy for safety. This is also not just a utility problem. The proposal needs to be more explicit about the requirements for ground circuit interrupters on the

upstream as well as what's going to be required at the dock. He does not feel comfortable with removing the green wire without those other caveats. He will send the link (300-201-7129-in search field).

**PROPOSAL:**

Mr. Erler and Mr. Harrington came up with proposal. Mr. Erler went through a PowerPoint to address his research in obtaining the proposal. His main concern is safety and his problem with NFPA 70, article 555. If the electrical system is up to code then there is electricity in the water. The residential docks are fundamentally different than marinas.

Mr. Harrington pointed out that if they cut off main circuit breaker in the house and voltage is still in water then this needs to be fixed, that everyone can at least agree on that.

Mr. Erler recommended a hybrid system (this is done in Europe) and explained the differences.

Mr. Holland questioned if the earthing system carries faulty current, it doesn't work in reverse. The problem is open neutral. No matter what, if a path exists, the current will follow any path available to get to the water and the metal parts of the dock or metal equipment at the dock.

Mr. Erler responded that the neutral is not connected.

Mr. Kines questioned how the over current at the house trips.

Mr. Erler responded that it trips GFCI, which Mr. Kines pointed out is not a requirement of the 2014 NEC. Mr. Erler admitted he would need to change his proposal so that to remove the service ground to the dock, you would have to install GFCI in sequence even though its not a current requirement.

Mr. Dorr suggested bringing lower voltage out there instead of removing green wire and suggested that there are 5 approaches to eliminate shock and not have people drown.

Mr. Holland pointed out that it is flawed trying to manipulate TT side from TN-C-S side.

Ms. Davis questioned if the power companies are involved in the conversation.

Mr. Erler responded yes, Southside Appalachian Co-op is the utility. Dominion doesn't provide any service to the lake and that the power company is aware of the battle over faulty current and the conflicts between the requirements of the NFPA and the existing problem of loose current in the lake. Their view is that this is just part of the way it's done and that everything that's on the other side of the meter base isn't the power company's problem.

Mr. Kines pointed out that the current code does not require any GFP protection. The 2017 goes to 30mamp on the feeder and addresses shore power at 100. It still requires GFCI at all 15-20amp 120v receptacles.

Mr. Holland explained that he whole-heartedly supports use of GFCI in the code and expanding that protection where able, but he is wholly against removing the equipment grounding conductor and relying solely on GFCI which is not the manner it's intended to be used. He suggested to completely withdraw proposal submitted, revise the proposal to take in Article 553 & 555 from the 2020 code making process. Further, he recommends submitting a proposal to the 2023 NEC code making panel. The 2017 NEC requirements for 555 are enough, although it will not address the stray voltage problem.

Ms. Davis suggested that we look at the other countries to see what they have put into place to address the issue as the proponents have indicated. She asked if article 303 does not address residential docks. Mr. Holland confirmed that it is not for residential docks and that he believes adhering to the most recent codes approved by stakeholders and vetted through the code making process is the best course of action.

Mr. Kines said the 2020 555 section of the NEC includes residential buildings, townhomes, etc and that's probably why he brought it up. Ms. Davis asked what changed in the 2020.

Mr. Kines said no matter what you do the stray voltage from the utility will be there.

Mr. Jefferson responded that the power company's position is to recommend adherence to National Electrical Safety Code. He will continue to have conversations with others. He admitted this has been an issue for a while, but he doesn't have any specifics.

Mr. Loftis questioned if the grounding system to the docking facility (ie ground wire neutral connection) is sinking or sourcing

Mr. Holland responded that there is no known solution to stray voltage anywhere. The NEC is not the proper place to address the matter, especially if the suggested solution reduces the minimum requirement of the code approved by an ANSI consensus process

Mr. Kines pointed out that we need testing data from here including the tripping then we can talk about this. He pointed out that we should test with our voltage in America and not in Europe. Mr. Erler also asked for measurements to be conducted on the grounding issue since both sides seem to be making claims without evidence of what's actually happening with code compliant docks.

Ms. Davis suggested creating a list of next steps: what needs testing, reaching out to the 2023 code making process and contacting other country's using different systems to see what they have in place and how it may differ from the electrical structures in place in the U.S.

Mr. Holland pointed out that we can't change the utility system here in the US with the VA Building Code.

Mr. Trimble pointed out that we have one proposal we need to work on that and will work with VA Tech to do the testing but it could take several months.

Mr. Kines suggested substituting 555 only from the 2021 NEC.

## CLOSING

Proposals closes Sept, 10 2020 (can submit proposal online) for the 2023 NEC

We will supply the link to do the code proposal process through NFPA/NEC.

Research on International Electrical Code and other countries successes with residential docks.

Research power companies if there is anything that should or would be done to remove stray voltage.

Mr. Holland will provide information on GFCI relatability based on current standards.

Next meeting will go out with Doodle Poll January 28- 30, 2019.

**Residential Dock Electrical Safety Sub-Workgroup**
**January 28, 2020**
**Virginia Housing Center – 4224 Cox Road, Glen Allen, VA 23060**

## Attendees:

| | |
|---|---|
| Haywood Kines | I.A.E.I. |
| Allen Turner | I.A.E.I. |
| David Humphrey | I.A.E.I. |
| Neil Harrington | SML Marine Fire Rescue |
| David Trimble | Smith Mountain Lake |
| Randy Holloway (remote) | Smith Mountain Lake |
| John Lane | Smith Mountain Lake |
| Florin Moldovan | VBCOA - Spotsylvania County |
| Jim Erler | Stakeholder - Bedford County |
| Casey Littlefield | Goochland County |
| Guy Tomberlin | Underwriters Laboratory |
| Greg Cade | NFPA |
| Robby Dawson | NFPA |
| Jeff Sargent | NFPA |
| Fred Reyes (remote) | NFPA |
| Bryan Holland | NEMA |
| Kevin Arnold (remote) | EATON |
| Gary Loftis (remote) | Loftis Engineering |
| Larry Jackson | APCO |
| George Felts | Southside Electric Cooperative |
| Cindy Davis | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |
| Thomas King | DHCD |
| Paul Messplay | DHCD |
| Brian Hildebrand (remote) | DHCD |

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**Welcome/Introductions**

Ms. Davis opened the floor for introductions and for everyone in attendance to identify their representations. She summarized the issues discussed previous: stray voltage, provisions for grounding and alternative systems that could address this issue.

**Presentation from Bryan Holland, NEMA:**

Mr. Holland gave a presentation and summarized some information available about addressing concerns that arise from various grounding systems. One such document balances the costs and benefits of grounding and bonding, but that it increases risks from stray voltage and electric shock.

Mr. Holland did research with several national code representatives, including studies and standards from UL 943, and officials with Florida Power and Light. He emphasized from his conversations with various national and state-level officials that whatever result we produce from this sub-workgroup should be a wholesale improvement of the aspects of the code and not include weakening or trade off measures.

Mr. Holland recommended several provisions from the 2020 NEC to improve the protections around grounding and stray voltage. He recommended ground detection devices on the neutral and surge protection devices. Further, he recommended bringing Articles 555 and from the 2020 NEC forward to increase protection at residential docks. He also had some other items that could be part of an alternate proposal to improve safety in the water around docks.

Mr. Harrington summarized the goal of the proposal and the limited scope of the dock proposal and the residents of Smith Mountain Lake not seeking to expand the proposal to everything Mr. Holland brought up.

Mr. Kines summarized an issue with the proposal and how a fault could still travel to the dock if the equipment feeder was removed. Mr. Erler stated that the GFCI would resolve that issue. Mr. Holland explained the path the fault would take to electrify all magnetic parts of the equipment if that feeder ground was removed.

Mr. Kines asked how far the house panel is from the dock panel. Mr. Erler estimated about 100 feet. Mr. Kines speculated that they are trying to use 100 feet of earth to block the path of the current. Mr. Felts summarized the current practice that Southside Electric has been conducting to investigating the concerns of residents at Smith Mountain Lake. Mr. Jackson agreed and further commented that due to the amount of mica in the soil, the best ground path is always going to be around lakes or bodies of water.

**Presentation from Mr. Erler:**

Mr. Erler began his presentation. He summarized the various problems with the NEMA presentation and recommendations and identified what other best practices there are around the world to address electric shock drowning. Mr. Humphrey pointed out again that the whole scope of different equipment that is utilized internationally makes it completely impossible to compare our system to theirs. Also, that this proposal only seeks to address a single source of stray voltage, that it still comes from other residences, boats and the utility.

**Discussion:**

Mr. Holland emphasized the need for this to be moved to the national code making process where more expertise, researching and testing is available.

Mr. Arnold offered his role on the national code making panel with jurisdiction over the relevant sections of the NEC to bring forth this proposal and all the research from the residents of Smith Mountain Lake to the 2023 discussion. Mr. Holland pointed out how the NEC code operates and that what is common practice at residential docks at Smith Mountain Lake exceeds the code and proposals to codify and modify those practices create conflicts in what is supposed to be a minimum code.

Mr. Moldovan brought up the possibility that the experts in the room instead of picking holes in the proposal could come together to craft a passable code change that meets code.

Ms. Davis closed out the first half of the meeting by inviting the participants to help craft a proposal that can be submitted as a consensus item and that no matter what happens, the proposals developed here will go through the rest of the workgroup process. Mr. Humphrey offered to contact colleagues in Canada who work on the Electrical Safety Authority in that country and if they have established protocols for residential docks.

Mr. Holloway brought up a list of best practices he has posted on his website (Smith Mountain Lake Fire and Marine Rescue) and offered it up for discussion and critique. Several people reacted favorably including representatives from NFPA/NEMA. Mr. Holland offered that the list be modified to state that “work being conducted to improve the electrical safety should be performed by a licensed and insured electrician.” Mr. Humphrey offered the aid of IAEI in education to the public and professionals in this area.

Mr. Holland brought up the ESFi.org website and the Boat and Marina Safety section which has numerous resources for educational purposes and best practices. Mr. Holland indicated that Jeff Sargent, on the conference line, is a staff liaison for submittal from the public to NFPA.

Mr. Holland drew a simple diagram of the issue with the proposal to remove the green wire for residential docks. He explained the various paths that the electric current could take to return to the source and that removing the one path Mr. Erler is proposing, it still leaves infinite other paths which could cause the lowest impedance shock path leading to shock drowning.

Mr. Tomberlin spoke to the differences between legislative action and regulation and the fears that this conversation is getting a bit off topic. He argued in favor of this code making process and the expertise in the room.

Mr. Harrington asked how the residents can engage a testing organization to provide information and a report that would be acceptable to NFPA/NEC. Mr. Dawson said that the NFPA research foundation has that ability and stated that it would not be quick but could be done. Mr. Humphrey asked the group if they could at least agree that the 2020 NEC provided improvements in safety for residential docks and marinas for ground fault protections.

Ms. Davis summarized Mr. Kines proposal and the suggestions Mr. Holland made in his presentation. She asked if any kind of consensus proposal could be crafted to bring this discussion to a head. Mr. Erler indicated that none of those proposals would address stray current in the water and that the only solution that's acceptable to them is to permit removing the equipment grounding conductor.

Mr. Sargent explained the code submission process for changes to the NEC and how codes are correlated and judged to be acceptable submissions and who will review the submissions for integration into the code.

**Closing:**

Ms. Davis summarized the next steps. The April 15th meeting will be the next meeting where the proposals are discussed. This meeting is a full workgroup meeting. If it still needs more time, there will be an additional full workgroup meeting in May. We will continue to keep our eyes out for further information and anything that could potentially shed more light on this discussion from research into what works in Europe to recommendations from the NFPA to get the proposal through.

# Residential Uses Subworkgroup

**Background – BHCD October 19, 2020**

The Residential Uses Subworkgroup was convened to review all of the residential use groups, how to define them and how to permit newer types of residential dwellings, including Accessory Dwelling Units (ADUs). The stakeholders who participated in this subworkgroup included representatives from: City of Virginia Beach government; Gentry Locke; Home Builders Association of Virginia (HBAV) Spotsylvania County; Henrico County; Virginia Realtors; Department of Behavioral Health and Developmental Services (DBHDS); Chesterfield County; Affordable Housing advocates, Winchester County; Virginia Association of Counties (VACo); Virginia Assisted Living Association (VALA); American Institute of Architects (AIA Virginia); Arlington County; Virginia Department of Social Services; Apartment and Office Building Association of Metropolitan Washington (AOBA); Virginia Department of Fire Programs (VDFP); Gotiny.com; Alexandria City; Richmond City; Galax County; Fairfax County; Prince William County; and Goochland County.

This subworkgroup met frequently over the code change cycle, covering much ground between spring 2019 and summer 2020. The initial meeting to discuss the benefits of forming the Residential Uses Subworkgroup was conducted on June 26th, 2018. The ensuing subworkgroup meetings were held on April 12th, 2019; May 31st, 2019; July 10th, 2019; July 16th, 2019; August 9th, 2019; March 26th, 2020; April 6th, 2020, and June 29th, 2020. Below is a summary of consensus proposals as well as information on one nonconsensus proposal specific to Accessory Dwelling Units (ADUs)

**Clarification Consensus Proposal**

The primary focus of the subworkgoup revolved around clarifying and defining the many different types of residential uses currently within the code in an effort to eliminate or reduce conflicts and confusion. This resulted in a consensus proposal (B310.1-18) to eliminate the existing laundry lists of examples for each residential use group classification; instead defining each residential use group based on how they are used and for how long. This proposal also includes the addition of a new code section where all of the existing exceptions and special

requirements related to State Regulated Care Facilities were compiled and reorganized for clarification.

**Affordability Consensus Proposals**

Another primary focus of the group included finding ways to incorporate new technology to reduce housing costs and reduce costly retrofits for existing homes wishing to incorporate Accessory Dwelling Units (ADUs). Of particular note:

- An alternative compliance path has been designated with the body of the code for tiny homes.
- A path for compliance for retrofitting shipping containers has been provided in the body of the code.*

**Affordability Nonconsensus Proposal**

- A proposal that will permit ADUs (RB302.3(2)-18) is before the Board as a non-consensus item. The subworkgroup is in agreement with the proposal but there was one individual who opposed the proposal at the full workgroup meeting. Detailed discussion is included behind the proposal in the board package.

**NOTE: The proposal to include a reference to the ICC shipping container guidelines was a staff proposal vetted at the full workgroup but did not originate from this subworkgroup.**

**Residential Use Workgroup**

**Issue #1: Attached Accessory Dwelling Units (AADU)**

**Attending:**

| | |
|---|---|
| Kenney Payne | AIA |
| Greg Revels | Henrico County |
| Heather Trickle | Va Behavioral Health |
| Brian Gordon | AOBA |
| Joe Lerch | Virginia Association of Counties |
| Florin Moldovan | Spotsylvania County |
| Jason Laws | Chesterfield County |
| Judit McGreal | Va Department of SS |
| Ron Clements | Chesterfield County |
| Shahriar Amiri | Arlington County |
| Kristen Yavorsky | Behavioral Health |
| John Catlett | DHCD (Catlett Code Consulting) |
| Jeff Brown | DHCD |
| Cindy Davis | DHCD |

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The residential use group work group was formed to discuss issues formed around the use of residential single-family dwellings. Through initial discussions with the work group, two themes emerged that will require additional thought and possible code changes.

**Attached Accessory Dwelling Units (AADU)**

Recent desires in several communities to allow accessory dwelling units within owner occupied dwellings have occurred. This has provided local code officials with the dilemma of how to classify the use, and what code provisions should be applied. The code currently would classify this use as a two-family dwelling under the 2015 VCC, IRC reference with Virginia amendments. The code requires a fire separation between the dwelling units as well as additional life safety features.

Background:

The discussion reveled several reasons that accessory dwelling concept has become popular.

- Real Estate taxes on elderly home owners have become excessive, making it difficult to retain their homes;
- The need for affordable housing options in metropolitan areas have led to local zoning ordinances that provide for supplemental units;
- Available land to develop affordable housing is decreasing in favor of high rent units.

The group discussed several options but focused in on two possible solutions.

The first was to create a new use group, possibly an R6 that would contain specific regulations for the intended use. These would be a hybrid of requirements currently held for two family units. However further discussion developed a series of conclusions. These include the following:

- It is hard to delineate between the creation of a separate apartment in a space within a dwelling and habitable space within a typical single-family dwelling.
- Uses such as in-law suites or expanded living space for families that are normally allowed by local zoning most resemble the intended level of safety currently provided by the IRC for a single-family home.
- There are no requirements within the IRC to have separate utilities for each dwelling unit.
- In typical two-family units, the fire separation is provided in some scenarios due to deed or lot line establishment for individual sale. In these cases, there should be a reasonable expectation that what the occupant does on one side of required fire separation should not affect the occupant on the other side.
- There is no requirement in the IRC for each dwelling unit in a two-family dwelling to have interconnected smoke detection. Therefore, the occupants on one side of a fire separation would not receive early notification of a fire on the other side.
- The building code does not establish a definition of family in either number of people or relationship status. This is typically established through local zoning ordinances.
- Comparing the requirements for an owner-occupied bed and breakfast facility and the life safety risk associated with an AADU were found to be similar. The IBC establishes in section 310.4.2, "Lodging houses. Owner-occupied lodging houses with five or fewer guest rooms and 10 or fewer total occupants shall be permitted to be constructed in accordance with the International Residential Code." The IRC establishes in section 202, "LODGING HOUSE. A one-family dwelling where one or more occupants are primarily permanent in nature, and rent is paid for guestrooms." The work group agreed that an AADU would not have a higher level of intensity or fire risk than a lodging house that can be placed in a single-family home.
- In addition, comparison between a two-family dwelling, R2 apartment unit, and AADU for fire separation requirements provided the following:
    - An owner-occupied dwelling that contains an AADU most resembles uses already allowed in a single-family dwelling without fire separation.
    - A higher level of expectation by the occupants of an R2 Dwelling Unit should have a higher level of expectation that they are protected from what occupants in other dwelling units do that could affect them (fire hazard, noise, etc.).
    - In a true two-family dwelling, the potential for individual ownership, property lines, condominium deeds, etc. create a higher level of expectation from what the occupants of the other dwelling unit does that could affect them (fire hazard, noise, etc.).
- The group expressed a desire to include the AADU use within the definition of an IRC Dwelling Unit.

  "DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation; <u>including such units within the same building where one unit is occupied by the owner.</u> For the definition applicable in Chapter 11, see Section N1101.6."

Additional investigation is needed to regarding administration provisions of how the new definition would be applied. The following needs to be addressed:

- In an existing single-family dwelling where the AADU is utilized without major alterations considered. Would there be a need for:
    - Is there a need for additional regulations addressing emergency egress windows or direct access to the outside by door, addressing deficient ceiling heights, and addressing the lack of interconnected smoke detectors in AADU areas previously finished in to habitable space;
    - How would the new definition apply and what regulations may be needed where an in-law suite (or similar space intended for use by the owner's family) was previously added meeting all the requirements at the time of alteration, but not meeting current code provisions. This includes pre-USBC and post-USBC applications.
    - Should such provisions be contained within the VRC or the VEBC? Current efforts underway are intended to make any reference to any existing building under the VEBC.

Assignments were made to provide draft regulations for the group to consider at its next meeting. Shahriar Amiri agreed to provide the first drafts.

**Residential Use Sub-workgroup**

**April 12, 2019 at 9:30 AM**

**Issue #2: Other Residential Applications including State Licensed Health and Mental Health Use groups**

**Attending:**

| | |
|---|---|
| Kenney Payne | AIA |
| Greg Revels | Henrico County |
| Heather Trickle | Va Behavioral Health |
| Brian Gordon | AOBA |
| Joe Lerch | Virginia Association of Counties |
| Florin Moldovan | Spotsylvania County |
| Jason Laws | Chesterfield County |
| Judit McGreal | Va Department of SS |
| Ron Clements | Chesterfield County |
| Shahriar Amiri | Arlington County |
| Kristen Yavorsky | Behavioral Health |
| John Catlett | DHCD (Catlett Code Consulting) |
| Jeff Brown | DHCD |
| Cindy Davis | DHCD |

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The residential use group work group was formed to discuss issues formed around the use of residential single-family dwellings. Through initial discussions with the work group, several areas of concern were raised with some requiring additional thought and possible code changes. This summary captures the remaining issues raised by the workgroup. This is the second summary of two of the first meeting.

General discussions included:

- Why Hotels ( https://whyhotel.com/ ) – Shahriar Amiri reported that there is a new brand of hotel that offers hotel (R1) uses in buildings designed as an R2 apartments or condominiums. The chain offers completed, but unsold/rented units for short term occupancies. There was no specific direction by the work group to address the issue at this time.

- Transit Orient/short term rental dwelling units – The workgroup felt there was no additional concerns from a code perspective regarding Air BB and similar short-term rentals of dwelling units. There are no greater hazards associated with the use than found in time shares or lodging houses.

  However, current provisions do not allow the uses for anything other than the purposes of "complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation" which are called out in the definition of a dwelling unit. Uses for wedding venues or other similar uses would not be considered complying with the requirements and would need to be addressed within the requirements of the IBC. Local zoning and/or homeowner associations may be better geared to regulate the

number of and requirements for parking, licensing, etc. than attempting to regulate them through the building code.

**State licensed facilities allowed in dwelling units and exemption allowances**

It was reported that there is considerable difficulty both understanding and applying the requirements and exemptions regarding various levels of care facilities allowed in dwelling units. This led to a broader discussion regarding confusion in application of the various I and R uses by State Health and Mental Health licensing regulations and the exemptions/exceptions they contain.

In addition, localities are regularly receiving complaints regarding living conditions in unregulated and license exempt home care facilities.

The following existing provisions were discussed:

- HOSPICE FACILITY. An institution, place, or building owned or operated by a hospice provider and licensed by the Virginia Department of Health as a hospice facility to provide room, board, and palliative and supportive medical and other health services to terminally ill patients and their families, including respite and symptom management, on a 24-hour basis to individuals requiring such care pursuant to the orders of a physician.

- STATE REGULATED CARE FACILITY (SRCF). A building with an occupancy in Group R-2, R-3, R-4 or R5 occupied by persons in the care of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education or the Virginia Department of Juvenile Justice.

- AMBULATORY CARE FACILITY. Buildings or potions thereof used to provide medical care on less than a 24-hour basis that are licensed by the Virginia Department of Health as outpatient surgical hospitals.

- CUSTODIAL CARE. Assistance with day-to-day living tasks, such as assistance with cooking, taking medication, bathing, using toilet facilities, and other tasks of daily living. In other than in hospice facilities, custodial care includes occupants that have the ability to respond to emergency situations and evacuate at a slower rate or who have mental and psychiatric complications, or both.

- 308.3 Institutional Group I-1. This occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive custodial care. Buildings of Group I-1, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 308.3.1. Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancy conditions indicated in Section 308.3.1 or 308.3.2. This group shall include, but not be limited to, the following:

Alcohol and drug centers
Assisted living facilities
Congregate care facilities
Group homes
Halfway houses
Residential board and care facilities
Social rehabilitation facilities

308.3.1

- Condition 1. This occupancy condition shall include buildings in which all persons receiving custodial care who, without any assistance, are capable of responding to an emergency situation to complete building evacuation. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents that may require the physical assistance reside on a single level of exit discharge. 308.3.2

- Condition 2. This occupancy condition shall include buildings in which there are persons receiving custodial care who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation. Five of the residents may require physical assistance from more than one staff member to respond to an emergency.

- 308.4 Group I-2. This occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation. This group shall include, but not be limited to, the following:

  Convalescent facilities
  Detoxification facilities
  Foster care facilities
  Hospice facilities
  Hospitals Nursing homes
  Psychiatric hospitals

  Exception: Hospice facilities occupied by 16 or less occupants, excluding staff, are permitted to be classified as Group R-4.

- Add the following exception to Section 308.6 of the IBC to read:

  Exception: Family day homes under Section 310.9.

- Change Section 310.3 of the IBC to read:

  310.3 Residential Group R-1. Residential occupancies containing sleeping units where the occupants are primarily transient in nature, including:

Boarding houses (transient) with more than 10 occupants
Congregate living facilities (transient) with more than 10 occupants
Hotels (transient)
Motels (transient)

Exceptions:

1. Non-proprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height with a maximum of 10 occupants total are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R5.

2. Proprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height, that are also occupied as the residence of the proprietor, with a maximum of five guest room sleeping units provided for the transient occupants are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.

- Change Section 310.6 of the IBC to read:

310.6 Residential Group R-4. This occupancy shall include buildings, structures or portions thereof for more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive custodial care. Buildings of Group R-4, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 310.6.1.

Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancy conditions indicated in Sections 310.6.1 or 310.6.2. This group shall include, but not be limited to, the following:

Alcohol and drug centers
Assisted living facilities
Congregate care facilities
Group homes
Halfway houses
Residential board and care facilities
Social rehabilitation facilities
This occupancy shall also include hospice facilities with not more than 16 occupants, excluding staff. Group R-4 occupancies shall meet the requirements

for construction as defined for Group R-3, except as otherwise provided for in this code.

Exceptions:

1. Group homes licensed by the Virginia Department of Behavioral Health and Developmental Services that house no more than eight persons with one or more resident counselors shall be classified as Group R-2, R-3, R-4 or R5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

2. In Group R-4 occupancies classified as the occupancy condition indicated in Section 310.6.1, other than in hospice facilities, not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a single level of exit discharge and other than using a ramp, a change of elevation using steps or stairs is not within the path of egress to an exit door.

3. Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, and all of the residents are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5.

4. Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, may be classified as Group R-5 when in compliance with all of the following:
   4.1. The building is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.
   4.2. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation.
   4.3. All residents who may require physical assistance from staff to respond to an emergency situation reside on a single level of exit discharge and other than using a ramp, a change in elevation using steps or stairs is not within the path of egress to an exit door.

5. Hospice facilities with five or fewer occupants are permitted to comply with the IRC provided the building is protected by an automatic sprinkler system in accordance with IRC Section P2904 or IBC Section 903.3.

- Change Sections 310.6.1 and 310.6.2 of the IBC to read:

310.6.1 Condition 1. This occupancy condition shall include buildings in which all persons receiving custodial care who, without any assistance, are capable of responding to an emergency situation to complete building evacuation and hospice facilities.

310.6.2 Condition 2. This occupancy condition shall include buildings in which there are persons receiving custodial care who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation.

- Change Section 310.7 of the IBC to read:

  310.7 Residential Group R-5. Residential occupancies in detached single-family and two-family dwellings, townhouses and accessory structures within the scope of the IRC. Change Sections 310.8 and 310.8.1 of the IBC to read: 310.8 Group R-5. The construction of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.

  310.8.1 Additional requirements. Methods of construction, materials, systems, equipment or components for Group R-5 structures not addressed by prescriptive or performance provisions of the IRC shall comply with applicable IBC requirements.

- Change Section 310.9 of the IBC to read:

  310.9 Family day homes. Family day homes where program oversight is provided by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.

  Note: Family day homes may generally care for up to 12 children. See the DHCD Related Laws Package for additional information.

Issues discussed:

- There is considerable confusion regarding the application of the code based on State licensing requirements:
  - R vs I uses; R5 vs. R3 or R4
  - State licensing authority regulatory differences
  - Lack of definitions for terminology used by various State licensing authorities
  - Lack of consistency between regulatory agencies for similar uses
  - Some State licensing regulations have more stringent building code requirements for what would be considered lower potential life safety concerns, while others have less stringent regulations where the life safety concern is greater
- There would be some benefit if the various regulatory agencies could agree to and combine exceptions.
- References to the IRC appear confusing as to whether the Virginia IRC provisions or national IRC provisions apply. The most significant difference is the fire sprinkler requirement for the national IRC that have been deleted in Virginia.

Solutions and Paths Forward

- Add administration section to VCC, similar to what was added to the 2015 VEBC.
    - Section 101.5 “Use of terminology and notes.” The provisions of this code shall be used as follows….
        - 6. References to International Codes and standards, where used in this code, include state amendments made to those International Codes and standards in the VCC.

2018 VCC Code Change Language:

101.5 Use of terminology and notes. The provisions of this code shall be used as follows:

1. The term “this code,” or “the code,” where used in the provisions of Chapter 1, in Chapters 2 - 35 of the IBC or in the state amendments to the IBC, means the USBC, unless the context clearly indicates otherwise.

2. The term “this code” or “the code” where used in a code or standard referenced in the IBC, means that code or standard, unless the context clearly indicates otherwise.

3. The use of notes in Chapter 1 is to provide information only and shall not be construed as changing the meaning of any code provision.

4. Notes in the IBC, in the codes and standards referenced in the IBC, and in the state amendments to the IBC, may modify the content of a related provision and shall be considered to be a valid part of the provision, unless the context clearly indicates otherwise.

<u>5. References to International Codes and standards, where used in this code, include state amendments made to those International Codes and standards in the VCC.</u>

- Creation of a matrix with all of the various State Health and Mental Health agencies building code use group designations and exceptions that allow a less restrictive level of safety.
- See if there is a path forward to bringing the various State Health and Mental Health stakeholders together to see if their regulations could be modified to bring uniformity to hazard levels and use group designations.
- There should be a definition for “self-preservation” or “physical assistance during an emergency”.
    - DSS stated that they consider care recipient capable of self-preservation if it only takes one verbal command to respond.

**Recovery Homes**

- Recovery homes are utilizing existing homes, and some have been reported to have over twenty residents.
- Does this use more resemble an R4 or R5?
- Currently, there are no licensing or building code necessities beyond the current R5

- GA passed a requirement for certification in 2019 with HB 2045
- The following is a national organization's explanation of Recovery Homes:

> Recovery Housing refers to safe, healthy, and substance-free living environments that support individuals in recovery from addiction. While recovery residences vary widely in structure, all are centered on peer support and a connection to services that promote long-term recovery. Recovery housing benefits individuals in recovery by reinforcing a substance-free lifestyle and providing direct connections to other peers in recovery and recovery services and supports.
>
> Many residents live in recovery housing during and/or after outpatient addiction treatment. Length of stay is self-determined and can last for several months to years. Residents often share resources, give experiential advice about how to access health care and social services, find employment, budget and manage finances, handle legal problems, and build life skills. Many recovery homes are organized under the leadership of house manager and require residents to participate in a recovery program, such as 12-step and other mutual aid groups.
>
> Recovery housing ranges from independent, resident-run homes to staff-managed residences where clinical services are provided. The National Alliance of Recovery Residences (NARR) has classified four levels of recovery residences; the levels are differentiated by the rules and organizational structure of the house, and the types of services and supports that are provided within the home. Additionally, NARR provides ethical principles and measurable quality standards for operating recovery housing across the four levels (see https://narronline.org/resources/).

- Questions to be answered by the sub-workgroup:
  - Is there a need for building code provisions?
  - Should the uses be limited in occupancy similar to lodging houses
  - Should minimum life safety requirements be required:
    - Interconnected smoke detection
    - Occupancy standards based on space available
    - Fire extinguishers
    - Staff and occupant safety training
    - Minimum plumbing fixtures based on number of occupants
    - Others not currently listed

**In-Home Hospice Facilities (Hospice Homes)**

- There appears to be no minimum/maximum for a licensing threshold.
- Current Virginian Regulations

12VAC5-391-120. Hospice Facilities.

- A. Providers seeking to operate a hospice facility shall comply with the appropriate facility licensing regulation as follows:
- 1. Facilities with 16 or fewer beds shall be licensed as a hospice facility pursuant to this chapter. Such facilities with six or more beds shall obtain a Certificate of Use and Occupancy with a Use Group designation of I-2; or
- 2. Facilities with more than 16 beds shall be licensed as a hospital pursuant to 12VAC5-410 or as a nursing facility pursuant to 12VAC5-371. Such facilities shall obtain the applicable Certificate of Public Need prior to the development or construction of the facility.
- B. Only patients diagnosed terminally ill shall be admitted to a hospice facility. The facility shall admit only those patients whose needs can be met by the accommodations and services provided by the facility.
- C. To the maximum extent possible, care shall be provided in the patient's home. Admission to a hospice facility shall be the decision of the patient in consultation with the patient's physician. No patient shall be admitted to a hospice facility at the discretion of, or for the convenience of, the hospice provider, the primary caregiver, or the family.
- D. All hospice providers operating a hospice facility shall use its facility to provide, to the extent possible, respite and symptom management services to all patients in the hospice program needing such services.
- E. No hospice facility shall receive patients for care, palliative treatment, respite, or symptom management services in excess of its licensed bed capacity.
- F. No hospice facility provider shall add additional patient beds or renovate facility space without first notifying the OLC. OLC notifications must be in writing to the director of the OLC.
- G. The OLC will not accept any requests for variances to this section.
- **Statutory Authority** §§ 32.1-12 and 32.1-162.5 of the Code of Virginia.
- **Historical Notes** Derived from Volume 21, Issue 23, eff. November 1, 2005; amended, Virginia Register Volume 24, Issue 11, eff. March 5, 2008; Volume 27, Issue 11, eff. March 2, 2011.

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12VAC5-391-40. Exemption from Licensure.

- A. This chapter is not applicable to hospice programs described in § 32.1-162.2 of the Code of Virginia.

- B. The hospice program must file a request for exemption from licensure in writing to the director of the OLC. The request shall contain documentation explaining the hospice program's relationship to the practice of religious tenets of a recognized church or denomination.
- C. The hospice program shall be notified in writing that the exemption from licensure has been registered.
- D. Exempt hospice programs shall remain subject to complaint investigations in keeping with state law.

- **Statutory Authority** §§ 32.1-12 and 32.1-162.5 of the Code of Virginia.
- **Historical Notes** Derived from Volume 21, Issue 23, eff. November 1, 2005; amended, Virginia Register Volume 24, Issue 11, eff. March 5, 2008; Volume 26, Issue 26, eff. September 30, 2010.

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12VAC5-391-440. General Facility Requirements.

PART IV. HOSPICE FACILITIES

- A. All construction of new buildings and additions, renovations or alterations of existing buildings for occupancy as a hospice facility shall conform to state and local codes, zoning and building ordinances and the Uniform Statewide Building Code.
- In addition, hospice facilities shall be designed and constructed according to section 4.2 of Part 4 of the 2006 Guidelines for Design and Construction of Health Care Facilities of the American Institute of Architects. However, the requirements of the Uniform Statewide Building Code and local zoning and building ordinances shall take precedence.
- B. All buildings shall be inspected and approved as required by the appropriate regional state fire marshal's office or building and fire regulatory official. Approval shall be a Certificate of Use and Occupancy indicating the building is classified for its proposed licensed purpose.
- C. The facility must have space for private patient family visiting and accommodations for family members after a patient's death. Patients shall be allowed to receive guests, including small children, at any hour.
- D. Patient rooms shall not exceed two beds per room and must be at grade level or above, enclosed by four ceiling-high walls. Each room shall be equipped for adequate nursing care, the comfort and privacy of patients, and with a device for calling the staff member on duty.

- E. Designated guest rooms for family members or patient guests and beds for use by employees of the facility shall not be included in the bed capacity of a hospice facility provided such beds and locations are identified and used exclusively by staff, volunteers or patient guests.
- Employees shall not utilize patient rooms nor shall bedrooms for employees be used by patients.
- F. Waste storage shall be located in a separate area outside or easily accessible to the outside for direct pickup or disposal. The use of an incinerator shall require permitting from the nearest regional permitting office for the Department of Environmental Quality.
- G. The facility shall provide or arrange for under written agreement, laboratory, x-ray, and other diagnostic services, as ordered by the patient's physician.
- H. There shall be a plan implemented to assure the continuation of essential patient support services in case of power outages, water shortage, or in the event of the absence from work of any portion of the workforce resulting from inclement weather or other causes.
- I. No part of a hospice facility may be rented, leased or used for any purpose other than the provision of hospice care at the facility.
- J. A separate and distinct entrance shall be provided if the program intends to administer and provide its community-based hospice care from the facility so that such traffic and noise shall be diverted away from patient care areas.
- K. The hospice facility shall maintain a complete set of legible "as built" drawings showing all construction, fixed equipment, and mechanical and electrical systems, as installed or built.

- **Statutory Authority** §§ 32.1-12 and 32.1-162.5 of the Code of Virginia.
- **Historical Notes** Derived from Volume 21, Issue 23, eff. November 1, 2005; amended, Virginia Register Volume 27, Issue 11, eff. March 2, 2011.

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12VAC5-391-445. Additional Building Regulations and Standards.

- A. Water shall be obtained from an approved water supply system. Hospice facilities shall be connected to sewage systems approved by the Department of Health or the Department of Environmental Quality.
- B. Each hospice facility shall establish a monitoring program for the internal enforcement of all applicable fire and safety laws and regulations.

- C. The hospice facility's food services shall comply with 12VAC5-421, as applicable.
- D. A hospice facility's pharmacy services shall comply with Chapters 33 (§ 54.1-3300 et seq.) and 34 (§ 54.1-3400 et seq.) of Title 54.1 of the Code of Virginia and 18VAC110-20.
- **Statutory Authority** §§ 32.1-12 and 32.1-162.5 of the Code of Virginia.
- **Historical Notes** Derived from Volume 27, Issue 11, eff. March 2, 2011.

**There was no additional action on this item and it will be carried over to the second meeting.**

**There were no additional items for consideration.**

**The meeting was adjourned at 2:15 PM**
**(Continued)**
**Items received after the meeting was adjourned:**

**From: Revels, Gregory <rev04@henrico.us>**
**Sent: Friday, August 17, 2018 10:21 AM**
**To: Clements, Ron <ClementsRo@chesterfield.gov>; Gordon, Richard T. <RTGordon@hanovercounty.gov>; Allen, Bob <all56@henrico.us>; Scott, Chris <sco052@henrico.us>; Fisher, Gary <gfisher@goochlandva.us>; cindy.davis@dhcd.virginia.gov**
**Subject: Re: Alcohol/Substance Abuse Recovery Homes**

**Group - I have added Cindy Davis and Gary Fisher to this discussion. Cindy because maybe she can add insight from what she is hearing from DSS and BHDS, Gary because he has also worked on this issue previously. A few additional points to discuss.**

**1) Non-transient rental homes (boarding houses, congregate living, alcohol/drug recovery houses, etc.) vs. single-family dwellings. Seems to me there should be an allowable occupancy limit where these can be classified as R-5 single-family dwellings vs. R-3. Otherwise, all rental dwellings in college towns are R-3 and require sprinklers. The transient uses (Airbnb's, bed and breakfasts, etc.) already get a break here with up to 10 occupants/5 bedrooms for rent with no sprinklers so should up to 10 be allowed for non-transient in R-5 as well? A single family dwelling in a subdivision gets converted to an alcohol recovery house and goes from R-5 to R-3 and it gets sprinklered regardless of # of occupants? doesn't seem consistent if the facility does not require licensing because no care is being provided.**

**2) It appears that 310.5.1 actually has no real application as any facility that provides "care" is subject to State licensure from DSS or BHDS which puts you into the exceptions in 310.6. Can 310.5.1 be deleted or are there care facilities out there that are not required to be licensed by the State?**
**3) 310.6 Exception #2 allows facilities (except hospice) to have up to 5 residents that require physical assistance when the occupancy meets Occupancy Condition 1 @ 310.6.1. Occupancy Condition 1 requires that all residents be capable of responding without assistance thus the exception conflicts with 310.6.1. Why this provision is here at all - especially as an exception to 310.6 vs. a subsection? Can this exception be deleted or does it have any application?**
**4) Per 310.1, single family dwellings are regulated via the IRC and actually don't have an occupancy classification, yet we have assigned it R-5 in 310 of the VCC. 310.1 should be revised to be consistent with the amendments.**
**5) I cannot find any use of the defined term "personal care service" - at least not in 310.**
**6) The height and area limits for R-1, R-2 and R-4 are all the same. R-3 is UL area and 3 Stories for Type 5, 4 Stories for Types 2-4, and UL for Type 1 construction.**

**Gregory H. Revels**
**Building Official**
**Department of Building Construction & Inspections**
**Telephone: 804/501-4374**
**Fax: 804/501-4984**

**_____**

**From: Fisher, Gary <gfisher@goochlandva.us>**
**Sent: Wednesday, August 22, 2018 5:00 PM**
**To: Revels, Gregory <rev04@henrico.us>; Clements, Ron <ClementsRo@chesterfield.gov>; Gordon, Richard T. <RTGordon@hanovercounty.gov>; Allen, Bob <all56@henrico.us>; Scott, Chris <sco052@henrico.us>; cindy.davis@dhcd.virginia.gov**
**Subject: RE: Alcohol/Substance Abuse Recovery Homes**

**One more thing.**

**The 2012 ICC Commentary under “Personal Care Services” indicates that there are three types of “care”:**

**Personal – occupants are supervised but do not need custodial or medical care**

**Custodial – elderly and/or impaired occupants supervised but are capable of self-preservation, may need assistance with everyday tasks such as cooking and cleaning**

**Medical – supervised occupants bedridden and dependent medical on medical gases and emergency power to maintain life**

**GLF**

**Residential Use Sub-Workgroup**

**May 31, 2019**

**Attending:**

| | |
|---|---|
| Kenney Payne | AIA |
| Cheri Hainer | Virginia Beach |
| Shawn Pharr | AOBA |
| Jason Laws | Chesterfield County |
| Sharon Stroble | Va Department of SS |
| Judit McGreal | Va Department of SS |
| Ron Clements | Chesterfield County |
| John Catlett | DHCD (Catlett Code Consulting) |
| Jeff Brown | DHCD |

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**Attached Accessory Dwelling Units (AADU)**

The group reviewed the change submitted by Shahriar Amiri:

> **DWELLING UNIT.** A single unit providing complete independent living facilities for one or more persons, including permanent provisions for one or more living, sleeping, eating, cooking and sanitation.

After discussion by those in attendance, it was felt that this proposal was too broad and had many unintended consequences. The group felt that there should be a limit of not more than one unit and one of the units must contain the property owner to be eligible. Without those limitations, the proposal would be basically making R2 designations obsolete. There was consensus that the change did not capture the conversation from the previous meeting that would limit the scope of an additional unit in an owner- occupied dwelling.

Further discussions took us back to previous proposals. After consideration of unintended consequences such as lack of interconnected smoke detection, lack of emergency egress and rescue openings, etc., the following proposal was crafted.

**B310.8.2-18: 1 (New)**

**Proponent:** Residential Use Subworkgroup

**2015 Virginia Construction Code**

**Add new text as follows:**

**310.8.2 Accessory dwelling unit.** Where one unit is occupied by the owner, not more than one additional dwelling unit shall be permitted in the same building without meeting the VRC requirements for two-family dwellings, provided the following are met:

1. Smoke alarms are installed in compliance with Section R314 of the VRC and interconnected in such a manner that actuation of one alarm will activate all of the alarms in both units.

2. Every sleeping room complies with Section R310 of the VRC.

Proposal # 205

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B310.8.2-18

There was unanimous agreement by those present to move the change forward.

**Other residential uses:**

Due to an emergency absence by Greg Revels, complete review of hi proposal was deferred until the end of the meeting. A review of the matrix created by Kenney Payne was conducted with Kenney leading us through the document. Everyone felt that the work was excellent and a good start to a matrix to be included in the USBC. However, it would need further review and modification should the proposals by Greg Revels become part of a final package. Discussion on where a matrix could be placed in the code followed. Options includes in Chapter 3 under the residential uses, an appendix to the code, or in the Related Laws documents where there are currently MOUs and other matrix type items to help code users.

A brief review of Greg's proposals was performed. The group listed questions as side notes to the document available under the review tab in Word. The group felt it better to keep the review cursory until the next meeting when Greg could be present to walk us through the document.

The meeting concluded at 3:30 PM.

**Residential Sub-workgroup Meetings**

**July 10 and July 16, 2019**

**9:30 AM**

The notes from the July 10 and July 16 meetings are combined as the subjects are a continuation on the discussion of state regulated care facilities and how they apply to the residential provisions of the IBC.

**Attending:**

| | | |
|---|---|---|
| Kenney Payne | AIA | Both meetings |
| Jason Laws | Chesterfield County | Both meetings |
| Ron Clements | Chesterfield County | Both meetings |
| Greg Revels | Henrico County | Both meetings |
| Pam Kestner | DHCD-Division of Housing | July 10 |
| Shaun Pharr | AOBA | July 10 |
| Judith McGreal | Va Department of SS | July 10 |
| Sharon Stroble | Va Department of SS | July 16 |
| Heather Trickle | Va Behavioral Health | July 16 |
| Shahriar Amiri | Arlington County | July 16 |
| Thom Stanton | Tiny House Industry | July 16 |
| Kristen Yavorsky | Va Behavioral Health | July 16 |
| Mark Blackwell | DBHD | July 16 |
| John Catlett | DHCD (Catlett Code Consulting) | |
| Jeff Brown | DHCD | |

**July 10, 2019**

The work group held a meeting on July 10 to discuss the proposal by Greg Revels introduced at the previous meeting. Greg is intending to make the application of the residential use groups consistent with hazards instead of pigeon-holing laundry list within R1, R2, R3, R4, and R5. This included better clarification of state regulated and licensed facilities typically found in residential occupancies.

The proposal basically removed laundry list that were representations of uses but not considered complete. It then attempted to place the state regulated care facilities within the text of each code section.

**Proposal:**

**See notes from last meeting attached to section**

# SECTION 310
# RESIDENTIAL GROUP R

# 310.1Residential Group R.

Residential Group R includes, among others, the use of a *building* or *structure*, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the ~~*International*~~ *Virginia Residential Code*.

# 310.2Definitions.

The following terms are defined in Chapter 2:

**BOARDING HOUSE.**

**CONGREGATE LIVING FACILITIES.**

**DORMITORY.**

**GROUP HOME.**

**GUEST ROOM.**

**LODGING HOUSE.**

**PERSONAL CARE SERVICE.**

**TRANSIENT.**

# 310.3 Residential Group R-1.

Residential occupancies with more than 10 occupants ~~containing sleeping units~~ where the occupants are primarily transient ~~in nature, including~~:

- ~~Boarding houses (transient) with more than 10 occupants~~
- ~~Congregate living facilities (transient) with more than 10 occupants~~
- ~~Hotels (transient)~~
- ~~Motels (transient)~~

~~**Exceptions:**~~

~~1.Nonproprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height with a maximum of 10 occupants total are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.~~

~~2.Proprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height, that are also occupied as the residence of the proprietor, with a maximum of five guest room sleeping units provided for the transient occupants are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.~~

# 310.4Residential Group R-2.

Residential Group R-2 occupancies containing *sleeping units* or more than two *dwelling units* where the occupants are not primarily transient ~~permanent in nature, including:~~

- ~~Apartment houses~~
- ~~*Boarding houses* (nontransient) with more than 16 occupants~~
- ~~*Congregate living facilities* (nontransient) with more than 16 occupants~~
- ~~Convents~~
- ~~*Dormitories*~~
- ~~Fraternities and sororities~~
- ~~Hotels (nontransient)~~
- ~~*Live/work units*~~
- ~~Monasteries~~
- ~~Motels (nontransient)~~
- ~~Vacation timeshare properties~~

## 310.5 Residential Group R-3.

Residential Group R-3 occupancies where the occupancy is not classified as Group R-1, R-2, R-4, R-5 or I~~,~~ ~~including~~ and the building contains no more than two *dwelling units and:*

1. *The* occupants are *not* primarily *transient* ~~permanent in nature,~~ or
2. There are no more than 10 transient occupants per dwelling unit,

- ~~Buildings that do not contain more than two *dwelling units*~~
- ~~*Boarding houses* (nontransient) with 16 or fewer occupants~~
- ~~*Boarding houses* (*transient*) with 10 or fewer occupants~~
- ~~Care facilities that provide accommodations for five or fewer persons receiving care~~
- ~~*Congregate living facilities* (nontransient) with 16 or fewer occupants~~
- ~~*Congregate living facilities* (*transient*) with 10 or fewer occupants~~
- ~~*Lodging houses* with five or fewer *guest rooms*~~

## ~~310.5.1Care facilities within a dwelling.~~

~~Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the *International Residential Code* provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the *International Residential Code*.~~

## ~~310.5.2Lodging houses.~~

~~*Owner*-occupied *lodging houses* with five or fewer guest rooms shall be permitted to be constructed in accordance with the *International Residential Code*.~~

## 310.6 Residential Group R-4.

This occupancy shall include buildings, structures or portions thereof for more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive *custodial care*. Buildings of Group R-4, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 310.6.1. Assisted living facilities

licensed by the Virginia Department of Social Services shall be classified as one of the occupancy conditions indicated in Section 310.6.1 or 310.6.2. ~~This group shall include, but not be limited to, the following:~~

- ~~Alcohol and drug centers~~
- ~~Assisted living facilities~~
- ~~Congregate care facilities~~
- ~~Group homes~~
- ~~Halfway houses~~
- ~~Residential board and care facilities~~
- ~~Social rehabilitation facilities~~

This occupancy shall also include hospice facilities with not more than 16 occupants, excluding staff.

Group R-4 occupancies shall meet the requirements for *construction* as defined for Group R-3, except as otherwise provided for in this code.

**Exceptions:**

1.Group homes licensed by the Virginia Department of Behavioral Health and Developmental Services that house no more than eight persons with one or more resident counselors shall be classified as Group R-2, R-3, R-4 or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

2.In Group R-4 occupancies classified as the occupancy condition indicated in Section 310.6.1, other than in hospice facilities, not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a single level of exit discharge and other than using a ramp, a change of elevation using steps or stairs is not within the path of egress to an exit door.

3.Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, and all of the residents are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5.

4.Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, <u>where not more than five of the residents require physical assistance from staff to respond to an emergency</u> <u>situation</u> with one or more resident counselors, may be classified as Group R-5 when in compliance with all of the following:

4.1.The *building* is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.

~~4.2.Not more than five of the residents may require physical assistance from staff to respond to an emergency situation.~~

4.3.All residents who may require physical assistance from staff to respond to an emergency situation reside on a single level of exit discharge and other than using a ramp, a change in elevation using steps or stairs is not within the path of egress to an exit door.

5.Hospice facilities with five or fewer occupants are permitted to comply with the IRC provided the *building* is protected by an automatic sprinkler system in accordance with IRC Section P2904 or IBC Section 903.3.

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## 310.6.1 Condition 1.

This occupancy condition shall include hospice facilities and buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete *building* evacuation ~~and hospice facilities~~.

## 310.6.2 Condition 2.

This occupancy condition shall include buildings in which there are persons receiving *custodial care* who require assistance by not more than one staff member while responding to an emergency situation to complete *building* evacuation.

## *** Radon-resistant construction in Groups R-3 and R-4 structures.

Groups R-3 and R-4 structures shall comply with the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC. Either add to each section or leave in current place and add note under R3 and R4.

## 310.7 Residential Group R-5.

This occupancy shall include residential occupancies in detached single- and two-family dwellings, townhouses and accessory structures within the scope of the IRC. The construction of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.

## ~~310.8 Group R-5.~~

~~The *construction* of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.~~

## 310.~~8~~ 7.1 Additional requirements.

Methods of *construction*, materials, systems, *equipment* or components for Group R-5 structures not addressed by prescriptive or performance provisions of the IRC shall comply with applicable IBC requirements.

(remaining to be renumbered) (IBC to be changed to VCC)

## 310.9 Family day homes.

Family day homes where program oversight is provided by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.

**Note:** Family day homes may generally care for up to 12 children. See the DHCD "Related Laws Package" for additional information.

## ~~310.10 Radon-resistant construction in Groups R-3 and R-4 structures.~~

~~Groups R-3 and R-4 structures shall be subject to the radon-resistant *construction* requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.~~

## 310.11Amendments to the IRC.

The following changes shall be made to the IRC for its use as part of this code:

(DHCD Note: The changes to the IRC are available in the *Virginia Residential Code* published by ICC, or the pamphlet form of the VCC published by DHCD. They are not included in this printing of the VCC.)

***R101.2 Scope.*** *The provisions of the ~~International~~ Virginia Residential Code for One- and Two-family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings, townhouses, and care facilities for five or fewer persons receiving care not more than three stories above grade plane in height with a separate means of egress and their accessory structures. The use of such structures for transient occupancies shall not exceed 10 persons per dwelling unit.*

2018 IBC

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~~308.3.2 Five or fewer persons receiving medical care. A facility with five or fewer persons receiving medical care shall be classified as Group R-3 or shall comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~

~~308.2.4 Five or fewer persons receiving custodial care. A facility with five or fewer persons receiving custodial care shall be classified as Group R-3 or shall comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~

~~308.2.3 Six to 16 persons receiving custodial care. A facility housing not fewer than six and not more than 16 persons receiving custodial care shall be classified as~~

~~Group R-4~~

2018 VCC Code Change Language:

101.5 Use of terminology and notes. The provisions of this code shall be used as follows:

1. The term “this code,” or “the code,” where used in the provisions of Chapter 1, in Chapters 2 - 35 of the IBC or in the state amendments to the IBC, means the USBC, unless the context clearly indicates otherwise.

2. The term “this code” or “the code” where used in a code or standard referenced in the IBC, means that code or standard, unless the context clearly indicates otherwise.

3. The use of notes in Chapter 1 is to provide information only and shall not be construed as changing the meaning of any code provision.

4. Notes in the IBC, in the codes and standards referenced in the IBC, and in the state amendments to the IBC, may modify the content of a related provision and shall be considered to be a valid part of the provision, unless the context clearly indicates otherwise.

5. References to International Codes and standards, where used in this code, include state amendments made to those International Codes and standards in the VCC.

Notes. Need clarification that I2 can include assisted living facilities where 24 hour custodial care is provided as occupants are non-ambulatory.

