AGENDA

STATE BUILDING CODE TECHNICAL REVIEW BOARD

Friday, March 21, 2014 – 10:00 a.m.
Virginia Housing Center
4224 Cox Road
Glen Allen, Virginia

I. Roll Call **(Tab 1)**

II. Approval of January 24, 2014 Minutes **(Tab 2)**

III. Public Comment

IV. Approval of Final Order **(Tab 3)**

In Re: Appeal of Rave Soccer, LLC
Appeal No. 13-5

V. Appeal of Final Order **(Tab 4)**

In Re: Appeal of Stark Jones
Appeal No. 13-6

VI. Appeal Hearing **(Tab 5)**

In Re: Appeal of Milari Madison
Appeal Nos. 13-3, 13-7 and 14-2

VII. Secretary's Report

STATE BUILDING CODE TECHNICAL REVIEW BOARD

Updated December 2013

J. Robert Allen, CBO
Building Inspections Dept.
Henrico Co. Gov't Center
2nd Floor
Post Office Box 90775
4301 East Parham Road
Henrico, Virginia 23273-07753
H (804) 330-9637
all56@co.henrico.va.us
(VBCOA)

Matthew Arnold
1640 Trap Road
Vienna, VA 22182
W (703) 801-4337
mda1618@gmail.com
(Virginia Society of AIA)

W. Keith Brower, Jr.
39320 Rickard Road
Lovettsville, Virginia 20180
W: 703-777-0333
keith.brower@loudoun.gov
(Commonwealth at large)

Vince Butler
5750 White Flint Court
Manassas, Virginia 20112
Cell phone (703) 928-4550
vbutler@bbcbuilders.com
(Home Builders Association)

J. Daniel Crigler
935 Good Hope Church Road
Aroda, Virginia 22709
W (540) 948-6230
Cell phone: (540) 718-5602
(Va. Assoc. of PHCC)
jdc@ldassociatesinc.com

James R. Dawson
11122 Chester Garden Cir.
Chester, VA 23831
W (804) 717-6838
DawsonJ@chesterfield.gov
(Va. Fire Chiefs Assoc.)

John H. Epperson, PE
4701 Feldspar Quay
Chesapeake, Va. 23321
W (804) 254-6679
Cell (757) 615-4066
jhepe@yahoo.com
(Va. Soc. of Professional Engineers)

Joseph A. Kessler, III
1033 Locust Avenue
Charlottesville, Virginia 22901
W (434) 220-0862
Cell: (434) 962-0044)
jay@kesslermail.com
(Assoc. General Contractors)

John A. Knepper, Jr.
Trumbo Electric
Post Office Box 1
Broadway, Virginia 22815
W (540) 896-7095 Ext. 115
jak@trumboelectric.com
(Electrical Contractor)

James N. Lowe
1351 Orphanage Road
Danville, Virginia 24540
W (434) 836-6777
H (434) 724-4465
Cell phone: (434) 251-9940
(Va. Assoc. of PHCC)

Eric Mays
12905 Chaparral Drive
Woodbridge, Virginia 22192
W (703) 792-6873
emays@pwcgov.org
(VBCOA)

Joanne D. Monday
Wilton Capitol Mgmt. Srvs.
P. O. Box 29628
Richmond, Virginia 23242
2520-A Gaskins Road
Richmond, Virginia 23238
H (804) 750-2272
W (804) 290-0808
Cell phone: (804) 212-4434
jmonday@wiltoncms.com
(Va. Bldg. Owners and Mgrs.)

Patricia S. O'Bannon
County Administrator's Office
Henrico Co. Gov't Center, 3rd Fl.
Post Office Box 27032
4301 East Parham Road
Richmond, Virginia 23273
W (804) 501-4208
pob@patobannon.com
(Commonwealth at large)

R. Schaefer Oglesby
Oglesby Management Group, Inc.
2309 Heron Hill Place
Lynchburg, Virginia 24503
W (434) 385-5938
H (434) 384-6616
Cell: (434) 258-6616
ssoglesby@comcast.net
(National Apartment Assoc.)

James M. Flaherty
Assistant Attorney General
Financial Law and Government Support Section
Office of the Attorney General
900 East Main Street
Richmond, Virginia 23219
W (804) 371-2381
Fax: (804) 786-1991
jflaherty@oag.state.va.us

DRAFT MINUTES

STATE BUILDING CODE TECHNICAL REVIEW BOARD

MEETING
January 24, 2014

GLEN ALLEN, VIRGINIA

Members Present	Members Absent
Mr. J. Robert Allen, Chairman	Mr. R. Schaefer Oglesby, Vice-Chairman
Mr. Vince Butler	Mr. Matthew Arnold
Mr. W. Keith Brower, Jr.	Mr. John A. Knepper, Jr.
Mr. J. Daniel Crigler	Ms. Patricia S. O'Bannon
Mr. James R. Dawson	
Mr. John H. Epperson	
Mr. Joseph A. Kessler, III	
Mr. James N. Lowe	
Mr. Eric Mays	
Ms. Joanne D. Monday	

Call to Order

The meeting of the State Building Code Technical Review Board (Review Board) was called to order by the Chairman at approximately 10:00 a.m.

Roll Call

The attendance was established by Mr. Vernon W. Hodge, Secretary, and constituted a quorum. Ms. Elizabeth Myers, Assistant Attorney General in the Office of the Attorney General, was present and serving as the Board's legal counsel.

The Secretary informed the Board members of the hospitalization of the Vice-Chairman and advised that the Board members would be kept abreast of his condition. A get well soon card was distributed for signatures and well wishes and all expressed concern over the Vice-Chairman's absence.

Approval of Minutes

After consideration, Mr. Lowe moved to approve the minutes of the September 20, 2013 meeting as presented in the Review Board members' agenda package. The motion was seconded by Mr. Crigler and passed unanimously with Messrs. Brower and Mays and Ms. Monday abstaining from the vote. Ms. Monday requested that draft minutes be distributed as soon as possible following a meeting. Staff noted that draft minutes would be distributed to the Board members when being posted in the future instead of waiting for the next agenda package to be distributed.

Public Comment

The Chairman opened the floor for public comment. The Secretary reported that no one was preregistered. The Chairman closed the public comment period.

Final Orders

Appeal of Keith Kurtz; Appeal No. 13-2:

After consideration, Mr. Lowe moved to approve the final order as presented in the Review Board members' agenda package. The motion was seconded by Mr. Epperson and passed unanimously with Messrs. Brower and Mays and Ms. Monday abstaining from the vote.

New Business

Appeal of Rave Soccer, LLC; Appeal No. 13-5:

A hearing convened with the Chairman serving as the presiding officer. The appeal concerned the construction of an indoor soccer facility at 2949 Shipps Corner Road in Virginia Beach and the issue on appeal was whether to overturn the disapproval of a modification request under Part I of the Virginia Uniform Statewide Building Code (USBC) for an increase in building area without a sprinkler system.

The following persons were sworn in and given an opportunity to present testimony:

Kelly J. Olt, Architect
Daniel W. Speight, P.E., Structural Engineer
Cheri Hainer, City of Virginia Beach building official

Also present were:

R. Edward Bourdon, Jr., Esq., legal counsel for Rave
B. K. Wilson, Esq., legal counsel for Virginia Beach

The following exhibit was submitted by Rave Soccer, LLC, to supplement the documents in the Review Board members' agenda package:

Exhibit A – Transcript of the hearing of the City appeals board

An objection to the exhibit was voiced by Ms. Wilson concerning the handwritten notes in the margins. The Chairman ruled to admit the exhibit due to the notes being generally illegible.

New Business

Appeal of Rave Soccer, LLC; Appeal No. 13-5 (continued):

After testimony concluded, the Chairman closed the hearing and stated a decision from the Review Board members would be forthcoming and the deliberations would be conducted in open session. It was further noted that a final order reflecting the decision would be considered at a subsequent meeting and, when approved, would be distributed to the parties and would contain a statement of further right of appeal.

Decision – Appeal of Rave Soccer, LLC; Appeal No. 13-5:

After deliberation, Mr. Epperson moved to uphold the decision of the City of Virginia Beach building official, affirmed by the City of Virginia Beach Board of Building Code Appeals, New Construction Division, to deny the modification request for an increase in the building area without a full sprinkler system. The motion was seconded by Mr. Dawson and passed unanimously.

Appeal of Stark Jones, LLC; Appeal No. 13-6:

A hearing convened with the Chairman serving as the presiding officer. The appeal concerned whether Stark Jones, the proprietor of JB's Restaurant and Lounge, located at 2328 Melrose Avenue in Roanoke, had approval to operate the business as a night club or whether its use as a night club constitutes a change of occupancy under the USBC.

The following persons were sworn in and given an opportunity to present testimony:

Stark Jones
Bane Compton, City of Roanoke acting building official
Neil M. Holland, City of Roanoke building department
Ronald Campbell, City of Roanoke building department

Also present were:

John Prillaman, Esq., legal counsel for Stark Jones
Steve Talevi, Esq., legal counsel for the City of Roanoke

New Business

Appeal of Stark Jones, LLC; Appeal No. 13-6 (continued):

No exhibits were submitted at the hearing to supplement the record in the appeal.

After testimony concluded, the Chairman closed the hearing and stated a decision from the Review Board members would be forthcoming and the deliberations would be conducted in open session. It was further noted that a final order reflecting the decision would be considered at a subsequent meeting and, when approved, would be distributed to the parties and would contain a statement of further right of appeal.

Decision – Appeal of Stark Jones, LLC; Appeal No. 13-6:

After deliberation, Mr. Dawson moved to uphold the decision of the City of Roanoke building official, affirmed by the City of Roanoke Building and Fire Code Board of Appeals, that the use of JB's Restaurant and Lounge did constitute a change of occupancy to a night club. The motion was seconded by Mr. Crigler and passed with only Mr. Lowe voting in opposition.

Secretary's Report

The Secretary reviewed the meeting dates for 2014 and there was agreement to continue meeting on the third Friday of the month when necessary.

The Board's legal counsel then discussed a ruling by the City of Portsmouth Circuit Court concerning Review Board Appeal No. 11-13; Appeal of Glenn Yates, Jr. After discussion, it was agreed to have legal counsel seek clarification of the decision and to keep Review Board staff apprised of any deadlines for further appeal.

Adjournment

There being no further business, the meeting was adjourned by motion of Mr. Crigler at approximately 2:00 p.m.

Approved: March 21, 2014

Chairman, State Building Code Technical Review Board

Secretary, State Building Code Technical Review Board

VIRGINIA:

BEFORE THE
STATE BUILDING CODE TECHNICAL REVIEW BOARD (REVIEW BOARD)

IN RE: Appeal of Rave Soccer Complex, LLC
Appeal No. 13-5

Hearing Date: January 24, 2014

DECISION OF THE REVIEW BOARD

I. PROCEDURAL BACKGROUND

The State Building Code Technical Review Board (Review Board) is a Governor-appointed board established to rule on disputes arising from application of regulations of the Department of Housing and Community Development. See §§ 36-108 and 36-114 of the Code of Virginia. The Review Board's proceedings are governed by the Virginia Administrative Process Act. See § 36-114 of the Code of Virginia.

II. CASE HISTORY

In early 2010, the City of Virginia Beach Department of Permits and Inspections (City building department or City building official) issued a building permit under Part I of the Virginia Uniform Statewide Building Code, known as the Virginia

Construction Code, or VCC, for the construction of an indoor soccer facility at 2949 Shipps Corner Road.

The VCC incorporates by reference nationally recognized model building codes for the technical requirements for construction. The 2006 edition of the International Building Code (IBC) was the model code applicable at the time of the issuance of the permit.

While the plans for the building submitted for the permit indicated that a fire sprinkler system would be installed, the building was constructed without one.

In early 2013, the City building department notified the owner, Rave Soccer Complex, LLC (Rave), that the building was being occupied without approval and that no sprinkler system had been installed. An agreement was reached in conjunction with the City's fire department to provide a fire watch while the building was occupied until the issue of the sprinkler system installation was resolved.

Rave then requested that the City building department grant a modification under the VCC to install only a limited area sprinkler system around the interior perimeter of the building in lieu of a full sprinkler system, based on the facts that the 2006 IBC did not require a sprinkler system to protect participant sport areas and that the building did not have any spectator seating areas.

The City building official, after consideration, decided not to grant the modification request. Rave then appealed the refusal to grant the modification to the City of Virginia Beach Board of Building Code Appeals, New Construction Division (City VCC appeals board), which heard the appeal in July of 2013 and ruled to uphold the City building official's decision.

Rave further appealed the City VCC appeals board's decision to the Review Board and a hearing before the Review Board was conducted with all parties present.

III. FINDINGS OF THE REVIEW BOARD

While the 2006 IBC does not require a sprinkler system to be installed to protect participant sport areas under an exception contained in Section 903.2.1.3, that exception is not applicable to Rave's building due to the building design utilizing an automatic sprinkler system increase of area allowance in Section 506.3 to achieve the desired size of the building. Section 506.3 specifically states that to obtain a allowance increase in area, a building is required to be sprinklered throughout in accordance with Section 903.3.1.1, which references the National Fire Protection Association's Standard No. 13 (NFPA 13) for the installation of sprinkler systems. NFPA 13 does not have an exception for the omission of sprinklers in participant sport areas.

Modification approvals under Section 106.3 of the VCC are based on a modification meeting the spirit and functional intent of the VCC and assuring the public heath, safety and welfare. In this case, the increase in the size of the building, from the 19,000 square feet permitted without a sprinkler system, to the 33,000 square feet actually constructed, does not meet the spirit and functional intent of the VCC with only a limited area sprinkler system around the interior perimeter. Too much of the interior of the building would not have sprinkler protection, which is the functional intent of the sprinkler area increase allowance. No other method of protecting the entire interior of the building was offered by Rave.

In addition, it is noted that subsequent editions of the IBC do not have the exception for excluding participant sport areas from sprinkler system protection, which reinforces the importance of providing the functional equivalent of sprinkler protection in the consideration of a modification request to omit sprinklers.

IV. FINAL ORDER

The appeal having been given due regard, and for the reasons set out herein, the Review Board orders the decision of the City building official and the affirmation of that decision by the City VCC appeals board to be, and hereby is, upheld.

Chairman, State Technical Review Board

Date Entered

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 Vernon W. Hodge, 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.

VIRGINIA:

BEFORE THE
STATE BUILDING CODE TECHNICAL REVIEW BOARD (REVIEW BOARD)

IN RE: Appeal of Stark Jones
Appeal No. 13-6

Hearing Date: January 24, 2014

DECISION OF THE REVIEW BOARD

I. PROCEDURAL BACKGROUND

The State Building Code Technical Review Board (Review Board) is a Governor-appointed board established to rule on disputes arising from application of regulations of the Department of Housing and Community Development. See §§ 36-108 and 36-114 of the Code of Virginia. The Review Board's proceedings are governed by the Virginia Administrative Process Act. See § 36-114 of the Code of Virginia.

II. CASE HISTORY

Stark Jones (Jones) is the proprietor of a business known as JB's Restaurant and Lounge (JB's), located at 2328 Melrose Avenue NW, in the City of Roanoke. In May of 2013, Jones applied to the City of Roanoke Planning, Building and Development Department (City building department or City building official) for a building permit for modifications to the business to create separate smoking and nonsmoking areas and to obtain a new certificate of occupancy for the building, as permitted under Part I of the Virginia Uniform Statewide Building Code (USBC)(Part I being known as the Virginia Construction Code or VCC), to show compliance with regulations of the Virginia Department of Health related to smoking in restaurants.

In review of documents submitted for the building permit, the City building official determined that the business was being operated as a night club, as defined under the VCC, but the existing VCC certificate of occupancy was only for a restaurant. As there are differences in safety standards under the VCC for restaurants versus nightclubs, the City building official informed Jones that the night club use would have to be discontinued and then the new certificate of occupancy for the restaurant indicating compliance with the smoking regulations could be issued.

Jones contended that the business had been operating as a night club for years prior to his involvement with it and had been approved as such by the City building department.

Unable to reach a solution agreeable to both Jones and the City building official, in July of 2013, Jones filed an appeal to the City of Roanoke Building and Fire Code Board of Appeals (City VCC appeals board).

After a hearing, the City VCC appeals board ruled to uphold the City building official's decision that to use Jones' business as a night club would constitute a change of occupancy under the VCC and before a certificate of occupancy could be issued authorizing the night club use, the building would have to modified to comply with the applicable provisions of the VCC.

Jones then further appealed to the Review Board and a hearing was held before the Review Board with Jones and the City building official, and their respective legal counsel, present.

III. FINDINGS OF THE REVIEW BOARD

The VCC requires a certificate of occupancy to be issued when the construction of a building is completed and for that certificate of occupancy to be on file for the life of the building, unless the occupancy classification of the building changes and a new certificate of occupancy is issued to reflect approval of the new occupancy classification.

While the classification designations in the VCC have changed over time, the VCC has always distinguished between restaurants and night clubs and had different safety standards for both. Night club standards require more fire protection measures, such as sprinkler and alarm systems, since occupants at a night club may be less aware of their surroundings or be less capable of reacting to an emergency situation due to alcohol consumption, low lighting and high sound levels.

The latest certificate of occupancy on file with the City building department for JB's approves it only as a restaurant, and not as a night club. Several prior certificates of occupancy were also produced, but they all also only approved the business as a restaurant, and not as a night club.

Consequently, the business cannot be operated as a night club without first obtaining a certificate of occupancy for night club use from the City building department.

The issue of whether the building complies with the change of occupancy provisions in the VCC for night club use is not before the Review Board in the appeal; however, the City building official indicated that modifications to the building would have to be made. Attention should be given to the alternative methods prescribed by the VCC for the conversion of buildings at the least possible cost consistent with recognized standards for health and safety, as outlined in Part II of the USBC, known as the Virginia Rehabilitation Code.

IV. FINAL ORDER

The appeal having been given due regard, and for the reasons set out herein, the Review Board orders the decision of the City building official that using JB's as a night club constitutes a change of occupancy under the VCC, and the affirmation of that decision by the City VCC appeals board, to be, and hereby is, upheld.

Chairman, State Technical Review Board

Date Entered

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 Vernon W. Hodge, 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.

VIRGINIA:

BEFORE THE
STATE BUILDING CODE TECHNICAL REVIEW BOARD

IN RE: Appeal of Milari Madison
Appeal Nos. 13-3, 13-7 and 14-2

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Additional Documents Submitted by NTA, Inc.	#

VIRGINIA:

BEFORE THE
STATE BUILDING CODE TECHNICAL REVIEW BOARD

IN RE: Appeal of Milari Madison
Appeal Nos. 13-3, 13-7 and 14-2

REVIEW BOARD STAFF DOCUMENT

Suggested Statement of Case History and Pertinent Facts

1. In May of 2011, Milari Madison (Madison) purchased a modular home from Milton Homes Systems, Inc.[1] (Milton) for installation and erection on her property at 40153 Janney Street, in Loudoun County.

2. During and after installation of the home, Madison identified a number of problems and filed complaints with the State Buildings Codes Office (SBCO) of the Virginia Department of Housing and Community Development, the state administrator for the Virginia industrialized building program. SBCO staff visited the site and responded to Madison's complaints. Madison filed appeals of the SBCO responses to the Review Board, identified by Review Board staff respectively as Appeal Nos. 13-3 and 13-7.

3. Review Board staff conducted several informal fact-finding conferences, attended by Madison, SBCO staff and legal counsel, Milton representatives and legal counsel, Loudoun County building department staff and a representative of NTA, a compliance assurance agency involved in the manufacturing of the home.[2] The result of the final informal fact-finding conference was to merge the appeals for the purposes of scheduling a single hearing before the Review Board. It was also noted at

[1] Integrity Building Systems was the manufacturer, but Milton assumed responsibility through a successor by name change.
[2] Madison objected to NTA's participation by telephone at one conference and Milton's participation by telephone at a subsequent conference.

the final conference that an additional pending decision of the SBCO would likely be appealed, and that appeal, if filed, would also be merged for the single hearing. That did occur and the third appeal was identified by Review Board staff as Appeal No. 14-2.

4. As a result of the conference, the following are clarifications of the aspects of construction in question:

From the September 23, 2013 correspondence from the SBCO.

> Issue #3 – the first floor floor joists are perpendicular to the foundation wall in some places and parallel to the foundation wall in other areas and extend over the foundation wall approximately four inches to permit the installation of brick veneer on the outside of the foundation wall; therefore the band boards do not sit on the foundation.
>
> Issue #4 – this is relative to the first floor floor framing.
>
> Issue #5 – this is relative to whether the sections or modules are properly connected together.
>
> Issue #8 (see also the paragraph after Issue #12) – the issue with the chimney is the boxing-in of the chimney within the modules and its installation from the second floor ceiling to the termination of the chimney.

<u>Suggested Issues for Resolution by the Review Board</u>

(In relation to Appeal No. 13-7)

1. Whether to overturn the decisions of the SBCO that suggested issues for resolution numbers 2, 3, 5, 8 (excluding the portions of the chimney in the modules), 9, 10, 11 and 12 are governed by the Virginia Construction Code (VCC) (Part I of the Virginia Uniform Statewide Building Code) rather than the Virginia Industrialized Building Safety Regulations (IBSR), and if ruling to overturn any or all of those decisions, whether a violation of the IBSR exists for any or all of the aspects of construction identified in those issues.

2. (Issue #1 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that the lack of joist hangers under the sunroom is not a violation of the IBSR.

3. (Issue #3 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that the lack of blocking and joist hangers where the first floor floor framing cantilevers over the foundation walls is not a violation of the IBSR.

4. (Issue #4 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that the joist hangers are not in violation of the IBSR.

5. (Issue #5 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that no violations of the IBSR are present relative to the connection of the modules together.

6. (Issue #6 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that no violations of the IBSR exist relative to the placement of the compliance assurance labels on the home without the home being in compliance with the IBSR.

7. (Issue #7 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that no violation of the IBSR exists relative to the data plate and the number of stories, R-value specifications and square footage of the home.

8. (Issue #8 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that no violations of the IBSR exist relative to the (i) width of the stairs from the kitchen to the den, (ii) size and height of the chimney, (iii) knee walls being of unequal height, (iv) deviation of the overall dimensions of certain walls, (v) basement windows not lining up with the den and bathroom windows and (vi) different distances of the eave overhangs.

9. (Issue #9 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that the lack of or improper installation of the collar ties, or both, is not a violation of the IBSR.

10. (Issue #10 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that the hinged portions of the roof were not in violation of the IBSR.

11. (Issue #11 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that cutting roof rafters to create access from the attic or third level to the storage space above the master bedroom is not a violation of the IBSR.

12. (Issue #12 of the Sept. 6, 2013 SBCO decision) Whether to overturn the decision of the SBCO that the deviations in the roof alignment is not a violation of the IBSR.

13. Whether to overturn the decision of the SBCO that no violation of the IBSR exists relative to the data plate and the size of the electrical service.

(In relation to Appeal No. 13-3)

14. Whether to overturn the SBCO decision not to issue any notices of violation under the Virginia Industrialized Building Safety Regulations (IBSR) to NTA.

(In relation to Appeal No. 14-2)

15. Whether to overturn the decision of the SBCO that the length of the floor joists under the kitchen is not in violation of the IBSR.

16. Whether to overturn the decision of the SBCO that no violations of the IBSR exist relative to the placement of the seals and labels on the home prior to the approval of the plans by NTA.

(In relation to all appeals)

17. Whether any other issues identified by Madison are properly before the Review Board, and if so, whether to overturn the decision of the SBCO relative to any additional issues determined to be properly before the Review Board.

Appeal of Milari Madison
v. State Building Code Office
Appeal Nos. 13-3, 13-7 and 14-2

COMBINED DOCUMENTS SUBMITTED
BY BOTH PARTIES

Robert F. McDonnell
Governor

James S. Cheng
Secretary of
Commerce and Trade

William C. Shelton
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF
HOUSING AND COMMUNITY DEVELOPMENT

INDUSTRIALIZED BUILDING CONSUMER COMPLAINT FORM

Name of person(s) requesting assistance in resolving dispute: (please print)
Milari Madison

Building Project Information:

Owner: Milari Madison
Site Location-Street address: 40153 Janney St.
City: Waterford State: VA Zip code: 20197
Daytime phone: 540-882-3160 Evening or weekend phone:
E-mail address: huntermadison2002@yahoo.com
Date Certificate of Occupancy issued: not Date purchased: May 2011
Date delivered to site location: July 2011

Additional information - mailing address if different from site address:

Name:
Street Address:
City: State: Zip code:
Daytime phone: Evening or weekend phone:
E-mail address:

Manufacturer of building:

Name of manufacturer: IBS / Milton
Name of contact person at plant (if known): Richard Rowe
Street address: 2435 Housels Run Rd
City: Milton State: PA Zip code: 17847
Telephone: c/o Gina Schaecher, Rees Broome P.C.
1900 Gallows Rd. Ste. 700, Tysons Corner VA
22182 tel. 703-790-1911

Description of concerns:

See e-mail dated 3-9-13 and PDF

Madison seeks enforcement of IBSR (36-73) against DHCD Regulant NTA Inc. The industrialized building does not meet building code although NTA Inc. affixed such labels (36-79)

NTA Inc. failed to provide the notification to the SBCAO for units built by Milton. 13VAC 5-91-40. The SBCAO shall "take such other actions as are required to enforce this chapter". Under 13VAC 5-91-180, NTA Inc. affirms they will resolve all complaints. They have not. NTA states (13 VAC 5-91-200) and approves of the manufacturer's installation procedures. No installation guideline exist for 3 story houses. Barlow Engineering affirms the house is 3 stories, including extended unobstructed stairs to the 3rd floor. NTA Inc. approves the truss system which calls the roof a "cape" but erroneously calls the house a 2-story. No certification of three story or 2.5 stories exist for Milton. NTA Inc. failed to keep a list of labels issued to Milton (13 VAC 5-91-240) whereby Milton ended up with extra labels seeking a refund from DHCD. NTA Inc. failed to ensure that the data plate is complete or accurate (13 VAC 5-91-245). Because they failed to account for the 3rd floor, the design floor live load is incorrect, the R value is wrong, the special instructions for installing were incomplete and not up-to-date, and the electrical service rating is wrong. NTA failed to comply with 13VAC 5-91-250 1, 2, 3 and 4. NTA Inc. caused a failure of 13VAC-5-91-270 as the installation specs are not for 3 story units and no "approved" or stamped sheet exists.

[Please attach additional pages as necessary]

From data plate-state label # VA 2011-0695→0703 ?

Data Plate Information:

Serial number: 01-0611-1991 A thru I (9 boxes)

Virginia certification seal No.: F2-336774, F2-336773, F2-336772

Date manufactured: 7-14-11 F2-336769, F2-336770

F2-336768, F2-336766

Building purchased from:

Name: Darren McNott d/b/a Convenient Installations

Name of contact person:

Street address: 371 McKinnon Drive

City: Kilgore State: TX Zip code: 75662

Telephone: 903-932-0202

E-mail address:

Have you contacted the (manufacturer, retailer or installer) regarding your complaint?

Yes ✓ No ____ If Yes please specify below:

Person/firm contacted: David / Eric Tompos of NTA Inc. and Hilton

Date(s) Contacted: 305 North Oakland Ave. Box 490 Nappanee IN 46550

In writing or by phone? Both - many times

[Please attach additional pages as necessary]

Attach copies of all written correspondence to or from the manufacturer, retailer, installer, or owner. Also, attach copies of any other documentation to support your dispute. **Please note these documents will not be returned.**

Print Name of person submitting complaint: Milari Madison

Signature: Milari Madison Date: 3-9-13

Return this form and attachment documents to:

Department of Housing and Community Development
State Building Code Administrative Office
600 East Main Street
Suit 300
Richmond, VA 23219-1321
(804) 371-7160

THE APPEAL (APPEAL NO. 12-6)
IS WITHDRAWN FOR THE FOLLOWING
REASONS:

THE ISSUE OF WHETHER MILTON HOME
SYSTEMS, INC. IS THE SUCCESSOR
IN NAME TO INTEGRITY BUILDING
SYSTEMS, INC. IS MOOT AS RESOLVED
PURSUANT TO THE ATTACHED NOVEMBER
19, 2012 LETTER; AND

THE ISSUES RAISED IN THE APPEAL AS TO
POTENTIAL VIOLATIONS CONCERNING THE
STAIRWAY AND ELECTRICAL PANEL / DATA PLATE
REMAIN UNDER INVESTIGATION AND
MS. MADISON AND MILTON RETAIN THEIR RIGHTS
TO APPEAL ANY FINAL DETERMINATION
WITH REGARD TO THE APPLICATION OF THE
IBSR.

DATED: MARCH 15, 2013

Milan Madison Milan Madison appellant

Gina L. Schaecher, Counsel for Milton Home Systems, Inc.
GINA L. SCHAECHER, COUNSEL FOR
MILTON HOME SYSTEMS, INC

Mike F. Melis, Assistant Attorney General
Counsel to the State Building Code Administrative Office

Robert F. McDonnell
Governor

James S. Cheng
Secretary of
Commerce and Trade

COMMONWEALTH of VIRGINIA

William C. Shelton
Director

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

April 15, 2013

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

Dear Ms. Madison,

I am in receipt of the Industrialized Building Consumer Complaint Form that you submitted to this office on March 9, 2013. According to your complaint, you seek "enforcement of IBSR (36-73) against DHCD regulant NTA Inc."

The State Building Codes Office (SBCO) has been designated by the Virginia Department of Housing and Community Development to enforce the Virginia Industrialized Building Safety Regulations and acts as the building official for registered industrialized buildings.

NTA was the Compliance Assurance Agency (CAA) that contracted with the company now known as Milton Homes Systems, Inc., the manufacturer of a home you purchased, for evaluation, monitoring and inspection services under the IBSR. The SBCO approves and designates agencies that may serve as a CAA. A CAA provides oversight, but does not manufacture buildings or their components. As the CAA under contract with the manufacturer, NTA was responsible for evaluating, monitoring and inspecting the manufacture of the home. See 13 VAC 5-91-40(B). If a manufactured building is not code compliant, the SBCO looks to the manufacturer, not the CAA, to take corrective action.

The IBSR does not authorize the SBCO to issue notices of violation to a CAA or to require a CAA to correct violations. Under 13 VAC 5-91-40, the SBCO "shall have authority to issue inspection reports for corrections of violations caused by the manufacturer and to take such other actions as are required to enforce this chapter". Under 13 VAC 5-91-60, if the SBCO finds a violation of the IBSR, it shall order "the person responsible therefore to bring the building into compliance within a reasonable time, to be fixed in the order." This language contemplates that the violation of the IBSR for which the SBCO orders correction is a non-code compliant building that must be brought into compliance. The person responsible for creating the violation – the manufacturer – is the person to which the SBCO issues a notice of violation.

In this case, NTA did not manufacture any part of the home and your complaint does not identify a manufacturing defect in the home that was caused by NTA. The IBSR contains no provisions authorizing the SBCO to issue a notice of violation to NTA.

For the reasons stated above, we are unable to assist you in this matter.

Without commenting on whether you have the right to appeal the SBCO's decision regarding your complaint against NTA, 13 VAC 5-91-70 states: "Any person aggrieved by DHCD's application of this chapter shall be heard by the State Review Board established by § 36-108 of the Code of Virginia. Such appeal shall be submitted within 21 calendar days of receipt of DHCD's decision. A copy of the decision of DHCD to be appealed shall be submitted with the application for appeal. Failure to submit an application for appeal within the time limit established by this section shall constitute acceptance of DHCD's decision." By informing you of this provision, the SBCO is not conceding that the SBCO's decision regarding your complaint against NTA is subject to appeal.

Please feel free to contact me at 804-371-7161 if you have any questions regarding this correspondence.

Sincerely,

Cindy L. Davis

Cindy L. Davis, C.B.O., Director
State Building Codes Office
600 E. Main Street – Suite 300
Richmond, VA 23219

C: Mr. Emory Rodgers, Deputy Director
Mike Melis, OAG
Eric Tompos, P.E. – NTA, Inc.

Robert F. McDonnell
Governor

James S. Cheng
Secretary of
Commerce and Trade

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

William C. Shelton
Director

April 15, 2013

Mr. Eric Tompos
NTA Inc.
305 North Oakland Ave.
P.O. Box 490
Nappanee, IN 46550-0490

Dear Mr. Tompos:

The State Building Codes Office (SBCO) has received an official complaint related to oversight work performed by NTA for a single family dwelling manufactured by Milton Homes (formerly Integrity Building Systems), for Ms. Milari Madison, 40153 Janney Street, Waterford, Loudon County VA.

For your use and information, I have enclosed a copy of that complaint and the response to that complaint from this office.

As a result of that complaint and to ensure that NTA, as a Compliance Assurance Agency, continues to provide adequate oversight to ensure the safety of the residents of Virginia, we are requesting a meeting with you and/or representatives of NTA within the next 30 days, at our offices in Richmond, VA. We will review the approval procedures NTA followed during the course of design and construction of the aforementioned dwelling, as well as to review NTA's policies and procedures in general for all plants that utilize NTA as their CAA.

Please contact me by phone at (804) 371-7161 or email at cindy.davis@dhcd.virginia.gov to provide dates you are available for this meeting.

Sincerely,

Cindy L Davis

Cindy L. Davis, C.B.O., Director
State Building Codes Office

Enclosures

C: Emory Rodgers, Deputy Director
Mike Melis, Office of Attorney General
Eric Leatherby, Senior Construction Inspector II

EXHIBIT
tabbies
B

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
Technical Assistance Services Office (TASO) and Office of the State Technical Review Board
Main Street Centre, 600 E. Main Street, Suite 300, Richmond, Virginia 23219
Tel: (804) 371-7150, Fax: (804) 371-7092, Email: TASO@dhcd.virginia.gov

APPLICATION FOR ADMINISTRATATIVE APPEAL

Regulation Serving as Basis of Appeal (check one):

____ Uniform Statewide Building Code

____ Statewide Fire Prevention Code

_✓_ Industrialized Building Safety Regulations

____ Amusement Device Regulations

Appealing Party Information (name, address, telephone number and email address):

Milari Madison 540-882-3160
40153 Sunny St. Box 302 cindy.davis@dhcd.virginia.co
Waterford VA 20197 huntermadison2002@yahoo.com

Opposing Party Information (name, address, telephone number and email address of all other parties):

Cindy Davis, SBCO tel. 804-371-7161
DHCD
600 E. Main St. #300 Richmond VA 23219

Additional Information (to be submitted with this application)

- Copy of enforcement decision being appealed
- Copy of record and decision of local government appeals board (if applicable and available)
- Statement of specific relief sought

CERTIFICATE OF SERVICE

I hereby certify that on the 25 day of April, 2013 a completed copy of this application, including the additional information required above, was either mailed, hand delivered, emailed or sent by facsimile to the Office of the State Technical Review Board and to all opposing parties listed.

Note: This application must be received by the Office of the State Technical Review Board within five (5) working days of the date on the above certificate of service for that date to be considered as the filing date of the appeal. If not received within five (5) working days, the date this application is actually received by the Office of the Review Board will be considered to be the filing date.

Signature of Applicant: Milari Madison

Name of Applicant: Milari Madison
(please print or type)

Milari Madison
40153 Janney Street
Box 302
Waterford, VA 20197

April 25, 2013

In Re: Appeal to April 15, 2013 Davis Letter

The Davis Letter is predicated on the refusal by the SBCAO to apply the Industrialized Building SafetyRegulations ("IBR") under the auspice that the SBCAO does not have authority to do so with respect to the Compliance Assurance Agency ("CAA"). The Davis Letter inexplicably is a legal opinion that is inconsistent with the law and without merit[1]. The appeal question is therefore limited to: Does the SBCAO have the authority to enforce the IBR with respect to the CAA[2]?

The IBR states at 13 VAC 5-91-40, that "The SBCAO is designated as the administrator's representative **for the enforcement of this chapter** and shall act as the building official for registered industrialized buildings." In addition, the SBCAO shall have authority "**to take such other actions as are required to enforce this chapter**". At 13 VAC 5-91-90, the law states "In accordance with § 36-83 of the Code of Virginia, any person, firm or corporation violating **any provisions of this chapter** shall be considered guilty of a Class 1 misdemeanor and, upon

1 In the Madison Appeal (12-6), the SBCOA initially refused to enforce the code, stating that the manufacturer was no longer in business, which was erroneous. Then, upon irrefutable evidence to the contrary, the SBCAO further refused to apply the code claiming that the business changed their name and was no longer the responsible, a pattern of erroneous legal interpretations.

2 Pursuant to § 36-114, The Review Board shall have the power and duty to hear all appeals from decisions arising under application of the "rules and regulations implementing the Industrialized Building Safety Law (§ 36-70 et seq.)" § 36-71.1 defines a "Compliance assurance agency" as "an architect or professional engineer registered in Virginia, or an organization, determined by the Department to be specially qualified by reason of facilities, personnel, experience and demonstrated reliability, to investigate, test and evaluate industrialized buildings; to list such buildings complying with standards at least equal to those promulgated by the Board; to provide adequate follow-up services at the point of manufacture to ensure that production units are in full compliance; and to provide a label as evidence of compliance on each manufactured section or module.

conviction, shall be fined not more than $1,000." Clearly, the General Assembly contemplated that any person, firm or corporation *could* violate the code, not just the "manufacturer" and be subject to enforcement.

If the General Assembly intended that *the only party* to which the SBCAO has jurisdiction over through the administration of the IBR, they would have said so. They did not. In limiting the authority, there would be no contemplation of § 36-83 and § 36-70 as referenced and included in the IBR. § 36-71.1 defines "The law" or "this law" as "the Virginia Industrialized Building Safety Law as provided in this chapter", specifically defining and including the CAA[3].

In addition, the duties and obligation found within the IBR are nearly 50% attributable to a CAA. if the General Assembly wished to limit the enforcement of the IBR to just the manufacturer as Ms. Davis wishes, then nothing contained within the IBR would prescribe legal duties and obligations of the CAA. DHCD selected a CAA that has proved to have performed negligently and is simply refusing to apply the law to their hand-picked vendor or designee which is improper.

As a single example of NTA Inc's failure to comply with the IBR, NTA Inc. violated 13 VAC 5-91-40, section B, which states "The compliance assurance agency will notify the SBCAO within 30 days of signing a new contract or terminating an existing contract with any manufacturer." Mr. Melis, counsel for DHCD stated that NTA Inc. failed to provide the required notice to DHCD, but as part of the Complaint, filed and supplemented, the SBCAO states they only enforce the IBR against the manufacture which is contrary to the intention of the General Assembly.

> **From:** "Melis, Mike F." <mmelis@oag.state.va.us>
> **To:** Hunter Madison <huntermadison2002@yahoo.com>
> **Cc:** Cindy (DHCD) Davis <cindy.davis@dhcd.virginia.gov>
> **Sent:** Tuesday, December 18, 2012 1:58 PM
> **Subject:** RE: Document request
>
> Ms. Madison -

3 In Madison Appeal 12-6, Mr. Vernon Hodge, while at a fact finding conference in Leesburg, indicated that it would be proper for the SBCAO to issue a correction letter to the CAA regarding the erroneous data plate.

The SBCAO does not have any documents responsive to your request.

Mike F. Melis
Assistant Attorney General
Office of the Attorney General
900 East Main Street
Richmond, Virginia 23219
(804) 371-7965
(804) 371-2087 (fax)

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Tuesday, December 18, 2012 9:45 AM
To: Melis, Mike F.; Cindy (DHCD) Davis
Subject: Document request

As an alternative to a subpoena, do you have a copy of the notification letter NTA Inc. sent to "the SBCAO" required under 13 VAC 5-91-40, inspection and enforcement. "The compliance assurance agency will notify the SBCAO within 30 days of signing a new contract..." for the addition of Integrity Building Systems, Inc. (now Milton)? Can you kindly e-mail it to me or confirm that it does or does not exist?

Thank you.

Milari Madison

Specific Relief Sought

The Appellant requests that the TRB review the record as a whole and find that a CAA is subject to the IBR and the matter should be remanded back to SBCAO for enforcement and compliance as requested by the Appellant in the initial complaint and supplements as submitted to the Department.

Respectfully submitted,

COMMONWEALTH of VIRGINIA

Office of the Attorney General

Kenneth T. Cuccinelli, II
Attorney General

900 East Main Street
Richmond, Virginia 23219
804-786-2071
FAX 804-786-1991
Virginia Relay Services
800-828-1120
7-1-1

MAY 13 2013
AM

May 10, 2013

Via E-Mail (alan.mcmahan@dhcd.virginia.gov)
and U.S. Mail
Alan McMahan, Staff
State Building Code Technical Review Board
Virginia Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219

Re: Appeal of Milari Madison to the Review Board (Appeal No. 13-3)

Dear Mr. McMahan:

Pursuant to your April 26, 2013, e-mail message regarding this appeal, enclosed please find the SBCO's Response to Application for Administrative Appeal filed by Milari Madison. Thank you for your attention to this matter. Please feel free to call me at (804) 371-7965 if you have any questions or need any additional information.

Very truly yours,

Mike F. Melis,
Assistant Attorney General

cc: Cindy Davis
Milari Madison
Chris Thompson
Gina L. Schaecher
Eric Tompos

VIRGINIA:

BEFORE THE STATE BUILDING CODE TECHNICAL REVIEW BOARD

IN RE: Appeal of Milari Madison
Appeal No. 13-3

RESPONSE TO APPLICATION FOR ADMINISTRATIVE APPEAL

To the extent it is determined that an appeal is proper in this matter, the State Building Code Administrative Office, currently known as the State Building Codes Office ("SBCO"), of the Virginia Department of Housing and Community Development, states as follows in response to the Application for Administrative Appeal dated April 25, 2013 and filed by Milari Madison.

In the Application, Ms. Madison frames the issue on appeal as, "Does the SBCAO have the authority to enforce the IBR [Industrialized Building Safety Regulations or "IBSR"] with respect to the CAA [Compliance Assurance Agency]." And in her Industrialized Building Consumer Complaint Form ("the Complaint"), Ms. Madison stated that she seeks "enforcement of IBSR (36-73) against DHCD regulant NTA Inc. [a CAA]." Ms. Madison now asks the State Building Code Technical Review Board ("the Board") to "find that a CAA is subject to the IBR and that the matter should be remanded back to SBCAO for enforcement and compliance as requested . . . in the initial complaint and supplements submitted."

The SBCO interpreted Ms. Madison's Complaint as requesting that the SBCO issue a notice of violation or correction to NTA, which was the CAA that contracted with the manufacturer of a home purchased by Ms. Madison, regarding alleged IBSR violations.[1] In this regard, the SBCO's position is set forth in its April 15, 2013 letter to Ms. Madison, which is

[1] Ms. Madison previously filed a separate complaint against the manufacturer of her home, Milton Home Systems, Inc., which she brought to the Board in an appeal of the SBCO's response to that complaint. *See In Re: Appeal of Milari Madison,* Appeal No. 12-6.

attached as Exhibit A and incorporated into this Response. In short, a CAA does not manufacture buildings and, if a manufactured building is not code compliant, the SBCO looks to the manufacturer, not the CAA, to take corrective action. The language of the IBSR contemplates that a violation for which the SBCO orders correction is a non-code compliant building that must be brought into compliance. *See* 13 VAC 5-91-40, 5-91-60. The person responsible for creating the violation - the manufacturer - is the person to which the SBCO issues a notice of violation and the person required to bring the building into compliance.

The SBCO does not dispute that certain provisions of the IBSR (but not all) apply to a CAA and are enforced by the SBCO. But such enforcement is not by way of a notice of violation or correction under 13 VAC 5-91-40 or 5-91-60. For example, the SBCO approves and designates agencies that may serve as a CAA. A CAA that contracts with a manufacturer is responsible for evaluating, monitoring and inspecting the manufacture of a home. *See* 13 VAC 5-91-40(B). If a CAA like NTA demonstrates a pattern of failing to perform as required by IBSR provisions applicable to the CAA, the SBCO addresses this issue as part of its discretionary determination of which agencies it approves and designates for purposes of serving as a CAA. *See, e.g.,* 13 VAC 5-91-180, 5-91-200. In the instant matter, the SBCO has contacted NTA to initiate a review of procedures NTA followed during the course of the design and construction of Ms. Madison's home, as well as NTA's policies and procedures in general for all plants that utilize NTA as their CAA. *See* Apr. 15, 2013 Letter attached as Exhibit B.

For the foregoing reasons, the SBCO respectfully requests that Ms. Madison's appeal be dismissed as improper on grounds that the SBCO's response to Ms. Madison's Complaint was appropriate and consistent with the IBSR.

Respectfully submitted,

Department of Housing and Community Development – State Building Code Office

By: ______________________
Counsel

KENNETH T. CUCCINELLI, II
Attorney General

WESLEY G. RUSSELL, JR.
Deputy Attorney General

PETER R. MESSITT
Senior Assistant Attorney General

*MIKE F. MELIS (VSB# 43021)
Assistant Attorney General

Office of the Attorney General
900 East Main Street
Richmond, Virginia 23219
Tel: (804) 371-7965
Fax: (804) 371-2087
mmelis@oag.state.va.us

**Counsel of Record for the State Building Code Office*

CERTIFICATE OF SERVICE

I certify that on May 10, 2012, a true and accurate copy of the foregoing was forwarded by e-mail and by U.S. mail, first class, postage prepaid, to:

Milari Madison
40153 Janney Street
Post Office Box 302
Waterford, Virginia 20197
huntermadison2002@yahoo.com

Chris Thompson
Loudoun County Code Enforcement Division
1 Harrison Street
SE Mailstop #60b
Post Office Box 7000
Leesburg, Virginia 20177
Chris.Thompson@loudoun.gov

Gina L. Schaecher, Esq.
Rees Broome, PC
1900 Gallows Road, Suite 700
Tysons Corner, Virginia 22182
gschaecher@reesbroome.com

Eric Tompos
NTA, Inc.
305 North Oakland Avenue
Post Office Box 490
Nappanee, Indiana 46550-0490
tompos@ntainc.com

Mike F. Melis

VIRGINIA:

BEFORE THE STATE BUILDING CODE
TECHNICAL REVIEW BOARD

IN RE: Appeal of Milari Madison
Appeal No. 13- 3

MILTON HOME SYSTEMS, INC. STATEMENT CONTESTING JURISDICTION

Milton Home Systems, Inc., by and through counsel, respectfully submits that it is not a party in interest to the above- noted appeal and that therefore, the Board lacks jurisdiction to issue any determination as to Milton Home Systems, Inc. in the above- captioned appeal.

Pursuant to the Application For Administrative Appeal submitted by Ms. Madison on or about April 25, 2013, Ms. Madison is appealing the determinations contained in an April 15, 2013 from Cindy Davis to Milari Madison. In the April 15, 2013, Ms. Davis advises that the IBSR contains no provisions authorizing the SBCO to issue a notice of violation to NTA, Inc.

As the determination on appeal concerns only NTA, Inc. and the SBCO's authority to issue a violation to NTA, Inc., Milton Home Systems, Inc. respectfully submits that the April 15, 2013 from which Ms. Madison appeals, and the above- captioned appeal do not concern or relate to Milton Home Systems, Inc. as there has been no determination against and/or in favor of Milton Home Systems, Inc. in the April 15, 2013 letter. Consequently, Milton Home Systems, Inc. is not a party in interest, and the Board has no jurisdiction over Milton Home Systems, Inc. in this appeal. Milton Home Systems, Inc. cannot be a party to the above- captioned appeal.

Milton Home Systems, Inc. is not a party to this appeal and must be released for any and all alleged obligation to participate and/or appear in, and/or respond to this appeal.

Dated this 10th day of May, 2013.

MILTON HOME SYSTEMS, INC.

By Counsel:

REES BROOME, P.C.

Gina L. Schaecher, Esq. (VSB #70281)
Leesburg Area Office
39959 Catoctin Ridge Street
Paeonian Springs, Virginia
(540) 882-4747 – Telephone
(540) 882-4603 – Facsimile
gschaecher@reesbroome.com

1900 Gallows Road, Suite 700
Tysons Corner, Virginia 22182
(703) 790-1911 - Telephone
(703) 848-2530 - Facsimile
Counsel for Milton Home Systems, Inc.

CERTIFICATE OF SERVICE

The undersigned certifies that on this 10th day of May, 2013, a true and correct copy of Milton Home Systems, Inc.'s Statement Contesting Jurisdiction was served on the following via electronic transmission:

Milari Madison
40153 Janney Street
Post Office Box 302
Waterford, Virginia 20197
huntermadison2002@yahoo.com

Michael Melis, Esq.
Assistant Attorney General
Office of the Attorney General
900 East Main Street
Richmond, Virginia 23219
mmelis@oag.state.va.us
Counsel for State Building Codes Office
Virginia Department of Housing & Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219

Alan McMahan
State Building Code Technical Review Board
Virginia Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219
alan.mcmahan@dhcd.virginia.gov

Gina L. Schaecher, Esquire

Robert F. McDonnell
Governor

James S. Cheng
Secretary of
Commerce and Trade

COMMONWEALTH of VIRGINIA

DEPARTMENT OF
HOUSING AND COMMUNITY DEVELOPMENT

William C. Shelton
Director

INDUSTRIALIZED BUILDING CONSUMER COMPLAINT FORM

Name of person(s) requesting assistance in resolving dispute: (please print)

Milari Madison

Building Project Information:

Owner: Milari Madison

Site Location-Street address: 40153 Janney St.