Should we bring in ambulatory and non ambulatory definition

After a complete review of the code proposal, the group agreed with the concept, but identified several areas that needed further work. The main areas were state regulated facilities that were designated use group I that had thresholds that allowed limited occupancies to be classified within R3 and R4. Kenney Payne offered to take the information from the meeting and create a new proposal.

The group was also asked to review the late submission by Arlington County regarding accessory dwelling units. However, due to storms the previous night the Shariar could not make the meeting or join by phone.

**June 12, 2021**

The group reconvened to review Kenney’s rewrite which was to bring all of uses, properly classified, within the text.

# RESIDENTIAL USE SUB-WORKGROUP

**2018 IBC language:** w/ 2015 VCC amendment language in blue text

Proposed changes submitted by Greg Revels and/or discussed and approved by the workgroup are in green text.

Proposed changes for the workgroup's consideration at the next meeting (July 23?) are in red text or orange text if it was Virginia-amended text being changed.

*Note: 2018 IBC deleted "310.2 Definitions," thus all of the 2018 section numbers should be one less than they were in 2015 (e.g., R-4 was 310.6 under 2015 but is now 310.5 under 2018). The text below has been corrected to match the 2018 IBC section numbers.*

**310.5 Residential Group R-4.** ~~Residential Group R-4~~ This occupancy shall include hospice facilities with not more than 16 occupants, excluding staff; and buildings, structures or portions thereof for more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised ~~residential~~ environment and receive custodial care. Buildings of Group R-4~~, other than assisted living facilities licensed by the Virginia Department of Social Services,~~ shall be classified as one of the occupancy condition~~s~~ ~~specified~~ ~~indicated~~ specified in Section 310.5.1 ~~or 310.5.2~~ or 310.5.2. ~~Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancy conditions indicated in Sections 310.5.1 or 310.5.2.~~ ~~This group shall include, but not be limited to, the following:~~ Group R-4 occupancies shall comply with the requirements for construction as required for Group R-3, except as otherwise provided for in this code; and shall comply with the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.

*[Note: References to licensed facilities have been relocated under the appropriate "Condition"]*

~~Alcohol and drug centers~~
~~Assisted living facilities~~
~~Congregate care facilities~~
~~Group homes~~
~~Halfway houses~~
~~Residential board and care facilities~~
~~Social rehabilitation facilities~~

~~This occupancy shall also include hospice facilities with not more than 16 occupants, excluding staff.~~

*[Note: This provision was relocated to 310.5 in the first sentence – which is consistent with the change the workgroup did under 310.5.1.]*

~~Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in this code.~~

*[Note: This provision was relocated to 310.5 as the last sentence – to avoid a "dangling" paragraph.]*

DRAFT

After review, the group felt that the text was actually more confusing than before. The group discussed several options before making the decision that the easiest and best way to clarify the appropriate uses for the residential state regulated facilities was to create a totally new section in Chapter 4 that creates each SRF and appropriate residential use with thresholds. The group worked on producing the first draft as follows:

*B302.1-18 302.1, SECTION 432 (New)*

*Proponents: Residential Use Subworkgroup (dhcdresidentialuse@gmail.com)*

*2015 Virginia Construction Code*

*STATE REGULATED CARE FACILITY (SRCF). A building with an occupancy in Group R-2, R-3, R-4, R-5 or R-5 I occupied by persons in the care of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education, the Virginia Department of Health or the Virginia Department of Juvenile Justice.*

*302.1 General. Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in this section. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.*

*1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.*

*2. Business (see Section 304): Group B.*

*3. Educational (see Section 305): Group E.*

*4. Factory and Industrial (see Section 306): Groups F-1 and F-2.*

*5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.*

*6. Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4.*

*7. Mercantile (see Section 309): Group M.*

*8. Residential (see Section 310): Groups R-1, R-2, R-3 and R-4.*

*9. Storage (see Section 311): Groups S-1 and S-2.*

*10. Utility and Miscellaneous (see Section 312): Group U.*

*11. State Regulated Care Facilities (see Section 432)*

*Add new text as follows:*

*SECTION 432State Regulated Care Facilities*

*432.1 General. Not withstanding any other requirements of this code, this section applies to the use and occupancy classification of licensed state regulated care facilities addressed in this section.*

*432.2 Assisted Living Facilities. Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancies specified in sections 432.2.1 through 432.2.6.*

*432.2.1 Group I-1 Condition 1. Facilities with seventeen or more persons receiving care, in which all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.*

*Note: These facilities would be licensed as ambulatory facilities by the Virginia Department of Social Services.*

*432.2.2 Group I-1 Condition 2. Facilities with seventeen or persons receiving care, in which there are persons who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 2. Not more than five of the persons may require physical assistance from more than one staff member to respond to an emergency situation.*

*Note: These facilities would be licensed as non-ambulatory facilities by the Virginia Department of Social Services.*

*432.2.3 Group I-2 Condition 1. Facilities with six or more persons receiving care who require assistance by more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group I-2 Condition 1.*

*Note: These facilities would be licensed as non-ambulatory facilities by the Virginia Department of Social Services.*

*432.2.4 Group R-4 Condition 1. Facilities with nine to sixteen persons receiving care, where all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.*

*Note: These facilities would be licensed as ambulatory by the Virginia Department of Social Services.*

*432.2.5 Group R-4 Condition 2. Buildings with nine to sixteen persons receiving care, who may require assistance by not more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group R-4 Condition 2. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.*

*Note: These facilities would be licensed as non-ambulatory by the Virginia Department of Social Services.*

*432.2.6 Group R-2, R-3 or R-5. Facilities with no more than eight persons receiving care, with one or more resident counselors, and all persons are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5. Up to five of the persons may*

*require physical assistance from staff to respond to an emergency situation when in compliance with the following:*

*1. All residents that require physical assistance from staff reside on a level of exit discharge and the path of egress to the exit does not include steps.*

*2. The building is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC*

*Note: These facilities would be licensed as ambulatory by the Virginia Department of Social Services.*

*432.3 Family Day Homes. Family day homes registered or licensed by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.*

*432.4 Group Homes. Group Homes licensed by the Virginia Department of Behavioral Health and Developmental Services shall be classified as one of the occupancies specified in sections 432.4.1 through 432.4.3.*

*432.4.1 Groups R-2, R-3, R-4 Condition 1 or 2 or R-5. Facilities with no more than eight persons receiving care, with one or more resident counselors, shall be classified as Group R-2, R-3, R-4 (Condition 1 or 2) or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.*

*432.4.2 Group R-4 Condition 1. Facilities with eight to sixteen persons receiving care, where all persons, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as Group R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.*

*432.4.3 Group R-4 Condition 2. Facilities with eight to sixteen persons receiving care or facilities with more than five persons requiring physical assistance from staff to respond to an emergency situation shall be classified as Group R-4 Condition 2.*

*432.5 Hospice Facilities. Hospice facilities licensed by the Virginia Department of Health shall be classified as one of the occupancies specified in sections 432.5.1 through 432.5.3.*

*432.5.1 Group I-2. Facilities with sixteen or more persons receiving care shall be classified as Group I-2.*

*432.5.2 Group R-4 Condition 1. Facilities with less than sixteen persons receiving care shall be classified as Group R-4 Condition 1.*

*432.5.3 Group R-5. Facilities with five or fewer persons receiving care are permitted to be classified as Group R-5.*

*Reason Statement: This proposal is not intended to make any significant changes to the requirements or classifications of SRCFs, but to simplify application of the existing requirements (exceptions) by putting all use group classification requirements for SRCFs together in Chapter 4. This proposal is not completed, but is intended to give an idea of the concept that is being utilized to complete this clean up effort. The Residential Uses Subworkgroup plans to continue working on this proposal by identifying any other*

*licensed facilities that may also need to be included in the new section and deleting any existing state amendments throughout VCC Chapter 3 that are covered in the new Section 432.*

*Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency*

*No impact on resiliency.*

*Cost Impact Statement: The code change proposal will not increase or decrease the cost of construction*

*No impact on cost*

The group was joined by Shariar by phone so he could go over his submittal. The group felt that the Arlington proposal was too broad utilizing multiple units. The group also felt that the group's consensus proposal covered what was intended without the modification.

Arlington County Proposal

Summary and Discussion point:

As noted in the minutes of the meeting, most urban areas such as Arlington are experiencing high housing costs and affordability has become a crisis, both for new families and individuals and for the elderly that desire to age in place. High real estate assessments mean higher taxes for elderly that are on a fixed income. The desire is to allow part of existing dwelling units to be occupied by both transient lodgers (such as Airbnb) or long-term renters that desire some degree of independence and privacy from an owner-occupied dwelling. The challenge is to codify these intermittent uses within a dwelling unit while maintaining the true character of a single dwelling unit such as a common entrance and egress, common utilities, etc. We also noted that family relationship does not affect the application of the building code. As such, if a single dwelling unit has the appropriate area for a bedroom or living space and is equipped with appropriate egress and detection facility, the building code does not limit the number of occupants in a dwelling unit based on relationship. Furthermore, we discussed whether a separate use group classification for such accessory uses (i.e.; R-6) would make sense. As a practicing building code professional for over 34 years, I keep coming back to a simple interpretation that I (and many others) have believed in (perhaps wrongly so) for a long time. That interpretation stems from a fact that every-time I see a separate cooking facility, I question whether code-wise, that constitutes a separate dwelling unit. I never question whether there are more than one bedroom, living or bathing facility constituting a separate dwelling unit. My intentions are not to change the physical character of a dwelling unit as we see it today, but to allow homeowners to offer additional affordable housing options while creating a source of income to the elderly. I have struggles for a couple years to codify and legalize the use of an accessory dwelling unit or short-term rental in a dwelling unit but keep coming back to a fundamental mis-interpretation of the code. So, I propose to clarify the definition of a dwelling unit as stated below:

***DWELLING UNIT.A single unit providing complete independent living facilities for one or more persons, including permanent provisions for one or more living, sleeping, eating, cooking and sanitation.***

I believe this proposal solves the issue that if a separate cooking facility is constructed for a mother-in-law suite, a care-giver suite or an accessory dwelling unit, the code would not classify those accessory

uses as a separate dwelling unit so long as the swelling unit meets/met all the requirements of the Virginia Residential Code at the time of the construction. I also considered changing Virginia Existing Building Code/ Rehab Code to require retro-active requirements for inter-connected smoke detectors when such accessory uses are established. I decided against it since such use would not be considered a change of use and would not require a permit. The enforcement of such requirements would be problematic in my opinion. I look forward to our discussion tomorrow and await further direction from the group.

Additional Proposal 2.

*Accessory Dwelling Unit*

*DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. For the purpose of this code, an Accessory dwelling unit shall be considered as part of the main dwelling unit.*

*Accessory Dwelling Unit: An independent living, sleeping, cooking and sanitation facility within a single dwelling unit.*

Justification: with the rise of housing and real estate prices and the need for elderly to be able to age in place, it becomes necessary for some households to create independent living facility for elder parents or as a source of income for rental purposes. This change is not intended to replace the requirements established for two-dwelling units which is characteristically different than an accessory dwelling unit.

**Tiny House Proposals**

The group discussed tiny house proposals including one submitted by Thom Stanton. The group felt there was consensus to move the adoption of appendix Q without repeating the language. The proposal is as follows:

*Proponents: Residential Use Subworkgroup*

*2015 Virginia Residential Code*

*Add new text as follows:*

*R332*

*TINY HOUSES*

*R332 General.*

*Appendix Q may be used as an alternative to the requirements of this code where a dwelling is 400 square feet (37 m2) or less in floor area.*

Reason Statement: This proposal introduces a new section that would allow the use of Appendix Q, which contains provisions specific to tiny homes. The appendix gives special considerations to elements such as ceiling heights, stairways, landings, handrails, guards, etc.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency

This proposal will neither increase nor decrease Resiliency

Cost Impact Statement: The code change proposal will not increase or decrease the cost of construction

The code change proposal will not increase or decrease the cost of construction

The meeting adjourned at 4:05 PM

# Residential Uses Sub-Workgroup
# August 9, 2019

## Attendees:

| | |
|---|---|
| Kenney Payne | AIA (on the phone) |
| Peter Broadbent | VCTA |
| Sharon Stroble | DSS |
| Judith McGreal | DSS |
| Ron Clements | Chesterfield County/VBCOA |
| Mackenzie Glassco | DBHDS |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Nicole Donaldson | DHCD |

_____

**Welcome/Introductions**

**Discussion of proposals**

**BAQ104.1.2-18 (Tiny Homes)**

The meeting began with a recommendation from Mr. Stanton to edit the "Tiny Homes Appendix Q" proposal (BAQ104.1.2-18), that was previously reviewed and supported by the group, to include a requirement that ladders providing access to loft areas be designed for a minimum 300 lb. load. This change was agreed to by the group. DHCD staff will update the proposal to include this change. This proposal will be on the August 21st combined workgroup 1-4 meeting agenda.

**B302.1-18 (SRCFs)**

This proposal was only partially completed when presented to workgroups 1 and 2 at their July 24th meeting, to give an idea of the concept that the subworkgroup had in mind (eliminate the laundry lists under the Group R use group classifications and replace with specific characteristics of each use; move all of the SRCF exceptions to a new section in Chapter 4). The workgroups generally supported the concept and the proposal was carried over to the August 21st combined workgroup 1-4 meeting.

The group began reviewing a completed draft of the proposal that was submitted by Mr. Payne. The following suggestions and concerns raised during the July 24th workgroup meeting were incorporated and addressed during review of the draft:

- Family Day Homes are described as "generally up to 12 children". Some may be approved for over 12.

- Proposals B310.3(1)-18 and B310.3(2) were also tabled during the July 24th workgroup meeting, to be coordinated with this proposal, as they were also amending the R-1 use group description.
- Adding a reference in Section 302.1, to the new Chapter 4 SRCF section, should not be done by adding #11 to the existing list of occupancy classifications.

A few additional changes were made based on comments and discussions during review of the draft. The final draft that was approved by the group is attached. DHCD staff will update the proposal in cdpVA to include all changes. This proposal will be on the August 21st combined workgroup 1-4 meeting agenda.

**B310.1-18 (R Uses Clean Up)**

This proposal was carried over at the July 24th workgroup 1 & 2 meeting, to the August 21st combined workgroup 1-4 meeting. The group agreed to merge this proposal with B302.1-18. All changes previously agreed to in this proposal were included in the draft B302.1-18 proposal from Mr. Payne that was reviewed and finalized. This proposal will be withdrawn.

# B302.1-18 FINAL DRAFT

## SECTION 101
## GENERAL

**101.5 Use of terminology and notes**. The provisions of this code shall be used as follows:

1. The term “this code,” or “the code,” where used in the provisions of Chapter 1, in Chapters 2–35 of the IBC or in the state amendments to the IBC, means the USBC, unless the context clearly indicates otherwise.
2. The term “this code” or “the code,” where used in a code or standard referenced in the IBC, means that code or standard, unless the context clearly indicates otherwise.
3. The use of notes in Chapter 1 is to provide information only and shall not be construed as changing the meaning of any code provision.
4. Notes in the IBC, in the codes and standards referenced in the IBC, and in the state amendments to the IBC, may modify the content of a related provision and shall be considered to be a valid part of the provision, unless the context clearly indicates otherwise.
5. References to International Codes and standards, where used in this code, include state amendments made to those International Codes and standards in the VCC.

## SECTION 202
## GENERAL DEFINITIONS

**STATE REGULATED CARE FACILITY (SRCF)**. A building ~~with an occupancy in Group R-2, R-3, R-4, R-5 or R-5~~ occupied by persons in the care of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education, the Virginia Department of Health or the Virginia Department of Juvenile Justice.

## SECTION 302
## CLASSIFICATION

**302.1 General.** Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in this section. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
2. Business (see Section 304): Group B.

3. Educational (see Section 305): Group E.
4. Factory and Industrial (see Section 306): Groups F-1 and F-2.
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.
6. Institutional (see Section 308 and Section 432 for SRCFs): Groups I-1, I-2, I-3 and I-4.
7. Mercantile (see Section 309): Group M.
8. Residential (see Section 310 and Section 432 for SRCFs): Groups R-1, R-2, R-3 and R-4.
9. Storage (see Section 311): Groups S-1 and S-2.
10. Utility and Miscellaneous (see Section 312): Group U.

## SECTION 308
## INSTITUTIONAL GROUP I

**308.1 Institutional Group I**. Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are not capable of self-preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4.

**308.2 Institutional Group I-1**. This occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive custodial care. Buildings of Group I-1~~, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 308.3.1. Assisted living facilities licensed by the Virginia Department of Social Services~~ shall be classified as one of the occupancy conditions indicated in Section 308.2.1 or 308.2.2. ~~This group shall include, but not be limited to, the following:~~

~~Alcohol and drug centers~~

~~Assisted living facilities~~

~~Congregate care facilities~~

~~Group homes~~

~~Halfway houses~~

~~Residential board and care facilities~~

~~Social rehabilitation facilities~~

**308.2.1 Condition 1**. This occupancy condition shall include buildings in which all persons receiving custodial care who, without any assistance, are capable of responding to an emergency situation to complete building evacuation. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents that may require the physical assistance reside on a single level of exit discharge.

**308.2.2 Condition 2**. This occupancy condition shall include buildings in which there are persons receiving custodial care who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation. Five of the residents may require physical assistance from more than one staff member to respond to an emergency.

**308.2.3 Six to 16 persons receiving custodial care**. ~~A facility housing not fewer than six and not more than 16 persons receiving custodial care shall be classified as Group R-4.~~

**308.2.4 Five or fewer persons receiving custodial care**. ~~A facility with five or fewer persons receiving custodial care shall be classified as Group R-3 or shall comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~

**308.3 Institutional Group I-2**. This occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation. ~~This group shall include, but not be limited to, the following:~~

~~Convalescent facilities~~

~~Detoxification facilities~~

~~Foster care facilities~~

~~Hospice facilities~~

~~Hospitals~~

~~Nursing homes~~

~~Psychiatric hospitals~~

~~**Exception**: Hospice facilities occupied by 16 or less occupants, excluding staff, are permitted to be classified as Group R-4.~~

**308.3.1 Occupancy Conditions**. Buildings of Group I-2 shall be classified as one of the occupancy conditions specified in Section 308.3.1.1 or 308.3.1.2.

**308.3.1.1 Condition 1**. This occupancy condition shall include facilities that provide nursing and medical care but do not provide emergency care, surgery, obstetrics or in-patient stabilization units for psychiatric or detoxification, including but not limited to nursing homes and foster care facilities.

**308.3.1.2 Condition 2**. This occupancy condition shall include facilities that provide nursing and medical care and could provide emergency care, surgery, obstetrics or in-patient stabilization units for psychiatric or detoxification, including but not limited to hospitals.

**308.3.2 Five or fewer persons receiving medical care**. ~~A facility with five or fewer persons receiving medical care shall be classified as Group R-3 or shall comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~

## SECTION 310
## RESIDENTIAL GROUP R

**310.1 Residential Group R**. Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the ~~International Residential Code~~ VRC.

**310.2 Residential Group R-1**. Residential occupancies ~~containing sleeping units~~ with more than 10 occupants where the occupants are primarily transient. ~~in nature, including:~~

~~Boarding houses (transient) with more than 10 occupants~~

~~Congregate living facilities (transient) with more than 10 occupants~~

~~Hotels (transient)~~

~~Motels (transient)~~

~~**Exceptions**:~~

1. ~~Nonproprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height with a maximum of 10 occupants total are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5~~

2. ~~Proprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height, that are also occupied as the residence of the proprietor, with a maximum of five guest room sleeping units provided for the transient occupants are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.~~

**310.3 Residential Group R-2**. Residential Group R-2 occupancies containing sleeping units or more than two dwelling units where the occupants are not primarily transient. ~~permanent in nature, including:~~

~~Apartment houses~~

~~Boarding houses (nontransient) with more than 16 occupants~~

~~Congregate living facilities (nontransient) with more than 16 occupants~~

~~Convents~~

~~Dormitories~~

~~Fraternities and sororities~~

~~Hotels (nontransient)~~

~~Live/work units~~

~~Monasteries~~

~~Motels (nontransient)~~

~~Vacation timeshare properties~~

**310.4 Residential Group R-3**. Group R-3 occupancies where the occupancy is not classified as Group R-1, R-2, R-4, R-5 or I, ~~including~~ and the building contains no more than two dwelling units and:

1. The occupants are not primarily transient ~~permanent in nature~~, or
2. There are no more than 10 transient occupants per dwelling unit.

~~Buildings that do not contain more than two dwelling units~~

~~Boarding houses (nontransient) with 16 or fewer occupants~~

~~Boarding houses (transient) with 10 or fewer occupants~~

~~Care facilities that provide accommodations for five or fewer persons receiving care~~

~~Congregate living facilities (nontransient) with 16 or fewer occupants~~

~~Congregate living facilities (transient) with 10 or fewer occupants~~

~~Lodging houses with five or fewer guest rooms~~

**310.4.1 ~~Care facilities within a dwelling~~ Radon-resistant construction**. ~~Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~ Group R-3 buildings and structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.

**310.4.2 Lodging houses**. ~~Owner-occupied lodging houses with five or fewer guest rooms shall be permitted to be constructed in accordance with the International Residential Code. Bed and breakfast and other transient boarding facilities shall comply with Section 310.4.2.1 or 310.4.2.2.~~

**310.5 Residential Group R-4.** This occupancy shall include buildings, structures or portions thereof for more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised residential environment and receive custodial care. Buildings of Group R-4~~, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 310.6.1. Assisted living facilities licensed by the Virginia Department of Social Services~~ shall be classified as one of the occupancy conditions indicated in Section 310.6.1 or 310.6.2. ~~This group shall include, but not be limited to, the following:~~

~~Alcohol and drug centers~~

~~Assisted living facilities~~

~~Congregate care facilities~~

~~Group homes~~

~~Halfway houses~~

~~Residential board and care facilities~~

~~Social rehabilitation facilities~~

~~This occupancy shall also include hospice facilities with not more than 16 occupants, excluding staff.~~

Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in this code.

~~**Exceptions**~~:

1. ~~Group homes licensed by the Virginia Department of Behavioral Health and Developmental Services that house no more than eight persons with one or more resident counselors shall be classified as Group R-2, R-3, R-4 or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.~~

2. ~~In Group R-4 occupancies classified as the occupancy condition indicated in Section 310.6.1, other than in hospice facilities, not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a single level of exit discharge and other than using a ramp, a change of elevation using steps or stairs is not within the path of egress to an exit door.~~

3. ~~Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, and all of the residents are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5.~~

4. ~~Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, where not more than five of the residents require physical assistance from staff to respond to an emergency situation with one or more resident counselors, may be classified as Group R-5 when in compliance with all of the following:~~

    ~~4.1. The building is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.~~

    ~~4.2. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation.~~

    ~~4.3. All residents who may require physical assistance from staff to respond to an emergency situation reside on a single level of exit discharge and other than using a ramp, a change in elevation using steps or stairs is not within the path of egress to an exit door.~~

5. ~~Hospice facilities with five or fewer occupants are permitted to comply with the IRC provided the building is protected by an automatic sprinkler system in accordance with IRC Section P2904 or IBC Section 903.3.~~

**310.5.1 Condition 1**. This occupancy condition shall include buildings in which all persons receiving custodial care who, without any assistance, are capable of responding to an emergency situation to complete building evacuation or, in which not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from

staff reside on a level of exit discharge and the path of egress to the exit does not include steps.

**310.5.2 Condition 2**. This occupancy condition shall include buildings in which there are persons receiving custodial care who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation.

**310.5.3 Radon-resistant construction**. Groups R-4 buildings and structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.

**~~310.7~~ 310.6 Residential Group R-5**. ~~Residential~~ This occupancy shall include residential occupancies in detached single- and two-family dwellings, townhouses and accessory structures within the scope of the IRC. The construction of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.

The provisions of the International Residential Code for One- and Two-family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings ~~and~~, townhouses~~,~~ and care facilities for five or fewer persons receiving care not more than three stories above grade plane in height with a separate means of egress and their accessory structures. The use of such structures for transient occupancies shall not exceed 10 persons per dwelling unit.

~~**310.8 Group R-5**. The construction of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.~~

**~~310.8.1~~ 310.6.1 Additional requirements**. Methods of construction, materials, systems, equipment or components for Group R-5 structures not addressed by prescriptive or performance provisions of the IRC shall comply with applicable IBC requirements.

~~**310.9 Family day homes**. Family day homes where program oversight is provided by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.~~

~~**Note**: Family day homes may generally care for up to 12 children. See the DHCD "Related Laws Package" for additional information.~~

~~**310.10 Radon-resistant construction in Groups R-3 and R-4 structures**. Groups R-3 and R-4 structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.~~

~~310.11~~ **310.7 Amendments to the IRC**. The following changes shall be made to the IRC for its use as part of this code…..

## SECTION 432 (New Section)
## STATE REGULATED CARE FACILITIES (SRCF)

**432.1 General**. Notwithstanding any other requirements of this code, this section applies to the use and occupancy classification of state regulated care facilities addressed in this section.

**432.2 Assisted Living Facilities**. Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancies specified in sections 432.2.1 through 432.2.6.

**432.2.1 Group I-1 Condition 1**. Facilities with seventeen or more persons receiving care, in which all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**432.2.2 Group I-1 Condition 2**. Facilities with seventeen or persons receiving care, in which there are persons who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 2. Not more than five of the persons may require physical assistance from more than one staff member to respond to an emergency situation.

**432.2.3 Group I-2 Condition 1**. Facilities with six or more persons receiving care who require assistance by more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group I-2 Condition 1.

**432.2.4 Group R-4 Condition 1**. Facilities with nine to sixteen persons receiving care, where all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**432.2.5 Group R-4 Condition 2**. Buildings with nine to sixteen persons receiving care, who may require assistance by not more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group R-4 Condition 2. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

**432.2.6 Group R-2, R-3 or R-5**. Facilities with no more than eight persons receiving care, with one or more resident counselors, and all persons are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5. Up to five of the persons may require physical assistance from staff to respond to an emergency situation when in compliance with the following:

1. All residents that require physical assistance from staff reside on a level of exit discharge and the path of egress to the exit does not include steps.
2. The building is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.

**432.3 Family Day Homes**. Family day homes registered or licensed by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.

**432.4 Group Homes**. Group Homes licensed by the Virginia Department of Behavioral Health and Developmental Services shall be classified as one of the occupancies specified in sections 432.4.1 through 432.4.3.

**432.4.1 Groups R-2, R-3, R-4 Condition 1 or 2 or R-5**. Facilities with no more than eight persons receiving care, with one or more resident counselors, shall be classified as Group R-2, R-3, R-4 (Condition 1 or 2) or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

**432.4.2 Group R-4 Condition 1**. Facilities with eight to sixteen persons receiving care, where all persons, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as Group R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency , provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**432.4.3 Group R-4 Condition 2**. Facilities with eight to sixteen persons receiving care or facilities with more than five persons requiring physical assistance from staff to respond to an emergency situation shall be classified as Group R-4 Condition 2.

**432.5 Hospice Facilities**. Hospice facilities licensed by the Virginia Department of Health shall be classified as one of the occupancies specified in sections 432.5.1 through 432.5.3.

**432.5.1 Group I-2**. Facilities with sixteen or more persons receiving care shall be classified as Group I-2.

**432.5.2 Group R-4 Condition 1**. Facilities with less than sixteen persons receiving care shall be classified as Group R-4 Condition 1.

**432.5.3 Group R-5**. Facilities with five or fewer persons receiving care are permitted to be classified as Group R-5.

**Residential Uses Subworkgroup**
**Remote Meeting – Adobe Connect**
**March 26, 2020**

| | |
|---|---|
| Thom Stanton | Timber Trails & Go Tiny |
| Mackenzie Glassco | DBHDS |
| Judy Hackler | VALA |
| Sean Farrell | VBCOA |
| Ron Clements | Chesterfield County |
| Allison Cook | Arlington |
| Ellen Eggerton | Alexandria |
| Richard Grace | Fairfax County |
| Jane Kim | Fairfax County |
| Dan Willham | Fairfax County |
| Kenney Payne | AIA Virginia |
| Cindy Davis | DHCD |
| Pam Kestner | DHCD |
| Paul Messplay | DHCD |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |
| Stephen Reynolds | DHCD |
| Rajan Engh | DHCD |

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Mr. Brown began by suggesting we table the first item on the Agenda until later in the meeting and began by summarizing from the last meeting on August 9th.

**R310.1**

Mr. Brown pointed out specific elements that staff had changed per the recommendations from previous Residential Uses SWG meetings. He summarized the changes to use group language and State Regulated Care Facilities.

Mr. Clements raised a question about IRC changes in the proposal, as he recalled there was a change being made to the R-5 section. Mr. Brown said that's correct that in the language it makes changes to the R-5 section n Chapter 3. Mr. Brown said he recalled some of the issues in this section were brought up by Mr. Revels regarding short-term rentals and licensing. Mr. Brown stated that the group had previously agreed to stick with the concept regardless of how many people stay there, that once it's an R-5 it's always an R-5.

Mr. Payne mentioned that we also talked about Extended Stay hotels where people regularly stay longer than the requirement in the use group definition. Mr. Willham asked if people were actually staying longer than 30 days in reality. Ms. Cook said that in Arlington they are telling these types of places that they have to comply with the R-1 requirements for egress and life safety because it is more restrictive.

Mr. Clements added that based on the definition of “sleeping unit” if a structure has sleeping units and no dwelling units, it isn’t an R-1.

Mr. Brown said some hotels do contain dwelling units and transient stays. Mr. Clements said what if we modify it so that R-1 can contain dwelling units. Mr. Clements said R-1 was transient or more than one dwelling unit and it would still allow for Residence Inns with rooms with kitchens in them. Mr. Clements said if you get rid of the boarding house and congregate living facilities in R-1 it may work. Ms. Cook asked what would become of a congregate living facility with more than 10 occupants under this proposal.

Ms. Davis said if you leave the 10 occupants in there you need to add an exception. Ms. Cook recommended the text read: “Residential occupancies with more than 10 occupants containing sleeping units or more than two dwelling units where the occupants are transient in nature”

Mr. Clements edited it slightly to say: “Residential occupancies with more than 10 occupants, containing sleeping units or more than two dwelling units where the occupants are primarily transient.”

Mr. Brown recommended we do a list containing all of the following: 1, 2, 3 and add the above stipulations as a list.

Ms. Davis asked if we determined that bedrooms are not sleeping units. Mr. Clements provided the definition and some of the exceptions to it. She asked if we could write the text as: Residential Occupancies other than R-5 with the following (list the above).

Mr. Brown began drafting a proposal based on the suggestions in the room. Ms. Davis is recommending we bring forward the “sleeping unit” definition so that it remains clear to the group and in this proposal that sleeping units are not in dwelling units. Mr. Brown brought up the change and read it aloud and confirmed that the change in the definition keeps it clear that if you have dwelling units there are no sleeping units. The group agrees to scrap the list format and just include the two specifications as a single sentence.

Mr. Brown begins to make changes to R310.6 R-5 use groups. Mr. Clements said removing the 10 occupants limit makes it clear what an R-5 is, and Mr. Payne agrees but brings up that some localities are wanting to consider “Beach homes” as R-1’s when they should not be, but Mr. Clements says that where that occurred it was from pressure due to Zoning Ordinances and there was reluctance form the building department to classify beach homes as an R-1.

For R-3 facilities the group discussed how to classify a transition home and what would be needed for an adequate definition for both DBHDS and DSS needs. Several tweaks were made to this proposal and Ms. Davis recommended emailing this draft to Greg Revels as he was one of those most concerned with these use groups.

Mr. Brown brought up the proposed edit to VCC section 101.5 that was included in this proposal. Mr. Brown asked if anyone would adopt this as a solo proposal so it could be removed from the bulk SRCF proposal. Several people agreed this was a good proposal to be by itself and Mr. Payne offered to submit it.

Ms. Hackler said that section 308.2.1 is inconsistent from other parts of the SRCF section and they need to be correlated so that the exit discharge is on the level of egress access. That section needs to be

consistent with other SCRF requirements. Mr. Farrell brought up that the exit discharge may not have access to the public way. Ms. Hackler and Mr. Willham pointed out that in order for it to meet the definition of “exit discharge” it has to have access to the public way.

Mr. Brown read through the rest of the R310.1 proposal and asked if there was any concerns in the rest of the document. He will send the current version to Mr. Revels and then make sure the revisions still address his concerns.

**R310.3(1)**

Mr. Willham stated that he will withdraw his proposal at the full workgroup meeting so long as the previous proposal moves forward (R310.1), but would like to keep it just in case the other is not approved

**Accessory Dwelling Unit**

The next item on the agenda is the Accessory Dwelling Unit proposal and Mr. Brown summarized the prior discussions on this proposal. Ms. Cook summarized the existing practice of people trying to remodel a basement to allow for this, and Ms. Cook said this serves a purpose of allowing elderly to age in place and also promotes more housing options. Mr. Amiri went over the history of the need for this and its requirement outside of the issues with zoning. Ms. Davis followed up on this by emphasizing the need for a uniformity issue so that some parts of the state are not interpreting what constitutes a new dwelling unit. When is it no longer an accessory dwelling unit and it becomes a new dwelling unit. Mr. Amiri pointed out that there was a similar situation in the 80s when there was a societal need to change the family day care limit from five or less to 16 and this was due to the social need for more access to day care facilities. He compared that social need to the need for more housing options for localities. Several people noted that this section fits better in the VEBC. Mr. Clements said if it was in the VEBC it would have to be in Chapter 1 for it to be clear.

Mr. Farrell echoed the point Ms. Davis made above – that these ADUs are not prohibited already. It seems to be a land use or zoning issue. He does not want to solve an interpretation issue with a code change.

Ms. Cook provided some alternative language for the VEBC. Mr. Farrell wanted to assure everyone that if he was the only person who had concerns about using the Accessory Dwelling Unit terminology that he would defer to the group as he did not want to hold up the meeting.

Mr. Payne asked if we should avoid putting technical provisions in Chapter 1. Ms. Davis asked how the West Coast handles these and Mr. Stanton answered that they handled it through zoning.

Mr. Clements recommended that instead of defining an ADU, we should define when to require protections for a secondary dwelling unit. Ms. Cook agrees that approach seems interesting.

Mr. Farrell believes the code already allows a second dwelling unit to be rented out by the owner without triggering the requirements for protections for a second dwelling unit. To address the concerns, Ms. Cook alters the proposal to say “accessory living unit” and specify all the excepted requirements.

Ms. Eggerton asked that it be clear that there be a water cutoff in each unit. Ms. Davis clarified that it is already the intent of the proposal to require disconnect access to all major services disconnects or shut-offs.

Ms. Cook urged the group to delete provision 6 calling out the specific services that would be required to be accessed per the VRC. She indicated the potential conflict since item 5 already requires this by mandating compliance with the VRC for a dwelling unit.

Mr. Payne offered that he needs time to rethink this because it may not fit well in the VEBC. Ms. Cook agrees with the sentiment and says that there's a way to remove this from Chapter 1 by leaving a pointer for "accessory living unit" in Chapter 1 and moving the current provision to Chapter 3 under use groups for R-5.

Mr. Brown thanked the attendees and said we would be returning for another meeting to detail this proposal. Ms. Cook asked for DHCD to facilitate feedback from those who are in opposition to this concept so that we can address their concerns before the next meeting. Mr. Brown agreed that this was a good idea.

Ms. Hackler asked about Table 405.2 Fire and Evacuation Drill Frequency and Participation. There is an exception for Hospice under Group R. Should we include an exception for the Participation of I-1 and R-4 for residents on hospice? Ms. Davis said this will be tabled until our next meeting. Staff will review that question and provide an answer to DSS and DBHS before the next meeting.

DHCD Note: It appears that a hospice facility, not classified as Group R, would be classified as Group I-2. SFPC Table 405.2 only requires employee participation for Group I-2 facilities and should achieve what Ms. Hackler was suggesting.

**Residential Uses Subworkgroup**
**Remote Meeting – Adobe Connect**
**April 6, 2020**

| | |
|---|---|
| Thom Stanton | Timber Trails & Go Tiny |
| Mackenzie Glassco | DBHDS |
| Judy Hackler | VALA |
| Sean Farrell | VBCOA |
| Ron Clements | Chesterfield County |
| Greg Revels | Henrico County |
| Haywood Kines | IAEI Virginia Chapter |
| Tara Ragland | DSS |
| Shaun Pharr | AOBA and VAMA |
| Ellen Eggerton | Alexandria |
| Dan Willham | Fairfax County |
| Kenney Payne | AIA Virginia |
| Helen Hardiman | Board of Housing and Community Development |
| Cindy Davis | DHCD |
| Paul Messplay | DHCD |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |
| Paul Messplay | DHCD |
| Travis Luter | DHCD |
| Brian Hilderbrand | DHCD |

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Mr. Brown began by summarizing the results of the last meeting and commenting on the discussion that's been ongoing since then.

**R310.1 (SRCF)**

Mr. Brown summarized why this proposal was brought in from the VCC. He went into the changes that have been made from various comments and suggestions from the past meeting.

Mr. Payne suggested that we change the R-5 language to include "Shall be permitted to comply with the IRC" for the purposes of the Accessory Dwelling Unit proposal since that will be situated in the VEBC.

In an earlier email, Mr. Revels had brought up a discrepancy in the current VCC regarding the classification of manufactured homes as R-5 since the R-5 description as written does not fit manufactured homes, but most localities designate manufactured homes as an R-5 on COs. Mr. Brown suggested a rewrite of the R-5 section to clarify that a manufactured home is an R-5. Everyone agreed to the proposed changes to the section.

It was suggested that rather than create a new section in VCC Chapter 4, all of the SRCF requirements be moved to a new section at the end of Chapter 3. Mr. Payne asked if we need to create a new use group category and letter designation for SRCFs. Mr. Revels said you just title the new section SRCFs and go

with that, which Mr. Clements agreed with. The group agreed to move the new section form the end of Chapter 4, to the end or Chapter 3.

Mr. Revels brought up an issue with R-5 occupancy limits for vacation and other short-term rentals and mentioned how sometimes these places will have 15+ people in them. Mr. Brown said the existing state amendments/exceptions that the draft proposal is deleting address short term rentals of guest rooms in a SFD, like Bed and Breakfast or AirB&B, but vacation or short-term lodging rentals do not meet the definition of lodging houses since they are not renting guest rooms, so those same exceptions do not apply. He suggested adding back in IBC section 310.5.2 Lodging houses, including the existing state amendment requirements for fire alarms.

Mr. Revels said he is fine with the above, but wants the ability to require smoke detectors whatever the use classification is for these types of group lodgings, whether they are large vacation rentals or B&Bs. Mr. Kines wants the detectors to be hard wired with a battery backup and not only battery powered as most people already do not replace batteries when they are supposed to.

The group agrees to draft new sections for rental houses and lodging houses for the purposes of requiring smoke alarms. Mr. Payne mentions that we probably need to include the rental houses section elsewhere or address this through the VEBC. He also asked if there is a reason why we would use "owner occupied" versus "proprietor" and if that was something that was previously discussed.

Ms. Hackler brought up some slight differences in the language, highlighting that assistance is "physical assistance" for egress. Also, that the definition of R-4 is limited to no more than 8 persons in the definition and then in the next section it defines R-4 as 8-16 people. Mr. Brown clarifies that the limit is for physical assistance not total occupants and he does not believe it's a conflict. Also that the main language specifies you pick which use group applies to your facility R-1, -2, -3 or -4 and then goes on to explain the differences.

Mr. Brown further clarifies that the difference between the first section and the subsequent sections is related to different egress requirements and not a conflict for the use groups' definitions.

**Accessory Dwelling Units**

Mr. Brown summarized the results of the discussion last time and the agreement to use the term "accessory living unit" since dwelling unit is already a defined term.

Mr. Brown walked through the draft document that's been prepared since the last meeting, including moving the requirements form Chapter 7 to Chapter 3

Mr. Payne asked how you even get to the code if there's no permits or construction to alter a dwelling for this new concept, "accessory living unit".

There was some discussion regarding whether or not to include something in the definition regarding the configuration of access and egress between units. It was decided that this was not necessary and removed the reference to internal access between units.

Mr. Hines stated that it was important for the tenant to not only have access to the main service disconnect, but to all disconnects to branch circuits serving the unit. Mr. Brown read the two IRC

electrical sections that are referenced in the proposal and Mr. Hines confirmed that if those sections are mandatory for the ALU that satisfied his concerns.

Mr. Payne pointed out the cost implications of converting an attic and having to essentially construct a fire escape, or if it's a true basement, having to dig out a stair to comply with egress. If the purpose of this is to provide affordable housing, these cost constraints would limit that. Mr. Stanton asked if separate structures like detached garages or barns would trigger this language and Mr. Brown answered the existing code covers that.

Mrs. Eggerton asks if having a common access room excludes someone from having this section apply, like a common laundry room or common system cut off room. Mr. Kines echoed this concern.

Mr. Brown drafted some alterations to the "Accessory Living Unit" proposal specifically to make the distinction between sleeping units and dwelling units clear.

Mr. Payne asked if group was going to deal with the issue of requiring smoke alarms in beach houses and vacation rentals or if that would be a separate proposal. Mrs. Eggerton asked the same question. Mr. Brown said that would likely be dealt with through a separate proposal and would discuss with Mr. Revels.

The group generally agreed to move forward with the ALU proposal as amended during the discussions, however, after the meeting concluded discussions continued through email and it was decided that based on some of the recommendations made, additional work was needed on the proposal. Mr. Revels agreed to work on drafting an alternate ALU proposal based on the discussions for the group to review.

# B310.1-18

**VCC: , 302.1, 308.3 (New), 308.3.1, 308.2.3, 308.3.4, 308.4 (New), 308.3.2, 310.3, 310.4, 310.5, 310.5.1, 310.6.1, 310.5.2, 310.6, 427.2, 310.7, 310.7.1, 310.8, 310.9, 310.10, 310.6.3 (New), 313 (New); VFC: , TABLE 405.2**

**Proponents:** Residential Use Subworkgroup

## 2015 Virginia Construction Code

**STATE REGULATED CARE FACILITY (SRCF).**

A *building* ~~with an occupancy in Group R-2, R-3, R-4 or R-5 occupied~~ occupied by persons in the care of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education , the Virginia Department of Health or the Virginia Department of Juvenile Justice.

**302.1 General.** Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in this section. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a *structure* is proposed for a purpose that is not specifically provided for in this code, such *structure* shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
2. Business (see Section 304): Group B.
3. Educational (see Section 305): Group E.
4. Factory and Industrial (see Section 306): Groups F-1 and F-2.
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.
6. Institutional (see Section 308 and Section 313 for SRCFs)
7. Mercantile (see Section 309): Group M.
8. Residential (see Section 310 and Section 313 for SRCFs): Groups R-1, R-2, R-3, R-4 and R-5.
9. Storage (see Section 311): Groups S-1 and S-2.
10. Utility and Miscellaneous (see Section 312): Group U.

**Revise as follows:**

**308.3 Institutional Group I-1** This occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive custodial care. Buildings of Group I-1~~, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 308.3.1. Assisted living facilities licensed by the Virginia Department of Social Services~~ shall be classified as one of the occupancy conditions indicated in Section 308.3.1 or 308.3.2. ~~This group shall include, but not be limited to, the following:~~

~~Alcohol and drug centers~~

~~Assisted living facilities~~

~~Congregate care facilities~~

~~Group homes~~

~~Halfway houses~~

~~Residential board and care facilities~~

~~Social rehabilitation facilities~~

**308.3.1 Condition 1.** This occupancy condition shall include buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete *building* evacuation. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents that may require the physical assistance reside on ~~a single level~~ a level of exit ~~discharge.~~ discharge and the path of egress to the exit does not include steps.

**Delete without substitution:**

**308.3.3 Six to 16 persons receiving custodial care.** A facility housing not fewer than six and not more than 16 persons receiving *custodial care* shall be classified as Group R-4.

**308.3.4 Five or fewer persons receiving custodial care.** A facility with five or fewer persons receiving *custodial care* shall be classified as Group R-3 or shall comply with the International Residential Code provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.

**Revise as follows:**

**308.4 Institutional Group I-2** This occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation. This group shall include, but not be limited to, the following:

- Convalescent facilities
- Detoxification facilities
- Foster care facilities
- Hospice facilities
- Hospitals
- Nursing homes
- Psychiatric hospitals

Exception: Hospice facilities occupied by 16 or less occupants, excluding staff, are permitted to be classified as Group R-4.

**Delete without substitution:**

**308.4.2 Five or fewer persons receiving medical care.** A facility with five or fewer persons receiving medical care shall be classified as Group R-3 or shall comply with the International Residential Code provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.

**Revise as follows:**

**310.3 Residential Group R-1.** Residential occupancies containing sleeping units or more than two dwelling units, and: where the occupants are primarily transient in nature, including:

Boarding houses (transient) with more than 10 occupants
Congregate living facilities (transient) with more than 10 occupants
Hotels (transient)
Motels (transient)

**Exceptions:**

1. Nonproprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height with a maximum of 10 occupants total are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.
2. Proprietor occupied bed and breakfast and other transient boarding facilities not more than three stories above grade plane in height, that are also occupied as the residence of the proprietor, with a maximum of five guest room sleeping units provided for the transient occupants are permitted to be classified as either Group R-3 or R-5 provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3 or Section R314 of the IRC for Group R-5.

1. The occupants are primarily transient, and
2. There are more than 10 occupants.

**310.4 Residential Group R-2.** Residential Group R-2 occupancies containing *sleeping units* or more than two *dwelling units* where the occupants are not primarily permanent transient. in nature, including:

Apartment houses
*Boarding houses* (nontransient) with more than 16 occupants
*Congregate living facilities* (nontransient) with more than 16 occupants
Convents
*Dormitories*
Fraternities and sororities
Hotels (nontransient)
*Live/work units*
Monasteries
Motels (nontransient)
Vacation timeshare properties

**310.5 Residential Group R-3.** Residential ~~Group R-3~~ occupancies containing no more than two dwelling units and where the ~~occupants are primarily permanent in nature and~~ occupancy is not classified as Group R-1, R-2, R-4, R-5, or I, ~~including:~~ and:

~~Buildings that do not contain more than two *dwelling units*~~
~~*Boarding houses* (nontransient) with 16 or fewer occupants~~
~~*Boarding houses* (*transient*) with 10 or fewer occupants~~
~~Care facilities that provide accommodations for five or fewer persons receiving care~~
~~*Congregate living facilities* (nontransient) with 16 or fewer occupants~~
~~*Congregate living facilities* (*transient*) with 10 or fewer occupants~~
~~*Lodging houses* with five or fewer *guest rooms*~~

1. The occupants are not primarily transient, or

2. There are no more than 10 transient occupants per dwelling unit.

**310.5.1 ~~Care facilities within a dwelling~~ Radon-resistant construction.** ~~Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the International Residential Code provided an *automatic sprinkler system* is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.~~

Group R-3 buildings and structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R327 of the IRC.

**310.6.1 Condition 1.** This occupancy condition shall include buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete *building* evacuation ~~and hospice facilities.~~ or, in which not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a level of exit discharge and the path of egress to the exit does not include steps .

**Revise as follows:**

**310.5.2 Lodging houses.** *Owner*-occupied or proprietor-occupied *lodging houses* and other transient boarding facilities not more than three stories above grade plane in height, with five or fewer guest rooms and 10 or fewer total occupants shall be permitted to be ~~constructed in accordance with the International Residential Code~~ . classified as either Group R-3 or R-5, provided that smoke alarms are installed in compliance with Section 907.2.11.2 for Group R-3, or Section R314 of the IRC for Group R-5.

**310.6 Residential Group R-4.** ~~This occupancy shall include buildings, structures or portions thereof for~~ Residential occupancies with more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised environment and receive *custodial care*. Buildings of Group R-4, other than assisted living facilities licensed by the Virginia Department of Social Services, shall be classified as the occupancy condition indicated in Section 310.6.1. Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancy conditions indicated in Section 310.6.1 or ~~310.6.2. This group shall include, but not be limited to, the following:~~ 310.6.2.

~~Alcohol and drug centers~~
~~Assisted living facilities~~
~~Congregate care facilities~~
~~Group homes~~
~~Halfway houses~~
~~Residential board and care facilities~~
~~Social rehabilitation facilities~~

~~This occupancy shall also include hospice facilities with not more than 16 occupants, excluding staff.~~

~~Group R-4 occupancies shall meet the requirements for *construction* as defined for Group R-3, except as otherwise provided for in this code.~~

~~**Exceptions:**~~

1. ~~Group homes licensed by the Virginia Department of Behavioral Health and Developmental Services that house no more than eight persons with one or more resident counselors shall be classified as Group R-2, R-3, R-4 or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.~~
2. ~~In Group R-4 occupancies classified as the occupancy condition indicated in Section 310.6.1, other than in hospice facilities, not more than five of the residents may require physical assistance from staff to respond to an emergency situation when all residents who may require the physical assistance from staff reside on a single level of exit discharge and other than using a ramp, a change of elevation using steps or stairs is not within the path of egress to an exit door.~~

3. ~~Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, and all of the residents are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5.~~

4. ~~Assisted living facilities licensed by the Virginia Department of Social Services that house no more than eight persons, with one or more resident counselors, may be classified as Group R-5 when in compliance with all of the following:~~

   ~~4.1. The *building* is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.~~

   ~~4.2. Not more than five of the residents may require physical assistance from staff to respond to an emergency situation.~~

   ~~4.3. All residents who may require physical assistance from staff to respond to an emergency situation reside on a single level of exit discharge and other than using a ramp, a change in elevation using steps or stairs is not within the path of egress to an exit door.~~

5. ~~Hospice facilities with five or fewer occupants are permitted to comply with the IRC provided the *building* is protected by an automatic sprinkler system in accordance with IRC Section P2904 or IBC Section 903.3.~~

**427.2 Site work for manufactured homes.** Footing design, basements, grading, drainage, decks, stoops, porches and utility connections shall comply with the provisions of this code applicable to Group R-5 occupancies. Manufactured homes shall be classified as Group R-5, in accordance with Chapter 3 of this code. Additionally, all applicable provisions of Chapter 1 of this code, including but not limited to requirements for permits, inspections, certificates of occupancy and requiring compliance, are applicable to the installation and set-up of a *manufactured home*. Where the installation or erection of a *manufactured home* utilizes components that are to be concealed, the installer shall notify the building official that an inspection is necessary and assure that an inspection is performed and approved prior to concealment of such components, unless the building official has agreed to an alternative method of verification.

**310.7 Residential Group R-5.** Residential occupancies within the scope of the IRC, other occupancies ~~in detached single- and two-family dwellings, townhouses and accessory structures within the scope of the IRC.~~ specifically permitted in this code to be classified as Group R-5, and manufactured homes in accordance with the Virginia Manufactured Home Safety Regulations (23VAC5-91).

The provisions of the International Residential Code for One- and Two-family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of the following when classified as Group R-5:

1. Detached single-family and two-family dwellings
2. Townhouses
3. Care facilities for five or fewer people
4. Owner- or proprietor-occupied lodging houses with no more than five guest rooms and 10 or fewer total occupants.
5. Accessory structures of group R-5 occupancies.

The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC and the IBC shall be considered to be references to this section.

**~~310.8.1~~ 310.7.1 Additional requirements.** Methods of *construction*, materials, systems, *equipment* or components for Group R-5 structures not addressed by prescriptive or performance provisions of the IRC shall comply with applicable IBC requirements.

**Delete without substitution:**

~~**310.8 Group R-5.** The *construction* of Group R-5 structures shall comply with the IRC. The amendments to the IRC set out in Section 310.11 shall be made to the IRC for its use as part of this code. In addition, all references to the IRC in the IBC shall be considered to be references to this section.~~

~~**310.9 Family day homes.** Family day homes where program oversight is provided by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.~~

~~**Note:** Family day homes may generally care for up to 12 children. See the DHCD "Related Laws Package" for additional information.~~

~~**310.10 Radon-resistant construction in Groups R-3 and R-4 structures.** Groups R-3 and R-4 structures shall be subject to the radon-resistant *construction* requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R324 of the IRC.~~

**Add new text as follows:**

**310.6.3 New Code Section Radon-resistant construction** Groups R-4 buildings and structures shall be subject to the radon-resistant construction requirements in Appendix F of the IRC in localities enforcing such requirements pursuant to Section R327 of the IRC.

**313 New Code Section State Regulated Care Facilities (SRCF) 313.1 General** . Notwithstanding any other requirements of this code, this section applies to the use and occupancy classification of state regulated care facilities addressed in this section.

**313.2 Assisted Living Facilities** . Assisted living facilities licensed by the Virginia Department of Social Services shall be classified as one of the occupancies specified in sections 432.2.1 through 432.2.6.

**313.2.1 Group I-1 Condition 1** . Facilities with more than sixteen persons receiving care, in which all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**313.2.2 Group I-1 Condition 2** . Facilities with more than sixteen persons receiving care, in which there are persons who require assistance by not more than one staff member while responding to an emergency situation to complete building evacuation, shall be classified as Group I-1 Condition 2. Not more than five of the persons may require physical assistance from more than one staff member to respond to an emergency situation.

**313.2.3 Group I-2 Condition 1** . Facilities with more than five persons receiving care who require assistance by more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group I-2 Condition 1.

**313.2.4 Group R-4 Condition 1** . Facilities with nine to sixteen persons receiving care, where all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency, provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**313.2.5 Group R-4 Condition 2** . Buildings with nine to sixteen persons receiving care, who may require assistance by not more than one staff member when responding to an emergency situation to complete building evacuation, shall be classified as Group R-4 Condition 2. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

**313.2.6 Group R-2, R-3 or R-5** . Facilities with no more than eight persons receiving care, with one or more resident counselors, and all persons are capable of responding to an emergency situation without physical assistance from staff, may be classified as Group R-2, R-3 or R-5. Up to five of the persons may require physical assistance from staff to respond to an emergency situation when in compliance with the following:

1. All residents that require physical assistance from staff reside on a level of exit discharge and the path of egress to the exit does not include steps.

2. The building is protected by an automatic sprinkler system installed in accordance with Section 903.3 or Section P2904 of the IRC.

**313.3 Family Day Homes** . Family day homes registered or licensed by the Virginia Department of Social Services shall be classified as Group R-2, R-3 or R-5.

**313.4 Group Homes** . Group Homes licensed by the Virginia Department of Behavioral Health and Developmental Services shall be classified as one of the occupancies specified in sections 432.4.1 through 432.4.3.

**313.4.1 Groups R-2, R-3, R-4 Condition 1 or 2 or R-5** . Facilities with no more than eight persons receiving care, with one or more resident counselors, shall be classified as Group R-2, R-3, R-4 (Condition 1 or 2) or R-5. Not more than five of the persons may require physical assistance from staff to respond to an emergency situation.

**313.4.2 Group R-4 Condition 1** . Facilities with eight to sixteen persons receiving care, where all persons, without any assistance, are capable of responding to an emergency situation to complete building evacuation shall be classified as Group R-4 Condition 1. Not more than five of the persons may require physical assistance from staff to respond to an emergency , provided all persons requiring assistance reside on a level of exit discharge and the path of egress to the exit does not include steps.

**313.4.3 Group R-4 Condition 2** . Facilities with eight to sixteen persons receiving care or facilities with more than five persons requiring physical assistance from staff to respond to an emergency situation shall be classified as Group R-4 Condition 2.

**313.5 Hospice Facilities** . Hospice facilities licensed by the Virginia Department of Health shall be classified as one of the occupancies specified in sections 432.5.1 through 432.5.3.

**313.5.1 Group I-2** . Facilities with sixteen or more persons receiving care shall be classified as Group I-2.

**313.5.2 Group R-4 Condition 1** . Facilities with less than sixteen persons receiving care shall be classified as Group R-4 Condition 1.

**313.5.3 Group R-5** . Facilities with five or fewer persons receiving care are permitted to be classified as Group R-5.

**STATE REGULATED CARE FACILITY (SRCF).** A building ~~with an occupancy in Group R-2, R-3, R-4, or R-5~~ occupied by persons in the care

of others where program oversight is provided by the Virginia Department of Social Services, the Virginia Department of Behavioral Health and Developmental Services, the Virginia Department of Education , the Virginia Department of Health, or the Virginia Department of Juvenile Justice.

**TABLE 405.2**
**FIRE AND EVACUATION DRILL FREQUENCY AND PARTICIPATION**

| GROUP OR OCCUPANCY | FREQUENCY | PARTICIPATION |
|---|---|---|
| Group A | Quarterly | Employees |
| Group B[b] | Annually | All occupants |
| Group B[b], [c] (Ambulatory care facilities) | Annually | Employees |
| Group B[b] (Clinic, outpatient) | Annually | Employees |
| Group E | Monthly[a] | All occupants |
| Group F | Annually | Employees |
| Group I-1 | Semiannually on each shift[a] | All occupants |
| Group I-2 | Quarterly on each shift[a] | Employees |
| Group I-3 | Quarterly on each shift[a] | Employees |
| Group I-4 | Monthly on each shift[a] | All occupants |
| Group R-1 | Quarterly on each shift | Employees |
| Group R-2[d] | Four annually | All occupants |
| Group R-4 | Semiannually on each shift[a] | All occupants |
| Group R SRCF , except hospice | Monthly | All occupants |

a. In severe climates, the *fire code official* shall have the authority to modify the emergency evacuation drill frequency.

b. Emergency evacuation drills are required in Group B buildings having an *occupant load* of 500 or more persons or more than 100 persons above or below the lowest *level of exit discharge.*

c. Emergency evacuation drills are required in ambulatory care facilities in accordance with Section 403.3.

d. Emergency evacuation drills in Group R-2 college and university buildings shall be in accordance with Section 403.10.2.1. Other Group R-2 occupancies shall be in accordance with Section 403.10.2.2.

**Reason Statement:** This proposal is intended to clarify the residential use group classifications by deleting the laundry lists of examples under each group and simplifying the descriptions of each group based on the number of occupants, if the occupants are transient or not, and if the use includes sleeping and/or dwelling units.

**Resiliency Impact Statement:** This proposal will neither increase nor decrease Resiliency
This proposal will neither increase nor decrease Resiliency

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction

**Amend VEBC Section 102.2.2:**

**102.2.2 ~~Reconstruction, alteration or repair in~~ Group R-5 occupancies**. Compliance with ~~this section~~ the VRC shall be an acceptable alternative to compliance with this code for Group R-5 occupancies, ~~at the discretion of the owner or owner's agent. The VCC may be used for the reconstruction, alteration or repair of Group R-5 buildings or structures~~ subject to the following criteria:

**Exception:** *Accessory living units* shall comply with Section 308 and any applicable provisions of Items 1 through 5.

1. Any reconstruction, alteration or repair shall not adversely affect the performance of the building or structure or cause the building or structure to become unsafe or lower existing levels of health and safety.
2. Parts of the building or structure not being reconstructed, altered or repaired shall not be required to comply with the requirements of the VCC applicable to newly constructed buildings or structures.
3. The installation of material or equipment, or both, that is neither required nor prohibited shall only be required to comply with the provisions of the VCC relating to the safe installation of such material or equipment.
4. Material or equipment, or both, may be replaced in the same location with material or equipment of a similar kind of capacity.

   Exceptions:

   1. This section shall not be construed to permit noncompliance with any applicable flood load or flood-resistant construction requirements of the VCC.
   2. Reconstructed decks, balconies, porches and similar structures located 30 inches (762mm) or more above grade shall meet the current code provisions for structural loading capacity, connections and structural attachment. This requirement excludes the configuration and height of handrails and guardrails.
5. In accordance with Section 36-99.2 of the Code of Virginia, any replacement glass installed in buildings constructed prior to the first edition of the USBC shall meet the quality and standards for glass installed in new buildings as are in effect at the time of installation. In addition, as a requirement of this code, the installation of replacement of glass in buildings constructed under any edition of the USBC shall be as required for new installations.

**Add New VEBC Definition:**

**ACCESSORY LIVING UNIT.** A space within a *dwelling unit*, providing complete living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation; and where the *dwelling* is occupied by the owner. The units may share utilities, systems or equipment, including utility services, disconnecting means, or other components thereof.

**Add New VEBC Section:**

# SECTION 308
# ACCESSORY LIVING UNITS

**308.1 General.** Except as modified in this section, *accessory living units* shall comply with the applicable provisions of this code and the VCC.

1. An *accessory living unit* shall be served by an egress door complying with Section R311.2 of the VRC.
2. Every sleeping room of an *accessory living unit* shall comply with Section R310 of the VRC.
3. Smoke alarms, installed in accordance with Section R314 of the VRC, shall be provided throughout the existing *dwelling unit* and the *accessory living* unit and interconnected in such a manner that actuation of one alarm will activate all of the alarms in the *dwelling unit* and the *accessory living unit*.
4. Separation requirements found in Sections R302.3 and R302.4 of the VRC shall not apply to the *dwelling unit* and the *accessory living unit*.
5. Return air requirements of Section M1602.2 Item 6 of the VRC, shall not apply to return air between the *dwelling unit* and the *accessory living unit*.
6. An accessory living unit must comply with Sections P2801.4, E3601.6.2, E3705.8 and G2420.1.3 (409.1.3) of the VRC.

**308.3 Where permitted.** *Accessory living units* shall be permitted in accordance with the following:

1. An *accessory living unit* shall only be permitted within an existing R-5 *dwelling unit*.
2. Not more than one *accessory living unit* shall be permitted within a *dwelling unit*.

**Residential Uses Subworkgroup**
**Remote Meeting – Adobe Connect**
**June 29, 2020**

| | |
|---|---|
| Haywood Kines | IAEI Virginia Chapter |
| Allison Cook | Arlington County |
| Greg Revels | Henrico County |
| Shaun Pharr | AOBA and VAMA |
| Ellen Eggerton | City of Alexandria |
| Dan Willham | Fairfax County |
| Kenney Payne | AIA Virginia |
| Joe Lerch | VACO |
| Michelle Winters | AHS |
| Shahriar Amiri | Arlington County |
| Cindy Davis | DHCD |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |

Mr. Brown opened the discussion with the two ADU options that had been put forward from the discussion that has been ongoing since the last Residential Uses meeting. Option C requires a door or passageway for interconnectivity. Option D permits does not require an internal passageway. Both require full access to all utility shut-offs. Both require interconnectivity of life safety systems and if fire separation is not provided between units, a household fire alarm system complying with NFPA 72 is required to be installed.

There was some discussion about ensuring that tenants were provided with access to utility shutoffs and electrical disconnects as required. Mr. Brown indicated that both units are dwelling units and must fully comply with the access requirements, so the design would have to indicate this. If there's no connectivity then they have to work out shared access to utilities. Mr. Kines said he cannot support these because of the lack of utility access. Mr. Brown said they are not changing utility access. Both dwelling units have to have full utility access.

Mr. Revels disagrees with adding the ADU definition. It is not needed and it contradicts other code proposals from the group seeking to clean up other sections of the VCC by removing similar, vague terms, but he will not oppose the proposal.

Mrs. Eggerton asked about the cost of the types of systems for interconnectivity of smoke alarm systems and Mr. Brown said he had obtained ballpark estimates upwards of $5,000.

Ms. Davis summarized the two options and the very small ways they differ.

A vote is held on Option D, it does not require a door but does not prohibit one. Michelle Winters, , Shahriar Amiri, Allison Cook, Dan Willham, Kenney Payne and Ellen Eggerton all support.

Mr. Revels said he can support but disagrees with the definition.

Mr. Amiri prefers the door in Option C, but would support either proposal. Ms. Davis clarified that it is an option and Mr. Kines indicates he can support.

Ms. Davis fully summarizes both Options again after Mr. Kines indicates he's confused on which Option is being moved forward.

A vote is held on Option D and the group has support except for Haywood Kines, who now is not willing to support either option. The group agrees to move "Option D" forward to be heard at the July 15th Workgroup 4 meeting.

# Resiliency Subworkgroup

**Background – BHCD October 19, 2020**

Executive Order 24 directed DHCD staff to confer with stakeholders and subject matter experts to identify and suggest resilience-specific improvements for inclusion in the 2018 USBC. The Executive Order stated that the Resiliency considerations were intended to "… protect lives and property from multiple threats and reduce taxpayer exposure through fiscally responsible planning."

In response to the Executive Order, DHCD staff convened a stakeholder group of interested parties to participate in a Resiliency Subworkgroup. This group was charged with brainstorming and developing proposals to increase resiliency for the 2018 code update process, and met four times: on May 7th, 2019; July 17th, 2019; December 10th, 2019, and March 10th, 2020. The group developed a total of 16 proposals, a list of which is attached to this report.

Related to the Executive Order directive, DHCD staff added a new feature to the online code development system, cdpVA, which requires a "Resiliency Impact Statement" to be included with every code change proposal submitted for the 2018 codes. This new feature allowed for analysis of individual code change proposal as well as overall resiliency impacts for the 2018 cycle. The Resiliency Subworkgroup is currently analyzing all approved 2018 code change proposals and their submitted resiliency impact statements and will submit the final analysis to the Board when it is complete.

**Participants**

Many stakeholders were present for these meetings, and the following participated: Annette Osso, Resilient Virginia; Andrew Clark, the Home Builders' Association of Virginia (HBAV); Craig Toalson (HBAV); George Homewood, City of Norfolk; John Ainslie, Ainslie Group; John Ingargiola, Rebecca Quinn for Federal Emergency Management Agency (FEMA); Charles Baker (FEMA); Kenneth Somerset, City of Poquoson; Kenney Payne, American Institute of Architects (AIA Virginia); Kevin Utt, City of Fredericksburg; Wendy Howard Cooper, Department of Conservation and Recreation (DCR); Kristin Owen (DCR); Angela Davis (DCR); Mark Dreyer,

Department of General Services (DGS); Michael Redifer, City of Newport News; Steve Shapiro, City of Hampton; Steve Sunderman, Terrazia; Whitney Katchmark, Hampton Roads Planning District Commission (HRPDC); and Garrett Dyer, State Fire Marshal's Office (SFMO). Rachel Smucker, MD-DC-VA Solar Energy Industry Association; Carol Considine, Old Dominion University and Glenn Overcash, AECOM Engineering.

**Proposals - Consensus for Approval**

**RB322.2.1** – Moves elevation requirements for garage and carport floors in flood hazard areas into Section R322 (was in R309.3). **[From 2021 I-Code]**

**RB322.3.3** – Foundation section for coastal high-hazard areas and Coastal A Zones reorganized and clarified regarding pilings and columns. **[From 2021 I-Code]**

**RB301.2(1)** – Coordinates the wind design criteria in the IRC with the currently referenced edition (2016) of ASCE 7. Updates basic wind speed maps for Risk Category II buildings and revises roof component and cladding loads for buildings with mean roof heights less than or equal to 60 feet. **[From 2021 I-Code]**

**RB301.2.1** – Companion to proposal RB301.2(1), submitted by Glenn Overcash. **[From 2021 I-Code]**

**RB609.4 –** Requires garage doors have a permanent label that provides a way for the owner to be able to determine their performance characteristics after the building has been occupied. **[From 2021 I-Code]**

**B1709.5.2** - Requires garage doors have a permanent label that provides a way for the owner to be able to determine their performance characteristics after the building has been occupied. **[From 2021 I-Code]**

**RB301.2.1.1** – Corrects errors regarding the applicability of the IRC to areas where wind speeds exceed the prescriptive provisions of the IRC. **[From 2021 I-Code]**

**RB200** – Adds the existing VEBC definitions for "substantial damage" and "substantial improvement" to the IRC

**A109.3** – Where dry flood proofing is proposed, requires the engineering details to include details of the walls, floors and flood shields.

**A113.3** – Adds additional minimum inspections to establish lowest floor and elevation in flood hazard areas

**A117.2** – Requires flood hazard documentation for moved buildings (if in flood hazard areas) before the buildings can be occupied.

**Proposals - Non-Consensus**

**B1612.2.1** – Increases the minimum building elevation (lowest floor or lowest horizontal structural member of the lowest floor) from base flood elevation plus 1 ft to BFE plus 2 ft.

**B1804.8** – Adds requirements to the IBC and IRC for the top surface of floors of all buildings to be elevated to one foot above the highest adjacent grade to protect from local storm water/drainage flooding. Also incorporates ASCE 24 definition for "Highest Adjacent Grade", but definition is modified to specify above the "finished ground".

**RB332** – Requires power inlet to be installed, for an optional (portable) generator, for all new one and two-family homes, and for existing one and two-family homes when the electric service is being upgraded.

**B1612.4** – Adds additional documentation for construction in flood hazard and coastal high hazard areas. This includes a flood emergency plan as specified in Chapter 6 of ASCE 24 and a requirement to meet engineered flood opening requirements of Section 2.7.2.2 of ASCE 24. **[From 2021 I-Code]**

**RB703.11.1** – Improves the wind performance of soffits by clarifying installation requirements for the most common types of soffits. **[From 2021 I-Code]**

**Resiliency Subworkgroup**
**May 7, 2019**
**Chesterfield Community Development Building**

**Attendees:**

| | |
|---|---|
| Kenney Payne | AIA |
| Charles Baker | FEMA |
| Steven Sites | VDFP/SFMO |
| Matt Duerksen | DEB |
| Steve Sunderman | Terrazia PC |
| George Homewood | City of Norfolk |
| Whitney Katchmark | Hampton Roads PDC |
| Michael Redifer | City of Newport News |
| Kyle Flanders | DHCD |
| Gina DiCicco | DCR |
| Kevin Utt | City of Fredericksburg |
| Annette Osso | Resilient VA |

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In November 2018, Governor Northam issued Executive Order #24, "Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards", part of the ongoing efforts to protect public health and safety, our environment and natural resources, and the economic wellbeing of the Commonwealth. The order directed DHCD to consult with stakeholders and subject matter experts for the purpose of identifying and suggesting resilience-specific improvements to the USBC for inclusion in the 2018 code update.The Resiliency Subworkgroup was formed to accomplish the task.

**Welcome & Introductions**

At the beginning of the meeting, each participant was given an opportunity to introduce themselves and explain what they hoped to see come from the subworkgroup.

Kevin Utt suggested including conference calls as an option to attend meeting for those that are not able to attend.

Matt Durskin with Virginia DEB conveyed concerns on behalf of Mark Copa (who was not able to attend) who does not agree with a study that came out recommending a 3ft freeboard as it would result in great cost increases to state building construction. He explained that Mr. Copa wants a balance between cost and safety.

George Homewood stated that he believes that a 3 ft freeboard is an absolute minimum and that it is important to think long term regarding building design and construction.

Steve Saunderman indicated that he is a strong proponent of re4siliency and specifically durable resilient concrete construction.

Matt Durskin reiterated that mandating a 3 ft freeboard everywhere would affect someone in the western part of the state.

George Homewood suggested adopting a viewpoint of "total cost of ownership of a building" versus focusing on initial construction costs.

Charles Baker added that there are benefits to reducing insurance premiums over many years and you are lessening risk for the life of the structure, potentially 100 years.

**Background & Code Development Overview**

After the introductions and initial discussions, Jeff Brown provided the following information:

- An overview of Virginia's code development process including Virginia's online code development system (cdpVA) and explanation of the stakeholder workgroups and subworkgroup processes.
- Highlights of information in Executive Order #24 including economic and housing impacts as a result of sea level rise, land subsidence, higher average temperatures and more frequent intense weather events.
- An overview of the USBC and it's three parts: Virginia Construction Code (Part I) = New Construction; Virginia Existing Building Code (Part II) = Alteration, Change of Occupancy in Existing Buildings; and Virginia Maintenance Code (Part III) = Maintenance of Existing Buildings
- The history and purpose of the Existing Building Code which is now mandatory when working on an existing building. The VEBC does not require full compliance with the VCC, but encourages rehabilitation of existing buildings by allowing alterations while maintaining the current level of safety, sanitation, etc.

The group discussed the difference in code requirements that are applicable when work is being performed and "retrofitting" which is requiring building upgrades when no work is being planned/performed. The USBC does not typically require retrofitting, however there are a few existing retrofitting requirements in the USBC (requiring fire protection features in existing dormitories, hotels, assisted living facilities, etc.) and they are found in VEBC Chapter11.

It was pointed out that there is an exception in the USBC that allows one & two family dwellings to be "grandfathered". They are allowed to be reconstructed "like for like", so the code under which they were originally constructed can be applied when they are repaired or renovated.

**Identification of Code Provisions**

The group discussed what "resiliency" is and what the group could focus on in the building code. The group agreed that resiliency is a very broad topic; there are many features in structures that can be designed and constructed to increase resiliency; and there are already many requirements in the code that increase resiliency.

Mr. Homewood stated that sea level rise in the City of Norfolk (and most of Hampton) is not "an event", but an insidious creeping of water. He suggested that as we design buildings and think about resilience, we need to think about how we deal with that stress of impacts that are coming. A hurricane should be the least of our concerns because FEMA helps us address those. When the tide is high and the moon is full (every month) the kayak is the preferred use of transportation in the historic part of our town. We

have to think of Resilience as not only “event driven” and not only “disaster related”. We also need to think about the things that are happening now.

Kenney Payne suggested that the group not get bogged down in attempting to define resiliency. Executive order #24 gave direction of developing code changes to increase resiliency. We just need to decide as a group what we are going to address: hurricanes, wildfires, flooding, severe storms, earthquakes, etc. and to what extent we can address them. We could simply submit code changes to require buildings to meet the same design parameters as other high risk areas such as Florida, California, and Kansas and if the code change proposals are approved, new structures will have increased resiliency.

George Homewood made a suggestion to adopt the Florida hurricane standards either as a requirement or allow Coastal Virginia communities to adopt it optionally. He also stated that although one could say that many hazards are addressed in the code, they may not necessarily be adequately addressed. He also reiterated that it is important to think long term when planning or designing for resiliency.

Annette Osso pointed out that Florida has higher standards for coastal areas and questioned if the group copuld propose that type of regulation or do requirements have to be uniform/statewide. Some existing provisions that are applicable regionally were discussed (wind zones, snow load zones, earthquake, etc.).

Suggestions were made to develop a list of the hazards faced by each individual locality and to look at regional hazard mitigations plans as a way to focus the groups efforts.

Kenney Payne suggested one option might be to add a list of hazards in the code and allow the jurisdiction to decide which one(s) are applicable and they want to address. Once the local hazards are identified, that would take you to a code section that deals with that particular hazard.

Charles Baker pointed out that leaving it up to the communities to decide could lead to unintended negative impacts. For example, if a locality decided they did not want to adopt the fire or earthquake provisions , that would have an impact on insurance rates for building and home owners.

The group began identifying and listing the various hazards that are currently addressed in the code, including:

- Flooding- rising water, moving water
- Wind- high wind
- Wind driven rains- hurricanes, tornado
- Wildfires- ( sometimes considered wind driven)
- Seismic activity
- Terrorism

As the group continued discussing the various hazards currently addressed in the code, they agreed that it would be a good idea to develop a short list of a couple of hazards that they could focus on and research to help identify specific changes that might be discussed at the next meeting. The group agreed to focus on two specific hazards: flooding and high wind events.

The group also decided it will need to identify and understand what the code currently does to address these hazards, determine if there is room for improvement and decide if changes should be proposed.

Prior to the next meeting, the group will work to compile current code requirements and examples of other standards or state regulations that are out there for review.

The group discussed IBHS 2018 “Rating the States” report and the fact that Virginia slipped to second place behind Florida in the 2018 report. One of the key reasons cited in the report was the lack of mandated continuing education for contractors in Virginia. It was suggested that a review of Florida’s building code requirements for residential construction in hurricane prone regions might reveal some specific construction provisions that could easily be added to Virginia’s code to increase resiliency to high wind storms/events.

The group also discussed identifying/researching above code design standards (FORTIFIED, etc.) that are already out there that might be referenced in the code or made mandatory in certain “high hazard” zones. The high hazard zones could be identified on maps in the code. Developing the maps could take considerable time and resources. Development of this type of code change proposal would likely require outside assistance and might not be achievable this code update cycle. The group agreed to continue discussing this type of proposal at future meetings, but to also try to identify some code changes that could be implemented and result in significant increases to resiliency during the current code update cycle.

Charles Baker (FEMA) then provided the following additional recommendations to help resiliency in the Commonwealth of Virginia:

- Implement provisions in Reducing Flood Losses Through the I-Codes: https://www.fema.gov/media-library-data/1411731781834-d0c7d7f9ff0d195ce3c33901ba73daac/ReducingFloodLosses_4thED_Final_508.pdf
- Take advantage of the financial benefits outlined in the Bi-Partisan Budget Act (BBA) and the Disaster Recovery Reform Act (DRRA) as it provides for code activities pre and post disaster.
- Amend the 2018 IBC to require ICC 500 complainant hurricane shelters in new schools, critical and first responder facilities.
- Implement Insurance Institute for Business and Home Safety Standards (IBHS) Fortified Standards in the UBC.
- Encourage communities to participate in Federal Alliance for Safe Homes (FLASH) Hurricane Strong Communities Program.
- The number one thing Virginia can do is to ensure it adopts the latest codes and that they are adopted to include all flood provisions and not weakened in any manner. Higher Regulatory Standards are implemented in the I-Codes because data shows the benefits of construction practices adhering to the minimums of the I-Codes.

**Group Assignments:**

- Identify existing provisions in the USBC related to "Flooding" (coastal & riverine) and "High Wind Events" (hurricanes, tornado & other wind events) for review and discussion at the next meeting.
- Identify existing "above code" building standards (FORTIFIED Home, etc.).
- Identify codes or initiatives in other states aimed at increasing building resiliency.
- Identify differences between Virginia's and Florida's building codes (roofing requirements in hurricane prone regions, etc.). A report/comparison may already exist.

# Resiliency Subworkgroup
# July 17, 2019
# Virginia Housing Center

**Members in attendance:**

| | |
|---|---|
| Steve Sunderman | Terrazia PC |
| George Homewood | City of Norfolk |
| Steve Shapiro | City of Hampton |
| Whitney Katchmark | Hampton Roads PDC |
| Michael Redifer | City of Newport News |
| Mark Dreyer | DEB |
| Kevin Utt | City of Fredericksburg |
| Kristen Owen | DCR |

**Others in attendance:**

| | |
|---|---|
| Jeff Brown | DHCD |
| Thomas King | DHCD |
| Nicole Donaldson | DHCD |
| Kyle Flanders | DHCD |
| Angela Davis | DCR |
| Abigail Johnson | BHCD |
| Paul Battaglia | Clark Nexson |
| Thom Stanton | Tiny Home Industry Association |

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**Welcome & Introductions:**

At the beginning of the meeting, each participant was given an opportunity to introduce themselves. There were a few members present that did not attend the first meeting (Kristin Owen, Mark Dreyer, Steve Shapiro)

Mr. Brown recapped the discussions and results of the last meeting. The group previously agreed that they would work more efficiently if they focused on a couple of items at a time and had agreed leading into this meeting to focus on two "threats", flooding and high wind events.

Mr. Brown also discussed an email he sent to the group, based on a suggestion from Mr. Homewood, with a print out of all of the code change proposals submitted in cdpVA, encouraging everyone to review the resiliency impact statements for submitted proposals to determine if they were accurately capturing impacts. The group reviewed a document submitted by Mr. Homewood that contained some questions and comments based on his review of the proposal and impact statements.

Mr. Homewood pointed out that some of his questions were related to proposed changes to the energy codes and asked for clarification on how the International Energy Conservation Code related to the state code and how the code changes relate to the model and state energy codes.

Mr. Brown provided an explanation and pointed out that the I-Codes are incorporated as part of the USBC, so the changes/improvements in each new edition of the I-Codes become part of the USBC each time it is updated, unless there is a state amendment that amends an I-Code section. He explained that all of the changes or amendments to the model codes are published and posted on the DHCD website.

Mr. Homewood suggested that the group analyze all existing amendments to the energy code and any proposed code changes.

Ms. Owen stated that it is important to look at these things because the general public does not keep up with the process and does not have the time to review these details. If we as a state are serious about increasing resiliency, and we rely on the general public, we are doing a huge disservice to the entire state. We should look at these proposals or set up some guidelines to help the Board review these items to ensure that resiliency is being adequately addressed.

Mr. Brown agreed that it would be good for the members to review these items, but there are potentially hundreds of items to review, so that additional work should take place outside of the meetings and if specific issues related to resiliency are discovered, they could be brought back to the group to be addressed. There is a separate energy subworkgroup meeting that reviews each energy related proposal and makes a recommendation on each. There are also many others interested stakeholders that are actively involved in the process, participate in the discussions and help make recommendations for each proposal. He also reminded everyone that there is a public comment feature in cdpVA where anyone can submit comments on any proposal.

Mr. Homewood stated that he disagreed with some of the resiliency impact statements, as outlined in his document. He also really liked some of the proposals like one that provided a standard to utilize for rainwater harvesting and reuse and thinks the group should be pushing these kinds of thing going forward.

**Discussion of potential changes**

Mr. Homewood suggested the following as potential code changes:

- Require for all 1& 2 family new construction and substantial improvement, installation of an external connection for a generator and a transfer switch. The ability for people to remain in place is a key resiliency element.
- Mandate standby generators for certain uses (nursing homes, etc.).

- Require any construction (remodeling, etc.) to certain uses to meet the most current codes (no grandfathering).

Mr. Brown explained the process for the group discussing and developing proposals as well as how any proposals would be further vetted by the full workgroups and the Board. The proposed regulations phase is soon coming to a close. This group can continue working on developing some proposals and submit them during the final regulations phase.

Ms. Owen pointed out that she has noticed, at the local level, a deficiency or lack of understanding or familiarity with the existing flooding standards in the building code. Even if we don't propose changes, we still need to address the education piece. The existing codes contain good resiliency requirements, if they are properly enforced.

Ms. Owen also pointed out that there is a disconnect between the local floodplain requirements and the building code requirements. One example is related to substantial improvements, that should be tracked and documented, but are not always regulated by the building code (painting, floor coverings, etc.). There needs to be more education so that the locals understand how the two regulations work together to ensure they are not missing important requirements.

Mr. Brown suggested that if the group identifies an issue, like education, that would really make an impact on resiliency, but is not related to the work of this group, we might consider making a recommendation or list of recommendations to other groups to address those issues.

Some other programs were discussed such as Hurricane High Velocity Wind Zone requirements in Florida and FORTIFIED building standards. It was pointed out that the Florida codes focus on weak point such as roofs, garage doors and soffits

Mr. Homewood suggested that maybe, for this round, we look at proposing to allow the localities to consider adopting the FORTIFIED requirements for certain zones and then look at the Florida requirements next round. We can let the coastal communities adopt what they want so it's not the Commonwealth imposing the code but it's up to the localities and the local official take the responsibility on what is decided.

It was pointed out that Florida uses a projective wind zone and Virginia uses a historic wind zone.

It was suggested to reevaluate the wind zones in Virginia more frequently. Maybe there are outside resources, like college students/groups, that would be willing to help gather data.

Ms. Owens suggested that substantial damages and improvements could be applied outside of the flood zone, requiring retrofitting of existing structures to current code when certain thresholds of property improvements are reached. It would make it much more clear for everyone to remove any conflicts or differing requirements between the USBC and the NFIP.

The following documents form the shared Dropbox folder were briefly reviewed and discussed:

- 2015 USBC and I-Code Provisions Applicable to Construction in Flood Hazard Areas
- NFIP 2015 I-Codes and ASCE 24 Checklist (list of all NFIP requirements and where they are satisfied in the IBC and/or ASCE 24)
- Payne 2018 IBC Resiliency References (Included a draft proposal to amend IBC appendix G for use in Virginia and a draft appendix for high-wind based on the IBC Tsunami appendix).

Mr. Brown suggested that the group pick one of the suggested code changes to discuss to see if there was consensus to further develop it and move it forward. Homewood suggested to put forward a proposal for a requirement for some kind of emergency generator hookup on new construction and significant rehabilitation.

Ms. Owen suggested consideration of a proposal to require all structures to comply with the substantial damage and substantial improvement requirements that are currently only applicable to structures in a flood hazard area. It does not make sense to apply the requirements to one house and not to one that is several feet away, just outside of the flood hazard area.

Mr. Redifer stated that, if you require a generator connection for a generator, you will have to specify the details and requirements such as electrical requirements, minimum circuits served, minimum capacity, manual or automatic transfer switch, etc.

The group identified the inability to remain in a home after an event, when power is lost, as an important resiliency issue and having a safe connection for connection of a portable generator would make it possible, in many instances, to remain in place for an extended period of time.

It was agreed to draft a code change proposal that would require installation of a minimum 30 amp connection for a generator for all newly constructed Group R-2, R-3, R-4 and R-5 dwelling units and for existing dwelling units anytime the electrical service is being upgraded. DHCD staff will develop the draft proposal, based on the discussions and bring a draft back to the group at the next meeting for review.

A suggestion was made to identify or make available wind zone and other maps for Virginia that are easier to read. The small maps in the I-code books are so small it is hard to see what zone a locality is in.

Mr. Homewood brought up an issue with corrosion resistant fasteners. It is addressed in flood hazard areas and some other areas, but not in all areas near slat water. Corrosion of fasteners occurs anywhere saltwater or brackish water is present. The group discussed identifying areas where this is a concern and developing a map where corrosion resistant fasteners are required. Ms. Katchmark discussed a VDOT study that is being conducted to identify and map areas where corrosion is an issue for VDOT structures. She suggested reviewing their findings to see

if that information could be used as a starting point for determining where the group could propose to require corrosion resistant fasteners in the USBC. A suggestion was also made that a list of localities where specific requirements apply could be added in lieu of a map. The proposal should include information to support the idea that although the current code requires corrosion resistant fasteners in certain locations, but there are other areas where corrosion is also an issue that need to be addressed. The group will work on researching this prior to the next meeting.

Other suggestions related to requiring additional hold-down and strapping devices in hurricane prone regions and inclusion of standards such as FORTIFIED as an option for localities to adopt in certain high hazard areas were discussed and determined to need additional research on what the code already requires.

Ms. Owens stated that she has some questions related to flood-proofing of accessory structures, installation of recreational vehicles in flood hazard areas, the USBC definition of substantial damage and elevation documentation requirements that she would like to discuss to determine if these sections would benefit from clean up. She also has general questions about application of some of the language in the building code. She will do research and discuss with Mr. Brown prior to the next meeting and if any issues are identified, will bring back them back for discussion at the next meeting.

The group will meet again prior to the final regulations phase workgroups meet.

**2nd Resiliency Subworkgroup Meeting**
**VHC at VHDA**
**4224 Cox Road, Glen Allen VA**
**July 17, 2019**
**SIGN IN SHEET**

| NAME | REPRESENTING | EMAIL ADDRESS |
|---|---|---|
| Paul Battaglia | Clark Nexsen | pbattaglia@clarknexsen.com |
| THOM SHANNON | TINY HOME INDUSTRY ASSN | GOTINY.COM@GMAIL.COM |
| Steve Sunderman | Terrazia PC | steve@terrazia.com |
| GEORGE HOMEWOOD | City of Norfolk | george.homewood@norfolk.gov |
| Steve Shapiro | City of Hampton | sshapiro@hampton.gov |
| Michael Reliford | City of Newport News | reliford@nnva.gov mreliford@nngov |
| Mark Dreyer | Commonwealth of VA / DEB | mark.dreyer@dgs.virginia.gov |
| Kristin Owen | VA DCR | kristin.owen@dcr.virginia.gov |
| Angela Davis | VA DCR | angela.davis@dcr.virginia.gov |
| Kevin Wurtz | City of Fredericksburg | kwurtz@fredericksburgva.gov |
| Whitney Katchmark | HRPDC | wkatchmark@hrpdcva.gov |
| Abigail Johnson | PDC Board | |
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| | | |
| | | |
| | | |

**Resiliency Sub-Workgroup**
**December 10, 2019**

## Attendees:

| | |
|---|---|
| Kenney Payne | AIA |
| Steve Shapiro | City of Hampton |
| Kristin Owen | DCR |
| Charles Baker | FEMA |
| George Homewood | City of Norfolk |
| Garrett Dyer | VDFP/SFMO |
| Stacey Smith | Viridiant |
| Carol Considine | ODU |
| Craig Toalson | HBA Virginia |
| Andrew Clark | HBA Virginia |
| John Ainslie | Ainslie Group |
| Steve Sunderman | Resilient VA |
| Abigail Johnson (remote) | BHCD Member |
| Whitney Katchmark (remote) | HRPDC |
| Annette Osso (remote) | Resilient Virginia |
| Richard Potts | DHCD |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Traci Munyan | DHCD |
| Lee Hutchinson | DHCD |

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**Welcome/Introductions**

**Discussion of Executive Order 24 and 45**

Mr. Brown summarized the intent of Executive Order 24 and the past work of this Subworkgroup. Mr. Brown explained that, during a previous meeting, there was an agreement to first focus on flooding and high wind events before working on some of the other identified shocks/stresses. At the previous meeting, this group agreed to draft a proposal to require all new dwelling units to be provided with a portable generator hookup. Mr. Brown summarized the current status of the code change process and indicated that any proposals from the group would need to be finalized and submitted by April or May to be considered at a regular workgroup meeting prior to conclusion of the final regulations phase. He also encouraged participants to work together, between meetings, to come up with potential code changes to submit to the group for consideration.

Mrs. Owen summarized the work that has been done so far related to Executive Order 24. She also summarized the report submitted by DCR at the direction of EO 24 that included several recommendations. Mrs. Owen summarized the actions taken under Executive Order 45, which included rescinding a previous Executive Memorandum 2-97 which created the Flood Plain Management program, updating flood prevention provisions for building construction for state owned buildings and updating Virginia's Flood Map to NOAA 2100.

**Discussion of draft "Generator Connection" proposal**

Mr. Brown opened the discussion on the draft code change proposal, developed as a result of the previous meeting, to require a generator connection for individual dwelling units. He went over the individual items in the proposal, explained how it would work for new construction of dwelling units and when it would apply to existing buildings.

Mr. Payne suggested having the term "optional standby power system" refer back to NFPA 70. Mr. Brown suggested having it read "….an optional standby power system in accordance with NFPA 70".

Questions were raised regarding natural gas power and applicability for multi-unit apartments/condos and if this proposal unintentionally creates an unsafe situation by having multiple individual portable generator connections for each unit in a multi-family building.

Mr. Payne asked what items would be covered by this emergency power supply – the heater, the lighting, the oven, the refrigerator, etc. Mrs. Owen asked if the emergency standby power in the NFPA is already limited to just lighting and elevators and would already prohibit the powering of refrigerators and heating/cooling.

Mr. Ainslie questioned if the proposal conflicts, by increasing the cost of a home, with other guidance from the Governor to promote affordable housing. There was some discussion on what this type of connection would include (transfer switch, wiring, generator receptacle, etc.) and what it would cost. Mr. Brown stated he had installed one in his own home for about $150 in materials, but that the price to a homeowner including installation would likely be higher. Mr. Brown asked the HBAV representatives if they would help determine estimated costs to provide one of these connections for a new home.

Based on several concerns that were raised by various members regarding application of the requirements to multi-family buildings, the group agreed to first focus on finding a solution for one and two-family dwellings.

Mr. Ainslie suggested that the language in the draft proposal should strike the word "optional" and state that it's mandatory, if it's agreed that it should be mandatory. Mr. Ainslie spoke to the unintended consequences of making this type of hookup available to homeowners who may not be informed on safe operation.

Mr. Dyer spoke to the importance of and complications in educating the public and ensuring life safety in an emergency.

There was some discussion that many homeowners purchase portable generators leading up to or after severe weather events and try to find a way to connect it to their home. There was general agreement that having a code compliant connection already installed on a home would be much safer than a homeowner attempting to install one on their own in the aftermath of an event.

Mrs. Osso said item 5 on the proposal would seem to be the best way to get to the issue that we're facing.

Mr. Brown asked for input or ideas on how the proposal might be amended to alleviate the concerns raised related to the cost of the proposed change and possibly reach consensus on the proposal. Mr. Shapiro added that any resiliency improvements that we identify are going to come with some additional cost and if there is going to be opposition to any cost increase, regardless of the benefits, we should just go home now. It was mentioned that the proposed generator connections might be funded through existing or new grants to offset the initial cost. Mr. Toalson and Mr. Ainslie offered to research funding options, total cost increase to the home and possible cost offsets from things like homeowners insurance.

Mr. Shapiro offered to find out if there are any approved changes coming in the 2021 edition of the model codes related to generators that might be beneficial to the discussions.

Mr. Brown tabled the discussion on this proposal until the next meeting to allow time for additional research on costs and submission of any suggested amendments to help reach consensus.

**Discussion of draft "Flood Hazard Area Construction" proposal**

Mr. Brown opened the discussion with a summary of George Homewood's proposal and the discussion from last meeting.

Mr. Homewood summarized his proposal, explaining that it allows localities to consider adoption of specific above-code requirements in coastal areas designated as "high risk" related to wind and flooding. The proposal included a requirement to design to elevations based on 50-year sea level rise projections with an additional of 3 feet of freeboard, and a continuous load path (from the roof to foundation) designed to handle all expected environmental loads expected for 50 years. The proposal includes options for local enforcement of recognized above-code construction standards and prohibitions or restrictions on basement construction. The proposal also included several pages of minor technical and clarification changes throughout the existing flood provisions of the code.

Mr. Sunderman suggested expanding the proposal so that all localities within high wind zones and coastal areas can optionally adopt their own resiliency related ordinances.

Mr. Shapiro indicated that item 2 under scoping requires compliance with technical bulletins that contain non-regulatory language (not mandatory). Mr. Baker said this is correct, FEMA Technical Bulletins are not written as mandates.

Mrs. Owen said item 1 could be correlated with similar provisions in EO 45.

Mrs. Osso asked whether the General Assembly would have to enact legislation to permit localities to adopt these changes. The group agreed that it would not require GA action.

Mr. Payne asked for clarification on item 1 and how it would be determined what 50 year projection means. Mrs. Owen and Mr. Homewood said that part of the EO 45 work will include identifying specific sea level rise projections and sea level rise inundation areas. They indicated an interactive map for sea level rise projections already exists on NOAA's website.

Mrs. Considine stated that the solution would be to just incorporate the map the Governor's Office has published online and to go to the 50 year curve and stack the freeboard requirement around that. The ASCE also has incorporated this 50 year curve recommendation into their resilient design standard.

Mr. Brown suggested pulling out the requirement to design to projected sea level rise and making it a proposal on its own.

Mrs. Owen said the definition for "base flood" is not the same as "base flood elevation" for computing flood rates and the two definitions need to be matched throughout for clarity and in the USBC as well.

Mr. Brown suggested pulling out items that everyone agrees with as separate proposals, and grouping similar changes into separate proposals, like all definition definitions and all items related to elevation certificate, etc.

Mrs. Owen asked throughout the definitions that we do not use "100-year floodplain" and instead use a 1% chance or greater of flooding in a given year for consistency with FEMA regulations.

Under minimum inspections 113.3 there was a requirement added to require certifying the elevation of the lowest floor before proceeding with construction.

Mrs. Owen said we need to go back and make sure that the elevation of the lowest floor is being certified before the building is finished and the problem is still fixable, but that this doesn't need to be in 113.3. Also there are places in the code where it directs you to use the elevation certificate and in other places it just says use whatever the surveyor uses. We should go through the code and remove the words elevation certificate and just let the builder choose

whether they use the surveyor info or the elevation certificate form or RDP certification of the elevation.

Mrs. Owen asked that FEMA Technical Bulletins be included or referenced in some capacity even if they aren't referenced as standards that must be complied with.

**Discussion of draft "Resiliency References"**

Mr. Payne's discussed his draft proposal that brought forward many IBC changes recommended to increase flood resistance in Chapter 5 of FEMA's "Reducing Flood Losses Through the International Codes". He explained that most of the changes were to the IBC Appendix G "Flood-Resistant Construction".

Mrs. Owen indicated that some states utilize Appendix G, but Appendix G does not fit with Virginia, so DCR utilizes a draft local floodplain ordinance that localities adopt to incorporate the NFIP requirements that are not within the scope of the USBC and are addressed in the Appendix and suggested that adoption of the Appendix is not desirable in Virginia.

Mr. Baker added that adoption of Appendix G will help with BCEGS ratings and will help with insurance rates. Additional discussions focused on the benefits of utilizing either Appendix G or a local floodplain ordinance.

Mr. Payne suggested that one way to add additional strength/resiliency for structures in certain high risk areas, without making significant changes to the IBC, would be requiring all buildings in specific/identified high risk areas to be designed/built as Risk Category IV, in accordance with the IBC. This would make the requirements clear, versus utilizing terms like "stronger", as the specific requirements are already laid out in the IBC. Additional discussion included adding a new Rick Category and requiring compliance with all requirements of Risk Category IV, with exceptions for any that were identified as non-applicable.

Mr. Payne asked what could be pulled over from his proposal to the technical proposals already put forth. Several people agreed that the elevation requirements could be brought over, in addition to the records retention items.

Mrs. Owen stated that she has been working to identify any areas where there are items that could be clarified in the USBC to ensure that there are no conflicts with the model floodplain ordinance language, and will meet with Mr. Brown prior to the next meeting to finalize a list of specific changes that she would like to recommend.

For example, flood hazard records, to comply with FEMA have to be kept in perpetuity. The current USBC ties records retention to the Library of Virginia, which is not up to date with FEMAs requirement. USBC Section 105.4 specifies records retention requirements, Mr. Brown suggested we could propose an amendment to this section to make it clear that NFIP compliance records must be kept in perpetuity and can be stored digitally.

**Adjournment**

**Next Steps:**

- The Generator Connection proposal will be limited to one and two-family dwellings for the time being and will be added to the next meeting agenda for further discussion.
- Mr. Ainslie and Mr. Toalson will research cost, grants and other offsets for mandatory residential generator connections.
- Identify changes that have been approved for the 2021 I-Codes, that increase resiliency
- Identify specific provisions in the Florida building codes that have been amended to increase resiliency and bring back to group for consideration.
- Mr. Shapiro offered to work on obtaining copies of the Florida codes.
- Mrs. Owen will work with Mr. Brown to develop a list of suggested amendments to the USBC to better coordinate with the floodplain ordinances and NFIP requirements.
- Prior to the next meeting, DHCD staff will work with Mr. Homewood, Mr. Payne and Mrs. Owen to compile and categorize the various individual changes submitted/discussed into multiple proposals for consideration at the next meeting: administrative requirements, elevation certificates, definitions, specific technical requirements, stand-alone items, etc.

**Resiliency Subworkgroup**
**Pretlow Anchor Branch Norfolk Public Library**
**111 W. Oceanview Ave, Norfolk, VA**
**March 10, 2020**

| | |
|---|---|
| Phil Abraham | Vector Corp |
| Chelsea Harnish | VA EE Council |
| Whitney Katchmark | Hampton Roads Planning District |
| Ben McFarlane | Hampton Roads Planning District |
| George Homewood | City of Norfolk |
| Steven Shapiro | City of Hampton Building Official |
| Rebecca Quinn | FEMA Building Science |
| Stacey Smith | Viridiant |
| Glen Overcash | AECOM/FEMA |
| Charlie Baker | FEMA Region 3 |
| Garrett Dyer | VDFP/SFMO |
| Steve Sunderman | Terrazia PC, LEED Architect |
| Kenney Payne | AIA Virginia |
| Cindy Davis | DHCD |
| Thomas King | DHCD |
| Jeff Brown | DHCD |
| Richard Potts | DHCD |
| Lee Hutchinson | DHCD |
| Travis Luter | DHCD |

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**Summary**

Mr. Brown opened the meeting with introductions. The first item for discussion comes from 2021 approved proposals related to resiliency. Mrs. Quinn summarized the FEMA proposals related to resiliency starting with 1612.4.

**B1612.4-18 – Consensus Approved**
Mrs. Quinn said it is FEMA's position that they want uniformity on the type of documentation being required and so this proposal captures that. Mr. Shapiro pointed out that all the 2021 items up for discussion were reviewed by engineers and professionals at the national level as well as the OGCV process and are, therefore, well vetted proposals. Mr. Homewood noted that breakaway walls are part of FEMAs "higher standards" provisions and some localities in Coastal A and VE zones have banned breakaway walls already.

Mr. Brown pointed out the process for proposals approved here, that they will go to the full Workgroup Committee and Mr. Potts pointed out the deadlines for submission of items to be considered.

**RB322.2.1-18 – Consensus Approved**

Mrs. Quinn points out this is paired with **R322.3.2** and we are only showing 2 of the changes and there are a few others, including 309.5 which currently has provisions for Garages. She summarized that this is not a technical change, but makes clearer the distinction and she recommends adding R309.5 to these two (R322.2.1 and R322.3.2) and further that the change in R309.5 is primarily a pointer. Additionally that for these proposals FEMA secured the support of the National Homebuilders Association.

Mr. Homewood asked if there was a word missing from one of the proposals. Mrs. Quinn researched her documents and confirmed that sub-section 4.2 should begin with the word "They" and not "The". Mr. Payne asked about the relevance of carports for this provision which Mrs. Quinn answered. Mr. Brown asked if this was related to NFIP. Mrs. Quinn said the purpose is that is to indicate that it should not be permitted to enclose carports unless they meet these provisions.

**RB322.3.3 – Consensus Approved**

Mr. Shapiro asked why we are striking "slabs and pools" and the group researched and discovered that this was moved from 2015 to 2018 and so when comparing the 2021 to our current code this section should be removed. Mr. Brown asked if the group was in consensus.

**B1612.2.1 – Consensus Approved (BFE+2)**

Mr. Brown summarized that this set of proposals are not in code change format and are, instead, a guide that can be used to determine what's the best flood elevation height for a particular flood hazard area. Mr. Homewood proposed the BFE plus 3 is desirable but that he would be OK with BFE plus 2. The rest of the room was in agreement that plus 2 was better but with the reservation that the Homebuilders of Virginia may not be in agreement. Mr. Homewood answered a question about the cost of one foot of elevation versus two feet. In Norfolk, they studied it and it's under $10,000. Mr. Payne pointed out that there is a concern for ADA compliance as only single family homes are exempt and other elevated buildings would require a ramp, and with three feet of elevation it would be a large ramp. Mr. Brown summarized that as the group was in agreement, that staff would pull out all the Base Flood Elevation sections in flood hazard sections, coastal high hazard areas and A zones, as well as ASCE 24, and create a proposal.

**B1804.8 – Approved As Amended**

Mr. Shapiro said that 1804.8 should be changed to "AHJ" or "as approved" instead of engineer. Mr. Homewood questioned how this would work in cities that aren't as flat a Norfolk. Mr. Homewood argued for banning slab on grade adjacent to roads and suggested we should promote raised slab construction in these regions. Mr. Payne asked if this would supersede the change to BFE+2 from above. Mrs. Quinn explained how it would work like the rest of the code where the higher standard takes precedent. The group argued that this provision should not be tied to an adjacent road and should instead be structured to the "highest adjacent grade unless otherwise approved." The group agreed to strike the new definition and Mr. Shapiro said that ASCE 24 has a definition for "highest adjacent grade" that we can reference or pull into our code.

**1612.2 and Enclosed Areas Below Elevation – Tabled**

The group briefly discussed these sections (1612.2, R322.2.2, R322.3.5, R322.3.6, R322.3.3). Mr. Shapiro said that he cannot support these changes as it would overrule the structural engineers that approved

these sections in the international process. The group briefly discussed moving R322.3.3 forward with the deleted exception, but that did not have support.

Mr. Brown asked if anyone would take this proposal on as it does not have committee support, and Mr. Homewood said it should be tabled.

**RB35 – Consensus Approved**

Mr. Overcash presented the justifications for this section. It was approved by the international review process and is not a FEMA proposal. It was put forward by ASCE, IBHS, and CSC and would bring Virginia into ASCE 7-16. Mr. Payne had questions about the special wind regions and where they apply on the map. There was no opposition to the proposal. Mr. Overcash stated that he would submit his proposal in cdpVA and Staff would put it forward as a subworkgroup recommendation.

**B1709.5.2-18 – Consensus Approved**

The sentence "Structural performance of garage doors…shall meet the acceptance criteria of ANSI/DASMA 108" was agreed to be deleted.

**RB609.4-18 – Approved As Amended**

Mr. Homewood asked if we could mandate that the labels were affixed to the door. Mr. Brown explained how the definition of "label" and "labeled" already mandate that. The group agreed to italicize "label" and "labeled" and change "provided" to "affixed".

**R703.11.1 Soffits (VRC) – Consensus Approved**

Mr. Overcash summarized that this is a joint FEMA/IBHS proposal that incorporates design standards in the Florida Building Codes. These changes resulted from some of the studies conducted after Hurricane Irma and Harvey that found that cheap materials used in soffits were causing the roof to uplift in high wind scenarios and destroy the home. Mr. Brown summarized that this proposal is already approved in the 2021 process.

**RB301.2.1.-18– Consensus Approved**

Mr. Overcash summarized that this is an approved proposal from the 2021 cycle with changes that clarify the use of ultimate design wind speed for special wind regions.

**RB332 – Consensus Approved**

Mr. Shapiro recommended we change language in Item 1 to "Shall be permitted" instead of "can be". Mrs. Harnish asked if this was 2021 language and remarked on the irony of mandating connections for fossil fuel burning equipment – home generators – when the purpose of the resiliency SWG is to address the result of climate change, which is caused by fossil fuel pollution. Mr. Shapiro recommended instead of making edits to this, that we just approve it and let the full Workgroup tweak the language.

**RB200 – Approved as Amended**

Mr. Brown summarized that this was from Kristen Owens office and would add the identical definition for "substantial damage" that exists in the VEBC and VCC and duplicate it in the IRC/VRC. Mrs. Quinn

asked about the “substantial improvement” definition from the VEBC. The group agreed to duplicate both improvement and damage definition in the IRC.

**ASCE 24 Reference to FEMA Technical Bulletins – Consensus Disapproval**

Mr. Shapiro is completely opposed to altering the text of a reference standard with our code language.

**George Homewood Proposals**

*Administration*

*A102.2.2-18 - Tabled*

Mrs. Quinn asked if the resilience areas would include a map and who would publish it. Mr. Homewood stated that eventually there will be a map. Mr. Shapiro asked why we would create code provisions which would be unenforceable until a map exists, especially when there is no timeframe for this map to be completed. Mrs. Davis asked if these zones would be clear to localities and was hesitant to create many different codes and summarized the need for a Uniform code. Mr. Payne asked if the map would be available by the effective date of the 2018 codes. Mrs. Davis said that we should just skip this section and possibly bring it forward as an emergency proposal once the maps become available.

*A109.3-18 – Approved as Amended*

Mr. Payne recommended deleting “adequately” and Mrs. Quinn recommends adding “Section 1612 for dry floodproofing and Chapter 16 of tis code” as a pointer for dryfloodproofing.

*A113.1-18 – Approved as Amended*

Mrs. Quinn suggested we add “located… in any flood hazard area or special flood hazard area” to Item 4. Mr. Brown said staff would correlate the elevation inspection provisions to where they exist in the Virginia administration sections so that they are conducted before construction can proceed beyond base elevation.

*A117.2-18 – Consensus as Amended*

Mr. Payne pointed out his e-mail where he edited this with “if required by Chapter 15 and R322 of the IRC…”. The group agreed to those changes.