City: Waterford State: VA Zip code: 20197

Daytime phone: 540-882-3160 Evening or weekend phone:

E-mail address: huntermadison2002@yahoo.com

Date Certificate of Occupancy issued: Not Date purchased: May 5, 2011

Date delivered to site location: late July 2011

Additional information - mailing address if different from site address:

Name:

Street Address:

City: State: Zip code:

Daytime phone: Evening or weekend phone:

E-mail address:

Manufacturer of building:

Name of manufacturer: Integrity Building Systems Inc. Now d/b/a "Millbrook"

Name of contact person at plant (if known):

Street address:

City: State: Zip code:

Telephone:

Revised 01-01-2012

Data Plate Information:

Serial number: 01-06-11-1991 A through I (9 boxes) VA 2011-0695-0705

Virginia certification seal No.: F2-336774, F2-336773, F2-336772, F2-336769, F2-336770

Date manufactured: 7-14-11 F2-33678, F2-336766

Building purchased from:

Name: Milton and Milton's dealer, Darren McNutt

Name of contact person: Richard Rowe, Milton's President

Street address: c/o Gina Schaecher Rees Broom 1900 Gallows Rd #700

City: Tysons Corner VA 22182 State: (PA Company) Zip code:

Telephone: 703-790-1911

E-mail address: rrrjr@windstream.net

Have you contacted the (manufacturer, retailer or installer) regarding your complaint?

Yes X No If Yes please specify below:

Person/firm contacted: Richard Rowe

Date(s) Contacted: numerous

In writing or by phone? both

[Please attach additional pages as necessary]

Attach copies of all written correspondence to or from the manufacturer, retailer, installer, or owner. Also, attach copies of any other documentation to support your dispute. **Please note these documents will not be returned.**

Print Name of person submitting complaint: Milan Marsic

Signature: Milan Marsic Date: July 25, 2013

Return this form and attachment documents to:

Department of Housing and Community Development
State Building Code Administrative Office
600 East Main Street
Suit 300
Richmond, VA 23219-1321
(804) 371-7160

Revised 01-01-2012

Madison "concerns" dated July 25, 2013, under protest.

Complainant states that issues have already been identified to DHCD and wishes to adopt by reference and inclusion any complaints already filed against Milton and NTA Inc., including supplements, for DHCD to require corrections by the manufacture or NTA Inc. Complainant asserts that the list may continue to grow as a result of additional inspections continue to yield new problems.

No joist hangers under the sun-room as shipped from the factory (deviation from approved plan specifications). I have e-mailed a photo of the joists without hangers or support under the sunroom.

One of the joist hangers under the den has been improperly fastened to the joist. I have e-mailed a photo of it.

Milton prepared the foundation plan and did the engineer work to calculate the load for the support beams, see sub-set F1. Portions of the house cantilever over the foundation (mostly identified as Section B-B) while the July 14, 2011 approved plan, by NTA Inc., shows that the house does not cantilever over the foundation wall, for example, at page 14 of 94. In reality, as built at the factory, there is no blocking and no joist hangers where the first floor cantilevers over the foundation wall which is inconsistent with the approved plan. There are no joist hangers where the house sits over the foundation wall. My concern is that the deviation from the approved plan has resulted in a code violation regarding load and the manner in which the house is supposed to be installed.

According to the Simpson product literature, the joist hangers are undersized. This may be contributing to the deflection problem. Simpson recommends that the joist hangers be at least 60% of the joist height, (see page three letter O of their documentation). The approved plan calls for "typical joist hangers". The joist hangers as seen in the basement that support the first floor measure 4.5". The joist is 9.25, or a 2 x 10. I am concerned that the hangers utilized and improperly concealed are undersized as well. This issue should be clarified with the factory as to what they actually used in the parts of the house that are now concealed by Milton's "dealer" and Milton's own staff that assisted in the installation.

The installer failed to contact the building official before concealment (USBC 424.5), so it is unknown if the manufacturer's installation procedures were followed where the concealments occurred. As visible from the basement and above the master bedroom, there are no through bolts. The only two lag bolts that appear to have been installed are two, under the sunroom, but they are not through bolts as called for in the plan. Milton's dealer's brother screwed some screws in certain bays also seen in the basement. It is unclear if this is an acceptable substitute as called for in the approved plan.

Compliance assurance labels have been affixed to the house when the building does not meet code:

> § 36-79. Effect of label of compliance assurance agency. Any industrialized building shall be deemed to comply with the standards of the Board when bearing the label of a compliance assurance agency

The data plate remains uncorrected and inaccurate specific to the the fact the house is three stories, not two (see Barlow Engineering corrected document calling out the "3rd" floor in the November 16, 2012 document which is found within the July 14, 2011 approved document from NTA Inc. Barlow notes that they failed to call out the space as a "habitable attic" in the e-mail sent to the Chris Thompson, Loudoun County). In the November 19, 2012 correction letter from DHCD, the space is referred to as the "third" floor as well. Applicable code defines "STAIRWAY" as "one or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another." "STORY" as "that portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above." "ATTIC, HABITABLE" as "a finished or unfinished area, not considered a story, complying with all of the following requirements"

1. The occupiable floor area is at least 70 square feet (17 m2), 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.

My concern is that the data plate is incorrect because what was actually shipped to me is at least a two and a one-half story house, not a two story house. NTA Inc's legal counsel stated in Court that the house is a two and a half story house. The fact that the living space is significantly increased by this space also makes the data plate incorrect in terms of the R value calculation and the overall square footage.

It should be noted at all times relevant neither Milton nor their dealer/distributor was authorized to engage in business in the Commonwealth.

The approved plan and what was delivered are not consistent for other things, for example, width of stairs from kitchen to den, the size and height of the chimney as built and installed by Milton, the "permit" drawings provided by NTA Inc. shows the third floor space with two walls (knee walls) of equal height, creating the interior living space. The factory built and installed walls that are of unequal height. The overall dimensions of certain exterior walls deviate, perhaps causing the misalignment with the foundation. The basement windows found under the den do not fall centered below the windows installed in the den and bathroom. The eave overhangs are of different distances.

The letter from the truss manufacturer indicates that the collar ties were not installed properly and are lacking. This letter has been emailed to DHCD on July 25, 2013. The truss manufacturer has indicated that the portions of the roof that were hinged at the factory were possibly the wrong size, a deviation of the approved plan. Milton staff cut roof joists to cause an opening from the third floor living space to the storage space above the master bedroom without the engineered stamped approval. The roof over the main block is lumpy and has a significant roll. I am concerned that the deviation in size and the lack of collar ties has caused a violation in the building code, knowing the trusses were not installed in compliance with the manufacturers' recommendations. I am concerned that the roof over the master bedroom cannot support the load, including the load of the brick.

VIRGINIA ACTS OF ASSEMBLY -- 2010 SESSION

A

CHAPTER 77

An Act to amend and reenact §§ 36-73 and 36-82.1 of the Code of Virginia, relating to the Industrialized Building Safety Law.

[H 313]

Approved March 9, 2010

Be it enacted by the General Assembly of Virginia:

1. That §§ 36-73 and 36-82.1 of the Code of Virginia are amended and reenacted as follows:

§ 36-73. Authority of Board to promulgate rules and regulations.

The Board shall from time to time promulgate rules and regulations prescribing standards to be complied with in industrialized buildings for protection against the hazards thereof to safety of life, health and property and prescribing procedures for the administration, enforcement and maintenance of such rules and regulations. The standards shall be reasonable and appropriate to the objectives of this law and within the guiding principles prescribed by the General Assembly in this law and in any other law in pari materia. The standards shall not be applied to manufactured homes defined in § 36-85.3.

In making rules and regulations, the Board shall have due regard for generally accepted safety standards as recommended by nationally recognized organizations, ~~such as the Building Officials and Code Administrators International, Inc., the Southern Building Codes Congress, the International Conference of Building Officials,~~ *including but not limited to the International Code Council and* the National Fire Protection Association ~~and the Council of American Building Officials~~.

Where practical, the rules and regulations shall be stated in terms of required levels of performance, so as to facilitate the prompt acceptance of new building materials and methods. Where generally recognized standards of performance are not available, the rules and regulations of the Board shall provide for acceptance of materials and methods whose performance has been found by the Department, on the basis of reliable test and evaluation data presented by the proponent, to be substantially equal in safety to those specified.

§ 36-82.1. Appeals.

~~Appeals from local building officials, compliance assurance agencies, or manufacturers of industrialized buildings concerning~~ *Any person aggrieved by* the Department's application of the rules and regulations of the Industrialized Building Safety Law shall be heard by the State Building Code Technical Review Board established by § 36-108. The Technical Review Board shall have the power and duty to render its decision in any such appeal, which decision shall be final if no further appeal is made.

CHAPTER 63

An Act to amend and reenact §§ 36-105 and 36-114 of the Code of Virginia, relating to the Uniform Statewide Building Code; appeals to the local board of Building Code appeals and the State Technical Review Board.

[H 312]

Approved March 9, 2010

Be it enacted by the General Assembly of Virginia:

1. That §§ 36-105 and 36-114 of the Code of Virginia are amended and reenacted as follows:

§ 36-105. Enforcement of Code; appeals from decisions of local department; inspection of buildings; inspection warrants; inspection of elevators.

A. Enforcement generally. Enforcement of the provisions of the Building Code for construction and rehabilitation shall be the responsibility of the local building department. There shall be established within each local building department a local board of Building Code appeals whose composition, duties and responsibilities shall be prescribed in the Building Code. ~~Appeals from the local building department concerning~~ *Any person aggrieved by the local building department's* application of the Building Code or refusal to grant a modification to the provisions of the Building Code ~~shall first lie~~ *may appeal* to the local board of Building Code appeals. No appeal to the State Building Code Technical Review Board shall lie prior to a final determination by the local board of Building Code appeals. Whenever a county or a municipality does not have such a building department or board of Building Code appeals, the local governing body shall enter into an agreement with the local governing body of another county or municipality or with some other agency, or a state agency approved by the Department for such enforcement and appeals resulting therefrom. For the purposes of this section, towns with a population of less than 3,500 may elect to administer and enforce the Building Code; however, where the town does not elect to administer and enforce the Building Code, the county in which the town is situated shall administer and enforce the Building Code for the town. In the event such town is situated in two or more counties, those counties shall administer and enforce the Building Code for that portion of the town ~~which is~~ situated within their respective boundaries. Fees may be levied by the local governing body in order to defray the cost of such enforcement and appeals.

B. New construction. Any building or structure may be inspected at any time before completion, and shall not be deemed in compliance until approved by the inspecting authority. Where the construction cost is less than $2,500, however, the inspection may, in the discretion of the inspecting authority, be waived. A building official may issue an annual permit for any construction regulated by the Building Code. The building official shall coordinate all reports of inspections for compliance with the Building Code, with inspections of fire and health officials delegated such authority, prior to issuance of an occupancy permit.

C. Existing buildings and structures.

1. Inspections and enforcement of the Building Code. The local governing body may also inspect and enforce the provisions of the Building Code for existing buildings and structures, whether occupied or not. Such inspection and enforcement shall be carried out by an agency or department designated by the local governing body.

2. Complaints by tenants. However, upon a finding by the local building department, following a complaint by a tenant of a residential dwelling unit that is the subject of such complaint, that there may be a violation of the unsafe structures provisions of the Building Code, the local building department shall enforce such provisions.

3. Inspection warrants. If the local building department receives a complaint that a violation of the Building Code exists that is an immediate and imminent threat to the health or safety of the owner, tenant, or occupants of any building or structure, or the owner, occupant, or tenant of any nearby building or structure, and the owner, occupant, or tenant of the building or structure that is the subject of the complaint has refused to allow the local building official or his agent to have access to the subject building or structure, the local building official or his agent may present sworn testimony to a magistrate or a court of competent jurisdiction and request that the magistrate or court grant the local building official or his agent an inspection warrant to enable the building official or his agent to enter the subject building or structure for the purpose of determining whether violations of the Building Code exist. The local building official or his agent shall make a reasonable effort to obtain consent from the owner, occupant, or tenant of the subject building or structure prior to seeking the issuance of an inspection warrant under this section.

4. Transfer of ownership. If the local building department has initiated an enforcement action against the owner of a building or structure and such owner subsequently transfers the ownership of the building

or structure to an entity in which the owner holds an ownership interest greater than 50%, the pending enforcement action shall continue to be enforced against the owner.

5. Elevator, escalator, or related conveyance inspections. The local governing body shall, however, inspect and enforce the Building Code for elevators, escalators, or related conveyances, except for elevators in single- and two-family homes and townhouses. Such inspection shall be carried out by an agency or department designated by the local governing body.

§ 36-114. Board to hear appeals.

The Review Board shall have the power and duty to hear all appeals from decisions arising under application of the Building Code, the ~~amusement device regulations~~ *Virginia Amusement Device Regulations adopted pursuant to § 36-98.3*, the Fire Prevention Code adopted under the Statewide Fire Prevention Code Act (§ 27-94 et seq.), *and rules and regulations implementing* the Industrialized Building Safety Law (§ 36-70 et seq.), ~~the Virginia Manufactured Housing Construction and Safety Standards Law (§ 36-85.2 et seq.), and the Virginia Certification Standards adopted by the Board of Housing and Community Development,~~ and to render its decision on any such appeal, which decision shall be final if no appeal is made therefrom. 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.

Robert F. McDonnell
Governor

James S. Cheng
Secretary of
Commerce and Trade

COMMONWEALTH of VIRGINIA

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

William C. Shelton
Director

SEP 23 2013
AM

September 23, 2013

Mr. Richard R. Rowe Jr.
Milton Home Systems, Inc.
2435 Housels Run Road
Milton, PA 17847

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

RE: Consumer complaints – Milari Madison vs Integrity Building Systems, Inc.
Industrialized Building Serial #01-0611 A thru I

Dear Mr. Rowe and Ms. Madison,

The Virginia State Building Codes Office (SBCO) has been designated by the Department of Housing and Community Development to enforce the Virginia Industrialized Building Safety Regulations (IBSR). The SBCO acts as the building official for Virginia registered industrialized buildings and has the authority to require the correction of IBSR violations caused by the manufacturer in the plant. Pursuant to 13 VAC 5-91-100(B) all site work associated with the installation or erection of an industrialized building is subject to the Uniform Statewide Building Code (USBC) which is enforced by the local building official.

This office received the attached complaint Dated July 25, 2013 from the above referenced consumer regarding potential building code violations that may have been introduced into her home during construction by Integrity Building Systems, Inc., now doing business as Milton Home Systems, Inc. The complaint was forwarded to Milton's legal counsel, Gina L. Schaecher, Rees Broome, P.C. on August 27, 2013.

Portions of the above referenced home located at 40153 Janney Street, Waterford, VA, were constructed by Integrity Building Systems, Inc., in their Pennsylvania manufacturing facility on July 14, 2011. The completed home consists of:

- Nine modular units constructed in the PA plant bearing the required certification seals for Virginia. The plant construction portion of these units is regulated under the IBSR.
- One panelized section (sunroom) assembled on site, regulated by the USBC
- One foundation with full basement constructed on site, regulated by the USBC.

A site inspection was conducted at the home on September 6, 2013 by Eric Leatherby, SBCO, to examine the issues raised in Ms. Madison's complaint. The issues will be addressed below in the order that they were presented in the complaint. Ms. Madison's complaints are shown in bold type and are followed by the SBCO response based on the report and information provided by Mr. Leatherby.

1. **No joist hangers under the sun-room:** The sun-room was panelized, open construction, completed on-site and not subject to the IBSR. This issue is under the jurisdiction of the local building official and subject to the USBC. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

2. **One of the joist hangers under the den has been improperly fastened to the joist:** As shown on the attached picture, one joist hanger is not securely fastened to the band joist. Additionally, it was observed that four joist hangers were not installed under the family room to the band joist (see attached photo). This is a violation of the IBSR and must be corrected by the manufacturer.

3. **There is no blocking and no joist hangers where the first floor cantilevers over the foundation wall which is inconsistent with the approved plan:** The plans that Integrity Building Systems submitted to NTA for review and which NTA stamped as code compliant and which were submitted to the building official for the issuance of a permit, showed the home sitting flush on the foundation with no cantilever. Any deviations from the approved plan due to the construction of the foundation may require consultation with a local professional engineer and the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation..

4. **According to the Simpson product literature, the joist hangers are undersized. Simpson recommends that the joist hangers be at least 60% of the joist height. The joist hangers in the basement are 4.5". The joist is 9.25":** A product manufacturer's or distributor's recommendation is not a code requirement. Follow up with the technical support division of Simpson was conducted and confirmed. No code violation exists.

5. **The installer failed to contact the building official before concealment, so it is unknown if the manufacturer's installation procedures were followed where concealments occurred. As visible from the basement and above the master bedroom, there are no through bolts:** The issue of attachment of the modular units to each other is under the jurisdiction of the local building official and is not in violation of the IBSR. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

6. **Compliance assurance labels have been affixed to the house when the building does not meet code:** The labels are not, of and in themselves a violation. Notices are sent by the SBCO to correct any code violations that occurred in the plant.

7. **The data plate remains uncorrected and inaccurate specific to the fact the house is three stories not two...The fact that the living space is significantly increased by this space** (habitable attic) **also makes the data plate incorrect in terms of the R value calculation and the overall square footage:** The data plate is correct in identifying the factory built portion of the home as two stories. The building plans that were reviewed and approved by NTA and submitted for permitting, identify the home as "Two-Story". Subsequent to the home being installed, additional site work was performed in the unfinished attic including the installation of drywall on the walls and ceiling, finished flooring, electrical outlets and heating and air conditioning. All of the work and code requirements related to this additional site work were not included or approved by NTA and are not regulated by the IBSR. The additional site work falls under the jurisdiction of the USBC and the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

8. **The approved plans and what was delivered are not consistent i.e. width of stairs from kitchen to den; size and height of the chimney; knee walls are of unequal height; the overall dimensions of certain walls deviate; basement windows under the den do not fall centered below the windows installed in the den and bathroom; the eave overhangs are of different distances:** None of these issues constitute a violation of the IBSR.

9. **Collar ties were not installed properly and are lacking:** The home has a hinged roof system which was raised at the building site and therefore the collar ties would have to be site installed and is under the jurisdiction of the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

10. **The truss manufacturer has indicated that the portions of the roof that were hinged at the factory were possibly the wrong size:** During the September 6, 2013 inspection Mr. Leatherby did not observe any apparent code violations or any substantial deflection or failure of the roof system. No violation of the IBSR is indicated.

11. **Milton staff cut roof joists to cause an opening from the third floor living space to the storage space above the master bedroom without the engineered stamped approval:** Site work is under the jurisdiction of the local building official. Alterations made on site to the approved construction may require consultation with a professional engineer and the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

12. **The roof over the main block is lumpy and has a significant roll:** During the September 6, 2013 inspection a visual examination of the roof from the exterior and portions of the attic did not indicate a structural failure or excessive deflections. No violation of the IBSR is indicated.

In addition to above enumerated items, during the September 6, 2013 inspection Ms. Madison expressed concern regarding the adequacy of the framing of the fireplace flue chase and its' ability to support the brick chimney: The framing and the installation of the chimney flue were performed on site and is under the jurisdiction of the local building official and the USBC. No violation of the IBSR is indicated.

In an attempt to provide closure to other outstanding issues related to Ms. Madison's home, this office makes the following findings:

Ms. Madison has previously stated that the data plate is also in error by identifying the electrical service as 200 amps instead of 400 amps: The building plans and the electrical calculations for the home and that were reviewed and approved by NTA show a 200 amp service (it should be noted that the calculations performed indicated a 100 amp load). On-site electrical work was not considered in the approved service load calculations. Two 200 amp service panels have been installed in the home. Based on drawing and documents provided, it is our determination that one panel was wired for factory installed outlets and fixtures. The other panel was shipped lose and provided for site installed outlets and equipment that corresponds to the electrical invoice submitted by Billy's Electrical Service for work performed on site. Milton Homes has acknowledged that the second 200 amp panel was supplied by the manufacturer at Ms. Madison's request and was shipped loose for installation on-site. Therefore the data plate is correct and no violation of the IBSR exists.

A previous notice of violation required that an apparent headroom violation between the first and second floor be corrected. Based on Mr. Leatherby's inspection on September 6, 2013, that violation has been corrected. As such, a violation of the IBSR no longer exists.

In conclusion this office finds Milton to be responsible for the issue of joist hangers as identified in item #2 and requires corrective action within the next twenty (20) calendar days. We also find as indicated many site related issues that should be forwarded to the local building official for investigation and resolution.

Any person aggrieved by DHCD's application of this chapter shall be heard by the State Technical Review Board established by 36-108 of the Code of Virginia. Such appeal shall be submitted within 21 calendar days of receipt of DHCD's decision. A copy of the decision of DHCD to be appealed shall be submitted with the application or appeal. Failure to submit an application for appeal within the time limit established by the section shall constitute acceptance of the DHCD's decision.

I can be reached at 804-371-7161 or by email at cindy.davis@dhcd.virginia.gov should you have any questions.

Sincerely,
Cindy L. Davis

Cindy L. Davis, C.B.O., Director
State Building Codes Office

cc:	Mike F. Melis	Christopher Thompson	Eric Leatherby
	Emory Rodgers	David Tompos, Sr.	Vernon Hodge
	Steve Rodgers	Gina Schaecher	Alan McMahan

Milari Madison
40153 Janney Street
Waterford, VA 20197
tel: 540-882-3160

APPEAL TO SEPTEMBER 23, 2013 DAVIS LETTER

PARTIES

In all relevant documents, Mr. Darren McNutt d/b/a Convenient Installation was identified as the "dealer", "contractor", "agent", and "distributor" by Milton, now residing in Texas. Mr. McNutt was unlicensed to conduct business in Virginia although held-out by Milton as a vetted and qualified contractor.

Milton Home Systems, Inc., f/k/a Integrity Building Systems, Inc. ("Milton") is a Pennsylvania corporation. At all times relevant, Milton was a manufacturer of modular or industrialized buildings, identified as the "manufacturer" in the House Contract. Milton is identified as the "Designer/Contractor" in the Compliance Certificate found within the NTA Approved House Document dated July 14, 2011. Milton was unlicensed to conduct business in Virginia and unlicensed to perform contracting services upon the house. Milton utilized Mr. McNutt as an agent to negotiate the contract and to perform work as a building contractor.

NTA, Inc. ("NTA) is an Indiana corporation and designated compliance assurance agency.[1] NTA and modular manufacturers are subject to the

1 At 13 VAC 5-91-10, a compliance assurance agency means "an architect or professional engineer registered in Virginia, or an organization, determined by DHCD to be specially qualified by reason of facilities, personnel, experience, and demonstrated reliability, to investigate, test and evaluate industrialized buildings; to list such buildings complying with standards at least equal to this chapter; to provide adequate follow-up services at the point of manufacture to ensure that production units are in full compliance; and to provide a label as evidence of compliance on each manufactured section or module."

Industrialized Building Safety Regulations ("IBSR"). In order to become a CAA and in accordance with IBSR section 13 VAC 5-91-200, NTA made extensive representations regarding services and protocol involved in the inspection, certification of documents, standards, and the resolution of all complaints. Although a CAA is required to be independent, the NTA and Milton contract affords NTA with broad and full indemnification against negligence and other claim by third parties. NTA directly benefited from the Madison project, has been a named defendant in ongoing litigation, and is serving as an expert for Milton in the same litigation. NTA is not independent.

STATEMENT OF FACTS

Ms. Madison entered a contract with Milton's distributor/agent, Mr. McNutt, and a performance agreement directly with Milton, for the purchase of a custom "two-story modular home" that consisted of nine boxes. Milton actively and directly engaged in the sale and design of the house, provided a factory tour, made a sales call to Ms. Madison's residence, performed site visits to the installation site, provided a pre-payment cash discount to the price of the house, provided company literature, worked directly with other subcontractors (HVAC and foundation) involved in the project, exchanged numerous emails and telephone calls with Ms. Madison, and provided the first design schematic in December 2009 in order to secure the May 5, 2011 contract.

Ms. Madison entered into the Performance Agreement directly with Milton on May 4, 2011 as a prerequisite to signing the House Contract with Milton's distributor/agent. The executed House Contract with Mr. McNutt served as an attachment to the Milton Performance Agreement upon which Milton agreed to "stand behind and guarantee the performance" of the House Contract. The approved house plan by Ms. Madison was the only schematic approved by Ms. Madison for the building design and layout as provided in writing and was attached to the Performance Agreement. The NTA Approved House Document, is different than the house plan schematic approved by Ms. Madison. Under the contract, any alterations to the design, as signed off by Ms. Madison, were required to be in writing and signed by both parties.

On June 27, 2011, Ms. Madison's units F, G, H and I were red-tagged by NTA. The Approved House Document was stamped and certified by NTA on July 14, 2011, certifying that the house plan met the building code requirements set forth in the IBSR. Established under 13 VAC 5-91-200, NTA affirms to the state and public under oath that Milton must "...conform to NTA's procedures or the agreed upon requirements of the client." (ISSOP 5.2, provided to DHCD). On July 13, 2011, NTA issued the compliance assurance labels, one day prior to the approval of the Approved House Document and one day prior to the production date of the house. The house data sheet states the house was manufactured on July 14, 2011, the same day of the approval document. It is impossible that NTA inspected the units, for compliance assurance, prior to the certification that the house met applicable code and prior to the manufacture of house. In other words, there was no way that NTA could certify and inspect that the house was built per the Approved House Document, or that Milton relied upon the document for building specifications and production, when the Approved House Document did not exist.

Found within the NTA Approved House Document is an engineering document prepared by Barlow Engineering. P.C. On November 16, 2012, Barlow Engineering corrected the original engineering document, as found in the July 14, 2011, NTA Approved Hose Document, to properly designate the third floor as habitable attic space, designed and built with an unobstructed and permanent stairway. Although the stairs from the second floor to the third floor were installed at the factory, and they are shown in the NTA Approved House Document delineated as "up", Milton and NTA misrepresented that the house was a two story home. In addition, NTA's lawyer conceded in open court that the house as provided to Ms. Madison, was a "two-story cape", a different model than a two-story.

It should be clear, the house as manufactured and altered by Milton is inconsistent with the NTA Approved House Document, never approved or required to be approved by Ms. Madison. Section 13 VAC 5-91-250 of the IBSR provides that "[t]he design of the building has been found by a compliance assurance agency to be in full compliance with this chapter. Approved designs shall be evidenced by the stamp and date of approval on each design sheet by the compliance assurance agency..." and "[t]he compliance assurance agency has conducted any necessary testing and evaluation of the building and its component parts." Because Milton and NTA were responsible for the plans and house, that proved to be defective, they are responsible for the corrections.

On July 15, 2011, the house shipped to a nearby staging area to the erection site. Milton, the manufacturer, participated and was on site during the initial house set-up and later returned on a piece-meal basis to continue the installation and to cure manufacturing defects, including code violations. For example, one evening, without adequate lighting or notice, Ms. Madison happened to go to the house and found Milton staff preparing to further cut and enlarge the third floor stairway opening. Milton already demolished a wall from the second floor, along the staircase, to the third floor, leaving dangling hot electric wires and unguarded openings. Ms. Madison asked to look at the plan dated August 25, 2011, that Milton staff was utilizing without permits or written approval. The spiral stair plan was not approved by NTA, as required under the IBSR, but was prepared by Mr. Patrick O'Toole. Ms. Madison pointed out that the plan would not work because it proposed that a center pole for a spiral staircase would rest upon the voided space of the staircase below. Milton staff consulted with their supervisor, agreed the plan would not work, and never returned.

By installing an unobstructed staircase, from floor two to floor three at the factory, with a ¾ inch plywood floor, Milton manufactured a two and one half story house or a three story house. However, for the purpose of the instant complaint, the SBCO wishes for the parties to believe that a mislabeled house and erroneous data plate becomes the model with the mislabel. It is inconsistent with the intent of the building code to accept that a mislabel, then not expect compliance with the code. For example, a bathroom mislabeled as a closet does not make it a closet; it needs to meet applicable code for a bathroom regardless--- Just as the third floor, habitable attic, was manufactured into the house.

Ms. Madison secured a building permit on March 29, 2011, based on an approved project by the county's Historic District Review Committee. The purpose of securing the permit was to demonstrate reliance upon and affirmative action based on the county's approval. Neither Milton nor Mr. McNutt ever obtained a building permit for the erection and installation of the house, or for any alterations and repairs, as required under the law.

After the house was partially set, Ms. Madison contacted the local code official. Pursuant to 13 VAC 5-91-100, "[a]ll building officials are authorized by § 36-81 of the Code of Virginia to enforce the provisions of this chapter and shall be responsible for and authorized to... [n]otify the SBCAO of any apparent violations of this chapter to include defects and noncompliance. " Instead of contacting the SBCAO, the county code official brought his brother-in-law to the site to provide Ms. Madison with a plan and quotation dated October 15, 2011, to remedy one of the code violations; the stairs from the second floor to the third floor that dead-ended into the roofline. In an effort to quickly resolve the matter, the quotation and plan was shared with Milton; however, they declined to remediate the code violation.

On April 9, 2012, DHCD's Eric Leatherby and Cindy Davis, NTA, former counsel for Milton, and the Loudoun County Code Official visited the house. As a result of the inspection, NTA produced an inspection report but has refused to provide it to DHCD or Ms. Madison. The TRB is encouraged to subpoena the document in an effort to understand the facts.

By affixing the labels to the industrialized units and by stamping the construction plans, Milton and NTA erroneously represented that the house was something it was not; it did not meet code, had deficiencies and deviations from the Approved House Documents, including code violations manufactured into the house by Milton, and among other thins, was not a two story house.[2]

ISSUES FOR APPEAL

The September 23, 2013 Davis Letter ("September Davis Letter") states that the SBCO has "authority to require the correction of IBSR violations caused by the manufacturer *in the plant*." (Paragraph 1, Page 1). The SBCO has the authority to require the correction of violations caused by the CAA and the manufacturer on-site as well. If the General Assembly intended to limit the corrections to "in plant" violations only, as stated in the September Davis Letter, it would have said so. Under 13 VAC 5-91-40, "The SBCAO shall have authority to issue inspection reports for correction of violations **caused by the manufacturer and to take such other actions as are required to enforce this chapter**." Nowhere does the VAC 5-91-40 limit the SBCO to corrections caused only by the manufacturer and only at the plant.

In addition and contrary to the September Davis Letter, a manufacturer is liable for "on-site work" as long as the on-site work was under his control. Section 13 VAC 5-91-80, states "[t]he manufacturer of a registered industrialized building shall not be required to remedy violations caused by on-site work by others not under his control or violations involving components and materials

2 Pursuant to Virginia Code § 36-79, the effect of a label of a compliance assurance agency states "[a]ny industrialized building shall be deemed to comply with the standards of the Board when bearing the label of a compliance assurance agency".

furnished by others and not included with the registered industrialized building". Here, and under the IBSR, the on-site work performed by Milton, the manufacturer, is distinguishable from the installation or erection of an industrialized building by a contractor. The work performed by the manufacture at the site was clearly under his control and his responsibility.

Pursuant to 13 VAC 5-91-40 "[t]he SBCAO... shall have authority to make inspections during reasonable hours... at building sites where industrialized buildings are being installed. The SBCAO shall have authority to issue inspection reports for correction of violations caused by the manufacturer and to take such other actions as are required to enforce this chapter". If the SBCO was limited to in plant violations only, it would by unnecessary for the SBCO to inspect buildings after installation, as was done in this case, not just while they are being installed, so she may take other actions to enforce this chapter.

The SBCO utilized the Approved House Document, stamped and dated by NTA, for compliance related matters because the manufacturer is required to build the house based on an approved plan by a CAA. 13 VAC 5-91-250 requires that "[a]pproved designs shall be evidenced by the stamp and date of approval on each design sheet by the compliance assurance agency." However, Milton continued to build and assemble the chimney chute, box, and chimney support structure on-site with an engineered plan provided by Mr. Patrick O'Toole, not a CAA. This document does not appear to have been approved by NTA. The work performed is inconsistent with the specifications as seen in the drawing and some of the work is concealed as pointed out during Mr. Leatherby's September inspection. The plan provided by Mr. O'Toole required additional demolition to access other structural components, which was not done. The chimney is clad in brick and adds considerable weight. There is significant cracking in the ceilings and walls under the chimney on the second floor, in the master bedroom. On July 21, 2011, Ms. Madison asked the Loudoun County Code Official if he needed to inspect the chimney work. Ms. Thompson replied:

> On Friday, July 22, 2011 8:54 AM, "Thompson, Chris" <Chris.Thompson@loudoun.gov> wrote:
>
> Milari,
> I don't need to stop by. The modular company surly has run into the issue with the chimney before...
> Chris

ISSUES FOR APPEAL RESPONDED IN NUMERICAL ORDER PER THE SEPTEMBER DAVIS LETTER

#1 The sunroom was a component supplied by the manufacturer, assembled by the manufacture, and bolted to the adjacent rooms by the manufacturer. 13 VAC 5-91-80 states the manufacturer of a registered industrialized building is required to remedy violations caused by on-site work under his control or violations involving components and materials furnished by him and included with the registered industrialized building. There is no doubt that Milton built, assembled, furnished, and attached the sunroom to the industrialized building, and is, therefore, responsible for the lack of joist hangers and any other code violations related to the sunroom.

#2 Agreed building code violation.

#3 Ms. Davis is correct that the NTA Approved House Document shows the foundation is flush with the first floor. Milton worked with the foundation company and charged Ms. Madison an additional fee of $600.00 to prepare and complete the foundation plan. The foundation plan approved by Ms. Madison, for the purpose of entering the contracts, shows the foundation is flush with the first floor as well. The foundation document was utilized by Milton to design, manufacture and assemble the house. However, the house as-built by Milton cantilevers over portions of the foundation wall leaving open voids, without joist hangers or blocking, which is contrary to the Approved House Document. Where the cantilever occurs, sometimes no joist sits on the foundation wall, depending on the direction the joist runs. The Loudoun County Code Official was specifically asked to look at the cantilever over the one-story den and stated it was not a problem. Milton prepared the basement plan, was responsible for the accuracy of the plans, incorporated it into the NTA Approved House Document, came to the site after the foundation was installed to measure the foundation, and relied on the basement plan to build the house. The source of the error lies with Milton. NTA ISSOP 5.2, states "All complaints received from clients or other parties are subject to this policy." Because NTA affirms to the state, they will resolve all complaints and they have procedures to deal with any defective buildings resulting from oversight and non-conforming work, by not taking corrective action, NTA and Milton have violated the requirements prescribed under 13 VAC 5-91-200.

#4 Pursuant to 13 VAC 5-91-200, NTA is selected as a CAA by DHCD because they affirm under oath they will ensure that processes and procedures will be followed for non-conforming and defective work. NTA serves as essentially as a building official imposing additional requirements upon the manufacturer. NTA's ISSOP 3.6 states that non-conforming work that requires correction occurs when "[m]anufacturer's installation instructions not followed for item installed" and "[i]nstallation instructions are not being used by manufacturer to install listed product." NTA's affirmation is a condition to serving as a CAA under the law.

The USBC states at 112.3 that "...[i]n determining whether any material... assembly or method of construction complies with this code, the building official shall approve items listed by nationally recognized testing laboratories (NRTL), when such items are listed for the intended use and application..." Further, under the IBSR, 13 VAC 5-91-270 states "[p]ersons or firms installing or erecting registered industrialized buildings shall install or erect the building in accordance with the manufacturer's instructions." It is unreasonable that the SBCO simply dismissed the recommendations found in the manufacturer's installation procedures, because lack of conformance is and can be a code violation as stated in the IBSR.

Specific to the use of Simpson Strong Ties, found in the ICC, IBC 2009, 2304.10.2 at floor framing, the code states "[a]pproved... hangers shall be provided where wood beams, girders or <u>trusses rest on masonry or concrete walls</u>. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, <u>or they shall be supported by an approved metal hanger into which the ends of the beams</u> shall be closely fitted." Contrary to the NTA Approved House Document that called for "typical" joist hangers, in many locations there are no joist hangers even where the floor truss was shown to sit on the masonry wall. The fact remains that the joist hangers, lack thereof, and improper installation, constitute a code violation.

Ms. Madison followed-up with Simpson's engineer, Mr. Sam Hensen. Page 14-15 of the Simpson Strong Tie catalog, INSTALL09.pdf, specifically prohibits the use of joist hangers that are "too short". The "light" U brackets (LUS26) measure 4 and 3/4 and are affixed to 2x10's that measure 9.25", supporting 2 x 10's and attaching to 2x10's. The 60% rule is independent from issues with load and the incorrect size of the nail utilized to attach the brackets. Simpson's ESR2549, states that the LUS26 requires 4 10d nails. The Install 09 PDF says the 10d nails are 3" (page 10). According to the ESR2549, to achieve maximum load capacity, the hangers require 4, 3" nails. Ms. Madison removed two factory installed nails from the joist hangers in the basement and they measured 1.5 inches. Some joist hanger have missing nails, or nails that have not been fully embedded into the wood. The kitchen and dining room floors shake when walked upon. Numerous floors have buckled and sagged since installation.

On Wednesday, October 9, 2013 10:34 AM, Mr. Hensen, PE with Simpson wrote:

> Ms. Madison,
>
> ...I see that on the plans you sent earlier, a hanger is called out at the floor joist (see excerpt below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be 20 psf for this application. Thus the total demand load on the hanger is 60 psf, and it would be calculated as follows:

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately 60 psf x 1.33 ft. x 15.75 ft. / 2 = 628 lbs.

The LUS26 hanger is rated for 865 lbs., but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (**we do not permit this nail in our hanger**), the allowable load for the hanger will drop to 419 lbs. (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. **Thus the allowable load for the hanger as installed is less than the demand load. 628 lbs. < 419 lbs.**

For reasons unknown, DHCD would like to accept the undersized, missing, and diminished installation of the joist hangers, inconsistent with the calculations performed by an engineer, and inconsistent with those specified in the NTA Approved House Document. Ms. Madison fears the same joist hanger problems apply to the second and third floor construction already concealed, where there is buckling, sagging and cracking of the floors, walls, and ceilings.

#5 Milton staff assisted with the on-site completion of the house. Section 13 VAC 5-91-80, states "[t]he manufacturer of a registered industrialized building shall not be required to remedy violations caused by on-site work by others not under his control. Milton staff should be subpoenaed (§ 36-115) to testify that they installed and assembled the sunroom, including bolting the sunroom to the adjacent units to complete the building. Under the plain meaning rule, work performed on the house by the manufacturer is manufacturing and subject to the IBSR.

#6 Compliance assurance labels were affixed to the house when the building did not meet code. Ms. Madison asserts that the SBCO is plainly wrong in her application of the code stating "[t]he labels are not, of and in themselves a violation. Notices are sent by the SBCO to correct any code violations that occurred in the plant". Pursuant to Virginia Code § 36-79, the effect of a label of a compliance assurance agency states "[a]ny industrialized building shall be deemed to comply with the standards of the Board when bearing the label of a compliance assurance agency". By affixing the labels, the CAA states that the house complies with the standards of the IBSR including 13 VAC 5-91-250, Industrialized buildings eligible for registration:

> Any industrialized building must meet all of the following requirements to be registered and eligible for a Virginia registration seal:
> 1. The design of the building has been found by a compliance assurance agency to be in full compliance with this chapter. Approved designs shall be evidenced by the stamp and date of approval on each design sheet by the compliance assurance agency.
> 3. The compliance assurance agency has provided the required inspections and other quality assurance follow-up services at the point of manufacture to assure the building complies with this chapter.
> 4. The building contains the appropriate evidence of such compliance through a label permanently affixed by the compliance assurance agency.

It is unclear where and how the SBCO can create an interpretation of the code that is inconsistent with the intent of the General Assembly. The improper labeling and misrepresentation of the house not only violates the IBSR but also violates other Virginia law such as the Virginia Consumer Protection Act. The SBCO has a duty to uphold the law, not to protect the CAA, acting essentially as a building code official.

#7. The house was misrepresented and mislabeled by Milton and NTA. **<u>The house, as built in the factory, was not a two-story house.</u>** The stairs from the second floor to the floor were installed at the factory causing the code violations with respect to inadequate headroom clearance, incorrect information on the data plate, the miscalculation of the R-value, the misrepresentation of the model, and the misrepresentation of the square feet. DHCD originally took the wrong position that the stairs were installed on site. Rich Spicher, 120 S. 12th St, Lewisburg, PA 17837, tel. (570) 768-4016, formerly with Milton, assisted with the assembly and could easily confirm that the unobstructed stairs served the third floor from the factory. For the purpose of the July 25, 2013 complaint, the SBCO wishes to pretend that the space *misidentified* by Milton and NTA was not constructed by the manufacturer when it was. The SBCO seems to take the position that since the stairs were not installed at the factory (even though they were installed at the factory), the habitable attic/third floor space did not exist, or, since the drywall was hung after the initial set-up, the manufacturer did not construct the space.

Stairs are typically installed at the factory and did not ship loose per the related documents. In the November 19, 2012 correction letter from DHCD to Milton, the space is referred to as the "third" floor. The letter states in part:

> Section R311.7.2 of the VRC requires that the minimum headroom in all parts of the stairway shall not be less than 6 feet 8 inches. It was observed that the headroom in the stairway leading from the first floor to the second floor was 6 feet 4 inches measured vertically from the sloped line adjoining the tread to the stairway headroom. Additionally, the headroom in the stairway **from the second floor to the third floor**/attic was approximately 4 feet measured

vertically from the tread to the stairway header.

For the purpose of the July 25, 2013 complaint and the September Davis Letter, it should be emphasized that Milton never appealed the November 19, 2012 finding by DHCD. Milton and NTA, having inspected the house themselves, accepted the code violation. DHCD found that the third floor code violation was the responsibility of the manufacturer. The third floor existed as built by the manufacturer causing the data plate to be incorrect and the house mislabeled.

Further, on November 16, 2011, Barlow Engineering. P.C., a sub-engineer, filed a revised engineering plan sent to Loudoun County and Ms. Madison and stated:

> Attached is a revised copy of the shearwall calculations we provided to IBS for the C-484709-2 plan. The only revision we made was on the Main House summary sheet <u>showing the roof as a 3rd floor.</u> The calculations were done correctly originally but <u>we didn't call the habitable attic a floor</u>.

The revision was forwarded by Ms. Madison to NTA and DHCD. The requirements for a habitable attic is "a specific requirement" for attic areas; and in accordance with R102.1; "the specific requirements shall be applicable". The code defines an as: "ATTIC, HABITABLE. A finished **<u>or unfinished area</u>**, not considered a story, complying with all of the following requirements:"

> 1. The occupiable floor area is at least 70 square feet (17 m2), 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.

It is simply disingenuous to call a bathroom a closet and to pretend that it does not need to meet building code and have the code official agree that the bathroom is not a bathroom but a closet. The third floor space is a habitable attic or a third story with substantial square footage as defined by Barlow Engineering and the code. The house, when shipped, had an installed 3/4" plywood floor, with a hardwired smoke detector, certain electrical wiring to the third floor and a knee wall to provide Ms. Madison with the space that met all of the code requirements for a habitable attic. Ms. Madison was advised by Milton that due to the limitations of delivering a modular house, by way of the roof assembly and folded down knee walls, she would have to hang the drywall, i.e., they could not provide the finished walls in the third floor. DHCD was provided with emails from Ms. Madison to Milton and Milton's agent indicating the intended purchase and use of the third floor.

From: Hunter Madison
[mailto:huntermadison2002@yahoo.com]
Sent: Sun 4/10/2011 7:26 AM
To: Martin Sickle
Subject: RE: HVAC - electric

Marty,

I want to have my super fan installed in the attic. If necessary, I will supply the fan but the ducts need to be added prior to closing off walls with insulated 8" duct, 4, r6 insulation. The ducts are illustrate in the PDF product manual as attached. I think the I should have one in the ceiling of the **to be finished attic**, one in the master bed, one in the second floor hallway, and one in bedroom 3.

As for the HVAC, I will end up with two zones. **The one unit should be placed behind the attic knee wall to be finished to heat and cool the attic and second floor.** Can your experts provide some ball park as to where the chase needs to be and any rough ducts? I am working diligently to move this along but as of now, have little forward movement with the HVAC system.

Milari 540-882-3160

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Fri 3/4/2011 8:45 AM
To: Martin Sickle
Subject: House price, Madison

Marty,

I have concerns about putting the bits and pieces together as the details add up either at your factory or for me to finish later...

...We need Ethernet wiring to the family room, den, office and **attic...**

On Sunday, June 12, 2011 6:31 AM, Hunter Madison <huntermadison2002@yahoo.com> wrote:

Marty,

As you know, **I intend to finish the attic area** of the main block, 43 x 30. Some of HVAC equipment will be behind the south (back) knee wall in the attic, where my Super Fan will be installed too.

Can you make sure the electric is available to easily/sensibly tie into up there?

On Nov 5, 2012 at 2:30 PM, Mr. Mike Melis, Counsel for the SBCO, wrote:

> Dear Mr. Hodge:
>
> I write on behalf of Ms. Davis and the State Building Code Administrative Office. You have asked: 1) whether we agree that the stairs between **the second floor and third floor/attic** were installed at the factory; and, 2) if so, whether we determined that they were in violation of the IBSR. I write to provide our position on these two questions.
>
> 1) We have no first-hand knowledge of whether the set of stairs at issue was installed at the factory or shipped loose. Counsel for Milton has indicated that the stairs appear to have been shipped loose, which is typical.
>
> 2) Whether the stairs at issue were installed at the factory or shipped loose, **we determined that the stairs did not meet applicable headroom requirements.** This determination was based on both Loudoun County's determination as well as the site inspection completed by Eric Leatherby on April 9, 2012. **This issue appeared to arise from a design flaw. As a result, there was an IBSR violation.**

It should be noted that Mr. Mike Melis, counsel for the SBCO, concedes that a code violation to the IBSR occurred due to a "design flaw" originating at the factory. In other words, whether or not the work occurred at the site, that the stairs were installed from the second floor to the **third floor**, at the site or at the factory, the violation of the IBSR was caused by Milton.

Mr. Chris Thompson, the Loudoun County Code Official, stated in his summary of building code violations that the house had a "third floor" ; Mr. Thompson wrotes:

> **From:** "Thompson, Chris" <Chris.Thompson@loudoun.gov>
> **To:** Hunter Madison <huntermadison2002@yahoo.com>; "potter@rudnitskyhackman.com" <potter@rudnitskyhackman.com>

Cc: "Leatherby, Eric (DHCD)"
<Eric.Leatherby@dhcd.virginia.gov>; "Brock, Larry (DHCD)"
<Larry.Brock@dhcd.virginia.gov>; John E Berry
<woodwise2001@earthlink.net>
Sent: Tuesday, February 28, 2012 9:12 AM
Subject: RE: Madison/Milton Settlement, violation report

Milari,
There were several items in your home that were not code compliant.
They were the stairs leading to the wing off the kitchen which did not meet the requirements of section R311.5.3.3 Profile.
Specifically the treads were temporary and did not meet the profile requirements and had open risers in excess of 4 inches.
The stairway to the second floor did not meet the requirements of section R311.5.2 Headroom
The stairway to the third floor did not meet the requirement of section R311.5.2 Headroom and R311.5.4 Landings for Stairways.
There are temporary guards that do not meet the requirements of section R312.1 Guards.
County of Loudoun
Building and Development
Code Enforcement Division
Chris Thompson

Applicable definitions, found in the ICC, IBC 2009 Section on Definitions are:

STAIR. A change in elevation, consisting of one or more risers.
STAIRWAY. One or more *flights* of *stairs,* either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.
"STORY" as "that portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above."

Because the house was was manufactured and designed with a third floor, the R-value calculation with respect to the air barrier and conditioned space is incorrect. The square footage of the house is incorrect. The identification of the model is incorrect. The electric service rating is incorrect as addressed later. NTA and Milton have refused to provide Ms. Madison with examples of other approved house models that are two story capes, three stories, or two and one half stories for comparison. Ms. Madison intends to file a Motion to Compel in on-going litigation as the refusal is significant. Ms. Madison encourages the TRB to subpoena the same plans and data that she has requested to better understand the facts.