*Definitions - Tabled*

Mr. Payne recommended we change the word “community” to “locality” throughout the definitions proposal. Mrs. Quinn said that we should not change “Design Flood Elevation” to include additional height above the water as it could cause confusion between *base flood* and *design flood*. Mr. Homewood offered to break up his definitions into individual proposals with reason statements.

*Certification - Tabled*

Section 1612.4 item 2.3 conflicts with other business conducted in this meeting so we should delete that section. Mr. Payne has concerns with 1603.1.7 about using “grade beam” for a reference.

**Closing**

Mr. Brown apologized for going over and not having time to discuss the Florida Building Codes in this meeting. He asked the attendees to go back and review the items we discussed today and see if there was a consensus item we could bring back in, and if we can, we will look into scheduling an additional meeting.

# B1612.4-18

**IBC®: 1612.4**

**Proponents:**

## 2018 International Building Code

**1612.4 Flood hazard documentation.** The following documentation shall be prepared and sealed by a *registered design professional* and submitted to the *building official*:

1. For construction in *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*:

1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.11.1.

1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, *construction documents* shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

1.3. For dry floodproofed nonresidential buildings, *construction documents* shall include a statement that the dry floodproofing is designed in accordance with ASCE 24, and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.

2. For construction in *coastal high hazard areas* and *coastal A zones*:

2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.11.1.

2.2. *Construction documents* shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.

2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m$^2$) determined using *allowable stress design*, *construction documents* shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

2.4. For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

**Reason Statement:** Consensus Approval item from Resiliency Subworkgroup

**Bibliography:** This proposal will increase Resiliency
Additional compliance with ASCE 24 will increase resiliency.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This is primarily an administrative change and will require documentation.

# RB322.2.1-18

**IRC®: R322.2.1, R322.3.2, R309.3**

**Proponents:** Rebecca Quinn (rcquinn@earthlink.net)

## 2018 International Residential Code

**R322.2.1 Elevation requirements.**

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
4. Garage and carport floors shall comply with the following:

   4.1. They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.

   4.2. They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage.

**Exception:** Enclosed areas below the design flood elevation, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

**R322.3.2 Elevation requirements.**

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. Garages used solely for parking, building access or storage and carports, shall comply with Item 1, or shall be at or above grade on not less than one side.
4. The use of fill for structural support is prohibited.
5. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
6. Walls and partitions enclosing areas below the ~~design flood~~ elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

**R309.3 Flood hazard areas.** For buildings located in flood hazard areas as established by Table R301.2(1), garage floors shall be one of the following:

1. Elevated to or above the ~~design flood~~ required lowest floor elevation as determined in accordance with Section R322.
2. Located below the ~~design flood~~ required lowest floor elevation provided that the floors are at or above *grade* on not less than one side, are used solely for parking, building access or storage, meet the requirements of Section R322 and are otherwise constructed in accordance with this code.

**Reason Statement:** Consensus Approval item from the Resiliency Subworkgroup

**Bibliography:** This proposal will increase Resiliency
This proposal will increase resiliency by ensuring garages and carports are not enclosed in Flood Hazard Areas.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This proposal is not a technical requirement, it just forbids a practice already limited in flood prone localities.

# RB322.3.3-18

**IRC®: R322.3.3**

**Proponents:**

## 2018 International Residential Code

**R322.3.3 Foundations.** Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns.

1. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.

2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). ~~Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.~~ Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. ~~Pile systems design and installation shall be certified in accordance with Section R322.3.9. Spread~~

3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24 .

4. Flood and wave loads shall be those associated with the design flood. Wind loads shall be those required by this code.

5. Foundation designs and construction documents shall be prepared and sealed in accordance with Section R322.3.9.

**Exception:** In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided that the foundations are designed to account for wave action, debris impact, erosion and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.

**Reason Statement:** This is a consensus approval item from the Resiliency Subworkgroup

**Bibliography:** This proposal will increase Resiliency
These items will affect pile and column design in flood areas.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
These may affect the cost of construction

# B1612.2.1-18

**IBC®: 1612.2, 1612.2.1 (New); IRC®: R322.2.1, R322.3.2**

**Proponents:**

## 2018 International Building Code

**1612.2 Design and construction.** The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

**Revise as follows:**

**1612.2.1 Modification of ASCE 24: Elevation requirements.** The minimum elevation requirements shall be as specified in ASCE 24 or the base flood elevation plus 2 feet, whichever is higher.

## 2018 International Residential Code

**R322.2.1 Elevation requirements.**

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus ~~1 foot (305 mm)~~ 2 feet (610 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus ~~1 foot (305 mm)~~ 2 feet (610 mm), or the design flood elevation, whichever is higher.

**Exception:** Enclosed areas below the design flood elevation, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

**Revise as follows:**

**R322.3.2 Elevation requirements.**

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus ~~1 foot (305 mm)~~ 2 feet (610 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
5. Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.5 and R322.3.6.

**Reason Statement:** This item was consensus approval by the Resiliency Subworkgroup and adjusts all base flood elevation requirements to BFE +2 feet.

**Bibliography:** This proposal will increase Resiliency
This will increase resilience to flood damage.

**Cost Impact:** The code change proposal will increase the cost of construction
The additional height in construction will increase costs.

# B1804.8-18

**IBC®: (New); IRC®: 200 (New); IBC®: 1804.8 (New); IRC®: R501.3 (New)**

**Proponents:**

## 2018 International Building Code

**Add new text as follows:**

**HIGHEST ADJACENT GRADE**

Highest elevation of the finished ground surface prior to construction next to the proposed foundation of a *structure* .

## 2018 International Residential Code

**Add new text as follows:**

**HIGHEST ADJACENT GRADE**

Highest elevation of the finished ground surface prior to construction next to the proposed foundation of a *structure*.

## 2018 International Building Code

**Add new text as follows:**

**1804.8 Protection from local drainage.** The top surface of floor systems and concrete floors shall be elevated to one foot (305 mm) above the highest adjacent grade unless otherwise approved.

## 2018 International Residential Code

**Add new text as follows:**

**R501.3 Protection from local drainage.** The top surface of floor systems and concrete floors shall be elevated to one foot (305 mm) above the highest adjacent grade unless otherwise approved.

**Reason Statement:** This proposal is a consensus item from the resiliency subworkgroup and incorporates ASCE 24-14 definition for Highest Adjacent Grade but modified to specify the finished grade.

**Bibliography:** This proposal will increase Resiliency
This proposal increases resiliency by reducing flood risk adjacent to buildings.

**Cost Impact:** The code change proposal will increase the cost of construction
This change proposal will increase the cost by requiring additional elevation in some flood areas.

# RB35-19

**IRC®: TABLE R301.2(2), TABLE R301.2(2) (New), TABLE R301.2(3), FIGURE R301.2(8), FIGURE R301.2(5)A, FIGURE R301.2(5)B**

**Proponent:** Jennifer Goupil, American Society of Civil Engineers (ASCE), representing American Society of Civil Engineers (ASCE) (jgoupil@asce.org); Don Scott, representing Representing National Council of Structural Engieers Association (dscott@pcs-structural.com); T. Eric Stafford, Insurance Institute for Business and Home Safety, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

## 2018 International Residential Code

**Delete without substitution:**

~~TABLE R301.2(2)~~
~~COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)[a, b, c, d, e]~~

Delete table in its entirety.

**Add new text as follows:**

**TABLE R301.2(2)**
**COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf) [a,b,c,d,e,f,g]**

| | Zone | Effective Wind Areas (feet²) | Ultimate Design Wind Speed, $V_{ult}$ | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90 | | 95 | | 100 | | 105 | | 110 | | 115 | | 120 | | 130 | | 140 | | 150 | | 160 | | 170 | | 180 | |
| | | | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg |
| Flat and Gable Roof 0 to 7 degrees | 1 | 10 | 3.6 | -13.9 | 4.0 | -15.5 | 4.4 | -17.2 | 4.8 | -19.0 | 5.3 | -20.8 | 5.8 | -22.7 | 6.3 | -24.8 | 7.4 | -29.1 | 8.6 | -33.7 | 9.9 | -38.7 | 11.2 | -44.0 | 12.7 | -49.7 | 14.2 | -55.7 |
| | 1 | 20 | 3.3 | -13.0 | 3.7 | -14.5 | 4.1 | -16.0 | 4.5 | -17.7 | 5.0 | -19.4 | 5.4 | -21.2 | 5.9 | -23.1 | 7.0 | -27.1 | 8.1 | -31.4 | 9.3 | -36.1 | 10.5 | -41.1 | 11.9 | -46.4 | 13.3 | -52.0 |
| | 1 | 50 | 3.0 | -11.8 | 3.4 | -13.1 | 3.8 | -14.5 | 4.1 | -16.0 | 4.5 | -17.6 | 5.0 | -19.2 | 5.4 | -20.9 | 6.3 | 24.5 | 7.4 | -28.4 | 8.4 | -32.6 | 9.6 | -37.1 | 10.8 | -41.9 | 12.2 | -47.0 |
| | 1 | 100 | 2.8 | -10.8 | 3.1 | -12.1 | 3.5 | -13.4 | 3.8 | -14.7 | 4.2 | -16.2 | 4.6 | -17.7 | 5.0 | -19.2 | 5.9 | -22.6 | 6.8 | -26.2 | 7.8 | -30.0 | 8.9 | -34.2 | 10.0 | -38.6 | 11.3 | -43.3 |
| | 2 | 10 | 3.6 | -18.4 | 4.0 | -20.5 | 4.4 | -22.7 | 4.8 | -25.0 | 5.3 | -27.4 | 5.8 | -30.0 | 6.3 | -32.7 | 7.4 | -38.3 | 8.6 | -44.5 | 9.9 | -51.0 | 11.2 | -28.1 | 12.7 | -65.6 | 14.2 | -73.5 |
| | 2 | 20 | 3.3 | -17.2 | 3.7 | -19.2 | 4.1 | -21.2 | 4.5 | -23.4 | 5.0 | -25.7 | 5.4 | -28.1 | 5.9 | -30.6 | 7.0 | -35.9 | 8.1 | -41.6 | 9.3 | -47.8 | 10.5 | -54.3 | 11.9 | -61.4 | 13.3 | -68.8 |
| | 2 | 50 | 3.0 | -15.6 | 3.4 | -17.4 | 3.8 | -19.3 | 4.1 | -21.3 | 4.5 | -23.3 | 5.0 | -25.5 | 5.4 | -27.8 | 6.3 | -32.6 | 7.4 | -37.8 | 8.4 | -43.4 | 9.6 | -49.4 | 10.8 | -55.8 | 12.2 | -62.5 |
| | 2 | 100 | 2.8 | -14.4 | 3.1 | -16.1 | 3.5 | -17.8 | 3.8 | -19.7 | 4.2 | -21.6 | 4.6 | -23.6 | 5.0 | -25.7 | 5.9 | -30.1 | 6.8 | -35.0 | 7.8 | -40.1 | 8.9 | -45.7 | 10.0 | -51.5 | 11.3 | -57.8 |
| | 3 | 10 | 3.6 | -25.0 | 4.0 | -27.9 | 4.4 | -30.9 | 4.8 | -34.1 | 5.3 | -37.4 | 5.8 | -40.9 | 6.3 | -44.5 | 7.4 | -52.2 | 8.6 | -60.6 | 9.9 | -69.6 | 11.2 | -79.1 | 12.7 | -89.4 | 14.2 | -100.2 |
| | 3 | 20 | 3.3 | -22.6 | 3.7 | -25.2 | 4.1 | -28.0 | 4.5 | -30.8 | 5.0 | -33.8 | 5.4 | -37.0 | 5.9 | -40.3 | 7.0 | -47.2 | 8.1 | -54.8 | 9.3 | -62.9 | 10.5 | -71.6 | 11.9 | -80.8 | 13.3 | -90.6 |
| | 3 | 50 | 3.0 | -19.4 | 3.4 | -21.7 | 3.8 | -24.0 | 4.1 | -26.5 | 4.5 | -29.0 | 5.0 | -31.7 | 5.4 | -34.6 | 6.3 | -40.6 | 7.4 | -47.0 | 8.4 | -54.0 | 9.6 | -61.4 | 10.8 | -69.4 | 12.2 | -77.8 |
| | 3 | 100 | 2.8 | -174.0 | 3.1 | -19.0 | 3.5 | -21.0 | 3.8 | -23.2 | 4.2 | -25.5 | 4.6 | -27.8 | 5.0 | -30.3 | 5.9 | -35.6 | 6.8 | -41.2 | 7.8 | -47.3 | 8.9 | -53.9 | 10.0 | -60.8 | 11.3 | -68.2 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gable Roof >7 to 20 degrees | 1, 2e | 10 | 5.4 | -16.2 | 6.0 | -18.0 | 6.7 | -19.9 | 7.4 | -22.0 | 8.1 | -24.1 | 8.8 | -26.4 | 9.6 | -28.7 | 11.3 | -33.7 | 13.1 | 39.1 | 15.0 | 44.9 | 17.1 | -51.0 | 19.3 | -57.6 | 21.6 | -64.6 |
| | 1, 2e | 20 | 4.9 | -16.2 | 5.4 | -18.0 | 6.0 | -19.9 | 6.6 | -22.0 | 7.2 | -24.1 | 7.9 | -26.4 | 8.6 | -28.7 | 10.1 | -33.7 | 11.7 | -39.1 | 13.5 | -44.9 | 15.3 | -51.0 | 17.3 | -57.6 | 19.4 | -64.6 |
| | 1, 2e | 50 | 4.1 | -9.9 | 4.6 | -11.0 | 5.1 | -12.2 | 5.6 | -13.4 | 6.1 | -14.7 | 6.7 | -16.1 | 7.3 | -17.5 | 8.6 | -20.6 | 10.0 | -23.8 | 11.4 | -27.4 | 13.0 | -31.1 | 14.7 | -35.2 | 16.4 | -39.4 |
| | 1, 2e | 100 | 3.6 | -5.0 | 4.0 | -5.6 | 4.4 | -6.2 | 4.8 | -6.9 | 5.3 | -7.5 | 5.8 | -8.2 | 6.3 | -9.0 | 7.4 | -10.5 | 8.6 | -12.2 | 9.9 | -14.0 | 11.2 | -15.9 | 12.7 | -18.0 | 14.2 | -20.2 |
| | 2n, 2r, 3e | 10 | 5.4 | -23.6 | 6.0 | -26.3 | 6.7 | -29.1 | 7.4 | -32.1 | 8.1 | -35.2 | 8.8 | -38.5 | 9.6 | -41.9 | 11.3 | -49.2 | 13.1 | -57.0 | 15.0 | -65.4 | 17.1 | -74.5 | 19.3 | -84.1 | 21.6 | -94.2 |
| | 2n, 2r, 3e | 20 | 4.9 | -20.3 | 5.4 | -22.7 | 6.0 | -25.1 | 6.6 | -27.7 | 7.2 | -30.4 | 7.9 | -33.2 | 8.6 | -36.2 | 10.1 | -42.4 | 11.7 | -49.2 | 13.5 | -56.5 | 15.3 | -64.3 | 17.3 | -72.6 | 19.4 | -81.4 |
| | 2n, 2r, 3e | 50 | 4.1 | -16.0 | 4.6 | -17.9 | 5.1 | -19.8 | 5.6 | -21.8 | 6.1 | -24.0 | 6.7 | -26.2 | 7.3 | -28.5 | 8.6 | -33.5 | 10.0 | -38.8 | 11.4 | -44.6 | 13.0 | -50.7 | 14.7 | -57.2 | 16.4 | -64.2 |
| | 2n, 2r, 3e | 100 | 3.6 | -12.8 | 4.0 | -14.3 | 4.4 | -15.8 | 4.8 | -17.4 | 5.3 | -19.1 | 5.8 | -20.9 | 6.3 | -22.8 | 7.4 | -26.7 | 8.6 | -31.0 | 9.9 | -35.6 | 11.2 | -40.5 | 12.7 | -45.7 | 14.2 | -51.3 |
| | 3r | 10 | 5.4 | -28.0 | 6.0 | -30.2 | 6.7 | -34.6 | 7.4 | -38.1 | 8.1 | -41.8 | 8.8 | -45.7 | 9.6 | -49.8 | 11.3 | -58.4 | 13.1 | -67.8 | 15.0 | -77.8 | 17.1 | -88.5 | 19.3 | -99.9 | 21.6 | -112.0 |
| | 3r | 20 | 4.9 | -24.0 | 5.4 | -26.7 | 6.0 | -29.6 | 6.6 | -32.7 | 7.2 | -35.9 | 7.9 | -39.2 | 8.6 | -42.7 | 10.1 | -50.1 | 11.7 | -58.1 | 13.5 | -66.7 | 15.3 | -75.9 | 17.3 | -85.6 | 19.4 | -96.0 |
| | 3r | 50 | 4.1 | 18.7 | 4.6 | -20.8 | 5.1 | -23.1 | 5.6 | -25.4 | 6.1 | -27.9 | 6.7 | -30.5 | 7.3 | 33.2 | 8.6 | -39.0 | 10.0 | -45.2 | 11.4 | -51.9 | 13.0 | -59.0 | 14.7 | -66.6 | 16.4 | -74.7 |
| | 3r | 100 | 3.6 | -14.7 | 4.0 | -16.3 | 4.4 | -18.1 | 4.8 | -20.0 | 5.3 | -21.9 | 5.8 | -24.0 | 6.3 | -26.1 | 7.4 | -30.6 | 8.6 | -35.5 | 9.9 | -40.8 | 11.2 | -46.4 | 12.7 | -52.3 | 14.2 | -58.7 |
| Gable Roof >20 to 27 degrees | 1, 2e | 10 | 6.5 | -12.4 | 7.3 | -13.9 | 8.0 | -15.4 | 8.9 | -16.9 | 9.7 | -18.6 | 10.6 | -20.3 | 11.6 | -22.1 | 13.6 | -26.0 | 15.8 | -30.1 | 18.1 | -34.6 | 20.6 | -39.3 | 23.3 | -44.4 | 26.1 | -49.9 |
| | 1, 2e | 20 | 5.6 | -12.4 | 6.3 | -13.9 | 7.0 | -15.4 | 7.7 | -16.9 | 8.4 | -18.6 | 9.2 | -20.3 | 10.0 | -22.1 | 11.7 | -26.0 | 13.6 | -30.1 | 15.6 | -34.6 | 17.8 | -39.3 | 20.1 | -44.4 | 22.5 | -49.8 |
| | 1, 2e | 50 | 4.4 | -10.6 | 5.0 | -11.8 | 5.5 | -03.1 | 6.1 | -14.4 | 6.6 | -15.8 | 7.3 | -17.3 | 7.9 | -18.8 | 9.3 | -22.1 | 10.8 | -25.6 | 12.3 | -29.4 | 14.0 | -33.5 | 15.9 | -37.8 | 17.8 | -42.4 |
| | 1, 2e | 100 | 3.6 | -9.1 | 4.0 | -10.2 | 4.4 | -11.3 | 4.8 | -12.4 | 5.3 | -13.6 | 5.8 | -14.9 | 6.3 | -16.2 | 7.4 | -19.0 | 8.6 | -22.1 | 9.9 | -25.3 | 11.2 | -28.8 | 12.7 | -32.5 | 14.2 | -36.5 |
| | 2n, 2r, 3e | 10 | 6.5 | -19.9 | 7.3 | -22.1 | 8.0 | -24.5 | 8.9 | -27.0 | 9.7 | -29.7 | 10.6 | -32.4 | 11.6 | -35.3 | 13.6 | -41.4 | 15.8 | -48.0 | 18.1 | -55.2 | 20.6 | -62.8 | 23.3 | -70.8 | 26.1 | -79.4 |
| | 2n, 2r, 3e | 20 | 5.6 | -17.4 | 6.3 | -19.4 | 7.0 | -21.5 | 7.7 | -23.7 | 8.4 | -26.0 | 9.2 | -28.4 | 10.0 | -31.0 | 11.7 | -36.3 | 13.6 | -42.1 | 15.6 | -48.4 | 17.8 | -55.0 | 20.1 | -62.1 | 22.5 | -69.6 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2n, 2r, 3e | 50 | 4.4 | -14.2 | 5.0 | -15.8 | 5.5 | -17.5 | 6.1 | -19.3 | 6.6 | -21.1 | 7.3 | -23.1 | 7.9 | -25.2 | 9.3 | -29.5 | 10.8 | -34.2 | 12.3 | -39.3 | 14.0 | -44.7 | 15.9 | -50.5 | 17.8 | -56.6 |
| | 2n, 2r, 3e | 100 | 3.6 | -11.7 | 4.0 | -13.0 | 4.4 | -14.5 | 4.8 | -15.9 | 5.3 | -17.5 | 5.8 | -19.1 | 6.3 | -20.8 | 7.4 | -24.4 | 8.6 | -28.3 | 9.9 | -32.5 | 11.2 | -37.0 | 12.7 | -41.8 | 14.2 | -46.8 |
| | 3r | 10 | 6.5 | -23.6 | 7.3 | -26.3 | 8.0 | -29.1 | 8.9 | -32.1 | 9.7 | -35.2 | 10.6 | -38.5 | 11.6 | -41.9 | 13.6 | -49.2 | 15.8 | -57.0 | 18.1 | -65.4 | 20.6 | -74.5 | 23.3 | -84.1 | 26.1 | -94.2 |
| | 3r | 20 | 5.6 | -19.9 | 6.3 | -22.1 | 7.0 | -24.5 | 7.7 | -27.0 | 8.4 | -29.7 | 9.2 | -32.4 | 10.0 | -35.3 | 11.7 | -41.4 | 13.6 | -48.0 | 15.6 | -55.2 | 17.8 | -62.8 | 20.1 | -70.8 | 22.5 | -79.4 |
| | 3r | 50 | 4.4 | -14.7 | 5.0 | -16.3 | 5.5 | -18.1 | 6.1 | -20.0 | 6.6 | -21.9 | 7.3 | -24.0 | 7.9 | -26.1 | 9.3 | -30.6 | 10.8 | -35.5 | 12.3 | -40.8 | 14.0 | -46.4 | 15.9 | -52.3 | 17.8 | -58.7 |
| | 3r | 100 | 3.6 | -14.7 | 4.0 | -16.3 | 4.4 | -18.1 | 4.8 | -20.0 | 5.3 | -21.9 | 5.8 | -24.0 | 6.3 | -26.1 | 7.4 | -30.6 | 8.6 | -35.5 | 9.9 | -40.8 | 11.2 | -46.4 | 12.7 | -52.3 | 14.2 | -58.7 |
| Gable Roof >27 to 45 degrees | 1, 2e, 2r | 10 | 8.0 | -14.7 | 8.9 | -16.3 | 9.9 | -18.1 | 10.9 | -20.0 | 12.0 | -21.9 | 13.1 | -24.0 | 14.2 | -26.1 | 16.7 | -30.6 | 19.4 | -35.5 | 22.2 | -40.8 | 25.3 | -16.4 | 28.5 | -52.3 | 32.0 | -58.7 |
| | 1, 2e, 2r | 20 | 7.1 | -12.4 | 7.9 | -13.9 | 8.8 | -15.4 | 9.7 | -16.9 | 10.6 | -18.6 | 11.6 | -20.3 | 12.6 | -22.1 | 14.8 | -26.0 | 17.2 | -30.1 | 19.8 | -34.6 | 22.5 | -39.3 | 25.4 | -44.4 | 28.5 | -49.8 |
| | 1, 2e, 2r | 50 | 5.9 | -9.5 | 6.6 | -10.6 | 7.3 | -11.7 | 8.1 | -12.9 | 8.9 | -14.2 | 9.7 | -15.5 | 10.5 | -16.9 | 12.4 | -19.8 | 14.3 | -22.9 | 16.5 | -26.3 | 18.7 | -30.0 | 21.1 | -33.8 | 23.7 | -37.9 |
| | 1, 2e, 2r | 100 | 5.0 | -7.3 | 5.6 | -8.1 | 6.2 | -9.0 | 6.9 | -9.9 | 7.5 | -10.8 | 8.2 | -11.9 | 9.0 | -12.9 | 10.5 | -15.1 | 12.2 | -17.6 | 14.0 | -20.2 | 15.9 | -22.9 | 18.0 | -25.9 | 20.2 | -29.0 |
| | 2n, 3r | 10 | 8.0 | -16.2 | 8.9 | -18.0 | 9.9 | -19.9 | 10.9 | -22.0 | 12.0 | -24.1 | 13.1 | -26.4 | 14.2 | -28.7 | 16.7 | -33.7 | 19.4 | -39.1 | 22.2 | -44.9 | 25.3 | -51.0 | 28.5 | -57.6 | 32.0 | -64.6 |
| | 2n, 3r | 20 | 7.1 | -14.4 | 7.9 | -16.1 | 8.8 | -17.8 | 9.7 | -19.7 | 10.6 | -21.6 | 11.6 | -23.6 | 12.6 | -25.7 | 14.8 | -30.1 | 17.2 | -34.9 | 19.8 | -40.1 | 22.5 | -45.6 | 25.4 | -51.5 | 28.5 | -57.8 |
| | 2n, 3r | 50 | 5.9 | -12.2 | 6.6 | -13.5 | 7.3 | -15.0 | 8.1 | -16.5 | 8.9 | -18.2 | 9.7 | -19.9 | 10.5 | -21.6 | 12.4 | -25.4 | 14.3 | -29.4 | 16.5 | -33.8 | 18.7 | -38.4 | 21.1 | -43.4 | 23.7 | -48.6 |
| | 2n, 3r | 100 | 5.0 | -10.4 | 5.6 | -11.6 | 6.2 | -12.9 | 6.9 | -14.2 | 7.5 | -15.6 | 8.2 | -17.1 | 9.0 | -18.6 | 10.5 | -21.8 | 12.2 | -25.3 | 14.0 | -29.0 | 15.9 | -33.0 | 18.0 | -37.3 | 20.0 | -41.8 |
| | 3e | 10 | 8.0 | -19.9 | 8.9 | -22.1 | 9.9 | -24.5 | 10.9 | -27.0 | 12.0 | -29.7 | 13.1 | -32.4 | 14.2 | -35.3 | 16.7 | -41.4 | 19.4 | -48.0 | 22.2 | -55.2 | 25.3 | -62.8 | 28.8 | -70.8 | 32.0 | -79.4 |
| | 3e | 20 | 7.1 | -17.6 | 7.9 | -19.6 | 8.8 | -21.8 | 9.7 | -24.0 | 10.6 | -26.3 | 11.6 | -28.8 | 12.6 | -31.3 | 14.8 | -36.8 | 17.2 | -42.7 | 19.8 | -49.0 | 22.5 | -55.7 | 25.4 | -62.9 | 28.5 | -70.5 |
| | 3e | 50 | 5.9 | -14.7 | 6.6 | -16.3 | 7.3 | -18.1 | 8.1 | -20.0 | 8.9 | -21.9 | 9.7 | -24.0 | 10.5 | -26.1 | 12.4 | -30.6 | 14.3 | -35.5 | 16.6 | -40.8 | 18.7 | -46.4 | 21.1 | -52.3 | 23.7 | -58.7 |
| | 3e | 100 | 5.0 | -12.4 | 5.6 | -13.9 | 6.2 | -15.4 | 6.9 | -16.9 | 7.5 | -18.6 | 8.2 | -20.3 | 9.0 | -22.1 | 10.5 | -26.0 | 12.2 | -30.1 | 14.0 | -34.6 | 15.9 | -39.3 | 18.0 | -44.4 | 20.2 | -49.8 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hipped Roof >7 to 20 degrees[g] | 1 | 10 | 6.5 | -14.7 | 7.3 | -16.3 | 8.0 | -18.1 | 8.9 | -20.0 | 9.7 | -21.9 | 10.6 | -24.0 | 11.6 | -26.1 | 13.6 | -30.6 | 15.8 | -35.5 | 18.1 | -40.8 | 20.6 | -46.4 | 23.3 | -52.3 | 26.1 | -58.7 |
| | 1 | 20 | 5.6 | -14.7 | 6.3 | -16.3 | 7.0 | -18.1 | 7.7 | -20.0 | 8.4 | -21.9 | 9.2 | -24.0 | 10.0 | -26.1 | 11.7 | -30.6 | 13.6 | -35.5 | 15.6 | -40.8 | 17.8 | -46.4 | 20.1 | -52.3 | 22.5 | -58.7 |
| | 1 | 50 | 4.4 | -11.3 | 5.0 | -12.6 | 5.5 | -14.0 | 6.1 | -15.4 | 6.6 | -16.9 | 7.3 | -18.5 | 7.9 | -20.2 | 9.3 | -23.7 | 10.8 | -27.4 | 12.3 | -31.5 | 14.0 | -35.8 | 15.9 | -40.4 | 17.8 | -45.3 |
| | 1 | 100 | 3.6 | -8.7 | 4.0 | -9.7 | 4.4 | -10.8 | 4.8 | -11.9 | 5.3 | -13.1 | 5.8 | -14.3 | 6.3 | -15.5 | 7.4 | -18.2 | 8.6 | -21.2 | 9.9 | -24.3 | 11.2 | -27.6 | 12.7 | -31.2 | 14.2 | -35.0 |
| | 2r | 10 | 6.5 | -19.1 | 7.3 | -21.3 | 8.0 | -23.6 | 8.9 | -26.0 | 9.7 | -28.6 | 10.6 | -31.2 | 11.6 | -34.0 | 13.6 | -39.9 | 15.8 | -46.3 | 18.1 | -53.1 | 20.6 | -60.4 | 23.3 | -68.2 | 26.1 | -76.5 |
| | 2r | 20 | 5.6 | -17.2 | 6.3 | -19.2 | 7.0 | -21.3 | 7.7 | -23.4 | 8.4 | -25.7 | 9.2 | -28.1 | 10.0 | -30.6 | 11.7 | -35.9 | 13.6 | -41.7 | 15.6 | -47.9 | 17.8 | -54.4 | 20.1 | -61.5 | 22.5 | -68.9 |
| | 2r | 50 | 4.4 | -14.7 | 5.0 | -16.4 | 5.5 | -18.2 | 6.1 | -20.0 | 6.6 | -22.0 | 7.3 | -24.0 | 7.9 | -26.1 | 9.3 | -30.7 | 10.8 | -35.6 | 12.3 | -40.9 | 14.0 | -46.5 | 15.9 | -52.5 | 17.8 | -58.8 |
| | 2r | 100 | 3.6 | -12.8 | 4.0 | -14.3 | 4.4 | -15.8 | 4.8 | -17.4 | 5.3 | -19.1 | 5.8 | -20.9 | 6.3 | -22.8 | 7.4 | -26.7 | 8.6 | -31.0 | 9.9 | -35.6 | 11.2 | -40.5 | 12.7 | -45.7 | 14.2 | -51.3 |
| | 2e, 3 | 10 | 6.5 | -20.6 | 7.3 | -22.9 | 8.0 | -25.4 | 8.9 | -28.0 | 9.7 | -30.8 | 10.6 | -33.6 | 11.6 | -36.6 | 13.6 | -43.0 | 15.8 | -49.8 | 18.1 | -57.2 | 20.6 | -65.1 | 23.3 | -73.5 | 26.1 | -82.4 |
| | 2e, 3 | 20 | 5.6 | -18.5 | 6.3 | -20.6 | 7.0 | -22.9 | 7.7 | -25.2 | 8.4 | -27.7 | 9.2 | -30.3 | 10.0 | -32.9 | 11.7 | -38.7 | 13.6 | -44.8 | 15.6 | -51.5 | 17.8 | -58.6 | 20.1 | -66.1 | 22.5 | -74.1 |
| | 2e, 3 | 50 | 4.4 | -15.8 | 5.0 | -17.6 | 5.5 | -19.5 | 6.1 | -21.5 | 6.6 | -23.6 | 7.3 | -25.8 | 7.9 | -28.0 | 9.3 | -32.9 | 10.8 | -38.2 | 12.3 | -43.8 | 14.0 | -49.9 | 15.9 | -56.3 | 17.8 | -63.1 |
| | 2e, 3 | 100 | 3.6 | -13.7 | 4.0 | -15.3 | 4.0 | -16.9 | 4.8 | -18.7 | 5.3 | -20.5 | 5.8 | -22.4 | 6.3 | -24.4 | 7.4 | -28.6 | 8.6 | -33.2 | 9.9 | -38.1 | 11.2 | -43.3 | 12.7 | -48.9 | 14.2 | -54.8 |
| Hipped Roof >20 to 27 degrees | 1 | 10 | 6.5 | -11.7 | 7.3 | -13.0 | 8.0 | -14.5 | 8.9 | -15.9 | 9.7 | -17.5 | 10.6 | -19.1 | 11.6 | -20.8 | 13.6 | -24.4 | 15.8 | -28.3 | 18.1 | -32.5 | 20.6 | -37.0 | 23.3 | -41.8 | 26.1 | -46.8 |
| | 1 | 20 | 5.6 | -10.4 | 6.3 | -11.6 | 7.0 | -12.8 | 7.7 | -14.1 | 8.4 | -15.5 | 9.2 | -16.9 | 10.0 | -18.4 | 11.7 | -21.6 | 13.6 | -25.1 | 15.6 | -28.8 | 17.8 | -32.8 | 20.1 | -37.0 | 22.5 | -41.5 |
| | 1 | 50 | 4.4 | -8.6 | 5.0 | -9.6 | 5.5 | -10.6 | 6.1 | -11.7 | 6.6 | -12.8 | 7.3 | -14.0 | 7.9 | -15.3 | 9.3 | -17.9 | 10.8 | -20.8 | 12.3 | -23.9 | 14.0 | -27.2 | 15.9 | -30.7 | 17.8 | -34.4 |
| | 1 | 100 | 3.6 | -7.3 | 4.0 | -8.1 | 4.4 | -9.0 | 4.8 | -9.9 | 5.3 | -10.8 | 5.8 | -1.9 | 6.3 | -12.9 | 7.4 | -15.1 | 8.6 | -17.6 | 9.9 | -20.2 | 11.2 | -22.9 | 12.7 | -25.9 | 14.2 | -29.0 |
| | 2e, 2r, 3 | 10 | 6.5 | -16.2 | 7.3 | -18.0 | 8.0 | -19.9 | 8.9 | -22.0 | 9.7 | -24.1 | 10.6 | -26.4 | 11.6 | -28.7 | 13.6 | -33.7 | 15.8 | -39.1 | 18.1 | -44.9 | 20.6 | -51.0 | 23.3 | -57.6 | 26.1 | -64.6 |
| | 2e, 2r, 3 | 20 | 5.6 | -14.4 | 6.3 | -16.1 | 7.0 | -17.8 | 7.7 | -19.7 | 8.4 | -21.6 | 9.2 | -23.6 | 10.0 | -25.7 | 11.7 | -30.1 | 13.6 | -34.9 | 15.6 | -40.1 | 17.8 | -45.6 | 20.1 | -51.5 | 22.5 | -57.8 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2e, 2r, 3 | 50 | 4.4 | -12.2 | 5.0 | -13.5 | 5.5 | -15.0 | 6.1 | -16.5 | 6.6 | -18.2 | 7.3 | -19.9 | 7.9 | -21.6 | 9.3 | -25.4 | 10.8 | -29.4 | 12.3 | -33.8 | 14.0 | -38.4 | 15.9 | -43.4 | 17.8 | -48.6 |
| | 2e, 2r, 3 | 100 | 3.6 | -10.4 | 4.0 | -11.6 | 4.4 | -12.9 | 4.8 | -14.2 | 5.3 | -15.6 | 5.8 | -17.1 | 6.3 | -18.6 | 7.4 | -21.8 | 8.6 | -25.3 | 9.9 | -29.0 | 11.2 | -33.0 | 12.7 | -37.3 | 14.2 | -41.8 |
| Hipped Roof >27 to 45 degrees | 1 | 10 | 6.2 | -12.4 | 6.9 | -13.9 | 7.7 | -15.4 | 8.5 | -16.9 | 9.3 | -18.6 | 10.2 | -20.3 | 11.1 | -22.1 | 13.0 | -26.0 | 15.1 | -30.1 | 17.3 | -34.6 | 19.7 | -39.3 | 22.2 | -44.4 | 24.9 | -49.8 |
| | 1 | 20 | 5.4 | -11.0 | 6.0 | -12.3 | 6.7 | -13.6 | 7.4 | -15.0 | 8.1 | -16.5 | 8.9 | -18.0 | 9.6 | -19.6 | 11.3 | -23.0 | 13.1 | -26.7 | 15.1 | -30.7 | 17.1 | -34.9 | 19.4 | -39.4 | 21.7 | -44.2 |
| | 1 | 50 | 4.4 | -9.2 | 4.9 | -10.2 | 5.4 | -11.3 | 5.9 | -12.5 | 6.5 | -13.7 | 7.1 | -15.0 | 7.7 | -16.3 | 9.1 | -19.2 | 10.5 | -22.2 | 12.1 | 25.5 | 13.8 | -29.0 | 15.5 | -32.8 | 17.4 | -36.7 |
| | 1 | 100 | 3.6 | -7.8 | 4.0 | -8.7 | 4.4 | -9.6 | 4.8 | -10.6 | 5.3 | -11.6 | 5.8 | -12.7 | 6.3 | -13.8 | 7.4 | -16.2 | 8.6 | -18.8 | 9.9 | -21.6 | 11.2 | -24.6 | 12.7 | -27.8 | 14.2 | -31.1 |
| | 2e | 10 | 6.2 | -14.8 | 6.9 | -16.5 | 7.7 | -18.3 | 8.5 | -20.2 | 9.3 | -22.1 | 10.2 | -24.2 | 11.1 | -26.3 | 13.0 | -30.9 | 15.1 | -35.9 | 17.3 | -41.2 | 19.7 | -46.8 | 22.2 | -52.9 | 24.9 | -59.3 |
| | 2e | 20 | 5.4 | -11.7 | 6.0 | -13.0 | 6.7 | -14.5 | 7.4 | -15.9 | 8.1 | -17.5 | 8.9 | -19.1 | 9.6 | -20.8 | 11.3 | -24.4 | 13.1 | -28.3 | 15.1 | -32.5 | 17.1 | -37.0 | 19.4 | -41.8 | 21.7 | -46.8 |
| | 2e | 50 | 4.4 | -7.3 | 4.9 | -8.1 | 5.4 | -9.0 | 5.9 | -9.9 | 6.5 | -10.8 | 7.1 | -11.9 | 7.7 | -12.9 | 9.1 | -15.1 | 10.5 | -17.6 | 12.1 | -20.2 | 13.8 | -22.9 | 15.5 | -25.9 | 17.4 | -29.0 |
| | 2e | 100 | 3.6 | -7.3 | 4.0 | -8.1 | 4.4 | -9.0 | 4.8 | -9.9 | 5.3 | -10.8 | 5.8 | -11.9 | 6.3 | -12.9 | 7.4 | -15.1 | 8.6 | -17.6 | 9.9 | -20.2 | 11.2 | -22.9 | 12.7 | -25.9 | 14.2 | -29.0 |
| | 2r | 10 | 6.2 | -18.7 | 6.9 | -20.9 | 7.7 | -23.1 | 8.5 | -25.5 | 9.3 | -28.0 | 10.2 | -30.6 | 11.1 | -33.3 | 13.0 | -39.1 | 15.1 | -45.4 | 17.3 | -52.1 | 19.7 | -59.2 | 22.2 | -66.9 | 24.9 | -75.0 |
| | 2r | 20 | 5.4 | -15.7 | 6.0 | -17.5 | 6.7 | -19.4 | 7.4 | -21.4 | 8.1 | -23.5 | 8.9 | -25.7 | 9.6 | -28.0 | 11.3 | -32.8 | 13.1 | -38.1 | 15.1 | -43.7 | 17.1 | -49.8 | 19.4 | -56.2 | 21.7 | -63.0 |
| | 2r | 50 | 4.4 | -11.7 | 4.9 | -13.1 | 5.4 | -14.5 | 5.9 | -16.0 | 6.5 | -17.5 | 7.1 | -19.2 | 7.7 | -20.9 | 9.1 | -24.5 | 10.5 | -28.4 | 12.1 | -32.6 | 13.8 | -37.1 | 15.5 | -41.9 | 17.4 | -47.0 |
| | 2r | 100 | 3.6 | -8.7 | 4.0 | -9.7 | 4.4 | -10.8 | 4.8 | -11.9 | 5.3 | -13.1 | 5.8 | -14.3 | 6.3 | -15.5 | 7.4 | -18.2 | 8.6 | -21.2 | 9.9 | -24.3 | 11.2 | -27.6 | 12.7 | -31.2 | 14.2 | -35.0 |
| | 3 | 10 | 6.2 | -20.0 | 6.9 | -22.3 | 7.7 | -24.7 | 8.5 | -27.2 | 9.3 | -29.9 | 10.2 | -32.7 | 11.1 | -35.6 | 13.0 | -41.7 | 15.1 | -48.4 | 17.3 | -55.6 | 19.7 | -63.2 | 22.2 | -71.4 | 24.9 | -80.0 |
| | 3 | 20 | 5.4 | -15.0 | 6.0 | -16.8 | 6.7 | -18.6 | 7.4 | -20.5 | 8.1 | -22.5 | 8.9 | -24.6 | 9.6 | -26.7 | 11.3 | -31.4 | 13.1 | -36.4 | 15.1 | -41.8 | 17.1 | -47.5 | 19.4 | -53.7 | 21.7 | -60.2 |
| | 3 | 50 | 4.4 | -8.7 | 4.9 | -9.7 | 5.4 | -10.8 | 5.9 | -11.9 | 6.5 | -13.1 | 7.1 | -14.3 | 7.7 | -15.5 | 9.1 | -18.2 | 10.5 | -21.2 | 12.1 | -24.3 | 13.8 | -27.6 | 15.5 | -31.2 | 17.4 | -35.0 |
| | 3 | 100 | 3.6 | -8.7 | 4.0 | -9.7 | 4.4 | -10.8 | 4.8 | -11.9 | 5.3 | -13.1 | 5.8 | -14.3 | 6.3 | -15.5 | 7.4 | -18.2 | 8.6 | -21.2 | 9.9 | -24.3 | 11.2 | -27.6 | 12.7 | -31.2 | 14.2 | -35.0 |

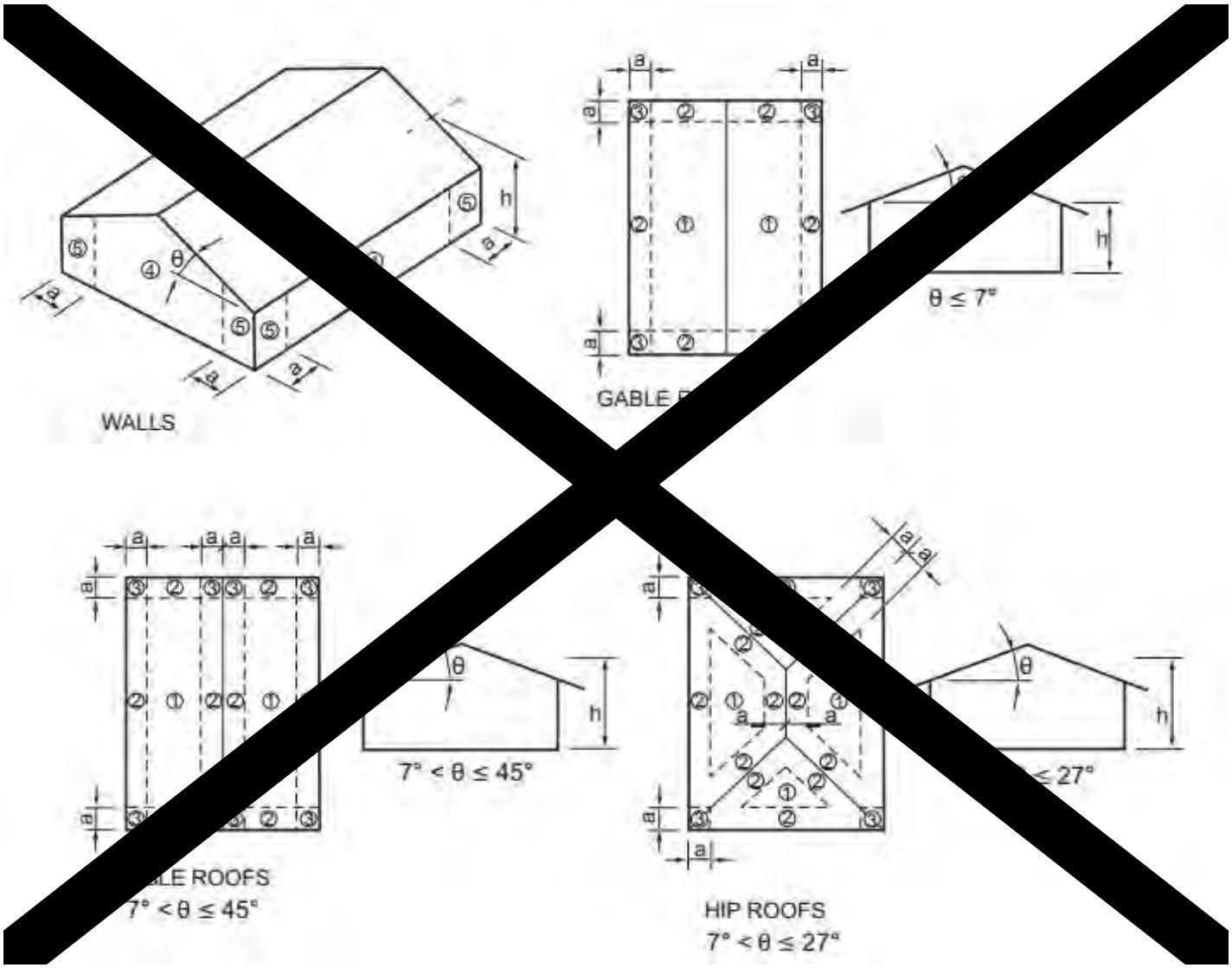
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall | 4 | 10 | 8.7 | -9.5 | 9.7 | -10.6 | 10.8 | -11.7 | 11.9 | -12.9 | 13.1 | -14.2 | 14.3 | -15.5 | 15.5 | -16.9 | 18.2 | -19.8 | 21.2 | -22.9 | 24.3 | -26.3 | 27.6 | -30.0 | 31.2 | -33.8 | 35.0 | -37.9 |
| | 4 | 20 | 8.3 | -9.1 | 9.3 | -10.1 | 10.3 | -11.2 | 11.4 | -12.4 | 12.5 | -13.6 | 13.6 | -14.8 | 14.8 | -16.2 | 17.4 | -19.0 | 20.2 | -22.0 | 23.2 | -25.3 | 26.4 | -28.7 | 29.8 | -32.4 | 33.4 | -36.4 |
| | 4 | 50 | 7.8 | -8.6 | 8.7 | -9.5 | 9.7 | -10.6 | 10.7 | -11.7 | 11.7 | -12.8 | 12.8 | -14.0 | 13.9 | -15.2 | 16.3 | -17.9 | 18.9 | -20.7 | 21.7 | -23.8 | 24.7 | -27.1 | 27.9 | -30.6 | 31.3 | -34.3 |
| | 4 | 100 | 7.4 | -8.2 | 8.3 | -9.1 | 9.2 | -10.1 | 10.1 | -11.1 | 11.1 | -12.2 | 12.1 | -13.3 | 13.2 | -14.5 | 15.5 | -17.1 | 18.0 | -19.8 | 20.6 | -22.7 | 23.5 | -25.8 | 26.5 | -29.2 | 29.7 | -32.7 |
| | 4 | 500 | 6.5 | -7.3 | 7.3 | -8.1 | 8.0 | -9.0 | 8.9 | -9.9 | 9.7 | -10.8 | 10.6 | -11.9 | 11.6 | -12.9 | 13.5 | -15.1 | 15.8 | -17.6 | 18.1 | -20.2 | 20.6 | -22.9 | 23.3 | -25.9 | 26.1 | -29.0 |
| | 5 | 10 | 8.7 | -11.7 | 9.7 | -13.0 | 10.8 | -14.5 | 11.9 | -15.9 | 13.1 | -17.5 | 14.3 | -19.1 | 15.5 | -20.8 | 18.2 | -24.4 | 21.2 | -28.3 | 24.3 | -32.5 | 27.6 | -37.0 | 31.2 | -41.8 | 35.0 | -46.8 |
| | 5 | 20 | 8.3 | -10.9 | 9.3 | -12.2 | 10.3 | -13.5 | 11.4 | -14.9 | 12.5 | -16.3 | 13.6 | -17.8 | 14.8 | -19.4 | 17.4 | -22.8 | 20.2 | -26.4 | 23.2 | -30.3 | 26.4 | -34.5 | 29.8 | -39.0 | 33.4 | -43.7 |
| | 5 | 50 | 7.8 | -9.9 | 8.7 | -11.0 | 9.7 | -12.2 | 10.7 | -13.4 | 11.7 | -14.7 | 12.8 | -16.1 | 13.9 | -17.5 | 16.3 | -20.6 | 18.9 | -23.9 | 21.7 | -27.4 | 24.7 | -31.2 | 27.9 | -35.2 | 31.3 | -39.5 |
| | 5 | 100 | 7.4 | -9.1 | 8.3 | -10.1 | 9.2 | -11.2 | 10.1 | -12.4 | 11.1 | -13.6 | 12.1 | -14.8 | 13.2 | -16.1 | 15.5 | -19.0 | 18.0 | -22.0 | 20.6 | -25.2 | 23.5 | -28.7 | 26.5 | -32.4 | 29.7 | -36.3 |
| | 5 | 500 | 6.5 | -7.3 | 7.3 | -8.1 | 8.0 | -9.0 | 8.9 | -9.9 | 9.7 | -10.8 | 10.6 | -11.9 | 11.6 | -12.9 | 13.6 | -15.1 | 15.8 | -17.6 | 18.1 | -20.2 | 20.6 | -22.9 | 23.3 | -25.9 | 26.1 | -29.0 |

**Revise as follows:**

**TABLE R301.2(3)**
**HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE R301.2(2)**

| MEAN ROOF HEIGHT | EXPOSURE | | |
|---|---|---|---|
| | B | C | D |
| 15 | 0.82 ~~1.00~~ | 1.21 | 1.47 |
| 20 | 0.89 ~~1.00~~ | 1.29 | 1.55 |
| 25 | 0.94 ~~1.00~~ | 1.35 | 1.61 |
| 30 | 1.00 | 1.40 | 1.66 |
| 35 | 1.05 | 1.45 | 1.70 |
| 40 | 1.09 | 1.49 | 1.74 |
| 45 | 1.12 | 1.53 | 1.78 |
| 50 | 1.16 | 1.56 | 1.81 |
| 55 | 1.19 | 1.59 | 1.84 |
| 60 | 1.22 | 1.62 | 1.87 |

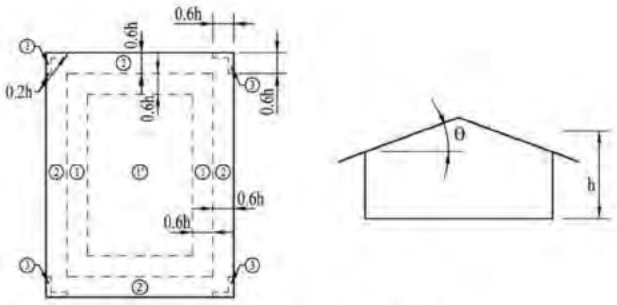
**Delete and substitute as follows:**



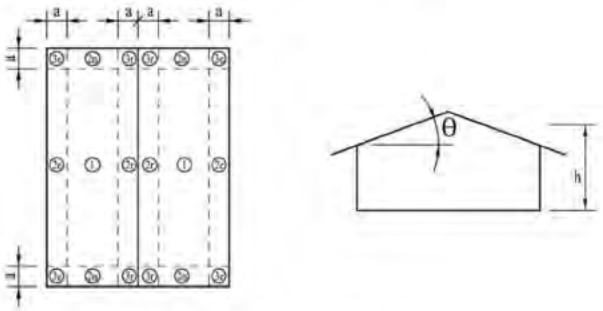

For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

**Note:** a = 4 feet in all cases.

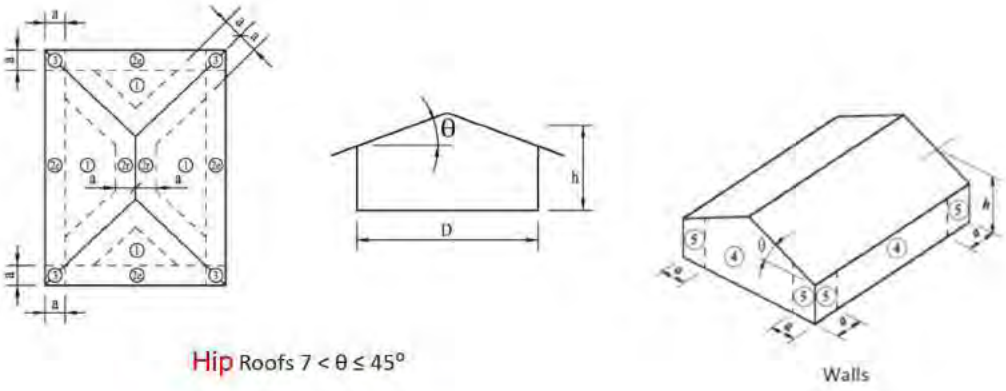
**FIGURE R301.2(8)**
**COMPONENT AND CLADDING PRESSURE ZONES**




Gable and Flat Roofs θ ≤ 7°




Gable Roofs 7 < θ ≤ 45°

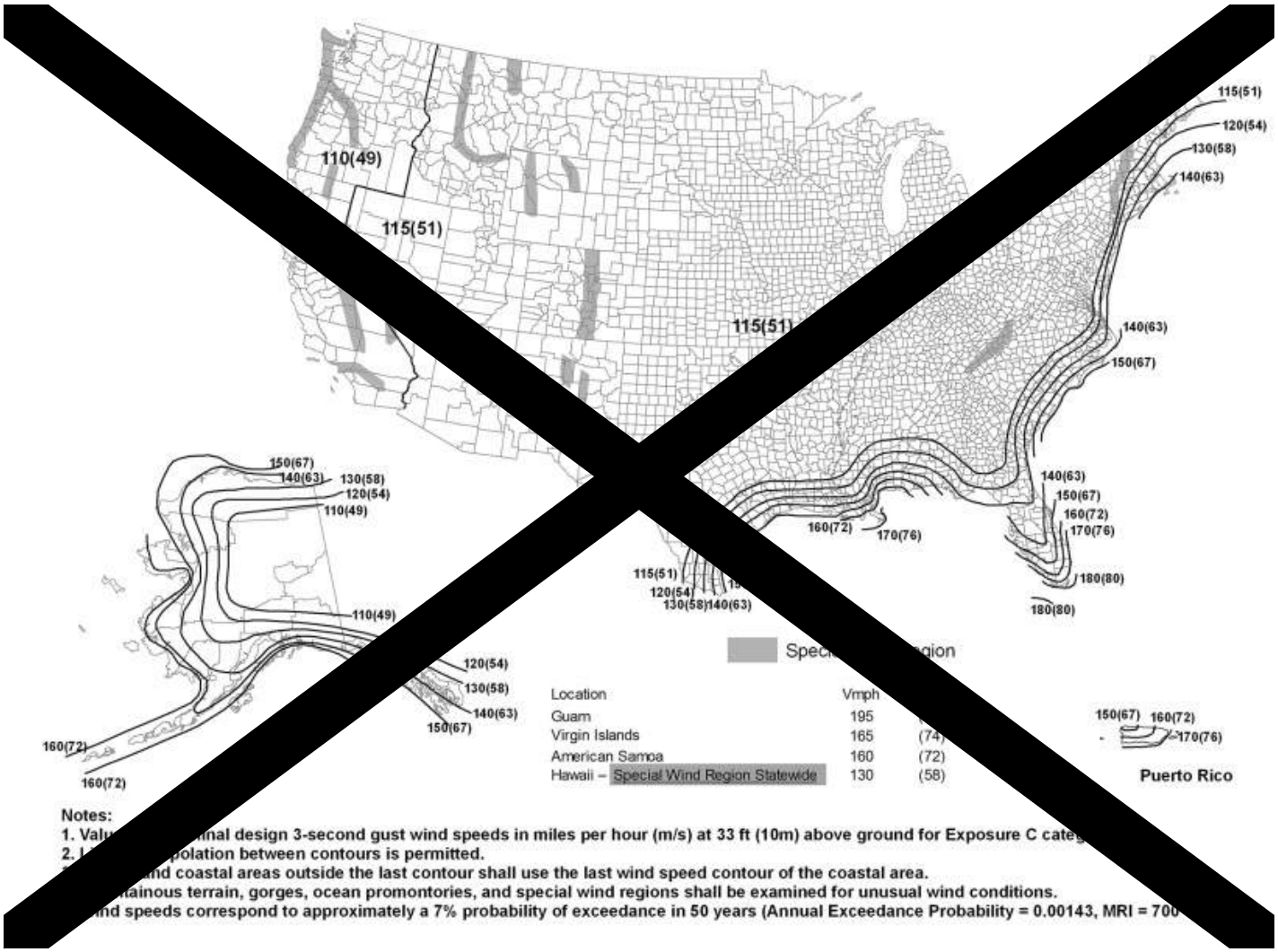



Hip Roofs 7 < θ ≤ 45°

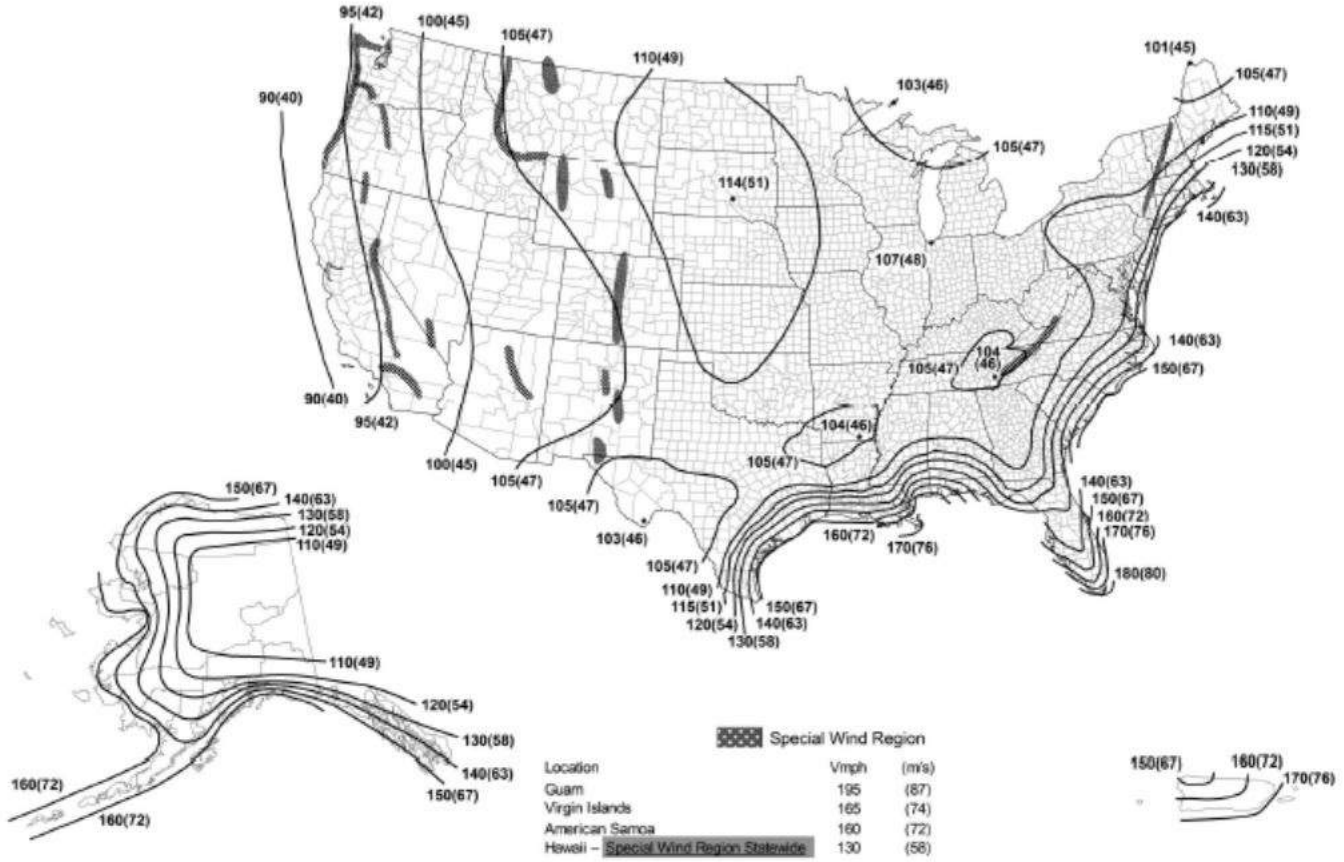
For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

Note: a = 4 feet in all cases.