#8 The NTA House Approval Document is inconsistent with what was delivered and manufactured. In order to serve as a CAA, the Administrator requires certain information from a CAA prescribed at 13 VAC 5-91-200. Found in the NTA ISSOP3.6, a source code of violation includes "[t]he approved design was deviated from." By deviating from the required information provided to the Administrator under 13 VAC 5-91-200, as was done in this instant matter, it is a violation of the code and affirmations made under the code. 13 VAC 5-91-200 required specific processes and procedures to address non-conforming work and defective work which is incorporated into the standards in complying with the code. The numerous deviations from the Approved House Document are inconsistent with each design sheet approved by a CAA. See 13 VAC 5-91-250. Industrialized buildings eligible for registration; "[t]he design of the building has been found by a compliance assurance agency to be in full compliance with this chapter. Approved designs shall be evidenced by the stamp and date of approval on each design sheet by the compliance assurance agency." Where the as-built house is not reflected in the stamped and dated design sheet, it is violative of the IBSR and needs to be corrected.

#9 The collar ties were installed by the manufacturer under the manufacturer's control on site. An insufficient number of collar ties were sent as part of the industrialized building as prescribed in the documents and also noted in the truss manufacturer's inspection report. NTA, serving as a building code official, required Milton to comply with the manufacturer's installation instructions. This was not done.

#10 The roof truss company themselves thoroughly inspected and prepared a report stating that the truss components and installation are defective, including those portions sized and built at the factory. The report provided to DHCD speaks for itself. During the September 6, 2013 site visit, Mr. Leatherby took no measurements, did not go on the roof, nor did endeavor to look at the roof exposed along the exterior of the third floor/attic knee walls. Mr. Leatherby did not measure or test but the SBCO dismissed the truss manufacturer's findings.

#11 Milton's manufacturing staff cut roof joists without an approved plan by NTA or a CAA. The CAA approved a specific plan and construction that has been deviated from by Milton. NTA affirms that non-conforming work will be evaluated for correction as evidenced by a corrected stamped and dated design sheet required for registered industrialized buildings.

#12 The truss manufacturing document notes several concerns with the roof. Mr. Leatherby did not go on the roof, measure, test, survey, or inspect the roof. Because the September Davis Letter states that "portions of the attic did not indicate a structural failure or excessive deflections", the TRB is asked to ascertain from DHCD what tests were performed to reach their conclusions. In short, a catastrophic failure is not the only test for structural integrity and to demonstrate that the required building and production processes were followed.

OTHER ISSUES

400 amp electrical service

Mr. Leatherby's April 19, 2013 Letter states "...Ms Madison also has complained about the data plate reflecting the 200 amp electrical service in the home, while the home has been wired for 400 amp service...Ms. Madison refers to a plan showing two panels and a June 22, 2011 email from Martin Sickle indicating that Milton is "building the house with 2-200 amp service panels"". Ms. Madison provided to DHCD the June 20, 2011 Milton work order information that states "totaling 400 amps", a plan detail that shows 2 200 amp panels "loop plus 1", and information from the electric company forward to Martin Sickle stating that the load requirement was 400 amps. The house was designed, planned for, and shipped with wiring for 400 amps. Section 13 VAC 5-91-80 states that a manufacturer is responsible for violations regarding components included with the registered building. The two panel boxes were both shipped with breakers installed, tucked in the floor of the joists of one of the units. Milton's own electrician came to the site to fix the electric, attempted to connect the wiring of the units together, without success. The electrician merely stated that he did not know why it was not working. Because the TRB has the authority to issue subpoenas, the Milton electricians should be called upon to testify. 13 VAC 5-91-245 requires the designation of electrical service. Here, the designation is incorrect, the house was built with 2 200 amp service panels, and the data plate is incorrect which for the purpose of the July 25, 2013 complaint, the SBCO wants to dismiss.

From: Martin Sickle <MartyS@integritybuild.com>
To: Hunter Madison <huntermadison2002@yahoo.com>
Sent: Wednesday, June 22, 2011 8:15 AM
Subject: RE: Mtr base sizing, two 200 amp panels

We are building the house with 2-200 amp service panels

Martin Sickle
V.P.Sales & Marketing
Integrity Building Systems, Inc.
2435 Housels Run Road
Milton, PA 17847
Phone (800) 553-4402 Ext. 3629
Cell Phone (570) 274-3031
Fax: (570) 522-0089
msickle@integritybuild.com
www.integritybuild.com

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Wed 6/22/2011 7:48 AM
To: Martin Sickle
Subject: Fw: Mtr base sizing, two 200 amp panels

Marty,

The power company maintains that I need two 200 amp panel boxes (see below). Darren said I need 400 amp service too.

Please confirm that this is done as I am having the power company bring in the line ASAP.

Milari

There is no doubt that DHCD previously took the position that the house was built with a 400 amp service because it was, asked Milton about it, and has ignored reasonable evidence.

code violation, floor one to floor two

With respect to the code violation at the Madison house, inadequate headroom from the first floor to the second floor staircase, Mr. Eric Leatherby directed Milton to correct the violation as approved by a CAA. The approved and agreed upon plan, stamped and dated by the CAA as required under the IBSR for correction has not been executed. The noted code violation was not appealed by Milton. Milton accepted the requirement to fix the code violation. In accordance with 13 VAC 5-91-60, § 36-82 of the Code of Virginia, whenever the administrator shall find any violation of this chapter, **he shall order the person responsible therefor to bring the building into compliance within a reasonable time, to be fixed in the order**. Milton has not brought the building into compliance per the approved and agreed upon plan.

RELIEF SOUGHT

1. The TRB shall direct for correction and find that the data plate is incorrect with respect to the model of the house (2.5 or three stories, not two); the electrical service is 400 amps (not 200); the R-value calculation needs to include the third floor and be corrected; the square footage calculation needs to include the habitable attic space and be corrected.
2. The TRB shall direct for repair and find that the manufacturer is required to correct the code violations per an approved, stamped and dated plan by a CAA, including the installation and lack thereof of the joist hangers, bolting, and blocking in the basement and the concealed areas, and to repair the demolition work as needed.
3. The TRB shall direct for repair and find that the manufacturer is required to repair the chimney structure to conform with an approved plan by a CAA.
4. The TRB shall direct for repair and find that the manufacturer is responsible

to evaluate and correct the deficiencies with the roof and the walls, ceilings and floors that are alleged to be buckling and cracking, as well as the movement alleged to continue, in accordance with an approved plan by a CAA.

5. The TRB shall direct for repair and find that the manufacture is required to bring the staircases (floor one to two, floor two to three, and off of the kitchen) in compliance with the code, agreeable to Ms. Madison, in accordance with an approved plan by a CAA.
6. And any other matters the TRB deems warranted to address as alleged in the complaints filed with respect to the modular house.

Robert F. McDonnell
Governor

James S. Cheng
Secretary of
Commerce and Trade

COMMONWEALTH of VIRGINIA

William C. Shelton
Director

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

September 23, 2013

Mr. Richard R. Rowe Jr.
Milton Home Systems, Inc
2435 Housels Run Road
Milton, PA 17847

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

RE: Consumer complaints – Milari Madison vs Integrity Building Systems, Inc.
Industrialized Building Serial #01-0611 A thru I

Dear Mr. Rowe and Ms. Madison,

The Virginia State Building Codes Office (SBCO) has been designated by the Department of Housing and Community Development to enforce the Virginia Industrialized Building Safety Regulations (IBSR). The SBCO acts as the building official for Virginia registered industrialized buildings and has the authority to require the correction of IBSR violations caused by the manufacturer in the plant. Pursuant to 13 VAC 5-91-100(B) all site work associated with the installation or erection of an industrialized building is subject to the Uniform Statewide Building Code (USBC) which is enforced by the local building official.

This office received the attached complaint Dated July 25, 2013 from the above referenced consumer regarding potential building code violations that may have been introduced into her home during construction by Integrity Building Systems, Inc., now doing business as Milton Home Systems, Inc. The complaint was forwarded to Milton's legal counsel, Gina L. Schaecher, Rees Broome, P.C. on August 27, 2013.

Portions of the above referenced home located at 40153 Janney Street, Waterford, VA, were constructed by Integrity Building Systems, Inc., in their Pennsylvania manufacturing facility on July 14, 2011. The completed home consists of:

- Nine modular units constructed in the PA plant bearing the required certification seals for Virginia. The plant construction portion of these units is regulated under the IBSR.
- One panelized section (sunroom) assembled on site, regulated by the USBC
- One foundation with full basement constructed on site, regulated by the USBC.

A site inspection was conducted at the home on September 6, 2013 by Eric Leatherby, SBCO, to examine the issues raised in Ms. Madison's complaint. The issues will be addressed below in the order that they were presented in the complaint. Ms. Madison's complaints are shown in bold type and are followed by the SBCO response based on the report and information provided by Mr. Leatherby.

1. **No joist hangers under the sun-room:** The sun-room was panelized, open construction, completed on-site and not subject to the IBSR. This issue is under the jurisdiction of the local building official and subject to the USBC. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

2. **One of the joist hangers under the den has been improperly fastened to the joist:** As shown on the attached picture, one joist hanger is not securely fastened to the band joist. Additionally, it was observed that four joist hangers were not installed under the family room to the band joist (see attached photo). This is a violation of the IBSR and must be corrected by the manufacturer.

3. **There is no blocking and no joist hangers where the first floor cantilevers over the foundation wall which is inconsistent with the approved plan:** The plans that Integrity Building Systems submitted to NTA for review and which NTA stamped as code compliant and which were submitted to the building official for the issuance of a permit, showed the home sitting flush on the foundation with no cantilever. Any deviations from the approved plan due to the construction of the foundation may require consultation with a local professional engineer and the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation..

4. **According to the Simpson product literature, the joist hangers are undersized. Simpson recommends that the joist hangers be at least 60% of the joist height. The joist hangers in the basement are 4.5". The joist is 9.25":** A product manufacturer's or distributor's recommendation is not a code requirement. Follow up with the technical support division of Simpson was conducted and confirmed. No code violation exists.

5. **The installer failed to contact the building official before concealment, so it is unknown if the manufacturer's installation procedures were followed where concealments occurred. As visible from the basement and above the master bedroom, there are no through bolts:** The issue of attachment of the modular units to each other is under the jurisdiction of the local building official and is not in violation of the IBSR. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

6. **Compliance assurance labels have been affixed to the house when the building does not meet code:** The labels are not, of and in themselves a violation. Notices are sent by the SBCO to correct any code violations that occurred in the plant.

7. **The data plate remains uncorrected and inaccurate specific to the fact the house is three stories not two...The fact that the living space is significantly increased by this space (habitable attic) also makes the data plate incorrect in terms of the R value calculation and the overall square footage:** The data plate is correct in identifying the factory built portion of the home as two stories. The building plans that were reviewed and approved by NTA and submitted for permitting, identify the home as "Two-Story". Subsequent to the home being installed, additional site work was performed in the unfinished attic including the installation of drywall on the walls and ceiling, finished flooring, electrical outlets and heating and air conditioning. All of the work and code requirements related to this additional site work were not included or approved by NTA and are not regulated by the IBSR. The additional site work falls under the jurisdiction of the USBC and the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

8. **The approved plans and what was delivered are not consistent i.e. width of stairs from kitchen to den; size and height of the chimney; knee walls are of unequal height; the overall dimensions of certain walls deviate; basement windows under the den do not fall centered below the windows installed in the den and bathroom; the eave overhangs are of different distances:** None of these issues constitute a violation of the IBSR.

9. **Collar ties were not installed properly and are lacking:** The home has a hinged roof system which was raised at the building site and therefore the collar ties would have to be site installed and is under the jurisdiction of the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

10. **The truss manufacturer has indicated that the portions of the roof that were hinged at the factory were possibly the wrong size:** During the September 6, 2013 inspection Mr. Leatherby did not observe any apparent code violations or any substantial deflection or failure of the roof system. No violation of the IBSR is indicated.

11. **Milton staff cut roof joists to cause an opening from the third floor living space to the storage space above the master bedroom without the engineered stamped approval:** Site work is under the jurisdiction of the local building official. Alterations made on site to the approved construction may require consultation with a professional engineer and the local building official. The local building official determines if violations exist under the USBC and issues any notices of correction or violation.

12. **The roof over the main block is lumpy and has a significant roll:** During the September 6, 2013 inspection a visual examination of the roof from the exterior and portions of the attic did not indicate a structural failure or excessive deflections. No violation of the IBSR is indicated.

In addition to above enumerated items, during the September 6, 2013 inspection Ms. Madison expressed concern regarding the adequacy of the framing of the fireplace flue chase and its' ability to support the brick chimney: The framing and the installation of the chimney flue were performed on site and is under the jurisdiction of the local building official and the USBC. No violation of the IBSR is indicated.

In an attempt to provide closure to other outstanding issues related to Ms. Madison's home, this office makes the following findings:

Ms. Madison has previously stated that the data plate is also in error by identifying the electrical service as 200 amps instead of 400 amps: The building plans and the electrical calculations for the home and that were reviewed and approved by NTA show a 200 amp service (it should be noted that the calculations performed indicated a 100 amp load). On-site electrical work was not considered in the approved service load calculations. Two 200 amp service panels have been installed in the home. Based on drawing and documents provided, it is our determination that one panel was wired for factory installed outlets and fixtures. The other panel was shipped lose and provided for site installed outlets and equipment that corresponds to the electrical invoice submitted by Billy's Electrical Service for work performed on site. Milton Homes has acknowledged that the second 200 amp panel was supplied by the manufacturer at Ms. Madison's request and was shipped loose for installation on-site. Therefore the data plate is correct and no violation of the IBSR exists.

A previous notice of violation required that an apparent headroom violation between the first and second floor be corrected. Based on Mr. Leatherby's inspection on September 6, 2013, that violation has been corrected. As such, a violation of the IBSR no longer exists.

In conclusion this office finds Milton to be responsible for the issue of joist hangers as identified in item #2 and requires corrective action within the next twenty (20) calendar days. We also find as indicated many site related issues that should be forwarded to the local building official for investigation and resolution.

Any person aggrieved by DHCD's application of this chapter shall be heard by the State Technical Review Board established by 36-108 of the Code of Virginia. Such appeal shall be submitted within 21 calendar days of receipt of DHCD's decision. A copy of the decision of DHCD to be appealed shall be submitted with the application or appeal. Failure to submit an application for appeal within the time limit established by the section shall constitute acceptance of the DHCD's decision.

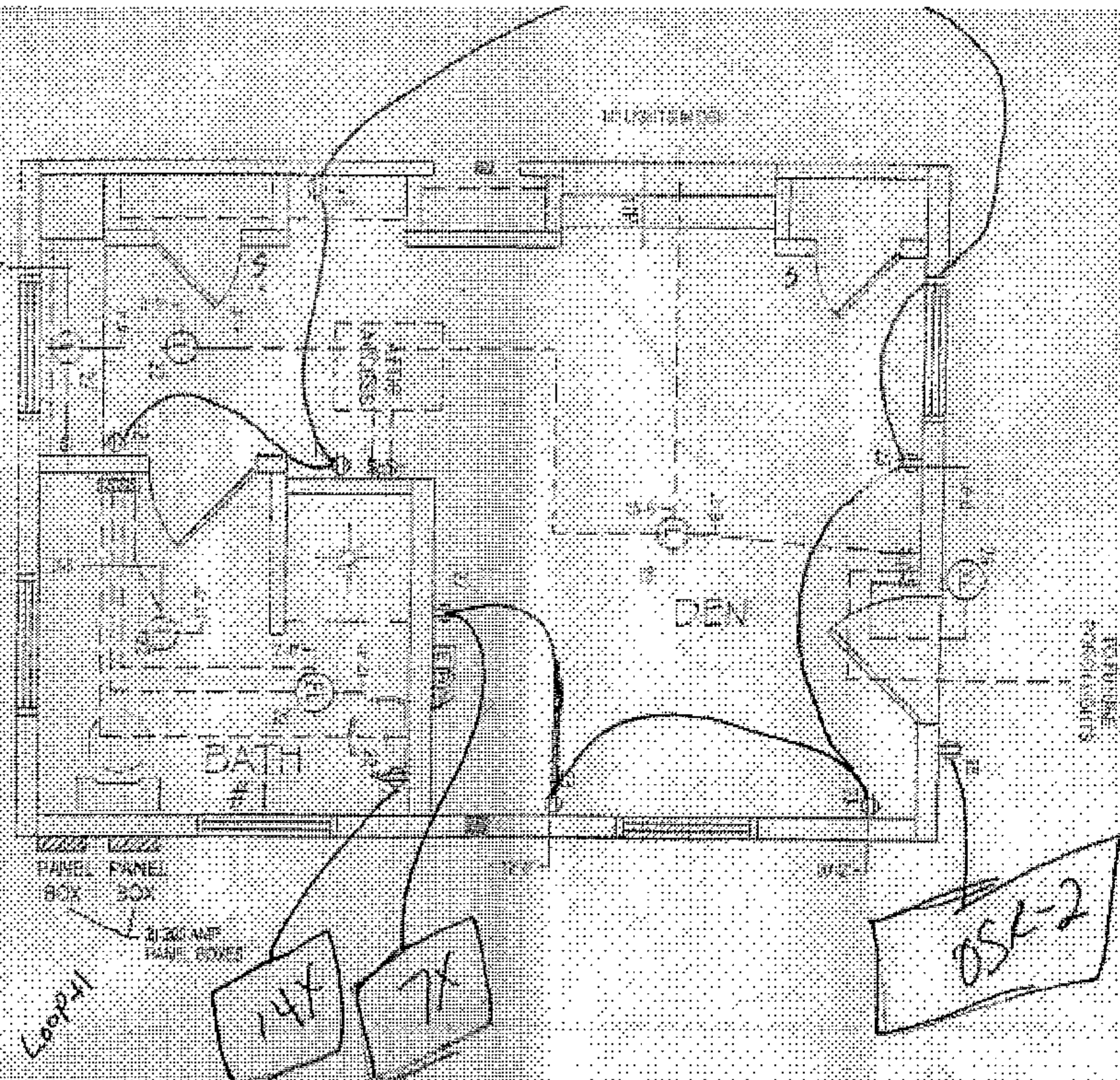
I can be reached at 804-371-7161 or by email at cindy.davis@dhcd.virginia.gov should you have any questions.

Sincerely,

Cindy L. Davis

Cindy L. Davis, C.B.O., Director
State Building Codes Office

cc: Mike F. Melis
Emory Rodgers
Steve Rodgers
Christopher Thompson
David Tompos, Sr.
Gina Schaecher
Eric Leatherby
Vernon Hodge
Alan McMahan


DEN
BATH #1
PANEL BOX
PANEL BOX
ATTIC ACCESS
TO FUTURE PORCH LIGHTS
OSK-2
14X
7X
Loop#1

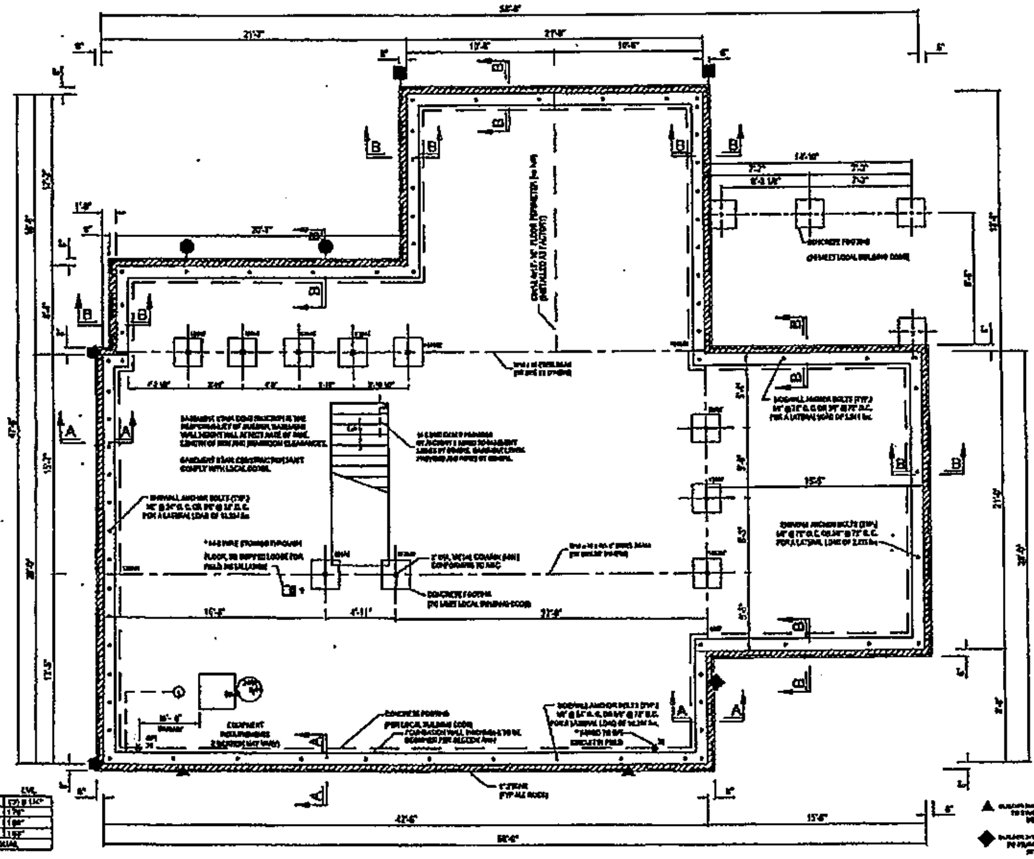
"C"

12-2

NOTES:
1. FOUNDATION DESIGNED PER LOCAL SITE CONDITIONS.
2. FOOTINGS SHALL EXTEND BELOW THE FROST LINE OF THE LOCALITY.
3. CONCRETE BLOCK PIERS LAID IN TYPE "M" OR "S" MORTAR.
4. CENTER GIRDER SPLICES SHALL BE SUPPORTED OR GANG NAILED.
5. 18" x 24" ACCESS PROVIDED FOR CRAWL SPACE FOUNDATIONS.
6. CRAWL SPACES VENTILATED PER STATE AND LOCAL CODES.
7. FOUNDATION DESIGN BY REGISTERED ARCHITECT OR ENGINEER FAMILIAR WITH LOCAL CONDITIONS. OWNER IS RESPONSIBLE FOR CONTRACTING THIS PERSON. FOUNDATION PLAN(S) TO BE SEALED BY R.A. OR P.E. AS REQUIRED BY LOCAL JURISDICTION.
8. SILL PLATE AND ALL MATERIAL BELOW BY OTHERS.
9. SILL PLATE ANCHORED w/ 1/2" BOLTS w/ 2" HOOKS EMBEDDED 15" INTO MASONRY. ALT: SIMPSON PLATE ANCHORS (OR EQUAL) INSTALLED PER MANUFACTURER'S INSTALLATION INSTRUCTION OR LOCAL CODE, WHICHEVER IS MORE RESTRICTIVE.
10. THIS IS A TRUE FOOTPRINT FOR THE MODULAR UNIT BUILDING AND IS SPECIFIC TO SAID UNIT. THIS DRAWING(S) SHALL BE USED BY THE BUILDER'S ARCHITECT OR ENGINEER FOR DIMENSIONAL INFORMATION ONLY.
11. LOADING INFORMATION PROVIDED BY FACTORY TO BUILDER'S ARCHITECT OR ENGINEER UPON REQUEST.
12. FOUNDATION DRAINAGE AND DAMPPROOFING PERFORMED ON SITE BY OTHERS IN CONFORMANCE WITH APPLICABLE CODE REQUIREMENTS.
13. BASEMENT CEILING OR WALL INSULATION BY OTHERS IN CONFORMANCE WITH APPLICABLE CODE REQUIREMENTS.
14. MECHANICAL AND/OR ELECTRICAL INSTALLATIONS COMPLETED ON SITE BY OTHERS IN CONFORMANCE WITH APPLICABLE CODE REQUIREMENTS.
15. BACKFILL TO BE IN AND TAMPED PRIOR TO MODULE(S) ARRIVAL.
16. MINIMUM DISTANCE FROM BOTTOM OF SIDING TO TOP OF FINISHED GRADE SHALL BE 6".
17. THE MINIMUM NET AREA OF VENTILATION OPENINGS SHALL NOT BE LESS THAN 1 SQ FT FOR EACH 150 SQ FT OF UNDER FLOOR SPACE AREA. (SEE SECTION R408 FOR OTHER REQUIREMENTS)

COLUMN PLATES NEED TO BE SIZED TO THE ACCUMULATED WIDTH OF ALL GIRDER MEMBERS AND GAPS. ALL COLUMNS AND PLATES TO BE SUPPLIED BY BUILDER.

WHEN GAPS OCCUR OR ARE INTENTIONALLY PART OF THE UNIT DESIGN, THEY MUST BE PACKED OUT BEFORE BOLTING OF FLOOR, CEILING AND ROOF BEAMS. DUE TO SETTING TOLERANCES AND FOUNDATION SIZE VARIATIONS UNITS CANNOT BE PRE-PACKED AT THE FACTORY, THEREFORE IT IS THE BUILDER'S RESPONSIBILITY TO PROVIDE MATERIALS FOR THE SET CREW TO COMPLETE AS REQUIRED.



TWO-STORY - KIP LOADING PER LINEAL FOOT

MODULE WIDTH	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

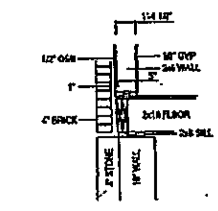
GIRDERS - FLOOR LOAD ONLY
40 PSF

MODULE WIDTH	[illegible]	[illegible]	[illegible]	[illegible]	LVL [illegible]	LVL [illegible]	LVL [illegible]	LVL [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	NA	NA	[illegible]	[illegible]	NA	NA	[illegible]	[illegible]
[illegible]	NA	NA	[illegible]	[illegible]	NA	NA	[illegible]	[illegible]

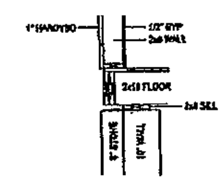
FIRST FLOOR FLOOR BEAM SPANS: TWO-STORY #45 PSF ROOF LIVE LOAD

MODULE WIDTH	(4) 2X8	(4) 2X10	LVL (4) 7 1/4"	LVL (4) 9 1/4"	(6) 2X8	(6) 2X10	LVL (6) 7 1/4"	LVL (6) 9 1/4"	LVL (8) 7 1/4"	LVL (8) 9 1/4"
10'-0" TO 12'-6"	37"	47.25"	77.5"	98"	48.25"	61.75"	88.75"	113.25"	97.75"	124.75"
12'-7" TO 14'-0"	NA	44.25"	NA	95.25"	NA	57.25"	NA	109"	NA	120"
14'-1" TO 15'-9"	NA	41.5"	NA	91"	NA	53.25"	NA	104.75"	NA	115.25"
NOTE: LVL THICKNESS - 1 1/2" & LUMBER SPECIES = SPF #2 (MIN)										

NA = NOT APPLICABLE



SECTION A-A



SECTION B-B

APPROVED BY
JUL 14 2011
NTA INC

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION	DATE: 5/24/10	MODEL: CUSTOM 2-STORY	CONTROL NUMBER C-484709-2	SUB-SET	F1
	CUSTOMER: MADISON	DRAWN BY: CDK	Scale: 1/8" = 1'-0"			

EXHIBIT A-86

Leatherby, Eric (DHCD)

From: Hunter Madison [huntermadison2002@yahoo.com]
Sent: Monday, April 09, 2012 6:19 PM
To: Leatherby, Eric (DHCD); Davis, Cindy (DHCD)
Subject: Fw: RE: Foundation issues for Dick
Attachments: C484709-2-1stElec (4-4-11).pdf; C484709-2-1stFl (4-4-11).pdf; C484709-2-2ndElec (4-4-11).pdf; C484709-2-2ndFl (4-4-11).pdf

----- Forwarded Message ----
From: Hunter Madison <huntermadison2002@yahoo.com>
To: acwhiz1@gmail.com
Sent: Monday, April 4, 2011 4:56 PM
Subject: Fw: RE: Foundation issues for Dick

I also want to have a 15 foot x 43 foot finished third floor space.

Thank you.
Milari 540-882-3160

--- On **Mon, 4/4/11, Martin Sickle** <*MartyS@integritybuild.com*> wrote:

From: Martin Sickle <MartyS@integritybuild.com>
Subject: RE: Foundation issues for Dick
To: "Hunter Madison" <huntermadison2002@yahoo.com>
Date: Monday, April 4, 2011, 8:44 AM

Malari,

Attached are the latest revisions to the plan. Could you please review them and then let me know if any other changes need to be made. If final changes have been made we can start with the beam calculations in the basement.

Martin Sickle
V.P.Sales & Marketing
Integrity Building Systems, Inc.
2435 Housels Run Road
Milton, PA 17847
Phone (800) 553-4402 Ext. 3629
Cell Phone (570) 274-3031
Fax: (570) 522-0089
msickle@integritybuild.com
www.integritybuild.com

Success is not what you get; it is what you become

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Mon 4/4/2011 6:52 AM
To: Martin Sickle
Cc: jiancelotta@weaverprecast.com
Subject: Foundation issues for Dick

Marty,

EXHIBIT B 87

We need to make sure that the plan takes into account the potions of the house that do not have brick. It would seem to me that the house would have to hang over the foundation more to make the transition as minimal as possible (smooth from stone to Hardiplank). In those areas the house would need to hang over 6".

I want to reduce the cost wherever it makes sense. I will not finish the basement but can see the west wing and under th sun room as eventually being walled off so any lally columns can be placed there. I am sure the lally columns are cheaper than steal or foundation wall.

The brick ledge will be 6".

According to Jack's most recent drawing, I am trying to get rid of the lally columns.

Leave two lally columns encasing the stairs.
Leave any lally columns supporting the west wing bump out (the exterior wall of the main block).
Remove the wall from the main block to the west wing.
The crawl space can be a full basement with lally columns replacing the wall.
The west wing will be used for utilities and can have a lower ceiling (the floor does not need to step down)
No foundation walls to support front stoop/slab.
Basement egress will have a a 36" wide door and a bilco exit (stairs).
Width of basement windows will be 36".

--- On **Sun, 4/3/11, Jack Lancelotta** *<jlancelotta@weaverprecast.com>* wrote:

From: Jack Lancelotta <jlancelotta@weaverprecast.com>
Subject: Re: Hopefully, last few questions
To: "Hunter Madison" <huntermadison2002@yahoo.com>
Date: Sunday, April 3, 2011, 5:19 PM

This is my latest version based on the last info I received from Marty

SIMPSON
Strong-Tie

October 7, 2013

Eric Leatherby
Sr. Construction Inspector II
State Building Codes Office
Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, VA 23219
Tel: 804-371-7165

Re: Simpson Joist Hanger and the 60% Rule
Project: Modular home sited at 40153 Janney Street, Waterford, VA

Dear Mr. Leatherby:

This letter is written regarding the recommendation that Simpson Strong-Tie joist hangers be at least 60% of the height of the joist. Simpson Strong-Tie recommends that the height of our joist hangers be at least 60% of the height of the joist they support, so that the hanger will help resist joist rotation during construction prior to the roof or floor decking being installed. This recommendation is meant to reduce possible rotation of the joist out of the supporting hanger while contractors walk on the roof members prior to the installation of the decking.

As long as other means are provided to resist joist rotation (such as clips and/or blocking), or in the case of modular construction where this temporary rotation support is not an issue, it is acceptable to Simpson Strong-Tie for the joist hanger to be less than 60% of the joist hanger height rule, provided the hanger is otherwise properly sized for the joist width and load capacity.

All installation specifications noted in the Simpson Strong-Tie *Wood Construction Connectors* catalog (C-2013) shall be strictly followed. If you have any other questions or need further assistance regarding the content of this letter, please contact the engineering department of Simpson Strong-Tie at 1-800-999-5099.

Sincerely,
Simpson Strong-Tie, Inc.

Sam Hensen, PE
Engineering Manager, Southeastern US

dw/BB

Cc: Bobby Sager, Simpson Strong-Tie Company, Inc.

EXHIBIT
C

NTA INC.

ENGINEERS
PLANNERS
CONSULTANTS

305 NORTH OAKLAND AVENUE • P.O. BOX 490 • NAPPANEE, INDIANA 46550
WEB: WWW.NTAINC.COM

PHONE: 574-773-7975
FAX: 574-773-5739

November 11, 2013
IBS050213-11b

State Building Code Technical Review Board
State Building Code Office
Division of Building & Fire Regulation
Department of Housing & Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219

RE: MADISON APPEAL OF DHCD 9/23/2013 LETTER ITEM #4

Simpson's recommendation that the height of a joist hanger is at least 60% of the joist height has no effect on the final installed strength or performance of the hanger. This recommendation applies to the installation of hangers in conventional construction where construction workers may walk on the joists *prior to the attachment of sheathing*. The factory built construction process does not require workers to walk on joists prior to attachment of the floor sheathing and, as a result, this recommendation does not apply.

The "metal hanger" requirements cited by Mrs. Madison, under Section 2304.10.2 of the *2009 International Building Code*, are applicable only to "Heavy Timber Construction" and do not apply to light-framed conventional construction built under the *2009 International Residential Code* (2009 IRC). Joist hangers are not required where at least 1.5-inches of bearing is provided (2009 IRC, R502.6).

With respect to the rim joist-to-joist connection, it is standard practice in the modular industry to make this connection using end-nailing in lieu of or in addition to a ledger strip or joist hanger. The use of this attachment method, with or without a ledger strip or joist hanger, is permitted under 2009 IRC, Section R104. In Mrs. Madison's home, this connection consists of (5) 0.131"x3" end nails, which provide a capacity of 275 lbf by itself or in addition to any additional connection hardware, such as a joist hanger.

Regarding the email provided by Mrs. Madison from Simpson's engineer, Mr. Sam Hensen, PE, the analysis contained in the email contains several incorrect assumptions and omissions. Most notably, the analysis considers an excessive dead load while omitting the additional strength of the aforementioned end nailing. A corrected calculation is attached which justifies that the band joist-to-joist connection is adequate to support the required loads.

Respectfully,

Eric J. Tompos, PE, SE, CBO
NTA, Inc.

EXHIBIT
D

Attachment A
Corrected Calculation

From: Hunter Madison <huntermadison2002@yahoo.com>
Date: October 10, 2013 5:50:55 AM EDT
Subject: Fw: Madison house
Reply-To: Hunter Madison <huntermadison2002@yahoo.com>

On Wednesday, October 9, 2013 10:34 AM, Sam Hensen <shensen@strongtie.com> wrote:
Ms. Madison,

The attachment you sent was for the shearwall calculations. It does not include any information on the hangers in question. However, I see that on the plans you sent earlier, a hanger is called out at the floor joist (see excerpt below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be ~~20 psf~~ 10 psf for this application. Thus the total demand load on the hanger is ~~60 psf~~ 50 psf, and it would be calculated as follows:

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately ~~60 psf~~ 50 psf x 1.33 ft. x ~~15.75~~ 15.3 ft. / 2 ~~= 628 lbs.~~ 509 lbf

The LUS26 hanger is rated for ~~868 lbs.~~ 740 lbf (SPF/HF), but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (we do not permit this nail in our hanger), the allowable load for the hanger will drop to ~~419 lbs.~~ 396 lbf (SPF/HF). (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. Thus the allowable load for the hanger as installed is less than the demand load. ~~628 lbs.~~ < 419 lbs.

(4) 0.131" x 1.5" NAILS 328 lbf HANGER ALONE

509 lbf < 603 lbf OK

Hope that information helps. I recommend you hire a forensics engineer to assist you with this issue. Simpson Strong-Tie does not get involved in litigious issues like this situation.

Thank You,

Sam Hensen, P.E. | Engineering Manager, Southeastern US | Simpson Strong-Tie |
2221 Country Lane | McKinney, TX 75069 | 972.439.3027

ENTIRE CONNECTION CAPACITY:

(5) 0.131" X 3" END NAIL RIM-TO-JOIST = 55 lbf x 5 = 275 lbf

(4) 0.131" x 1.5" FACE NAIL HANGER-TO-RIM = 82 lbf x 4 = 328 lbf

603 lbf

∴ INSTALLED CAPACITY 603 lbf EXCEEDS REQUIRED LOAD OF 509 lbf

Page	Description	Date	Revision
TP	Title Page	5/17/11	
F1	Preliminary Foundation Plan*	5/17/11	
A1	1st Floor Plan	5/17/11	
A2	2nd Floor Plan	5/17/11	
EL1	Elevations	5/17/11	
E1	1st Floor Electrical Plan	5/17/11	
E2	2nd Floor Electrical Plan	5/17/11	
S1	Two-Story Cross Section	5/17/11	
P1	Plumbing Notes	5/17/11	

* See note #7 on page F1
SPECIFIC ANCHOR BOLT/TIE DOWN STRAPPING (IF REQUIRED) WILL BE INCLUDED WITH CALCULATIONS, OTHERWISE COMPLY WITH LOCAL REQUIREMENTS

BEAM AND HEADER SYSTEMS PAGE REFERENCES
Ranch: Systems Pg S-9
Cape: Systems Pgs S8 & S8.1
Two Story: Systems Pgs S10 & S10.1
Two Story w/Cape Roof: Systems Pgs S10.2 & S10.3

Manufacturer	Integrity Building Systems
	2435 Housels Run Rd
	Milton, PA 17847
	570-522-3600
Model	C-484709-2 Two-Story
Windows	Marvin Integrity Fiberglass
Construction	Wood Frame VB
Type	Single Family Dwelling
Site Address	40153 Janney Street
	Leesburg, VA 20197
	Loudoun County
2009 Virginia Uniform Statewide Building Code	
Building Code	2009 IRC
Electrical Code	2008 NEC
Energy Code	2009 IECC
Use Group	R-5
Ground Snow Load	30 PSF
Wind Speed	90 MPH Exposure C
Design Criteria	Sect 1609 of 2009 IBC
Seismic Design Category	B
Floor Live Load	40 PSF
Floor LL (sleeping areas)	30 PSF
Floor Dead Load	10 PSF

C-484709-2 Two-Story

INTEGRITY
BUILDING
SYSTEMS

2435 HOUSELS RUN RD.
MILTON, PA 17847
570-522-3600

THIS MODEL IS TO BE BUILT UNDER THE VIRGINIA APPROVED MODULAR BUILDING SYSTEM

TO THE BEST OF MY KNOWLEDGE, BELIEF, AND PROFESSIONAL JUDGMENT, THESE PLANS AND SPECIFICATIONS COMPLY WITH THE ENERGY CONSERVATION CONSTRUCTION CODE OF VIRGINIA. COMPLIANCE SHALL BE DEMONSTRATED TO THE LOCAL BUILDING OFFICIAL BY VA RESCHECK.

APPROVED BY

JUL 14 2011

NTA INC

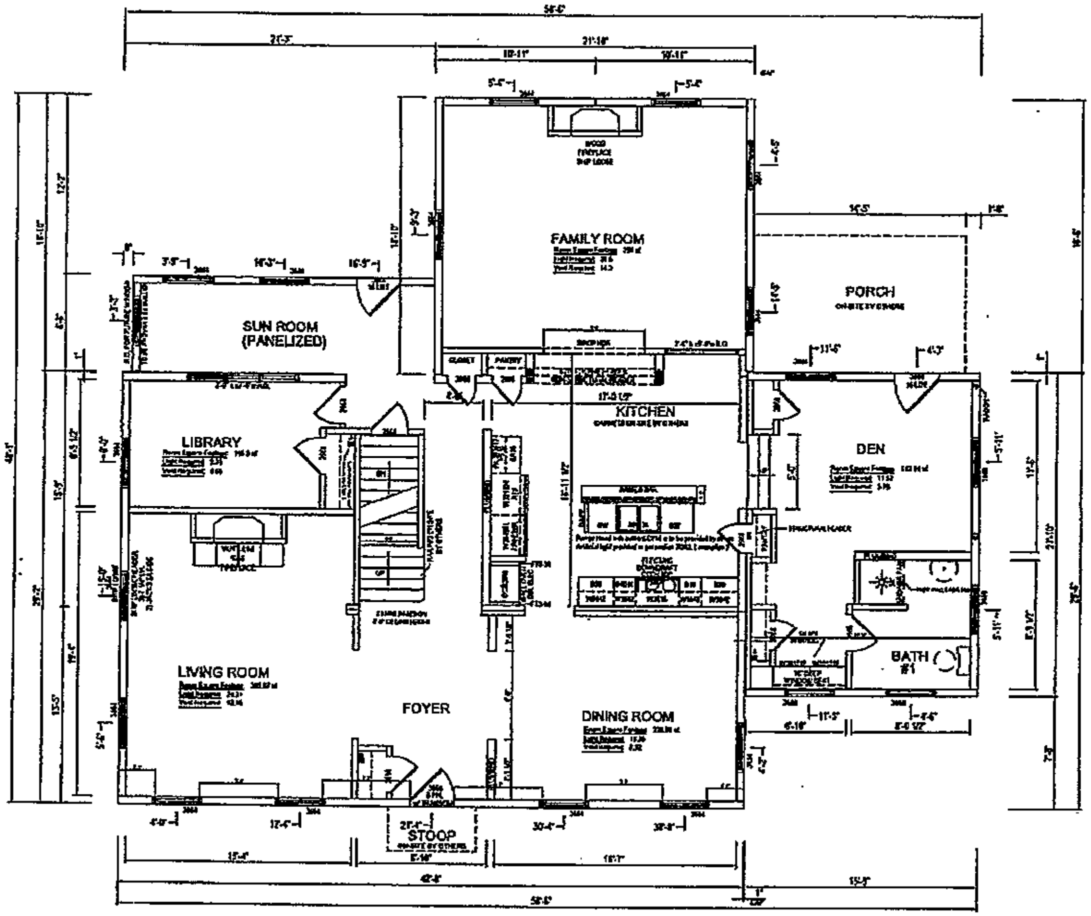
EXHIBIT E

Builder: Convenient Installation
351 Thistle Ridge Lane
Ranson, WV 25438
304-279-6028

Rev	Drn By	Description	Date
F	[illegible]	[illegible]	[illegible]
G	jab	[illegible]	[illegible]
H	jab	[illegible]	[illegible]
I	jab	[illegible]	[illegible]
J	jab	[illegible]	[illegible]
K	jab	[illegible]	[illegible]
L	[illegible]	[illegible]	[illegible]
M	jab	[illegible]	[illegible]
N	jab	[illegible]	[illegible]
O	cdk	[illegible]	[illegible]
O	cdk	[illegible]	[illegible]

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION	DATE: 5/24/10	MODEL: CUSTOM 2-STORY	CONTROL NUMBER C-484709-2
	CUSTOMER: MADISON	DRAWN BY: CDK	Scale: 1/8" = 1'- 0"	SUB-SET TP

92



▲STATE MODULAR LABEL
■NTA LABEL
●DATA PLATE

APPROVED BY

JUL 14 2011

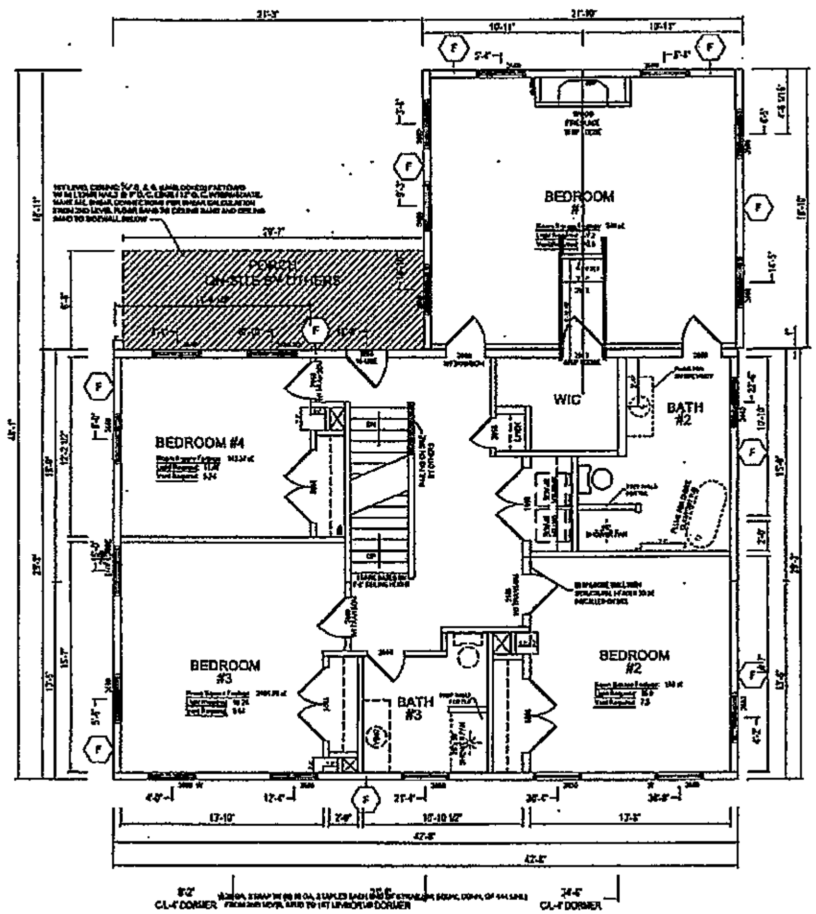
NTA INC

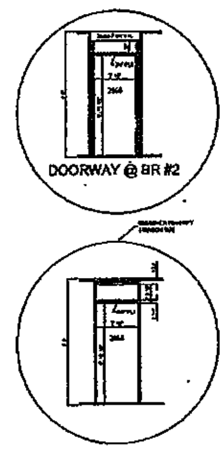
1st FLOOR
9'-0" CEILING

NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION
NOTE: PRESSURE TREATED LUMBER TO BE USED FOR PERIMETER BANDS AT FAMILY ROOM, DEN, BATH #1, & DINING ROOM AREAS

DP RATING: 25 MAX.

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION CUSTOMER: MADISON	DATE: 5/24/10 MODEL: CUSTOM 2-STORY DRAWN BY: CDK Scale: 1/8" = 1'- 0"	CONTROL NUMBER C-484709-2	SUB-SET A1





APPROVED BY

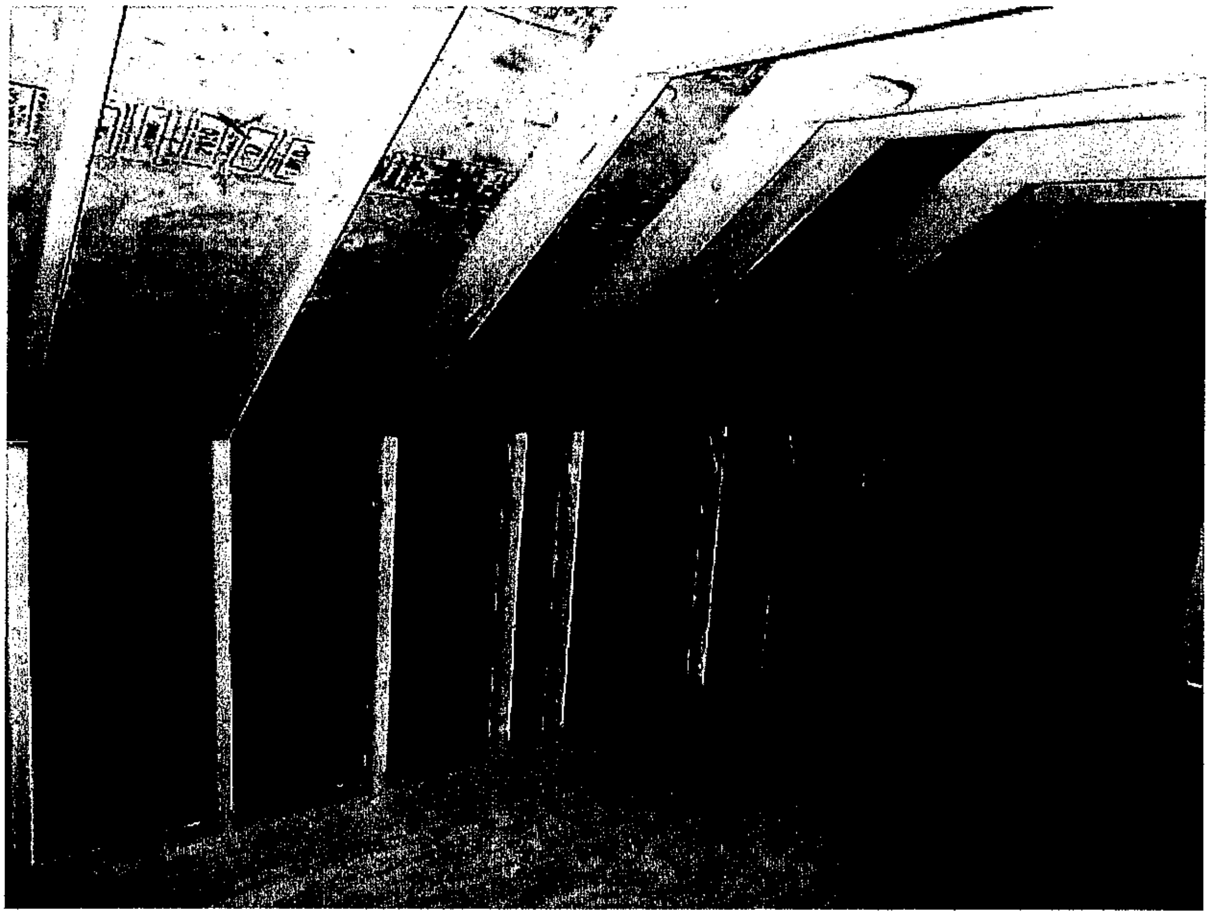
JUL 14 2011

NTA INC

2nd FLOOR
8'-6" CEILING

2ND LEVEL ENDWALL & SIDEWALL
NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION CUSTOMER: MADISON	DATE: 5/24/10 DRAWN BY: CDK	MODEL: CUSTOM 2-STORY Scale: 1/8" = 1'- 0"	CONTROL NUMBER C-484709-2	SUB-SET	A2



EXHIBIT

F95

Electrical Load Calculation:

Date: 5/17/11 Performed By: CDK Mfg: Integrity Building Systems

Project: va Model: C484709-2

Air Conditioning	(	x 1.0) *	0
Central Electric Space Heating	(	x .65) *	0
Less Than Four Separately Controlled Electric Space Heating Units	(0	x .65) *	0
Four or More Separately Controlled Electric Space Heating Units	(0	x .40) *	0

* Use the larger of the air-conditioning or the diversified demand of the heating load.