**FIGURE R301.2(8)**
**COMPONENT AND CLADDING PRESSURE ZONES**




**~~FIGURE R301.2(5)A~~**
**~~ULTIMATE DESIGN WIND SPEEDS~~**

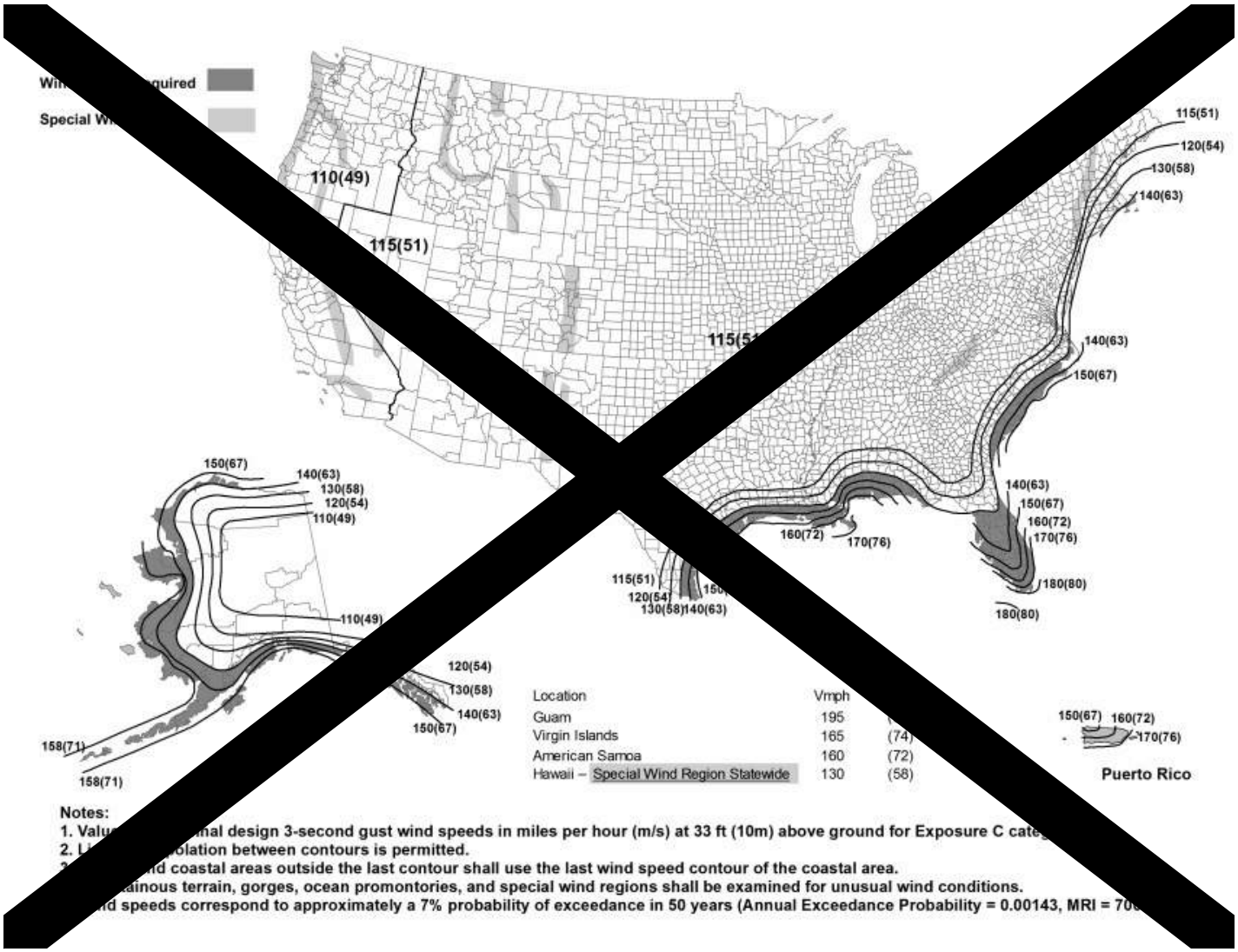



**Notes:**

1. **Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.**
2. **Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.**
3. **Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.**
4. **Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.**
5. **Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).**
6. **Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed**

**FIGURE R301.2(5)A**
**ULTIMATE DESIGN WIND SPEEDS**

**Revise as follows:**




Notes:

1. Valu… …nal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C cate…
2. Li… …olation between contours is permitted.
3. …nd coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. …ainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. …nd speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 70…

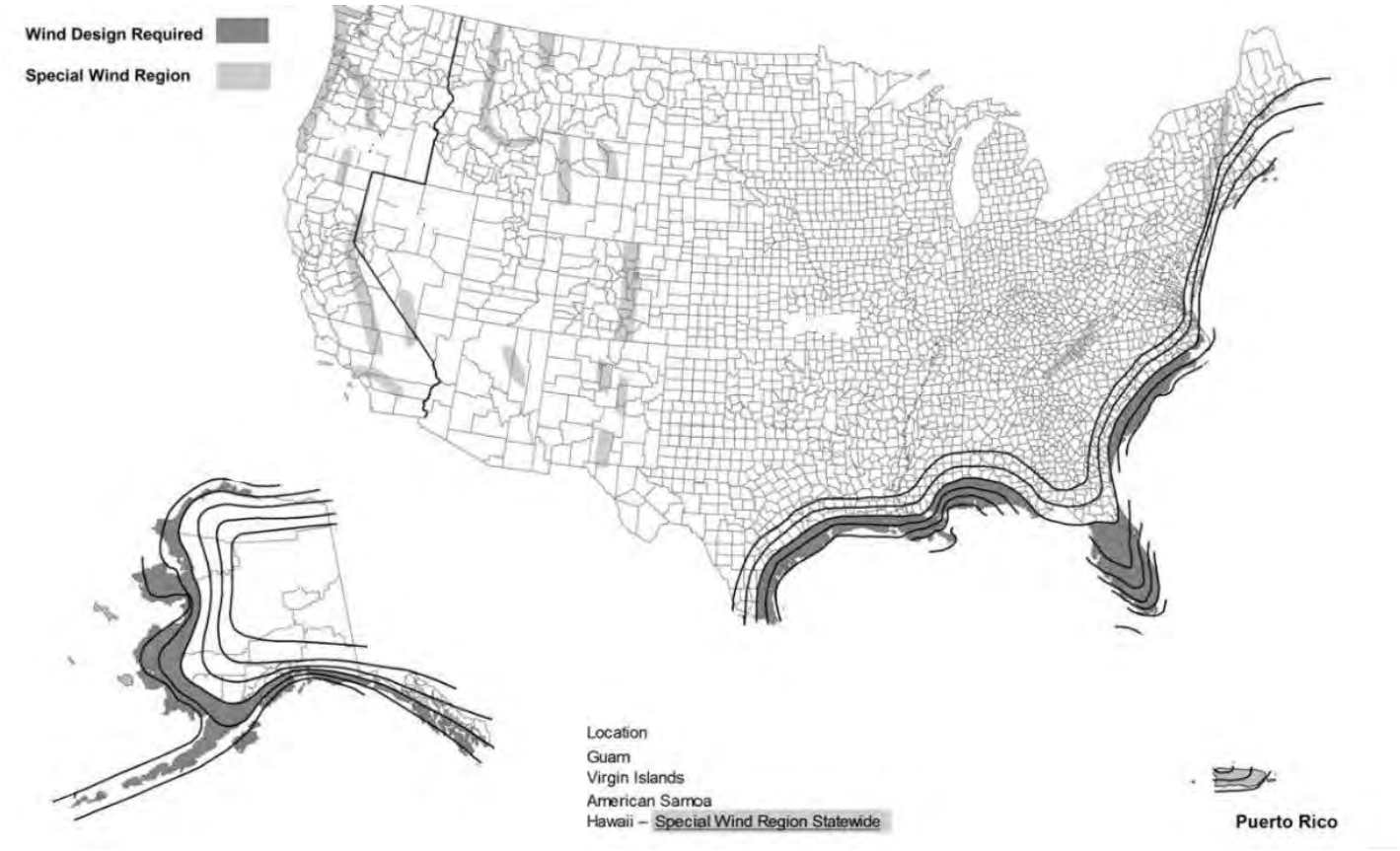



**FIGURE R301.2(5)B**
**REGIONS WHERE WIND DESIGN IS REQUIRED**

**Reason:** This proposal coordinates the wind design criteria in the IRC with currently referenced 2016 edition of the loading standard *ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE 7-16).
There are two primary proposed changes to the IRC for coordination with the revised wind loading criteria in ASCE 7-16: (1) updated basic wind speed maps for Risk Category II buildings and (2) revised roof component and cladding loads for buidings with mean roof heights less than or equal to 60 feet.

(1) Updated Map:

In ASCE 7-16, wind speeds in non-hurricane prone areas of the contiguous United States have been revised using contours to better reflect the regional vairation in the extreme wind climate. Point values are provided to aid interpolation, in a style similar to that used for the other hazard maps in ASCE 7. Summaries of the datat and methods used to estiimate both the non-hurriane and hurricanewind speeds are provided in the Commentary to ASCE 7-16 Chpater 26 (attached to this proposal). The wind speeds in the hurricane-prone region have not changed from ASCE 7-10, the previous edition. Revised Figure R301.2(4)A is the wind speed map from ASCE 7-16 for Risk Category II Buildings.

Update to R301.2(4)B removes the notes, only.

(2) Revised Tables:

The simplified component and cladding loads in Table R301.2(2) are proposed to be revised for correlation with the new roof component and cladding loads for buildings with mean roof heights less than or equal to 60 feet. The roof zones and pressure coefficients in ASCE 7-16 Figure 30.4-2 (which includes Figures 30.4-2A through

30.4-2I) have been revised based on an analysis of an extensive wind tunnel database. All source data used in the study are publically accessible throught the National Institiute of Standards and Technology (NIST) website. Compared to previous versions of ASCE 7, the pressure coefficients have been increased, and are now more consistent with coefficients for buildings higher than 60 feet. Roof zones sizes are also modified from those of earlier versions in order to minimize the increase of pressure coefficients in Zones 1 and 2. The data indicate that for these low-rise buildings, the size of the roof zones depend primarilly on the builing height, h. The GCp values given in ASCE 7-16 Figures 30.4-2A through 30.4-2I are associated with wind tunnel tests perfomed in both Exposure B and C. For ASCE 7-16 Figure 30.4-2A, the coefficients applly equally to Exposure B and C, based on wind tunnel data that show insignificant difference in (GCp) for Exposure B and C. Consequently, the truncation for Kz in Table 30.3-1 of ASCE 7-10 is not requiredfor buiding below 30 feet, and the lower Kz values may be used as hown revised in Figure R301.2(3) of the IRC. More explaination is found in the Commentary to ASCE 7-16 Chapter 30 (attached to this proposal).

NOTE: Due to cdpAccess functionality, the revised table was added as a NEW table, however, it is intended to replace the existing R301.2(2). Also, in the NEW table, only footnotes f and g are NEW. The footnotes a to e remain unchanged from previous IRC, but only look new due to cdpAccess legislative format editor.

**Cost Impact:** The code change proposal will increase the cost of construction
Component and cladding loads for roofs in buildings with mean roof heights less than or equalt to 60 feet are higher for some roof slopes and zones than for similar roof slopes in 2018 IRC. Construction costs will increase for roofing products and decking for some areas of the country in the hurricane-prone region. However, for much of the country outside the hurricane-prone region, the wind speeds are actually lower and therefore even with an increase in GCp, the loads do not change and there is no impact on costs.Also, loads for wall components such as windows, doors, siding, etc., are lower for mean roof height under 30 feet. Loads on Main Wind Force Resisting Systems, such as shear walls and diaphragms, are decreasing in areas where the design wind speed has decreased.

Proposal # 5220

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RB35-19

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# B1709.5.2-18

**IBC®: 1709.5.2, 1709.5.2.1 (New)**

**Proponents:**

## 2018 International Building Code

**1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1.** Exterior window and door assemblies shall be tested in accordance with ASTM ~~E330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108.~~ E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

**Revise as follows:**

**1709.5.2.1 Garage doors and rolling doors.** Garage doors and rolling doors shall be tested in accordance with either ASTM E 330 or ANSI/DASMA 108, and shall meet the pass/fail acceptance criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be *labeled* with a permanent *label* identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

**Reason Statement:** This would clarify that garage doors must be labeled and defines performance standards.

**Bibliography:** This proposal will neither increase nor decrease Resiliency
No effect

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
No cost effect.

# RB609.4-18

**IRC®: R609.4, R609.4.1 (New)**

**Proponents:**

## 2018 International Residential Code

**R609.4 Garage doors.** Garage doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the ~~acceptance~~ pass/fail criteria of ANSI/DASMA 108.

**Revise as follows:**

**R609.4.1 Garage door labeling.** Garage doors shall be *labeled* with a permanent *label* affixed to the garage door by the manufacturer. The *label* shall identify the garage door manufacturer, the garage door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

**Reason Statement:** The proposal requires labeled to be affixed and lays out design standards.

**Bibliography:** This proposal will increase Resiliency
This sets design standards for garage doors

**Cost Impact:** The code change proposal will increase the cost of construction
It requires additional documentation.

**Soffit Proposal for the 2021 VRC**

**Revise as follows:**

**R703.11.1 Installation.** Vinyl siding~~, soffit~~ and accessories shall be installed in accordance with manufacturer's instructions.

~~**R703.11.1.4 Vinyl soffit panels.** Soffit panels shall be individually fastened to a supporting component such as a nailing strip, fascia, or subfascia component or as specified by the manufacturer's instructions.~~

**Add new section as follows:**

**SECTION R704**

**SOFFITS**

**R704.1 General wind limitations.** Where the design wind pressure is 30 psf or less, soffits shall comply with Section R704.2. Where the design wind pressure exceeds 30 psf, soffits shall comply with Section R704.3. The design wind pressure on soffits shall be determined using the component and cladding loads specified in Table R301.2(2) for walls with an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

**R704.2 Soffit installation where the design wind pressure is 30 psf and less.** Soffit installation shall comply with Section R704.2.1, Section R704.2.2, Section R704.2.3, or Section R704.2.4. Soffit materials not addressed in Sections R704.2.1through R704.2.4 shall be in accordance with the manufacturer's installation instructions.

**R704.2.1 Vinyl soffit panels.** Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia or subfascia component in accordance with Figure R704.2.1. Where the unsupported span of soffit panels is greater than 16 inches, intermediate nailing strips shall be provided in accordance with Figure R704.2.2. Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

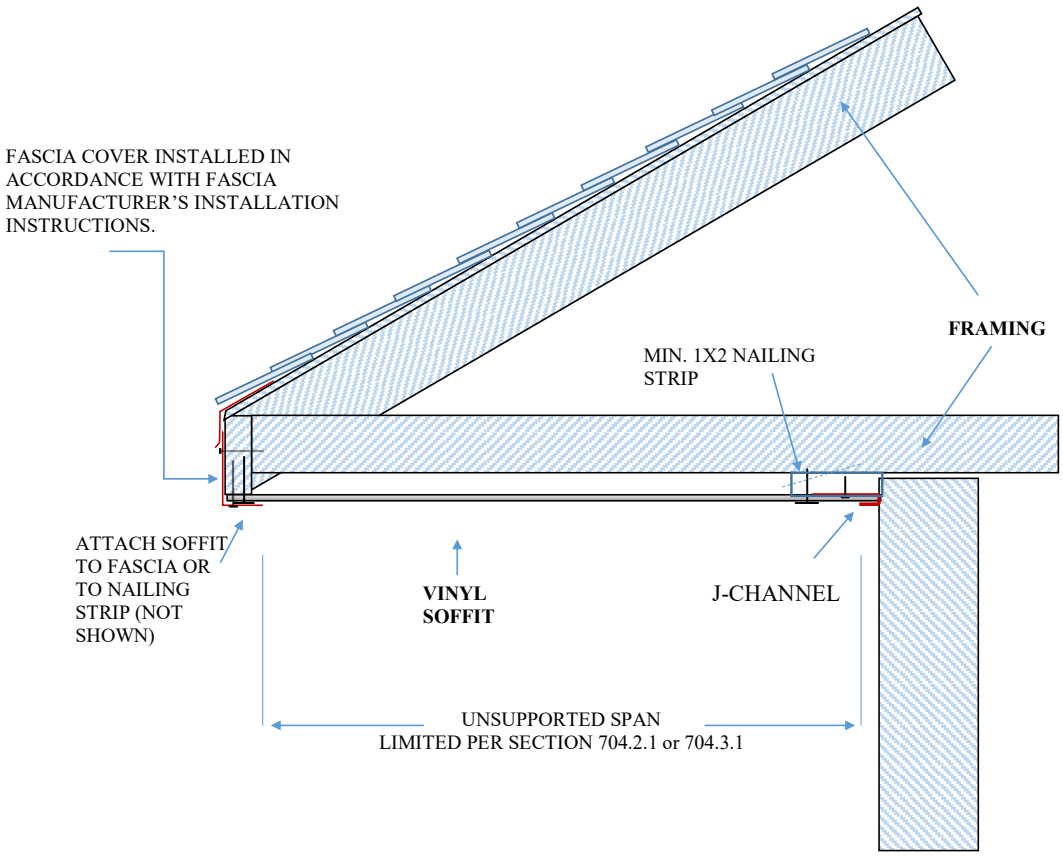



**Figure R704.2.1 Typical single span vinyl soffit panel support**

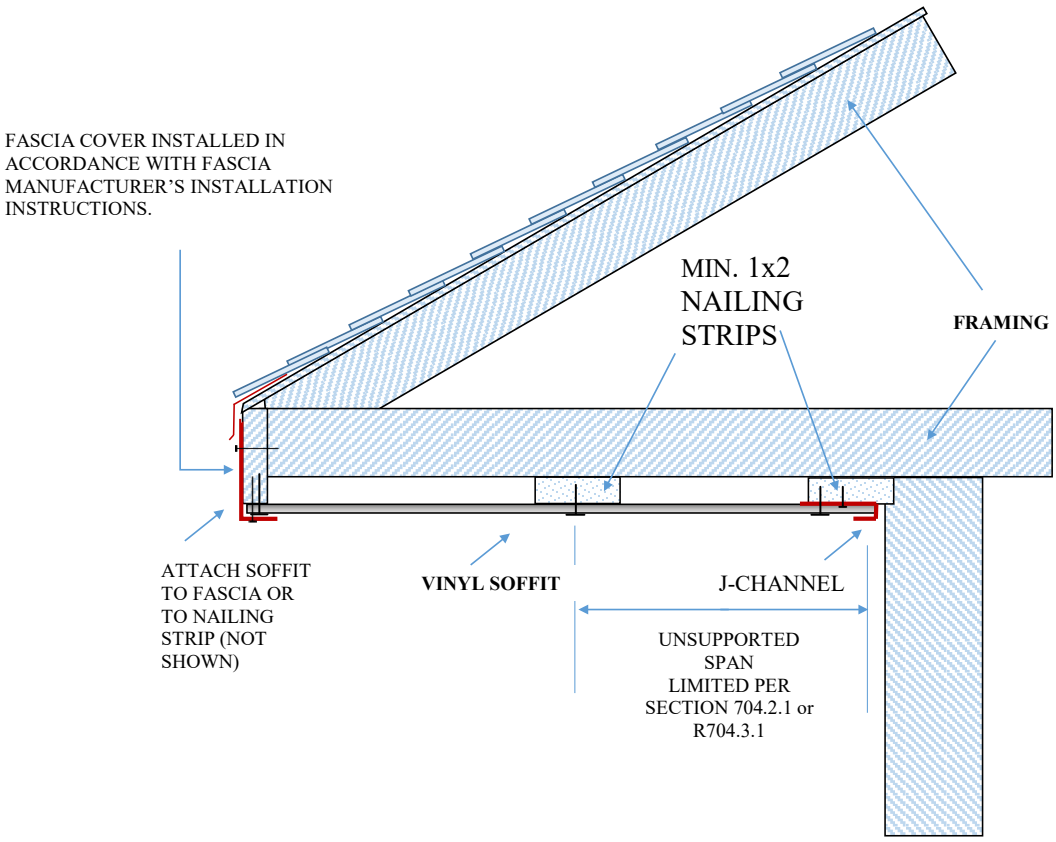



**Figure R704.2.2 Typical double span vinyl soffit panel support**

**R704.2.2 Fiber-cement soffit panels.** Fiber-cement soffit panels shall be a minimum of 1/4 inch in thickness and shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Panel joints shall occur over framing or over wood structural panel sheathing. Soffit panels shall be installed with spans and fasteners in accordance with the manufacturer's installation instructions.

**R704.2.3 Hardboard soffit panels.** Hardboard soffit panels shall be a minimum of 7/16 inch in thickness and shall be fastened to framing or nailing strips with 2 ½ " x 0.113" siding nails spaced not more than 6 inches on center at panel edges and 12 inches on center at intermediate supports.

**R704.2.4 Wood structural panel soffit.** The minimum nominal thickness for wood structural panel soffits shall be 3/8 inch (9.5 mm) and shall be fastened to framing or nailing strips with 2-inch by 0.099-inch (51 mm x 2.5 mm) nails. Fasteners shall be spaced not less than 6 inches (152 mm) on center at panel edges and 12 inches (305 mm) on center at intermediate supports.

**R704.3 Soffit installation where the design wind pressure exceeds 30 psf.** Soffit installation shall comply with Section R704.3.1, Section R704.3.2, Section R704.3.3, or Section R704.3.4. Soffit materials not addressed in Sections R704.3.1 through R704.3.4 shall be in accordance with the manufacturer's installation instructions.

**R704.3.1 Vinyl soffit panels.** Vinyl soffit panels and their attachments shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3). Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia, or subfascia component in accordance with Figure R704.2.1. Where the unsupported span of soffit panels is greater than 12 inches, intermediate nailing strips shall be provided in accordance with Figure R704.2.2. Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

**R704.3.2 Fiber-cement soffit panels.** Fiber-cement soffit panels shall comply with Section R704.2.2 and shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

**R704.3.3 Hardboard soffit panels.** Hardboard soffit panels shall comply with the manufacturer's installation instructions and shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

**R704.3.4 Wood structural panel soffits.** Wood structural panel soffits shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3). Alternatively, wood structural panel soffits shall be permitted to be installed in accordance with Table R704.3.4.

**Table 704.3.4**

**Prescriptive Alternative for Wood Structural Panel, Closed Soffit[b,c,d,e,f]**

| Maximum Design Pressure (- or + psf) | Minimum Panel Span Rating | Minimum Panel Performance Category | Nail Type and Size (inch) | Fastener[a] Spacing along Edges and Intermediate Supports (inch) | |
|---|---|---|---|---|---|
| | | | | Galvanized Steel | Stainless Steel |
| 30 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 6[f] | 4 |
| 40 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 6 | 4 |
| 50 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 4 | 4 |
| | | | 8d common (2½ x 0.131 x 0.281 head diameter) | 6 | 6 |
| 60 | 24/0 | 3/8 | 6d box (2 x 0.099 x 0.266 head diameter) | 4 | 3 |
| | | | 8d common (2½ x 0.131 x 0.281 head diameter) | 6 | 4 |
| 70 | 24/16 | 7/16 | 8d common (2½ x 0.131 x 0.281 head diameter) | 4 | 4 |
| | | | 10d box (3 x 0.128 x 0.312 head diameter) | 6 | 4 |
| 80 | 24/16 | 7/16 | 8d common (2½ x 0.131 x 0.281 head diameter) | 4 | 4 |
| | | | 10d box (3 x 0.128 x 0.312 head diameter) | 6 | 4 |
| 90 | 32/16 | 15/32 | 8d common (2½ x 0.131 x 0.281 head diameter) | 4 | 3 |
| | | | 10d common (3 x 0.148 x 0.312 head diameter) | 6 | 4 |

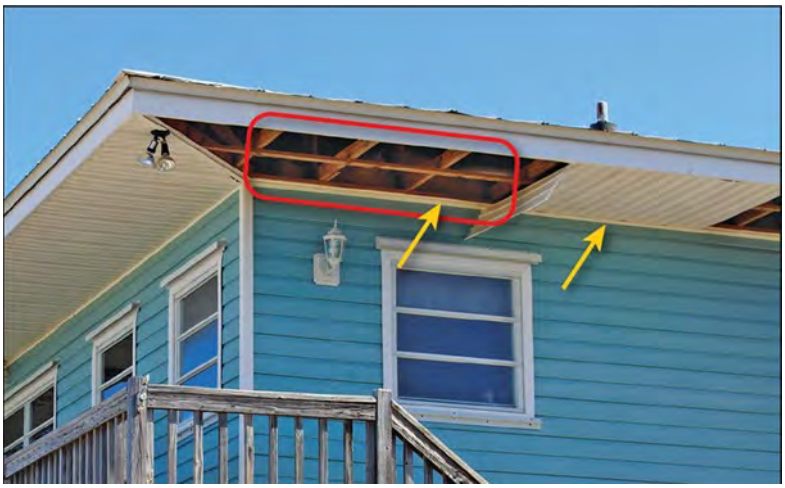
a. Fasteners shall comply with Sections R703.3.2 and R703.3.3.
b. Maximum spacing of soffit framing members shall not exceed 24 inches.
c. Wood structural panels shall be of an exterior exposure grade.
d. Wood structural panels shall be installed with strength axis perpendicular to supports with a minimum of two continuous spans.
e. Wood structural panels shall be attached to soffit framing members with specific gravity of at least 0.42. Framing members shall be minimum 2x3 nominal with the larger dimension in the cross section aligning with the length of fasteners to provide sufficient embedment depths.
f. Spacing at intermediate supports is permitted to be 12 inches on center.

**Reasons Statement:** The purpose of this code change proposal is to improve the wind performance of soffits by clarifying International Residential Code (IRC) installation requirements for the most common types of manufactured soffits and by providing a prescriptive alternative for wood structural panel soffits that complies with design wind pressures specified in the IRC and ASCE 7. The code change refines and further clarifies provisions that were adopted into the 2018 IRC and adds new provisions to address soffit installation in high wind regions. The proposal also moves the clarified soffit provisions to the new Section 704 to better distinguish from exterior wall covering provisions that make up nearly all of Section 703. In addition to separating the clarified soffit provisions to prevent them from being overlooked, new soffit provisions can easily be added as needed with this improved organization and simplified format.

As part of the response to Hurricane Harvey in Texas and Hurricane Irma in Florida, the Federal Emergency Management Agency (FEMA) deployed Mitigation Assessment Teams (MATs) composed of national and regional building science experts to assess the damage in both States. The primary purpose of a MAT is to improve the natural hazard resistance of buildings by evaluating the key causes of building damage, failure, and success, and developing strategic recommendations for improving short-term recovery and long-term disaster resilience from future natural hazard events. The following MAT-related information is included in the FEMA MAT Reports: Hurricane Irma in Florida (https://www.fema.gov/media-library/assets/documents/176315) and Hurricane Harvey in Texas (https://www.fema.gov/media-library/assets/documents/177700).

The FL MAT observed building envelope damage on both older and newer residential construction, and soffits were among the most frequently observed damaged envelope components. Based on estimated wind speeds at the sites visited, failure occurred to soffit components at wind speeds well below design wind speeds for these areas. The FL MAT observed both vinyl and metal soffit loss, but vinyl soffit panels were the most common product observed, particularly in the Florida Keys where vinyl soffit damage was widespread.

In many cases, inadequate support and attachment at the ends of the soffit panel led to failure of the soffit. The Sugarloaf Key house shown below (FL MAT Report Figure 4-19) lost its vinyl soffit in several areas. The red oval shows where the soffit panel was stripped from the assembly's J-channel, which remains attached along the exterior wall (yellow arrows). The soffit appears to have been fastened to only a single nailing strip across the midpoint of the framing above. Section 704.2.1 (including Figure 704.2.1) of the proposal has been included to clarify that vinyl soffit panels are required to be fastened at each end and the unsupported span cannot exceed specified limits (16 or 12 inches) unless permitted by the manufacturer's product approval.



In some cases, vinyl soffit failure appeared to have been associated with fascia cover loss as shown in the image below from Little Torch Key (FL MAT Report Figure 4-18). Loss of the fascia cover likely increases wind pressures on vinyl soffit where the edges of the soffit are exposed.



The inset shows the remaining exposed soffit edge on the left side of the ridge (yellow outline) and missing vinyl soffit panels on the right side of the ridge (red outline).

The TX MAT observed similar wind damage to residential soffits as indicated below. The dwelling in Cape Valero shown on the left (TX MAT Figure 4-44) lost re-covered vinyl soffit panels (green arrow) to high winds, exposing the vent opening (red arrows) to wind driven rain. The photo on the right (TX MAT Figure 4-45) shows a soffit opening that was previously covered by a ventilating fiber-cement board. Red arrows indicate where the attic is exposed to wind driven rain. As with examples shown from Florida, estimated wind speeds for the sites were below design wind speeds.



FL and TX MAT observations described above along with other examples detailed in the MAT Reports, led to the following conclusions and recommendations:

**Conclusion FL-10: The MAT observed evidence of inadequate resistance to wind pressures and improper installation of soffits on residential buildings.** Widespread loss of soffits was observed in residential construction, and wind-driven rain infiltrated some areas where soffits were displaced or lost.
**Recommendation FL-10a: Designers, contractors, and inspectors should place more emphasis on proper soffit installation to limit wind-driven rain.** Proper soffit installation should be emphasized by designers, contractors, and inspectors in order to limit wind-driven rain from entering building envelopes and damaging building interiors.
**Conclusion TX-18*:* Many soffits lacked adequate wind resistance, typically because the wrong material was used for the region or it was improperly installed.** The MAT observed widespread loss of soffits in residential and non-residential construction, generally due to improper materials, lack of fasteners, and/or inadequate framing, and wind-driven rain infiltrated some areas where soffits were displaced or lost. The loss of soffit vents can allow hurricane winds to drive large amounts of water through the openings and soak insulation, which can lead to mold growth and, in some cases, the collapse of ceilings.
**Recommendation TX-18: Designers, contractors, and inspectors should place more emphasis on proper soffit installation in high-wind regions**. Wind-driven rain should be limited from entering building envelopes and damaging building interiors through proper soffit installation.

In summary, widespread residential soffit damage observed in the wake of the 2017 Hurricane Season indicates the need for clarified installation provisions in the IRC. The proposed provisions apply to design wind pressures realized across the US, but are clearly differentiated where 30 pounds per square foot (psf) or less or where greater than 30 psf, so that installation requirements are tailored for the site-specific pressures. Regardless the soffit design wind pressure, the new provisions will provide greater clarity for the builder to implement code-compliant soffit installation and for the building official to verify code-compliant soffit installation.

**Cost Impact:** The code change proposal will not increase the cost of construction for buildings where design wind pressures are 30 psf or less because it only clarifies the existing requirements for soffit installation. The code change proposal may decrease costs for buildings where the design wind pressure exceeds 30 psf because it provides code compliant solutions in lieu of design.

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# RB301.2.1.1-18

**IRC®: R301.2.1.1**

**Proponents:**

## 2018 International Residential Code

**R301.2.1.1 Wind limitations and wind design required.** The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure ~~R301.2(5)B~~ R301.2(5)B or where the ultimate design wind speed, $V_{alt}$ in Figure R301.2(5)A equals or exceeds 140 mph in a special wind region.

**Exceptions:**

1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R608.
2. For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R610.
3. For cold-formed steel light-frame construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R505, R603 and R804.

In regions where wind design is required in accordance with Figure R301.2(5)B or where the ultimate design wind speed $V_{alt}$ in Figure R301.2(5)A equals or exceeds 140 mph in a special wind region, the design of buildings for wind loads shall be in accordance with one or more of the following methods:

1. AWC *Wood Frame Construction Manual* (WFCM).
2. ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600).
3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).
4. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings* (AISI S230).
5. International Building Code.

The elements of design not addressed by the methods in Items 1 through 5 shall be in accordance with the provisions of this code.

Where ASCE 7 or the International Building Code is used for the design of the building, the wind speed map and exposure category requirements as specified in ASCE 7 and the International Building Code shall be used.

**Reason Statement:** Special wind region adopts the 2021 cycle changes.

**Bibliography:** This proposal will increase Resiliency
This proposal increases resiliency

**Cost Impact:** The code change proposal will increase the cost of construction
Alters wind design criteria which could alter the cost of construction.

# RB200-18

**IEBC®: [BS]; IRC®: 1 (New), (New)**

**Proponents:**

## 2018 International Existing Building Code

**[BS] SUBSTANTIAL DAMAGE.** For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

**[BS] SUBSTANTIAL IMPROVEMENT.**
For the purpose of determining compliance with the flood provisions of this code, any *repair*, *alteration*, *addition*, or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure, before the improvement or *repair* is started. If the structure has sustained *substantial damage*, any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary, or safety code violations identified by the *code official* and that is the minimum necessary to ensure safe living conditions.
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

## 2018 International Residential Code

**Add new text as follows:**

**SUBSTANTIAL DAMAGE** For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

**SUBSTANTIAL IMPROVEMENT** For the purpose of determining compliance with the flood provisions of this code, any *repair* , *alteration* , *addition* , or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure, before the improvement or *repair* is started. If the structure has sustained *substantial damage* , any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary, or safety code violations identified by the *code official* and that is the minimum necessary to ensure safe living conditions.
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

**Reason Statement:** Mirrors definitions from the IEBC to the IRC

**Bibliography:** This proposal will neither increase nor decrease Resiliency
This is primarily to comply with flood regulations.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This is primarily to comply with flood regulations.

# A109.3-18

**VCC: 109.3**

**Proponents:** Rebecca Quinn (rcquinn@earthlink.net)

## 2015 Virginia Construction Code

**Revise as follows:**

**109.3 Engineering details.** When determined necessary by the building official, *construction* documents shall include adequate detail of the structural, mechanical, plumbing or electrical components. Adequate detail may include computations, stress diagrams or other essential technical data and when proposed buildings are more than two stories in height, adequate detail may specifically be required to include where floor penetrations will be made for pipes, wires, conduits, and other components of the electrical, mechanical and plumbing systems and how such floor penetrations will be protected to maintain the required structural integrity or fire-resistance rating, or both. ~~All~~ When dry floodproofing is proposed, the engineering details shall include adequate detail of the walls, floors, and flood shields designed to resist flood-related loads, with particular attention to sealing of floor and wall penetrations. All engineered documents, including relevant computations, shall be sealed by the RDP responsible for the design.

**Reason Statement:** Having site plans include flood hazard information improves review efficiency. FEMA post-flood investigations of dry floodproofed buildings identify frequent failures where walls and floors are penetrated by pipes, wires, conduits, etc.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
Having site plans include flood hazard information improves review efficiency. FEMA post-flood investigations of dry floodproofed buildings identify frequent failures where walls and floors are penetrated by pipes, wires, conduits, etc.

# A113.3-18

**VCC: 113.3**

**Proponents:**

## 2015 Virginia Construction Code

**113.3 Minimum inspections.** The following minimum inspections shall be conducted by the building official when applicable to the *construction* or permit:

1. Inspection of footing excavations and reinforcement material for concrete footings prior to the placement of concrete.
2. Inspection of foundation systems during phases of *construction* necessary to assure compliance with this code.
3. Inspection of preparatory work prior to the placement of concrete.
4. Inspection of the elevation of the lowest floor and prior to further vertical construction, upon submission of certification of the elevation of the lowest floor to the building official, for construction in flood hazard areas.
5. Inspection of structural members and fasteners prior to concealment.
6. Inspection of electrical, mechanical and plumbing materials, equipment and systems prior to concealment.
7. Inspection of energy conservation material prior to concealment.
8. Inspection of the elevation of the lowest floor in accordance with Section 110.3.10.1 prior to final inspection located in any flood hazard area or special flood hazard area.
9. Final inspection.

**Reason Statement:** Staff proposal build to break into pieces George Homewood's resiliency proposals.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
These provisions primarily concern with compliance with NFIP and using similar language.

# A117.2-18

**VCC: 117.2**

**Proponents:** Rebecca Quinn (rcquinn@earthlink.net)

## 2015 Virginia Construction Code

**Revise as follows:**

**117.2 Moved buildings and structures.** Any *building* or *structure* moved into a *locality* or moved to a new location within a *locality* shall not be occupied or used until ~~a certificate~~ the flood hazard documentation has been approved by the building official if required by Section 1612.5 and a certificate of occupancy is issued for the new location. Such moved buildings or *structures* shall be required to comply with the requirements of the VEBC.

**Reason Statement:** This alters the CO approval process for flood hazard areas.

**Cost Impact:** The code change proposal will not increase or decrease the cost of construction
This will not have any effect on cost.

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SUMMARY
DHCD WORKGROUP 1 MEETING
2018 Code Change Cycle

June 23, 2020 at 9:30 a.m.
Virtual - Adobe Connect
https://vadhcd.adobeconnect.com/workgroup/

## Participants:

- Bob Allen (Henrico County)
- Scott Andrews (AACT)
- Charlie Baker (FEMA)
- David Beahm (self/Warren County)
- Jeffrey Brown (DHCD)
- Ron Clements (Chesterfield County)
- Mr. Csizmadia (VFPA)
- Allison Cook (Arlington County)
- Cindy Davis (DHCD)
- Robby Dawson (NFPA)
- Gregg Fields (VBCOA)
- Sarah A. Foote (DHCD)
- Brian Gentilini (ADTAC)
- Richard Gordon (AOBA)
- Richard Grace (Fairfax County)
- David Hewitt
- Brian Hilderbrand (DHCD)
- Bryan Holland (NEMA)
- Patrick Hughes (City of Chesapeake)
- Christina Jackson (City of Norfolk/VBCOA)
- Haywood Kines (Prince William County, VA International Association of Electrical Inspectors)
- Thomas King (DHCD)
- James Lawrence
- Casey Littlefield (Goochland County/IAEI)
- Travis Luter (DHCD)
- Matthew Mertz
- Paul Messplay IV (DHCD)
- Andrew Milliken (Stafford County Fire)
- Florin Moldovan (DHCD)
- Sandi Morris (DHCD)
- Kenney Payne (AIA Virginia)
- Randy Pearce (City of Emporia)
- Shaun Pharr (AOBA/VAMA))

- Richard Potts (DHCD)
- Rebecca Quinn (FEMA)
- Stephen Reynolds (DHCD)
- Travis Rickman
- Donna Rubino
- Jonathan Sargeant
- David Sharp (BCAAC)
- Ross Shearer (self)
- David Smith (Eaton)
- Randy Smith (Virginia First Technology)
- Craig Toalson (HBAV)
- Dan Willham (Fairfax County)
- Rick Witt (VBCOA)

## Workgroup 1

Virginia Construction Code

### **A101.2** Incorporates the 2020 NFPA 70 (NEC). A101.5

**Proponent:** Haywood Kines (Prince William County)

**Comments:**

- Mr. Kines and Ms. Davis (DHCD) discuss how a previous SWG Meeting discussed shock hazards in residential dock areas as related to this proposal.That subworkgroup was unable to come to consensus on how best to address the hazard of electric shock drowning (ESD). This proposal incorporates the new NEC article 555 that addresses residential dock and marina safety. However, Mr. Kines is suggesting bringing in the entire new 2020 NEC and not just Article 555. He would like to see at least Article 555 updated to 2020 standards, but hopefully all of the 2020 code updates would be incorporated since it would be helpful for the industry to have all of them on the most up-to-date code standards.
- Mr. Holland of the National Electrical Manufacturers Association mentions that all of the electrical product safety measures could be updated to 2020 standards; he says all we would be receiving is benefits for bringing all code updates up to the 2020 standards for "code harmonization". It is harder to find 2017 code updates, so updating to 2020 would reduce confusion and increase safety and consistency. He is in full support.
- Mr. Beahm (representing himself) brings up the fact that there may be potential conflicts if the document has not been thoroughly vetted yet, and that to do a total 2020 update adoption seems premature and causes potential issues with IRC code agreement. He maintains support for updating just Article 555 at this time.
- Mr. Toalson of the Homebuilders Association of Virginia shares the concerns stated

above -that it's a bit too soon and premature.

- Ms. Davis concurs that this would be a huge amount of work, with potential drawbacks, to update all of the pieces to 2020 standards now without a full review first. She is not in support.
- Mr. Smith representing Eaton is in full support with NEC 2020 updates, citing Massachusetts as a state that has already gone ahead with adopting these code updates. He would like to see Virginia adopt these modernized codes as well.
- Additional discussion on the problems with incorporating all of the different residential updates from the 2020 NEC into the Virginia Residential Code. Staff concurred this would be exceedingly difficult to do.

**Results:** Consensus only incorporating Article 555 from the 2020 NEC

## **A101.5** State amendment clarification.

**Proponent:** Kenney Payne, representing AIA Virginia
**Comments:** None
**Results:** Consensus for Approval

## **A101.6** Order of precedence clarification.

**Proponent:** Kenney Payne, AIA Virginia
**Comments:** None
**Results:** Consensus for Approval

## **A103.1** Removes unnecessary reference to IEBC.

**Proponent:** Kenney Payne, AIA Virginia
**Comments:**

- Mr. Littlefield (IAEI) questions how many references to the VEBC the IEBC actually contains. Mr. Payne assures we have the ability to catch all the times it is referenced to make this linguistic change.
- Mr. Beahm (self) proposes we use "VEBC" or "this code" but not both. His preference is VEBC. Mr. Payne is not opposed to this suggestion.
- Mr. Clements (Chesterfield County) suggests we use the same language the VCC uses.
- Ms. Cook (Arlington County) suggests we leave in the language of "existing requirements" in the VCC.

**Results:** Consensus for Approval as Modified
**Modification:** Change IEBC to VEBC.

## **A109.3** Engineering details where dry flood proofing is proposed.

**Proponent:** Resiliency SWG
**Comments:**

- Mr. Brown of DHCD speaks on this.
- Mr. Beahm representing himself mentions the cost would increase, though he does not disagree with the change itself.
- Ms. Quinn of FEMA on building codes reminds us that dry-flood proofing tends to fail, and that this proposal offers good clarification.
- Mr. Baker of FEMA Region 3, Ms. Quinn of FEMA, Mr. Littlefield all discuss flood-proofing exemptions in Virginia, federal regulations already in place that require these measures, and agreement with Mr. Beahm's concern with cost increase.
- Mr. Pharr of the Apartment and Office Building Association of Metropolitan Washington (AOBA) and the Virginia Apartment Management Association (VAMA) reminds us that DPOR statutory scheme says that one can build their own home or one for a close relative without using an RDP.
- Mr. Clements (Chesterfield County) reminds us that state law overrides these regulations. We would have to go back to state law to clarify.
- Mr. Beahm reiterates support for this change with the caveat that there will be a cost impact and should be reflected as such.
- Mr. Brown of DHCD reminds us that this section already exists and the proposal is only adding a couple of additional items to the list of details that must be provided on plans.
- Ms. Quinn clarifies that FEMA supports this measure because these structures are "critical to proper design."
- Mr. Payne (AIA Virginia) wishes to clarify whether the word "detail" should be plural, and he questions whether the language should be "proposed" or "provided".
- Ms. Quinn (FEMA) further wishes to clarify whether it is "proposed" and "provided."
- Mr. Pharr of the Apartment and Office Building Association of Metropolitan Washington (AOBA) and the Virginia Apartment Management Association (VAMA) indicates support.
- Mr. Toalson of the Virginia Homebuilders' Association supports this proposal as well.

**Results:** Consensus for Approval as Modified
**Modification: Change "detail" to "details" and "proposed" to "provided"**.

## **A113.3** Elevation Certification Requirement

**Proponent:** Resiliency SWG - supported by many but not all members
**Comments:**

- Mr. Hughes (City of Chesapeake), Mr. Baker (FEMA), Ms. Quinn (FEMA) and Mr. Littlefield (IAEI) chatted in questions regarding the EC versus VEBC; Mr. Catlett suggests this belongs in the building code.

- Mr. Clark (HBAV) dissents, opposes. Follow-up conversation with Mr. Clark indicated they mistakenly opposed this proposal. The language has been changed to address their concerns and they are now in support. See attached email from Andrew Clark.

**Results:** Consensus for Approval

## **A113.8(2)** Requirement to energize during final inspection.

**Proponent:** Haywood Kines of VA International Association of Electrical Inspectors

**Comments:**

- Mr. Holland (NEMA) speaks in support of this proposal and mentions that the energy codes require some discussion of the systems.
- Mr. Payne of AIA Virginia suggests NOT capitalizing all trade names in the final version.
- Mr. Catlett of Catlett Code Consulting also speaks in support of this proposal.
- Mr. Beahm represents himself and the Admin committee; says Admin committee disapproved of this proposal. He agrees, but raises the issue of plumbing and electrical.
- Mr. Kines clarifies that he included plumbing due to the structures that are not on public utilities and instead use wells (even in Prince William County), and they still need power.
- Mr. Fields of VBCOA Admin Committee is opposed to the proposal because they believe the existing language is sufficient and requires no change.
- Mr. Kines reiterates that it is absolutely necessary to test things in the field and that he stands by his proposed change.
- Mr. Toalson of HBAV opposes this change, believing the existing language is sufficient.
- Mr. Witt representing himself suggests adding an exception to be able to use temporary power; this allows the existing language to provide a compromise to try and reach consensus.
- Mr. Kines disagrees with the compromise, because it doesn't provide wholesale safety.
- Ms. Davis of DHCD brings up the concern that this proposal borders on policing how the building officials do their jobs, which is not in our purview.

**Results:** Non-consensus

## **A115.2.1** Notice of violation issued under certain circumstances.

**Proponent:** Kenney Payne, AIA Virginia

**Comments:**

- Mr. Beahm (self) dissents.
- Mr. Farrell representing VBCOA provides legislative context; he is not in support.
- Mr. Clements (Chesterfield County) clarifies about what an exact copy might look like for further changes.
- Mr. Pharr (AOBA/VAMA) reaffirms that this is just verbatim what is stated in the Virginia State Code.

- Mr. Fields (VBCOA) and Mr. Catlett (Catlett Consulting) wish to change the Virginia Code, support a legislative change

**Results: Withdrawn.**

## A117.2-18 Moved Buildings and Structures

**Proponent:** Resiliency SWG

**Comments:** Mr. Brown of DHCD lends context to how this change will affect flood hazard areas, to make sure that these areas are approved by building code officials.