Other Loads:

	AREA	Watts or Volt-Amps	Circuit Ampacity	Wire Size
General Lighting	3798	11394	15	14-2
Small Appliances	(5 x 1500)	7500	20	12-2
Range		12000	40	8-3
Dishwasher		1200	20	12-2
Garbage Disposal		600	20	12-2
Washer		1500	20	12-2
Dryer		5000	30	10-3
Furnace		1500	20	12-2
Water Heater		4500	25	10-2
Other				
	Subtotal:	45194		

APPROVED BY

JUL 14 2011

NTA INC

First 10 KW of other loads @ 100% = 10000

Remainder of other loads @ 40% (35194 x .40) = 14078

Heat Above: 0

Total Calculated Load: = 24078

Required Service Size: 24078 ÷ 240 = 100 Amps

Installed Panel Size = 200 Amps

*HVAC system installed in field by builder

EXHIBIT

Billy's Electrical Service, Inc.
23707 Parsons Road
Middleburg, VA 20117
(540) 687-6226

Invoice

Date	Invoice #
10/7/2011	16449

Bill To
PAUL & MILARI MADISON 39638 RICKARD ROAD LOVETTSVILLE, VA 20180-3302

P.O. No.	Terms	Project
	Due on Receipt	

Quantity	Description	Rate	Amount
1	SEPTEMBER 12, 2011: MATERIAL AND LABOR TO BEGIN MAKING UP JUNCTION BOXES IN BASEMENT; PULL HOME RUNS TO PANEL AREA; REMOVED FRONT DOOR RECEPTACLES DUE TO BRICK AND RECEPTACLES NEED TO BE LOWERED; INSTALL BOXES IN BASEMENT FOR LIGHTS, WIRED UP BASEMENT LIGHTS, INSTALLED SWITCHES.	850.00	850.00
1	SEPTEMBER 13, 2011: MATERIAL AND LABOR TO MAKE UP JUNCTION BOXES IN BASEMENT AFTER SORTING THROUGH REMAINING WIRES; WIRE UP SUN ROOM AREA; CHANGED SWITCH BETWEEN CLOSET DOORS AT KITCHEN AREA ON FIRST FLOOR TO ALLOW FOR TRIM/STACK SWITCH TO OPERATE; CUT OUT RECESSED LIGHT IN KITCHEN, DELETED WIRES FOR UNDER CABINET LIGHTS, HOOD FAN AND RECEPTACLE UNDER STOVE; FISHED WALL AND PROPERLY INSTALLED WIRE FOR UNDER CABINET LIGHTS WITH SWITCH FEED, MAKE UP JUNCTION BOX IN CABINET FOR UNDER CABINET LIGHTS; WIRED FOR HOOD FAN; RANG OUT THREE-WAY FOR SUN ROOM AND HOOKED INTO NEW SWITCH BOX AT SUN ROOM BACK DOOR.	1,896.00	1,896.00
1	SEPTEMBER 14, 2011: MATERIAL AND LABOR TO MAKE UP JUNCTION BOXES IN ATTIC; TURN ON SECOND FLOOR RECEPTACLES; RELOCATE RECEPTACLES BEHIND CABINET; PULL NEW HOME RUNS TO DISHWASHER, MICROWAVE, FRONT DOOR RECEPTACLE, REAR RECEPTACLES, AND BATHROOM GFCI RECEPTACLE; TRACE OUT AND DELETE OLD WIRES ON PORCH; SET JUNCTION BOX ON OVEN; SET RECEPTACLE FOR STOVE; REPAIR RECEPTACLE IN DEN BATHROOM; WIRE UP LIGHTS ON PORCH; CHANGES BOXES (BOXES WITH PVC SLEEVES) ON FRONT OF HOUSE FOR BRICK; DRILLS HOLES FOR KITCHEN LIGHTS AND LOOP WIRES BETWEEN LIGHTS.	1,670.04	1,670.04

Pay online at:: https://ipn.intuit.com/xrm5b929

Invoices are due with in 15 days of billing date; if not customer shall be obligated to pay 2% interest per month, plus attorney's fee and court cost. Thank you for your business.

Total

EXHIBIT
H

Billy's Electrical Service, Inc.
23707 Parsons Road
Middleburg, VA 20117
(540) 687-6226

Invoice

Date	Invoice #
10/7/2011	16449

Bill To
PAUL & MILARI MADISON 39638 RICKARD ROAD LOVETTSVILLE, VA 20180-3302

P.O. No.	Terms	Project
	Due on Receipt	

Quantity	Description	Rate	Amount
1	SEPTEMBER 19, 2011: MATERIAL AND LABOR TO INSTALL GROUND WIRES IN PANEL; INSTALL COLD WATER GROUND WIRE; PULL FEEDS TO EXTERIOR AC UNITS, PULL FEEDS TO ATTIC UNIT-INSTALL DISCONNECTS AND WIRE UP, PULL FEEDS TO BASEMENT UNIT; HOOK UP CIRCUIT WIRES IN PANEL; PULLED HOME RUNS TO ATTIC AREA FOR ELECTRIC; PULL TV/TELEPHONE CABLE TO ATTIC AREA; PULLED BEDROOM SECOND FLOOR TV CABLE AND CUT IN BOX; INSTALLED LIGHT BOXES AND WIRED UP SECOND FLOOR PORCH AREA.	2,441.78	2,441.78
1	SEPTEMBER 21, 2011: MATERIAL AND LABOR TO CUT RECESSED LIGHT IN MASTER BATHROOM SHOWER, FISH WIRES TO SWITCH AND LIGHT, CUT IN SWITCH BOX, MAKE ALL CONNECTION; BUILD WALL TO MOUNT DISCONNECTS AT UNIT IN BASEMENT, WIRE UP DISCONNECTS AND UNIT; RAN CIRCUIT FOR BASEMENT UNIT CONDENSATION PUMP, SET BOX AND OUTLET; LOWER DOWN PORCH LIGHTS AS REQUESTED BY CARPENTER TO ALLOW FOR CEILING AND LIGHT BOXES TO BE FLUSH; DRILL HOLES IN BRICK, RUN WIRES OUT TO UNITS, SET DISCONNECTS AND WIRE UP ALL UNITS/DISCONNECTS; RUN WIRE OUT AND SET RECEPTACLE BY UNIT.	1,191.83	1,191.83
1	SEPTEMBER 24, 2011: MATERIAL AND LABOR TO BEGIN WIRING ATTIC AREA; PULLED TV CABLES TO ATTIC FOR DISH; PULLED TWO TELEPHONE CABLES TO ATTIC FOR SPARES; HOOKED UP WIRES AT PANEL FOR CIRCUITS; INSTALLED STACK SWITCH AT KITCHEN; INSTALLED TWO FLAPPER BOXES FOR KITCHEN LIGHTS; SET RECESSED LIGHTS AND BOXES IN ATTIC; CHANGED DRYER CORD FROM 3-WIRE TO 4-WIRE AS REQUESTED TO PROPERLY FIT EXISTING OUTLET; MOUNT TV/TELEPHONE BOX ON PANEL BOARD AND RUN WIRES DOWN INTO PANEL.	1,084.44	1,084.44
1	SEPTEMBER 25, 2011: MATERIAL AND LABOR TO INSTALL FAN AND DUCT BOX ON BOTTOM OF COOK TOP AND THEN INSTALL COOK TOP BACK IN HOLE; INSTALL WIRE FROM JUNCTION BOX TO FANS AND TO RECEPTACLE BY UNIT; WIRE IN THIRD FLOOR ATTIC AREA FOR LIGHTS AND RECEPTACLES; BEGIN TAPPING UP ATTIC WIRING.	1,056.96	1,056.96

Pay online at:: https://ipn.intuit.com/xrm5b929

Invoices are due with in 15 days of billing date; if not customer shall be obligated to pay 2% interest per month, plus attorney's fee and court cost. Thank you for your business.	**Total**

98

Billy's Electrical Service, Inc.
23707 Parsons Road
Middleburg, VA 20117
(540) 687-6226

Invoice

Date	Invoice #
10/7/2011	16449

Bill To
PAUL & MILARI MADISON 39638 RICKARD ROAD LOVETTSVILLE, VA 20180-3302

P.O. No.	Terms	Project
	Due on Receipt	

Quantity	Description	Rate	Amount
1	SEPTEMBER 26, 2011: MATERIAL AND LABOR TO REMOVE LIGHT IN DINING ROOM - PUT DINING ROOM LIGHT TOGETHER, MODIFY AND REINSTALL; PUT HALL LIGHT TOGETHER, MODIFY AND HANG; CHECK OUT REFRIGERATOR CIRCUIT, LOCATE CIRCUIT AND INSTALL NEW BREAKER IN PANEL, MAKE CONNECTIONS.	375.06	375.06
1	SEPTEMBER 27, 2011: MATERIAL AND LABOR TO INSTALL RANGE CORD ON COOK TOP, MAKE ALL CONNECTIONS AND STRAPPED WIRE UNDER SINK IN CABINET SO IT WASN'T HANGING LOOSE.	165.64	165.64
1	OCTOBER 3, 2011: MATERIAL AND LABOR TO ADD RECEPTACLE FOR SUMP PUMP; INSTALL DISHWASHER FEED ON BREAKER IN PANEL; CHECK OUT AC/HEAT UNIT BREAKERS; INSTALLED LIGHTS AND RECEPTACLES IN SUN ROOM; INSTALL EXTERIOR WP RECEPTACLE OFF SUN ROOM STEP; RANG OUT THREE-WIRE ON THIRD FLOOR AND DELETED WIRE; HOOK UP THIRD FLOOR ARC FAULT BREAKERS, TAPED OFF AT PANEL; LEFT TRIMS IN ATTIC FOR THIRD FLOOR LIGHTS; INSTALL MASTER BATHROOM SHOWER RECESSED LIGHT TRIM AND BULB.	745.54	745.54

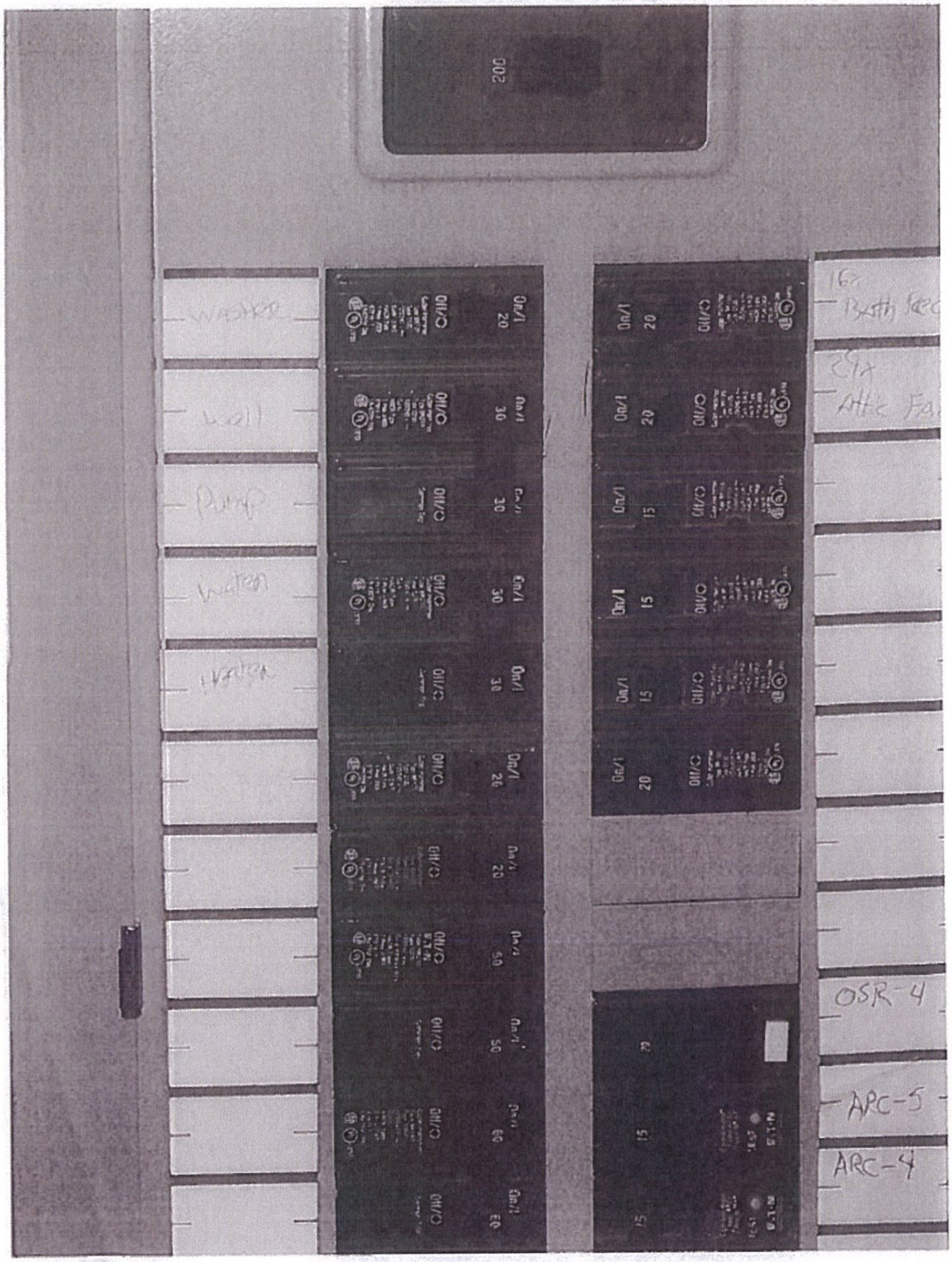
Pay online at:: https://ipn.intuit.com/xrm5b929

Invoices are due with in 15 days of billing date; if not customer shall be obligated to pay 2% interest per month, plus attorney's fee and court cost. Thank you for your business.	**Total** $11,477.29

99


Kitchen Rec
Kitchen Rec
Den Rec
Bath #1 Rec
Bath #3 Rec
outside Rec
Bed #1
Bed #2

EXHIBIT
I


Washer
Well
Pump
OSR-4
ARC-5
ARC-4

HIGH WIND
CALCULATIONS
FOR

INTEGRITY BUILDING SYSTEMS

MILTON, PA

C-484709-2
90 MPH
WIND EXPOSURE: C

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12

PREPARED BY:
BARLOW ENGINEERING. P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

NARRATIVE
110376
0232nec2011
IBS – C-484709-2
48.08' x 58.5' Two Story
9/12
90 mph
Exposure C
VA
ETHAN LOEWENTHAL
7/11/11

Analyses were performed for two parts of the structure: the Den and the Main House

Den

The Endwall #1 shear loads were added to the Main House Endwall #2 at the 1st level ceiling and floor. Shear connections were designed to transfer these loads.

The floor diaphragm continuity calc was removed, because it is a 1-module structure.

The roof truss uplift DL calcs were modified for the transverse roof orientation.

Main House

Because there are two orthogonal roof orientations, the perpendicular-to-ridge wind loading was used for both orthogonal directions. This is conservative loading.

Endwall #1 on the 1st level and Sidewall #2 on both levels end in segments shorter than H/3.5. Holddowns were designed for the true ends of these walls.

The lst level ceiling above the Sun Room was designed to transfer shear load out to the portion of Sidewall #1 at the Sun Room.

The structure dimensions were reduced in the shear connections calcs and in the overturning dead load calcs for the worst cases.

INDEX

SECTION 1 — **P1-14**
HIGH WIND CALCULATIONS – DEN

SECTION 2 — **P1-23**
HIGH WIND CALCULATIONS – MAIN HOUSE

SECTION 3 — **P1-3**
HAND CALCULATIONS

SECTION 4 — **P1**
ALTERNATE CONNECTIONS

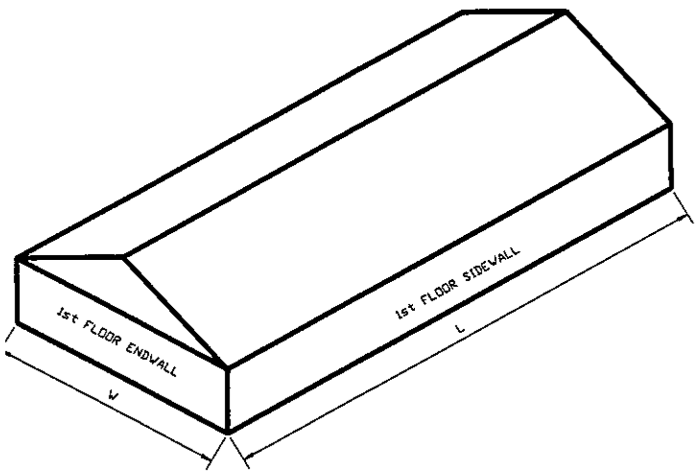
COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12

<u>Section 1</u>
HIGH WIND CALCULATIONS
DEN

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12



BUILDING INFORMATION:

JOB NUMBER =	110376		
PLAN NAME / NUMBER =	C-484709-2		
FIRST FLOOR WIDTH (W_1) =		21.83 ft	
FIRST FLOOR LENGTH (L_1) =		15.75 ft	
ROOF SPAN =		21.83 ft	
TRUSS SPACING (TOC)=		24 in	
STUD SPACING (SOC) =		24 in	
WIND SPEED (V3S) =		90 mph	
EXPOSURE FACTOR =	C		
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) =		1.196	
WALL HEIGHT ADJUSTMENT FACTOR (CWH) =	H / 8 =		1.125

SHEARWALL SUMMARY:

SHEATHING FASTENING MUST USE THE MORE RESTRICTIVE FASTENING OF THAT SPECIFIED FOR SHEARWALL SHEATHING FASTENING AND SHEATHING SUCTION FASTENING

FIRST FLOOR ENDWALL #1: THERMO-PLY (RED) SHEATHING EXTERIOR w/ 1/2" GWB INTERIOR
ADJACENT TO MAIN HOUSE WITH FASTENERS SPACED AT 3" EDGE

THERMOPLY FASTENED WITH 1" CROWN, 1 1/4" LEG 16 ga. STAPLE 3" O.C. EDGE & FIELD; STAPLES TO BE INSTALLED PARALLEL TO GRAIN

FIRST FLOOR ENDWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
OPPOSITE MAIN HOUSE WITH 8d COMMON NAILS SPACED AT 6" EDGE

FIRST FLOOR SIDEWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
DEN WITH 8d COMMON NAILS SPACED AT 6" EDGE

FIRST FLOOR SIDEWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BATH #1 WITH 8d COMMON NAILS SPACED AT 6" EDGE

ROOF SHEATHING: 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

CEILING SHEATHING: 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
FLOOR SHEATHING: 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

SHEATHING SUCTION FASTENING:

FOR ROOF ZONE 1: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.
FOR ROOF ZONE 2: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.
FOR ROOF ZONE 3 (CORNER): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.
FOR ROOF ZONE 3OH (CORNER OVERHANG): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 7 in o.c.
FOR WALL ZONE 4: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
FOR WALL ZONE 5: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
EDGE DIMENSION, Z = 3 ft

PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

CONNECTION SUMMARY: **CONNECTIONS TO BE AS SPECIFIED OR EQUIVALENT**

UPLIFT CONNECTIONS

REQUIRED TRUSS TIE DOWN: USE A SIMPSON H2.5A EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

1ST FLOOR STUD TO TOP PLATE / CEILING BAND: USE A 1.5" x 26 ga. STRAP EACH STUD WITH (6) 8d NAIL(S) EACH END
OR WITH (8) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

1st FLOOR STUD TO FLOOR BAND: USE A 1.5" x 26 ga. STRAP EACH STUD WITH (6) 8d NAIL(S) EACH END
OR WITH (8) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 260 lbs

FLOOR BAND TO SILL PLATE CONNECTION: USE A 1.5" x 22 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (17) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 780 lbs

LATERAL CONNECTIONS

TRUSS TO TOP PLATE CONNECTION: USE (2) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS
IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

PLATE TO STUD CONNECTION: USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

TOP PLATE SPLICES

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

SHEAR CONNECTIONS

FIRST FLOOR ENDWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
(AND SHEATHING TO TRUSS BOTTOM CHORD) OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 72" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 1292 lbs

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 66" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 72" O.C
OR USE 5/8" ANCHOR BOLTS @ 72" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

FIRST FLOOR SIDEWALL

UNIT SHEAR SHEATHING TO RIMBAND CONNECTION: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf

UNIT UPLIFT SHEATHING TO RIMBAND CONNECTION: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 14" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 53" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 72" O.C
OR USE 5/8" ANCHOR BOLTS @ 72" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

HOLDDOWN CONNECTIONS

FIRST FLOOR CORNER HOLDDOWN: NO PHYSICAL HOLDDOWN REQUIRED

FIRST FLOOR CORNER STUD CONNECTION: FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS

APPLICABILITY LIMITATIONS:

MEAN ROOF HEIGHT (MRH) =	16.10 ft
NUMBER OF STORIES =	1
FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
BUILDING ASPECT RATIO (L/W) =	0.72
FLOOR JOIST DEPTH =	9.25 in
MAX. VERTICAL FLOOR OFFSET =	0 in
FLOOR ASPECT RATIO (L/W) =	0.72
MAX. FLOOR DIAPHRAGM OPENING WIDTH =	0 ft
MAX. FLOOR DIAPHRAGM OPENING LENGTH =	0 ft
FIRST FLOOR HEIGHT (H_1) =	9 ft
CEILING ASPECT RATIO (L/W) =	0.72
MIN. SHEARWALL SEGMENT (H / 3.5) =	2.57 ft
ROOF PITCH =	9 /12

DESIGN MEETS LIMITATIONS OF THE WFCM METHODOLOGY

CONNECTION INFORMATION:

TRUSS TO PLATE CONNECTORS

UPLIFT STRENGTH:			SHEAR STRENGTH:	
SIMPSON H2.5	U =	365 lbs	F_2 =	130 lbs
SIMPSON H2.5A	U =	480 lbs	F_2 =	110 lbs
SIMPSON H10	U =	850 lbs	F_2 =	235 lbs
(5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)			U =	834 lbs
			F_2 =	486 lbs

200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	100 psi (END-GRAIN)
200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	200 psi (FACE)

FLAT STRAPS		MAXIMUM	FASTENERS: 8d NAIL		16 ga. STAPLE
1.5" x 26 ga. STRAP	Z =	485 lbs	Z =	76.7	49.9 lbs
1.5" x 22 ga. STRAP	Z =	810 lbs	Z =	127.2	48.6 lbs
1.5" x 20 ga. STRAP	Z =	973 lbs	Z =	127.3	48.3 lbs
(2) 1.5" x 22 ga. STRAP	Z =	1620 lbs	Z =	129.4	46.4 lbs
(2) 1.5" x 20 ga. STRAP	Z =	1946 lbs	Z =	131.4	46 lbs

HOLDDOWNS w/ 1 1/2" EDGE DISTANCE
MINIMUM 6" STEM WALL
ASSUME 3000 psi Fc CONCRETE

SIMPSON LSTHD8RJ	Z =	1950 lbs
SIMPSON STHD10RJ	Z =	3230 lbs
SIMPSON STHD14RJ	Z =	4430 lbs
(2) SIMPSON STHD14RJ	Z =	8860 lbs
1/2" DIA. THRU BOLT	Z =	623 lbs
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
1/4" DIA. LAG SCREW	Z =	224 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	100 lbs
0.131" x 2.5" COMMON NAIL (TOENAILED)	Z =	83 lbs
0.131" x 2.5" COMMON NAIL (ENDNAILED)	Z =	67 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs
0.162" x 3.5" COMMON NAIL (ENDNAILED)	Z =	128 lbs
8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER	Z =	95 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	69 lbs (7/16" SIDE: WITHDRAWAL)
(1) SIMPSON LTP4 PLATE	Z =	575 lbs
1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"	Z =	70 plf
7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	296 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	328 plf
19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	309 plf
19/32" MIN. OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	347 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	437 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	461 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 4"/12" & 2 1/2" o.c. @ PERIMETER, DOUBLE FRAMING	Z =	694 plf

NOTE: SIMPSON CONNECTORS & FASTEN VALUES ASSUME SPF FRAMING MATERIAL
ANCHOR BOLT VALUES ASSUME DF/SP VALUES

DESIGN UPLIFT LOADS

ROOF & CEILING ASSEMBLY DEAD LOAD = 15 psf
WALL DEAD LOAD (WDL) = 12 psf
FLOOR DEAD LOAD (FDL) = 10 psf
ROOF SPAN (RS) = 21.83 ft
TRUSS SPACING (TOC)= 24 in
STUD SPACING (SOC) = 24 in
FIRST FLOOR HEIGHT (H_1) = 9 ft

UPLIFT CONNECTION LOAD:

PER TABLE 2.2A, 2001 WFCM AT 21.83' (wup')= 204 plf
wup = wup' * CMRH - 0.6 * RDL * RS / 4 =
wup = 204 plf * 1.196 - 0.6 * 15 psf * 21.83 ft / 4 = $\boxed{194}$ plf

REQUIRED TRUSS TIE DOWN:

$P_{up} = w_{up}$ * TOC =
P_{up} = 194 plf * 24 in / 12 =
P_{up} = 389 lbs

USE A SIMPSON H2.5A EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

REQUIRED SIDEWALL STUD TIE DOWN LOADING:

1ST FLOOR STUD TO TOP PLATE / CEILING BAND: $P_{1tp} = w_{up}$ * SOC = 194 * 24 / 12 = 389 lbs

1st FLOOR STUD TO FLOOR BAND: $P_{1fb} = P_{1tp}$ - 0.6 * WDL * H_1 * SOC =
P_{1fb} = 389 lbs - 0.6 * 12 psf * 9 ft * 24 in / 12 = 260 lbs

CHECK FASTENERS: 8d NAIL Z = 76.7 lbs
389 lbs / 76.7 lbs / FASTENER = 5.07 FASTENERS
USE (6) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 49.9 lbs
389 lbs / 49.9 lbs / FASTENER = 7.79 FASTENERS
USE (8) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 26 ga. STRAP EACH STUD WITH (6) 8d NAIL(S) EACH END
OR WITH (8) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

SIDEWALL 1st FLOOR BAND TO SILL PLATE CONNECTION:

SIDEWALL UPLIFT AT SILL PLATE: $w_{sp} = P_{1fb}$ / SOC =
w_{sp} = 260 lbs * 12 / 24 in =
w_{sp} = 130 plf

CHECK STRAP AT ANCHOR BOLT LOCATIONS:

1/2" ANCHOR BOLT SPACING (BOC) = 72 in

P_{sp} = w_{sp} * BOC = 130 plf * 72 = 780 lb

CHECK FASTENERS: 8d NAIL Z = 127.2 lbs
780 lbs / 127.2 lbs / FASTENER = 6.13 FASTENERS
USE (7) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.6 lbs
780 lbs / 48.6 lbs / FASTENER = 16.05 FASTENERS
USE (17) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 22 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (17) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 780 lbs

CHECK BENDING IN RIMBAND:

DBL. 2x10 SPF #2 RIMBAND DESIGN VALUES:

SECTION MODULUS (S) = 42.78 in^3
ALLOWABLE BENDING (fb) = 875 psi

$M_{MAX} = \frac{w_{AP} * BOC^2}{8} =$

$M_{MAX} = \frac{130 \text{ plf} * (72 / 12)^2}{8} =$ 7020 in-lbs

APPLIED fb = $\frac{M_{MAX}}{S} = \frac{7020 \text{ in-lbs}}{42.78 \text{ in}^3} =$ 164 psi

ALLOWABLE BENDING (fb) = 875 psi > APPLIED fb = 164 psi

DBL. 2x10 SPF #2 RIMBAND IS OK

LATERAL LOAD AT ROOF/CEILING DIAPHRAGM

ROOF SPAN = 21.83 ft
ROOF PITCH = 9 /12

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM AT 21.83' (wl-per')= 121 plf
wl-per = wl-per' * CMRH * CWH =
wl-per = 121 plf * 1.196 * 1.125 = 164 plf

WIND PARALLEL TO RIDGE:

PER TABLE 2.5B, 2001 WFCM AT 21.83' (wl-para')= 75 plf
wl-para = wl-para' * CMRH * CWH =
wl-para = 75 plf * 1.196 * 1.125 = 102 plf

LATERAL LOAD AT FLOOR DIAPHRAGM

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM FLl-per' = 123 plf
FLl-per = FLl-per' * CMRH * CWH =
FLl-per = 123 plf * 1.196 * 1.125 = 166 plf

WIND PARALLEL TO RIDGE:

PER TABLE 2.5B, 2001 WFCM FLl-para' = 84 plf
FLl-para = FLl-para' * CMRH * CWH =
FLl-para = 84 plf * 1.196 * 1.125 = 114 plf

LATERAL FRAMING CONNECTION LOADS FROM WIND:
(FOR ROOF-TO-PLATE, PLATE-TO-PLATE, PLATE-TO-STUD, AND PLATE-TO-FLOOR)

PER TABLE 2.1, 2001 WFCM wl-wall' = 82 plf
wl-wall = Wl-wall' * CMRH =
wl-wall = 81.5 plf * 1.196 = 98 plf

TRUSS MULTIPLIER = 2
STUD MULTIPLIER = 2

TRUSS TO TOP PLATE CONNECTION:

$P_C = W_{l\text{-}wall} * M_{24} =$ 98 plf * 2 = 195 lbs

TRUSS CONNECTION: SIMPSON H2.5A $F_2 =$ 110 lbs

$P_C = P - F_2 =$
$P_C =$ 195 lbs - 110 lbs =
$P_C =$ 85 lbs

OF 0.131" x 2.5" COMMON NAIL (TOENAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{85 \text{ lbs}}{83 \text{ lbs}}$ = 2 NAILS

USE (2) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS

IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z * 12}{w_{l\text{-wall}}}$ = $\frac{100 \text{ lbs} * 12}{98 \text{ plf}}$ = 12 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

PLATE TO STUD CONNECTION:

$P_C = w_{l\text{-wall}} * M_{16}$ = 98 plf * 2 = 195 lbs

OF 0.162" x 3.5" COMMON NAIL (ENDNAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{195 \text{ lbs}}{128 \text{ lbs}}$ = 2 NAILS

USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z * 12}{w_{l\text{-wall}}}$ = $\frac{100 \text{ lbs} * 12}{98 \text{ plf}}$ = 12 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

TOP PLATE SPLICE LENGTH

STRUCTURE WIDTH (W) = 21.83 ft
STRUCTURE LENGTH (L) = 15.75 ft
0.162" x 3.5" COMMON NAIL (FACE NAILED) Z = 191 lbs
ROOF DIAPHRAGM LOADING ($w_{l\text{-per}}$) = 164 plf

DIAPHRAGM CHORD FORCE = $T = \frac{wl\text{-}per * L^2}{8 * W}$ = $\frac{164 \text{ plf} * 15.75 \text{ ft}^2}{8 * 21.83 \text{ ft}}$ = 233 lbs

REQUIRED SPLICE LENGTH (w/ (2) 16d 3" o.c.): $\frac{T * 3" / 12" / ft}{2 * Z}$ = $\frac{233 \text{ lbs} * 3" / 12" / ft}{2 * 191 \text{ lbs / NAIL}}$ = 1 ft

REQUIRED SPLICE LENGTH (w/ (2) 16d 12" o.c.): $\frac{T * 12" / 12" / ft}{2 * Z}$ = $\frac{233 \text{ lbs} * 12" / 12" / ft}{2 * 191 \text{ lbs / NAIL}}$ = 1 ft

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

ROOF DIAPHRAGM SHEATHING REQUIREMENTS

ROOF SPAN (RS) = 21.83 ft
ROOF LENGTH (RL) = 15.75 ft
ROOF PITCH = 9 /12
ROOF ANGLE (RA) = 36.9 °
$w_{l\text{-per}}$ = 164 plf
STANDARD ROOF SHEATHING = 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
ROOF SHEATHING SHEAR CAPACITY (v_r) = 296 plf
STANDARD CEILING SHEATHING = 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
CEILING SHEATHING SHEAR CAPACITY (v_c) = 70 plf

MAX DIAPHRAGM SHEAR (v) = $\frac{L * wl_{l\text{-per}} / 2}{RS}$ = $\frac{15.75 \text{ ft} * 164 \text{ plf} / 2}{21.83 \text{ ft}}$ = 60 plf

NET DIAPHRAGM SHEAR CAPACITY (v_n) = $v_r + v_c$ = 296 plf + 70 plf = 366 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 60 plf < **STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 366 plf**

STANDARD ROOF/CEILING DIAPHRAGM OK

FLOOR DIAPHRAGM SHEATHING REQUIREMENTS

BUILDING WIDTH (W) = 21.83 ft
BUILDING LENGTH (L) = 15.75 ft
FL_{1-per} = 166 plf
STANDARD FLOOR SHEATHING = 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
FLOOR DIAPHRAGM SHEAR CAPACITY (v) = 309 plf

MAX FLOOR DIAPHRAGM SHEAR (v) = $\frac{L * 3/4 * FL_{1-per} / 2}{W}$ = $\frac{15.75\text{ ft} * 3/4 * 166\text{ plf} / 2}{21.83\text{ ft}}$ = 45 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 45 plf < STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 309 plf

STANDARD FLOOR DIAPHRAGM OK

SHEATHING SUCTION CONNECTION (PER 2001 WFCM, TABLE 2.4, pp. 69)

TRUSS SPACING (TOC) = 24 in O.C.
STUD SPACING (SOC) = 24 in O.C.
0.131" x 2.5" COMMON NAIL (FACE NAILED) 69 lbs (7/16" SIDE MEMBER; WITHDRAWAL)
Z = 3 ft
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) = 1.196

FOR ROOF ZONE 1 (FIELD):

p' = 15 psf
p = p' * CMRH
p = 15 psf * 1.196
p = 17.94 psf

TRUSS LOADING = 17.94 psf x 24" o.c. / 12" / ft = 36 plf

$\frac{36\text{ plf}}{69\text{ lbs / FASTENER}}$ = 0.6 FASTENERS / ft = 20 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.

FOR ROOF ZONE 2 (EDGE):

p' = 28.9 psf
p = p' * CMRH
p = 28.9 psf * 1.196
p = 34.57 psf

TRUSS LOADING = 34.57 psf x 24" o.c. / 12" / ft = 69 plf

$\frac{69\text{ plf}}{69\text{ lbs / FASTENER}}$ = 1.0 FASTENERS / ft = 12 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.

FOR ROOF ZONE 3 (CORNER):

p' = 37.8 psf
p = p' * CMRH
p = 37.8 psf * 1.196
p = 45.21 psf

TRUSS LOADING = 45.21 psf x 24" o.c. / 12" / ft = 90 plf

$\frac{90\text{ plf}}{69\text{ lbs / FASTENER}}$ = 1.4 FASTENERS / ft = 8 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.

FOR ROOF ZONE 3OH (CORNER OVERHANG):

p' = 47 psf
p = p' * CMRH
p = 47 psf * 1.196
p = 56.22 psf

TRUSS LOADING = 56.22 psf x 24" o.c. / 12" / ft = 112 plf

$\frac{112 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 1.7 FASTENERS / ft = 7 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 7 in o.c.

FOR WALL ZONE 4 (FIELD):

p' = 16.2 psf
p = p' * CMRH
p = 16.2 psf * 1.196
p = 19.38 psf

STUD LOADING = 19.38 psf x 24" o.c. / 12" / ft = 39 plf

$\frac{39 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.6 FASTENERS / ft = 20 in O.C.
MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FOR WALL ZONE 5 (EDGE):

p' = 20.1 psf
p = p' * CMRH
p = 20.1 psf * 1.196
p = 24.04 psf

STUD LOADING = 24.04 psf x 24" o.c. / 12" / ft = 48 plf

$\frac{48 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.7 FASTENERS / ft = 17 in O.C.
MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FIRST FLOOR ENDWALL #1 SHEATHING LENGTH REQUIREMENTS ADJACENT TO MAIN HOUSE

FIRST FLOOR WIDTH (W_1) = 21.83 ft
FIRST FLOOR LENGTH (L_1) = 15.75 ft
SHEARWALL TYPE: THERMO-PLY (RED) SHEATHING EXTERIOR w/ 1/2" GWB INTERIOR
SHEATHING EDGE 6d COOLER NAIL SPACING = 3 in O.C. (6d COOLER NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 408 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 13.83 ft
1st FL. PERCENT FULL HEIGHT SHEATHING= 63 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT = 9 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.583 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{end1}) = L_1 * W_{i-per} / N_{end} + ADDITIONAL=
R_{end1} = 15.75 ft * 164 plf / 2 + 0 lbs = 1292 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 1292 lbs / 408 plf = 3.17 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 3.17 ft / 0.583 = 5.44 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 5.44 ft < PERFORATED FULL HEIGHT SHEATHING PROVIDED = 13.83 ft

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR ENDWALL #1: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 13.83 ft
SHEARWALL ADJUSTMENT FACTOR (C_P) = 0.583
SHEARWALL REACTION (R_{end2}) = 1292 lbs
WALL HEIGHT (H) = 9 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{end1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{1292 \text{ lbs} \times 9 \text{ ft}}{13.83 \text{ ft} \times 0.583} = 1443 \text{ lbs}$$

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL #2 SHEATHING LENGTH REQUIREMENTS
OPPOSITE MAIN HOUSE

FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	15.16 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	69 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.757 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end1}) = $L_1 * W_{t-per} / N_{end}$ + ADDITIONAL=
R_{end1} = 15.75 ft * 164 plf / 2 + 0 lbs = 1292 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 1292 lbs / 384 plf = 3.36 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 3.36 ft / 0.757 = 4.45 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 4.45 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 15.16 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR ENDWALL #2: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	15.16 ft
SHEARWALL ADJUSTMENT FACTOR (C_P) =	0.757
SHEARWALL REACTION (R_{end2}) =	1292 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O}$ =

U_{E1} = $\dfrac{1292 \text{ lbs} \times 9 \text{ ft}}{15.16 \times 0.757}$ = 1014 lbs

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL: SHEAR CONNECTIONS

FIRST FLOOR WIDTH (W_1) =	21.83 ft	
FIRST FLOOR LENGTH (L_1) =	15.75 ft	
FL_{t-per}=	166 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR ENDWALL SHEAR LOAD = 1292 lbs

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION:

# TOENAILS PER FOOT =	V / Z / W = 1292 lbs / 158 lbs / 21.83 ft =		0.4 NAILS / ft	
TOENAIL SPACING =	12 / # = 12 / 0.4 =	16 " O.C.		(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 1292 lbs / 575 lbs / 21.83 ft =		0.1 PLATES / ft	
LTP4 PLATE SPACING =	12 / # = 12 / 0.1 =	72 " O.C.		(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 72" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 1292 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX ENDWALL SHEAR + L_1 x (3/4 * FL_{L-per}) / 2 =
V = 1292 lbs + 15.75 ft x (3/4 * 166 plf) / 2 — 2272 lbs

# TOENAILS PER FOOT =	V / Z / W = 2272 lbs / 158 lbs / 21.83 ft =		0.7 NAILS / ft
TOENAIL SPACING =	12 / # = 12 / 0.7 =	16 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 2272 lbs / 575 lbs / 21.83 ft =		0.2 PLATES / ft
LTP4 PLATE SPACING =	12 / # = 12 / 0.2 =	66 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 66" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

SILL PLATE TO FOUNDATION CONNECTION:

# 1/2" ANCHOR BOLTS =	V / Z = 2272 lbs / 1056 lbs =	3 BOLTS
BOLT SPACING = (W - 2) / (N - 1) =	(21.83 ft - 2) / (3 - 1) =	72 in

USE 1/2" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

# 5/8" ANCHOR BOLTS =	V / Z = 2272 lbs / 1486 lbs =	2 BOLTS
BOLT SPACING = (W - 2) / (N - 1) =	(21.83 ft - 2) / (2 - 1) =	72 in

USE 5/8" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

$$\text{SHEAR FORCE (V)} = \frac{R_{end1}}{\Sigma L_i \times C_O} =$$

FIRST FLOOR ENDWALL #1: $V = \frac{1292 \text{ lbs}}{13.83 * 0.583} =$ 161 plf

FIRST FLOOR ENDWALL #2: $V = \frac{1292 \text{ lbs}}{15.16 * 0.757} =$ 113 plf

MAXIMUM FIRST FLOOR ENDWALL UNIT SHEAR = 161 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER — Z = 95 lbs

$$\text{\# OF 8d NAILS PER FOOT} = \frac{V}{Z} = \frac{161 \text{ plf}}{95 \text{ lbs / NAIL}}$$

# OF 8d NAILS PER FOOT =	1.7 NAILS PER FOOT	
OVERALL 8d NAIL SPACING =	12 / # = 12 / 1.7 =	7.05 " O.C.
# OF ROWS :	1 ROW(S)	
8d NAIL SPACING WITHIN EACH ROW =	1 * SPACING 1 * 7.05 o.c.	6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER — Z = 95 lbs

OF 8d NAILS PER FOOT = $\dfrac{V}{Z} = \dfrac{161 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 1.7 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 1.7 = 7.05 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 " SPACING 1 * 7.05 o.c. 6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 161 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE — Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\dfrac{V}{Z} = \dfrac{161 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}} =$ 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

FIRST FLOOR SIDEWALL #1 SHEATHING LENGTH REQUIREMENTS
DEN

FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	9.42 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	60 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.8 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.665 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = $W_1 * W_{i\text{-}para} / N_{side}$ + ADDITIONAL =
R_{side1} = 21.83 ft * 102 plf / 2 + 0 lbs = 1114 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 1114 lbs / 384 = 2.90 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{sw} / C_O = 2.9 ft / 0.665 = 4.37 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 4.37 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 9.42 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #1: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	9.42 ft
SHEARWALL ADJUSTMENT FACTOR (C_p) =	0.665
SHEARWALL REACTION (R_{side1}) =	1114 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\dfrac{R_{side1} \times H}{\Sigma L_i \times C_O}$ =

$U_{E1} = \dfrac{1114 \text{ lbs} \times 9 \text{ ft}}{9.42 \times 0.665}$ = 1601 lbs

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL #2 SHEATHING LENGTH REQUIREMENTS
BATH #1

FIRST FLOOR WIDTH (W_1) = 21.83 ft
FIRST FLOOR LENGTH (L_1) = 15.75 ft
SHEARWALL TYPE: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING = 6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 384 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 9.04 ft
1st FL. PERCENT FULL HEIGHT SHEATHING= 57 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT = 6.2 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.689 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{side1}) = W_1 * W_{l-para} / N_{side} + ADDITIONAL=
R_{side1} = 21.83 ft * 102 plf / 2 + 0 lbs = 1114 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 1114 lbs / 384 plf = 2.90 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{sw} / C_o = 2.9 ft / 0.689 = 4.22 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 4.22 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 9.04 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #2: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 9.04 ft
SHEARWALL ADJUSTMENT FACTOR (C_P) = 0.689
SHEARWALL REACTION (R_{side1}) = 1114 lbs
WALL HEIGHT (H) = 9 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{1114 \text{ lbs} \times 9 \text{ ft}}{9.04 \times 0.689} = 1610 \text{ lbs}$$

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL: SHEAR CONNECTIONS

FIRST FLOOR WIDTH (W_1) = 21.83 ft
FIRST FLOOR LENGTH (L_1) = 15.75 ft
FL_{l-para} = 114 plf
W_{l-para} = 102 plf

1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR SIDEWALL SHEAR LOAD = 1114 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX SIDEWALL SHEAR + W_1 x (3/4 * FL_{l-para}) / 2 =
V = 1114 lbs + 21.83 ft x (3/4 * 114 plf) / 2 = 2047 lbs

# TOENAILS PER FOOT =	V / Z / L_1 = 2047 lbs / 158 lbs / 15.75 ft =		0.8 NAILS / ft	
TOENAIL SPACING =	12 / # = 12 / 0.8 =	14 " O.C.		(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 2047 lbs / 575 lbs / 15.75 ft =		0.2 PLATES / ft	
LTP4 PLATE SPACING =	12 / # = 12 / 0.2 =	53 " O.C.		(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 14" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 53" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

SILL PLATE TO FOUNDATION CONNECTION:

# 1/2" ANCHOR BOLTS =		V / Z = 2047 lbs / 1056 lbs =	2 BOLTS
BOLT SPACING = (L - 2) / (N - 1) =		(15.75 ft - 2) / (2 - 1) =	72 in

USE 1/2" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

# 5/8" ANCHOR BOLTS =		V / Z = 2047 lbs / 1488 lbs =	2 BOLTS
BOLT SPACING = (L - 2) / (N - 1) =		(15.75 ft - 2) / (2 - 1) =	72 in

USE 5/8" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\dfrac{R_{end1}}{\Sigma L_i \times C_o}$ =

FIRST FLOOR SIDEWALL #1: V = $\dfrac{1114 \text{ lbs}}{9.42 \times 0.665}$ = 178 plf

FIRST FLOOR SIDEWALL #2: V = $\dfrac{1114 \text{ lbs}}{9.04 \times 0.689}$ = 179 plf

MAXIMUM FIRST FLOOR SIDEWALL UNIT SHEAR = 179 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\dfrac{V}{Z}$ = $\dfrac{179 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 1.89 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 1.89 = 6.34 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 " SPACING 1 " 6.34 o.c. 6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\dfrac{V}{Z}$ = $\dfrac{179 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 1.89 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 1.89 = 6.34 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 " SPACING 1 " 6.34 o.c. 6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 179 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE — Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z} = \frac{179 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}} =$ 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

COMBINED CORNER HOLDDOWN REQUIREMENTS

UPLIFT FORCES: (SEE ABOVE FOR CALCULATIONS)

1st FLOOR ENDWALL #1 UPLIFT FORCE (U_{E1}) =	1443 lbs
1st FLOOR ENDWALL #2 UPLIFT FORCE (U_{E1}) =	1014 lbs
1st FLOOR SIDEWALL #1 UPLIFT FORCE (U_{S1}) =	1601 lbs
1st FLOOR SIDEWALL #2 UPLIFT FORCE (U_{S1}) =	1610 lbs

DEAD LOADS:

FIRST FLOOR WIDTH (W_1) =	21.83 ft (MAX: 4 * CEILING HEIGHT)
FIRST FLOOR LENGTH (L_1) =	15.75 ft (MAX: 4 * CEILING HEIGHT)
FIRST FLOOR HEIGHT (H_1) =	9 ft
ROOF & CEILING ASSEMBLY DEAD LOAD (RDL) =	15 psf
WALL DEAD LOAD (WDL) =	12 psf
FLOOR DEAD LOAD (FDL) =	10 psf

SIDEWALL FIRST FLOOR CORNER:

ROOF DEAD LOAD =	0.6 * RDL * W_1 * L_1 / 8 =	
ROOF DEAD LOAD =	0.6 * 15 psf * 21.83 ft * 15.75 ft / 8 =	387 lbs
WALL DEAD LOAD =	0.6 * (WDL * H_1 * L_1 / 2) =	
WALL DEAD LOAD =	0.6 * 12 psf * 9 ft * 15.75 ft / 2 =	510 lbs
1st FLOOR DEAD LOAD =	0.6 * FDL * W_1 * L_1 / 8 =	
1st FLOOR DEAD LOAD =	0.6 * 10 psf * 21.83 ft * 15.75 ft / 8 =	258 lbs
	TOTAL DEAD LOAD = 510 lbs + 387 lbs + 258 lbs =	1155 lbs

CORNER STUD CONNECTION LOAD = MAX WALL UPLIFT - SELF WEIGHT
1610 lbs - 1155 lbs = 455 lbs

ENDWALL FIRST FLOOR CORNER:

WALL DEAD LOAD =	0.6 * (WDL * H_1 * W_1 / 2) =	
WALL DEAD LOAD =	0.6 * 12 psf * 9 ft * 21.83 ft / 2 =	708 lbs
GABLE WALL DEAD LOAD =	0.6 * (WDL * (H / 2) * W / 2) =	
GABLE WALL DEAD LOAD =	0.6 * 12 psf * ((9 / 12) * (21.83 ft / 2) / 2) * (21.83 ft) / 2 =	322 lbs
	TOTAL DEAD LOAD = 708 lbs + 322 lbs =	1030 lbs

CORNER STUD CONNECTION LOAD = MAX WALL UPLIFT - SELF WEIGHT
1443 lbs - 1030 lbs = 413 lbs

FIRST FLOOR HOLDDOWNS

UPLIFT FORCE = 1610 lbs (MAX. OF FIRST FLOOR UPLIFT FORCES)

FIRST FLOOR DEAD LOAD (DL_1) = 1155 lbs + 1030 lbs = 2185 lbs

HOLDDOWN FORCE = 1610 lbs - 2185 lbs = 0 lbs

NO PHYSICAL HOLDDOWN REQUIRED

FIRST FLOOR CORNER STUD CONNECTION

0.162" x 3.5" COMMON NAIL (FACE NAILED) — Z = 191 lbs

MAX CORNER STUD CONNECTION LOAD = 455 lbs

NAIL SPACING (2 ROWS) = $\frac{2 * H * Z}{U} = \frac{2 * 9 \text{ ft} * 191 \text{ lbs}}{455 \text{ lbs}} =$ 16 in O.C. (16" MAX)

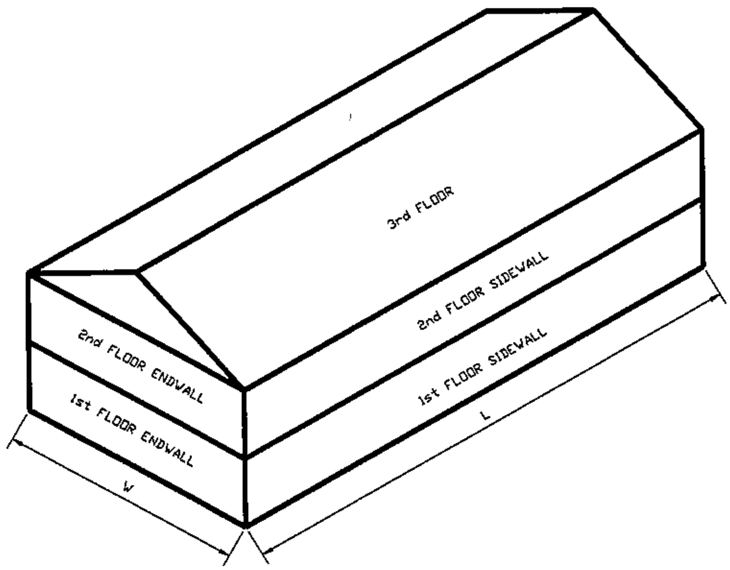
OF 1/4" DIA. LAG SCREW REQUIRED = $\frac{U}{Z} = \frac{455 \text{ lbs}}{224 \text{ lbs}} =$ 6 LAG SCREWS (6 MIN)

**FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS**

Section 2
HIGH WIND CALCULATIONS
MAIN HOUSE

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12



BUILDING INFORMATION:

JOB NUMBER =		110376	
PLAN NAME / NUMBER =	C-484709-2		
FIRST FLOOR WIDTH (W_1) =		48.08 ft	
SECOND FLOOR WIDTH (W_2) =		48.08 ft	
FIRST FLOOR LENGTH (L_1) =		42.67 ft	
SECOND FLOOR LENGTH (L_2) =		42.67 ft	
ROOF SPAN =		29.17 ft	
TRUSS SPACING (TOC)=		24 in	
STUD SPACING (SOC) =		24 in	
WIND SPEED (V3S) =		90 mph	
EXPOSURE FACTOR =		C	
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) =		1.330	
WALL HEIGHT ADJUSTMENT FACTOR FOR FLOORS (CWH) =	H / 8 =		1.125
WALL HEIGHT ADJUSTMENT FACTOR FOR ROOF (CWH) =	H / 8 =		1.063

SHEARWALL SUMMARY:

FIRST FLOOR ENDWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
LIBRARY / LIVING WITH 8d COMMON NAILS SPACED AT 3" EDGE

FIRST FLOOR ENDWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR, DOUBLE STUDS
FAMILY / DINING WITH 8d COMMON NAILS SPACED AT 2" EDGE

FIRST FLOOR SIDEWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SUN ROOM / FAMILY WITH 8d COMMON NAILS SPACED AT 4" EDGE

FIRST FLOOR SIDEWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
LIVING / DINING WITH 8d COMMON NAILS SPACED AT 4" EDGE

SECOND FLOOR ENDWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #3 & #4 WITH 8d COMMON NAILS SPACED AT 6" EDGE

SECOND FLOOR ENDWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #1 & #2 WITH 8d COMMON NAILS SPACED AT 6" EDGE

SECOND FLOOR SIDEWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #1 & #4 WITH 8d COMMON NAILS SPACED AT 6" EDGE

SECOND FLOOR SIDEWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #2 & #3 WITH 8d COMMON NAILS SPACED AT 6" EDGE

PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

ROOF SHEATHING: 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

CEILING SHEATHING: 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
FLOOR SHEATHING: 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

SHEATHING SUCTION FASTENING:
FOR ROOF ZONE 1: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.
FOR ROOF ZONE 2: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 10 in o.c.
FOR ROOF ZONE 3 (CORNER): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.
FOR ROOF ZONE 3OH (CORNER OVERHANG): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
FOR WALL ZONE 4: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
FOR WALL ZONE 5: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
EDGE DIMENSION, Z = 5 ft

CONNECTION SUMMARY: CONNECTIONS TO BE AS SPECIFIED OR EQUIVALENT

UPLIFT CONNECTIONS

REQUIRED TRUSS TIE DOWN: USE A SIMPSON H10 EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

2nd FLOOR STUD TO TOP PLATE / CEILING BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

2nd FLOOR STUD TO FLOOR BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 429 lbs

2nd FLOOR BAND TO 1st CEILING BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 429 lbs

1st FLOOR STUD TO CEILING BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 342 lbs

1st FLOOR STUD TO FLOOR BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 213 lbs

FLOOR BAND TO SILL PLATE CONNECTION: USE A 1.5" x 26 ga. STRAP WITH (3) 8d NAIL(S) EACH END
OR WITH (4) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 158 lbs

LATERAL CONNECTIONS

TRUSS TO TOP PLATE CONNECTION: USE (0) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS
IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

PLATE TO STUD CONNECTION: USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

TOP PLATE SPLICES

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 3 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

HORIZONTAL FLOOR DIAPHRAGM CONTINUITY

SECOND FLOOR
MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)
USE A MIN. OF (5) 1/2" DIA.THRU BOLTS

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)
USE A 1.5" x 20 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (18) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 854 lbs

FIRST FLOOR
MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)
USE A MIN. OF (5) 1/2" DIA.THRU BOLTS

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)
USE A 1.5" x 22 ga. STRAP WITH (6) 8d NAIL(S) EACH END
OR WITH (14) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 640 lbs

SHEAR CONNECTIONS

SECOND FLOOR ENDWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
(AND SHEATHING TO TRUSS BOTTOM CHORD) OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 46" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 4353 lbs

RIMBANDS TO BOTTOM / BEARING / TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) AT 6" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

BEARING PLATE TO CEILING BAND CONNECTION: USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 6" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

SECOND FLOOR SIDEWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBANDS TO BOTTOM, BEARING & TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 10" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

BEARING PLATE TO CEILING BAND CONNECTION: USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

FIRST FLOOR ENDWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 4" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 16" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 29" O.C
OR USE 5/8" ANCHOR BOLTS @ 41" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

FIRST FLOOR SIDEWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 7" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 28" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 54" O.C
OR USE 5/8" ANCHOR BOLTS @ 72" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

HOLDDOWN CONNECTIONS

NOTE: OVERTURNING UPLIFT HOLDDOWNS HAVE BEEN INDIVIDUALLY CALCULATED FOR SOME STRUCTURE CORNERS
SEE PAGE 3 OF THE HAND CALCS FOR THESE VALUES & CONNECTIONS, WHICH TAKE PRECEDENCE OVER THOSE LISTED BELOW

SECOND FLOOR CORNER HOLDDOWN: NO PHYSICAL HOLDDOWN REQUIRED

SECOND FLOOR CORNER STUD CONNECTION: FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS

FIRST FLOOR CORNER HOLDDOWN: USE A SIMPSON STHD10RJ AT EACH BUILDING CORNER OR EQUAL
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 2723 lbs

FIRST FLOOR CORNER STUD CONNECTION: FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 7" ON CENTER
OR USE (26) 1/4" DIA. LAG SCREWS

APPLICABILITY LIMITATIONS:

MEAN ROOF HEIGHT (MRH) =	26.97 ft
NUMBER OF STORIES =	2
FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
BUILDING ASPECT RATIO (L/W) =	0.89
FLOOR JOIST DEPTH =	9.25 in
MAX. VERTICAL FLOOR OFFSET =	0 in
FLOOR ASPECT RATIO (L/W) =	0.89
MAX. FLOOR DIAPHRAGM OPENING WIDTH =	11.25 ft
MAX. FLOOR DIAPHRAGM OPENING LENGTH =	4 ft
FIRST FLOOR HEIGHT (H_1) =	9 ft
SECOND FLOOR HEIGHT (H_2) =	8.5 ft
CEILING ASPECT RATIO (L/W) =	0.89
MIN. SHEARWALL SEGMENT (H / 3.5) =	2.43 ft
ROOF PITCH =	9 /12

DESIGN MEETS LIMITATIONS OF THE WFCM METHODOLOGY

CONNECTION INFORMATION:

TRUSS TO PLATE CONNECTORS

UPLIFT STRENGTH:			SHEAR STRENGTH:	
SIMPSON H2.5	U =	365 lbs	F_2 =	130 lbs
SIMPSON H2.5A	U =	480 lbs	F_2 =	110 lbs
SIMPSON H10	U =	850 lbs	F_2 =	235 lbs
(5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)			U =	834 lbs
			F_2 =	486 lbs
		200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	100 psi (END-GRAIN)
		200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	200 psi (FACE)

FLAT STRAPS			FASTENERS:	8d NAIL	16 ga. STAPLE
1.5" x 26 ga. STRAP	Z =	485 lbs	Z =	76.7	49.9 lbs
1.5" x 22 ga. STRAP	Z =	810 lbs	Z =	127.2	48.6 lbs
1.5" x 20 ga. STRAP	Z =	973 lbs	Z =	127.3	48.3 lbs
(2) 1.5" x 22 ga. STRAP	Z =	1620 lbs	Z =	129.4	46.4 lbs
(2) 1.5" x 20 ga. STRAP	Z =	1946 lbs	Z =	131.4	46 lbs

HOLDDOWNS w/ 1 1/2" EDGE DISTANCE
MINIMUM 8" STEM WALL
ASSUME 3000 psi Fc CONCRETE

SIMPSON LSTHD8RJ	Z =	1950 lbs
SIMPSON STHD10RJ	Z =	3230 lbs
SIMPSON STHD14RJ	Z =	4430 lbs
(2) SIMPSON STHD14RJ	Z =	8860 lbs
1/2" DIA. THRU BOLT	Z =	623 lbs
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
1/4" DIA. LAG SCREW	Z =	224 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	100 lbs
0.131" x 2.5" COMMON NAIL (TOENAILED)	Z =	83 lbs
0.131" x 2.5" COMMON NAIL (ENDNAILED)	Z =	67 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs

0.162" x 3.5" COMMON NAIL (ENDNAILED)	Z =	128 lbs
8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER	Z =	95 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	69 lbs (WITHDRAWAL)
(1) SIMPSON LTP4 PLATE	Z =	575 plf
1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"	Z =	70 plf
7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	296 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	328 plf
19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	309 plf
19/32" MIN. OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	347 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	437 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	461 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 4"/12" & 2 1/2" o.c. @ PERIMETER, DOUBLE FRAMING	Z =	694 plf

NOTE: SIMPSON CONNECTORS & FASTEN VALUES ASSUME SPF FRAMING MATERIAL
ANCHOR BOLT VALUES ASSUME DF/SP VALUES

DESIGN UPLIFT LOADS

ROOF & CEILING ASSEMBLY DEAD LOAD =	15 psf
WALL DEAD LOAD (WDL) =	12 psf
FLOOR DEAD LOAD (FDL) =	10 psf
ROOF SPAN (RS)=	29.17 ft
TRUSS SPACING (TOC)=	24 in
STUD SPACING (SOC) =	24 in
FIRST FLOOR HEIGHT (H_1) =	9 ft
SECOND FLOOR HEIGHT (H_2) =	8.5 ft

UPLIFT CONNECTION LOAD:

PER TABLE 2.2A, 2001 WFCM AT 24' (wup')= 256 plf

wup = wup' * CMRH - 0.6 * RDL * RS / 4 =

wup = 256 plf * 1.33 - 0.6 * 15 psf * 29.17 ft / 4 = 275 plf

REQUIRED TRUSS TIE DOWN:

$P_{up} = w_{up} * TOC =$

$P_{up} = 275$ plf * 24 in / 12 =

$P_{up} =$ 551 lbs

USE A SIMPSON H10 EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

REQUIRED SIDEWALL STUD TIE DOWN LOADING:

2nd FLOOR STUD TO TOP PLATE / CEILING BAND: $P_{2tp} = w_{up} * SOC =$ 275 * 24 / 12 = 551 lbs

2nd FLOOR STUD TO FLOOR BAND: $P_{2fb} = P_{2tp} - 0.6 * WDL * H_2 * SOC =$
$P_{2fb} =$ 551 lbs - 0.6 * 12 psf * 8.5 ft * 24 in / 12 = 429 lbs

2nd FLOOR BAND TO 1st CEILING BAND: $P_{2f1c} =$ $P_{2fb} =$ 429 lbs

1st FLOOR STUD TO CEILING BAND: $P_{1cb} = P_{2fb} - 0.6 * FDL * W_2 / 4 * SOC =$
$P_{1cb} =$ 429 lbs - 0.6 * 10 psf * 48.08 ft / 4 * 24 in / 12 =
$P_{1cb} =$ 342 lbs

1st FLOOR STUD TO FLOOR BAND: $P_{1fb} = P_{1cb} - 0.6 * WDL * H_1 * SOC =$
$P_{1fb} =$ 342 lbs - 0.6 * 12 psf * 9 ft * 24 in / 12 = 213 lbs

CHECK FASTENERS: 8d NAIL Z = 127.2 lbs
551 lbs / 127.2 lbs / FASTENER = 4.33 FASTENERS
USE (5) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.6 lbs
551 lbs / 48.6 lbs / FASTENER = 11.34 FASTENERS
USE (12) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

SIDEWALL 1st FLOOR BAND TO SILL PLATE CONNECTION:

SIDEWALL UPLIFT AT SILL PLATE: w_{sp} = P_{1fb} / SOC - 0.6 * FDL * W_t / 4 =
w_{sp} = 213 lbs * 12 / 24 in - 0.6 * 10 psf * 48.08 ft / 4 =
w_{sp} = 35 plf

CHECK STRAP AT ANCHOR BOLT LOCATIONS:

1/2" ANCHOR BOLT SPACING (BOC) = 54 in

P_{sp} = w_{sp} * BOC = 35 plf * 54 = 158 lbs

CHECK FASTENERS: 8d NAIL Z = 76.7 lbs
158 lbs / 76.7 lbs / FASTENER = 2.05 FASTENERS
USE (3) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 49.9 lbs
158 lbs / 49.9 lbs / FASTENER = 3.16 FASTENERS
USE (4) 16 ga. STAPLE(S) EACH END

**USE A 1.5" x 26 ga. STRAP WITH (3) 8d NAIL(S) EACH END
OR WITH (4) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 158 lbs**

CHECK BENDING IN RIMBAND:

DBL. 2x10 SPF #2 RIMBAND DESIGN VALUES:

SECTION MODULUS (S) = 42.78 in^3
ALLOWABLE BENDING (fb) = 875 psi

$M_{MAX} = \frac{w_{sp} * BOC^2}{8}$ =

$M_{MAX} = \frac{35 \text{ plf} * (54 / 12)^2}{8}$ = 1063 in-lbs

APPLIED fb = $\frac{M_{MAX}}{S} = \frac{1063 \text{ in-lbs}}{42.78 \text{ in}^3}$ = 25 psi

ALLOWABLE BENDING (fb) = 875 psi > APPLIED fb = 25 psi

DBL. 2x10 SPF #2 RIMBAND IS OK

LATERAL LOAD AT ROOF/CEILING DIAPHRAGM

ROOF SPAN = 29.17 ft
ROOF PITCH = 9 /12

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM AT 29.17' (wl-per')= 144 plf
wl-per = wl-per' * CMRH * CWH =
wl-per = 144 plf * 1.33 * 1.063 = 204 plf

WIND PARALLEL TO RIDGE:

PERP-TO-RIDGE LOADING USED FOR BOTH ORTHOGONAL DIRECTIONS: 204 plf

LATERAL LOAD AT FLOOR DIAPHRAGM

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM FLl-per' = 123 plf
FLl-per = FLl-per' * CMRH * CWH =
FLl-per = 123 plf * 1.33 * 1.125 = 185 plf

WIND PARALLEL TO RIDGE:

PER TABLE 2.5B, 2001 WFCM FLl-para' = 84 plf
FLl-para = FLl-para' * CMRH * CWH =
FLl-para = 84 plf * 1.33 * 1.125 = 126 plf

LATERAL FRAMING CONNECTION LOADS FROM WIND:
(FOR ROOF-TO-PLATE, PLATE-TO-PLATE, PLATE-TO-STUD, AND PLATE-TO-FLOOR)

PER TABLE 2.1, 2001 WFCM wl-wall' = 82 plf
wl-wall = Wl-wall' * CMRH =
wl-wall = 82 plf * 1.33 = 108 plf

TRUSS MULTIPLIER = 2
STUD MULTIPLIER = 2

TRUSS TO TOP PLATE CONNECTION:

$P_C = w_{l\text{-}wall} * M_{24} =$ 108 plf * 2 = 217 lbs

TRUSS CONNECTION: SIMPSON H10 $F_2 =$ 235 lbs

$P_C = P - F_2 =$
$P_C =$ 217 lbs - 235 lbs =
$P_C =$ -18 lbs

OF 0.131" x 2.5" COMMON NAIL (TOENAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{\text{-18 lbs}}{\text{83 lbs}}$ = 0 NAILS

USE (0) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS

IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z * 12}{w_{l\text{-}wall}}$ = $\frac{\text{100 lbs * 12}}{\text{108 plf}}$ = 11 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

PLATE TO STUD CONNECTION:

$P_C = w_{l\text{-}wall} * M_{16} =$ 108 plf * 2 = 217 lbs

OF 0.162" x 3.5" COMMON NAIL (ENDNAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{\text{217 lbs}}{\text{128 lbs}}$ = 2 NAILS

USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z * 12}{w_{l\text{-}wall}}$ = $\frac{\text{100 lbs * 12}}{\text{108 plf}}$ = 11 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

TOP PLATE SPLICE LENGTH

STRUCTURE WIDTH (W) = 48.08 ft
STRUCTURE LENGTH (L) = 42.67 ft
0.162" x 3.5" COMMON NAIL (FACE NAILED) Z = 191 lbs
ROOF DIAPHRAGM LOADING (wl-per) = 204 plf
FLOOR DIAPHRAGM LOADING (FLl-per) = 185 plf

ROOF DIAPHRAGM LOADING CONTROLS

CONTROLLING LOADING: 204 plf

DIAPHRAGM CHORD FORCE = $T = \frac{\text{wl-per} * L^2}{8 * W} =$ $\frac{\text{204 plf * 42.67 ft ^ 2}}{\text{8 * 48.08 ft}}$ = 966 lbs

REQUIRED SPLICE LENGTH (w/ (2) 16d 3" o.c.): $\frac{T * 3" / 12" / ft}{2 * Z}$ = $\frac{\text{966 lbs * 3" / 12" / ft}}{\text{2 * 191 lbs / NAIL}}$ = 1 ft

REQUIRED SPLICE LENGTH (w/ (2) 16d 12" o.c.): $\frac{T * 12" / 12" / ft}{2 * Z}$ = $\frac{\text{966 lbs * 12" / 12" / ft}}{\text{2 * 191 lbs / NAIL}}$ = 3 ft

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 3 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

ROOF DIAPHRAGM SHEATHING REQUIREMENTS

ROOF SPAN (RS) = 29.17 ft
ROOF LENGTH (RL) = 42.67 ft
ROOF PITCH = 9 /12
ROOF ANGLE (RA) = 36.9 °
$w_{l\text{-}per}$ = 204 plf
STANDARD ROOF SHEATHING = 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
ROOF SHEATHING SHEAR CAPACITY (v_r') = 296 plf
STANDARD CEILING SHEATHING = 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
CEILING SHEATHING SHEAR CAPACITY (v_c) = 70 plf

MAX DIAPHRAGM SHEAR (v) = $\frac{L \cdot wl_{per} / 2}{RS}$ = $\frac{42.67 \text{ ft} \cdot 204 \text{ plf} / 2}{29.17 \text{ ft}}$ = 150 plf

NET DIAPHRAGM SHEAR CAPACITY (v_n) = $v_r + v_c$ = 296 plf + 70 plf = 366 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 150 plf < **STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 366 plf**

STANDARD ROOF/CEILING DIAPHRAGM OK

FLOOR DIAPHRAGM SHEATHING REQUIREMENTS

BUILDING WIDTH (W) = 48.08 ft
BUILDING LENGTH (L) = 42.67 ft
$FL_{l\text{-}per}$ = 185 plf
STANDARD FLOOR SHEATHING = 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
FLOOR DIAPHRAGM SHEAR CAPACITY (v_f) = 309 plf

MAX FLOOR DIAPHRAGM SHEAR (v) = $\frac{L \cdot FLl_{per} / 2}{W}$ = $\frac{42.67 \text{ ft} \cdot 185 \text{ plf} / 2}{48.08 \text{ ft}}$ = 83 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 83 plf < **STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 309 plf**

STANDARD FLOOR DIAPHRAGM OK

SHEATHING SUCTION CONNECTION (PER 2001 WFCM, TABLE 2.4, pp. 69)

TRUSS SPACING (TOC) = 24 in O.C.
STUD SPACING (SOC) = 24 in O.C.
0.131" x 2.5" COMMON NAIL (FACE NAILED) 69 lbs (7/16" SIDE MEMBER; WITHDRAWAL)
Z = 5 ft
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) = 1.330

FOR ROOF ZONE 1 (FIELD):
p' = 15 psf
p = p' * CMRH
p = 15 psf * 1.33
p = 19.95 psf

TRUSS LOADING = 19.95 psf x 24" o.c. / 12" / ft = 40 plf

$\frac{40 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.6 FASTENERS / ft = 20 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.

FOR ROOF ZONE 2 (EDGE):

p' = 28.9 psf
p = p' * CMRH
p = 28.9 psf * 1.33
p = 38.44 psf

TRUSS LOADING = 38.44 psf x 24" o.c. / 12" / ft = 77 plf

77 plf / 69 lbs / FASTENER = 1.2 FASTENERS / ft = 10 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 10 in o.c.

FOR ROOF ZONE 3 (CORNER):

p' = 37.8 psf
p = p' * CMRH
p = 37.8 psf * 1.33
p = 50.28 psf

TRUSS LOADING = 50.28 psf x 24" o.c. / 12" / ft = 101 plf

101 plf / 69 lbs / FASTENER = 1.5 FASTENERS / ft = 8 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.

FOR ROOF ZONE 3OH (CORNER OVERHANG):

p' = 47 psf
p = p' * CMRH
p = 47 psf * 1.33
p = 62.51 psf

TRUSS LOADING = 62.51 psf x 24" o.c. / 12" / ft = 125 plf

125 plf / 69 lbs / FASTENER = 1.9 FASTENERS / ft = 6 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FOR WALL ZONE 4 (FIELD):

p' = 16.2 psf
p = p' * CMRH
p = 16.2 psf * 1.33
p = 21.55 psf

STUD LOADING = 21.55 psf x 24" o.c. / 12" / ft = 43 plf

43 plf / 69 lbs / FASTENER = 0.7 FASTENERS / ft = 17 in O.C.
MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FOR WALL ZONE 5 (EDGE):

p' = 20.1 psf
p = p' * CMRH
p = 20.1 psf * 1.33
p = 26.74 psf

STUD LOADING = 26.74 psf x 24" o.c. / 12" / ft = 53 plf

53 plf / 69 lbs / FASTENER = 0.8 FASTENERS / ft = 15 in O.C.
MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

SECOND FLOOR ENDWALL #1 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #3 & #4

FIRST FLOOR LENGTH (W_1) =	48.08 ft
SECOND FLOOR LENGTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.4 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING=	66 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.715 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end2}) = $L_2 * w_{l-per} / N_{end}$ + ADDITIONAL=
R_{end2} = 42.67 ft * 204 plf / 2 + 0 lbs = 4353 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end2} / V = 4353 lbs / 384 plf = 11.34 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_0 = 11.34 ft / 0.715 = 15.86 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 15.86 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 19.17 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR HORIZONTAL FLOOR DIAPHRAGM CONTINUITY:

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)
(DEEP BEAM HORIZONTAL SHEAR)

$$V_t = \frac{(3 * F_{L-per} / 4) * L}{2} = \frac{3/4 * 185 \text{ plf} * 42.67 \text{ ft}}{2} = 2961 \text{ lbs}$$

$$\text{\# 1/2" DIA. THRU BOLT} = \frac{V_t}{Z_{1/2\,BOLT}} = \frac{2961 \text{ lbs}}{623 \text{ lbs}} = 5 \text{ BOLTS}$$

USE A MIN. OF (5) 1/2" DIA.THRU BOLTS
TO ATTACH MODULE TO MODULE ALONG MATE LINE

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)
(CHORD FORCE CONTINUITY)

$$T = \frac{F_{t-pers} * W_2^2}{8 * L_2} = \frac{126 \text{ plf} * 48.08 \text{ ft} \wedge 2}{8 * 42.67 \text{ ft}} = 854 \text{ lbs}$$

CHECK FASTENERS:

8d NAIL Z = 127.3 lbs
854 lbs / 127.3 lbs / FASTENER = 6.71 FASTENERS
USE (7) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.3 lbs
854 lbs / 48.3 lbs / FASTENER = 17.68 FASTENERS
USE (18) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 20 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (18) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 854 lbs

SECOND FLOOR ENDWALL #1: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.715
SHEARWALL REACTION (R_{end2}) =	4353 lbs
WALL HEIGHT (H) =	8.5 ft

UPLIFT FORCE (U_{E2}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O}$ =

$U_{E2} = \dfrac{4353 \text{ lbs} \times 8.5 \text{ ft}}{19.17 \text{ ft} \times 0.715}$ = 2700 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR ENDWALL #2 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #1 & #2

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.4 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	32.76 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING=	68 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.729 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end2}) = $L_2 * w_{l-per} / N_{end}$ + ADDITIONAL=
R_{end2} = 42.67 ft * 204 plf / 2 + 0 lbs = 4353 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end2} / V = 4353 lbs / 384 lbs = 11.34 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 11.34 ft / 0.729 = 15.55 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 15.55 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 32.76 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR ENDWALL #2: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	32.76 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.729
SHEARWALL REACTION (R_{end2}) =	4353 lbs
WALL HEIGHT (H) =	8.5 ft

UPLIFT FORCE (U_{E2}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O}$ =

$U_{E2} = \dfrac{4353 \text{ lbs} \times 8.5 \text{ ft}}{32.76 \text{ ft} \times 0.729}$ = 1550 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR ENDWALL: SHEAR CONNECTIONS

EFFECTIVE SECOND FLOOR WIDTH (W_2) =	29.17 ft	
SECOND FLOOR LENGTH (L_2) =	42.67 ft	
FL_{l-per} =	185 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM SECOND FLOOR ENDWALL SHEAR LOAD = 4353 lbs

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION:

# TOENAILS PER FOOT =	V / Z / W = 4353 lbs / 158 lbs / 29.17 ft =			0.9 NAILS / ft
TOENAIL SPACING =	12 / # =	12 / 0.9 =	12 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 4353 lbs / 575 lbs / 29.17 ft =			0.3 PLATES / ft
LTP4 PLATE SPACING =	12 / # =	12 / 0.3 =	46 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 46" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 4353 lbs

RIMBANDS TO BOTTOM / BEARING / TOP PLATE CONNECTION:

V = MAX ENDWALL SHEAR + L_2 x FL_{1per} / 2 =
V = 4353 lbs + 42.67 ft x 185 plf / 2 — 8300 lbs

# TOENAILS PER FOOT =	V / Z / W = 8300 lbs / 158 lbs / 29.17 ft =			1.8 NAILS / ft
TOENAIL SPACING =	12 / # =	12 / 1.8 =	6 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 8300 lbs / 575 lbs / 29.17 ft =			0.5 PLATES / ft
LTP4 PLATE SPACING =	12 / # =	12 / 0.5 =	24 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) AT 6" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

BEARING PLATE TO CEILING BAND CONNECTION:

# FACENAILS PER FOOT =	V / Z / W = 8300 lbs / 191 lbs / 29.17 ft =		
# FACENAILS PER FOOT =	1.5 NAILS / ft		
FACENAIL SPACING =	12 / # =	12 / 1.5 =	8 " O.C.

USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 8" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\dfrac{R_{end2}}{\Sigma L_i \times C_O}$ =

SECOND FLOOR ENDWALL #1: V = $\dfrac{4353 \text{ lbs}}{19.17 \text{ ft} * 0.715}$ = 318 plf

SECOND FLOOR ENDWALL #2: V = $\dfrac{4353 \text{ lbs}}{32.76 \text{ ft} * 0.729}$ = 183 plf

MAXIMUM SECOND FLOOR ENDWALL UNIT SHEAR = 318 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER — Z = 95 lbs

OF 8d NAILS PER FOOT = $\dfrac{V}{Z}$ = $\dfrac{318 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 3.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 3.35 = 3.58 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 3.58 o.c. 3 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{318\text{ plf}}{95\text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 3.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 3.35 = 3.58 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 3.58 o.c. 3 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 318 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z}$ = $\frac{318\text{ plf}}{200\text{ psi} * 12"/\text{ft}}$ = 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

FIRST FLOOR ENDWALL #1 SHEATHING LENGTH REQUIREMENTS
LIBRARY / LIVING

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	3 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	654 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	66 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.52 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.717 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end1}) = $L_1 * FL_{i\text{-}per} / N_{end} + R_{end2}$ + ADDITIONAL=
R_{end1} = 42.67 ft * 185 plf / 2 + 4353 lbs + 0 lbs = 8300 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 8300 lbs / 654 plf = 12.69 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 12.69 ft / 0.717 = 17.71 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 17.71 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 19.17 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR HORIZONTAL FLOOR DIAPHRAGM CONTINUITY:

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)

(DEEP BEAM HORIZONTAL SHEAR)

$V_f = \frac{(3 * F_{L,per} / 4) * L}{2} =$ $\frac{3/4 * 185 \text{ plf} * 42.67 \text{ ft}}{2} =$ 2961 lbs

1/2" DIA. THRU BOLT = $\frac{V_f}{Z_{1/2\ BOLT}} = \frac{2961 \text{ lbs}}{623 \text{ lbs}} =$ 5 BOLTS

**USE A MIN. OF (5) 1/2" DIA.THRU BOLTS
TO ATTACH MODULE TO MODULE ALONG MATE LINE**

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)

(CHORD FORCE CONTINUITY)

$T = \frac{3/4 * F_{L,max} * W_1^2}{8 * L_1} =$ $\frac{3/4 * 126 \text{ plf} * 48.08 \text{ ft}^2}{8 * 42.67 \text{ ft}} =$ 640 lbs

CHECK FASTENERS: 8d NAIL Z = 127.2 lbs
640 lbs / 127.2 lbs / FASTENER = 5.03 FASTENERS
USE (6) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.6 lbs
640 lbs / 48.6 lbs / FASTENER = 13.17 FASTENERS
USE (14) 16 ga. STAPLE(S) EACH END

**USE A 1.5" x 22 ga. STRAP WITH (6) 8d NAIL(S) EACH END
OR WITH (14) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 640 lbs**

FIRST FLOOR ENDWALL #1: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.717
SHEARWALL REACTION (R_{end1}) =	8300 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\frac{R_{end1} \times H}{\Sigma L_i \times C_O} + U_{E2} =$

$U_{E1} = \frac{8300 \text{ lbs} \times 9 \text{ ft} + 2700 \text{ lbs}}{19.17 \times 0.717}$ = 8135 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL #2 SHEATHING LENGTH REQUIREMENTS
FAMILY / DINING

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR, DOUBLE STUDS
SHEATHING EDGE 8d NAIL SPACING =	2 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	828 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	25.25 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	60 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	9 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.559 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD FROM DEN =	0 lbs

SHEARWALL REACTION (R_{end1}) = $L_1 * FL_{l,per} / N_{end} + R_{end2}$ + ADDITIONAL=
R_{end1} = 42.67 ft * 185 plf / 2 + 4353 lbs + 0 lbs = 8300 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 8300 lbs / 828 plf = 10.02 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 10.02 ft / 0.559 =	**17.94 ft**

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 17.94 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 25.25 ft**

**ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO**

**PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615**

FIRST FLOOR ENDWALL #2: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 25.25 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) = 0.559
SHEARWALL REACTION (R_{end1}) = 8300 lbs
WALL HEIGHT (H) = 9 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{end1} \times H}{\Sigma L_i \times C_O} + U_{E2} =$$

$$U_{E1} = \frac{8300 \text{ lbs} \times 9 \text{ ft} + 1550 \text{ lbs}}{25.25 \times 0.559} = 6843 \text{ lbs}$$

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL: SHEAR CONNECTIONS

EFFECTIVE FIRST FLOOR WIDTH (W_1) = 26.25 ft
FIRST FLOOR LENGTH (L_1) = 42.67 ft
FL_{l-per} = 185 plf

1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR ENDWALL SHEAR LOAD = 8300 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX ENDWALL SHEAR + L_1 x (3/4 * FL_{l-per}) / 2 + V_{DEN} =
V = 8300 lbs + 42.67 ft x (3/4 * 185 plf) / 2 + 0 lbs 11260 lbs

TOENAILS PER FOOT = V / Z / W = 11260 lbs / 158 lbs / 26.25 ft = 2.7 NAILS / ft

TOENAIL SPACING = 12 / # = 12 / 2.7 = 4 " O.C. (16" MAX)

LTP4 PLATES PER FOOT = V / Z / W = 11260 lbs / 575 lbs / 26.25 ft = 0.7 PLATES / ft

LTP4 PLATE SPACING = 12 / # = 12 / 0.7 = 16 " O.C. (72" MAX)

**USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 4" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 16" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs**

SILL PLATE TO FOUNDATION CONNECTION:

1/2" ANCHOR BOLTS = V / Z = 11260 lbs / 1056 lbs = 11 BOLTS

BOLT SPACING = (W - 2) / (N - 1) = (26.25 ft - 2) / (11 - 1) = 29 in

**USE 1/2" ANCHOR BOLTS @ 29" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs**

5/8" ANCHOR BOLTS = V / Z = 11260 lbs / 1488 lbs = 8 BOLTS

BOLT SPACING = (W - 2) / (N - 1) = (26.25 ft - 2) / (8 - 1) = 41 in

**USE 5/8" ANCHOR BOLTS @ 41" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs**

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

$$\text{SHEAR FORCE (V)} = \frac{R_{end1}}{\Sigma L_i X C_O} =$$

FIRST FLOOR ENDWALL #1: $V = \frac{8300 \text{ lbs}}{19.17 \text{ ft} * 0.717} = 604$ plf

FIRST FLOOR ENDWALL #2: $V = \frac{8300 \text{ lbs}}{25.25 * 0.559} = 589$ plf

MAXIMUM FIRST FLOOR ENDWALL UNIT SHEAR = 604 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z} = \frac{604 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 6.36 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 6.36 = 1.88 " O.C.

OF ROWS : 2 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 2 * SPACING 2 * 1.88 o.c. 3 " O.C.

**USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf**

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z} = \frac{604 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 6.36 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 6.36 = 1.88 " O.C.

OF ROWS : 2 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 2 * SPACING 2 * 1.88 o.c. 3 " O.C.

**USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf**

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 604 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z} = \frac{604 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}} =$ 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

SECOND FLOOR SIDEWALL #1 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #1 & #4

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.4 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	26.92 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING=	63 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.83 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.663 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side2}) = W_2 * w_{i-para} / N_{side} + ADDITIONAL =
R_{side2} = 48.08 ft * 204 plf / 2 + 0 lbs = 4905 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side2} / V = 4905 lbs / 384 plf = 12.77 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 12.77 ft / 0.663 = 19.27 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 19.27 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 26.92 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR SIDEWALL #1: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 26.92 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) = 0.663
SHEARWALL REACTION (R_{end1}) = 4905 lbs
WALL HEIGHT (H) = 8.5 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{4905 \text{ lbs} \times 8.5 \text{ ft}}{26.92 \text{ ft} \times 0.663} = 2336 \text{ lbs}$$

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR SIDEWALL #2 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #2 & #3

FIRST FLOOR WIDTH (W_1) = 48.08 ft
SECOND FLOOR WIDTH (W_2) = 48.08 ft
FIRST FLOOR LENGTH (L_1) = 42.67 ft
SECOND FLOOR LENGTH (L_2) = 42.67 ft
SHEARWALL TYPE: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING = 6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 384 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.4 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 21.79 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING= 69 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT = 6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.736 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{side}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{side2}) = W_2 * w_{i-para} / N_{side} + ADDITIONAL=
R_{side2} = 48.08 ft * 204 plf / 2 + 0 lbs = 4905 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side2} / V = 4905 lbs / 384 plf = 12.77 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 12.77 ft / 0.736 = 17.36 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 17.36 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 21.79 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR SIDEWALL #2: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 21.79 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) = 0.736
SHEARWALL REACTION (R_{end1}) = 4905 lbs
WALL HEIGHT (H) = 8.5 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{4905 \text{ lbs} \times 8.5 \text{ ft}}{21.79 \text{ ft} \times 0.736} = 2600 \text{ lbs}$$

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR SIDEWALL: SHEAR CONNECTIONS

SECOND FLOOR WIDTH (W_2) =	48.08 ft	
SECOND FLOOR LENGTH (L_2) =	42.67 ft	
FL_{i-para} =	126 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM SECOND FLOOR SIDEWALL SHEAR LOAD = 4905 plf

RIMBANDS TO BOTTOM, BEARING & TOP PLATE CONNECTION:

V = MAX SIDEWALL SHEAR + W_2 x FL_{i-para} / 2 =
V = 4905 lbs + 48.08 ft x 126 plf / 2 — 7934 plf

TOENAILS PER FOOT = V / Z / L = 7934 lbs / 158 lbs / 42.67 ft = 1.2 NAILS / ft

TOENAIL SPACING = 12 / # = 12 / 1.2 = 10 " O.C. (16" MAX)

LTP4 PLATES PER FOOT = V / Z / W = 7934 lbs / 575 lbs / 42.67 ft = 0.3 PLATES / ft

LTP4 PLATE SPACING = 12 / # = 12 / 0.3 = 37 " O.C. (72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 10" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

BEARING PLATE TO CEILING BAND CONNECTION:

FACENAILS PER FOOT = V / Z / W = 7934 lbs / 191 lbs / 42.67 ft =
FACENAILS PER FOOT = 1.0 NAILS / ft

FACENAIL SPACING = 12 / # = 12 / 1 = 12 " O.C. (16" MAX)

USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\frac{R_{side2}}{\Sigma L_i X C_O}$ =

SECOND FLOOR SIDEWALL #1: V = $\frac{4905 \text{ lbs}}{26.92 \text{ ft} * 0.663}$ = 275 plf

SECOND FLOOR SIDEWALL #2: V = $\frac{4905 \text{ lbs}}{21.79 \text{ ft} * 0.736}$ = 306 plf

MAXIMUM SECOND FLOOR SIDEWALL UNIT SHEAR = 306 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER — Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{306 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 3.23 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 3.23 = 3.71 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 3.71 o.c. 3 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\dfrac{V}{Z} = \dfrac{306 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 3.23 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 3.23 = 3.71 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 3.71 o.c. 3 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 306 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\dfrac{V}{Z} = \dfrac{306 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}} =$ 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

FIRST FLOOR SIDEWALL #1 SHEATHING LENGTH REQUIREMENTS
SUN ROOM / FAMILY

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	4 In O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	525 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED =	21.67 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	68 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.52 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.733 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = W_1 * $FL_{l\text{-}para}$ / N_{side} + R_{side2} + ADDITIONAL =
R_{side1} = 48.08 ft * 126 plf / 2 + 4905 lbs + 0 lbs = 7935 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 7935 lbs / 525 plf = 15.11 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 15.11 ft / 0.733 = 20.62 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 20.62 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 21.67 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #1: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	21.67 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.733
SHEARWALL REACTION (R_{end1}) =	7935 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\dfrac{R_{side1} \times H}{\Sigma L_i \times C_O} + U_{E2} =$

$U_{E1} = \dfrac{7935 \text{ lbs} \times 9 \text{ ft} + 2336 \text{ lbs}}{21.67 \times 0.733}$ = 6833 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL #2 SHEATHING LENGTH REQUIREMENTS
LIVING / DINING

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	4 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	525 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED =	21.67 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	69 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.83 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.721 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = W_1 * FL_{l-para} / N_{side} + R_{side2} + ADDITIONAL =
R_{side1} = 48.08 ft * 126 plf / 2 +4905 lbs + 0 lbs = 7935 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 7935 lbs / 525 plf = 15.11 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 15.11 ft / 0.721 = 20.97 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 20.97 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 21.67 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #2: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	21.67 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.721
SHEARWALL REACTION (R_{end1}) =	7935 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\dfrac{R_{side1} \times H}{\Sigma L_i \times C_O} + U_{E2}$ =

U_{E1} = $\dfrac{7935 \text{ lbs} \times 9 \text{ ft} + 2600 \text{ lbs}}{21.67 \times 0.721}$ = 7171 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL : SHEAR CONNECTIONS

FIRST FLOOR WIDTH (W_1) =	48.08 ft	
FIRST FLOOR LENGTH (L_1) =	42.67 ft	
FL_{l-para} =	126 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR SIDEWALL SHEAR LOAD = 7935 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX SIDEWALL SHEAR + W_1 x (3/4 * FL_{l-para}) / 2 =
V = 7935 lbs + 48.08 ft x (3/4 * 126 plf) / 2 10207 lbs

# TOENAILS PER FOOT =	V / Z / L_1 = 10207 lbs / 158 lbs / 42.67 ft =		1.5 NAILS / ft	
TOENAIL SPACING =	12 / # = 12 / 1.5 =	7 " O.C.		(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 10207 lbs / 575 lbs / 42.67 ft =		0.4 PLATES / ft	
LTP4 PLATE SPACING =	12 / # = 12 / 0.4 =	28 " O.C.		(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 7" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 28" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

SILL PLATE TO FOUNDATION CONNECTION:

1/2" ANCHOR BOLTS = V / Z = 10207 lbs / 1056 lbs = 10 BOLTS

BOLT SPACING = (L - 2) / (N - 1) = (42.67 ft - 2) / (10 - 1) = 54 in

USE 1/2" ANCHOR BOLTS @ 54" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

5/8" ANCHOR BOLTS = V / Z = 10207 lbs / 1488 lbs = 7 BOLTS

BOLT SPACING = (L - 2) / (N - 1) = (42.67 ft - 2) / (7 - 1) = 72 in

USE 5/8" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\frac{R_{side1}}{\Sigma L_i \times C_0}$ =

FIRST FLOOR SIDEWALL #1: V = $\frac{7935 \text{ lbs}}{21.67 \text{ ft} * 0.733}$ = 500 plf

FIRST FLOOR SIDEWALL #2: V = $\frac{7935 \text{ lbs}}{21.67 * 0.721}$ = 508 plf

MAXIMUM FIRST FLOOR SIDEWALL UNIT SHEAR = 508 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{508 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 5.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 5.35 = 2.24 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 2.24 o.c. 2 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{508 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 5.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 5.35 = 2.24 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 2.24 o.c. 2 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 508 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z}$ = $\frac{508 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}}$ = 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

COMBINED CORNER HOLDDOWN REQUIREMENTS

UPLIFT FORCES: (SEE ABOVE FOR CALCULATIONS)

2nd FLOOR ENDWALL #1 UPLIFT FORCE (U_{E2}) =	2700 lbs
2nd FLOOR ENDWALL #2 UPLIFT FORCE (U_{E2}) =	1550 lbs
2nd FLOOR SIDEWALL #1 UPLIFT FORCE (U_{S2}) =	2336 lbs
2nd FLOOR SIDEWALL #2 UPLIFT FORCE (U_{S2}) =	2600 lbs
1st FLOOR ENDWALL #1 UPLIFT FORCE (U_{E1}) =	8135 lbs
1st FLOOR ENDWALL #2 UPLIFT FORCE (U_{E1}) =	6843 lbs
1st FLOOR SIDEWALL #1 UPLIFT FORCE (U_{S1}) =	6833 lbs
1st FLOOR SIDEWALL #2 UPLIFT FORCE (U_{S1}) =	7171 lbs

DEAD LOADS:

EFFECTIVE FIRST FLOOR WIDTH (W_1) =	29.17 ft (MAX: 4 * CEILING HEIGHT)
EFFECTIVE SECOND FLOOR WIDTH (W_2) =	29.17 ft (MAX: 4 * CEILING HEIGHT)
EFFECTIVE FIRST FLOOR LENGTH (L_1) =	21.83 ft (MAX: 4 * CEILING HEIGHT)
EFFECTIVE SECOND FLOOR LENGTH (L_2) =	21.25 ft (MAX: 4 * CEILING HEIGHT)
FIRST FLOOR HEIGHT (H_1) =	9 ft
SECOND FLOOR HEIGHT (H_2) =	8.5 ft
ROOF & CEILING ASSEMBLY DEAD LOAD (RDL) =	15 psf
WALL DEAD LOAD (WDL) =	12 psf
FLOOR DEAD LOAD (FDL) =	10 psf

SIDEWALL SECOND FLOOR CORNER:

ROOF DEAD LOAD =	0.6 * RDL * W_2 * L_2 / 8 =	
ROOF DEAD LOAD =	0.6 * 15 psf * 29.17 ft * 21.25 ft / 8 =	697 lbs
WALL DEAD LOAD =	0.6 * (WDL * H_2 * L_2 / 2) =	
	0.6 * 12 psf * 8.5 ft * 21.25 ft / 2 =	650 lbs
	TOTAL DEAD LOAD = 697 lbs + 650 lbs =	1348 lbs
CORNER STUD CONNECTION LOAD =	MAX WALL UPLIFT - SELF WEIGHT=	
	2600 lbs - 1348 lbs =	1252 lbs

SIDEWALL FIRST FLOOR CORNER:

WALL DEAD LOAD =	0.6 * (WDL * H_1 * L_1 / 2) =	
WALL DEAD LOAD =	0.6 * 12 psf * 9 ft * 21.83 ft / 2 =	707 lbs
2nd FLOOR DEAD LOAD =	0.6 * FDL * W_2 * L_2 / 8 =	
2nd FLOOR DEAD LOAD =	0.6 * 10 psf * 29.17 ft * 21.25 ft / 8 =	465 lbs
1st FLOOR DEAD LOAD =	0.6 * FDL * W_1 * L_1 / 8 =	
1st FLOOR DEAD LOAD =	0.6 * 10 psf * 29.17 ft * 21.83 ft / 8 =	478 lbs
	TOTAL DEAD LOAD = 707 lbs + 465 lbs + 478 lbs =	1650 lbs
CORNER STUD CONNECTION LOAD =	MAX WALL UPLIFT - SELF WEIGHT, INCLUDING ABOVE WALL(S)	
	7171 lbs - 1650 lbs - 1348 lbs =	4173 lbs

ENDWALL SECOND FLOOR CORNER:

WALL DEAD LOAD =	0.6 * (WDL * H_2 * W_2 / 2) =	
WALL DEAD LOAD =	0.6 * 12 psf * 8.5 ft * 29.17 ft / 2 =	893 lbs
GABLE WALL DEAD LOAD =	0.6 * (WDL * (H / 2) * W / 2) =	
GABLE WALL DEAD LOAD =	0.6 * 12 psf * ((9 / 12) * (29.17 ft / 2) / 2) * (29.17 ft) / 2 =	575 lbs
	TOTAL DEAD LOAD = 893 lbs + 575 lbs =	1468 lbs
CORNER STUD CONNECTION LOAD =	MAX WALL UPLIFT - SELF WEIGHT	
	2700 lbs - 1468 lbs =	1232 lbs