**Results:** Consensus for Approval

## **A118.1** Unsafe buildings and structures in the VCC.

**Proponent:** Ron Clements (Chesterfield County)

**Comments:** Withdrawn before Workgroup meeting. Will revisit for next code cycle.

**Results:** Withdrawn

## A119.5 Appeals to the State Review Board

**Proponent:** Kenney Payne, AIA Virginia

**Comments:**

- Mr. Beahm (VBCOA admin committee) says the Fire Committee thought changing the days from 14 to 21 may be too long. He isn't sure if the Fire Committee has seen the updated version yet.
- Mr. Pharr (AOBA/VAMA) mentions that more clarity is always a good thing, and this proposal seems to provide that. He isn't sure there is a valid statutory phrase in the Fire Prevention Code.
- Mr. Farrell (VBCOA) indicates that the Admin Committee voted to support this.
- Mr. Catlett (Catlett Consulting) is in favor except for the 21-day appeal language.
- Mr. Pharr (AOBA/VAMA) sees the rationale for the shorter time period, but he is in support for the longer time period and would actually propose 30 days instead of 21.
- Ms. Hale of Loudoun County Fire agrees with Mr. Catlett, for safety reasons.
- Mr. Payne with AIA Virginia discusses earlier dissent from this proposal, but the 14-day time frame is only in cases where there is no local Board.
- Mr. Milliken (Stafford County Fire) mentions that if changed to 21 days, it would be in conflict with a different code.
- Mr. Pharr concurs about a lack of time periods regulated in a statute.
- Mr. Beahm wishes for clarification regarding commentary language - it will stay the same.
- Ms. Davis from DHCD wishes to clarify when the amendment to this proposal can be made, and whether we are checking with the AG.

**Results:** Consensus, provided we can verify the statutory time allowing 14 days

## Virginia Existing Building Code

### **EB102.2.3** Additions connected with a fire wall.

**Proponent:** Kenney Payne, AIA Virginia

**Comments:**

- Mr. Pharr (AOBA/VAMA) wonders if the language could reflect "shall".
- Mr. Clements (Chesterfield County) clarifies that if this change doesn't go through, it's already in place in most ways as long as it's being interpreted as was originally intended.
- Mr. Catlett (Catlett Consulting) suggests that this change is too stringent: a firewall ought to be treated as a firewall, but he wishes for the flexibility to treat it as a separate entity.
- Ms. Cook (Alexandria) clarifies that if you're going to put up a firewall, it needs to be in compliance with VCC standards already.
- Mr. Payne agrees - we need the "shall" included in the language.
- Mr. Hughes (City of Chesapeake) suggested "newly constructed" terminology to provide additional clarity.

**Results:** Consensus for Approval as Modified

**Modification:** with the addition of the phrasing "newly constructed" (and to put this language in the included note, as well)

## Virginia Maintenance Code

### **PM106** Simplification of the unsafe provisions.

**Proponent:** Ron Clements (Chesterfield County

**Comments:** Withdrawn. Will revisit during next code cycle.

**Results:** Withdrawn prior to meeting

### **PM105.2** Notice to owner when they are not the responsible party.

**Proponent:** Ron Clements, VBCOA legislative committee

**Comments:**

- AOBA/VAMA support PM105.2; Home Builders Association of Virginia - HBAV supports; VBCOA Admin supports
- Mr. Hughes (City of Chesapeake) thanked Mr. Clements for this legal clarity.
- Ms. Jackson (City of Norfolk) is curious about who will be responsible, seeks clarity - could we ignore the owner? What purpose does this addition serve?
- Mr. Clements wants to give the option to report directly to the owner or to the responsible party if it isn't the owner.

- Mr. Catlett (Catlett Consulting) maintains that under this provision, it will be required to report to the owner EVEN IF the responsible party is not the owner.
- Mr. Witt (VBCOA) underscores that this provision means we copy the owner in every case.

**Results:** Consensus for Approval

## Virginia Statewide Fire Prevention Code

## **FP107.2(1)** Operational permit for State Regulated Care Facilities (SCFRs).

**Proponent:** Andrew Milliken, Stafford County Fire Dept.
**Comments:** All were in support.
**Results: Consensus for Approval**

## **FP107.2(2)** Operational permit for commercial cooking.

**Proponent:** Andrew Milliken, Stafford County Fire Dept.
**Comments:**

- Mr. Pharr (AOBA/VAMA) states that AOBA/VAMA support FP107.2(2)
- Mr. Beahm (Warren County) dissents on the basis that this measure is "too intrusive."
- Mr. Catlett (Catlett Consulting) mentions that if you have a commercial cooking appliance in your home, you might not be producing enough damaging byproducts (grease and vapors) to cause a safety concern.
- Ms. Hale (Loudoun County Fire) brings up how the commercial businesses still should be subject to scrutiny, even during COVID closures.
- Mr. Witt (VBCOA) asks about whether this covers daycare facilities and church fellowship halls. Mr. Milliken clarifies that those types of facilities, if already covered by preexisting codes, would be exempt from this additional code regulation.
- Mr. Beahm brings up "change of use" and how those who are reviewing the code might find the proposed language and interpretation problematic.
- Mr. Milliken clarifies the exemptions held above.
- Mr. Beahm raises the concern for home businesses, home bakeries in particular.
- Ms. Davis of DHCD asked if creating a VA Department of Health exemption similar to the existing USBC restaurant requirements for farm structures would work. Mr. Beahm is concerned regarding whether the caveat would create the restriction of having to operate as a restaurant.
- Mr. Catlett brings up the Department of Agriculture and catering services and whether using the commercial appliances offsite affects the meaning of the proposal.

- Mr. Farrell (VBCOA) wishes to clarify the meaning of "assembly use group" and brings up three separate classifications elsewhere for this language (restaurant vs. not a restaurant, occupancy limits, etc.)
- Mr. Milliken clarifies that his proposal is not intended to define what an assembly use group is, but it should only cover the equipment that would require a permit. He also clarifies that the localities can also provide more stringent definitions than the proposal outlines, but this is the baseline.
- Ms. Hale suggests adding "open to the public" to limit the application of this proposal.
- Mr. Witt raises a question regarding whether something is inspected and approved, what the continuing issue would be with obtaining a permit. Would it be after inspection?
- Mr. Catlett rephrases Mr. Witt's question regarding obtaining an operational permit.
- Ms. Davis of DHCD maintains that this process is already in place - that for COO compliance, an occupational permit is already required.

**Results: Carryover to August meeting**

## **FP112.5** Application for appeal.

**Proponent:** Linda Hale, Loudoun County Fire Department

**Comments:**

- Mr. Pharr (AOBA/VAMA) supports the intent of the code change, but doesn't think there is a statutory basis for expanding or altering this change. He mentions that there is no language regarding "standing" until much later in the summation. He supports revising this statement with recognition of the VCC.
- Mr. Witt (VBCOA) is concerned about the overreach that may result in this code change, and whether those who enforce code have the right to do what the passage describes.
- Mr. Payne (AIA Virginia) also raises concerns about distance from a homeowner via number of feet to a fireworks stand. He worries about the word "aggrieved" and that AIA Virginia cannot support as written.
- Mr. Milliken (FSB) summarizes that the Fire Services Board is willing to sign off on it with the language amended.
- Ms. Hale takes these semantic concerns into account and suggests the AG take a look at it, with respect to what the TRB would advise.
- Mr. Pharr discusses the interpretation of "aggrieved" in the context of different examples. Semantically he does not support due to the legal language being unspecific, but he supports the spirit of the code change.
- Mr. Allen (Henrico County) would like to clarify the difference between standing and status.
- Ms. Hale is in support of carrying over to August.

**Results:** Carry over to August meeting; support of the intent, just need to finesse language.

## Virginia Amusement Device Regulations

### **AD20** Adds provisions and incorporates standards for Aerial Adventure Courses.

**Proponent**: Randy Smith, VA First Technology

**Comments:**

- Mr. Gentilini, ADTAC Chair and VBCOA are opposed on the basis that this would create "niche certifications and inspections."
- Mr. Smith wishes to clarify that this is not intended to limit current inspectors' ability to inspect. If this is a semantic piece, he is confident they can figure it out.
- Mr. Andrews of AACT underscores Mr. Smith's stance and explanation.

**Results:** Non-Consensus

### **AD40(2)** Updating standards.

**Proponent**: ADTAC - Brian Gentilini

**Comments:** Workgroup is in support of this proposal.

**Results:** Consensus for Approval

### **AD75(2)** Recommended changes to fees.

**Proponent**: ADTAC - Brian Gentilini

**Comments:** Workgroup is in support.

**Results:** Consensus for Approval

## Virginia Certification Standards

### **CS10** Updates to definitions.

**Proponent**: BCAAC - David Sharp

**Comments:** Workgroup is in support.

**Results:** Consensus for Approval

### **CS31** Cleans up qualification and examination requirements section.

**Proponent**: BCAAC - David Sharp

**Comments:** Workgroup is in support.

**Results:** Consensus for Approval

### **CS41** Reduces the time training must have been completed prior to certification.

**Proponent**: BCAAC - David Sharp

**Comments:** Workgroup supports.
**Results:** Consensus for Approval

## **CS45** Grammatical correction.

**Proponent**: BCAAC - David Sharp
**Comments:** Workgroup was in agreement about the grammatical correction.
**Results:** Consensus for Approval

## **CS51** Issuance of certificates.

**Proponent**: BCAAC - David Sharp
**Comments:**

- Mr. Witt (VBCOA) suggests that the existing language and policy is sufficient, and to leave it alone. He objects to the changing of the hours as being something that is regulatory.
- Mr. Beahm (self) recalls that the lifting of this rule is intended to gain hours/increase hours - he agrees with Mr. Witt to keep the hours at 16.
- Mr. Pearce (City of Emporia) supports the committee's decision.
- Ms. Jackson (City of Norfolk) is concerned about the qualifications for the Active Certificate which have been taken out per this change, and is not in support.
- Mr. Fields (VBCOA) states that the VBCOA Admin Committee disapproves this change - disagree with taking out of regulatory for the reasons previously provided

**Results:** Non-consensus

## **CS61** Removes noncompliance notices from this section.

**Proponent**: BCAAC - David Sharp
**Comments:** Mr. Csizmadia BCAAC (VFPA Rep) supports committee's changes
**Results:** Consensus for Approval

## Virginia Manufactured Home Safety Regulations

## **MH20** Specifies federal regulations.

**Proponent**: DHCD Staff
**Comments:** None
**Results:** Consensus for Approval

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# SUMMARY
# WORKGROUP 2
# MEETING
# 2018 Code Change Cycle

June 30, 2020 at 9:30 a.m.

Remote Meeting Link
https://vadhcd.adobeconnect.com/workgroup/

- John Ainslie
- William Aceto
- Laura Baker (RECA)
- David Beahm (self/Warren County)
- Jeffrey Brown (DHCD)
- Greg Cade
- John Catlett (Catlett Code Consulting)
- Andrew Clark (HBAV)
- Allison Cook (Arlington County)
- Robby Dawson (NFPA)
- Cindy Davis (DHCD)
- Joshua Davis
- Garrett Dyer
- Ellen Eggerton (City of Alexandria)
- Rajan Engh (DHCD)
- Sarah A. Foote (DHCD)
- Chris Fox (VanMetre)
- Richard Grace (Fairfax County)
- Eric Goplerud (FACS)
- Randy Grumbine
- Linda Hale (Loudoun County Fire)
- Jay Hall (VA Department of Corrections)
- Dennis Hart (VBCOA/VPMIA)
- Brian Hilderbrand (DHCD)
- Bryan Holland (NEMA)
- Haywood Kines (Prince William County)
- Thomas King (DHCD)

- Eric Lacey (RECA)
- Curt Linderman (DEQ)
- Ernie Little (VFSB)
- Travis Luter (DHCD)
- Jeff Mang
- Jimmy Moss (VBCOA)
- Andrew Milliken (Stafford County Fire)
- Paul Messplay IV (DHCD)
- Florin Moldovan (DHCD)
- Kenney Payne (AIA Virginia)
- William Penniman (Sierra Club)
- Shaun Pharr (AOBA/VAMA)
- Richard Potts (DHCD)
- Rebecca Quinn (FEMA)
- Michael Redifer (NNVA)
- Greg Revels
- Stephen Reynolds (DHCD)
- Travis Rickman (VDFP)
- Ross Shearer
- Chris Snidow
- Rick Statzer
- Susan Stillman
- Craig Toalson
- Jennifer Tolley (DHCD)
- Charles Walker
- John Walser
- Nabeel Waseem
- Dan Willham (Fairfax County)
- Paul Wallace
- Tread Willis

## BU101-18 - Tall Wood

**Proponents:** John Catlett (catlettcodeconsulting@gmail.com)

2015 Virginia Construction Code

**Comments:**

- Mr. Milliken wonders about the efficacy of this proposed change.
- Ms. Davis reminds the group that the appendix is not optional.
- Ms. Hale points out that Fire Code and Building Code differ significantly in terms of appendices.

- Mr. Catlett agrees that it could use a bit of clarifying.

**Results:** Carryover to August meeting

## B202(3)-18 Permit Holder Definition

**Proponents:** Michael Redifer (redifermd@nnva.gov)

**Comments:**

- Ms. Davis clarifies with Mr. Redifer that the permit-holder is the applicant.
- Mr. Beahm asserts the proposal isn't as comprehensive as it could be, on the grounds of the permit language being unspecific.

**Results:** Carry over to August meeting

## B202(4)-18 Correlates Definition of Building

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr (clementsro@chesterfield.gov)

**Comments:** None

**Results:** Consensus for Approval

## B307.1(1)-18 Deletes Permissible Fireworks Row

**Proponents:** Glenn Dean (gad.pompier@gmail.com)

**Comments:** Mr. Walker of TNT Fireworks respectfully disagrees on the basis of consumer fireworks framed as "allowable" fireworks. Proponent not present at meeting.

**Results:** Consensus for Disapproval

## B310.3(1)-18 Residential Uses Provisions

**Proponents:** Daniel Willham (Daniel.Willham@fairfaxcounty.gov)

**Comments:**

- Mr. Brown (DHCD) provides context for this proposal.
- Mr. Beahm echoes Jeff.
- Withdrawn by proponent in favor of B310.1..

**Results:** Withdrawn

## B310.3(2)-18 Addresses Dwelling Units in R-1

**Proponents:** Daniel Willham (Daniel.Willham@fairfaxcounty.gov)

**Comments:** Withdrawn by proponent in favor of B310.1.

**Results:** Withdrawn

## B310.8.2-18 Accessory Dwelling Units

**Proponents:** Residential Use Subworkgroup
**Comments:** Subworkgroup submitting alternative ADU proposal for Workgroup 3.
**Results:** Withdrawn

## B404.5-18 Smoke Control Exception

**Proponents:** Christopher Campbell (christopher.campbell@arup.com); Raymond Grill (ray.grill@arup.com)
**Comments:**

- Proponent not present at meeting.
- Mr. Milliken asserts that the Fire Services Board does not support; concerns about smoke removal ability.
- Mr. Pharr wanted to voice support so that the proposal's proponent would have a bit more time to refine the language of the proposal.
- Nabeel Waseem is not in support.
- Mr. Davis wishes to clarify whether the proposal would be carried over or just voted down for consensus disapproval.

**Results:** Consensus for disapproval

## B713.8-18 Penetrations in Shaft Enclosures

**Proponents:** Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov); Richard Grace (richard.grace@fairfaxcounty.gov)
**Comments:**

- Mr. Beahm brings up that the IBC Committee may not have been presented with this proposal prior to bringing it to Workgroup 2.
- Mr. Grace clarifies that he is not sure whether this particular proposal was sent over to the committee.
- Mr. Beahm is not necessarily opposed to the proposal; he was just unaware of it and agrees that it be presented to the committee as well as WG2.
- Mr. Hart agrees to carry it over to run it through the IBC Committee.

**Results:** Carryover to August

## B713.11-18 Enclosure at the Bottom of Shaft Enclosures

**Proponents:** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)
**Comments:** None
**Results:** Carryover to August

## B903.2.6-18 Group I-3 Automatic Sprinkler Systems for Exercise Yards

**Proponents:** Jay Hall, Virginia Dept of Corrections (william.hall@vadoc.virginia.gov)
**Comments:**

- Mr. Milliken of Fire Services is not in support of this.
- Mr. Hall wishes to identify "a number that the Fire Services Board would be happy with."
- Mr. Milliken says he does not have a number in mind specifically.

**Results:** Carryover to August; Mr. Hall will collaborate with the Fire Services

## B903.4.2-18 Alarm Exception

**Proponents:** Casey Littlefield (caseylittlefieldmcp@gmail.com)

**Comments:**

- Ms. Davis of DHCD provides context for proposal in lieu of Mr. Littlefield (absent).
- Mr. Milliken is opposed; Fire Services Board has not yet reviewed this proposal.
- Representing himself, Mr. Milliken argues this proposal will "muddy the waters."

**Results:** Consensus for disapproval

## B905.5.3-18 Subject to the Approval of the Building Code Official

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:**

- Mr. Beahm wishes to clarify who else would have to approve -- the building official? The code official?
- Mr. Payne and Mr. Beahm engage in a discussion regarding who would be able to enforce that this code is followed -- what is the allowable interpretation, and who else would need to approve the code itself?
- Mr. Milliken (representing the Fire Services Board) does not support this proposal.
- Mr. Little also does not support.
- Mr. Payne clarifies that this, in response to Mr. Milliken's assertion that this allows "choices," it's not about what you like and what you don't like.
- Mr. Pharr says that AOBA/VAMA support this proposal.

**Results:** Non-consensus

## B907.3.2-18 Corrects Section Reference

**Proponents:** SBCO Staff

**Comments:**

- Ms. Hale speaks in opposition as the proposal was not able to be viewed in cdpVA prior to the meeting
- Mr. Brown clarifies this is just a clarification to the existing language, suggests a carryover to allow time for review
- Mr. Milliken supports carryover.

**Results:** Carryover to August

## B916-18 Emergency Responder Communication

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)
--Public Comments for: B916-18
Discussion by Kenney Payne Apr 17, 2020 17:03 UTC -
**Comments:**

- Mr. Payne expounds on this in verbal discussion regarding repeated attempts to change the code language over multiple cycles. He opposes this change on behalf of AIA Virginia.
- Mr. Pharr and Mr. Milliken provide discussion with a move for non-consensus.

**Results:** Non-consensus

## B1004.3-18 Adds Mercantile to Posting of Occupant Load Requirement

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)
**Comments:**

- Ms. Davis clarifies whether this is a national Fire Code piece. (It is not.)
- Mr. Catlett and Ms. Cook support this proposal "in concept" but in practice have some concerns regarding the workload in terms of building loads/mercantile per locality.
- Mr. Payne and Mr. Milliken seek clarification from DHCD regarding retro-fit requirements that would bear an impact on this proposal.
- Ms. Cook clarifies that the workload wouldn't be able to give "all systems go" on an immediate basis.
- Mr. Payne of AIA Virginia and Mr. Engh of DHCD clarify that VEBC requirements would "only be triggered by work under the VEBC - alteration, addition, repair, change of occupancy."
- Mr. Dawson agrees. Therefore, this proposal would only come into play when they hit on one of those actions.
- Mr. Milliken clarifies that this proposal only was put forward to lend consistency to the other pieces of the VEBC.
- Ms. Cook suggests we move this piece to Chapter 6, 7, and 8 of the existing building code, or Chapter 3.
- Ms. Davis asserts that she is "99 percent sure" we went through all the retro-fit requirements.
- Mr. Catlett recalls how in Alexandria, they used to issue printed notices.
- Mr. Revels is opposed to B1004.3-18 "on the basis that it should be submitted through ICC and not BHCD. This is an issue that should be consistent on a national level and Virginia should not be an outlier. Also, agree that it should not be retrofit as past code editions for M uses have different sq. ft. thresholds for calculating occupant loads."
- Mr. Payne recommends moving this piece to Chapter 302.4 - not specific to repairs, COO, etc.; "once you're in the code, you've got to comply with Chapter 3."
- Ms. Cook voices support for the relocation to chapter 3 of the EBC.

- Mr. Redifer mentions that even in Chapter 3 it's a retrofit which is specifically prohibited by 103.4 VEBC. Mr. Catlett agrees.
- Mr. Revels does not lend support due to the fact that this is not reflected at the national level and we should be outfitting the Virginia code to fit the national.
- Mr. Milliken responds that this is not sufficient as a reason to move toward non-consensus but that in the interest of moving forward he'll acquiesce.
- Ms. Davis grants context behind Mr. Revels' dissent.
- Discussion on retrofit vs. new construction and when renovations/alterations are done.

**Results:** Carry over to August - likely to still be non-consensus but the hope is to get closer to consensus.

## B1010.1.9.6-18 Removes Deletion Section

**Proponents:** John Mather (john@matherarchitects.com)
Public Comments for: B1010.1.9.6-18
**Comments:** DHCD staff has some concerns regarding replication of some of the pieces that we have previously moved to Chapter 4. DHCD staff worries this may cause some confusion and lack of clarity. Mr. Brown of DHCD staff speaks on behalf of this proposal in lieu of Mr. Mather (absent).
**Results:** Consensus for Disapproval

## B1612.4-18 Flood Hazard Documentation

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region II; Terrazia; City of Newport News
**Public Comments:** Discussion by Kenney Payne Jun 19, 2020 20:36 UTC
**Comments:** Mr. Brown of DHCD lends context for this proposal on behalf of the Resiliency SWG.

- Mr. Payne (AIA Virginia) voices concern for lack of specificity and problematic language.
- Ms. Quinn with FEMA (Charles City County region) asserts that floodproofing shield maintenance is dependent on the efficacy of floodproofing design and that this proposal is insufficient to provide proper design planning.
- Mr. Payne rebuts that "just because this planning has been around since 1998, doesn't mean we have been responsible for implementation or plan creation" - just design - for that amount of time.
- Mr. Beahm clarifies that regardless of what the plan is, they review every 3 years.
- Mr. Brown of DHCD clarifies that he does have some concerns regarding AHJ in terms of building officials, that they may not have the authority to properly review.

**Results:** Non-consensus

## B1612.2.1-18 Elevation Requirement

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region II; Terrazia; City of Newport News; AIA Virginia
**Comments:** Discussion among Ms. Quinn of FEMA, Ms. Cook of Arlington County, Mr. Payne and others revolves around this being a potentially cost-prohibitive action.
**Results:** Non-consensus

## B1703.1.3-18 Concrete Testing Personnel Credentials

**Proponents:** Kerry Sutton, American Concrete Institute (kerry.sutton@concrete.org) Concrete Testing Personnel Credentials
**Comments:**

- Proponent not present to provide context
- Mr. Beahm (self) dissents on the basis of verbiage.

**Results:** Consensus for disapproval

## B1709.5.2-18 Garage Door Testing Standards

Proponents: Resiliency Subworkgroup
**Comments:** Mr. Beahm is concerned with some of the verbiage.
**Results:** Consensus for approval

## B1804.8-18 Highest Adjacent Grade Definition

**Proponents:** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region II; Terrazia; AIA Virginia
**Comments:**

- Mr. Payne of AIA Virginia lends context to this proposal.
- Mr. Wallace labels the language as "extremely arbitrary" - could render a lot of properties "un-buildable". Brings up issues with grades, with age-in-place facilities, ADA-accessible structures, and how these would be affected.
- Ms. Quinn clarifies the levels of planes that would be required to remain in compliance.
- Homebuilders are opposed.

**Results:** Non-consensus

## B2902.3.2-18 IBC and PC Correlation

**Proponents:** DHCD Staff (sbco@dhcd.virginia.gov)
**Comments:** None
**Results:** Consensus for Approval

## E402.4.2-18 Skylights

**Proponents:** Haywood Kines, Energy Subworkgroup

**Comments:** None
**Results:** Consensus approval

## E404.5-18 deletes Supply Piping Sections

**Proponents:** Kenney Payne of AIA Virginia, Energy Subworkgroup
**Comments:** None
**Results:** Consensus Approval

**E501.1** Moved to tomorrow.

**E502** Moved to tomorrow.

**E503** Moved to tomorrow.

**E504.1** Moved to tomorrow.

## E1301.1.1.1-18 Removes All Energy Code State Amendments

**Proponent:** Andrew Grigsby.
**Comments:**

- Mr. Fox dissents on the grounds that Virginia is actually less rigorous than it needs to be with energy efficiency, especially when compared to other states including Nevada and Maryland.
- Ms. Stillman (representing herself as a private citizen) supports the full proposal.
- Mr. Penniman (Sierra Club) strongly supports full adoption of this full code update.
- Mr. Clark (Virginia Homebuilders' Association) supports this proposal, but not in its entirety, due to affordability of building residential structures.
- Mr. Shearer supports this full proposal.
- Mr. Payne raises the concern of whether this proposal would supersede an earlier deletion.
- Ms. Davis clarifies that it would have to go to the Board to achieve final consensus.
- Mr. Penniman questions whether this includes language about piping, among other pieces.
- Mr. Beahm strongly objects to the proposed change.
- Mr. Pharr of AOBA/VAMA: AAOBA/VAMA opposes E1301.1.1.1
- Mr. Goplerud mentions that "multi-unit dwellings are covered by commercial codes that are already at 2018 standards. It's the free standing affordable housing that the home

builders association is concerned about. There can't be a lot of single family affordable housing being built."

**Results:** Non-consensus

## RE402.1.2(4)-18 Ceiling R-Value Increase

**Proponents:** Laura Baker, Eric Lacey (RECA)

**Comments:**

- Mr. Fox of Van Metre Homes lends clarity to the proposal.
- Ms. Eggerton and Mr. Payne clarify that this is only a ceiling proposal, not wall installation.
- Mr. Lacey underscores his desire for Virginia to "catch up" with national standards.
- Ms. Eggerton clarifies that some of the areas of the building already can comply with this.
- Mr. Goplerud reminds us that Maryland already has adopted a much higher standard than Virginia's and goes above and beyond the national standards for building these elements into their structures.
- Mr. Lacey agrees to continue to table it for the time being, moves to carry it over to the August meeting.
- Mr. Wilham speaks in support of moving to August as well.

**Results:** Carry over to August meeting

## RE402.1.2(5)-18 Wall R-Value Increase

**Proponents:** Eric Lacey, RECA

**Comments:**

- Mr. Clark wishes to seek a "resolution that will work for everybody" on this proposal.
- Mr. Mang believes this amendment is "way overdue" and is cost-effective.
- Mr. Penniman (Sierra Club) strongly endorses this proposal and echoes Mr. Lacey's introductory comments to this proposal.
- Ms. Eggerton is in support and maintains that this would make more homes affordable for the long-term due to reduced utility costs.
- Mr. Shearer mentions that the continued weakening of the ICC model as the homebuilder's desire leads to an inventory of houses in Virginia that becomes obsolete prematurely.
- Mr. Beahm of the Homebuilder's Association of Virginia does not support and voices the fact that there is other opposition out there to this proposal as well.
- Mr. Payne wishes to clarify the thickness of the insulation.
- Mr. Lacey agrees to table this proposal til August.

**Results:** Carry over to August meeting

## RE503.1.1.1 Replacement Fenestration

**Proponents:** Eric Lacey, RECA
**Comments:** Request to move this proposal review to tomorrow's agenda.
**Results:** Moved to tomorrow (7/1)

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SUMMARY
WORKGROUP 2
MEETING 2018 Code
Change Cycle

July 1, 2020 at 9:30 a.m. Remote
Meeting Link
https://vadhcd.adobeconnect.com/workgroup/

## Meeting-Specific Notes:

- Reordered review of Energy proposals
- Request Submitted by Proponent to withdraw **FP604.8** by Jay Hall

**Ms. Davis welcomed everyone to the Workgroup meeting and thanked them for participating in the process. Future workgroup dates were provided.**

## FP101-18 - Tall Wood Appendix (IFC)

**Proponents:** John Catlett (catlettcodeconsulting@gmail.com)
**Comments:** Mr. Catlett agrees that both this proposal and its companion proposal (BU101-18, introduced to Workgroup 2 at the 6/30 meeting) could use some clarification.
**Results:** Carryover to August meeting

Ms. Davis thanked all of the stakeholders that worked on the next two proposals of fire code edits. She acknowledged the hundreds of hours of work that went into finalizing these edits.

## FP103.2.1 (VFSB SFPC Edit Part 2)-18 (Edits Chapters 27 & 50-56)

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)
**Public Comments for:** FP103.2.1 (VFSB SFPC Edit Part 2)-
**Comments:** Proposal from the Fire Code Edit Workgroup
**Results:** Consensus for Approval

## FP103.2.1 (VFSB SFPC Edit Part 3)-18 Edits Chapters 57-67

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov); Thomas King (thomas.king@dhcd.virginia.gov)
**Comments:** Proposal from the Fire Code Edit Workgroup
**Results:** Consensus for Approval

## FP202(4)-18: Adds a "cooking tent" definition

**Proponents:** Linda Hale of Loudoun County Fire Marshal's Office (Linda.Hale@Loudoun.gov)
**Comments:** Ms. Davis wishes to clarify whether this would apply even to a 10x10" pop-up tent, or just anything that is producing grease-laden vapors. Ms. Hale indicated that this could be for a pop up.
**Results:** Consensus for Approval

## FP319.1.1-18: Adds wheel chocks and minimum distance provisions for food preparation vehicles

**Proponents:** Linda Hale of Loudoun County Fire Marshal's Office (Linda.Hale@Loudoun.gov)
**Comments:**

- Mr. Beahm representing himself questions whether the non-registered-vehicles that are not road-worthy are considered mobile food preparation vehicles.
- Ms. Hale (Loudoun County) clarifies that the vehicles themselves might not even need to be mobile or in working order; if they have wheels, they are applicable. They can still cause problems regardless of their road-worthiness.
- Mr. Dawson of NFPA is in support of the proposal on the grounds of food trucks that are up on cinderblocks would still apply; they don't fall under building codes because they aren't structures.
- Mr. Beahm representing himself agrees on principle, but wishes for more clarified language to limit the interpretation. However, he does not oppose.

**Results:** Consensus for Approval

## FP319.2.1-18: Designated AHJ for food truck permit

**Proponents:** Linda Hale of Loudoun County Fire Marshal's Office (Linda.Hale@Loudoun.gov)
**Comments:**

- Mr. Dyer of SFMO supports the proposal FP319.2.1-18
- Mr. Beahm representing himself supports this change.
- Ms. Eggerton (Alexandria) mentions that this would support economic recovery for small businesses
- Mr. Milliken (Fire Services Board Codes and Standards Committee) supports this change
- Ms. Davis (DHCD) clarifies that Ms. Hale (LCFMO) will add language to clarify that it is referring to a Virginia local government and language for food trucks coming in from out-of-state, to address concerns raised by the group and bring the proposal back in August.

**Results:** Carryover to August, plan to approve then with more specific language added

## FP405.2-18: Fire and evacuation drill frequency (TABLE)

**Proponents:** Andrew Milliken representing Stafford County Fire Marshal's Office (amilliken@staffordcountyva.gov)

**Comments:** Mr. Milliken brings up the fact that emergency evacuation drills are required in Group R-2 occupancies that are designed or developed and marketed to senior citizens 55 years of age or older.

- Mr. Pharr of AOBA/VAMA worked closely with Mr. Milliken on this proposal and clarified the language within the body of the proposal to include the following clause: **Emergency evacuation drills are required in Group R-2 occupancies that are designed or developed and marketed to senior citizens 55 years of age or older in accordance with 42 U.S. Code, Section 3607(b)(2)**.
- Mr. Moss with VBCOA will support as long as the above modification is made.

**Results:** Consensus for Approval as Modified

## FP407.2-18: Material Safety Data Sheets

**Proponents:** Aaron Engi

**Comments:** Mr. Milliken speaks on behalf of the Fire Services Board Codes and Standards Committee. They are in support.

**Results:** Consensus for Approval.

## FP604.8-18: Testing of battery powered emergency lights and exit signs

**Proponents:** William Hall (william.hall@vadoc.virginia.gov)

**Comments:** Withdrawn by Proponent

**Results:** Withdrawn

## FP609.2-18: Cooking operations producing grease laden vapors

**Proponents:** Andrew Milliken representing the Stafford County Fire Marshal's Office (amilliken@staffordcountyva.gov)

**Comments:**

- Ms. Cook of Arlington County wishes to clarify whether this could have any possibility of being a retrofit requirement.
- Ms. Davis of DHCD seeks clarification on whether this proposal would require ventilation to be in place, including mechanical ventilation
- Mr. Payne representing AIA Virginia suggests the language could be more specific regarding whether the grease-laden vapor-producing devices would be held to required ventilation of the spaces
- Ms. Hale suggests this proposal offers direction on use for those who may be confused about what the issue with grease-laden vapors actually is - that the current language

included in the code is sometimes confusing when carrying out guidelines

- Mr. Moss of VBCOA, Mr. Catlett representing himself, Ms. Cook of Arlington County, and Ms. Eggerton of Alexandria all lend suggested language to this proposal to help further clarify
- Ms. Hale of Loudoun County's Fire Marshal's Office speaks in support based on helping define what the initial issue is that would require this amendment in the first place
- Ms. Eggerton of Alexandria points to Mechanical Code as a source of potential problem areas when interpreting this piece of code
- Ms. Cook of Arlington County mentions how the hood ventilation requirements have evolved and is concerned regarding the potential for retro-fit requirements down the line - she does not currently support
- Mr. Moss of VBCOA suggests clarifying language, citing partnership with Mr. Milliken on this concept previously. Mr. Milliken has no objection to making Mr. Moss's proposed change to the language to add further clarity.
- Ms. Eggerton (Alexandria) suggests that a proposed definition change should be run through the mechanical code group because the proposed change could run into issues with the mechanical code.
- Ms. Davis (DHCD) agrees - motion to carry over to August
- Mr. Catlett suggests wordsmithing this to ensure there is no conflict between the codes.
- Mr. Payne of AIA Virginia concurs with Ellen
- Mr. Grace (Fairfax County) concurs as well.
- Mr. Moss and Mr. Milliken resolve to work together to come up with revised language

**Additional Public Comments:**
Submitted by William Andrews in cdpVA UTC Suggest add "commercial" to clarify not apply within residences. Expect readers understand intent for inside, not outdoors. 2000 IFC sec. 609.2 read: "A type I hood shall be installed at or above all commercial food heat-processing appliances that produce grease vapors or smoke. Exceptions: Food heat-processing appliances installed within a dwelling unit." "Commercial Food Heat-Processing Appliance" was defined as in a food-processing establishment, which noted include any building or a portion thereof used for the processing of food. Helps fire official citing portable cooking risk which use not approved by building official. Instead of fire official citing vague unsafe condition or use other than as approved by building official, then need refer to or get building official to verify did not approve that type cooking activity there.
**Results:** Carryover to August meeting

## FP807.5.4-18: Group I-3 exception for combustible decorative materials

**Proponents:** William Hall, Virginia Dept of Corrections (william.hall@vadoc.virginia.gov)
**Comments:** Mr. Milliken (Fire Services Board Codes and Standards Committee) is in support.

**Results:** Consensus for Approval

## FP2306.2.1-18: SWCB regulated tanks

**Proponents:** DHCD Staff. Mr. Brown of DHCD provides context and explanation for this proposal. This proposal was a collaborative effort with DEQ to provide additional pointers in the SFPC where the State Water Control Board regulations should be referenced for certain tanks. Ms. Davis (DHCD) lends further support.

**Comments:** Mr. Milliken of the Fire Services Board Codes and Standards Committee says the FSBCSC has not yet reviewed this proposed change. However, he finds it straightforward and is in support of the proposal.

Ms. Davis of DHCD reassures Mr. Milliken and everyone in the meeting that if a proposal winds up being problematic to one of the stakeholders once it is at the Board review stage, it can still be pulled for further consideration.

**Results:** Consensus for Approval

## FP2306.2.1.1-18: Inventory records for underground tanks

**Proponents:** DHCD Staff : Mr. Brown of DHCD and Ms. Meadows of DEQ lend context to this proposal.

**Comments:**

- Mr. Milliken representing Fire Services Board Codes and Standards Committee suggests we “stick close to the Model Code language”
- Ms. Davis of DHCD agrees that the state water control board would supersede … is there national language we could use to more accurately mirror?
- Ms. Meadows of DEQ confirms that DEQ is fine with adding back in the last sentence.
- Mr. Brown of DHCD says that this is about record-keeping
- Ms. Hale of Loudoun County Fire Marshal’s Office agrees that this can be workable so long as we un-strike the last sentence

**Results:** Consensus for Approval - as Modified (Un-striking the last sentence)

## FP2403.2.1.3-18: Areas adjacent to spray booths

**Proponents:** Joseph Willis, Prince William County (jwillis@pwcgov.org); Haywood Kines, Prince William County (hkines@pwcgov.org); Mr. Willis provides context for the reasoning behind this proposal.

**Public Comments for:** FP2403.2.1.3-18

Discussion by Haywood Kines Jan 31, 2020 20:58 UTC

**Comments:**

- Ms. Davis (DHCD) wishes to clarify whether this would potentially

affect retroactive work; Mr. Willis says no, it wouldn't.
- Mr. Milliken of Fire Services Board Codes and Standards Committee supports this; it cleans up an old Virginia code.

**Results:** Consensus for Approval

## FP5003.1.1(1)-18: Adds a footnote to MAQ table for new A2L refrigerants

**Proponents:** Julius Ballanco (JBENGINEER@aol.com) of Daiken

**Comments:**

- Ms. Hale of Loudoun County Fire Marshal's Office and VPMIA are opposed. She is concerned about the lack of specificity with the language of "mildly flammable," and that the proposal seems to go beyond the scope of what the Fire Marshals' office is able to execute. She believes the proposal is premature.
- Ms. Davis offers the option to Mr. Ballanco to carry over the proposal if he is willing to work with the other groups who are opposed.
- Mr. Ballanco agrees to work with Loudoun County and VPMIA in order to carry the proposal over to Workgroup 4.
- Mr. Milliken adds that the proposal also needs to be in accordance with the Fire Code edits.

**Results:** Carryover to Next Meeting

## FP5003.1.1(2)-18: Adds a footnote to MAQ table for A2L refrigerants

**Proponents:** Julius Ballanco (JBENGINEER@aol.com) of Daiken

**Comments:**

- Ms. Hale of LCFMO voices concerns about jurisdiction, ability for Fire Officials to be able to put this code change into practice. She does not believe this proposal has been vetted properly and is not in support.
- Mr. Grace of Fairfax County, Mr. Beahm representing himself, all move to carry over.

**Results:** Carryover to Next Meeting

## FP5703.1.2-18: Classified locations for combustible liquids

**Proponents:** DHCD Staff (sbco@dhcd.virginia.gov)

**Comments:** This is an editorial change only. No one in opposition.

**Results:** Consensus for Approval

## FP5704.2.13.1.1-18: Exceptions for out of service tanks

**Proponents:** DHCD Staff (sbco@dhcd.virginia.gov)
**Comments:** Mr. Brown from DHCD explained that this was a result of the meeting with DEQ to align SWCB regs with USBC and SFPC regulations.

- Mr. Millken for Stafford County opposes.
- Ms. Meadows for DEQ mentions how this fire code requirement is currently in direct conflict with SWCB laws and regulations and as such, has created a lot of confusion for fire officials.
- Mr. Brown (DHCD) restates attempt to clean up this language so that compliance is achievable by all parties involved
- Mr. Milliken (Stafford County) suggests that revised language may make it more possible to move toward consensus but that in its current written state, the fire officials would be tasked with enforcing DEQ's regulations.

**Results:** Carryover to August

## FP5707.1-18: On-demand Mobile Fueling Operations

**Proponents:** Irene Koulouris; Mr. Catlett of Catlett Consulting speaks to lend background to this proposal.
**Comments:**

- Ms. Davis (DHCD) provided background and overview of the process related to this proposal. Since mobile fueling is prohibited by state law, this will obviously be consensus for disapproval. However, it is being discussed as the proponent did not withdraw the proposal. Additionally DHCD has been tasked with creating a report that details concerns with mobile fueling for members of the General Assembly. This conversation provides an opportunity to identify concerns. It is anticipated that a stakeholder group will be convened this fall for a fuller discussion.
- Mr. Payne of AIA Virginia clarifies with Mr. Catlett and the proponents that all the language should be underlined as it is new language.
- Mr. Beahm representing himself would like to know whether Exception No. 3 would be deleted
- Ms. Davis (DHCD) clarifies that the only removal would be a result of what is already illegal in the state of Virginia
- Mr. Catlett (Catlett Consulting) responds that this proposal would not remove the exemption
- Ms. Hale (Loudoun County) has concerns about trying to address this proposal preemptively - before it is legal in Virginia. She believes it is premature.
- Mr. Beahm representing himself concurs that this proposal is premature.
- Mr. Catlett (Catlett Consulting) invites other workgroup members to address further questions to him between this meeting and fall 2020

**Results:** Consensus for Disapproval

## PM604.3.1.1-18: Third party electrical inspectors

**Proponents:** Haywood Kines (hkines@pwcgov.org)

**Comments:**

- Mr Catlett makes a comment on language, but he doesn't have any concerns with the code change itself.
- Mr. Payne of AIA Virginia also makes a note on language; he doesn't believe the word "inspector" should be capitalized, but he has no issue with the code change itself.
- Everyone is in support for this proposal.

**Results:** Consensus for approval

## EB601.4(3)-18 Energy conservation

**Proponents:** Eric Lacey (eric@reca-codes.com); Energy Subworkgroup

**Comments:** Mr. Mang of Polyisocyanurate Insulation Manufacturers Association thanks the group for their hard work on this.

**Results:** Consensus for Approval

## E501.1: Deletes existing building provisions of the VECC

*Moved from June 30th meeting*

**Proponents:** Laura Baker of Responsible Energy Codes Alliance (RECA), Eric Lacey of RECA

**Comments:** This is the first in a series of proposals brought forth by RECA this code cycle. They believe it is important to have energy requirements in the VEBC, instead of just in the VECC.

**Results:** Consensus for Approval

## E502 Moves VECC existing building provisions to VEBC

*Moved from June 30th meeting*

**Proponents:** Laura Baker, Eric Lacey of RECA

**Comments:**

- Ms. Cook of Arlington County opposes the proposal as written, but suggests bringing it forth at the August meeting
- Mr. Payne of AIA Virginia suggests "building system" versus "building" language
- Mr. Beahm representing himself agrees.
- Mr. Pharr of AOBA/VAMA agrees with them, as well.
- Ms. Eggerton (Alexandria) appreciates the "not overloading the existing system" piece of language, but also supports compromise with languaging.

**Results:** Carry over to August meeting

## E503-18 Deletes existing building provisions of the VECC

*Moved from June 30th meeting*

**Proponents:** Laura Baker, Eric Lacey of RECA

**Comments:** Mr. Payne of AIA Virginia suggests we modify the language to say "Chapter 6 of the VEBC"

**Results:** Consensus for Approval with Modification

## E504.1 Moves VECC existing building provisions to VEBC

*Moved from June 30th meeting*

**Proponents:** Laura Baker, Eric Lacey

**Comments:**

- Ms. Cook of Arlington County suggests there's more refining to do.
- Mr. Payne (AIA Virginia) is not sure that the language regarding "repair" would necessitate a change, and that it may set a problematic/unsustainable precedent. Also brings up a cost issue.
- Ms. Cook (Arlington) and Mr. Payne (AIA Virginia) both suggest carrying over and working together to ensure that the language included in this doesn't already cover what has been included in 2015 code.
- Mr. Pharr mentions that AOBA/VAMA oppose E504.1

**Results:** Carry over to August

## RE503.1.1.1 Replacement fenestration

*Moved from June 30th meeting*

**Proponents:** Eric Lacey (RECA)

**Comments:**

- Supported by Energy Subworkgroup
- Mr. Lacey (RECA) suggests this proposal is no longer necessary as it has already been covered by a previous proposal's contents.
- Mr. Pharr (AOBA/VAMA) voices disapproval.
- Ms. Cook (Arlington) states: "The way I read this … [is] that this only applies when a building owner / tenant selects to replace fenestration, it does not require upgrading to meet energy requirements if they aren't already replacing the fenestration as part of the project."
- Mr. Brown of DHCD confirms with Mr. Lacey (proponent) that he would like to withdraw this proposal

**Results:** Withdrawn

## EB601.4(1)-18 Energy conservation

**Proponents:** Eric Lacey, Responsible Energy Codes Alliance (eric@reca-codes.com)
**Comments:** Because we already covered the materials in a previous proposal this cycle for Energy Conservation to be added into the Existing Building Codes, this is withdrawn by the proponent
**Results:** Withdrawn

## EB601.4(4)-18 Energy conservation/Roof replacement

**Proponents:** Jeff Mang, Polyisocyanurate Insulation Manufacturers Association (jeff.mang@hoganlovells.com); Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Energy Subworkgroup
**Comments:** Proponent says we have already covered the elements he wished to cover in this proposal and elects to withdraw.
**Results:** Withdrawn

## EB701.4-18 Moves VECC existing building provisions to VEBC

**Proponents:** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)
**Comments:**

- Mr. Payne with AIA Virginia opposes because energy conservation does not change based on occupancy. Currently, a change of occupancy requires a greater degree of each of the six elements; energy conservation is not one of the six.
- Ms. Cook (Arlington County) does not believe we can reach consensus if we carry this proposal over. If there's interest in revisiting and redefining, then there's potential for consensus for approval, but she is concerned about the huge cost implications.
- Mr. Payne (AIA Virginia) shares cost concerns. Not in support.
- Ms. Baker maintains that these are not new requirements, but she would rather work to compromise on the other two proposals, so agrees for this one to move forward as non-consensus.
- Ms. Cook (Arlington) wishes for cost statement to make its way to the Board; it is a substantial cost increase and she underscores that the Board should recognize this fact.

**Results:** Non-Consensus

## EB202(1)-18: Change of occupancy definition

**Proponents:** Michael Dellinger (mdellinger@albemarle.org)
Discussion by Kenney Payne Apr 17, 2020 19:19 UTC
**Comments:** This proposal is withdrawn by the proponent to be able to lend support to a very similar proposal - EB202(2) proposed by Casey Littlefield

**Results:** Withdrawn

## EB202(2)-18: Change of occupancy definition

**Proponents:** Casey Littlefield

Public Comments for: EB202(2)-18 Discussion by Kenney Payne

**Comments:**

- Mr. Payne (AIA Virginia) is concerned about the interpretation of the word "electrical" for Change of Occupancy. He also believes the VEBC already includes the language that would provide guidelines for what this proposal is supposed to cover.
- Mr. Kines (Prince William County) argues that there are several ways in which this proposal could be applied; he speaks in support of the proposal.
- Mr. Moss (VBCOA) agrees with Mr. Payne (AIA Virginia) and would not be in favor of this changeMr. Beahm (representing himself) agrees
- Ms. Cook (Arlington) and Ms. Eggerton (Alexandria) both assert that there are many reasons change of occupancy would require upgrades, including electrical
- Mr. Payne (AIA Virginia) suggests that this change is not necessary, supports punting this one to the next code cycle.

**Results:** Non-Consensus

## EB307-18: Roof covering and repair

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr (clementsro@chesterfield.gov); Mr. Payne provides history and context on this proposal

**Comments:** This is a technical change. No dissent voiced.

**Results:** Consensus for Approval

## EB402.1-18: Change of occupancy

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:**

- Mr. Payne provides context for the proposal regarding how this proposal would duplicate what is at the national code levels.
- Ms. Eggerton of Alexandria wonders if it is in alignment with DOJ standards, which Mr. Payne explains that it is. Ms. Eggerton is satisfied with his explanation of requirement compliance and is in support of the proposal.

**Results:** Consensus for Approval

## EB402.1.4.2-18: Roof/ceiling assembly

**Proponents:** Jeff Mang, Polyisocyanurate Insulation Manufacturers Association (jeff.mang@hoganlovells.com); Energy Subworkgroup

**Comments:**

- Mr. Brown of DHCD clarifies that this proposal was mistakenly assigned subject matter code "EB" and should have been "E"since it is energy related. DHCD staff will rename the proposal "E402.1.4.2-18" .
- Mr. Pharr of AOBA/VAMA and Ms. Eggerton of Alexandria voice support for this proposal.
- Mr. Lacey (Fairfax County) supports this too.

**Results:** Consensus for Approval

## EB404.3-18: Alterations affecting area of primary function

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:** Mr. Pharr of AOBA/VAMA supports EB404.3

**Results:** Consensus for Approval

## EB405.1-18: Historic buildings

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:** None

**Results:** Consensus for Approval

## EB502.1.1-18: Repairs to structural concrete

**Proponents:** Stephen Szoke, American Concrete Institute (steve.szoke@concrete.org)

**Comments:** Stephen Szoke absent; no other support for approval.

**Results:** Consensus for Disapproval

## EB504.1.6-18: Smoke alarms

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)

Public Comments for: EB504.1.6-18 Discussion by Kenney Payne

**Comments:** Mr. Payne (AIA Virginia) and Mr. Beahm (representing himself) support the proposal if moved to Chapter 3

**Results:** Consensus for Approval as Modified

## EB701.4: Moves VECC existing building provisions to VEBC

**Proponents:** Laura Baker, Eric Lacey of RECA

**Comments:**

- Ms. Baker explains that this proposal is designed to move VECC existing building language over in the VEBC Change of Occupancy chapter.
- Mr. Payne of AIA Virginia voices concern about moving the language over; currently, energy conservation requirements are not triggered by a Change of Occupancy. Thi would be a complete reversal, to which he is opposed.
- Ms. Cook of Arlington County mentions that she doesn't think we will reach consensus on this proposal; due to the current economic climate. There would be heavy financial implications. Thus, she is not in support.
- Mr. Payne brings up that if there is an alteration to a structure related to a change of occupancy, that may trigger energy conservation requirements - but as it stands, for existing buildings with no alterations, he is not in support.
- Ms. Cook (Arlington County) wishes to see the cost statement; Ms. Baker claims there isn't any because it is already contained within the VEBC. Ms. Cook believes this is factually incorrect, and that it is contained within the body of the Virginia Energy Code, but that to add it to the VEBC would have a large financial impact.

**Results:** Non-Consensus

## EB704.1-18 Fire protection

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:**

- Mr. Milliken (Fire Services Board Codes and Standards Committee) dissents in practice regarding sprinklers, on the basis of language that could be redefined as "fire areas"
- Mr. Payne (AIA Virginia) suggests that Mr. Milliken's interpretation of the code would be a "tremendous change" from how it has historically been interpreted
- Ms. Cook (Arlington) supports this code change proposal because it is clarifying
- Mr. Milliken (Fire Services Board Codes and Standards Committee) patently disagrees with Mr. Payne.

**Results:** Non-Consensus

## EB801.1-18 Revising and reorganization of VEBC/VECC

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:** Withdrawn

**Results:** Withdrawn

## EB1401.1-18 Evaluation process

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)

**Comments:** There were additional substantive changes in certain places that cdpVA would not accept, so are not shown in the main part of the proposal, so those additional changes are outlined in the reason

statement and Mr. Payne wanted to make sure everyone was aware that those additional changes were there and are part of the proposal. With those changes taken into account, this is Consensus for Approval
**Results:** Consensus for Approval

## EB1101.18(1)-18 High-rise fire sprinklers

**Proponents:** Andrew Milliken (amilliken@staffordcountyva.gov)
**Public Comments for:** EB1101.18(1)-18 Discussion by Kenney Payne (AIA Virginia)
**Comments:** Discussion regarding sprinklers versus fire areas
**Results:** Withdrawn

## EB1101.18(2)-18 Address identification

**Proponents:** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)
**Comments:**

- Ms. Hale (Loudoun County) and Mr. Beahm (representing himself) lend discussion to clarity of Authority Having Jurisdiction.
- Mr. Milliken representing the Virginia Fire Services Board and Standards states that the committee was not in support of this.
- Mr. Milliken (VFSB) asserts that he would like to amend the last sentence in order to be able to fully support this proposal. Mr. Beahm suggests reworking some of the language but doesn't have strong feelings about it one way or the other.
- The workgroup is in favor of this proposal going back to Mr. Payne for further workshopping of the language, with the intent to bring it forward in August for final review.

**Results:** Carry over to August for final review

# SUMMARY
# WORKGROUP 3 MEETING
## 2018 Code Change Cycle

July 15, 2020 at 9:30 a.m.
Remote Meeting Link
https://vadhcd.adobeconnect.com/workgroup/

## Participants

- Philip Abraham (Vectre Corp.)
- Bob Allen (Henrico County)
- William Aceto (Fairfax County)
- Charlie Baker (FEMA Region III)
- Laura Baker (RECA)
- Steve Banashek (self)
- David Beahm (self/Warren County)
- Jeffrey Brown (DHCD)
- Greg Cade (NFPA)
- Andrew Clark (HBAV)
- Ron Clements (Chesterfield County)
- Robby Dawson (NFPA)
- Cindy Davis (DHCD)
- Ellen Eggerton (City of Alexandria)
- Sean Farrell (VBCOA)
- Sarah A. Foote (DHCD)
- Richard Grace (Fairfax County)
- Eric Goplerud (FACS)
- Brian Gordon (AOBA)
- Linda Hale (Loudoun County Fire)
- Chelsea Harnish
- Bryan Holland (NEMA)
- Todd House
- Patrick Hughes (City of Chesapeake)
- Don Iverson
- Maggie Kelley (SEEA) Southeast Energy Efficiency Alliance
- Haywood Kines (Prince William County)
- Thomas King (DHCD)

- Susan Larsen
- Jason Laws (Chesterfield County/VBCOA)
- Eric Lacey (RECA)
- Joy Loving (CAAV)
- Travis Luter (DHCD)
- Ivy Main (self)
- Paul Messplay IV (DHCD)
- Matthew Mertz
- Jimmy Moss (VBCOA)
- Andrew Milliken (Stafford County Fire)
- Florin Moldovan (DHCD)
- Andrea Papageorge (Southern Company Gas)
- Kenney Payne (AIA Virginia)
- William Penniman (Sierra Club)
- Alexandria Phillips (Washington Gas)
- Natalie Pien
- Richard Potts (DHCD)
- Rebecca Quinn (FEMA)
- Michael Redifer (NNVA)
- Greg Revels (Henrico County)
- Stephen Reynolds (DHCD)
- Jonathan Sargeant
- Jeff Shapiro (International Code Consultants)
- David Sharp (BCAAC)
- Ross Shearer (self)
- Bob Shippee (self)
- David Smith
- Eric Stafford
- Rick Statzer (VBCOA)
- Susan Stillman
- Jennifer Tolley (DHCD)
- Timothy Vaughan (Columbia Gas)
- Morgan Whayland (Virginia Natural Gas)
- Dan Willham (Fairfax County)

**Virginia Residential Code (Building)**

## RB44 - Removes 13R reference

**Proponent(s):** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com) - Consultant, National Fire Sprinkler Associates
**Comments:**

- Mr. Beahm (representing himself) says that if the current code doesn't conflict with anything in the state amendments, he would prefer to leave it in. He would "typically be opposed" to this change.
- Mr. Milliken (Stafford County Fire) and Mr. Brown of DHCD mention a reference in R310.1 that is reflected at the state level in the VCC that is used.
- Mr. Shapiro agrees with the above comments and withdraws.

**Results:** Withdrawn

## RB200 Substantial damage and substantial improvement definitions

**Proponent(s):** Resiliency Subworkgroup (explained by Mr. Brown of DHCD)
**Comments:**

- Mr. Payne (AIA Virginia) brings up the difference in definitions between the IEBC and the VEBC; Mr. Brown clarifies that this proposal should match the VEBC definition
- Ms. Quinn of FEMA claims that national code language is based on FEMA requirements, so she wants to clarify whether this proposal should match the IEBC requirements.

**Results:** Carry over to August

## RB301.2(1) Ultimate design wind speeds

**Proponent(s):** City of Hampton, Hampton Roads Planning District, City of Norfolk, VA DCR, FEMA Region III, City of Newport News; AIA Virginia
**Comments:** HBAV clarifies that they will support and join as proponent based on the approval of RB301.2.1; DHCD staff will update this proposal's list of proponents to reflect Mr. Clark's addition.
**Results:** Consensus for Approval

## RB301.2.1 Wind design criteria

**Proponent(s):** Glenn Overcash (AECOM)
**Comments:**

- This is a companion proposal to RB301.2
- Proponent not in attendance.
- Mr. Brown (DHCD) explains that the proposal was discussed by the Resiliency Subworkgroup and matches a proposal put forth by the IRC.

**Results:** Consensus for Approval

## RB301.2.1.1 Wind limitations and wind design required

**Proponent(s):** Resiliency Subworkgroup
**Comments:** Brings in approved changes to 2021 IRC; no opposition
**Results:** Consensus for Approval

## RB302.1 Exterior wall projections

**Proponent(s):** Ronald Clements Jr. (clementsro@chesterfield.gov), Chesterfield County
**Comments:** Proponent provided an overview of his proposal of exterior wall projections; no opposition
**Results:** Consensus for Approval

## RB302.2 Townhouses 2021 change

**Proponent(s):** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com) - Consultant, National Fire Sprinkler Associates
**Comments:**

- Mr. Beahm (representing VBCOA) suggests running this through VBCOA's IRC committee before approving this change; some more time and discussion is needed

**Results:** Carryover to August

## RB302.2.2 Sprinkler piping in common walls

**Proponent(s):** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com) - Consultant, National Fire Sprinkler Associates
**Comments:**

- Ms. Eggerton (Alexandria) is concerned about the freezing temperatures that could potentially occur within the shared walls.
- Mr. Payne (AIA Virginia) provides editorial context and clarifies language about "waterfill" with the proponent
- Mr. Clark of the Homebuilders of VA is in support.
- There is wide support for eliminating the words "that it"

**Results:** Consensus for Approval as Modified

## RB302.2.6 Add exception for structural independence

**Proponent(s):** Jeff Shapiro (jeff.shapiro@intlcodeconsultants.com) - Consultant, National Fire Sprinkler Associates
**Comments:**

- The workgroup went back to revisit this proposal and updated to use the same language as the following proposal, RB302.3(1)
- Mr. Clark of the Homebuilders of VA is in support.

**Results:** Consensus for Approval as Amended

## RB302.3(1) Removes specific reference to NFPA 13

**Proponent(s):** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com) Consultant, National Fire Sprinkler Associates

**Comments:**

- Mr. Dawson (NFPA) says it should include all standards, instead of just eliminating one.
- Mr. Milliken (Stafford County Fire) voices support plus adding the pieces Mr. Dawson mentioned.
- Mr. Beahm (Warren County) echoes Mr. Dawson and Mr. Milliken.
- Mr. Shapiro agrees to add 13 and 13R.
- Mr. Payne of AIA Virginia supports.

**Results:** Consensus for Approval as Modified; adding NFPA 13 and 13R

## RB302.3(2) Accessory dwelling unit

**Proponent(s):** Residential Use Subworkgroup

**Comments:**

- Mr. Kines of Prince William County is concerned about potential safety issues with this proposal - he is not in support.

**Results:** Non-consensus

## RB313.1 Sprinkler systems in townhouses

**Proponent(s):** Glenn Dean (gad.pompier@gmail.com), representing himself

**Comments:**

- Mr. Dawson (NFPA) provides background on the proposal in Mr. Dean's absence.
- Ms. Hale of Loudoun County strongly supports.
- Mr. Clark of the Homebuilders' Association is not in support.
- Mr. Shapiro (National Fire Sprinkler Associates) gives an example of how this proposed change has worked well in other states, such as Washington

**Results:** Non-Consensus

## RB314.6(1) Specifies 10-year battery for smoke alarm power source exception

**Proponent(s):** Andrew Milliken (amilliken@staffordcountyva.gov), Stafford County

Comments:

- Mr. Beahm (representing himself) wishes to add the language of this being a "minimum 10-year battery"
- Mr. Clark with the Homebuilders' Association supports.

**Results:** Consensus for Approval as Modified

## RB314.6(2) Removes broken reference

**Proponent(s):** DHCD Staff (sbco@dhcd.virginia.gov)

**Comments:** No opposition

**Results:** Consensus for Approval

## RB322.2.1 Garage and carport elevation requirements

**Proponent(s):** HBAV; City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; City of Newport News

**Comments:**

- This is a proposal being worked on by the Resiliency Subworkgroup; they requested more time to work on it, so it has been tabled until the August meeting.

**Results:** Carryover to August

## RB322.3.3 Foundations in coastal high-hazard areas and A zones

**Proponent(s):** HBAV; City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; City of Newport News

**Comments:**

- Ms. Quinn of FEMA claims that buildings have to be elevated on pilings or columns; this proposal does not add anything, it just clarifies the language reflected on the national level.
- Mr. Payne of AIA Virginia supports so long as this proposal updates to reflect the language to the 2021 IRC. Will be added as a proponent.
- Mr. Brown (DHCD) adds the language "and shall comply with the following:"

**Results:** Consensus for Approval as Modified

## RB325.1 Habitable attics 2021 change

**Proponent(s):** Jeffrey Shapiro (jeff.shapiro@intlcodeconsultants.com) - Consultant, National Fire Sprinkler Associates

**Comments:**

- DHCD staff suggests carrying over to Combined Workgroup meeting.
- Mr. Brown (DHCD) suggests that Mr. Moldovan of DHCD meet with Mr. Shapiro and with Mr. Clark of the Homebuilders' Association to come up with an amended proposal.

**Results:** Carryover to August

## RB332(2) Standby power systems

**Proponent(s):** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; Virginia DCR; FEMA Region III; Terrazia; AIA Virginia

**Comments:**

- Mr. Holland (NEMA) supports.
- Mr. Clark says the Homebuilders' Association opposes.

**Results:** Non-Consensus

## RB403.1.6 Foundation anchorage

**Proponent(s):** Ronald Clements Jr (clementsro@chesterfield.gov), Chesterfield County

**Comments:** No opposition

**Results:** Consensus for Approval

## RB609.4 Garage door labeling

**Proponent(s):** Resiliency Subworkgroup
**Comments:** Mr. Brown of DHCD provides context.
**Results:** Consensus for Approval

## RB703.11.1: Faucet Attachment and Bracing Requirements

**Proponent(s):** City of Hampton; Hampton Roads Planning District Commission; City of Norfolk; City of Newport News; AIA Virginia
**Comments:**

- Mr. Stafford provides context for this proposal.
- This proposal includes 2021 language.
- Mr. Clark (Homebuilder's Association of Virginia) opposes.

**Results:** Non-Consensus

**Virginia Residential Code (Electrical)**

## RTE3902.16(1): Arc-Fault Circuit Interrupters

**Proponent(s):** Haywood Kines (hkines@pwcgov.org), Prince William County
**Comments:**

- Mr. Holland (NEMA) claims we are missing the ability to more comprehensively protect people in preventing fires, and that this proposal fixes some of the discrepancies. He is in support.
- Mr. Clark of the Homebuilders' Association talks about incremental adoption of the GFCI technologies, as opposed to the full adoption this proposal outlines. He is in support of RTE3902.16(2) instead.
- Mr. Smith of Eaton supports this proposal.
- Mr. Farrell (VBCOA) is in full support of this proposal and RTE3902.16(2).

**Results:** Non-Consensus

## RTE3902.16(2)-18

**Proponent(s):** Allen Turner (allen.turner@jamescitycountyva.gov), James City County
**Comments:** Identical proposal except with GFCI exemptions
**Results:** Consensus for Approval

**Virginia Residential Code (Plumbing)**

## RTP608.15 - Backflow Preventers

**Proponent(s):** Richard Grace, VPMIA (richard.grace@fairfaxcounty.gov)
**Comments:**

- Mr. Clark of the Homebuilders' Association of Virginia brings up an issue with the language potentially not including "manufacturers' instructions"
- Mr. Beahm (representing himself) suggests modification to ensure no conflicts between manufacturers and the code itself. Also, had issues with "ready access" language.
- Mr. Beahm and Mr. Grace have a discussion regarding changing the "or" in this clause to "and," and whether the manufacturers' specifications are going to apply, or the residential codes, and which would take precedence.
- DHCD staff brings up the fact that the most restrictive code shall apply.

**Results:** Carry over to August

## RTP2801.6: Plastic Pans

**Proponent(s):** Richard Grace, VPMIA (richard.grace@fairfaxcounty.gov)
**Comments:** No opposition
**Results:** Consensus for Approval

**Virginia Residential Code (Energy)**

## RE404.2 - Electric Readiness

Proponent(s): William Penniman (wpenniman@aol.com), Sierra Club
Comments:

- Mr. Holland (NEMA) speaks strongly in support of this proposal.
- Ms. Main, representing herself, is strongly in support.
- Mr. Banashek representing himself is strongly in support.
- Mr. Kines (Prince William County) agrees with the principle; however, he has some concerns with the specificity of language regarding electrical requirements.
- Mr. Statzer of VBCOA agrees with Mr. Kines: support in theory, opposes in practice.
- Mr. Holland acknowledges that modifications will still need to be made, but he still underscores the importance of this proposed change. He notes that this was what was put forward for the 2021 codes, and it would be better for this proposal to reflect more comprehensively what was eventually decided for the 2021 codes.
- Mr. Goplerud (Faith Alliance for Climate Solutions) supports.
- Ms. Eggerton (Alexandria) is in strong support on the grounds that this will help localities come up with environmental action plans.
- Mr. Clark of HBAV opposes on the grounds of cost.
- Mr. Vaughan of Columbia Gas opposes, citing gas still being a very important and affordable piece of the heating and cooling market.
- Ms. Papageorge of Southern Company Gas opposes.

**Results:** Carryover

## E405.10 - Electric Vehicle Charging Stations

Proponent(s): William Penniman (wpenniman@aol.com), Sierra Club

**Comments:**

- Mr. Abraham of Virginia Association of Commercial Real Estate is opposed based on language.
- Mr. Holland of NEMA is strongly in support based on efficiency, affordability, and consistency of standards across localities in the state. He notes there is support at the national level as well during the 2021 code adoption process.
- Mr. Banashek representing himself discusses how we could solve many issues with EV charging stations. He is in support.
- Ms. Tamres representing herself speaks out in strong support of this proposal.
- Mr. Gordon of AOBA is opposed on the grounds that the one-size-fits-all solutions don't really apply here. The data don't support this, and this would be more appropriate at the local level.
- Mr. Statzer of VBCOA supports.
- Ms. Eggerton of Alexandria is in support, pointing out that EV charging stations are part of a larger environmental impact plan.
- Ms. Kelley of Southeastern Energy Efficiency Alliance is in full support of this proposal.
- Mr. Clark of ~~VBCOA~~ HBAV disagrees with Mr. Penniman on the grounds that if code doesn't force developers to include charging stations for single-family homes, then they just won't do it. He has seen evidence to the contrary.
- Ms. Loving representing CAAV supports this proposal. As a consumer, she also speaks in support.

**Results:** Non-consensus

## E1301.1.1.1 - Deletion of All State Amendments to the Energy Code

**Proponent(s):** Andrew Grigsby (grigsby.ac@gmail.com)

**Comments:**

- Mr. Penniman (Sierra Club) is in support.
- Mr. Goplerud (FACS) makes the point that Virginia as a state is behind many other states in terms of energy amendment adoptions. He supports.
- Mr. Shippee (self) fully supports this proposal.
- Mr. Clark of ~~VBCOA~~ HBAV opposes.
- Mr. Beahm (Warren County) opposes.
- Mr. Statzer (VBCOA Energy Committee) supports.
- Mr. Shearer representing himself supports.

**Results:** Non-Consensus

## RE402.1.2(6) - Insulation and fenestration criteria

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club

**Comments:**

- Mr. Payne (AIA Virginia) suggests that the proposal itself include what would be the end result. There seems to be a vague target with this proposal.

- Mr. Clark of ~~VBCOA~~ HBAV opposes.
- Mr. Shearer representing himself agrees with Mr. Payne.
- Mr. Lacey (RECA) is in support of this proposal, and is happy to work together to accomplish these goals as well as those related to his RECA proposals in WG2.
- Ms. Shutler of the Virginia Grassroots Coalition is in support.
- Mr. Gordon (AOBA) supports a carryover, but he is concerned based on the premise of the cost-benefit analysis that consumers or owners would not make the right decision on their own.
- Mr. Penniman wishes to clarify that the first priority is health and safety of residents, and cost-saving measures are helpful, but secondary.

**Results:** Carry over to August

## RE402.4.1.2(2) - Air Leakage Rate Testing/Limits

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

**Results:** Non-Consensus

## RE403.1.2 - Electric Resistance Heat Restrictions

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

- Ms. Eggerton of Alexandria is in support.
- Ms. Stillman representing herself is in support of this proposal.
- Ms. Main representing herself speaks in support as well, that it benefits the buyers.
- Mr. Payne (AIA Virginia) opposes; he believes this language should be in the existing building code.
- Mr. Beahm (Warren County) speaks in opposition.
- Mr. Gordon (AOBA) opposes.

**Results:** Non-Consensus

## RE403.1.4 - Primary Space Heating Systems

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club
**Comments:**

- Ms. Stillman (self) is in support.
- Mr. Shippee (self) is in support.
- Mr. Clark (HBAV) is opposed.
- Ms. Whayland of Virginia Natural Gas is opposed on a cost basis.
- Mr. Vaughan of Columbia Gas is opposed on the grounds that heat pumps won't be as effective for all types of homes throughout the state.
- Ms. Eggerton of Alexandria argues against this point; current heat pumps' technology heats from the lowest temperature of 7 degrees Fahrenheit.
- Mr. Payne of AIA Virginia is opposed.
- Ms. Phillips of Washington Gas is also opposed.
- Ms. Papageorge of Southern Company Gas opposes this proposal.
- Ms. Shutler of the Virginia Grassroots Coalition is in support of this proposal.

**Results:** Non-Consensus.

## E404.2 - Solar-Ready Zone (Mandatory)

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club

Comments:

- Ms. Loving (CAAV) is in support; for the building industry, solar can be a very good opportunity.
- Ms. Eggerton of Alexandria supports.
- Mr. Clark of ~~VBCOA~~ HBAV opposes and asks about a certain spot on the roof being designated for solar energy - Mr. Penniman clarifies that that is the case.
- Mr. Holland of NEMA supports.
- Mr. Statzer mentions that the VBCOA Energy Code Committee, in part, supports this proposal.
- Mr. Payne (AIA Virginia) points out that shaded areas are very subjective; what happens if there is a tree that isn't on your property that blocks the mandatory solar panel? Mr. Payne identifies that there could be a tightening of language.
- Ms. Loving speaks on behalf of self and the Climate Action Alliance of the Valley. CAAV supports this proposal.
- Ms. Main (representing herself) speaks in support of this proposal.
- Mr. Beahm (speaking for himself and Warren County) opposes on the basis of "vague language."

**Results:** Non-Consensus

## RE407.1.1 -Additional Energy Requirements

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club

**Comments:**

- Ms. Shutler of the Virginia Grassroots Coalition supports. She does not think this proposal is too ambitious.
- Mr. Clark with ~~VBCOA~~ HBAV is in opposition.
- Mr. Payne (AIA Virginia) is concerned about the subjectivity of the language of this proposal.

- Mr. Lacey (RECA) is in support based on the fact that the proposal is based largely on the 2021 code requirements, and that RECA certainly supports this.
- Ms. Eggerton of Alexandria clarifies that Virginia has used future model code language into code development for deck requirements many years ago and in other cases as well. She is in support.
- Mr. Shearer (representing himself) is also in support.
- Ms. Loving of CAAV is also in support and like Mr. Lacey, believes this change would provide greater options and flexibility; she would welcome further stringency as well.
- Mr. Gordon of AOBA is opposed to the proposal due to the vague language and cost concerns.
- Mr. Farrell of VBCOA is concerned about including "non-mandatory options" in the proposal because they would be difficult to enforce from a maintenance perspective.

**Results:** Non-Consensus

## ERB101 - Zero energy building standards appendix

**Proponent(s):** William Penniman (wpenniman@aol.com), Sierra Club

**Comments:**

- Ms. Shutler of Virginia Grassroots Coalition is in support, but believes there should be mandatory language for what constitutes as "zero energy."
- Ms. Loving (CAAV) is in support
- Mr. Shearer (representing himself) is in support.
- Mr. Beahm representing himself, opposes on the grounds that this does not need to be brought in until 2021.
- Mr. Payne of AIA Virginia wonders why this is in the appendix and not the BODY of the code.
- Mr. Clark of HBAV is opposed.
- Mr. Lacey of RECA speaks in support, in that it may be helpful for consumers and builders.
- Mr. Clements of Chesterfield County opposes, based on lack of enforceability.

**Results:** Non-Consensus

# SUMMARY
# WORKGROUP 4 MEETING
## 2018 Code Change Cycle

July 22, 2020 at 9:30 a.m.
Remote Meeting Link
https://vadhcd.adobeconnect.com/workgroup/

## Participants

- Bob Allen (Henrico County)
- Scott Andrews (AACT)
- David Beahm (self/Warren County)
- Jeffrey Brown (DHCD)
- Andrew Clark (HBAV)
- Ron Clements (Chesterfield County)
- Robby Dawson (NFPA)
- Rajan Engh (DHCD)
- Sean Farrell (VBCOA)
- Sarah A. Foote (DHCD)
- Richard Grace (Fairfax County)
- Dennis Hart (VPMIA)
- Brian Hilderbrand (DHCD)
- Bryan Holland (NEMA)
- Patrick Hughes (City of Chesapeake)
- Christina Jackson (City of Norfolk/VBCOA)
- Thomas King (DHCD)
- Curt Linderman (DEQ)
- Danielle Manuel (DHCD)
- Paul Messplay IV (DHCD)
- Kenney Payne (AIA Virginia)
- Richard Potts (DHCD)
- Michael Redifer (City of Newport News/VBCOA)
- Stephen Reynolds (DHCD)
- Jonathan Sargeant
- David Sharp (BCAAC)
- David Smith
- Brent Werlein
- Dan Willham (Fairfax County)

## National Electrical Code (NFPA 70)

### T2701.1.1(1) Changes to NFPA 70 for private noncommercial docks

**Proponent(s):** James Erler (jim@erlerdesign.com); John Lane (redcloudjl@aol.com); Neil Harrington, Smith Mountain Lake Marine Volunteer Fire Rescue (neil.r.harrington@gmail.com)
**Comments:**

- Mr. Holland of NEMA is in opposition - part of the electrical subworkgroup on 6/29. He has concerns that this proposal not only does not address the problems identified, but that it introduces additional safety concerns. There are 10 sections of the elec code that are violated by the language of the proposal. Unknown consequences and maybe even greater hazards than there already are without this proposal. He believes a solution has already been presented to the problems this proposal intends to address, to be presented to the Board at a later date - Article 555 in the 2020 code will address these issues.
- Mr. Dawson (NFPA) agrees with all of the above.
- Mr. Payne of AIA Virginia wonders if the assumption is that Article 555 would take care of the issues that this proposal intend to address; does it do that fully?
- Mr. Holland brings up the public comments for the 6/29/2020 subworkgroup meeting where he identified safety concerns that could arise as a result of this proposal and his own independently proposed safety measures

**Results:** Consensus for Disapproval

## International Mechanical Code

### TM403.3.1.1 Minimum ventilation rates

**Proponent(s):** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)
**Comments:** No opposition
**Results:** Consensus for Approval

### TM504.10 Editorial correction

**Proponent(s):** DHCD staff
**Comments:** No opposition, editorial correction for a previous mislabel
**Results:** Consensus for Approval

### TM505.5 Exhaust systems for kitchens

**Proponent(s):** Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov); Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)
**Comments:** No opposition
**Results:** Consensus for Approval

### TM607.6.2.2 Equipment shutdown

**Proponent(s)**: Clay Dalon (claydalon@gmail.com)
**Comments:**

- Mr. Grace speaking on behalf of himself suggests Mr. Dalon was just trying to clear things up. He is in support.

- Mr. Payne of AIA Virginia wants to know if the addition is for all three words concerned; AIA Virginia is in support due to the flexibility and options that this proposal would provide.
- Mr. Grace clarifies the language.
- Mr. Allen of Henrico County suggests this change may be unnecessary, that it's just additional wordsmithing of language that was already fine the way it was.
- Mr. Clements of Chesterfield County agrees with Mr. Allen of Henrico County.
- Mr. Grace concedes that it is "wordsmithing," but believes it ultimately helps.

**Results:** Non-consensus

### TM1101.2 Refrigerant systems

**Proponent(s):** Julius Ballanco (JBENGINEER@aol.com)
**Comments:** Mr. Grace of VPMIA opposes; Mr. Ballanco is not in attendance to seek resolution.
**Results:** Consensus for Disapproval

## International Plumbing Code

### RTP608.15 Backflow preventers

**Proponent(s):** Richard Grace of VPMIA/VBCOA
**Comments:** Proponent wishes to carry over to August meeting
**Results:** Carry over to August Meeting

### TP403.1 Airport toilet facilities

**Proponent(s):** Cornelia Weiss (koislmeier@yahoo.com)
**Comments:**

- Mr. Payne worked with Ms. Weiss to help provide code language for womens' bathrooms; he speaks in support of Ms. Weiss and himself, with either of their proposals going forward
- Mr. Grace of VPMIA/VBCOA echoes Mr. Payne

**Results:** Consensus for Approval

### TP403.1(2) Airport toilet facilities

**Proponent(s):** Kenney Payne, AIA Virginia
**Comments:**

- Mr. Payne supports Ms. Weiss' proposal but prefers his own. Ms. Weiss' seems more conservative and less comprehensive. Mr. Payne notes that if the workgroup and Board support Ms. Weiss' proposal, he would back her, but outlines the benefits of his own plan.
- Mr. Wilham of Fairfax County outlines how some airports, like Dulles, implement these measures voluntarily.

**Results:** Consensus for Approval

### TP403.3.3 Location of toilet facilities

**Proponent(s):** Richard Grace (VPMIA/VBCOA)
**Comments:** No opposition
**Results:** Consensus for Approval

## TP1209.3.1 Toilet and bathing facilities

**Proponent(s):** Kenney Payne of AIA Virginia
**Comments:**

- Mr. Payne lends context for several previous proposals.
- Mr. Grace of VPMIA/VBCOA worked with Mr. Payne on this and it passed through the committee with an approximately 60/40 split at the time before there was any updated language added.
- Mr. Grace speaking on behalf of himself has some concerns about language going forward that need to be addressed when we are ready to look at 2021 code development updates.

**Results:** Consensus for Approval

## TP2902.1 Minimum number of fixtures

**Proponent(s):** Kenney Payne, AIA Virginia
**Comments:** No opposition from the workgroup
**Results:** Consensus for Approval

## TP2902.1.1 Minimum fixture calculations

**Proponent(s):** Richard Grace, VPMIA/VBCOA
**Comments:** Mr. Brown of DHCD clarifies that this proposal serves as a backup just in case Mr. Payne's proposal TP1209.3.1 does not get approved by the Board. If Mr. Payne's proposal is approved by the Board, then the proponent wishes for this proposal to be withdrawn.
**Results:** Consensus for Approval

# SUMMARY
# COMBINED WORKGROUP1, 2, 3 and 4 MEETING
## 2018 Code Change Cycle

August 11, 2020 at 9:30 a.m.
Remote Meeting Link
https://vadhcd.adobeconnect.com/workgroup/

**Participants**

William Aceto
Bob Allen (Henrico County)
Scott Andrews
Laura Baker (RECA)
David Beahm (self/Warren County)
Russell Bikoff (Virginia Democracy Forward)
Jeffrey Brown (DHCD)
Lily Byer
John Catlett (American Wood Council, Catlett Code Consulting)
Andrew Clark (Home Builders Association of Virginia)
Kristin Clay
Paul Coats (American Wood Council)
Claudia Cotton
Cindy Davis (DHCD)
Dennis Dineen
Garrett Dyer (VDFP)
Ellen Eggerton (City of Alexandria)
Russ Ellison (DEQ)
Sarah A. Foote (DHCD)
Charles Gerena (Drive Electric RVA)
Robert Glass
Eric Goplerud (FAAC)
Richard Grace (VPMIA/VBCOA)
Randy Grumbine (Virginia Manufactured and Modular Home Association)
Linda Hale (Loudoun County Fire)
Karen Haley-Wingate
Chelsea Harnish (VAEEC)
Dennis Hart (VPMIA/VBCOA)
Brian Hilderbrand (DHCD)
Kathie Hoekstra (350 Alexandria)

Bryan Holland (NEMA)
Renee Hooper (DEQ)
Patrick Hughes (City of Chesapeake)
Maggie Kelley - Southeast Energy Efficiency Alliance (SEEA)
Jane Kim (VBCOA)
Thomas King (DHCD)
Haywood Kines (Prince William County)
Dr. Frederick Krimgold (Virginia Tech)
Eric Lacey (RECA)
Annette Lang (representing herself)
Jason Laws (VBCOA)
Joy Loving (CAAV)
Travis Luter (DHCD)
Ivy Main (representing herself)
Paul Messplay IV (DHCD)
Andrew Milliken (Stafford County Fire/Fire Services Board)
Florin Moldovan (DHCD)
Jimmy Moss (VBCOA)
Jay Murdoch
Nancy Najarian (Virginia Democracy Forward)
Kathleen Nawaz (representing herself)
Keith Oberg (representing himself)
Mike O'Connor (VPCMA)
Andrea Papageorge (Southern Company Gas)
William Penniman (Sierra Club)
Shaun Pharr (AOBA/VAMA)
Alexandria Phillips (Washington Gas)
Richard Potts (DHCD)
Rebecca Quinn (FEMA)
Michael Redifer (representing himself)
Travis Rickman (VDFP)
Jonathan Sargeant (OmegaFlex)
Jeff Shapiro (International Code Consultants)
David Sharp (Fairfax County)
Ross Shearer (representing himself)
Sharon Shutler (The Virginia Grassroots Coalition)
David Smith
Andrew Smith (Farm Bureau of Virginia)
Chris Snidow (Henrico County)
Susan Stillman (Sierra Club)
Kerry Sutton (American Concrete Institute)

Jennifer Tolley (DHCD)
Morgan Whayland (Natural Gas)
Dan Willham (VBCOA)
Rick Witt (VBCOA Fire Code Committee)
Petrina Jones Wrobling
Chad Zaynow (Columbia Gas)

## BU101 Tall Wood Appendix

**Proponent(s):** John Catlett (catlettcodeconsulting@gmail.com), Catlett Code Consulting
**Summation of Proposal:** These proposals (FP101) bring in changes approved by the 2021 ICC code update process for construction of Tall Wood (mass timber) buildings.
**Other Pertinent Information:**

- This proposal and its companion piece, FP101 Tall Wood Appendix, originated in the proposed phase. They were carried over for issues arising from implementation.
- Concerns were voiced regarding the construction requirements as an appendix and the need to ensure that it was not optional. Mr. Witt suggested to get the 2021 language that was approved and insert that into the main body of the code.

**Comments:**

- Ms. Davis (DHCD) provides context for this proposal, Mr. Catlett (AWC) discusses issues with cdpVA and how he has encountered difficulty on his side with updating information to this proposal as he needed to.
- He has attempted to "clean up" the text and appendix, and he also submitted a verification
- Mr. Milliken (Fire Services Board Codes and Standards Committee) is opposed due to this proposal being part of an appendix; he wishes for it to be included in the body of the text.
- Mr. Milliken doesn't see an issue with this proposal being included as part of the body of the code, but is resistant to it being an appendix in the fire code.
- Ms. Davis agrees - she suggests wordsmithing it.
- Mr. Catlett has no issue including this language in Chapter 3 as opposed to an appendix, claims this is based on 2018 code language - he suggests carrying this over to the September meeting to give time to wordsmith it to satisfy both the Fire Services Board concerns and the American Wood Council
- Mr. Coats of the American Wood Council is happy to work with Mr. Catlett on this as well as Mr. Milliken.

**Results:** Carry over to 9/1

## FP101 Tall Wood Appendix

**Proponent(s):** John Catlett - Catlett Code Consulting (representing American Wood Council)
**Summation of Proposal:** This is a companion proposal to BU101 and reflects changes approved for mass timber construction by the 2021 ICC code process.
**Other Pertinent Information:** Along with BU101, this proposed change was carried over from the 2019 Workgroup 1&2 meeting.
**Comments:** See Companion Proposal BU101.

**Results:** Carryover to 9/1

## B202(3) Permit Holder Definition

**Proponent(s):** Michael Redifer
**Summation of Proposal:** Adds a definition for permit holders.
**Other Pertinent Information:** This proposed change was carried over from the June 2020 Workgroup 2 meeting to revise language based on feedback.
**Comments:**

- Mr. Redifer (representing himself) - this has been pared down to the reason statement
- Mr. Willham of VBCOA Building Codes Committee supports this change.

**Results:** Consensus for Approval

## B713.8 Penetrations in Shaft Enclosures

**Proponent(s):** Dennis Hart, VPMIA/VBCOA (dennis.hart@fairfaxcounty.gov); Richard Grace VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)
**Summation of Proposal:** This change coordinates the penetration's requirements with the current language for shaft construction.
**Other Pertinent Information:** This proposed change was carried over from the June 2020 Workgroup 2 meeting to give the VBCOA IBC Committee an opportunity to review.
**Comments:**

- Mr. Grace provides context, gives history to what providing shafts means according to previous codes (2006 and 2009), and how it relates to the current code.
- Mr. Willham representing the VBCOA Building Code Committee opposes this change on the basis that the current language is sufficient as-is.
- Mr. Snidow suggests leaving out "vertical" and "horizontal" language, and just refer to them as penetrations.

**Results:** Non-consensus

## B713.11 Enclosures at the Bottom

**Proponent(s):** Richard Grace, VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)
_
**Summation of Proposal:** This companion change to B713.8 will align the two code sections and still permit a duct contained within a shaft to terminate in a room having a use related to the purpose of the shaft without requiring the installation of a fire damper
**Comments:**

- This is a companion piece to B713.8; Mr. Grace provides background information on the proposal.
- Dan Willham of VBCOA building code committee opposes; the committee believes the current code language suffices.
- Mr. Beahm (IBC Committee) asserts that the construction code should stay with the construction code. They are opposed to this proposal, arguing that it takes options away instead of providing additional measures for construction. He believes this is a philosophical difference between the two committees involved.
- Mr. Grace maintains they aren't taking away a viable option - the option remains in Chapter 7.

**Results:** Non-consensus

## B903.2.6 Exception for automatic sprinklers in exercise yards

**Proponent(s):** William Hall, Virginia Dept of Corrections (william.hall@vadoc.virginia.gov)
**Summation of Proposal:** This reflects a compromise proposal between VADOC and Andrew Milliken but it is not a full compromise at this time. This proposal seeks to except certain exercise yards from automatic sprinklers.
**Other Pertinent Information:** Carried over from the June 2020 Workgroup 2 meeting to address feedback.
**Comments:**

- Ms. Davis solicits opposition/support stances.
- Mr. Willham of VBCOA IBC is in opposition.
- Mr. Milliken - opposition. They have tried to work out additional language, but they still have overarching concerns.

**Results:** Consensus for Disapproval

## B907.3.2 Special locking systems

**Proponent(s):** DHCD Staff (sbco@dhcd.virginia.gov)
**Summation of Proposal:** This proposal correlates section numbers that had been previously changed.
**Comments:**

- Mr. Willham - in support of this change

**Results:** Consensus for Approval

## B918.1 Emergency Responder radio coverage

**Proponent(s):** Linda Hale, Loudoun County Fire Marshal's Office (Linda.Hale@Loudoun.gov); Andrew Milliken, Stafford County Fire Marshal's Office (amilliken@staffordcountyva.gov)
**Summary:** This proposal defines how emergency radio coverage should be installed in certain buildings. It mandates the use of specific technology.
**Comments:**

- Ms. Hale provides reasoning - it shouldn't be on taxpayers to pay for radio coverage
- Mr. Pharr of AOBA and VAMA opposes - they say it is entirely appropriate to use tax revenue to fund local essential safety measures. Further, we shouldn't saddle building owners with these costs. Nobody is arguing that these safety measures aren't critical to safety.
- Mr. Witt (VBCOA Fire Code Committee) opposes; he suggests we carry to the next code cycle, acknowledges the need for an update but believes the stakeholders all need to come together to make some decisions that are mutually acceptable.
- Mr. Willham (VBCOA Committee) also opposes for the reasons stated above.
- Mr. Milliken (Fire Services Board) is in support. He believes that due to the technologies that have come out since this code was originally penned, an update is warranted, but he wants to at least get the discussion going.
- Mr. Dyer (SFMO) is in support for the reasons already stated.
- Public comment by Mr. Payne of AIA Virginia cites that he is concerned about functionality and longevity of this proposal's suggested changes due to "line-of-sight" language (just in case another building is constructed later).

- Mr. Pharr (AOBA/VAMA) points out that the current language makes suggestions as opposed to outlining requirements. There is most likely "latitude that has not been explored" to enact some of these infrastructure ideas. He would not be opposed to a committee that explores how to update these ideas and the language to describe them; he is however vehemently opposed to using this proposal to "turn existing code on its head."
- Ms. Hale maintains it is a small dollar amount that would make the difference between the model code and the code with these changes in place and that she was not attempting to recreate anything through this proposal; she is not sure a workgroup would allow any sort of consensus.
- Mr. Pharr disagrees, and clarifies that what he meant was that there may be equivalent, different approaches to the problems laid out by this proposal, other than those that have been suggested. He wishes to note that AOBA/VAMA also submitted a comment on cdpVA.

**Results:** Non-consensus

## B1004.3 Posting of occupant load for mercantile use

**Proponent(s):** Andrew Milliken (self), (amilliken@staffordcountyva.gov)
**Summation of Proposal:** This proposal attempts to add a posting of occupancy loads for mercantile uses.
**Other Pertinent Information:** Carried over from the June 2020 Workgroup 2 meeting to revise and get closer to consensus based on feedback.
**Comments:**

- Mr. Milliken explains that this first proposal is one that was submitted before, but that B1004.3 and B1004.3(2) are companion proposals with similar ideas, they only plan to try and get one of the two to consensus.
- Mr. Willham (VBCOA Building Code Committee) opposes.
- Mr. Beahm (IBC Committee) does not believe this is a change that is drastically needed. He is opposed.
- Ms. Hale (Virginia Fire Prevention Association) disagrees; she believes that this list should be "proactive" rather than "reactive," and this change is something that is necessary. She is in support.
- Mr. Snidow claims they can reference the C.O.
- Ms. Eggerton (Alexandria) thinks that posting the occupancy load will help with COVID, which limits the occupant loads in retail. But she also acknowledges that there is a cost to getting the signs up.
- Mr. Milliken suggests moving companion proposal B1004.3(2) to non-consensus.

**Results:** Withdrawn

## B1004.3(2) Posting occupant load for mercantile use

**Proponent(s):** Andrew Milliken (representing himself), (amilliken@staffordcountyva.gov)
**Summation of Proposal:** Similar to proposal 329 - B1004.3-18 but adds correction to VMC 702.1
**Comments:**

- See comments from B1004.3.
- Mr. Willham (VBCOA Building Code Committee) opposes.

**Results:** Non-Consensus

## EB103.2 Short-term rentals

**Proponent(s):** Greg Revels, Henrico County (greg.revels@henrico.us)

**Summation of Proposal:** Provides clarification and exceptions for change of occupancy for R-5 units used as short term rentals.

**Other Pertinent Information:**

- Short-term rental has been a long-standing issue that's been discussed at the Residential Use Group meetings, including meetings on: May 31 2019, July 10 2019, August 9th and the final ADU meeting (split as a separate proposal) in June 2020. There has been disagreement within the building code community for use-group classification of beach rental homes with multiple sleeping units, and it has also been a sticking point for some of the ADU discussion where people are converting basements into rental units. This can create a fire hazard and life safety hazard since both these groups of structures are not designed for multiple occupancies, but effectively they're being converted into such.
- At the May 31, 2019 meeting, suggested added language regarding ADUs was brought forth; nothing was decided upon because the group believed it would be helpful to have Mr. Revels (not in attendance that day) to walk the group through the proposed changes. The discussion at that meeting yielded the following results: The workgroup felt there was no additional concerns from a code perspective regarding Air BnB and similar short-term rentals of dwelling units. There are no greater hazards associated with the use than found in time shares or lodging houses. However, current provisions do not allow the uses for anything other than the purposes of "complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation" which are called out in the definition of a dwelling unit. Uses for wedding venues or other similar uses would not be considered complying with the requirements and would need to be addressed within the requirements of the IBC. Local zoning and/or homeowner associations may be better geared to regulate the number of and requirements for parking, licensing, etc. than attempting to regulate them through the building code.

**Comments:**

- Proponent is not present.
- Ms. Davis (DHCD) gives background to this proposal in Mr. Revels' stead.
- Ms. Hale is concerned that it isn't inclusive enough - doesn't include fire code.
- Mr. Allen (Henrico County) speaks on behalf of Mr. Revels.
- Mr. Beahm (representing self) is opposed to the change, claiming this proposal would implement a solution for a locality's issue as opposed to a statewide issue.
- Mr. Milliken is also opposed, for the reasons outlined by Mr. Beahm. The Fire Services Board are concerned with it remaining an R-5. He questions how or whether this affects the residential subworkgroup.
- Mr. Brown of DHCD clarifies that this did not affect the subworkgroup, and that Mr. Revels did intend for it to be inclusive statewide, not merely just bound to help one locality.
- Mr. Allen is in support.

**Results:** Non-consensus

## EB307 Roof covering

**Proponent(s):** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr (clementsro@chesterfield.gov) - not on the call
**Summation of Proposal:** Clarifies roof repairs and roof coverings in the context of the existing building code.
**Comments:**

- This proposal was Consensus for Approval at the July Workgroup 2 meeting. Subsequently, DHCD suggested language to clarify the definition for "roof covering" and the proponent agreed. Since there was a change, the proposal brought before the workgroup again.
- Mr. Witt supports.
- Mr. Pharr supports.
- Mr. Penniman has questions for Mr. Payne and wishes for it to be carried over to the final workgroup meeting.

**Results:** Carry over to 9/1 meeting

## EB701.4 Move VECC C505 to Ch. 7 of VEBC

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)
**Summation of Proposal:** This proposal moves portions of the VECC to the VEBC for improved energy efficiency.
**Comments:**

- Ms. Baker (RECA) provides background for the three energy proposals that go together.
- Mr. Witt questions whether the committee has indicated consensus, and that the language included in this proposal is consensus language. Ms. Baker indicates that is her understanding.
- Mr. Pharr (AOBA/VAMA) is opposed based on cost, claiming that there is a "statutory obstacle" to the Board adopting new code changes that would increase the cost on existing buildings, and that this proposed change goes against that.
- Ms. Eggerton of Alexandria mentions that these requirements are already in the VECC.
- Mr. Penniman (Sierra Club) claims that retrofits are far more expensive than building energy-efficient buildings upfront. He is concerned that energy requirements aren't being considered fully, but he is in support.
- Ms. Baker maintains that these are the best ways to implement these energy-efficient measures in ways that are not cost-burdensome for stakeholders - builders and owners.
- Mr. O'Connor questions whether this includes residential buildings or whether it would apply to state buildings. Ms. Davis answers that this would not include fuel-switching and maintains that this would be up to DGS (as both the builder and the owner of state government buildings) to either take these requirements as minimum code, or require stricter codes (LEED requirement, 100 percent Net Zero Energy, etc.).
- Mr. Lacey provides clarity on the compromises between the VEBC standards and minimal energy efficient updates being made.
- Chelsea Harnish (VAEEC) supports this proposal
- Mr. Beahm (self) opposes. He says that options are great, but that this would be too opinion-based of a change.
- Mr. Pharr wishes to double-down on the language of "the least possible cost". He repeats that he can't support due to the cost considerations that would be prohibitive for so many builders and owners.

- Ms. Eggerton clarifies that this would not apply to historic buildings and would be a cost-saving measure to all others.
- Ms. Baker clarifies that this proposal only covers Proposal Section B, and to ignore Section A.
- Mr. Witt wants to clarify about whether this enforces a standard that is not applied to other building structures of having to bring all buildings up to all most modern standards when they change occupancy.
- Mr. Beahm mentions that if the proposal were only limited to Option B, he may have a different answer or opinion, but at the moment he is still opposed.
- Mr. Penniman (Sierra Club) reiterates the importance of energy efficiency, he is still in support.
- Mr. Lacey mentions that the 2015 Virginia Residential Code already includes the residential language in section N1111.2, almost verbatim. This proposal just puts it into the Existing Building Code.
- Ms. Harnish and Ms. Baker suggest carrying all three proposals over to the September meeting to let Kenney Payne and Allison Cook air their insights, too.
- Ms. Davis agrees.

**Results:** Carryover to 9/1 meeting

## EB1101.18(2) Address identification

**Proponent(s):** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com)
**Summation of Proposal:** Moves the address identification requirement to indicate that it is required to be present.
**Comments:**

- Mr. Milliken (representing himself) speaks on behalf of Mr. Payne, who is not in attendance.
- Mr. Penniman questions whether this is a misprint - does it extend to existing or future buildings? Mr. Beahm has the same question.
- Mr. Milliken and Ms. Davis lend context that it is for both existing and future buildings.

**Results:** Consensus for Approval

## FP103.2.1 Supplemental info

**Proponent(s):** Andrew Milliken (SFPC) - amilliken@staffordcountyva.gov
**Summation of Proposal:** Helpful for users to identify which applicable building code applies.
**Comments:**

- Ms. Davis notes that this supplemental information is not a proposal, per se, but it is not something that goes through a regulatory process.
- Mr. Milliken wishes for this to be consistently incorporated into building code discussions.
- Ms. Davis agrees to discuss this further.

**Results:** This is not a proposal

## FP103.2.1 VFSB SFPC Edit Part 4

**Proponent(s):** Andrew Milliken (SFPC) amilliken@staffordcountyva.gov
**Summation of Proposal:** This proposal includes VFSB recommended changes to Chapters 1-9 and 38 of the SFPC that have been reviewed and recommended by the SFPC Edit Workgroup

.

**Comments:**

- Ms. Davis mentions that this proposal is intended to remove construction language and clarify maintenance language regarding how the fire service does inspections.
- Mr. Milliken is very appreciative of the fact that there was an additional Fire Code Edit to help workshop this further.
- Mr. Witt wishes to carry this to the 9/1 meeting, so that the committee has a chance to review the parts of the chapters 1-9 within FP103.2.1 that they haven't addressed yet.
- Ms. Davis and Mr. Brown (DHCD) clarifies that the ones we have consensus on, out of the SFPC edits, will move forward – but not the ones that have not been reviewed yet -- in response to Mr. Witt's concerns.
- Mr. Moss speaks in support.

**Results:** Consensus for Approval

## FP103.2.1 VFSB SFPC Edit Chapters 1-10

**Proponent(s):** Andrew Milliken (SFPC) - amilliken@staffordcountyva.gov

**Summation of Proposal:** This proposal includes VFSB recommended changes to Chapters 1-10 and 38 of the SF

**Comments:**

- Those concerned with these edits haven't gotten to Ch. 9 yet, so making a decision for Chapters 1-10 would be premature at this time.

**Results:** Carry over to 9/1 Meeting

## FP107.2(2) Commercial cooking operational permit

**Proponent(s):** Andrew Milliken (Stafford County Fire), amilliken@staffordcountyva.gov

**Summation of Proposal:** This adds an operation permit for commercial cooking operations outside the situations where it already applies.

**Comments:**

- Mr. Beahm previously had concerns, but is fine with the proposal as it stands currently.

**Results:** Consensus for Approval

## FP112.5 Application for appeal

**Proponent(s):** Linda Hale, Loudoun County Fire (Linda.Hale@Loudoun.gov); Andrew Milliken, Stafford County Fire (amilliken@staffordcountyva.gov)

**Summation of Proposal:** This proposal seeks to clarify who can file appeals for decisions made by the Fire Official.

**Comments:**

- Ms. Hale provides context for this proposal.
- Mr. Pharr supports the intent, but he is concerned about the statutory authority and thinks it needs further clarification.
- Ms. Davis gives voice to a conversation she had recently with the assistant AG who says there is no statutory issue, but that he is concerned that this may be more of a zoning issue, and may be hard to enforce.
- Mr. Witt has issues with the language. He believes it is too broad and is seeking more specific definitions for pieces like "economic impact" and "adverse effects."
- Mr. Dyer (SFMO) is in support.

**Results:** Non-Consensus

## FP319.2.1 Permits for food trucks

**Proponent(s):** Linda Hale, Loudoun County Fire (Linda.Hale@Loudoun.gov); Andrew Milliken, Stafford County Fire (amilliken@staffordcountyva.gov)
**Summation of Proposal:** Adds permit requirements for food trucks.
**Comments:**

- Ms. Hale provides context for this proposal.
- Mr. Smith (Farm Bureau of Virginia) has no comment on it, but that he sent it to the Food Truck Association and heard nothing back from them.
- Mr. Witt is concerned that this sets up a conflict between the local government and the state fire office.
- Ms. Hale clarifies that this is not a divergence from what is already in the code.
- Ms. Hale and Ms. Davis engage in conversation regarding which jurisdictions would be the ones to have permits issued per food truck.

**Results:** Consensus for Approval

## FP609.2 Ventilation for cooking operations

**Proponent(s):** Andrew Milliken, Stafford County Fire (amilliken@staffordcountyva.gov)
**Summation of Proposal:** This proposal indicates how a fire official can interface with the building official for cooking operations occurring without adequate ventilation.
**Comments:**

- Mr. Witt has issues with this proposal. He wants to parse out parts of the proposal, and he wonders about the necessity of specifying grease-laden vapors, as opposed to anytime a cooking operation is being performed.
- Ms. Hale is in support; she disagrees with Mr. Witt and claims that the specificity is very necessary.
- Mr. Moss (Fire Code Subcommittee) is in support.
- Mr. Grace (VPMIA/VBCOA) also wishes to discuss with Mr. Milliken and Mr. Witt.

**Results:** Carry over to 9/1

## FP3104.15.5 Cooking tents

**Proponent(s):** Andrew Milliken, Stafford County Fire (amilliken@staffordcountyva.gov)
**Summation of Proposal:** Correction by the VFSB Codes and Standards Committee to avoid conflicting terms due to the new definition of "cooking tent"
**Comments:** None
**Results:** Withdrawn

## FP3107.12.5 Cooking tents

**Proponent(s):** Linda Hale, Loudoun County Fire (Linda.Hale@Loudoun.gov)
**Summation of Proposal:** This proposal adds additional safety precautions and clarifies that cooking tents, regardless of whether they have sides, are included in this provision.
**Comments:**

- Ms. Hale (Loudoun County Fire) provides context for this proposal.
- Mr. Smith (Farm Bureau of Virginia) is opposed.

- Mr. Milliken (Fire Code Standards Committee) acknowledges that whether there are drops on the side of the tent does not actually matter, and that Mr. Smith's fears that this would affect a farmers' market are thus moot.
- Ms. Hale maintains that this is designed to make the existing code clearer, it doesn't actually change anything.
- Mr. Smith suggests carrying over and talking with Linda Hale.

**Results:** Carry over to 9/1

## FP5003.1.1(1) Footnote for max refrigerant

**Proponent(s):** Julius Ballanco (JBENGINEER@aol.com)
**Summation of Proposal:** This adds a footnote for Group A2L refrigerants to the MAQ table in Chapter 50.
**Comments:**

- Mr. Glass (Goodman Manufacturing) represents Mr. Ballanco, who is unable to make this meeting.
- Mr. Milliken clarifies that the Fire Code Edits removed these tables. He also mentions that it is important to measure against the SFPC to make sure the footnote makes sense.
- Mr. Shapiro (International Code Consultants) claims it's being discussed for 2024. Nothing for 2021 related to refrigerant storage.
- Ms. Hale mentions that she doesn't think it is necessary - there is no data to support this since it hasn't been discussed yet by the ICC.
- Mr. Milliken mentions that because it's in the wrong book entirely, it should be voted as consensus for disapproval.

**Results:** Consensus for Disapproval

## FP5003.1.1(2) Footnote for max refrigerant

**Proponent(s):** Julius Ballanco (JBENGINEER@aol.com)
**Summation of Proposal:** This adds a footnote for Group A2L refrigerants to the MAQ table in Chapter 50.**Comments:**

- Mr. Glass wishes to clarify whether the table is removed for the Virginia fire code; Ms. Davis clarifies that this is only in regard to the IFC, but the reference still remains.

**Results:** Consensus for Disapproval

## FP5704.2.13.1.1 Exceptions for SWCB tanks

**Proponent(s):** Resiliency Subworkgroup
**Summation of Proposal:** Makes reference to the SWCB regulation section since there are some specific requirements that are different from the requirements in this section.
**Comments:** Mr. Brown of DHCD gives context.
**Results:** Consensus for Approval.

## E404.2 Solar readiness

**Proponent(s):** William Penniman (Sierra Club), wpenniman@aol.com
**Summation of Proposal:** This proposal specifies a requirement for rooftops to be overbuilt in preparation for installation of solar panels, but does not mandate the installation of solar panels. The proposal has exceptions for when solar panels would be ineffective and therefore does not require overbuilding of the roof.

**Comments:**

- Mr. Penniman provides context for all the energy proposals, including this one.
- Ms. Nawaz is in support - she discusses how she hopes homeowners of all means will be able to install solar, and if not, figure out why.
- Ms. Loving (CAAV) is in support. She mentions the urgency for Virginia to adopt these energy-efficient measures.
- Ms. Hoekstra is in support - that it is great to have a backup energy source.
- Ms. Stillman (Sierra Club) is in support; she claims it will indeed be a cost-saving measure.
- Mr. Clark (Virginia Homebuilders' Association) is opposed; he acknowledges that solar would be good for the environment, but the upfront costs provide issues.
- Mr. Beahm (self) is opposed to the change. He believes this should be up to the homeowner, not something that is forced upon them through regulation.
- Bryan Holland (NEMA) fully endorses and supports Proposal E404.2-18 as a means to further improve the effective use and conservation of energy on dwellings.
- Ms. Main (self) is in support.
- Ms. Najarian (Virginia Democracy Forward) is in support. She mentions that there is real consumer demand for residential solar energy, especially among younger homeowners/homebuyers.
- Mr. Pharr (AOBA/VAMA) mentions that whatever expenditures there are could also be irrelevant if the solar isn't being used.
- Mr. Witt suggests making this a non-mandatory appendix.
- Mr. Goplerud mentions that this is focused on residential structures only, not commercial.
- Ms. Namaz mentions that nobody is discussing the cost-savings measures that occur over the lifetime of solar panels. She suggests postponing this proposal for later consideration so that we can take a closer look at the numeric breakdown.
- Mr. Pharr describes how the construction code outlines "5 stories or less". He mentions how some localities use incentives as opposed to mandates to increase the chances that consumers will adopt solar.
- Mr. Beahm claims that oftentimes consumers are literally saving every dollar, so even if a $100 figure may be objectively low for some, it could still be cost-prohibitive for others, especially those who are trying to buy their first homes.
- Ms. Nawaz maintains that there is documentation to suggest that the costs are not slated to be prohibitive.
- Mr. Witt questions who is going to verify the solar readiness: how would this be enforced?
- Mr. O'Connor represents Virginia-based businesses in the propane and heating oil industries. Any equipment they install in a residence is self funded not the result of a state subsidy or mandate. He opposes this process as it puts the governments' foot on the scale for one supplier of home energy while discriminating against others.