ENDWALL FIRST FLOOR CORNER:

WALL DEAD LOAD = 0.6 * (WDL * H_1 * W_1 / 2) =
WALL DEAD LOAD = 0.6 * 12 psf * 9 ft * 29.17 ft / 2 = 946 lbs

CORNER STUD CONNECTION LOAD = MAX WALL UPLIFT - SELF WEIGHT, INCLUDING ABOVE WALL(S)
8135 lbs - 946 lbs - 1468 lbs = 5721 lbs

SECOND FLOOR CORNER HOLDDOWNS

UPLIFT FORCE = 2700 lbs (MAX. OF SECOND FLOOR UPLIFT FORCES)

SECOND FLOOR DEAD LOAD (DL_2) = 1348 lbs + 1468 lbs = 2816 lbs

HOLDDOWN FORCE = 2700 lbs - 2816 lbs = 0 lbs

CHECK FASTENERS: 8d NAIL Z = 76.7 lbs
0 lbs / 76.7 lbs / FASTENER = 0 FASTENERS
USE (0) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 49.9 lbs
0 lbs / 49.9 lbs / FASTENER = 0 FASTENERS
USE (0) 16 ga. STAPLE(S) EACH END

NO PHYSICAL HOLDDOWN REQUIRED

SECOND FLOOR CORNER STUD CONNECTION

16d COMMON NAIL ALLOWABLE SHEAR (Z) = 191 lbs

MAX CORNER STUD CONNECTION LOAD = 1252 lbs

NAIL SPACING (2 ROWS) = $\frac{2 \cdot H \cdot Z}{U} = \frac{2 \cdot 8.5\text{ ft} \cdot 191\text{ lbs}}{1252\text{ lbs}} =$ 16 in O.C. (16" MAX)

OF 1/4" DIA. LAG SCREW REQUIRED = $\frac{U}{Z} = \frac{1252\text{ lbs}}{224\text{ lbs}} =$ 6 LAG SCREWS (6 MIN)

FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS

FIRST FLOOR HOLDDOWNS

UPLIFT FORCE = 8135 lbs (MAX. OF FIRST FLOOR UPLIFT FORCES)

FIRST FLOOR DEAD LOAD (DL_1) = 1650 lbs + 1348 lbs + 1468lbs + 946 lbs = 5412 lbs

HOLDDOWN FORCE = 8135 lbs - 5412 lbs = 2723 lbs

USE A SIMPSON STHD10RJ AT EACH BUILDING CORNER OR EQUAL
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 2723 lbs

FIRST FLOOR CORNER STUD CONNECTION

16d COMMON NAIL ALLOWABLE SHEAR (Z) = 191 lbs

MAX CORNER STUD CONNECTION LOAD = 5721 lbs

NAIL SPACING (2 ROWS) = $\frac{2 \cdot H \cdot Z}{U} = \frac{2 \cdot 9\text{ ft} \cdot 191\text{ lbs}}{5721\text{ lbs}} =$ 7 in O.C. (16" MAX)

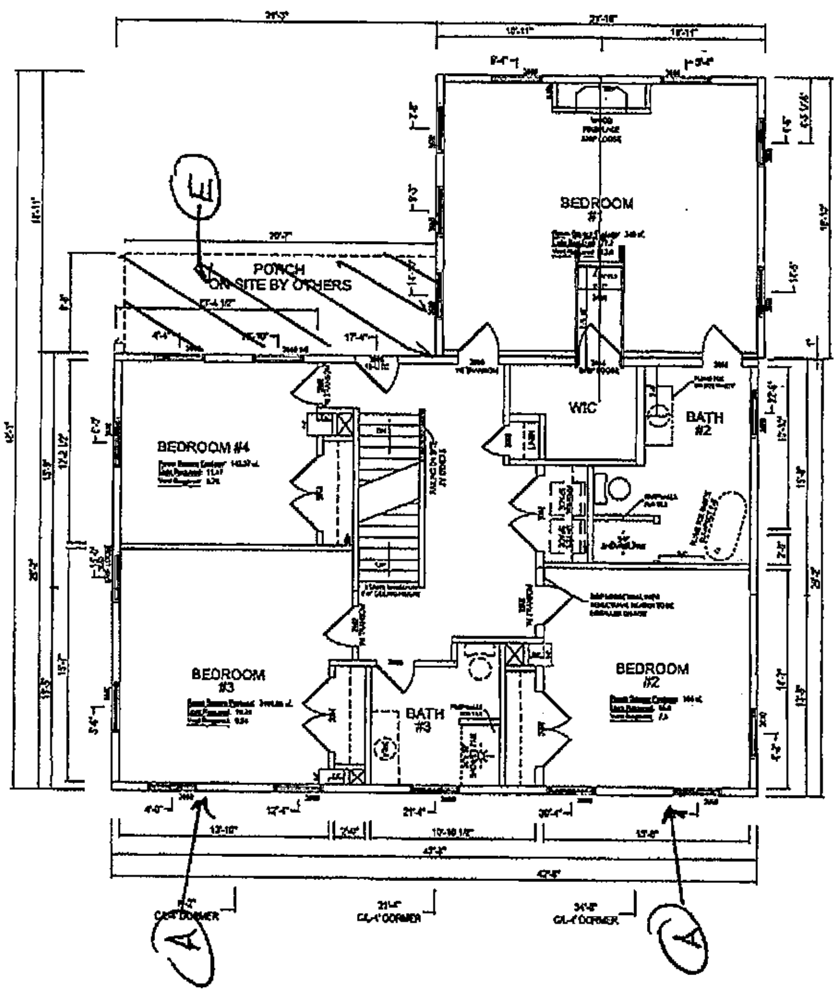
OF 1/4" DIA. LAG SCREW REQUIRED = $\frac{U}{Z} = \frac{5721\text{ lbs}}{224\text{ lbs}} =$ 26 LAG SCREWS (6 MIN)

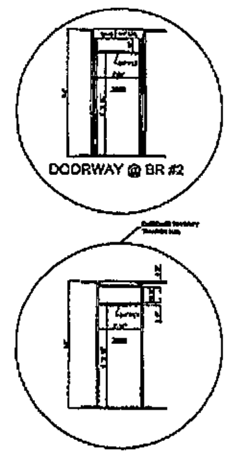
FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 7" ON CENTER
OR USE (26) 1/4" DIA. LAG SCREWS

Section 3
HAND CALCULATIONS

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12





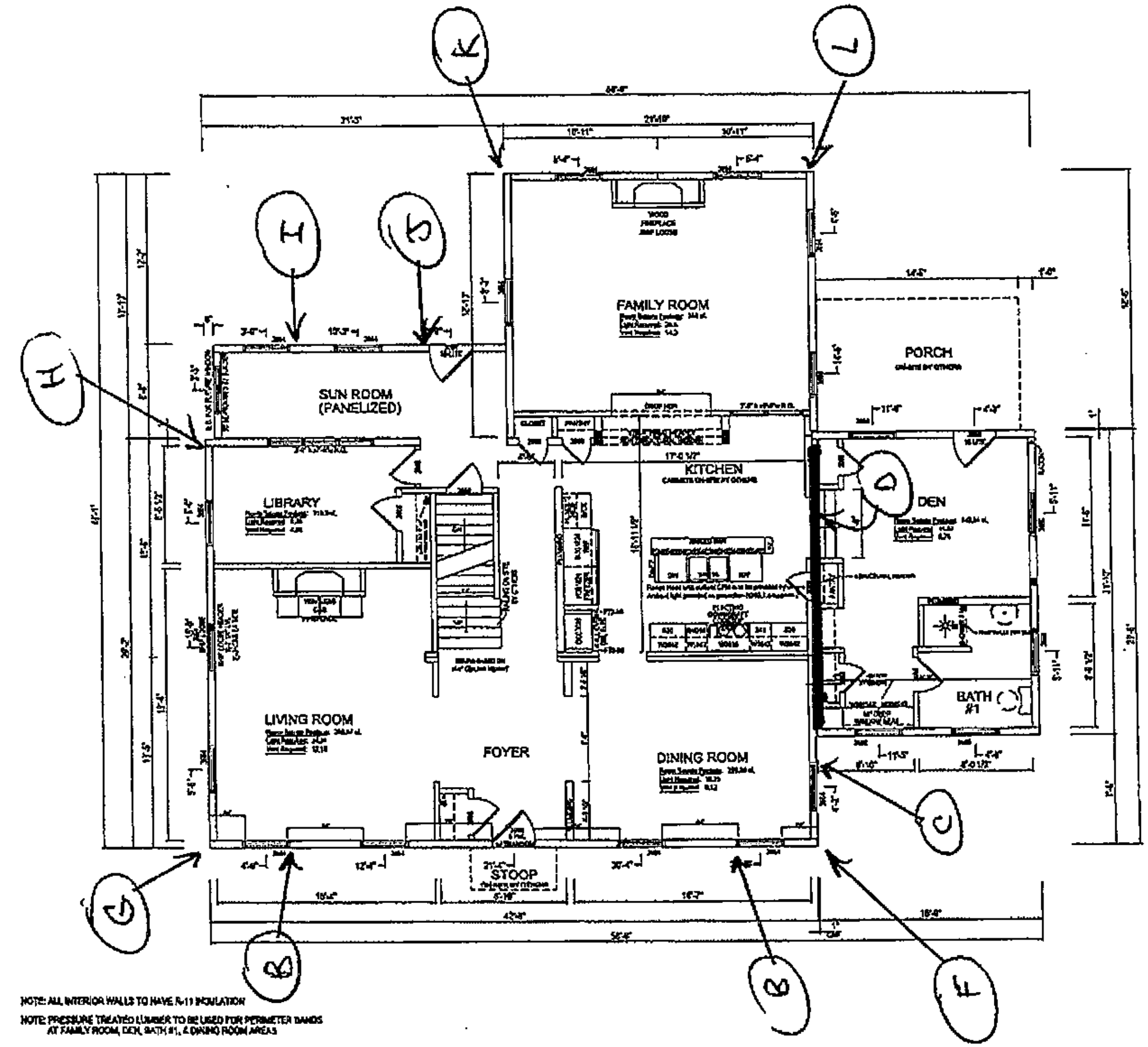
NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION

2nd FLOOR
8'-6" CEILING

110376

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION CUSTOMER: MADISON	DATE: 5/24/10 DRAWN BY: CDK	MODEL: CUSTOM 2-STORY Scale: 1/8" = 1'- 0"	CONTROL NUMBER C-484709-2	SUB-SET A2

Z



▲STATE MODULAR LABEL
■NTA LABEL
●DATA PLATE

NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION
NOTE: PRESSURE TREATED LUMBER TO BE USED FOR PERIMETER BANDS AT FAMILY ROOM, DEN, BATH #1, & DINING ROOM AREAS

DP RATING: 25 MAX.

1st FLOOR
9'-0" CEILING

110376

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION	DATE: 5/24/10	MODEL: CUSTOM 2-STORY	CONTROL NUMBER C-484709-2	SUB-SET A1
	CUSTOMER: MADISON	DRAWN BY: CDK	Scale: 1/8" = 1'- 0"		

110376
0232nec2011
IBS - C-484709-2

General Holddowns / Connections

Loc.	Load (lbs)	Connection	Cap (lbs)
A	444	(1) 1.5" x 26 ga. strap w/ (6) 8d or (9) 16 ga. staples each end each strap from 2nd level stud to 1st level stud	449
		net U = U - DL = 2600 lbs - 34' / 21.25' x 1348 lbs = 444 lbs	
B	2294	(1) Simpson STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 7171 lbs - 34' / 21.25' x 1348 lbs - 36' / 21.83' x 1650 lbs = 2294 lbs	
C	5171	(2) Simpson STHD14RJ	8860
		or (1) Simpson HDU8-SDS2.5 w/ 7/8" rod. Use (3) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row each stud	5665
		or (2) Simpson MSTCM40 (or 60) from stud to foundation	8440
		net U = U - DL = 6117 lbs - 946 lbs = 5171 lbs	
D	1292	nail Den truss to Main House Endwall #2 framing w/ (2) 16d (0.162" x 3.5") 24" o.c. max	4169
		lag Main House Endwall #2 floor band to blocking in Den Endwall #1 framing w/ a total of (5) 3/8" lags evenly spaced	1440
E	116 plf	1st level ceiling: 7/16" OSB (un-blocked) w/ 8d 6"/12".	296 plf
		Make all shear connections per shearcalc from 2nd level floor band to ceiling band and from ceiling band to Sidewall #1 below	
		v = 6.5' / 21.67' x 7935 lbs / 20.56' = 116 plf	
F	0	No foundation connection required.	N/A
		net U = U - DL = 2600 lbs - 2816 lbs < 0 lbs	
G, H	844	(1) STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 8135 lbs - 34' / 21.25' x 1348 lbs - 1468 lbs - 36' / 21.83' x 1650 lbs - 946 lbs = 844 lbs	
I, J	2847	(1) STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 4497 lbs - 1650 lbs = 2847 lbs	
K, L	1791	(1) STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 7667 lbs - 1348 lbs - 34' / 29.17' x 1468 lbs - 1650 lbs - 36' / 29.17' x 946 lbs = 1791 lbs	

Section 4
ALTERNATE CONNECTIONS

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12

7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C. = 238 plf
7/16" O.S.B. Sheathing w/ 15 GA. Staples @ 2" O. C. = 270 plf
7/16" O.S.B. Sheathing w/ 14 GA. Staples @ 2" O. C. = 295 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 16 GA. Staples @ 2" O. C. = 476 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 15 GA. Staples @ 2" O. C. = 540 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 14 GA. Staples @ 2" O. C. = 590 plf

Required Sidewall Stud Tie Down
1. 1st Floor Stud to Top Plate
Load = 389 LBS
389 / 2 = 194.5 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

2. 1st Floor Stud to Floor Band
Load = 260 LBS
260 / 2 = 130 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

CONNECTIONS

STAPLE DESIGN VALUES
per ESR-1539 (July 1, 2009)

SPECIES GROUP: III
DESIGN FACTOR: 0.82
SPECIFIC GRAVITY (G): 0.42

STAPLE	MIN OD CROWN (in.)	WIRE DIA (in.)	MINIMUM PENETRATION (in.)	LATERAL STRENGTH (1) (lbs.)	% OF 16 GAGE	WITHDRAWAL STRENGTH (2) (lbs/in PENETRATION)	% OF 16 GAGE
16 GAGE	7/16	0.0625	1	39.80	1.00	20.00	1.00
15 GAGE	7/16	0.072	1	45.00	1.13	23.00	1.15
14 GAGE	7/16	0.08	1	49.20	1.24	25.00	1.25

(1) = TABLE 2, pg. 7 of 45 (2) = TABLE 4, pg. 8 of 45

SHEATHING CONNECTION W/ 7/16" O.S.B.

STAPLE	SPACING (in.)	UPLIFT (plf)
16 GAGE	2	238
15 GAGE	2	270
14 GAGE	2	295

7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C. = 238 plf
7/16" O.S.B. Sheathing w/ 15 GA. Staples @ 2" O. C. = 270 plf
7/16" O.S.B. Sheathing w/ 14 GA. Staples @ 2" O. C. = 295 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 16 GA. Staples @ 2" O. C. = 476 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 15 GA. Staples @ 2" O. C. = 540 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 14 GA. Staples @ 2" O. C. = 590 plf

Required Sidewall Stud Tie Down
1. 2nd Floor Stud to Top Plate
Load = 551 LBS
551 / 2 = 275.5 plf
7/16" O.S.B. Sheathing w/ 14 GA. Staples @ 2" O. C. or
7/16" O.S.B. Sheathing w/ (2) Rows of 16 GA. Staples @ 2" O. C.

2. 2nd Floor Stud to Floor Band – 2nd Floor Band to 1st Floor Ceiling Band
Load = 429 LBS
429 / 2 = 214.5 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

3. 1st Floor Stud to Ceiling Band
Load = 342 LBS
342 / 2 = 171 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

4. 1st Floor Stud to Floor Band
Load = 213 LBS
213 / 2 = 106.5 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

CONNECTIONS

STAPLE DESIGN VALUES
per ESR-1539 (July 1, 2009)

SPECIES GROUP: III
DESIGN FACTOR: 0.82
SPECIFIC GRAVITY (G): 0.42

STAPLE	MIN OD CROWN (in.)	WIRE DIA (in.)	MINIMUM PENETRATION (in.)	LATERAL STRENGTH (1) (lbs.)	% OF 16 GAGE	WITHDRAWAL STRENGTH (2) (lbs/in PENETRATION)	% OF 16 GAGE
16 GAGE	7/16	0.0625	1	39.80	1.00	20.00	1.00
15 GAGE	7/16	0.072	1	45.00	1.13	23.00	1.15
14 GAGE	7/16	0.08	1	49.20	1.24	25.00	1.25

(1) = TABLE 2, pg. 7 of 45 (2) = TABLE 4, pg. 8 of 45

SHEATHING CONNECTION W/ 7/16" O.S.B.

STAPLE	SPACING (in.)	UPLIFT (plf)
16 GAGE	2	238
15 GAGE	2	270
14 GAGE	2	295

From: Hunter Madison [huntermadison2002@yahoo.com]
Sent: Tuesday, October 15, 2013 3:01 PM
To: McMahan, Alan (DHCD); Hodge, Vernon (DHCD); Davis, Cindy (DHCD)
Subject: Fw: Madison house

Please include this e-mail exchange as an attachment for the appeal to the July 25, 2013 complaint (September Davis Letter) and as a response/supplement to the letter DHCD received from Simpson Strong Tie, same engineer.

Thank you.

Milari Madison

On Thursday, October 10, 2013 5:50 AM, Hunter Madison <huntermadison2002@yahoo.com> wrote:

On Wednesday, October 9, 2013 10:34 AM, Sam Hensen <shensen@strongtie.com> wrote:
Ms. Madison,

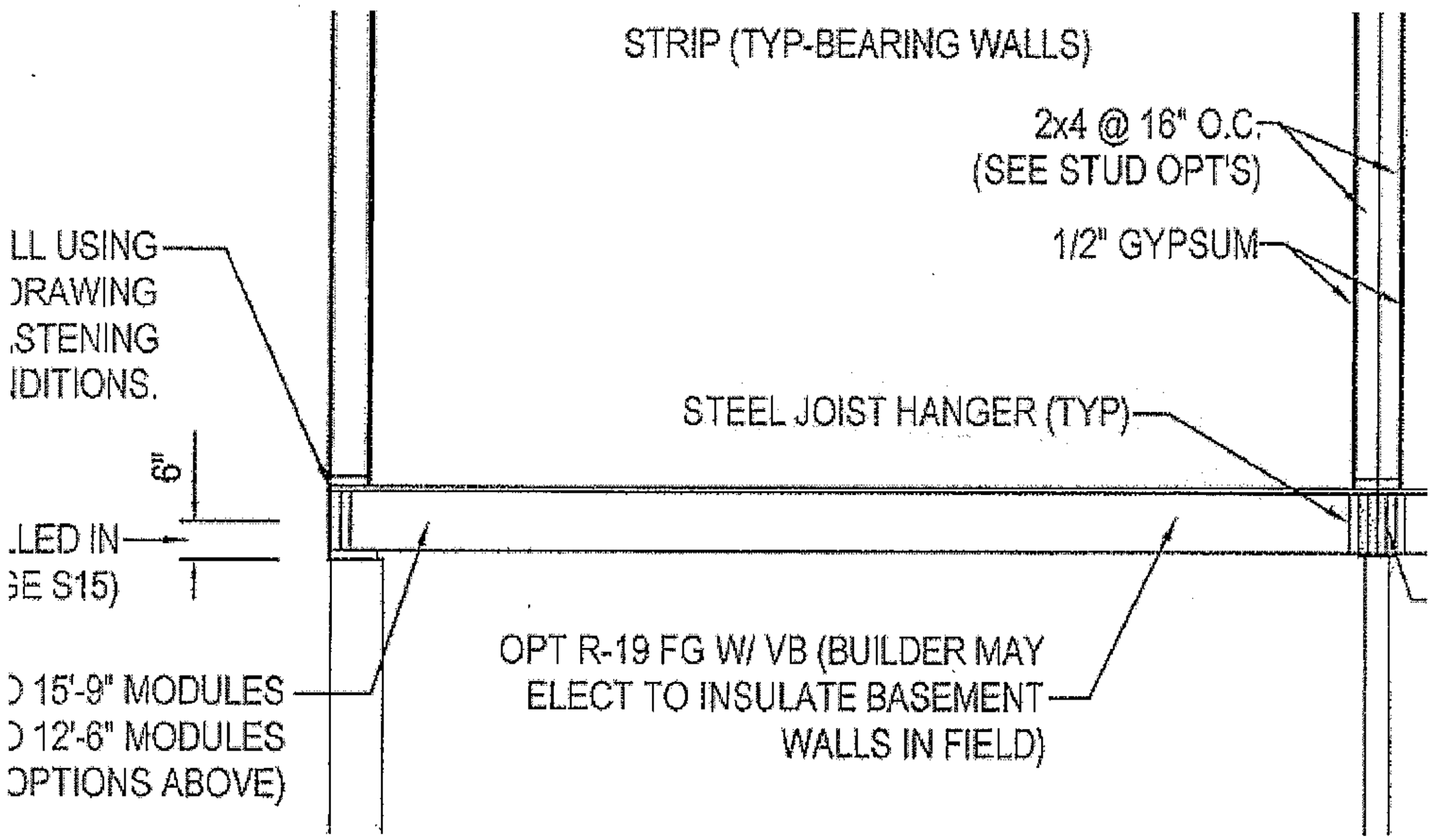
The attachment you sent was for the shearwall calculations. It does not include any information on the hangers in question. However, I see that on the plans you sent earlier, a hanger is called out at the floor joist (see excerpt below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be 20 psf for this application. Thus the total demand load on the hanger is 60 psf, and it would be calculated as follows:

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately 60 psf x 1.33 ft. x 15.75 ft. / 2 = 628 lbs.

The LUS26 hanger is rated for 865 lbs., but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (we do not permit this nail in our hanger), the allowable load for the hanger will drop to 419 lbs. (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. Thus the allowable load for the hanger as installed is less than the demand load. 628 lbs. < 419 lbs.

Hope that information helps. I recommend you hire a forensics engineer to assist you with this issue. Simpson Strong-Tie does not get involved in litigious issues like this situation.



Thank You,

Sam Hensen, P.E. | Engineering Manager, Southeastern US | Simpson Strong-Tie | 2221 Country Lane | McKinney, TX 75069 | 972.439.3027

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Tuesday, October 08, 2013 8:30 AM
To: Sam Hensen; Bobby Sager
Subject: Fw: Madison house

Dear Mr. Hensen,

I received a copy of your letter dated October 7, 2013 regarding the Simpson Strong Ties used in the construction of my house. The house was built in 2011. Page 14-15 of catalog INSTALL09.pdf specifically prohibits the use of joist hangers that are "too short". The "light" U brackets (LUS26) measure 4 and 3/4 and are affixed to 2x10's that measure 9.25", supporting 2 x 10's and attaching to 2x10's. I pulled out one of the nails affixing the U bracket and it measured 1.5 inches. I expressed my concern to DHCD over the 60% rule regarding deflection (my china cabinet shakes and my kitchen floor shakes) and the load capacity. The plan called for "typical joist hangers" but did not specify the size or weight. Contrary to the approved plan, certain portions of the house cantilever over the foundation wall where no joist hanger exists, assuming the load would be absorbed by foundation wall, band board and where the joists met. However, the fact that the house, as built, is different than what the plan called for, I remain concerned that the joist hangers are undersized with respect to the size of the nails utilized to affix the hangers and the size and weight of the joist hangers. DHCD is relying on your letter to dismiss my concern regarding the Simpson brackets. I think that it is fair and reasonable to provide you with additional information as to the scope of the concern and the conditions, including the utilized nail size and proposed load calculations (which differ from what was actually built) so that you can provide an opinion.

Thank you.

Milari Madison 540-882-3160

----- Forwarded Message -----
From: Mark Neal <mneal@barlow-engineering.com>
To: 'Hunter Madison' <huntermadison2002@yahoo.com>
Cc: Chris.Thompson@loudoun.gov
Sent: Friday, November 16, 2012 12:36 PM
Subject: RE: Madison house

Mrs. Madison & Mr. Thompson,

Attached is a revised copy of the shearwall calculations we provided to IBS for the C-484709-2 plan. The only revision we made was on the Main House summary sheet showing the roof as a 3rd floor. The calculations were done correctly originally but we didn't call the habitable attic a floor.

I trust this will clarify our portion of the design and I wish you the best in resolving your issues.

Please contact our office with any questions or comments.

Thanks,

Mark Neal
Barlow Engineering, P.C.
6612 Six Forks Rd.
Suite 104
Raleigh, NC 27615
(919) 845-1600

> -----Original Message-----
> **From:** Hunter Madison [mailto:huntermadison2002@yahoo.com]
> **Sent:** Friday, November 16, 2012 10:00 AM
> **To:** mneal@barlow-engineering.com
> **Subject:** Madison house
>
> Chris.Thompson@loudoun.gov
>
> Mark,
>
> As discussed, please send the corrected plan/calc for the third floor shear wall to me and the building code official. PDF is fine.
>
> Thank you.
>
> Milari Madison

COMMONWEALTH of VIRGINIA

Office of the Attorney General

Kenneth T. Cuccinelli, II
Attorney General

900 East Main Street
Richmond, Virginia 23219
804-786-2071
FAX 804-786-1991
Virginia Relay Services
800-828-1120
7-1-1

November 19, 2013

Via E-Mail (alan.mcmahan@dhcd.virginia.gov)
and U.S. Mail
Alan McMahan, Staff
State Building Code Technical Review Board
Virginia Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219

Re: Appeal of Milari Madison to the Review Board (Appeal No. 13-7)

Dear Mr. McMahan:

Enclosed please find the SBCO's Response to the appeal filed by Milari Madison. Thank you for your attention to this matter. Please feel free to call me at (804) 371-7965 if you have any questions or need any additional information.

Very truly yours,

Mike F. Melis,
Assistant Attorney General

cc: Cindy Davis
Milari Madison
Chris Thompson
Gina L. Schaecher
Eric Tompos

VIRGINIA:

BEFORE THE STATE BUILDING CODE
TECHNICAL REVIEW BOARD

IN RE: Appeal of Milari Madison
Appeal No. 13-7

RESPONSE TO APPEAL

The State Building Code Administrative Office, currently known as the State Building Code Office ("SBCO"), of the Virginia Department of Housing and Community Development, states as follows in response to the "Appeal to September 23, 2013 Davis Letter" ("Appeal") filed by Milari Madison.

ISSUES FOR APPEAL

This Response addresses the specific items raised by Ms. Madison in her July 25, 2013, complaint to the SBCO, to which the SBCO responded by letter dated September 23, 2013, ("SBCO Letter") which is now the subject of Ms. Madison's Appeal. The SBCO's positions are based on a site inspection conducted on September 6, 2013, as well as additional review of relevant materials such as the plans for the home. Moreover, the SBCO incorporates by reference its Response to Application for Administrative Appeal in Appeal No. 13-3, specifically with regard to the role and regulation of a CAA such as NTA.

1. No joist hangers under the sunroom.

The sunroom in Ms. Madison's home was not manufactured and shipped as an individual section, module or "box" to be connected or tied to other modules at the home site. Instead, the sunroom was panelized, open construction that was shipped as separate components which were assembled at the home site. A Virginia industrialized building certification seal was not issued for the sunroom. Thus the sunroom portion of Ms. Madison's home is not considered an "industrialized building" as defined by 13 VAC 5-91-10. Any alleged violations regarding the assembly and construction of the sunroom are, therefore, subject to the USBC, not the IBSR.

Ms. Madison argues that Milton "built, assembled, furnished, and attached the sunroom to the industrialized building, and is, therefore, responsible for the lack of joist hangers and any other code violation related to the sunroom." Appeal p. 9. Thus, Ms. Madison concedes that the sunroom was built on site and was not an industrialized building. And even assuming Milton did build, assemble, furnish and attach the sunroom to the industrialized building, such activity by Milton does not make the sunroom subject to the IBSR.

Contrary to Ms. Madison's assertion in her Appeal, 13 VAC 5-91-80 does not state that "the manufacturer of a registered industrialized building is required to remedy violations caused by on-site work under his control or violations involving components and materials furnished by him and included with the registered industrialized building." Appeal p. 9. In making this assertion, Ms. Madison relies on her own strained interpretation of 13 VAC 5-91-80. Her interpretation ignores the plain language of regulations expressly excluding site work from the IBSR and identifying such work as subject to the USBC.

> In accordance with § 36-99 of the Code of Virginia and in accordance with the USBC, *the installation or erection of industrialized buildings and alterations, additions, or repairs to industrialized buildings are regulated by the USBC and not this chapter.* The USBC provides for administrative requirements for permits inspections, and certificates of occupancy for such work.

13 VAC 5-91-20(C) (emphasis added).

> In accordance with § 36-99 of the Code of Virginia and the USBC, *all site work associated with the installation or erection of an industrialized building is subject to the USBC.* In addition, under the USBC, all administrative requirements for permits, inspections, and certificates of occupancy are also applicable.

13 VAC 5-91-100(B) (emphasis added). Thus, the issue of joist hangers under the sunroom, which Ms. Madison concedes was "built, assembled, furnished, and attached" on site, is a matter subject to the USBC, not the IBSR.

2. One of the joist hangers under the den has been improperly fastened to the joist.

The SBCO has identified this issue as a violation of the IBSR and has asked Milton to correct this violation.

3. There is no blocking and no joist hangers where the first floor cantilevers over the foundation.

With respect to the cantilever, the plans and the home, which was built consistent with the plans, comply with the IBSR. Upon further review, the plans for Ms. Madison's home do reflect a cantilever on the first floor and, with regard to the existence of the cantilever, what was built and installed appears to be consistent with the plans and with Ms. Madison's request. *See* Plans, attached as Exhibit A; 4/9/12 E-mail Chain, attached as Exhibit B. Moreover, any deviations from the approved plan due to the construction of the foundation or installation of the home on the foundation are matters subject to the USBC, not the IBSR.

4. According to the Simpson product literature, the joist hangers are undersized. Simpson recommends that the joist hangers be at least 60% of the joist height. The joist hangers in the basement are 4.5". The joist is 9.25".

As noted in the SBCO Letter, inspection did not reveal the joist hangers to be an IBSR violation and communication with Simpson confirms that the joist hangers are not undersized for their purpose. *See* 10/7/13 Simpson Letter, attached as Exhibit C. As for Ms. Madison's claim that nails used in the joint hangers are too short, this claim was not asserted in Ms. Madison's complaint, nor did she bring this issue to the attention of the SBCO inspector on September 6, 2013. But information provided by NTA regarding this issue would support a finding that no IBSR violation exists. *See* 11/11/13 NTA Letter, attached as Exhibit D.

5. The installer failed to contact the building official before concealment, so it is unknown if the manufacturer's installation procedures were followed where concealments occurred. As visible from the basement and above the master bedroom, there are no through bolts.

As noted above, pursuant to the IBSR, all site work associated with the installation of an industrialized building is subject to the USBC, not the IBSR.

6. Compliance assurance labels have been affixed to the house when the building does not meet code.

This complaint, by itself, does not implicate the IBSR. To the extent Ms. Madison's home in some way is non-compliant with the IBSR - meaning the construction completed at the point of manufacture does not meet the applicable code - the remedy is to request correction of the construction defect, not alteration of the compliance assurance labels.

7. The data plate remains uncorrected and inaccurate specific to the fact the house is three stories not two. The fact that the living space is significantly increased by this space (habitable attic) also makes the data plate incorrect in terms of the R value calculation and the overall square footage.

The data plate is correct in identifying the factory built portion of the home as two stories. The building plans that were reviewed and approved by NTA and submitted for permitting identify the home as "Two-Story". *See* Cover Page and Floor Plans, attached as Exhibit E. The habitable attic is not considered a story under 2009 International Residential Code. Moreover, it was not completed at the point of manufacture and, therefore, not subject to the IBSR. Subsequent to the installation of the home, additional site work was performed in the unfinished attic, including the installation of drywall on the walls and ceiling, finished flooring, electrical outlets and heating and air conditioning. As noted above, all of the work and code requirements related to additional site work are subject to the USBC and are not regulated by the IBSR. Any such additional site work not included as part of the original permit, would have required a second permit, so that specifications on code requirements would be provided to

Loudoun County. These specifications would include any additional required insulation, added electrical work, drywall specifications, use of space, *etc.*

8. The approved plans and what was delivered are not consistent, *i.e.*, width of stairs from kitchen to den; size and height of chimney; knee walls are of unequal height; the overall dimensions of certain walls deviate; basement windows under the den do not fall centered below the windows installed in the den and bathroom, the eave overhangs are of different distances.

As noted above, all site work is subject to the USBC, not the IBSR. The SBCO understands that the stairs from the kitchen to the den and the chimney were built and installed on site and, therefore, not subject to the IBSR. Ms. Madison's issues with regard to the knee walls, dimensions of certain walls, basement windows, and eave overhangs do not constitute violations of the IBSR requiring correction. To the extent Ms. Madison is dissatisfied with certain aesthetic features of her home that implicate neither the USBC nor the IBSR, such complaints are subject to whatever contractual remedies Ms. Madison may have.

9. Collar ties were not installed properly and are lacking.

Ms. Madison concedes that the collar ties were installed on site. *See* Appeal at pp. 21-22. Thus, under the IBSR, such site work is subject to the USBC, regardless of who did the work.

10. The truss manufacturer has indicated that the portions of the roof that were hinged at the factory were possibly the wrong size.

Based on the SBCO inspector's observations on September 6, 2013, the trusses were consistent with those shown on the approved plans. *See* Photo of Roof Trusses, attached as Exhibit F. The trusses were primarily constructed of 2x6 top chords and 2x10 bottom chords. There were no signs of deflection in the trusses. The truss manufacturer's report (May 21 by UFP Parker, LLC a Universal Forest Products Company) referenced by Ms. Madison uses vague, subjective language while providing no engineering support for Ms. Madison's conclusions. Nor does the report identify an IBSR violation.

11. Milton staff cut roof joists to cause an opening from the third floor living space to the storage space above the master bedroom without the engineered stamped approval.

As noted above, all site work is subject to the USBC, not the IBSR.

12. The roof over the main block is lumpy and has a significant roll.

The SBCO inspector visually inspected the exterior of the roof from ground level and from the attic. There were no significant signs of deflection.

13. Other issues - electrical service and floor one to floor two staircase.

The building plans and the electrical calculations for the home that were reviewed and approved by NTA provide for one 200 amp service panel. *See* 5/17/11 Electrical Load Calculation, attached as Exhibit G. It appears that one 200 amp panel was installed specifically for factory installed outlets and fixtures while the second 200 amp panel was shipped separately and provided for site installed outlets and equipment. Milton has acknowledged that the second 200 amp panel was supplied at Ms. Madison's request and was shipped loose for installation on site. An invoice from Billy's Electrical Service verifies such work performed on site. *See* 10/7/11 Invoice, attached as Exhibit H. The SBCO inspector's April 9, 2012, inspection of the home supports this conclusion. *See* Electrical Panel Photos, attached as Exhibit I. Each panel appeared to have been separately installed, which is consistent with the invoice reflecting electrical work on site. Moreover, to the extent any work was done on site by anyone, as noted above, such work is subject to the USBC, not the IBSR.

Regarding the apparent headroom violation at the stairway between the first and second floor, on September 6, 2013, the SBCO inspector took measurements and determined that, in its current condition, the stairway meets code. As such, no IBSR violation exists.

CONCLUSION

For the foregoing reasons, the SBCO respectfully requests that Ms. Madison's appeal be dismissed.

Respectfully submitted,

Department of Housing and Community Development – State Building Code Office

By: ______________________
Counsel

KENNETH T. CUCCINELLI, II
Attorney General

WESLEY G. RUSSELL, JR.
Deputy Attorney General

PETER R. MESSITT
Senior Assistant Attorney General

*MIKE F. MELIS (VSB# 43021)
Assistant Attorney General

Office of the Attorney General
900 East Main Street
Richmond, Virginia 23219
Tel: (804) 371-7965
Fax: (804) 371-2087
mmelis@oag.state.va.us

**Counsel of Record for the State Building Code Office*

CERTIFICATE OF SERVICE

I certify that on November 19th, 2013, a true and accurate copy of the foregoing was forwarded by e-mail and by U.S. mail, first class, postage prepaid, to:

Milari Madison
40153 Janney Street
Post Office Box 302
Waterford, Virginia 20197
huntermadison2002@yahoo.com

Chris Thompson
Loudoun County Code Enforcement Division
1 Harrison Street
SE Mailstop #60b
Post Office Box 7000
Leesburg, Virginia 20177
Chris.Thompson@loudoun.gov

Gina L. Schaecher, Esq.
Rees Broome, PC
1900 Gallows Road, Suite 700
Tysons Corner, Virginia 22182
gschaecher@reesbroome.com

Eric Tompos
NTA, Inc.
305 North Oakland Avenue
Post Office Box 490
Nappanee, Indiana 46550-0490
tompos@ntainc.com

Mike F. Melis

TO:

Eric Leatherlay

The Report does not address the model of the house, only the Stones.

Vernon -

For all appeals -

The Report concludes the house does Not meet code with respect to the joist hangers and joists that are visible.

He notes the stories of the house but not the model, 2 story cape.

ENGINEERING

LLM Engineering, PLLC
42996 Brookton Way
Ashburn, Virginia 20147
703-475-5921
703-729-8276 (fax)

December 26, 2013

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

Subject: **Report for Engineering Services**
40153 Janney Street, Waterford, VA 20197

Dear Ms. Madison:

I am pleased to submit this letter report of my structural observation at the subject site. This report includes a brief overview of the project information, a summary of my services, and the results of my evaluations.

Project Information

Project information was initially provided by Ms. Milari Madison on November 8, 2013. The subject site is located on 40153 Janney Street in Waterford, Virginia. A residence of modular construction located on the subject site. Reportedly, the residence was constructed in 2011. Problems associated with the (1) first floor joists and joists hangar, (2) floor vibration in the kitchen and dining room, and (3) house classification has been identified by Ms. Madison. Therefore, Ms. Madison requested that a professional engineer provide an opinion on why these problems exist.

Scope of Services

LLM Engineering, PLLC provided the following services:

1. Conducted two site visits to gather pertinent data and to observe the first floor framing system.
2. Prepared this written letter report which documents my observations and presents my evaluations, conclusions and recommendations.

References

1. Virginia Residential Code (2009)
2. ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, Reston, VA. (2005)
3. National Design Specification for Wood Construction with Commentary and Supplement (2005)
4. Simpson-Strong-tie Catalog, "Wood Construction Connectors 2011-2012" (2011)
5. ATC Design Guide 1 (1999) Minimizing Floor Vibration, Applied Technology Council.
6. Project Drawings approved by NTA, Inc. on July 14, 2011.

Observations

Kitchen Floor Framing

The first floor framing supporting the kitchen consists of ¾" oriented-strand board (OSB) plywood floor sheathing and nominal 2 x 10 wood floor joists spaced at 16 inches on-center spacing. The wood species and grade for the floor joists are Spruce-Pine-Fir (S-P-F), No. 2 (See Photo 1). The floor joists are attached to a 4-ply, 2x10 built-up wood beam at both ends. The built-up beam partially rests on W-section steel beam on one end and a W-section steel beam on the opposite end. The steel beams are supported by steel pipe columns. Simpson Strong-tie LUS-26 connects the floor joists to the built-up beams (See Photo 2).

Dining Area Floor Framing

The first floor framing supporting the dining area consists of ¾" oriented-strand board (OSB) plywood floor sheathing and nominal 2 x 10 wood floor joists spaced at 16 inches on-center spacing. The wood species and grade for the floor joists are a mixture of Spruce-Pine-Fir (S-P-F), No. 2 and Southern Pine (SYP), No. 2. The floor joists are attached to a 4-ply, 2x10 built-up wood beam at one end and a 2x sill plate which rests on a concrete basement wall on the opposite end. The built-up beam partially rests directly on a W-section steel beam. The steel beam is supported by steel pipe columns. Simpson Strong-tie LUS-26 connects the floor joists to the built-up beam.

Floor Vibration

The floor in both the kitchen and dining room was observed to vibrate unacceptably as a result of normal walking.

Residence Construction

The residence was observed to have a below grade basement and two floor stories above grade. A third occupied space was observed in the attic area.

Evaluations

I. Joist and Joist Hangars

An analysis was performed to determine if the first floor joists and joists hangars were adequate for the design loads. A review of the basement framing plan in Reference 6 indicated that the first floor joists are spanning four main areas. The four main areas have design span lengths of 15'-7", 15'-5", 13'-5" and 10'-6". Thus, each span length was investigated to determine if the floor joists and joist hangars are adequate to support the design loads.

1. Design Loading

The minimum design loading was determined by using the load combinations specified in the 2006 Virginia Residential Code and Minimum Design Loads for Buildings and Other Structures. The governing load combination included the dead load (D) and live load (L). The dead and live loads included the following:

A. Dead Load (D)

Hardwood Floor	= 4 PSF (Ref. 2)
¾" OSB Plywood Subflooring	= 3 PSF (Ref. 2)
2x10 Joists at 16" on-center	= 6 PSF (Ref. 2)
Mechanical and Electrical Allowance	= 4 PSF (Ref. 2)
TOTAL DEAD LOAD (D)	= 17 PSF
B. Live Load (L)	= 40 PSF (Ref. 1)

The live load (L) was taken from Table R301.5 (Minimum Uniformly Distributed Live Loads) for Rooms Other than Sleeping Rooms. Thus, the design dead plus live load used in the analysis was 17 + 40 = 57 PSF

2. Material/Component Properties

The material properties for 2x10 first floor joists and joist hangars included:

A. Spruce-Pine-Fir : Bending Stress (F_b) = 875 PSI
Shear Stress (F_v) = 135 PSI
Modulus of Elasticity (E) = 1,400,000 PSI

The allowable stress values for the Spruce-Pine-Fir were taken from Reference (3). The published value of the allowable bending stress was increased by a repetitive member factor of 1.15 to account for the load distribution to the other floor joists as allowed by the National Design Specification for Wood Construction (Ref. 3).

B. Simpson Strong-Tie LUS-26 Joist Hangar: Allowable Load = 490 pounds (Ref. 4)

3. Capacity Analysis Results

A. Floor Joists

The results of the capacity analysis are listed in the Table 1. The analysis showed that the floor joists are adequate to resist the shear stresses for all four span lengths and the design live load deflection is well within the allowable deflection for each span length. However, the bending stresses for the 15'-7" and 15'-5" spans were approximately 32 and 30 percent greater than the allowable bending stress, respectively. The allowable bending stress for 13'-5" span was only approximately 2 percent greater than the allowable bending stress.

TABLE 1. Capacity Analysis Results

Span Length	f_b (psi)	F'_b (psi)	F_v (psi)	F'_v (psi)	Deflection (in)	Allowable Deflection (in)	Joist Reaction (lb)	Allowable Joist Reaction (lb)
15'-7"	1290	980	64	135	0.38	0.52	592	492
15'-5"	1270	980	63	135	0.37	0.51	586	492
13'-5"	960	980	55	135	0.21	0.45	510	492
10'-6"	590	980	43	135	0.08	0.35	399	492

B. Joist Hangars

As stated earlier, the joist hangars were observed to be LUS-26 and manufactured by Simpson Strong-Tie. The published allowable load for this joist hangar is 740 pounds for joist manufactured from Spruce-Pine-Fir (S-P-F) and if 3-inch long 10D nails are used (Ref. 4). To confirm if the specified nails were used, it was decided to remove one nail from three joist hangars. One joist hangar was selected for span lengths of 15'-7", 15'-5" and 10'-6". The nails were determined to be approximately 1-1/2 inches long. Thus, it was assumed that all the joist hangars were attached with 1-1/2 inch long 10 D nails. Simpson Strong-Tie allows the use of 1-1/2 inch long nails but the allowable load of the joist hangar needs to be reduced by a factor of 0.64. Based on this determination, the allowable load for the LUS-26 joist hangars with 1-1/2 inch long 10D nails is 492 pounds. Therefore, as shown in Table 1, the joist hangars in the 15'-7", 15'-5" and 13'-5" floor spans are not adequate to support the design loads.

II. Floor Vibration

The floor vibration analysis was conducted according to the recommended analysis procedure listed in Reference 5 and published by the Applied Technology Council. This procedure requires that the natural frequency of the floor system be computed. The natural frequency is a function of the downward displacement of the floor joists, supporting girders, and columns, if they are present. Floor Structures which have a natural frequency between 8 and 15 hertz (Hz) can develop unacceptable natural vibration caused by walking (Ref. 5). The unacceptable natural vibrations are displayed by jolts felt by occupants and rattling objects that they hear (Ref. 5). If the floor system is very light, in the case of a wood framed floor and its natural frequency is above 15 Hz, then the natural vibration will dissipate rapidly and the natural vibration can be acceptable (Ref. 5). In our case, the natural frequency for the floor systems supporting both the kitchen area and dining room area was determined to be 11.25 Hz and 14.81 Hz, respectively. Therefore, based on their calculated natural frequencies, unacceptable natural vibration should occur in these two floor areas as previously identified.

III. Residence Identification

It was also requested that the proper designation of the residence be determined. The residence is listed as a "Two Story" on the house plate. However, the house has a habitable space between the roof and second story. The 2009 Virginia Residential Code states that a story is that "portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above". The 2009 Virginia Residential Code also states that a habitable attic can be "finished or unfinished" and is not considered a "story". Also, the habitable attic must have "(1) an occupiable floor area greater than 70 square feet, (2) the ceiling height of the occupiable floor area must be at least 7 feet, and (3) the occupiable space is enclosed by the roof assembly above and the floor-ceiling assembly below". According to Ms. Madison, the space above the second floor was purposely designed to be habitable space. The plan shows an unobstructed staircase delineated as "up", from the second floor to the occupiable space above. Mr. Dave Pumphrey, who works in Loudoun County's Department of Building and Development, was contacted to determine the local jurisdiction's ruling. Mr. Pumphrey stated that if the space meets the requirement of a habitable attic then it cannot be classified as a "story".

Recommendations

Based on my observations, it is recommended that the capacity deficiencies in the floor joist and joist hangars for the identified spans be remedied as soon as possible. Also, based on my conversation with Mr. Dave Pumphrey, the house plate correctly identifies the house as a two story residence.

Limitations

LLM Engineering, PLLC was retained to perform structural observation services for the referenced property. The conclusions and recommendations presented in this report are based on personal interviews of persons knowledgeable about the facility, my field observations and my experience on similar projects. No construction material testing was performed. The discovery of any additional information concerning the referenced property should be reported to me for my review so that I can reassess potential impacts and modify my conclusions and recommendations, if necessary. The use of this report is for the sole use of Ms. Milari Madison. Reliance of this report by a third party requires the execution of a secondary client agreement. No other warranty, express or implied, is made.

Closing

I appreciate the opportunity to present this report. Following your review of this report, if you have questions or if I may be of further assistance, please do not hesitate to contact me.

Sincerely,
LLM Engineering, PLLC

Laurence A. Burley, Jr., Ph.D., P.E.
Principal/Manager

COMMONWEALTH OF VIRGINIA
LAURENCE ALBERT
BURLEY, JR.
Lic. No. 033575
12/26/2013
PROFESSIONAL ENGINEER

RB REES BROOME, PC

ATTORNEYS AT LAW

1602 Village Market Blvd., S.E., Suite 270
Leesburg, Virginia 20175
Phone: (703) 443-6605
Fax: (703) 779-2804
www.reesbroome.com
gschaecher@reesbroome.com

January 13, 2014

VIA ELECTONIC TRANSMISISON
& FIRST CLASS U.S. MAIL

Eric Leatherby
Sr. Construction Inspector II
State Building Codes Office
Department of Housing and Community Development
Main Street Centre
600 East Main Street, Suite 300
Richmond, Virginia 23219

Re: ***Consumer Complaint; Milari Madison v. Integrity Building Systems, Inc.***
Milton Home Systems, Inc.'s Response to January 8, 2014 letter

Dear Mr. Leatherby:

In response to your January 8, 2014 letter concerning Milari Madison's December 1, 2013 complaint ("12/01/13 Complaint"), Milton Home Systems, Inc. ("Milton") consulted with NTA, Inc. which served as the Compliance Assurance Agency with respect to the modular units that were delivered to Ms. Madison at her residence. Milton has reviewed NTA, Inc.'s January 10, 2014 letter to the Department of Housing and Community Development regarding Ms. Madison's December 1, 2013 Complaint and Expert Report dated December 26, 2013 ("NTA Response") and adopts and incorporates the NTA Response to address the allegations contained in the December 1, 2013 Complaint.

Enclosed herewith and incorporated herein by reference is the NTA Response and provided herein in response to your January 8, 2014 letter. We respectfully submit that the NTA Response fully and completely refutes the allegations contained in Ms. Madison's December 2, 2013 Complaint.

Should you have any questions, or should this matter require any further discussion, please kindly contact us at your earliest opportunity.

Respectfully,

Gina L. Schaecher
Counsel for Milton Home Systems, Inc.

GLS:lrw
Enclosure

cc: Milari Madison *via first class U.S. mail w/ enclosure*
Christopher Thompson *via electronic transmission w/ enclosure*
Cindy Davis *via electronic transmission w/ enclosure*
Michael Melis *via electronic transmission w/ enclosure*
Eric Tompos *via electronic transmission w/ enclosure*

K:\90\90376\Milton Home Systems\Madison. Milari\Correspondence\140113 Ltr E. Leatherby.doc

NTA INC.

ENGINEERS
PLANNERS
CONSULTANTS

305 NORTH OAKLAND AVENUE • P.O. BOX 490 • NAPPANEE, INDIANA 46550
WEB: WWW.NTAINC.COM

PHONE: 574-773-7975
FAX: 574-773-5739

January 10, 2014
IBS050213-11c

Department of Housing and Community Development
State building Code Administrative Office
600 East Main Street, Suite 300
Richmond, Virginia 23219

RE: MADISON COMPLAINT (DATED 12/1/2013) AND EXPERT REPORT (DATED 12/26/2013)

Pursuant to the request of the Department of Housing and Community Development, I have reviewed the report prepared by Laurence A. Burley, Jr., Ph.D., P.E., dated December 26, 2013. Based on my review, I have determined that Dr. Burley's findings are based on an evaluation containing numerous errors, and if these errors were corrected the evaluation would show that the floor system in the Madison residence is adequate and no remedial action is required. The errors in Dr. Burley's evaluation are detailed in the list below:

DESIGN SPANS AND APPLIED LOADS

1. Dr. Burley incorrectly determined the design spans of the joists to be 15'-7", 15'-5", 13'-5" and 10'-6". The spans used by Dr. Burley correspond to the module widths, which are greater than the joist span. The modules are constructed with a double 2x band joist on each side, as a result, the design span of the joist is 6-in. less than the module width. The correct spans are 15'-1", 14'-11", 12'-11" and 10'-0", respectively. This error in Dr. Burley's evaluation resulted in an overestimation of the bending stress by up to 10-percent.

2. Dr. Burley incorrectly estimated the dead load of the joists and decking as 9 psf. The dead weight considered by Dr. Burley considers the weight of the structural sheathing *twice* as the tabulated dead load provided in ASCE 7-05, Commentary Table C3-1, (Ref. 2 in the report) includes both the weight of joists, subfloor and underlayment. From the 2005 NDS (Ref. 3 in the report), a 2x10 SPF joist at 16-in. on-center has a dead weight of 2.0 psf. From the *APA D510C, Panel Design Specification*, 3/4-in. thick plywood, 24-in. o.c. rated Sturd-I-Floor (combination subflooring underlayment), has a dead weight of 2.3 psf. The total dead weight of the structural material in the floor system is 4.3 psf (2.0 psf + 2.3 psf), whereas Dr. Burley considers a dead weight of 9 psf for the same materials. This error results in overestimation of the dead weight by 109-percent for these components.

3. Dr. Burley incorrectly adds a "Mechanical and Electrical Allowance" in the dead load calculation. This "allowance" is not required by code and is not warranted in residential construction where the actual weight of the supported mechanical and electrical equipment is very small. Pursuant to ASCE 7-95, Section 3.1.2, "In determining dead loads for purposes of design, the actual weights of materials and constructions shall be used..." As previously determined (Item 2), the actual weight of the structural materials in the floor is 4.3 psf. The original design considers a dead load of 10 psf, which provides 5.7 psf for finish materials, mechanical and electrical.

4. Dr. Burley incorrectly designs the floor for a total uniform load of 57 psf. Standard practice within the modular industry is to design light-framed residential floors in living areas for a 10 psf dead load and a 40 psf live load, which results in a total design load of 50 psf. The overall error in Dr. Burley's design load estimation due to the errors described in Item 2 and Item 3 is an overestimation of the total design load by 14-percent.

Floor Joists

5. Dr. Burley incorrectly determines the allowable stress for Spruce-Pine-Fire lumber. Pursuant to the *2005 National Design Specification for Wood Construction Supplement* (NDS/Ref. 3 in the report), Table 4A, the *Size Factor, C_F*, for 2x10 SPF No.2 lumber under flexural stress is 1.10. The correct allowable bending strength, F'_b, is 1107 psi (875 psi (F_b) x 1.15 (C_r) x 1.10 (C_F) = 1107 psi). This error results in underestimation of the allowable flexural strength, F_b', by 10-percent.

6. Dr. Burley has a calculation error in "Table 1, Capacity Analysis Results," column "F'_b." The bending stress, F'_b, presented in the table is 980 psi. This value is incorrect and does not correspond to the tabulated bending stress (875 psi) multiplied by the repetitive member factor (1.15), as described the report. Excluding the error described in Item 5, Dr. Burley should have calculated F'_b = 1006 psi (875 psi x 1.15 = 1006 psi). The errors described in Items 5 and 6 result in an underestimation of the allowable bending stress by 11-percent.

7. Dr. Burley incorrectly determines the applied shear load at the ends of the joists in "Table 1, Capacity Analysis Results," column "F_v." Pursuant to the *2005 National Design Specification for Wood Construction Supplement* (NDS/Ref. 3 in the report), Section 3.4.3.1, the "...uniformly distributed loads within a distance from supports equal to the depth of the bending member, d, shall be permitted to be ignored..." Dr. Burley's analysis does not ignore the load within *d* of the supports when determining the shear force. This error results in overestimation of the joist shear stress by up to 24-percent.

8. Dr. Burley has a calculation error in "Table 1, Capacity Analysis Results," column "Deflection." The tabulated deflection values are incorrect and appear to be based on a joist spacing of 12-in. on-center, whereas the joists are installed at 16-in. on-center. This error results in underestimation of the deflections by 25-percent.

9. Dr. Burley incorrectly concludes that the joists are overstressed in bending. Correcting the errors identified in Items 1 through 4, the applied bending stress, *fb*, is 1064 psi for a joist spanning 15'-1" spaced 16-in. on-center. Correcting the errors identified in Items 5 and 6, the allowable bending stress, F'_b, of a 2x10 SPF, No. 2 is 1107 psi, which is greater than 1064 psi. Therefore, the floor joists in the Madison residence are adequate and no remedial action is required. Alternately, the joists may be justified using the prescriptive tables in the *2009 Virginia Residential Code*. In the code, Table R502.3.1(2) (attached), permits a 16-in. on-center, 2x10 SPF, No. 2, to span 15'-5" under 10 psf dead load and 40 psf live load. The tabulated span permitted by the code exceeds the maximum design span in the Madison residence which is 15'-1"; therefore, the floor joists are acceptable and conform with the *2009 Virginia Residential Code*.

Joist Hangers

10. Dr. Burley incorrectly determines the capacity of the Simpson LUS26 joist hanger as 492 lbf. The reduction factor of 0.64, provided in Simpson's catalog (Ref. 4 in the report), does not apply to joist hangers that utilize "double shear nails." As detailed in NTA's letter regarding "Madison Appeal of DHCD 9/23/2013 Letter Item #4," dated 11/11/2013, the installed capacity of the LUS26 joist hanger is 328 lbf. This error in the analysis results in overestimation of the hanger capacity by 50-percent.

11. Dr. Burley incorrectly determines the total strength of the rim joist-to-joist connection. As provided in Milton's design manual, and in accordance with standard construction practice in the modular industry, end-nails were installed at this connection *in addition to* the joist hanger. As detailed in NTA's letter regarding "Madison Appeal of DHCD 9/23/2013 Letter Item #4," dated 11/11/2013, the end-nailing consists of (5) 0.131" x 3" end nails, which provide a strength of 275 lbf *in addition to* the strength of the LUS26 joist hanger. The resulting total connection strength is 603 lbf (275 lbf + 328 lbf = 603 lbf). This error in Dr. Burley's evaluation results in underestimation of the total connection strength by 29-percent.

12. Dr. Burley incorrectly concludes that the joist hangers are not adequate to support the design loads. Correcting the errors identified in Items 1 through 4, the maximum joist end reaction is 509 lbf. Correcting the errors identified in Items 10 and 11, the allowable connection strength is 603 lbf, which exceeds the maximum applied load of 509 lbf; therefore, the joist end connection is adequate.

FLOOR VIBRATION

13. Dr. Burley incorrectly concludes that the joists are unacceptable due to vibration. The vibration analysis performed is not a requirement of the *2009 Virginia Residential Code*. The *2009 Virginia Residential Code*, Table R502.3.1(2), permits a 16-in. on-center, 2x10 SPF, No. 2, to span 15'-5" under 10 psf and dead load and 40 psf live load. The tabulated span permitted by the code exceeds the maximum design span of 15'-1"; therefore, the floor joists are acceptable and conforms with the *2009 Virginia Residential Code*.

DATA PLATE

14. Dr. Burley asserts that "...the house plate correctly identifies the house as a two story residence." This conclusion is correct and in concurrence with NTA opinion on this matter.

As detailed herein, the evaluation performed by Dr. Burley contains numerous errors, which led to incorrect conclusions regarding the adequacy of the floor system. If the errors in Dr. Burley's analysis were corrected, his evaluation would show that the floor system in the Madison residence is adequate and no remedial action is required. The original design documents submitted to NTA, Inc. were justified using the prescriptive span tables found in the *2009 Virginia Residential Code* (attached), which clearly show that the floor system conforms with the code.

Respectfully,

Eric J. Tompos, PE, SE, CBO
NTA, Inc.

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/Δ = 360)[b]

JOIST SPACING (inches)	SPECIES AND *GRADE*		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)
12	Douglas fir-larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas fir-larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas fir-larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas fir-larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	18-5	22-5
	Southern pine	#2	10-9	14-2	18-0	21-9	10-9	14-2	16-11	19-10
	Southern pine	#3	9-4	11-11	14-0	16-8	8-6	10-10	12-10	15-3
	Spruce-pine-fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-pine-fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas fir-larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas fir-larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas fir-larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas fir-larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern pine	#1	9-11	13-1	16-9	20-4	9-11	13-1	16-4	19-6
	Southern pine	#2	9-9	12-10	16-1	18-10	9-6	12-4	14-8	17-2
	Southern pine	#3	8-1	10-3	12-2	14-6	7-4	9-5	11-1	13-2
	Spruce-pine-fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-pine-fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#2	9-4	12-3	$\boxed{15-5}$	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
19.2	Douglas fir-larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas fir-larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas fir-larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas fir-larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern pine	#1	9-4	12-4	15-9	19-2	9-4	12-4	14-11	17-9
	Southern pine	#2	9-2	12-1	14-8	17-2	8-8	11-3	13-5	15-8
	Southern pine	#3	7-4	9-5	11-1	13-2	6-9	8-7	10-1	12-1
	Spruce-pine-fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-pine-fir	#	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas fir-larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas fir-larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas fir-larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas fir-larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10[a]
	Hem-fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-1
	Southern pine	#1	8-8	11-5	14-7	17-5	8-8	11-3	13-4	15-11
	Southern pine	#2	8-6	11-0	13-1	15-5	7-9	10-0	12-0	14-0
	Southern pine	#3	6-7	8-5	9-11	11-10	6-0	7-8	9-1	10-9
	Spruce-pine-fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-pine-fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

a. End bearing length shall be increased to 2 inches.

b. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D_0, D_1, and D_2 shall be determined in accordance with Section R301.2.2.2.1.

Terence R. McAuliffe
Governor

Maurice A. Jones
Secretary of
Commerce and Trade

COMMONWEALTH of VIRGINIA

DEPARTMENT OF
HOUSING AND COMMUNITY DEVELOPMENT

William C. Shelton
Director

January 14, 2014

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

Dear Ms. Madison,

I am in receipt of the Industrialized Building Consumer Complaint form that you submitted to this office dated December 1, 2013 and also an engineering report dated December 26, 2012 that you submitted regarding the floor system in your home. According to your complaint, you seek "enforcement of IBSR (36-73) against Integrity Building Systems, Inc., now doing business as Milton Home Systems, Inc. (hereinafter "Milton"). The complaint involves your home which is a Virginia registered industrialized building manufactured by Milton on July 14, 2011.

The State Building Codes Office (SBCO) has been designated by the Virginia Department of Housing and Community Development (DHCD) to enforce the Virginia Industrialized Building Safety Regulations and acts as the building official for registered industrialized buildings.

Specifically the complaint involves the two issues listed below:

1. ***Complaint - "Floor joists under kitchen violate code". "Floor joists are too long for load and for wood species type".***

SBCO response – At the request of the SBCO, the Loudoun County Department of Building and Development performed an inspection of the kitchen floor joists and reported that the joists are 2"x10", #2 Spruce-Pine-Fir (SPF) spaced 16" o.c. and spanning a distance of 15 feet 1 and ¼ inches. Please be advised that Table R502.3.1(2) of the 2009 edition of the Virginia Residential Code (IRC) allows a 2"x10" #2 SPF floor joist spaced 16" o.c. and designed for a live load of 40 psf and a dead load of 10 psf to span 15 feet 5 inches. Please see the attached response from Milton Home Systems, Inc. and the engineering data from NTA, Inc. Based on the above information the SBCO determines the sizing of the floor joists to be in compliance with the IRC.

2. ***Complaint – The Virginia registration seals and the Compliance Assurance Agency (CAA) labels were applied to the home prior to the plans being approved by the CAA.***

SBCO response – It is common in the industrialized building industry to begin construction of a structure prior to the plans being approved by the CAA. In these cases, the plans have already been prepared by the manufacturer and the CAA inspectors use those plans as a basis for conducting inspections during the production process. The modules are red-tagged by the CAA until the plans are approved by the CAA. If discrepancies are noted between the approved plans and the as built structure, the manufacturer is required to take corrective action to bring the structure into compliance with the approved plans.

Please note that the data plate applied to your home identifies the home as being manufactured on July 14, 2011. The CAA approval stamp on the plans is also dated July 14, 2011. The CAA inspection report dated July 13, 2011 identifies the Virginia seals that will be issued for the home. The CAA inspection report dated July 14, 2011 releases the red-tag and notes that plans were approved (see attached). Therefore the SBCO has determined there is no violation in the manner that the modules were inspected and that CAA properly followed procedures for red-tagging the modules prior the plans being approved, and properly released the red-tags when the plans were approved by the CAA.

For the reasons stated above, we have determined that there are no violations of the Industrialized Building Safety Regulations related to this complaint.

Pursuant to section 13 VAC 5-91-70 of the Virginia Industrialized Building Safety Regulations any person aggrieved be the Department of Housing and Community Development's (DHCD) application of this chapter shall be heard by the State Review Board established by §36-108 of the Code of Virginia. Such appeal shall be submitted within 21 calendar days of receipt of DHCD's decision. A copy of the decision of DHCD to be appealed shall be submitted with the application for appeal. Failure to submit an application foe appeal within the time limit established by this section shall constitute acceptance of DHCD's decision. For your convenience, I have enclosed an application.

Please feel free to contact me at 804-371-7150 or by email at cindy.davis@dhcd.virginia.gov if you have any questions regarding this matter.

Sincerely,
Cindy L. Davis

Cindy L. Davis, C.B.O., Director
State Building Codes Office
600 E. Main Street – Suite 300
Richmond, VA 23219

cc: Emory Rodgers, Deputy Director
Mike Melis, OAG
Gina L. Schaecher, Counsel to Milton
Eric Tompos, P.E., NTA, Inc.

Milari Madison
40153 Janney Street
Box 302
Waterford, VA 20197
tel 540-882-3160

February 2, 2014

FEB - 4 2014
AM

Re: Appeal to January 14, 2014 Davis Letter

Comes now, Milari Madison, proceeding *pro se*, and respectfully asks the Review Board ("TRB") to overturn the January 14, 2014 Davis Letter pursuant to § 36-114 and to provide the requested relief.

As stated in *Kenley v. Newport News General & Non-Sectarian Hosp. Ass'n, Inc.*, 227 Va. 39, 44, 314 S.E.2d 52, 55 (1984), the court held that "[T]he 'heart' of a case decision 'is a fact determination respecting compliance with law." Ms. Davis made a fact determination and decided that Milton was in compliance with the law, that no law was violated. In *Randall A. Strawbridge and State Building Code Technical Review Board v. County of Chesterfieild, Virginia. Court of Appeals of Virginia, Richmond* (November 19, 1996), quoting *Daniels v. Truck & Equip. Corp.*, 205 Va. 579, 585, 139 S.E.2d 31 (1964), the Court held "[a] final order is one which disposes of the whole subject, gives all the relief contemplated ... and leaves nothing to be done in the cause....", and as such, "...[t]hat ruling was a final determination." Ms. Madison asserts that the Davis Letter disposed of the whole subject leaving a timely and ripe appeal now filed within the twenty one day time period set forth in the January Davis Letter.

DHCD is responsible for hand-picking Compliance Assurance Agencies ("CAA"), such as NTA, Inc. ("NTA). In this matter, NTA served as the CAA. 13 VAC 5-91-250 states, in part, that any industrialized building must meet the following requirement to be registered and eligible for a Virginia registration seal: "[T]he design of the building has been found by a compliance assurance agency to be in full compliance with this chapter. Approved designs shall be evidenced by the stamp and date of approval on each design sheet by the compliance assurance agency."

The Madison modular house was shipped with substantive and costly building code violations, ***none*** of which have been corrected utilizing an approved design sheet, evidenced with a stamp, as prepared by an independent CAA (*see* photos at Exhibit 1) by the responsible party. The documented code violations and deviations to the approved plan caused by Milton and NTA include, but are not limited to:

1. inadequate headroom from the second floor to the third floor (no correction to the code violation per an approved plan by a CAA has been completed by Milton);

2. inadequate headroom from the first floor to the second floor (no correction to the code violation per an approved plan by a CAA has been completed by Milton, as agreed);

3. the chimney chute and reinforcement of the floor and roof to support the brick were inadequate, deviate from the correction plan provided by Mr. O'Toole (not a CAA) and without approval by Ms. Madison or the CAA;

4. no joist hangers under portions of the family room were installed, code violation;

5. an improperly installed joist hanger under the den was installed, code violation;

6. a redesign of the west wall to close a 6"- 8" open gap and to support the brick were not approved in writing by Ms. Madison;

7. the redesign of the west eave overhang are without an approved plan for correction by a CAA;

8. the data plate is incorrect, the model is a two story cape, not a two story (*see* Exhibit 2 for comparison), the electric system is misidentified (it is 400 amp, not 200 *see* Exhibit 3), the square footage shown on the data plate is wrong, the R value calculation is wrong;

9. no blocking was installed where the foundation and the first floor meet leaving open gaps to the outside;

10. stairs installed through a factory repair work order from the kitchen to the den did not meet code;

11. the manufacturer's installation instructions were not followed to set the house by the factory;

12. the roof truss system failed to follow the manufacturer's report (*see* Exhibit 4);

13. the chimney chute built by the factory failed to meet code and the fireplace manufacture's installation instructions were not followed, although NTA affirms all manufacturer's installations recommendations will be followed;

14. the west wall along the kitchen to the den is significantly different and has a

bump out in the plane;

15. the interior kitchen pantry door has a header impeding access into the closet;

16. Milton asked in writing for the height of stairway from the kitchen to the den below, unaware of the height that should be obtained from the approved plan (the plan was not followed by Milton and does not accurately reflect actual stair height);

17. the roof eave overhangs are different in length (*see* photos);

18. the width of the kitchen stairs to the lower den are more narrow than shown in the plan;

19. the approved plan states the house meets code but it does not as noted above;

20. the plan does not show openings to the outside where the units cantilever over the foundation, the plan prepared by Milton;

21. the joists and rim band on the plan, under the kitchen show a distance of 181" not the actual distance of 181.25", causing the joists to *not* sit on the steel beam and to cantilever over the steel beam;

22. the roof plans, per the truss manufacturer (*see* report), are different than what was actually built, shipped, installed and corrected by Milton;

23. the chimney chute and reinforcements are inconsistent with the approved plan;

24. the window sizes in bedroom three and the sunroom are different;

25. the transom above the outside door is three pane, but shown as 4 pane on the drawings; and

26. the Approved House Document fails to show humps and rolls in the roof, walls

and floors, but instead straight, level and plumb lines, a deviation.

In short, what is shown in the Approved House Document, as stamped as meeting code, is different than what was built and delivered with deviations caused by Milton and NTA.

Although required under 13 VAC 5-91-10, the CAA is supposed to ensure that buildings are in "full compliance" with the code, and in this case, the CAA failed to do their job. It is unclear why the SBCO has not issued a notice of violation against the CAA as provided within the IBSR. Under Virginia Code § 36-79, the effect of a label of a compliance assurance agency provides that "[a]ny industrialized building shall be deemed to comply with the standards of the Board when bearing the label of a compliance assurance agency". Clearly, both NTA and Milton failed to comply with the standards and procedures, while causing and overlooking building code violations. Ms. Madison filed a lawsuit against Milton, NTA, and Mr. McNutt (Milton's dealer/agent/builder). Ms. Madison has been award a judgment against Mr. McNutt in the amount of $264.609.29. Mr. McNutt, unlicensed and uninsured, while held out by Milton as being well-vetted and performing in compliance with the law, now lives in Texas and appears to have few assets.

In order to serve as a CAA, NTA attests to the state they will "resolve all complaints" but has not. The IBSR requires that NTA be independent. NTA is not only a named defendant in ongoing litigation, their contract with Milton provides NTA with full indemnification. NTA has been utilized by Milton to serve as a consultant for discovery in the immediate litigation and has been identified to possibly appear as Milton's expert at the trial. Instead of resolving all complaints, NTA has sent a number of e-mails that are contrary to the professional work of an independent engineering firm.

David Tompos
To Me Alan.McMahan@dhcd.virginia.govcindy.davis@dhcd.virginia.gov and 4 More...
Oct 25, 2013

To be clear, NTA does not think we are a necessary party.

We are tired of the harassment.

I think we should let the courts decide. **We will not take any action until we are properly directed to do so by the courts.**

Thank you,

David A. Tompos
President
NTA, Inc.
www.ntainc.com
(574) 773-7975 ext 302
(574) 903-9584 cell

David Tompos
To Meralph@cowleslaw.comGSchaecher@reesbroome.com and 7 More...

Nov 11, 2013

Milari,
Please copy Eric Tompos at etompos@ntainc.com on all your emails. Also, please send us a copy of your engineer's report and his license information.

Thank you,
David Tompos

David Tompos

To MeEric Tomposralph@cowleslaw.com and 7 More...
Nov 13, 2013

Milari, do you want us to contact you or not? **It is like you have a split personality.** One day you want our help, which we tried to provide in the beginning, the next you want to bring up criminal charges. What do you want? Today you want our emails.

Please, please send your engineers report. We can't wait.

Sent from my iPhone

David Tompos
To Mebill.shelton@dhcd.virginia.govMike F. and 7 More...
Dec 3, 2013

I'm not conceding anything. As usual, you only hear what you want to hear. I **know the English language is difficult for you**, but that was a question. **I was poking fun at your absurd notion that a paid professional engineering is not independent.** As far as I know all professionals are paid.

You keep bringing up pending litigation. What are you talking about? The only thing pending is that you disagree with the courts decision that you have no case against NTA. I doubt anyone is surprised that you disagree with the courts.

There are no code violations in your home. Until you provide evidence of a code violation I think you should stop harassing us and wasting the states time. We have tried to help you up to this point, but this is getting ridiculous.

I found out yesterday that you verbally threatened Eric Tompos when he was at your home by asking if he had insurance and then saying you would "chase him through the gates of hell"

I can be nice and try to help you until you threaten my family.

David

David Tompos
To MeLeatherby (DHCD)bill.shelton@dhcd.virginia.gov and 8 More...

Dec 18, 2013

Maliri,

Please stop including anyone from NTA or our attorney from any correspondence. We would only like to hear from the state. Any additional communication from you will be considered harassment.

If your attorney would like to contact us he can do so via registered mail.

Merry Christmas,

David Tompos

It should be noted that NTA made unfounded and unsubstantiated statements that are disparaging, including the fact that they tried to help in the beginning. What help? For the purpose of the January 14 Appeal, the SBCO has erroneously relied on a defective report *ab initio* from a defendant. The NTA report violates the requirements prescribed under the law for such documents at 18VAC10-20-760, use of seal. The code requires that "[a]n appropriately licensed or certified professional **shall apply** a seal to final and complete original cover sheets of plans, drawings, plats, **technical reports and specifications** and to each original sheet of plans, drawings or plats, prepared by the professional or someone under his direct control and personal supervision. **The seal of each professional** responsible for each profession **shall be used and shall be on each document that was prepared under the professional's direction and for which that professional is responsible**. Application of the seal and signature indicates acceptance of responsibility for work shown thereon."

For reasons unknown, NTA failed to seal the report in violation of the law. The report from Dr. Burley is sealed and should be considered by the TRB and SBCO.

The NTA report and specifications state a span is 15' 1". The as-built measurement taken by Chris Thompson, with Loudoun County is 181.25", which is a deviation from the House Approval Document and contrary to the length stated by NTA. The additional .25 inch causes the rim band and joist hangers for the module to cantilever over the steel beam although shown to be on the beam in the Approved House Plan.

Thompson, Chris
To Leatherby, Eric (DHCD)Davis, Cindy (DHCD)Me
Jan 3, 2014

Eric,

The floor joists are 15 feet 1 and ¼ quarter inches long. (181.25 inches). I have attached a copy of the Engineers report and a photo of the lumber species.

Thanks,

Chris

Chris Thompson
Code Enforcement
Building and Development
County of Loudoun County
Virginia

703-771-5527
Chris.Thompson@Loudoun.gov

Simpson Strong Tie states the joist hangers used by Milton and approved by NTA are inadequate. In other words, Milton failed to follow the manufacturer's installation guidelines as NTA affirms will be done.

Sam Hensen
To Me

Oct 9, 2013

Ms. Madison,

The attachment you sent was for the shearwall calculations. It does not include any information on the hangers in question. However, I see that on the plans you sent earlier, a hanger is called out at the floor joist (see excerpt below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be 20 psf for this application. Thus the total demand load on the hanger is 60 psf, and it would be calculated as follows:

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately 60 psf x 1.33 ft. x 15.75 ft. / 2 = 628 lbs.

The LUS26 hanger is rated for 865 lbs., but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (**we do not permit this nail in our hanger**), the allowable load for the hanger will drop to 419 lbs. (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. **Thus the allowable load for the hanger as installed is less than the demand load. 628 lbs. < 419 lbs.**

Hope that information helps. I recommend you hire a forensics engineer to assist you with this issue. Simpson Strong-Tie does not get involved in litigious issues like this situation.

Thank You,

Sam Hensen, P.E. | Engineering Manager, Southeastern US | Simpson Strong-Tie | 2221 Country Lane | McKinney, TX 75069 | 972.439.3027

It has been admitted by Milton and NTA in open court that the house was built without the benefit of an approved plan. The necessary NTA evaluation and testing could therefore not occur utilizing the approved plan because it did not exist. The date of the approved plan and the release date of the units, both allegedly being July 14, 2011. The TRB should subpoena the records to understand the date and time the house was released, when built, and to ascertain whether or not it was physically inspected by NTA, and when.

The Davis Letter assumes that what NTA says in the unlawfully prepared engineering report, is somehow to be believed. By way of background, Milton first told DHCD they were out of business, which DHCD believed and decided not to issue a NOV. Milton told DHCD that the stairs from the second floor to the third floor were installed on-site and therefore were not a violation to the IBSR. After months of proving otherwise, DHCD reluctantly accepted the evidence. NTA stated the house met code but did not and currently does not. Now, we turn to DHCD's reliance on the NTA report procured by Milton, both defendants in lengthy litigation.

NTA overlooked several substantial building code violations. NTA's report is predicated on the fact that additional nailing of the rim joist and joist hangers actually occurred. This is a mere presumption improperly relied upon by the SBCO who did not make such an evaluation herself, nor did she view the conditions. Once again, DHCD has accepted the story as one of truth without supportive documentation and inspection reports that such additional nailing occurred. The TRB is asked to subpoena the records and witnesses from Milton and NTA to ascertain whether the alleged additional nailing occurred, when NTA actually inspected the additional nailing before or after the modules were red-tagged because Milton improperly built them without an approved plan.

The Approved House Document is dated July 14, 2011 and was not approved by Ms. Madison. Under the House Contract and Milton Performance Agreement, the house was to be manufactured, delivered and set, as a "finished building" under the IBSR definition of an industrial building (*see* § 36-71.1).

The Davis Letter states that on July 13, 2011, the NTA inspection report merely "**identifies** the Virginia seals that *will be* issued for your home". **This materially false determination and recasting can be overcome by actually reading the July 13, 2011 NTA Inspection Report** (see Exhibit 5). The report states **"ISSUED FOLLOWING LABELS"**, not will be issued as the Davis Letter improperly advises. Further, according to NTA's own Label Transaction Search, obtained through Discovery, the labels identified for the Madison units were "released" on 6/29/2011 (*see* Exhibit 6, page 5) and entitled as a file called "Labels **Released** to IBS.pdf". 6/29/2011 also contradicts the Davis "will be issued" date.

Worse, on July 13, 2011 at 4:44 p.m., Mr. Richard Rowe, then allegedly co-owner of Integrity Building Systems (now Milton, a shell company to defend the litigation), sends an e-mail to NTA stating, "Ryan, Please email Chris a copy of the cover sheet. I am going to forward him pictures of the repairs so he can release the modules for shipment" (*see* Exhibit 7). It should be noted Chris is/was employed by NTA and is the person identified as having performed the inspections). This correspondence suggests that that Chris Lehman, did not inspect and perform the necessary testing for the module units against the actual Approved House Document of July 14, 2011 but, at best, relied on pictures of "repairs". How could he have released the units based on evaluation and testing as a result of an emailed "cover sheet" and "pictures of repairs". NTA was supposed to evaluate the units based an an entire Approved House Document consisting of 94 pages. The TRB should subpoena Mr. Lehman to understand when and how he allegedly completed testing of the units and released the labels without having the Approved House Document completed to compare against (*see* 13 VAC 5-91-245 which states the manufacturer shall maintain copies of the data plate and reports of inspection, tests and any corrective action taken for a minimum period of 10 years from the date of manufacture of the building). Further, had Mr. Lehman actually inspected the modules, first hand, it would be nothing more than unconscionable to overlook the code violation for the stairs from the second floor to the third floor that ran into the roof. It would be obvious that the house as built is actually a two story cape as previously approved by NTA for Milton to build. The PDF file for Exhibit 8, obtained through a motion to compel from NTA's lawyer on December 23, 2013, is entitled "2 Story cape.pdf". The two story cape properly shows the stairs going from floor two to floor three (*see* Exhibit 8) just as in the Madison house where the stairs from floor two are shown to go "up".

In the Davis Letter, the SBCO states "it is common in the industrialized building industry to begin construction of a structure prior to the plans being approved by the CAA". It may be "common" but it is improper. NTA purports they will ensure that "approved designs will be made available prior to construction" (R-23), that design documents are followed, and that manufacturer's installation instructions and guidelines are met. The SBCO further notes that if there are discrepancies between the approved plan and the as built structure, the manufacturer is required to bring the structure into compliance with the approved plan. Many deviations were not reconciled as seen in the photographs and listed above numbers 1 – 26, nor were the complaints fully resolved.

Requested Relief:

1) The TRB should require that all deviations from the plan agreed to by Ms. Madison, assumed by Milton under the Milton Performance Agreement and the IBSR, are reconciled so the Approved House Document, and the corrections and alterations made by Milton, are an accurate reflection of what was actually built as the SBCO suggest is supposed to be done, and is sealed by an independent CAA;

2) that all code violations are corrected in compliance with an approved plan by an independent CAA and in an acceptable manner to Ms. Madison at the expense of the responsible party;

3) that the data plate is corrected to properly reflect the square footage, amperage serving the house, model of house, and R-value; and

4) that the manufacturer's installation instructions are fully complied with as NTA affirms is the requirement and standard they, as the original CAA, mandates, and in compliance with 13 VAC 5-91-80 (the manufacturer of a registered industrialized building shall be required to remedy violations caused by on-site work under his control) and 13 VAC 5-91-270 (persons or firms erecting registered industrialized buildings shall

install or erect the building in accordance with the manufacturer's instructions).

Respectfully submitted by:

Milari Madison

Exhibit 1

HIGH WIND
CALCULATIONS
FOR

INTEGRITY
BUILDING SYSTEMS

MILTON, PA

C-484709-2
90 MPH
WIND EXPOSURE: C

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12

PREPARED BY:
BARLOW ENGINEERING. P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

NARRATIVE
110376
0232nec2011
IBS – C-484709-2
48.08' x 58.5' Two Story
9/12
90 mph
Exposure C
VA
ETHAN LOEWENTHAL
7/11/11

Analyses were performed for two parts of the structure: the Den and the Main House

Den

The Endwall #1 shear loads were added to the Main House Endwall #2 at the 1st level ceiling and floor. Shear connections were designed to transfer these loads.

The floor diaphragm continuity calc was removed, because it is a 1-module structure.

The roof truss uplift DL calcs were modified for the transverse roof orientation.

Main House

Because there are two orthogonal roof orientations, the perpendicular-to-ridge wind loading was used for both orthogonal directions. This is conservative loading.

Endwall #1 on the 1st level and Sidewall #2 on both levels end in segments shorter than H/3.5. Holddowns were designed for the true ends of these walls.

The lst level ceiling above the Sun Room was designed to transfer shear load out to the portion of Sidewall #1 at the Sun Room.

The structure dimensions were reduced in the shear connections calcs and in the overturning dead load calcs for the worst cases.

INDEX

SECTION 1 — **P1-14**
HIGH WIND CALCULATIONS – DEN

SECTION 2 — **P1-23**
HIGH WIND CALCULATIONS – MAIN HOUSE

SECTION 3 — **P1-3**
HAND CALCULATIONS

SECTION 4 — **P1**
ALTERNATE CONNECTIONS

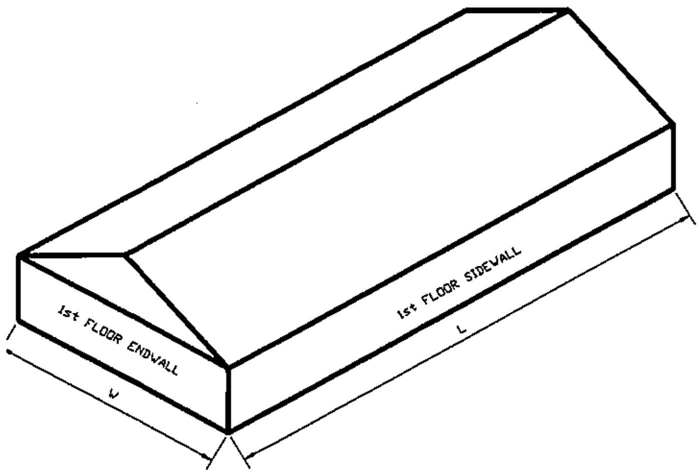
COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12

Section 1
HIGH WIND CALCULATIONS
DEN

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12



BUILDING INFORMATION:

JOB NUMBER =	110376		
PLAN NAME / NUMBER =	C-484709-2		
FIRST FLOOR WIDTH (W_1) =		21.83 ft	
FIRST FLOOR LENGTH (L_1) =		15.75 ft	
ROOF SPAN =		21.83 ft	
TRUSS SPACING (TOC)=		24 in	
STUD SPACING (SOC) =		24 in	
WIND SPEED (V3S) =		90 mph	
EXPOSURE FACTOR =	C		
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) =		1.196	
WALL HEIGHT ADJUSTMENT FACTOR (CWH) =	H / 8 =		1.125

SHEARWALL SUMMARY:

SHEATHING FASTENING MUST USE THE MORE RESTRICTIVE FASTENING OF THAT SPECIFIED FOR SHEARWALL SHEATHING FASTENING AND SHEATHING SUCTION FASTENING

FIRST FLOOR ENDWALL #1: THERMO-PLY (RED) SHEATHING EXTERIOR w/ 1/2" GWB INTERIOR
ADJACENT TO MAIN HOUSE WITH FASTENERS SPACED AT 3" EDGE

THERMOPLY FASTENED WITH 1" CROWN, 1 1/4" LEG 16 ga. STAPLE 3" O.C. EDGE & FIELD; STAPLES TO BE INSTALLED PARALLEL TO GRAIN

FIRST FLOOR ENDWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
OPPOSITE MAIN HOUSE WITH 8d COMMON NAILS SPACED AT 6" EDGE

FIRST FLOOR SIDEWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
DEN WITH 8d COMMON NAILS SPACED AT 6" EDGE

FIRST FLOOR SIDEWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BATH #1 WITH 8d COMMON NAILS SPACED AT 6" EDGE

ROOF SHEATHING: 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

CEILING SHEATHING: 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
FLOOR SHEATHING: 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

SHEATHING SUCTION FASTENING:

FOR ROOF ZONE 1: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.
FOR ROOF ZONE 2: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.
FOR ROOF ZONE 3 (CORNER): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.
FOR ROOF ZONE 3OH (CORNER OVERHANG): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 7 in o.c.
FOR WALL ZONE 4: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
FOR WALL ZONE 5: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
EDGE DIMENSION, Z = 3 ft

PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

CONNECTION SUMMARY: **CONNECTIONS TO BE AS SPECIFIED OR EQUIVALENT**

UPLIFT CONNECTIONS

REQUIRED TRUSS TIE DOWN: USE A SIMPSON H2.5A EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

1ST FLOOR STUD TO TOP PLATE / CEILING BAND: USE A 1.5" x 26 ga. STRAP EACH STUD WITH (6) 8d NAIL(S) EACH END
OR WITH (8) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

1st FLOOR STUD TO FLOOR BAND: USE A 1.5" x 26 ga. STRAP EACH STUD WITH (6) 8d NAIL(S) EACH END
OR WITH (8) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 260 lbs

FLOOR BAND TO SILL PLATE CONNECTION: USE A 1.5" x 22 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (17) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 780 lbs

LATERAL CONNECTIONS

TRUSS TO TOP PLATE CONNECTION: USE (2) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS
IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

PLATE TO STUD CONNECTION: USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

TOP PLATE SPLICES

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

SHEAR CONNECTIONS

FIRST FLOOR ENDWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
(AND SHEATHING TO TRUSS BOTTOM CHORD) OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 72" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 1292 lbs

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 66" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 72" O.C
OR USE 5/8" ANCHOR BOLTS @ 72" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

FIRST FLOOR SIDEWALL

UNIT SHEAR SHEATHING TO RIMBAND CONNECTION: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf

UNIT UPLIFT SHEATHING TO RIMBAND CONNECTION: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 14" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 53" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 72" O.C
OR USE 5/8" ANCHOR BOLTS @ 72" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

HOLDDOWN CONNECTIONS

FIRST FLOOR CORNER HOLDDOWN: NO PHYSICAL HOLDDOWN REQUIRED

FIRST FLOOR CORNER STUD CONNECTION: FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS

APPLICABILITY LIMITATIONS:

MEAN ROOF HEIGHT (MRH) =	15.10 ft
NUMBER OF STORIES =	1
FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
BUILDING ASPECT RATIO (L/W) =	0.72
FLOOR JOIST DEPTH =	9.25 in
MAX. VERTICAL FLOOR OFFSET =	0 in
FLOOR ASPECT RATIO (L/W) =	0.72
MAX. FLOOR DIAPHRAGM OPENING WIDTH =	0 ft
MAX. FLOOR DIAPHRAGM OPENING LENGTH =	0 ft
FIRST FLOOR HEIGHT (H_1) =	9 ft
CEILING ASPECT RATIO (L/W) =	0.72
MIN. SHEARWALL SEGMENT (H / 3.5) =	2.57 ft
ROOF PITCH =	9 /12

DESIGN MEETS LIMITATIONS OF THE WFCM METHODOLOGY

CONNECTION INFORMATION:

TRUSS TO PLATE CONNECTORS

UPLIFT STRENGTH:			SHEAR STRENGTH:	
SIMPSON H2.5	U =	365 lbs	F_2 =	130 lbs
SIMPSON H2.5A	U =	480 lbs	F_2 =	110 lbs
SIMPSON H10	U =	850 lbs	F_2 =	235 lbs
(5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)			U =	834 lbs
			F_2 =	486 lbs

200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	100 psi (END-GRAIN)
200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	200 psi (FACE)

FLAT STRAPS		MAXIMUM	FASTENERS: 8d NAIL		16 ga. STAPLE
1.5" x 26 ga. STRAP	Z =	485 lbs	Z =	76.7	49.9 lbs
1.5" x 22 ga. STRAP	Z =	810 lbs	Z =	127.2	48.6 lbs
1.5" x 20 ga. STRAP	Z =	973 lbs	Z =	127.3	48.3 lbs
(2) 1.5" x 22 ga. STRAP	Z =	1620 lbs	Z =	129.4	46.4 lbs
(2) 1.5" x 20 ga. STRAP	Z =	1946 lbs	Z =	131.4	46 lbs

HOLDDOWNS w/ 1 1/2" EDGE DISTANCE		
MINIMUM 8" STEM WALL		
ASSUME 3000 psi Fc CONCRETE		
SIMPSON LSTHD8RJ	Z =	1950 lbs
SIMPSON STHD10RJ	Z =	3230 lbs
SIMPSON STHD14RJ	Z =	4430 lbs
(2) SIMPSON STHD14RJ	Z =	8860 lbs
1/2" DIA. THRU BOLT	Z =	623 lbs
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
1/4" DIA. LAG SCREW	Z =	224 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	100 lbs
0.131" x 2.5" COMMON NAIL (TOENAILED)	Z =	83 lbs
0.131" x 2.5" COMMON NAIL (ENDNAILED)	Z =	67 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs
0.162" x 3.5" COMMON NAIL (ENDNAILED)	Z =	128 lbs
8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER	Z =	95 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	69 lbs (7/16" SIDE; WITHDRAWAL)
(1) SIMPSON LTP4 PLATE	Z =	575 lbs
1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"	Z =	70 plf
7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	296 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	328 plf
19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	309 plf
19/32" MIN. OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	347 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	437 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	461 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 4"/12" & 2 1/2" o.c. @ PERIMETER, DOUBLE FRAMING	Z =	694 plf

NOTE: SIMPSON CONNECTORS & FASTEN VALUES ASSUME SPF FRAMING MATERIAL
ANCHOR BOLT VALUES ASSUME DF/SP VALUES

DESIGN UPLIFT LOADS

ROOF & CEILING ASSEMBLY DEAD LOAD =	15 psf
WALL DEAD LOAD (WDL) =	12 psf
FLOOR DEAD LOAD (FDL) =	10 psf
ROOF SPAN (RS) =	21.83 ft
TRUSS SPACING (TOC)=	24 in
STUD SPACING (SOC) =	24 in
FIRST FLOOR HEIGHT (H_1) =	9 ft

UPLIFT CONNECTION LOAD:

PER TABLE 2.2A, 2001 WFCM AT 21.83' (wup')= 204 plf

wup = wup' * CMRH - 0.6 * RDL * RS / 4 =

wup = 204 plf * 1.196 - 0.6 * 15 psf * 21.83 ft / 4 = 194 plf

REQUIRED TRUSS TIE DOWN:

$P_{up} = w_{up}$ * TOC =

P_{up} = 194 plf * 24 in / 12 =

P_{up} = 389 lbs

USE A SIMPSON H2.5A EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

REQUIRED SIDEWALL STUD TIE DOWN LOADING:

1ST FLOOR STUD TO TOP PLATE / CEILING BAND: $P_{1tp} = w_{up}$ * SOC = 194 * 24 / 12 = 389 lbs

1st FLOOR STUD TO FLOOR BAND: $P_{1fb} = P_{1tp}$ - 0.6 * WDL * H_1 * SOC =
P_{1fb} = 389 lbs - 0.6 * 12 psf * 9 ft * 24 in / 12 = 260 lbs

CHECK FASTENERS: 8d NAIL Z = 76.7 lbs
389 lbs / 76.7 lbs / FASTENER = 5.07 FASTENERS
USE (6) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 49.9 lbs
389 lbs / 49.9 lbs / FASTENER = 7.79 FASTENERS
USE (8) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 26 ga. STRAP EACH STUD WITH (6) 8d NAIL(S) EACH END
OR WITH (8) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 389 lbs

SIDEWALL 1st FLOOR BAND TO SILL PLATE CONNECTION:

SIDEWALL UPLIFT AT SILL PLATE: $w_{sp} = P_{1fb}$ / SOC =
w_{sp} = 260 lbs * 12 / 24 in =
w_{sp} = 130 plf

CHECK STRAP AT ANCHOR BOLT LOCATIONS:

1/2" ANCHOR BOLT SPACING (BOC) = 72 in

P_{sp} = w_{sp} * BOC = 130 plf * 72 = 780 lb

CHECK FASTENERS: 8d NAIL Z = 127.2 lbs
780 lbs / 127.2 lbs / FASTENER = 6.13 FASTENERS
USE (7) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.6 lbs
780 lbs / 48.6 lbs / FASTENER = 16.05 FASTENERS
USE (17) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 22 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (17) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 780 lbs

CHECK BENDING IN RIMBAND:

DBL. 2x10 SPF #2 RIMBAND DESIGN VALUES:

SECTION MODULUS (S) = 42.78 in^3
ALLOWABLE BENDING (fb) = 875 psi

$M_{MAX} = \frac{w_{up} \cdot BOC^2}{8} =$

$M_{MAX} = \frac{130 \text{ plf} \cdot (72 / 12)^2}{8} =$ 7020 in-lbs

APPLIED fb = $\frac{M_{MAX}}{S} = \frac{7020 \text{ in-lbs}}{42.78 \text{ in}^3} =$ 164 psi

ALLOWABLE BENDING (fb) = 875 psi > APPLIED fb = 164 psi

DBL 2x10 SPF #2 RIMBAND IS OK

LATERAL LOAD AT ROOF/CEILING DIAPHRAGM

ROOF SPAN = 21.83 ft
ROOF PITCH = 9 /12

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM AT 21.83' (wl-per')= 121 plf
wl-per = wl-per' * CMRH * CWH =
wl-per = 121 plf * 1.196 * 1.125 = 164 plf

WIND PARALLEL TO RIDGE:

PER TABLE 2.5B, 2001 WFCM AT 21.83' (wl-para')= 75 plf
wl-para = wl-para' * CMRH * CWH =
wl-para = 75 plf * 1.196 * 1.125 = 102 plf

LATERAL LOAD AT FLOOR DIAPHRAGM

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM FLl-per' = 123 plf
FLl-per = FLl-per' * CMRH * CWH =
FLl-per = 123 plf * 1.196 * 1.125 = 166 plf

WIND PARALLEL TO RIDGE:

PER TABLE 2.5B, 2001 WFCM FLl-para' = 84 plf
FLl-para = FLl-para' * CMRH * CWH =
FLl-para = 84 plf * 1.196 * 1.125 = 114 plf

LATERAL FRAMING CONNECTION LOADS FROM WIND:

(FOR ROOF-TO-PLATE, PLATE-TO-PLATE, PLATE-TO-STUD, AND PLATE-TO-FLOOR)

PER TABLE 2.1, 2001 WFCM wl-wall' = 82 plf
wl-wall = Wl-wall' * CMRH =
wl-wall = 81.5 plf * 1.196 = 98 plf

TRUSS MULTIPLIER = 2
STUD MULTIPLIER = 2

TRUSS TO TOP PLATE CONNECTION:

$P_C = W_{l\text{-}wall} \cdot M_{24} =$ 98 plf * 2 = 195 lbs

TRUSS CONNECTION: SIMPSON H2.5A $F_2 =$ 110 lbs

$P_C = P - F_2 =$
$P_C =$ 195 lbs - 110 lbs =
$P_C =$ 85 lbs

OF 0.131" x 2.5" COMMON NAIL (TOENAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{85 \text{ lbs}}{83 \text{ lbs}}$ = 2 NAILS

USE (2) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS

IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z \cdot 12}{w_{l\text{-}wall}}$ = $\frac{100 \text{ lbs} \cdot 12}{98 \text{ plf}}$ = 12 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

PLATE TO STUD CONNECTION:

$P_C = w_{l\text{-}wall} \cdot M_{16}$ = 98 plf * 2 = 195 lbs

OF 0.162" x 3.5" COMMON NAIL (ENDNAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{195 \text{ lbs}}{128 \text{ lbs}}$ = 2 NAILS

USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z \cdot 12}{w_{l\text{-}wall}}$ = $\frac{100 \text{ lbs} \cdot 12}{98 \text{ plf}}$ = 12 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12" ON CENTER

TOP PLATE SPLICE LENGTH

STRUCTURE WIDTH (W) = 21.83 ft
STRUCTURE LENGTH (L) = 15.75 ft
0.162" x 3.5" COMMON NAIL (FACE NAILED) Z = 191 lbs
ROOF DIAPHRAGM LOADING ($w_{l\text{-}per}$) = 164 plf

DIAPHRAGM CHORD FORCE = $T = \frac{wl\text{-}per \cdot L^2}{8 \cdot W}$ = $\frac{164 \text{ plf} \cdot 15.75 \text{ ft}^2}{8 \cdot 21.83 \text{ ft}}$ = 233 lbs

REQUIRED SPLICE LENGTH (w/ (2) 16d 3" o.c.): $\frac{T \cdot 3" / 12" / ft}{2 \cdot Z}$ = $\frac{233 \text{ lbs} \cdot 3" / 12" / ft}{2 \cdot 191 \text{ lbs / NAIL}}$ = 1 ft

REQUIRED SPLICE LENGTH (w/ (2) 16d 12" o.c.): $\frac{T \cdot 12" / 12" / ft}{2 \cdot Z}$ = $\frac{233 \text{ lbs} \cdot 12" / 12" / ft}{2 \cdot 191 \text{ lbs / NAIL}}$ = 1 ft

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

ROOF DIAPHRAGM SHEATHING REQUIREMENTS

ROOF SPAN (RS) = 21.83 ft
ROOF LENGTH (RL) = 15.75 ft
ROOF PITCH = 9 /12
ROOF ANGLE (RA) = 36.9 °
$w_{l\text{-}per}$ = 164 plf
STANDARD ROOF SHEATHING = 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
ROOF SHEATHING SHEAR CAPACITY (v_r) = 296 plf
STANDARD CEILING SHEATHING = 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
CEILING SHEATHING SHEAR CAPACITY (v_c) = 70 plf

MAX DIAPHRAGM SHEAR (v) = $\frac{L \cdot wl_{per} / 2}{RS}$ = $\frac{15.75 \text{ ft} \cdot 164 \text{ plf} / 2}{21.83 \text{ ft}}$ = 60 plf

NET DIAPHRAGM SHEAR CAPACITY (v_n) = $v_r + v_c$ = 296 plf + 70 plf = 366 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 60 plf < **STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 366 plf**

STANDARD ROOF/CEILING DIAPHRAGM OK

FLOOR DIAPHRAGM SHEATHING REQUIREMENTS

BUILDING WIDTH (W) = 21.83 ft
BUILDING LENGTH (L) = 15.75 ft
FL_{4-psf} = 166 plf
STANDARD FLOOR SHEATHING = 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
FLOOR DIAPHRAGM SHEAR CAPACITY (v) = 309 plf

MAX FLOOR DIAPHRAGM SHEAR (v) = $\frac{L * 3/4 * FL_{psf} / 2}{W}$ = $\frac{15.75 \text{ ft} * 3/4 * 166 \text{ plf} / 2}{21.83 \text{ ft}}$ = 45 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 45 plf < STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 309 plf

STANDARD FLOOR DIAPHRAGM OK

SHEATHING SUCTION CONNECTION (PER 2001 WFCM, TABLE 2.4, pp. 69)

TRUSS SPACING (TOC) = 24 in O.C.
STUD SPACING (SOC) = 24 in O.C.
0.131" x 2.5" COMMON NAIL (FACE NAILED) 69 lbs (7/16" SIDE MEMBER; WITHDRAWAL)
Z = 3 ft
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) = 1.196

FOR ROOF ZONE 1 (FIELD):
p' = 15 psf
p = p' * CMRH
p = 15 psf * 1.196
p = 17.94 psf

TRUSS LOADING = 17.94 psf x 24" o.c. / 12" / ft = 36 plf

$\frac{36 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.6 FASTENERS / ft = 20 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.