**Results:** Non-consensus

## E405.10 Electric vehicle readiness

**Proponent(s):** William Penniman (Sierra Club), wpenniman@aol.com

**Summation of Proposal:** This proposal is anticipated to be in the 2021 IECC and includes provisions for additional installations of EV-charging stations and EV-Ready structures.

**Comments:**

- Mr. Penniman provides background, including cost-savings benefits for implementation.
- Ms. Hoekstra is in support due to the fact that climate change is doing irreversible harm to the environment.
- Ms. Loving (CAAV) is in support.
- Ms. Nawaz underscores the differences between electric vehicles and gasoline-powered vehicles, and the benefits of EV. She is in support.
- Bryan Holland (NEMA) fully supports Proposal E405.10 adding EV Capable and EV Ready requirements into the VECC.
- Ms. Stillman speaks to the benefits of installing EV charging stations upfront so that we don't have to retrofit later.
- Mr. Gerena (Drive Electric RVA) is in support and discusses how Virginia is already behind neighboring states and that we need to adopt more stringent carbon regulations.
- Maggie Kelley (SEEA) supports Proposal E405.10 - adding EV Capable and EV Ready requirements into the VECC, on the basis that this assists in creating a more energy-efficient Virginia.
- Mr. O'Connor brings up that this proposal means that consumers will have one choice of EV charging supplier- all of which are regulated monopolies with a guaranteed rate of return. He brings up how today, there are 4,236 stations selling gasoline in VA, and that consumers need more options, not fewer. He also mentions how, on July 1, Virginia increased its gasoline tax to 28. cents per gallon. Electric vehicles pay less than a tenth of that amount annualized but drive the same roads.
- Mr. Pharr - AOBA/VAMA are opposed due to the fact that there are no data to support the cost savings.
- Mr. Clark (HBAV - also representing Phil Abraham with the Virginia Association of Real Estate) still has concerns about this proposal, and is not in support, but that educating stakeholders and consumers to empower them to make these greener choices independently would be great instead of mandating the changes.
- Sharon Shutler (The Virginia Grassroots Coalition) supports this proposal.
- Annette Lang mentions that as a homeowner in an HOA, she has no options...
- Eric Goplerud (Faith Alliance for Climate Solutions) supports this proposal.
- Ivy Main (self) supports the EV proposal. Putting a plug in the parking area is cheap and easy when done during construction. There is no good reason not to do it.
- Charles Gerena (Drive Electric RVA) brings up, in response to comments on using incentives to encourage actions that benefit the environment rather than mandates, such incentives are far less effective if the built space prevents those actions from taking place. For example, a homeowner may want to install an EV charger, but she may be unable to do so because the panel box is one side of the house and the driveway is on the other side.
- Mr. Oberg compares the costs of retro-fitting versus folding in EV-readiness into a 30-year mortgage and strongly supports.
- Ms. Lang (representing herself) said that building in an EV charging station would be a huge incentive to buy an electric vehicle.
- Mr. Penniman supports.

**Results:** Non-consensus

## E502 Relocates VECC Sections C/R502 to VEBC

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com) - RECA
**Summation of Proposal:** This proposal moves the commercial and residential provisions of Section 502 from the VECC to the VEBC.
**Comments:** Proponent requested to carry over.
**Results:** Carry over to 9/1

## E504.1 Relocates VECC Sections C/R504 to VEBC

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com) - RECA
**Summation of Proposal:** This proposal moves the commercial and residential provisions of Section 504 from the VECC to the VEBC.
**Comments: Proponent requested to carry over.**
**Results:** Carry over to 9/1

## RE402.1.2(5) Insulation provisions

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com) - RECA
**Reason Statement:** The purpose of this proposal is to improve energy savings and increase
**Summation of Proposal:** This proposal brings in the wall insulation requirements of the 2018 IECC.
**Other pertinent information:**

- At the April 24th, 2019 Energy Subworkgroup meeting, this proposal was voted Non-consensus. HBAV opposed this proposal due to the cost increase to single-family homes. They believe these measures should be optional. Supporters of this proposal argued that savings in utility costs more than offset the initial increase in construction costs.
- At the August 2019 Energy Subworkgroup meeting, this proposal was voted Non-consensus. The proponent gave overview of their proposal and addressed the public comment submitted in cdpVA. A. Clark/HBAV was still in the process of evaluating the cost estimates and still did not have consensus among his members.

**Comments:** Proponents reached a compromise with HBAV, which includes withdrawing this proposal with agreement to move RE402.1.2(4) forward as consensus for approval.
**Results:** Withdrawn by the proponents

## RE402.1.2(4) Insulation provisions

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com) - RECA
**Summation of Proposal:** This proposal brings in the ceiling insulation requirements of the 2018 IECC.
**Comments:**

- Mr. Lacey provides context.
- Ms. Hoekstra is in support.
- Mr. Goplerud (Faith Action Alliance Council) is in support.
- Mr. Clark is greatly appreciative of all who put work into this proposal and their work on this compromise. HBAV supports.
- Ms. Harnish (VAEEC) is in full support.

- Maggie Kelley ( SEEA) supports this proposal

**Results:** Consensus for Approval

## RE402.1.2(6) 2018 IECC Insulation tables

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)

**Summation of Proposal:** This proposal brings in the full 2018 IECC insulation tables

**Comments:**

- Mr. Clark (HBAV) opposes on the basis of cost as well as some serious design flaws.
- Mr. Shearer (self) supports this proposal; he believes it is indicative of Virginia going in the "right direction."
- Kathie Hoekstra (350 Alexandria and self) supports this proposal.
- Mr. Goplerud (FAAC) supports based on cost savings as a result of increased energy efficiency.
- Mr. Pharr (AOBA/VAMA) is opposed.
- Ms. Nawaz supports this proposal.
- Ms. Main (self) supports this proposal, citing that it will reduce utility bills for owners and tenants over the life of the home. These bills are unaffordable for low-income residents, so this is a very important part of making housing affordable.
- Ms. Stillman (self) supports the improvement in insulation for walls and ceilings, citing that it is easier and cheaper to do in construction than later.
- Sharon Shutler (Virginia Grassroots Coalition) supports this proposal.
- Ms. Lang underscores the need to bring Virginia's code up to "modern standards."
- Dr. Frederick Krimgold (VT) speaks in support of the proposal, citing the greenhouse gases' increase in recent years and how climate change is so detrimental to our environment, our safety, and our homes in the long-term.
- Mr. Clark (HBAV) wishes to clarify whether support for this proposal also indicates support for the previous proposal…
- Mr. Penniman (Sierra Club) is not opposed to compromise.

**Results:** Non-consensus

## RE402.4.1.2(2) Air leakage testing

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)

**Summation of Proposal:** The purpose of this proposal is to bring the Virginia code up to date with the 2018/2012 IECC as it relates to blower door testing and 3 air changes per hour..

**Comments:**

- Ms. Najarian (Virginia Democracy Forward) is in support.
- Regarding air leakage testing, Mr. Lacey (RECA) stands by the compromise agreed to with HBAV, which includes mandatory blower door testing of all new homes at 5 ACH50, and the elimination of the visual inspection option.
- Ms. Harnish (VAEEC) agrees with Mr. Lacey's comment.
- Ms. Eggerton also supports the compromise that was worked out in the subcommittee.
- Mr. Clark with HBAV echoes Mr. Lacey's comment.
- Mr. Goplerud (FAAC) is in support of this proposal.
- Mr. Pharr (AOBA/VAMA) is in opposition, mentioning the "due regard" language contained within the proposal.

- Mr. Beahm (representing himself) agrees with the above HBAV and energy subworkgroup agreements.
- Mr. Witt disagrees with the idea that there should be a note included in the proposed code change. He asserts that the substance of the note included should be its own proposed code change.
- Mr. Penniman disagrees with the idea of a cheaper option being a better option if it does not protect the residents as well.
- Ms. Stillman (self) supports this proposal for less air infiltration. One gets more vermin in homes that are leaky. This is harmful to people's health.
- Dr. Krimgold (VT) is in support of this proposal.

**Results:** Non-consensus

## RE403.1.2 Electric resistance heat

**Proponent(s):** William Penniman (wpenniman@aol.com)
**Summation of Proposal:** This proposal restricts the use of electric resistance heat as a primary home heating method.
**Comments:**

- Ms. Lang (self) supports this proposal with regard for Mr. Penniman's explanation of benefits.
- Ms. Stillman supports, citing personal experience with both electric resistance heat and pump heat.
- Mr. Clark (HBAV) opposes.
- Mr. Beahm (representing self) does not support.
- Ms. Shutler (The Virginia Grassroots Coalition) supports this proposal
- Ms. Nawaz supports this proposal, mentioning that electric heat pumps are much more efficient than gas/fossil fuel sources.
- Ms. Eggerton (speaking for herself) supports this proposal.

**Results:** Non-Consensus

## RE403.1.4 Primary Space Heating Systems

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)
**Summation of Proposal:** This proposal prohibits the use of gas furnaces for primary heat sources.
**Comments:**

- Mr. Clark (HBAV) opposes.
- Mr. Beahm (self) stands by his comments from the last change (RE403.1.2) and opposes this proposal, RE403.1.4, as well.
- Ms. Lang (self) supports this proposal.
- Ms. Stillman (self) supports.
- Ms. Eggerton (Alexandria) says it is cheaper as a first cost to install a heat pump only over an air conditioner with a gas furnace. Modern heat pumps can perform down to 7 degrees so that no back up heat is needed.
- Ms. Nawaz supports this proposal.
- Ms. Najarian (Virginia Democracy Forward) supports this proposal.
- Ms. Shutler (Virginia Grassroots Coalition) supports this proposal
- Mr. Pharr (AOBA/VAMA) opposes RE403.1.4

- Ms. Whayland (Natural Gas) opposes.
- Ms. Main (self) supports.
- Mike O'Connor opposes.
- Alexandria Phillips (self and Washington Gas) opposes this proposal RE403.1.4
- Mr. Zaynow (Columbia Gas) opposes.
- Ms. Papageorge (Southern Company Gas) strongly opposes this proposal.
- Mr. Shearer (self): The code pertains to new construction, which should be moving towards zero carbon. He is in support.
- Ms. Main (self) supports, citing that a new law makes it the policy of the Commonwealth to achieve a net-zero economy by 2045, which will necessitate all buildings going electric. There is no reason to install gas heat in buildings today, that will have to be converted later.

**Results:** Non-consensus

## RE404.2 Electric readiness

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)
**Summation of Proposal:** This proposal requires additional electric wiring with the goal of allowing home owners to more easily switch to more energy efficient technology in the future.
**Comments:**

- Mr. Penniman provides background for this proposal.
- Ms. Clark mentions that if this proposal is the same as it was during the last workgroup meeting, HBAV is opposed. Phil Abraham on behalf of the Virginia Association of Commercial Real Estate asked Mr. Clark to pass along his opposition as well.
- Mr. O'Connor is opposed.
- Ms. Eggerton (The City of Alexandria) supports this as they have a goal of moving to electrification in the future as an action of the adopted Environmental Action Plan 2040. This proposal supports the goals to reduce carbon emissions by 50% by 2030 and 80-100% by 2050.
- Mr. Beahm (self) claims this change would create issues with different manufacturers' requirements, so he is opposed.
- Ms. Stillman (self) supports electric readiness.
- Ms. Papageorge (Southern Company Gas) is in opposition to this proposal. The proponent states that the proposal is based on language that will probably be in the 2021 IECC". It may not, as this provision from the 2021 edition of the IECC is currently being appealed to the Board of Directors of the International Code Council (ICC).
- Mr. Sargeant (OmegaFlex) says that unless this can be amended to require gas be piped to all electric appliances, they strongly oppose this proposal. This proposal seeks to force electrification.
- Ms. Stillman argues that this proposal just says you give customers choices by making the home electric ready. More choices.
- Alexandria Phillips, speaking on behalf of herself and Washington Gas, opposes this proposal RE404.2
- Bryan Holland (NEMA) strongly supports Proposal RE404.2. They worked with the proponent to address the comments made during the WG#3 meeting and feel the revised language is very workable and will enhance the effective use of energy in a dwelling.
- Jimmy Moss (self) opposes this proposal

- Ms. Najarian supports this proposal, claiming that it is apparent that Virginia, the country, and the world will convert to using electricity to combat climate change. Virginia is poised to finally be a frontrunner in the transition to use of renewable energy. The time to do this is when you are building. In addition, a very important aspect of environmental justice, is to make costs of utilities reduce. That includes cost of running energy efficient appliances. Let's do it at the front end.
- Ms. Main (self) is in support; let's not wait to convert to electric energy.
- Ms. Lang (self) supports.
- Ms. Shutler says The Virginia Grassroots Coalition supports this electric readiness proposal.
- Ms. Byer (self) supports this proposal.
- Ms. Eggerton (The City of Alexandria) supports this as we have a goal of moving to electrification in the future as an action of the adopted Environmental Action Plan 2040 and this proposal supports the goals to reduce carbon emissions by 50% by 2030 and 80-100% by 2050
- Mr. Clark (HBAV) is opposed, as is Phil Abraham on behalf of Virginia Association for Commercial Real-Estate.
- Ms. Main supports the electric readiness proposal. Again, it's Virginia policy to get off fossil fuels in the next 25 years, and we should not make it more expensive for homeowners to switch from gas to electric.
- Mr. Zaynow of Columbia Gas is opposed.

**Results:** Non-Consensus

## RE407.1.1 ERI Options

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)

**Summation of Proposal:** This proposal gives additional options for trade-offs to accomplish the required energy rating.

**Comments:**

- Keith Oberg (self) supports.
- Ms. Shutler supports.
- Ms. Najarian (Virginia Democracy Forward) supports this measure as it gives builders and owners a choice, and also supports increased energy efficiency. This is significant because energy efficiency is a win win. No one loses, and giving people choices empowers them and helps with the buy in.
- Ms. Nawaz supports this proposal.
- Mr. Witt (speaking for himself) opposes this change as it requires additional requirements to other requirements of the code. The residential code is a prescriptive code and any requirement should stand alone
- Mr. Clark opposes based on substance but also on the proposal's structure itself.
- Mr. Lacey (RECA) is in support.
- Ms. Harnish (VAEEC): VA Energy Efficiency Council supports this proposal
- Mr. Beahm (representing himself) opposes RE407.1.1
- Ms. Eggerton (City of Alexandria) supports this as options for improved efficiency that aligns with the adopted Environmental Action Plan 2040
- Mr. Shearer (self) is in support.

**Results:** Non-Consensus

## ERB101 Net Zero Energy Appendix

**Proponent(s):** William Penniman - Sierra Club (wpenniman@aol.com)
**Summation of Proposal:** This provides an appendix to encourage builders to construct "Zero Energy" dwellings by establishing basic standards.
**Comments:**

- Mr. Bikoff (VA Democracy Forward) supports.
- Mr. Willham (Fairfax County) supports RE407.1.1-18
- Susan Stillman is in support of the zero net energy proposal. This is for consumer protection.
- Ms. Najarian supports this on behalf of VA Democracy Forward and as an individual. Standardizing terminology puts transparency into the process for owners. Always critical in the buying and selling process.
- Ms. Lang supports on behalf of myself.
- Ms. Eggerton (City of Alexandria) supports this definition and criteria net zero proposal and assures consistent metrics according to the standards as improved efficiency options that align with adopted Environmental Action Plan 2040
- Ms. Shutler is in support. This does not require builders to construct buildings with these requirements, but they can choose to implement if they wish.
- Mr. Shearer is in support. He mentions that this proposal is crucial to consumer protection.
- Mr. Witt opposes ERB101-18, because code officials are not in the business of verifying marketing terms as it is not a code regulatory issue
- Mr. Clark (Home Builders Association of VA) is opposed to this measure - is there a Virginia-specific issue? Are there reports of builders using this marketing term?
- Ms. Nawaz supports this proposal. Clarifying the language of what is meant by "zero energy" or "net zero energy". The definition has evolved over time (NREL has publications on this) and clarity allows all parties involved in a home transaction to be clear on expectations. Standardization doesn't raise costs, just helps participants.
- Mr. Beahm agrees with Mr. Witt.

**Results:** Non-consensus

## RB200 Substantial Damage definition

**Proponent(s):** Resiliency Subworkgroup
**Summation of Proposal:** This is an approved proposal from the resiliency SWG to duplicate a definition in VRC.
**Other Pertinent Information:** RB200 comes from the Resiliency SWG, where the discussion was specifically held as part of the December 2019 and March 2020 meetings.

- At the December 2019 meeting, Mr. Payne (AIA Virginia) discussed a draft proposal that brought forward many IBC changes recommended to increase flood resistance in Chapter 5 of FEMA's "Reducing Flood Losses Through the International Codes". He explained that most of the changes were to the IBC Appendix G "Flood-Resistant Construction". Additional discussions focused on the benefits of utilizing either Appendix G or a local floodplain ordinance.

- At that same meeting, Mr. Payne suggested that one way to add additional strength/resiliency for structures in certain high risk areas, without making significant changes to the IBC, would be requiring all buildings in specific/identified high risk areas to be designed/built as Risk Category IV, in accordance with the IBC. This would make the requirements clear, versus utilizing terms like "stronger", as the specific requirements are already laid out in the IBC. Additional discussion included adding a new Rick Category and requiring compliance with all requirements of Risk Category IV, with exceptions for any that were identified as non-applicable.
- At the March 10, 2020 meeting the Subworkgroup discussed and approved RB200. It was approved as amended. Mr. Brown summarized that this was from Kristen Owens' (DCR) office, and would add the identical definition for "substantial damage" that exists in the VEBC and VCC and duplicate it in the IRC/VRC. Mrs. Quinn (FEMA) asked about the "substantial improvement" definition from the VEBC. The group agreed to duplicate both improvement and damage definition in the IRC.

**Comments:**
- Mr. Brown (DHCD) lends context to this proposal.
- Mr. Clark (Home Builders Association of VA) supports.

**Results:** Consensus for Approval

## RB302.2 Townhouses reference pointers

**Proponent(s):** Jeff Shapiro (jeff.shapiro@intlcodeconsultants.com)
**Summation of Proposal:** This proposal fixes additional section references for townhouse separations.
**Comments:**
- Andrew Clark - Home Builders Association of VA: HBAV supports 302.2 as well

**Results:** Consensus for Approval

## RB302.13 NFPA 13 Options

**Proponent(s):** DHCD Staff (sbco@dhcd.virginia.gov)
**Summation of Proposal:** Change is to correlate these sections with proposals RB302.3(1) and RB302.2.6 that were approved by Workgroup 3 where there was the addition of NFPA 13 and 13R references.
**Results:** Consensus for Approval

## RB325.1 Habitable Attics

**Proponent(s):** Jeff Shapiro (jeff.shapiro@intlcodeconsultants.com)
**Summation of Proposal:** Deletes the state amendment and brings in the 2018 language for habitable attics.
**Comments:**
- Mr. Clark (HBAV) asserts that he would be glad to have a conversation with Mr. Shapiro offline to iron out this proposal.
- Mr. Witt suggests reaching out to some of the other stakeholders who could help workshop this proposal further, such as Mr. Clements (Chesterfield County).
- Ms. Davis mentions that DHCD staff is concerned about the language that is contained within the proposal; Mr. Shapiro agrees to work with these groups.

**Results:** Carry over to 9/1 meeting with the agreement to meet with DHCD staff and other stakeholders prior to the meeting - Andrew Clark, David Beahm, Dan Willham, Jason Laws, Ron Clements, Andrew Milliken.

## RTP608.15 Location of backflow preventers

**Proponent(s):** Richard Grace - VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)
**Summation of Proposal:** This provides a requirement for access for backflow preventers.
**Comments:**

- Mr. Beahm (self) agrees with Mr. Grace; this is a good change.

**Results:** Consensus for Approval

## MH20(2) Editorial

**Proponent(s):** DHCD staff (sbco@dhcd.virginia.gov)
**Summation of Proposal:** Editorial correlation only
**Comments:** None
**Results:** Consensus for Approval

SUMMARY
COMBINED WORKGROUPS 1, 2, 3 & 4 MEETING
2018 Code Change Cycle

September 1, 2020 at 9:30 a.m.
Remote Meeting Link
https://vadhcd.adobeconnect.com/workgroup/

**Participants**
Scott Andrews
Laura Baker (RECA)
David Beahm (representing himself)
Jeff Brown (DHCD)
Greg Cade (NFPA)
Andy Caldwell
John Catlett (Catlett Code Consulting)
Andrew Clark (Home Builder's Association of Virginia)
Allison Cook (Arlington County)
Cindy Davis (DHCD)
Robby Dawson (VFPA)
Rajan Engh (DHCD)
Million Fiseha
Sarah A. Foote (DHCD)
Sean Farrell (VBCOA)
Russell Furr (VFPA)
Richard Grace (VPMIA)
Randy Grumbine (Virginia Manufactured and Modular Home Association)
Judy Hackler (VALA)
Linda Hale (Loudoun County Fire)
Brian Hilderbrand (DHCD)
Bryan Holland (NEMA)
Todd House
Pat Hughes (City of Chesapeake)
Matt Hunter (AWC)
Christina Jackson (City of Norfolk/VBCOA)
Thomas King (DHCD)
Eric Lacey (RECA)
Ernie Little (VFPA)
Jeff Mang (Polyisocyanurate Insulation Manufacturers Association)
Scott McGeary

Paul Messplay IV (DHCD)
Andrew Milliken (Stafford County Fire)
Florin Moldovan (DHCD)
Jimmy Moss (VBCOA)
Kenney Payne (AIA Virginia)
Shaun Pharr (AOBA/VAMA)
Alexandria Phillips (Washington Gas)
Richard Potts (DHCD)
Travis Rickman (VDFP)
Jonathan Sargeant (OmegaFlex)
Jeff Shapiro (International Code Consultants)
David Sharp (Fairfax County)
Matt Smolsky
Jennifer Tolley (DHCD)
Brent Werlein
Dan Willham (Fairfax County)
Rick Witt (VBCOA Fire Code Committee)

## B101 Tall Wood Supplemental Info

**Proponent(s):** John Catlett, (catlettcodeconsulting@gmail.com), Catlett Code Consulting, The American Wood Council

**Summation of Proposal:** This proposal brings forward changes approved for the 2021 IBC and IFC for construction of Tall Wood (mass timber) buildings.

**Background Information:**

- This proposal and its companion FP101 were carried over from the proposed phase, as well as the August 11, 2020 Combined Workgroup Meeting to iron out details related to implementation.
- In Workgroup 1&2, concerns were voiced regarding the construction requirements as an appendix and the need to ensure that it was not optional. Mr. Witt had suggested to get the 2021 language that was approved and insert that into the main body of the code.

**Comments:**

- Mr. Brown (DHCD) explained that he assisted the proponent in updating the proposal by incorporating the 2021 tall wood provisions by reference in Chapter 6 instead of adding the provisions in an appendix as previously proposed. The new format provides an alternative compliance path at the option of the permit applicant. It allows a building to be constructed in accordance with the 2021 IBC and IFC provisions specific to mass timber and types IV-A, IV-B or IV-C construction while also complying with all other provisions of the 2018 IBC/VCC. The amendments to the IFC in this proposal are made to the IFC as it is referenced by the VCC, not the SFPC.
- Mr. Brown also indicated that the proposal would be changed from “BU101” to “B101” going forward because it is no longer slated to be an appendix.

- The referenced/incorporated 2021 IBC tall wood provisions will be included as supplemental info in the back of the printed 2021 VCC books so it won't be necessary to purchase the 2021 IBC in order to use the new compliance path.
- Mr. Payne wishes to know if the 2021 IBC reference is intended to include Virginia amendments to the referenced sections. Ms. Davis responds that since the 2021 sections are only specific to Tall Wood, they did not exist in the 2018 Codes. Therefore amendments are not an issue. Mr. Payne wants to make sure it is straightforward and that this change wouldn't require multiple books when building.
- Mr. Beahm suggests this should indicate that the proposal should state specifically which 2021 provisions and which 2018 provisions are applicable. Mr. Brown (DHCD) clarifies that the current proposal includes all 2021 provisions specific to mass timber or Types IV-A, IV-B or IV-C construction, but otherwise all 2018 VCC provisions would be applicable.
- Mr. Beahm and Mr. Payne are concerned that for "laymen" it may be confusing to say all other requirements of "this code". It would be better to say the 2018 VCC.
- There was agreement to change the last sentence to read "….as well as all other applicable provisions of the 2018 VCC, including provisions for buildings of type IV construction."

**Result:** Consensus for Approval as Modified

## FP101 Tall Wood Supplemental Information

**Proponent(s):** John Catlett, (catlettcodeconsulting@gmail.com), Catlett Code Consulting, The American Wood Council

**Summation of Proposal:** This is a companion proposal to B101 that brings forward changes approved for the 2021 IFC related to maintenance and operation aspects of mass timber construction, to the SFPC.

**Background Information:**

- Along with B101, this proposed change was carried over from the proposed phase, as well as the August 11, 2020 Combined Workgroup Meeting. See background information for proposal B101.

**Comments:**

- Mr. Farrell claims the SFPC is not applicable to buildings under construction so he isn't sure how the proposed Section 3308.9 could even be enforced by the fire official.
- Mr. Pharr agrees with Mr. Farrell and indicates that state law says that the SFPC is not enforced until after CO.
- Mr. Catlett disagrees.
- Mr. Farrell says the VCC and IFC Chapter 33 covers these requirements already, but the requirements are enforced by the building official. Adding requirements in Chapter 33 of the SFPC may be problematic
- Mr. Catlett made a point that Chapter 33 in the SFPC has not been amended out of the code so he doesn't see how this is any different since this is just adding to it.
- Mr. Milliken says having Section 3308.9 in the SFPC is an important provision for the cooperation of the Fire Official and the Building Official; he is in support. He cites a large number of wooden frame fire accidents recently.

- Mr. Dawson says he does think the Fire Code applies to buildings under construction and thinks those who are opposed might be taking a broad view of the law.
- Ms. Hale echoes Mr. Catlett.
- Kenney Payne - AIA Virginia asks if amending the VCC 3302.3 would be the path to get to SFPC Chapter 33.
- Ms. Davis asks which authority would enforce if requirements were in both the VCC and SFPC.
- Mr. Beahm asks if it would mean we would need both Fire and Building approvals before construction.
- Mr. Farrell says that adding the language of this proposal into the SFPC may be problematic for enforceability.
- Mr. Milliken says that he will remove his support of proposal B101 if this one moves forward as NC, and allow both tall wood proposals to move forward as NC. Ms. Hale agrees.
- Mr. Farrell just wants to make sure this could be enforceable. He has no issues with the code in itself.
- Mr. Catlett has no issues with this proposal being flagged for attorney general office input prior to the Board Meeting.
- Mr. Witt suggests it should be Non-Consensus.
- Mr. Dyer supports the idea of Consensus.
- Mr. Farrell agrees on Consensus for Approval pending legal review of Section 3308.9 items 3 and 4.
- Everyone agreed to move the proposal forward as CA, pending review by AG to verify if Section 3308.9 would be enforceable under the SFPC prior to a CO being issued.
- Mr. Beahm suggested changing "fire code official and the fire chief" to "AHJ". Mr. Catlett agreed.

**Result:** Consensus for Approval as Modified -Changing item 2 to "authority having jurisdiction". Result pending legal review with the A.G. of items 3 and 4 of Section 3308.9- *Review whether the SFPC only applies after CO.*

## EB307 Roof covering

**Proponent(s):** Kenney Payne, AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr (clementsro@chesterfield.gov)

**Summation of Proposal:** Clarifies roof repairs and roof coverings in the context of the existing building code.

**Background Information:**

- This proposal was Consensus for Approval at the July Workgroup 2 meeting. Subsequently, DHCD suggested language to clarify the definition for "roof covering" in response to a workgroup participants' questioning, and the proponent agreed.
- Mr. Payne never heard from whomever had comments or concerns at the July meeting.
- Mr. Moldovan (DHCD) worked with the proponents to work out language to expand the definition because not all roof panels require the same type of supports. Now, this definition will be more inclusive of all roof coverings, not just metal ones. All that has changed between this past workgroup meeting and this one, is the wording of the definition.

**Comments:**

- Mr. Pharr says AOBA/VAMA support EB307-18.

**Result:** Consensus for Approval

## E502 Relocates VECC C/R 502 to VEBC

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com) - RECA

**Summation of Proposal:** This proposal moves the requirements of VECC Sections C502 and R502 to Chapter 8 of the VEBC. This proposal also provides a pointer in the VECC to the VEBC to assist code officials who may be used to looking at the VECC rather than the VEBC for existing building energy conservation requirements.

**Background Information:** The proponent requested a carryover at the Combined Workgroup Meeting on August 11, 2020.

**Comments:**

- Mr. Pharr was previously opposed, but he has removed his opposition.
- Mr. Payne pointed out to staff that they will want to review the references in Section 805 to 811.3 to verify that they are accurate.

**Result:** Consensus for Approval

## E504.1 Relocates VECC C/R 504 to VEBC

**Proponent(s)**: Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com) - RECA

**Summation of Proposal:** This proposal moves the requirements of Sections C504 and R504 of the VECC to Chapter 5 of the VEBC and clarifies that repairs cannot be done in a way to reduce energy efficiency. This proposal aligns with other proposals to move the energy conservation requirements for existing buildings from the VECC to the VEBC. This proposal leaves a pointer in the VECC to the VEBC to assist code officials who may be used to looking at the VECC rather than the VEBC for energy requirements for existing buildings.

**Background Information:** At the August 11, 2020 Combined Workgroup Meeting, the proponents requested that this proposal be carried to the final Combined Workgroup Meeting.

**Comments:**

- Mr. Payne cites VECC compliance and exceptions; more things falling under repairs, greater flexibility. He is in support.
- Mr. Pharr withdraws opposition.

**Result:** Consensus for Approval

## EB701.4 Move VECC C505 to Ch. 7 of VEBC

**Proponent(s):** Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

**Summation of Proposal:** This proposal moves portions of the VECC to the VEBC for improved energy efficiency.

**Background Information:**

- Some workgroup participants (such as AOBA/VAMA) had issues with this proposal on the basis of cost. They believe the costs outlined within the proposed changes would be

prohibitive to many builders and that the proposed changes place undue cost burdens on the builders.
- Other workgroup participants were heavily in favor of these proposed changes, claiming that they would help better outline and underscore the importance of energy efficiency standards statewide.
- The proponents wish to be clear that it is only Section B of the proposal that they are actually proposing; they ask that the participants and stakeholders ignore the options proposed in Section A.
- After a robust discussion during the first Combined Workgroup meeting on August 11, Ms. Harnish of VAEEC and Ms. Baker (proponent) of RECA agreed that getting the weigh-in of several key stakeholders would be worthwhile, and believed it best to carry the proposal over to the final combined workgroup meeting.
- Key stakeholders whose views are sought on this proposal and were not in attendance at the previous combined workgroup meeting include Kenney Payne (AIA Virginia) and Allison Cook (Arlington County).

**Comments:**
- Mr. Payne would oppose Option A, but would not oppose B. They have some concerns, but they would ultimately support Option B. Ms. Baker reiterates that Option B is the one that the proponents are actively advocating for, not Option A.
- Mr. Pharr has cost concerns; he is unprepared to withdraw his initial opposition because of this.
- Ms. Cook believes there was a lot of effort made to minimize the potential costs to small businesses; tries to reassure Mr. Pharr.

**Result:** Non-Consensus

## RB325.1 Habitable Attics

**Proponent(s):** Jeff Shapiro, (jeff.shapiro@intlcodeconsultants.com), International Code Consultants

**Summation of Proposal:** Deletes the state amendment and brings in the 2018 language for habitable attics.

**Background Information:** Proponent had some issues with cdpVA submitting the proposal and its associated amendments. At the first combined workgroup meeting, the proponent and other workgroup participants agreed this proposal should be carried over to the 9/1 combined workgroup meeting with Mr. Shapiro's commitment to meet with other stakeholders prior to the meeting - Andrew Clark, David Beahm, Dan Willham, Jason Laws, Ron Clements, and the VBCOA IRC Committee Chairman, Mr. Richard Moore. The aforementioned group met on August 18 and provided Mr. Shapiro with feedback.

**Comments:**
- Mr. Shapiro provides context for this proposal.
- The proponent provided an alternate proposal for the meeting via Word document. This version addresses feedback he received regarding heights of escape windows. This is the version he prefers to move forward, even if non-consensus.
- Mr. Catlett wants to allow fire retardant treated wood for rooftop structures. Mr. Shapiro agrees. **Will modify to add that part of it.**
- Mr. Clark (HBAV) suggests Non-Consensus but will continue to work with proponent.

**Result:** Non-Consensus

## FP609.2 Ventilation for cooking operations

**Proponent(s):** Andrew Milliken, Stafford County Fire (amilliken@staffordcountyva.gov)
**Summation of Proposal:** This proposal indicates how a fire official can interface with the building official for cooking operations occurring without adequate ventilation.
**Background Information:** This one has changes from the previous meeting; changed the name to "cooking operations" and worked with Rick Witt on consensus language.
**Comments:**

- Mr. Witt said that we been discussing for some time now and is ready to move it forward.
- Mr. Payne noted some issues with the wording.
- Ms. Hale clarified that the intent is the ventilation has to be turned on and has to be in operation.
- Mr. Grace (VPMIA) suggests some language to clarify "such ventilation as required".
- Mr. Witt has no issues with the proposal if all that's left to do is wordsmith.
- Mr. Milliken and Ms. Hale both agree that further clarifying the word "ventilation" instead of just saying "it".
- Mr. Farrell suggests removing "where" and "is" and the "it" before "shall" – ***"Ventilation at or above the applicable building code… shall be operated and maintained".***

**Result:** Consensus for Approval as Modified

## FP3107.12.5 Cooking tents

**Proponent(s):** Andrew Milliken, Stafford County Fire (amilliken@staffordcountyva.gov)
**Summation of Proposal:** This proposal adds additional safety precautions and clarifies that cooking tents, regardless of whether they have sides, are included in this provision.
**Background Information:**

- One of several proposals that initially posited additional regulations for cooking tents during this code cycle.
- The Farm Bureau initially had concerns.

**Comments:** Mr. Smith of the Farm Bureau has removed his opposition after meeting with Ms. Hale to review the proposed changes prior to today's meeting.
**Result:** Consensus for Approval

## FP103.2.1 SFPC Edits Part 4

**Summation:** This proposal includes sections that were reviewed by the SFPC edit workgroup during the July 30th SFPC Edit Workgroup meeting and recommended as CA by Workgroup 1 on August 11th. Additional items reviewed by the SFPC Edit WG at the August 20th meeting have been added to this proposal for consideration by Workgroup 1 today.
**Comments:** None
**Result:** Consensus for Approval

## FP103.2.1 SFPC Edit Chapters 1-10

**Proponent(s):** Andrew Milliken (SFPC) - amilliken@staffordcountyva.gov

**Summation of Proposal:** This proposal includes all remaining SFPC sections submitted by the VFSB that were not able to be reviewed by the SFPC Edit workgroup.

**Background Information:**

- Although the edits to SFPC Chapters 1-10 were completed during the 2015 code update cycle, the VFSB submitted additional changes to Chapters 1-10 of the SFPC in June 2020. Additional SFPC Edit Workgroup meetings were scheduled in an attempt to review these additional changes prior to the August 11th Combined Workgroup meeting. At the time of the August 11th Combined Workgroup meeting, all items that had been reviewed by the SFPC Edit WG were approved by Workgroup 1 (See proposal "FP103.2.1 SFPC Edits Part 4" above). The group agreed to carry over any remaining items to the 9/1 meeting and one more additional SFPC Edit Workgroup meeting was held on August 20, 2020. All items reviewed by the SFPC Edit WG at the August 20th meeting were added to proposal "FP103.2.1 SFPC Edits Part 4" and recommended CA by Workgroup 1 today.

**Comments:**

- The group utilized the remainder of the meeting to review all remaining SFPC Edit items (approximately 53 individual code sections) and make recommendations on each.
- Mr. Brown clarified that all items that receive recommendations today will be added to consensus proposal FP103.2.1 SFPC Edits Part 4. If there are any individual sections that are missed or do not receive a recommendation today they will remain with this proposal "FP103.2.1 SFPC Edit Chapters 1-10".
- Due to a document mix up, a couple of sections that had previously been reviewed and had recommendation may have been re-reviewed today. Mr. Brown clarified that if staff finds that is the case, the final review and recommendation from today will go forward. Note: During post meeting reviews, staff only found two instances of re-reviewed sections, and neither included non-consensus items.

**Result:** Non-Consensus (This recommendation is only applicable to any items remaining as part of this proposal as they did not receive a Workgroup 1 review and recommendation today.)

## 1030.1 General

**Result:** Consensus for Approval

## 1030.2 Minimum size

- Restores technical language, connects it back to the applicable building code. Makes sure operation of window is maintained, as well as the height to the floor.
- Mr. Witt, Mr. Farrell have concerns about enforceability.
- Mr. Sharp mentions how in previous codes, it may have been based on sill height.
- Ms. Hale says that operations matter; being able to open and operate the window properly.
- Mr. Willham agrees that it used to be based on sill height.
- Mr. Shapiro is in support of the text as it is.
- Mr. Witt opposes the idea of the "normal operations" language, claims it is too subjective to be enforced correctly.

**Result:** Consensus for Approval as Modified

## 1030.3 Maximum Height from Floor

- Mr. Farrell wants to make sure we are not forcing retroactive revisions to the code for current building owners.
- Mr. Moss suggests the following language: Emergency escape and rescue opening height shall be maintained in accordance with the applicable building code.
- Mr. Beahm states that he agrees with Mr. Moss' language.
- Mr. Payne suggests that Mr. Moss' recommendation would need to specify height.
- Mr. Willham mentions that up until 2012, things were still measured to the sill.
- Mr. Brown (DHCD) enters some modified language.

**Result:** Consensus for Approval As Modified

## 1030.4 Window Wells

**Result:** Consensus for Approval

## 1030.5 Bars, grilles, covers and screens

- Mr. Payne asks if the language could say "maintained and operated" in accordance with the applicably building code. He is not opposed to what is there already.
- Mr. Milliken agrees.
- Ms. Hale adds that sometimes, there is no applicable building code that applies, but that this regulation would help cut down on the confusion.

**Result:** Consensus for Approval

## 1031.4 Exit Signs (Revises a Reference to Ch. 12)

- Mr. Witt wants to have the word "installed" fixed to "maintained."
- Mr. Milliken acknowledges this oversight and agrees to that change.

**Result:** Consensus for Approval As Modified

## 1031.9 Floor Identification Signs

**Result:** Consensus for Approval

## 1031.11 Emergency Supplemental Hardware

- Mr. Payne wishes to know if the word "maintenance" includes storage, since the second sentence of the proposal indicates how the materials are to be stored. He worries the second sentence may be used to circumvent the first sentence.
- Mr. Witt has concerns about this being maintained in the applicable building code. He disagrees with Mr. Milliken.
- Mr. Payne backs Mr. Witt's assessment. He is opposed if this proposal expands upon what was already agreed upon; AIA Virginia is in support if the proposal is intended to be carried out as was previously discussed.
- Mr. Farrell comments that building officials have the authority to revoke or suspend COO according to the VCC, so he is not sure this is the proper way to explain this.

- Mr. Milliken claims that these items were found to be inappropriately used by Fire Officials more often than Building Officials; he just wants whatever is approved in the SFPC to be approved here.
- Mr. Payne suggests the following language: 10.1.1 Consultation and notification. Prior to approval of emergency supplemental hardware, the building code official shall consult with the local fire code official or state fire code official if no local fire code official exists, and head of the local law enforcement agency. The local fire code official, the state fire code official, and the local fire, EMS and law enforcement first responders shall be notified of such approval, after approval of such emergency supplemental hardware by the building code official.
- Mr. Willham brings up the "locks and latches" clause as supporting textual evidence: section 1010.1.9.3.
- Mr. Milliken, Ms. Hale, and Mr. Witt discuss who has the ability to revoke a previously-approved code. Mr. Witt claims that there is no authority for a fire official to revoke anything.
- Mr. Milliken suggests we duplicate the previously-approved language.
- Mr. Payne says that Ch. 1 grants administrative authority, and a state amendment. overrides that such as in this case. Mr. Witt disagrees, saying it is the opposite – that fire officials' authority consists of maintenance-only and that is codified in law.
- Ms. Hale maintains that fire officials perform both operations and maintenance.
- Mr. Witt is in opposition if the last proposed sentence is included.

**Result:** Non-Consensus

## 1031.12 Area of Refuge

**Result:** Consensus for Approval

## 1031.13 Door Opening Force

**Result:** Consensus for Approval

**Add new section 1032.1** – Adding a new section for the Virginia SFPC for Ch. 10; Attempting to bring in occupancy load language guidelines

- The other way to accomplish this would be by putting some administrative language in Ch. 1; proposal 110.4.1, "Unsafe Occupancy".
- Mr. Payne wishes to add the word "Section" so it will read "Section 110.4" if that proposal were approved.
- Mr. Witt wishes for the word "note" to be removed; as well as clarifying language added that serves the purpose of letting officials know this is temporary, until a building code official can step in and determine and enforce new (permanent) occupancy load signage.
- Mr. Pharr clarifies with Mr. Milliken that either one or the other of the proposals will be moved forward, whereas the other will be withdrawn.
- Mr. Payne wants to understand if this is for assembly spaces. He wants to know whether there is already existing language to indicate temporary signage.
- Mr. Farrell thinks this has potential but that it still needs to be workshopped.
- Mr. Payne, Mr. Farrell and Mr. Witt all believe this should be carried to the next code cycle; neither 110.4.1 nor 1032.1 is as fully-fleshed out as they would like to see.

- Mr. Payne suggests some other options: referencing the table in the VCC might be a workaround. Mr. Farrell seconds this idea.
- Mr. Willham says that the table is only a reference for maximum safe occupancy loads during initial design, as opposed to being a maximum safe occupancy load from that point forward. He would be hesitant to rely solely or even mainly on the table contained in the VCC for ongoing direction for the code officials regarding occupancy load signage.
- Mr. Milliken mentions overcrowding issues are not always going to be in A-use buildings; that in fact they'll often be in conflict with B-use buildings. Mr. Milliken wants to know whether the language would apply to continuous use (which is more variable) than a fixed number of people providing an occupancy load issue. Mr. Payne discusses with him; Mr. Payne offers to workshop some language and embed it in the chat box during the meeting.
- The participants discuss withdrawing this proposal in favor of trying to reach consensus on 110.4 instead to accomplish the same goals. Mr. Payne workshops specifying language for 110.4.1. (See 110.4.1)

**Result:** Withdrawn

**3804.1.1.6 (revisited)** – modified the language so that it sounds like the emergency or standby power shall be maintained in the context of high school laboratories, as opposed to the code officials maintaining the laboratories themselves.
**Result:** Consensus for Approval as Modified

## 304.1.2 Vegetation

- Mr. Witt doesn't believe we need some of this language and would prefer that the last sentence be removed from the proposal.
- Mr. Milliken maintains that the Wild Land Urban Interface Code is a referenced standard but does not apply to each state, including Virginia.
- Ms. Hale mentions that it does not have anything to do with building codes; that it refers strictly to vegetation.
- Mr. Farrell mentions that it may be helpful to pull out specific sections from the national code and adopt all of it and add it to the SFPC, as opposed to selectively enforcing based on what is required in Virginia. He suggests we move the pieces that are relevant to Virginia and add them to the SFPC.
- Mr. Witt is concerned that certain vegetation – like pine trees, certain bushes, and so on – will not be allowed to remain next to one's buildings. He thinks this may be an overreach, and encourages Mr. Milliken to push this toward the next code cycle so they can collectively examine the potential ramifications of this proposed change.
- Ms. Davis mentions how the Wild Land Urban Interface Code references only lots that have been designated by the locality as being within a Wild Land Urban Interface area as being required to submit a vegetation plan. She further indicated that this code had been considered for adoption by the BHCD previously and that proposal was disapproved. Mr. Milliken maintains that things have changed and that the Wildfire Risk would be the key element for consideration for this code cycle.

- Mr. Milliken cites 304.1.2 Vegetation: Weeds, grass, vines, or other growth that is capable of being ignited and endangering property shall be cut down and removed by the owner or occupant of the premises. Vegetation clearance requirements in wildfire risk areas shall be in accordance with section 603.1 through 607.2 and Appendix C of the International Wildland-Urban Interface Code.

**Result:** Non-Consensus

## 603.3.1 Fuel Oil Storage

- Mr. Milliken provided background.
- Ms. Davis Asked when the 660 gallon was established. Do we need verify the quantities have not changed since the early USBC adoption? Mr. Milliken stated they either weren't addressed early on or changed slightly.
- Mr. Brown pointed out that the 2015 and proposed regulations list the 660 gallons so regardless, that will be in there.
- Mr. Milliken clarified that the only change is to remove "comply" so the section would read "be maintained".

**Result:** Consensus for Approval

## 603.3.2.1 Quantity Limits

- Mr. Witt clarifies that if this proposal does not conflict with existing regulations, then he is on board with this proposed change. Mr. Milliken stated he'll look into this.
- Mr. Little states that the 660 gallon limit is in the 1984 Boca FPC.

**Result:** Consensus for Approval

## 110.4 Unsafe Occupancy

- There are broad concerns with signage from several stakeholders.
- Mr. Witt explains how there could be more than one occupant load and different occupant loads within sections of a building. He doesn't like the note. He thinks the proposal requires too much work and should be carried over.
- Mr. Milliken feels they need something to address overcrowding since the chapter 10 provisions were deleted.
- Mr. Payne cites 110.7 Overcrowding. Where the fire code official believes that overcrowding may exist, the fire code official shall be permitted to utilize the egress component sizing requirements of Section 1005 of the VCC and occupant load allowances under Section 1004 of the VCC to determine if overcrowding exists. Where such determination is made, the fire code official shall be permitted to require an approved temporary sign posting of the maximum allowable occupant load and such sign shall be maintained until the building official can determine the allowable occupant load at which time a permanent sign shall be posted or the temporary sign may be removed.
- Mr. Farrell explains how the fire official should be determining if a space is overcrowded, how it should be based on the occupant load and how that's determined.
- Mr. Little suggests adding overcrowding "may" exist. Mr. Payne agrees and says he originally used the word "may".

- Mr. Payne and Mr. Farrell have a short back and forth regarding the last sentence. Mr. Payne explained how he understands his concern but that it doesn't affect it the way he thinks it does for determining overcrowding.
- Mr. Farrell thinks this gets us where we need to be. Firm on the building official determining max occupant load. He suggests removing references to sections.
- Mr. Payne, Mr. Witt, and Mr. Farrell work on refining last sentence. Mr. Payne brings up italicizing defined terms.
- Mr. Farrell recommended moving to Chapter 10 and Mr. Milliken agreed. Added the provisions as a subsection - 1001.3.1 Temporary occupant load determination.

**Result:** Consensus for Approval as Modified

## 110.7 Overcrowding

**Result:** Consensus for Approval as Modified (see 110.4)

## 1001.3.1 Temporary Occupant Load Determination

- Mr. Dyer and Mr. Witt are both in support of the changes made.
- Ms. Hale wants to make sure this is enforceable.
- Amended language by Mr. Brown of DHCD (as well as weigh-in from Ms. Hale, Mr. Farrell, Mr. Milliken, and Mr. Payne) works for all.

**Result:** Consensus for Approval as Modified

## 1032.2 Emergency Occupant Load Identification

**Result:** Withdrawn

## 3801.1 Scope

- Milliken and Mr. Payne explain the changes made at the national level for Higher-ed labs.
- Mr. Beahm grants additional context; these changes were discussed 2-3 years ago.

**Result:** Consensus for Approval

## 3801.2 Application

**Result:** Consensus for Approval

## 603.3.2.2 Restricted Use and Connection

**Result:** Consensus for Approval

## 603.3.2.7 Tanks in Basements

- Mr. Farrell has some concerns with this one and will not revoke his opposition.

**Result:** Non-Consensus

## 605.8.1 Refrigerants Other Than Ammonia

- Mr. Farrell asks when this was entered into the code. Mr. Milliken says there have been changes and modifications to the code over the years.
- Mr. Witt disagrees with this language and thinks it's a retrofit. He asks if the "approved location" requirement has been the case since this was added to the code. Mr. Milliken answers that it has.
- Ms. Davis recommends applicable building code language. Mr. Farrell supports scoping it that way.
- Mr. Payne questions the language "approved location".
- Mr. Milliken, Mr. Witt, and Mr. Farrell debate the language for a while and delete a lot of it to change it to fit what is already approved in the building code.

**Result:** Consensus for Approval as Modified

## 605.9.1 Refrigeration System Emergency Shutoff

- Mr. Farrell suggests language. Revised to be in line with previous language.
- Mr. Brown (DHCD) adds, at the proponents' request, language that had been debated earlier and decided upon for previous proposal 605.8.1 and several subsequent proposed edits.

**Result:** Consensus for Approval as Modified

## 605.10.1 Automatic Crossover Valves

**Result:** Withdrawn

## 605.13 Mechanical Ventilation Exhaust

- Mr. Brown revises to be in line with previous language

**Result:** Consensus for Approval as Modified

## 605.17.1 Refrigerant Detection Systems Operations

- Makes the language more inclusive for both modern and older technologies

**Result:** Withdrawn

## 607.2 Where Required. Cooking Operations with Grease-Laden Vapors

- No discussion

**Result:** Withdrawn

## 701.7 Unsafe Conditions

- Editorial change, no discussion

**Result:** Consensus for Approval

## 704.2 Opening Protectives

- Relates to 705. 2

**Result:** Consensus for Approval

## 901.5.1 Occupancy

- Mr. Witt suggests this one be considered Non-Consensus.
- Mr. Farrell questions why. Mr. Witt argues that because the authority regarding occupancy is a building officials' responsibility, and that it does not fall to a fire official.

**Result:** Non-Consensus

## 905.5.3 Class II System

- Previous workgroup discussions included terminology, including "fire hose for use by trained personnel". This proposal attempts to add the language in order to clarify who can utilize the fire hoses in which context.
- Mr. Farrell argues that Class II specifically regards occupants. Mr. Milliken states that the exact proposed language already exists in the current NFPA.

**Result:** Non-Consensus

## 905.9 Valve Supervision

- Relates to 903.4 for supervision of valves; does not add construction language.
- Mr. King (DHCD) points to the section referenced: 903.4 Sprinkler system supervision and alarms. All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures, water-flow switches and alarms on all sprinkler systems shall remain in service in the normal position and properly sealed, locked, or electrically supervised in accordance with the applicable building code.

**Result:** Consensus for Approval

## 905.11 Locking Standpipe Outlet Caps

- No need for a Virginia amendment; keep IFC language.

**Result:** Consensus for Approval

## 907.3.2 Special Locking Systems

- No discussion

**Result:** Consensus for Approval

## 907.3.3 Elevator Emergency Operation

- No discussion

**Result:** Consensus for Approval, scoping language

## 907.4.2 Manual Fire Alarm Boxes

- No discussion

**Result:** Consensus for Approval

## 907.4.2.3 Color

- Mr. Pharr and Mr. Farrell voice concerns (Mr. Farrell has had issues with the "unless the applicable building code" language for several code cycles). Mr. Farrell is concerned this is headed for a "slippery slope" that recent code cycles have leaned on the language of "unless required by the applicable building code".
- Mr. Pharr brings up the idea of the wall being red – would it apply then?
- Mr. Witt and Mr. Pharr both echo Mr. Farrell's concerns; believes this could be incorrectly applied as a retrofit requirement
- Mr. Payne posits: if his alarm box is green, and the code language here outlines that the box should be red, would he be out of compliance?

**Result:** Non-Consensus

## Delete section 907.4.3 and 907.4.3.1

**Result:** Withdrawn

## 907.5 Occupant Notification Systems

- Mr. Witt advocates that this be non-consensus.
- Mr. Farrell claims that "technical prescriptive language" plus "the applicable building code" makes this much harder to enforce. It may lead to a conflict of requirements – two codes that are in direct opposition of each other.
- Mr. Milliken suggests the following language: Where required or provided in accordance with the applicable building code, a fire alarm system shall annunciate at the fire alarm control unit and shall initiate occupant notification upon activation in accordance with the applicable building code.

**Result:** Consensus for Approval as Modified

## 907.5.2 Audible Alarms

- Mr. Milliken and Mr. Witt discuss to seek amended language.
- There is some concern regarding the language beyond the first sentence.
- Mr. Brown and Mr. Pharr provides some suggested language; Mr. Farrell agrees.

**Result:** Consensus for Approval as Modified

## Delete Sections 907.5.2.2.1 and 907.5.2.2.2

**Result:** Withdrawn

## 907.5.2.2.3 Alternative Uses for Emergency Voices/Alarm Communication Systems

**Result:** Consensus for Approval (per August 20)

## 905.5.3 Class II System

**Result:** Non-Consensus

## 907.6.3 Initiating Device Identification

**Result:** Consensus for Approval

## 910.4.4 Activation

- Discussed smoke and heat vents regulations; only manual controls when the fire department says so.
- Amended language, approval

**Result:** Consensus for Approval as Modified

## 910.4.7 Controls

- Attempts to make sure manual controls are maintained.
- Mr. Payne, Mr. Milliken and Mr. Brown work on language, eliminating run-on sentences and directives.

**Result:** Consensus for Approval as Modified

## 912.2 Location

**Result:** Non-Consensus

## 912.2.1 Visible Location

**Result:** Non-Consensus