FOR ROOF ZONE 2 (EDGE):
p' = 28.9 psf
p = p' * CMRH
p = 28.9 psf * 1.196
p = 34.57 psf

TRUSS LOADING = 34.57 psf x 24" o.c. / 12" / ft = 69 plf

$\frac{69 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 1.0 FASTENERS / ft = 12 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.

FOR ROOF ZONE 3 (CORNER):
p' = 37.8 psf
p = p' * CMRH
p = 37.8 psf * 1.196
p = 45.21 psf

TRUSS LOADING = 45.21 psf x 24" o.c. / 12" / ft = 90 plf

$\frac{90 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 1.4 FASTENERS / ft = 8 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.

FOR ROOF ZONE 3OH (CORNER OVERHANG):

p' = 47 psf
p = p' * CMRH
p = 47 psf * 1.196
p = 56.22 psf

TRUSS LOADING = 56.22 psf x 24" o.c. / 12" / ft = 112 plf

$\frac{112 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 1.7 FASTENERS / ft = 7 in O.C.

MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 7 in o.c.

FOR WALL ZONE 4 (FIELD):

p' = 16.2 psf
p = p' * CMRH
p = 16.2 psf * 1.196
p = 19.38 psf

STUD LOADING = 19.38 psf x 24" o.c. / 12" / ft = 39 plf

$\frac{39 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.6 FASTENERS / ft = 20 in O.C.

MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FOR WALL ZONE 5 (EDGE):

p' = 20.1 psf
p = p' * CMRH
p = 20.1 psf * 1.196
p = 24.04 psf

STUD LOADING = 24.04 psf x 24" o.c. / 12" / ft = 48 plf

$\frac{48 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.7 FASTENERS / ft = 17 in O.C.

MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FIRST FLOOR ENDWALL #1 SHEATHING LENGTH REQUIREMENTS ADJACENT TO MAIN HOUSE

FIRST FLOOR WIDTH (W_1) = 21.83 ft
FIRST FLOOR LENGTH (L_1) = 15.75 ft
SHEARWALL TYPE: THERMO-PLY (RED) SHEATHING EXTERIOR w/ 1/2" GWB INTERIOR
SHEATHING EDGE 6d COOLER NAIL SPACING = 3 in O.C. (6d COOLER NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 408 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 13.83 ft
1st FL. PERCENT FULL HEIGHT SHEATHING= 63 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT = 9 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.583 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{end1}) = L_1 * W_{1-per} / N_{end} + ADDITIONAL=
R_{end1} = 15.75 ft * 164 plf / 2 + 0 lbs = 1292 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 1292 lbs / 408 plf = 3.17 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{sw} / C_o = 3.17 ft / 0.583 = 5.44 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 5.44 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 13.83 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR ENDWALL #1: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 13.83 ft
SHEARWALL ADJUSTMENT FACTOR (C_P) = 0.583
SHEARWALL REACTION (R_{end2}) = 1292 lbs
WALL HEIGHT (H) = 9 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{end1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{1292 \text{ lbs} \times 9 \text{ ft}}{13.83 \text{ ft} \times 0.583} = 1443 \text{ lbs}$$

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL #2 SHEATHING LENGTH REQUIREMENTS
OPPOSITE MAIN HOUSE

FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	15.16 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	69 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.757 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end1}) = L_1 * W_{l-par} / N_{end} + ADDITIONAL=

R_{end1} = 15.75 ft * 164 plf / 2 + 0 lbs = 1292 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 1292 lbs / 384 plf = 3.36 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 3.36 ft / 0.757 = 4.45 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 4.45 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 15.16 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR ENDWALL #2: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	15.16 ft
SHEARWALL ADJUSTMENT FACTOR (C_P) =	0.757
SHEARWALL REACTION (R_{end2}) =	1292 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O}$ =

$U_{E1} = \dfrac{1292 \text{ lbs} \times 9 \text{ ft}}{15.16 \times 0.757}$ = 1014 lbs

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL: SHEAR CONNECTIONS

FIRST FLOOR WIDTH (W_1) =	21.83 ft	
FIRST FLOOR LENGTH (L_1) =	15.75 ft	
FL_{l-par} =	166 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR ENDWALL SHEAR LOAD = 1292 lbs

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION:

# TOENAILS PER FOOT =	V / Z / W = 1292 lbs / 158 lbs / 21.83 ft =		0.4 NAILS / ft	
TOENAIL SPACING =	12 / # = 12 / 0.4 =	16 " O.C.	(16" MAX)	
# LTP4 PLATES PER FOOT =	V / Z / W = 1292 lbs / 575 lbs / 21.83 ft =		0.1 PLATES / ft	
LTP4 PLATE SPACING =	12 / # = 12 / 0.1 =	72 " O.C.	(72" MAX)	

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 72" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 1292 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX ENDWALL SHEAR + L_1 x (3/4 * FL_{4-psr}) / 2 =
V = 1292 lbs + 15.75 ft x (3/4 * 166 plf) / 2 — 2272 lbs

# TOENAILS PER FOOT =	V / Z / W = 2272 lbs / 158 lbs / 21.83 ft =			0.7 NAILS / ft
TOENAIL SPACING =	12 / # =	12 / 0.7 =	16 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 2272 lbs / 575 lbs / 21.83 ft =			0.2 PLATES / ft
LTP4 PLATE SPACING =	12 / # =	12 / 0.2 =	66 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 16" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 66" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

SILL PLATE TO FOUNDATION CONNECTION:

# 1/2" ANCHOR BOLTS =	V / Z = 2272 lbs / 1056 lbs =		3 BOLTS
BOLT SPACING = (W - 2) / (N - 1) =		(21.83 ft - 2) / (3 - 1) =	72 in

USE 1/2" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

# 5/8" ANCHOR BOLTS =	V / Z = 2272 lbs / 1488 lbs =		2 BOLTS
BOLT SPACING = (W - 2) / (N - 1) =		(21.83 ft - 2) / (2 - 1) =	72 in

USE 5/8" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2273 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

$$\text{SHEAR FORCE (V)} = \frac{R_{endi}}{\Sigma L_i X C_o} =$$

FIRST FLOOR ENDWALL #1: $V = \frac{1292 \text{ lbs}}{13.83 * 0.583} =$ 161 plf

FIRST FLOOR ENDWALL #2: $V = \frac{1292 \text{ lbs}}{15.16 * 0.757} =$ 113 plf

MAXIMUM FIRST FLOOR ENDWALL UNIT SHEAR = 161 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER — Z = 95 lbs

$$\text{\# OF 8d NAILS PER FOOT} = \frac{V}{Z} = \frac{161 \text{ plf}}{95 \text{ lbs / NAIL}}$$

# OF 8d NAILS PER FOOT =	1.7 NAILS PER FOOT	
OVERALL 8d NAIL SPACING =	12 / # = 12 / 1.7 =	7.05 " O.C.
# OF ROWS :	1 ROW(S)	
8d NAIL SPACING WITHIN EACH ROW =	1 * SPACING 1 * 7.05 o.c.	6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER   Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{161\text{ plf}}{95\text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 1.7 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 1.7 = 7.05 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 7.05 o.c. 6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 161 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 161 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE   Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z}$ = $\frac{161\text{ plf}}{200\text{ psi} * 12" / \text{ft}}$ = 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

FIRST FLOOR SIDEWALL #1 SHEATHING LENGTH REQUIREMENTS
DEN

FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	9.42 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	60 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.8 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.665 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = $W_1 * W_{l-para} / N_{side}$ + ADDITIONAL =
R_{side1} = 21.83 ft * 102 plf / 2 + 0 lbs = 1114 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 1114 lbs / 384 = 2.90 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 2.9 ft / 0.665 =	4.37 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 4.37 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 9.42 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #1: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	9.42 ft
SHEARWALL ADJUSTMENT FACTOR (C_P) =	0.665
SHEARWALL REACTION (R_{side1}) =	1114 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\frac{R_{side1} \times H}{\Sigma L_i \times C_O}$ =

U_{E1} = $\frac{1114\text{ lbs} \times 9\text{ ft}}{9.42 \times 0.665}$ = 1601 lbs

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL #2 SHEATHING LENGTH REQUIREMENTS
BATH #1

FIRST FLOOR WIDTH (W_1) =	21.83 ft
FIRST FLOOR LENGTH (L_1) =	15.75 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	9.04 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	57 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.2 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.689 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = W_1 * W_{l-para} / N_{side} + ADDITIONAL=
R_{side1} = 21.83 ft * 102 plf / 2 + 0 lbs = 1114 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 1114 lbs / 384 plf = 2.90 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{sw} / C_O = 2.9 ft / 0.689 = 4.22 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 4.22 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 9.04 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #2: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	9.04 ft
SHEARWALL ADJUSTMENT FACTOR (C_p) =	0.689
SHEARWALL REACTION (R_{side1}) =	1114 lbs
WALL HEIGHT (H) =	9 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{1114 \text{ lbs} \times 9 \text{ ft}}{9.04 \times 0.689} = 1610 \text{ lbs}$$

SEE PAGE 14 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL: SHEAR CONNECTIONS

FIRST FLOOR WIDTH (W_1) =	21.83 ft	
FIRST FLOOR LENGTH (L_1) =	15.75 ft	
FL_{l-para} =	114 plf	
W_{l-para} =	102 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR SIDEWALL SHEAR LOAD = 1114 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX SIDEWALL SHEAR + W_1 x (3/4 * FL_{l-para}) / 2 =
V = 1114 lbs + 21.83 ft x (3/4 * 114 plf) / 2 = 2047 lbs

# TOENAILS PER FOOT =	V / Z / L_1 = 2047 lbs / 158 lbs / 15.75 ft =		0.8 NAILS / ft
TOENAIL SPACING =	12 / # = 12 / 0.8 =	14 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 2047 lbs / 575 lbs / 15.75 ft =		0.2 PLATES / ft
LTP4 PLATE SPACING =	12 / # = 12 / 0.2 =	53 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 14" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 53" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

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SILL PLATE TO FOUNDATION CONNECTION:

1/2" ANCHOR BOLTS = V / Z = 2047 lbs / 1056 lbs = 2 BOLTS

BOLT SPACING = (L - 2) / (N - 1) = (15.75 ft - 2) / (2 - 1) = 72 in

USE 1/2" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

5/8" ANCHOR BOLTS = V / Z = 2047 lbs / 1488 lbs = 2 BOLTS

BOLT SPACING = (L - 2) / (N - 1) = (15.75 ft - 2) / (2 - 1) = 72 in

USE 5/8" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 2048 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\frac{R_{end1}}{\Sigma L_i \times C_O}$ =

FIRST FLOOR SIDEWALL #1: V = $\frac{1114 \text{ lbs}}{9.42 \times 0.665}$ = 178 plf

FIRST FLOOR SIDEWALL #2: V = $\frac{1114 \text{ lbs}}{9.04 \times 0.689}$ = 179 plf

MAXIMUM FIRST FLOOR SIDEWALL UNIT SHEAR = 179 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{179 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 1.89 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 1.89 = 6.34 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 " SPACING 1 " 6.34 o.c. 6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{179 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 1.89 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 1.89 = 6.34 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 " SPACING 1 " 6.34 o.c. 6 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 6" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 179 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 179 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z}$ = $\frac{179 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}}$ = 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

COMBINED CORNER HOLDDOWN REQUIREMENTS

UPLIFT FORCES: (SEE ABOVE FOR CALCULATIONS)

1st FLOOR ENDWALL #1 UPLIFT FORCE (U_{E1}) = 1443 lbs
1st FLOOR ENDWALL #2 UPLIFT FORCE (U_{E1}) = 1014 lbs
1st FLOOR SIDEWALL #1 UPLIFT FORCE (U_{S1}) = 1601 lbs
1st FLOOR SIDEWALL #2 UPLIFT FORCE (U_{S1}) = 1610 lbs

DEAD LOADS:

FIRST FLOOR WIDTH (W_1) = 21.83 ft (MAX: 4 * CEILING HEIGHT)
FIRST FLOOR LENGTH (L_1) = 15.75 ft (MAX: 4 * CEILING HEIGHT)
FIRST FLOOR HEIGHT (H_1) = 9 ft
ROOF & CEILING ASSEMBLY DEAD LOAD (RDL) = 15 psf
WALL DEAD LOAD (WDL) = 12 psf
FLOOR DEAD LOAD (FDL) = 10 psf

SIDEWALL FIRST FLOOR CORNER:

ROOF DEAD LOAD = $0.6 * RDL * W_1 * L_1 / 8$ =
ROOF DEAD LOAD = 0.6 * 15 psf * 21.83 ft * 15.75 ft / 8 = 387 lbs
WALL DEAD LOAD = $0.6 * (WDL * H_1 * L_1 / 2)$ =
WALL DEAD LOAD = 0.6 * 12 psf * 9 ft * 15.75 ft / 2 = 510 lbs
1st FLOOR DEAD LOAD = $0.6 * FDL * W_1 * L_1 / 8$ =
1st FLOOR DEAD LOAD = 0.6 * 10 psf * 21.83 ft * 15.75 ft / 8 = 258 lbs
TOTAL DEAD LOAD = 510 lbs + 387 lbs + 258 lbs = 1155 lbs

CORNER STUD CONNECTION LOAD = MAX WALL UPLIFT - SELF WEIGHT
1610 lbs - 1155 lbs = 455 lbs

ENDWALL FIRST FLOOR CORNER:

WALL DEAD LOAD = $0.6 * (WDL * H_1 * W_1 / 2)$ =
WALL DEAD LOAD = 0.6 * 12 psf * 9 ft * 21.83 ft / 2 = 708 lbs
GABLE WALL DEAD LOAD = 0.6 * (WDL * (H / 2) * W / 2) =
GABLE WALL DEAD LOAD = 0.6 * 12 psf * ((9 / 12) * (21.83 ft / 2) / 2) * (21.83 ft) / 2 = 322 lbs
TOTAL DEAD LOAD = 708 lbs + 322 lbs = 1030 lbs

CORNER STUD CONNECTION LOAD = MAX WALL UPLIFT - SELF WEIGHT
1443 lbs - 1030 lbs = 413 lbs

FIRST FLOOR HOLDDOWNS

UPLIFT FORCE = 1610 lbs (MAX. OF FIRST FLOOR UPLIFT FORCES)

FIRST FLOOR DEAD LOAD (DL_1) = 1155 lbs + 1030 lbs = 2185 lbs

HOLDDOWN FORCE = 1610 lbs - 2185 lbs = 0 lbs

NO PHYSICAL HOLDDOWN REQUIRED

FIRST FLOOR CORNER STUD CONNECTION

0.162" x 3.5" COMMON NAIL (FACE NAILED) Z = 191 lbs

MAX CORNER STUD CONNECTION LOAD = 455 lbs

NAIL SPACING (2 ROWS) = $\frac{2 * H * Z}{U}$ = $\frac{2 * 9 \text{ ft} * 191 \text{ lbs}}{455 \text{ lbs}}$ = 16 in O.C. (16" MAX)

OF 1/4" DIA. LAG SCREW REQUIRED = $\frac{U}{Z}$ = $\frac{455 \text{ lbs}}{224 \text{ lbs}}$ = 6 LAG SCREWS (6 MIN)

FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS

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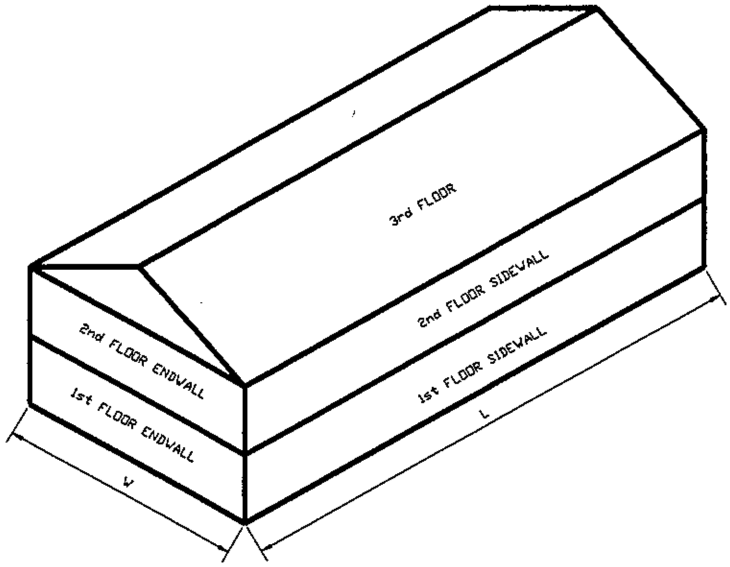
Section 2
HIGH WIND CALCULATIONS
MAIN HOUSE

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12



BUILDING INFORMATION:

JOB NUMBER =		110376	
PLAN NAME / NUMBER =	C-484709-2		
FIRST FLOOR WIDTH (W_1) =		48.08 ft	
SECOND FLOOR WIDTH (W_2) =		48.08 ft	
FIRST FLOOR LENGTH (L_1) =		42.67 ft	
SECOND FLOOR LENGTH (L_2) =		42.67 ft	
ROOF SPAN =		29.17 ft	
TRUSS SPACING (TOC)=		24 in	
STUD SPACING (SOC) =		24 in	
WIND SPEED (V3S) =		90 mph	
EXPOSURE FACTOR =		C	
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) =		1.330	
WALL HEIGHT ADJUSTMENT FACTOR FOR FLOORS (CWH) =	H / 8 =		1.125
WALL HEIGHT ADJUSTMENT FACTOR FOR ROOF (CWH) =	H / 8 =		1.063

SHEARWALL SUMMARY:

FIRST FLOOR ENDWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
LIBRARY / LIVING WITH 8d COMMON NAILS SPACED AT 3" EDGE

FIRST FLOOR ENDWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR, DOUBLE STUDS
FAMILY / DINING WITH 8d COMMON NAILS SPACED AT 2" EDGE

FIRST FLOOR SIDEWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SUN ROOM / FAMILY WITH 8d COMMON NAILS SPACED AT 4" EDGE

FIRST FLOOR SIDEWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
LIVING / DINING WITH 8d COMMON NAILS SPACED AT 4" EDGE

SECOND FLOOR ENDWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #3 & #4 WITH 8d COMMON NAILS SPACED AT 6" EDGE

SECOND FLOOR ENDWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #1 & #2 WITH 8d COMMON NAILS SPACED AT 6" EDGE

SECOND FLOOR SIDEWALL #1: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #1 & #4 WITH 8d COMMON NAILS SPACED AT 6" EDGE

SECOND FLOOR SIDEWALL #2: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
BEDROOMS #2 & #3 WITH 8d COMMON NAILS SPACED AT 6" EDGE

PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

ROOF SHEATHING: 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

CEILING SHEATHING: 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
FLOOR SHEATHING: 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"

SHEATHING SUCTION FASTENING:
FOR ROOF ZONE 1: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.
FOR ROOF ZONE 2: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 10 in o.c.
FOR ROOF ZONE 3 (CORNER): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.
FOR ROOF ZONE 3OH (CORNER OVERHANG): USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
FOR WALL ZONE 4: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
FOR WALL ZONE 5: USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.
EDGE DIMENSION, Z = 5 ft

CONNECTION SUMMARY: **CONNECTIONS TO BE AS SPECIFIED OR EQUIVALENT**

UPLIFT CONNECTIONS

REQUIRED TRUSS TIE DOWN: USE A SIMPSON H10 EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

2nd FLOOR STUD TO TOP PLATE / CEILING BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

2nd FLOOR STUD TO FLOOR BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 429 lbs

2nd FLOOR BAND TO 1st CEILING BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 429 lbs

1st FLOOR STUD TO CEILING BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 342 lbs

1st FLOOR STUD TO FLOOR BAND: USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 213 lbs

FLOOR BAND TO SILL PLATE CONNECTION: USE A 1.5" x 26 ga. STRAP WITH (3) 8d NAIL(S) EACH END
OR WITH (4) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 158 lbs

LATERAL CONNECTIONS

TRUSS TO TOP PLATE CONNECTION: USE (0) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS
IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

PLATE TO STUD CONNECTION: USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION: ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

TOP PLATE SPLICES

TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 3 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c

HORIZONTAL FLOOR DIAPHRAGM CONTINUITY

SECOND FLOOR
MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)
USE A MIN. OF (5) 1/2" DIA.THRU BOLTS

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)
USE A 1.5" x 20 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (18) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 854 lbs

FIRST FLOOR
MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)
USE A MIN. OF (5) 1/2" DIA.THRU BOLTS

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)
USE A 1.5" x 22 ga. STRAP WITH (6) 8d NAIL(S) EACH END
OR WITH (14) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 640 lbs

SHEAR CONNECTIONS

SECOND FLOOR ENDWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
(AND SHEATHING TO TRUSS BOTTOM CHORD) OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 46" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 4353 lbs

RIMBANDS TO BOTTOM / BEARING / TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) AT 6" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

BEARING PLATE TO CEILING BAND CONNECTION: USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 8" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

SECOND FLOOR SIDEWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBANDS TO BOTTOM, BEARING & TOP PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 10" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

BEARING PLATE TO CEILING BAND CONNECTION: USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

FIRST FLOOR ENDWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 4" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 16" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 29" O.C
OR USE 5/8" ANCHOR BOLTS @ 41" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

FIRST FLOOR SIDEWALL

UNIT SHEAR SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf

UNIT UPLIFT SHEATHING TO FLOOR BAND: USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf
ALTERNATE: FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

RIMBAND TO SILL PLATE CONNECTION: USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 7" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 28" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

SILL PLATE TO FOUNDATION CONNECTION: USE 1/2" ANCHOR BOLTS @ 54" O.C
OR USE 5/8" ANCHOR BOLTS @ 72" O.C
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

HOLDDOWN CONNECTIONS

NOTE: OVERTURNING UPLIFT HOLDDOWNS HAVE BEEN INDIVIDUALLY CALCULATED FOR SOME STRUCTURE CORNERS
SEE PAGE 3 OF THE HAND CALCS FOR THESE VALUES & CONNECTIONS, WHICH TAKE PRECEDENCE OVER THOSE LISTED BELOW

SECOND FLOOR CORNER HOLDDOWN: NO PHYSICAL HOLDDOWN REQUIRED

SECOND FLOOR CORNER STUD CONNECTION: FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS

FIRST FLOOR CORNER HOLDDOWN: USE A SIMPSON STHD10RJ AT EACH BUILDING CORNER OR EQUAL
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 2723 lbs

FIRST FLOOR CORNER STUD CONNECTION: FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 7" ON CENTER
OR USE (26) 1/4" DIA. LAG SCREWS

APPLICABILITY LIMITATIONS:

MEAN ROOF HEIGHT (MRH) =	26.97 ft
NUMBER OF STORIES =	2
FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
BUILDING ASPECT RATIO (L/W) =	0.89
FLOOR JOIST DEPTH =	9.25 in
MAX. VERTICAL FLOOR OFFSET =	0 in
FLOOR ASPECT RATIO (L/W) =	0.89
MAX. FLOOR DIAPHRAGM OPENING WIDTH =	11.25 ft
MAX. FLOOR DIAPHRAGM OPENING LENGTH =	4 ft
FIRST FLOOR HEIGHT (H_1) =	9 ft
SECOND FLOOR HEIGHT (H_2) =	8.5 ft
CEILING ASPECT RATIO (L/W) =	0.89
MIN. SHEARWALL SEGMENT (H / 3.5) =	2.43 ft
ROOF PITCH =	9 /12

DESIGN MEETS LIMITATIONS OF THE WFCM METHODOLOGY

CONNECTION INFORMATION:

TRUSS TO PLATE CONNECTORS

UPLIFT STRENGTH:			SHEAR STRENGTH:	
SIMPSON H2.5	U =	365 lbs	F_2 =	130 lbs
SIMPSON H2.5A	U =	480 lbs	F_2 =	110 lbs
SIMPSON H10	U =	850 lbs	F_2 =	235 lbs
(5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)			U =	834 lbs
			F_2 =	486 lbs
		200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	100 psi (END-GRAIN)
		200 psi MINIMUM CONSTRUCTION ADHESIVE	Z =	200 psi (FACE)

FLAT STRAPS			FASTENERS: 8d NAIL		16 ga. STAPLE
1.5" x 26 ga. STRAP	Z =	485 lbs	Z =	76.7	49.9 lbs
1.5" x 22 ga. STRAP	Z =	810 lbs	Z =	127.2	48.6 lbs
1.5" x 20 ga. STRAP	Z =	973 lbs	Z =	127.3	48.3 lbs
(2) 1.5" x 22 ga. STRAP	Z =	1620 lbs	Z =	129.4	46.4 lbs
(2) 1.5" x 20 ga. STRAP	Z =	1946 lbs	Z =	131.4	46 lbs

HOLDDOWNS w/ 1 1/2" EDGE DISTANCE
MINIMUM 8" STEM WALL
ASSUME 3000 psi Fc CONCRETE

SIMPSON LSTHD8RJ	Z =	1950 lbs
SIMPSON STHD10RJ	Z =	3230 lbs
SIMPSON STHD14RJ	Z =	4430 lbs
(2) SIMPSON STHD14RJ	Z =	8860 lbs
1/2" DIA. THRU BOLT	Z =	623 lbs
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
1/4" DIA. LAG SCREW	Z =	224 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	100 lbs
0.131" x 2.5" COMMON NAIL (TOENAILED)	Z =	83 lbs
0.131" x 2.5" COMMON NAIL (ENDNAILED)	Z =	67 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs

0.162" x 3.5" COMMON NAIL (ENDNAILED)	Z =	128 lbs
8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER	Z =	95 lbs
0.131" x 2.5" COMMON NAIL (FACE NAILED)	Z =	69 lbs (WITHDRAWAL)
(1) SIMPSON LTP4 PLATE	Z =	575 plf
1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"	Z =	70 plf
7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	296 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	328 plf
19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	309 plf
19/32" MIN. OSB (BLOCKED) w/ 8d NAILING @ 6"/12"	Z =	347 plf
7/16" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	437 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 6"/12" & 4" o.c. @ PERIMETER	Z =	461 plf
19/32" OSB (BLOCKED) w/ 8d NAILING @ 4"/12" & 2 1/2" o.c. @ PERIMETER, DOUBLE FRAMING	Z =	694 plf

NOTE: SIMPSON CONNECTORS & FASTEN VALUES ASSUME SPF FRAMING MATERIAL
ANCHOR BOLT VALUES ASSUME DF/SP VALUES

DESIGN UPLIFT LOADS

ROOF & CEILING ASSEMBLY DEAD LOAD =	15 psf
WALL DEAD LOAD (WDL) =	12 psf
FLOOR DEAD LOAD (FDL) =	10 psf
ROOF SPAN (RS)=	29.17 ft
TRUSS SPACING (TOC)=	24 in
STUD SPACING (SOC) =	24 in
FIRST FLOOR HEIGHT (H_1) =	9 ft
SECOND FLOOR HEIGHT (H_2) =	8.5 ft

UPLIFT CONNECTION LOAD:

PER TABLE 2.2A, 2001 WFCM AT 24' (wup')= 256 plf

wup = wup' * CMRH - 0.6 * RDL * RS / 4 =

wup = 256 plf * 1.33 - 0.6 * 15 psf * 29.17 ft / 4 = $\boxed{275}$ plf

REQUIRED TRUSS TIE DOWN:

$P_{up} = w_{up} * TOC =$

$P_{up} = 275$ plf * 24 in / 12 =

$P_{up} =$ 551 lbs

USE A SIMPSON H10 EACH TRUSS
OR USE (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE)
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

REQUIRED SIDEWALL STUD TIE DOWN LOADING:

2nd FLOOR STUD TO TOP PLATE / CEILING BAND: $P_{2tp} = w_{up} * SOC =$ 275 * 24 / 12 = 551 lbs

2nd FLOOR STUD TO FLOOR BAND: $P_{2fb} = P_{2tp} - 0.6 * WDL * H_2 * SOC =$
$P_{2fb} =$ 551 lbs - 0.6 * 12 psf * 8.5 ft * 24 in / 12 = 429 lbs

2nd FLOOR BAND TO 1st CEILING BAND: $P_{2f1c} =$ $P_{2fb} =$ 429 lbs

1st FLOOR STUD TO CEILING BAND: $P_{1cb} = P_{2fb} - 0.6 * FDL * W_2 / 4 * SOC =$
$P_{1cb} =$ 429 lbs - 0.6 * 10 psf * 48.08 ft / 4 * 24 in / 12 =
$P_{1cb} =$ 342 lbs

1st FLOOR STUD TO FLOOR BAND: $P_{1fb} = P_{1cb} - 0.6 * WDL * H_1 * SOC =$
$P_{1fb} =$ 342 lbs - 0.6 * 12 psf * 9 ft * 24 in / 12 = 213 lbs

CHECK FASTENERS: 8d NAIL Z = 127.2 lbs
551 lbs / 127.2 lbs / FASTENER = 4.33 FASTENERS
USE (5) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.6 lbs
551 lbs / 48.6 lbs / FASTENER = 11.34 FASTENERS
USE (12) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 22 ga. STRAP EACH STUD WITH (5) 8d NAIL(S) EACH END
OR WITH (12) 16 ga. STAPLE(S) EACH END
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 551 lbs

SIDEWALL 1st FLOOR BAND TO SILL PLATE CONNECTION:

SIDEWALL UPLIFT AT SILL PLATE: $w_{sp} = P_{1fb}$ / SOC - 0.6 * FDL * W_f / 4 =
w_{sp} = 213 lbs * 12 / 24 in - 0.6 * 10 psf * 48.08 ft / 4 =
w_{sp} = 35 plf

CHECK STRAP AT ANCHOR BOLT LOCATIONS:

1/2" ANCHOR BOLT SPACING (BOC) = 54 in

P_{sp} = w_{sp} * BOC = 35 plf * 54 = 158 lbs

CHECK FASTENERS: 8d NAIL Z = 76.7 lbs
158 lbs / 76.7 lbs / FASTENER = 2.05 FASTENERS
USE (3) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 49.9 lbs
158 lbs / 49.9 lbs / FASTENER = 3.16 FASTENERS
USE (4) 16 ga. STAPLE(S) EACH END

**USE A 1.5" x 26 ga. STRAP WITH (3) 8d NAIL(S) EACH END
OR WITH (4) 16 ga. STAPLE(S) EACH END
WRAPPED AROUND THE SILL PLATE AT EACH ANCHOR BOLT LOCATION
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 158 lbs**

CHECK BENDING IN RIMBAND:

DBL. 2x10 SPF #2 RIMBAND DESIGN VALUES:

SECTION MODULUS (S) = 42.78 in^3
ALLOWABLE BENDING (fb) = 875 psi

$M_{MAX} = \frac{w_{sp} \cdot BOC^2}{8}$ =

$M_{MAX} = \frac{35 \text{ plf} \cdot (54/12)^2}{8}$ = 1063 in-lbs

APPLIED fb = $\frac{M_{MAX}}{S}$ = $\frac{1063 \text{ in-lbs}}{42.78 \text{ in}^3}$ = 25 psi

ALLOWABLE BENDING (fb) = 875 psi > APPLIED fb = 25 psi

DBL. 2x10 SPF #2 RIMBAND IS OK

LATERAL LOAD AT ROOF/CEILING DIAPHRAGM

ROOF SPAN = 29.17 ft
ROOF PITCH = 9 /12

WIND PERPENDICULAR TO RIDGE:

'ER TABLE 2.5A, 2001 WFCM AT 29.17' (wl-per')= 144 plf
wl-per = wl-per' * CMRH * CWH =
wl-per = 144 plf * 1.33 * 1.063 = $\boxed{204}$ plf

WIND PARALLEL TO RIDGE:

PERP-TO-RIDGE LOADING USED FOR BOTH ORTHOGONAL DIRECTIONS: $\boxed{204}$ plf

LATERAL LOAD AT FLOOR DIAPHRAGM

WIND PERPENDICULAR TO RIDGE:

PER TABLE 2.5A, 2001 WFCM FLl-per' = 123 plf
FLl-per = FLl-per' * CMRH * CWH =
FLl-per = 123 plf * 1.33 * 1.125 = $\boxed{185}$ plf

WIND PARALLEL TO RIDGE:

PER TABLE 2.5B, 2001 WFCM FLl-para' = 84 plf
FLl-para = FLl-para' * CMRH * CWH =
FLl-para = 84 plf * 1.33 * 1.125 = $\boxed{126}$ plf

LATERAL FRAMING CONNECTION LOADS FROM WIND:
(FOR ROOF-TO-PLATE, PLATE-TO-PLATE, PLATE-TO-STUD, AND PLATE-TO-FLOOR)

PER TABLE 2.1, 2001 WFCM wl-wall' = 82 plf
wl-wall = Wl-wall' * CMRH =
wl-wall = 82 plf * 1.33 = $\boxed{108}$ plf

TRUSS MULTIPLIER = 2
STUD MULTIPLIER = 2

TRUSS TO TOP PLATE CONNECTION:

$P_C = w_{l\text{-wall}} * M_{24}$ = 108 plf * 2 = 217 lbs

TRUSS CONNECTION: SIMPSON H10 F_2 = 235 lbs

$P_C = P - F_2$ =
P_C = 217 lbs - 235 lbs =
P_C = -18 lbs

OF 0.131" x 2.5" COMMON NAIL (TOENAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{-18 \text{ lbs}}{83 \text{ lbs}}$ = 0 NAILS

USE (0) 0.131" x 2.5" COMMON NAIL (TOENAILED) PER TRUSS

IF (5) 0.131" x 3.25" ENDNAILS (TRUSS TO BAND) & (3) #8 x 4.5" TOE-SCREWS (TRUSS TO PLATE) TRUSS CONNECTION IS USED, ABOVE CONNECTION MAY BE OMITTED

PLATE TO PLATE CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z * 12}{w_{l\text{-wall}}}$ = $\frac{100 \text{ lbs} * 12}{108 \text{ plf}}$ = 11 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

PLATE TO STUD CONNECTION:

$P_C = w_{l\text{-wall}} * M_{16}$ = 108 plf * 2 = 217 lbs

OF 0.162" x 3.5" COMMON NAIL (ENDNAILED) REQUIRED = $\frac{P_C}{Z}$ = $\frac{217 \text{ lbs}}{128 \text{ lbs}}$ = 2 NAILS

USE (2) 0.162" x 3.5" COMMON NAIL (ENDNAILED) PER STUD

BOTTOM PLATE TO FLOOR CONNECTION:

SPACING OF 0.131" x 2.5" COMMON NAIL (FACE NAILED) = $\frac{Z * 12}{w_{l\text{-wall}}}$ = $\frac{100 \text{ lbs} * 12}{108 \text{ plf}}$ = 11 in O.C. (16" max)

ATTACH WITH 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 11" ON CENTER

TOP PLATE SPLICE LENGTH

STRUCTURE WIDTH (W) = 48.08 ft
STRUCTURE LENGTH (L) = 42.67 ft
0.162" x 3.5" COMMON NAIL (FACE NAILED) Z = 191 lbs
ROOF DIAPHRAGM LOADING (wl-per) = 204 plf
FLOOR DIAPHRAGM LOADING (FLl-per) = 185 plf

ROOF DIAPHRAGM LOADING CONTROLS
CONTROLLING LOADING: 204 plf

DIAPHRAGM CHORD FORCE = $T = \frac{wl\text{-}per * L^2}{8 * W}$ = $\frac{204 \text{ plf} * 42.67 \text{ ft}^{\wedge}2}{8 * 48.08 \text{ ft}}$ = 966 lbs

REQUIRED SPLICE LENGTH (w/ (2) 16d 3" o.c.): $\frac{T * 3" / 12" / ft}{2 * Z}$ = $\frac{966 \text{ lbs} * 3" / 12" / ft}{2 * 191 \text{ lbs / NAIL}}$ = 1 ft

REQUIRED SPLICE LENGTH (w/ (2) 16d 12" o.c.): $\frac{T * 12" / 12" / ft}{2 * Z}$ = $\frac{966 \text{ lbs} * 12" / 12" / ft}{2 * 191 \text{ lbs / NAIL}}$ = 3 ft

**TOP PLATE SPLICES SHALL BE A MINIMUM OF 1 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 3" o.c
OR A MINIMUM OF 3 ft w/ (2) ROWS 16d (0.162" x 3.5" COMMON NAIL (FACE NAILED)) 12" o.c**

ROOF DIAPHRAGM SHEATHING REQUIREMENTS

ROOF SPAN (RS) = 29.17 ft
ROOF LENGTH (RL) = 42.67 ft
ROOF PITCH = 9 /12
ROOF ANGLE (RA) = 36.9 °
$w_{l\text{-}per}$ = 204 plf
STANDARD ROOF SHEATHING = 7/16" OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
ROOF SHEATHING SHEAR CAPACITY (v_r') = 296 plf
STANDARD CEILING SHEATHING = 1/2" GWB (UN-BLOCKED) w/ FASTENERS @ 7"/7"
CEILING SHEATHING SHEAR CAPACITY (v_c) = 70 plf

MAX DIAPHRAGM SHEAR (v) = $\frac{L * wl_{per} / 2}{RS}$ = $\frac{42.67 \text{ ft} * 204 \text{ plf} / 2}{29.17 \text{ ft}}$ = 150 plf

NET DIAPHRAGM SHEAR CAPACITY (v_n) = $v_r + v_c$ = 296 plf + 70 plf = 366 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 150 plf < **STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 366 plf**

STANDARD ROOF/CEILING DIAPHRAGM OK

FLOOR DIAPHRAGM SHEATHING REQUIREMENTS

BUILDING WIDTH (W) = 48.08 ft
BUILDING LENGTH (L) = 42.67 ft
$FL_{l\text{-}per}$ = 185 plf
STANDARD FLOOR SHEATHING = 19/32" MIN. OSB (UN-BLOCKED) w/ 8d NAILING @ 6"/12"
FLOOR DIAPHRAGM SHEAR CAPACITY (v_f) = 309 plf

MAX FLOOR DIAPHRAGM SHEAR (v) = $\frac{L * FLl_{per} / 2}{W}$ = $\frac{42.67 \text{ ft} * 185 \text{ plf} / 2}{48.08 \text{ ft}}$ = 83 plf

DIAPHRAGM SHEAR CAPACITY REQUIRED = 83 plf < **STANDARD ROOF/CEILING DIAPHRAGM CAPACITY = 309 plf**

STANDARD FLOOR DIAPHRAGM OK

SHEATHING SUCTION CONNECTION (PER 2001 WFCM, TABLE 2.4, pp. 69)

TRUSS SPACING (TOC) = 24 in O.C.
STUD SPACING (SOC) = 24 in O.C.
0.131" x 2.5" COMMON NAIL (FACE NAILED) 69 lbs (7/16" SIDE MEMBER; WITHDRAWAL)
Z = 5 ft
MEAN ROOF HEIGHT ADJUSTMENT FACTOR (CMRH) = 1.330

FOR ROOF ZONE 1 (FIELD):
p' = 15 psf
p = p' * CMRH
p = 15 psf * 1.33
p = 19.95 psf

TRUSS LOADING = 19.95 psf x 24" o.c. / 12" / ft = 40 plf

$\frac{40 \text{ plf}}{69 \text{ lbs / FASTENER}}$ = 0.6 FASTENERS / ft = 20 in O.C.
MAX ALLOWABLE SPACING: $\boxed{12}$ in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 12 in o.c.

PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

FOR ROOF ZONE 2 (EDGE):

p' = 28.9 psf
p = p' * CMRH
p = 28.9 psf * 1.33
p = 38.44 psf

TRUSS LOADING = 38.44 psf x 24" o.c. / 12" / ft = 77 plf

77 plf / 69 lbs / FASTENER = 1.2 FASTENERS / ft = 10 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 10 in o.c.

FOR ROOF ZONE 3 (CORNER):

p' = 37.8 psf
p = p' * CMRH
p = 37.8 psf * 1.33
p = 50.28 psf

TRUSS LOADING = 50.28 psf x 24" o.c. / 12" / ft = 101 plf

101 plf / 69 lbs / FASTENER = 1.5 FASTENERS / ft = 8 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 8 in o.c.

FOR ROOF ZONE 3OH (CORNER OVERHANG):

p' = 47 psf
p = p' * CMRH
p = 47 psf * 1.33
p = 62.51 psf

TRUSS LOADING = 62.51 psf x 24" o.c. / 12" / ft = 125 plf

125 plf / 69 lbs / FASTENER = 1.9 FASTENERS / ft = 6 in O.C.
MAX ALLOWABLE SPACING: 12 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FOR WALL ZONE 4 (FIELD):

p' = 16.2 psf
p = p' * CMRH
p = 16.2 psf * 1.33
p = 21.55 psf

STUD LOADING = 21.55 psf x 24" o.c. / 12" / ft = 43 plf

43 plf / 69 lbs / FASTENER = 0.7 FASTENERS / ft = 17 in O.C.
MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

FOR WALL ZONE 5 (EDGE):

p' = 20.1 psf
p = p' * CMRH
p = 20.1 psf * 1.33
p = 26.74 psf

STUD LOADING = 26.74 psf x 24" o.c. / 12" / ft = 53 plf

53 plf / 69 lbs / FASTENER = 0.8 FASTENERS / ft = 15 in O.C.
MAX ALLOWABLE SPACING: 6 in O.C.

USE 0.131" x 2.5" COMMON NAIL (FACE NAILED) AT 6 in o.c.

SECOND FLOOR ENDWALL #1 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #3 & #4

FIRST FLOOR LENGTH (W_1) = 48.08 ft
SECOND FLOOR LENGTH (W_2) = 48.08 ft
FIRST FLOOR LENGTH (L_1) = 42.67 ft
SECOND FLOOR LENGTH (L_2) = 42.67 ft
SHEARWALL TYPE: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING = 6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 384 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.4 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 19.17 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING= 66 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT = 6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.715 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{end}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{end2}) = L_2 * $w_{l\text{-}per}$ / N_{end} + ADDITIONAL=
R_{end2} = 42.67 ft * 204 plf / 2 + 0 lbs = 4353 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end2} / V = 4353 lbs / 384 plf = 11.34 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 11.34 ft / 0.715 = 15.86 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 15.86 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 19.17 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR HORIZONTAL FLOOR DIAPHRAGM CONTINUITY:

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)
(DEEP BEAM HORIZONTAL SHEAR)

$V_f = \dfrac{(3 * F_{L\text{-}per} / 4) * L}{2}$ = $\dfrac{3/4 * 185 \text{ plf} * 42.67 \text{ ft}}{2}$ = 2961 lbs

1/2" DIA. THRU BOLT = $\dfrac{V_f}{Z_{1/2\,BOLT}}$ = $\dfrac{2961 \text{ lbs}}{623 \text{ lbs}}$ = 5 BOLTS

USE A MIN. OF (5) 1/2" DIA.THRU BOLTS
TO ATTACH MODULE TO MODULE ALONG MATE LINE

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)
(CHORD FORCE CONTINUITY)

$T = \dfrac{F_{L\text{-}pack} * W_2^2}{8 * L_2}$ = $\dfrac{126 \text{ plf} * 48.08 \text{ ft} \wedge 2}{8 * 42.67 \text{ ft}}$ = 854 lbs

CHECK FASTENERS:

8d NAIL Z = 127.3 lbs
854 lbs / 127.3 lbs / FASTENER = 6.71 FASTENERS
USE (7) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.3 lbs
854 lbs / 48.3 lbs / FASTENER = 17.68 FASTENERS
USE (18) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 20 ga. STRAP WITH (7) 8d NAIL(S) EACH END
OR WITH (18) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 854 lbs

SECOND FLOOR ENDWALL #1: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.715
SHEARWALL REACTION (R_{end2}) =	4353 lbs
WALL HEIGHT (H) =	8.5 ft

UPLIFT FORCE (U_{E2}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O}$ =

$U_{E2} = \dfrac{4353 \text{ lbs} \times 8.5 \text{ ft}}{19.17 \text{ ft} \times 0.715}$ = 2700 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR ENDWALL #2 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #1 & #2

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	384 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.4 ft
FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	32.76 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING=	68 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.729 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end2}) = L_2 * $w_{l\text{-}per}$ / N_{end} + ADDITIONAL=
R_{end2} = 42.67 ft * 204 plf / 2 + 0 lbs = 4353 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end2} / V = 4353 lbs / 384 lbs = 11.34 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 11.34 ft / 0.729 = 15.55 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 15.55 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 32.76 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR ENDWALL #2: UPLIFT DUE TO OVERTURNING

FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	32.76 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.729
SHEARWALL REACTION (R_{end2}) =	4353 lbs
WALL HEIGHT (H) =	8.5 ft

UPLIFT FORCE (U_{E2}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O}$ =

$U_{E2} = \dfrac{4353 \text{ lbs} \times 8.5 \text{ ft}}{32.76 \text{ ft} \times 0.729}$ = 1550 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR ENDWALL: SHEAR CONNECTIONS

EFFECTIVE SECOND FLOOR WIDTH (W_2) =	29.17 ft	
SECOND FLOOR LENGTH (L_2) =	42.67 ft	
$FL_{l\text{-}per}$ =	185 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM SECOND FLOOR ENDWALL SHEAR LOAD = 4353 lbs

TRUSS BOTTOM CHORD TO TOP PLATE CONNECTION:

# TOENAILS PER FOOT =	V / Z / W = 4353 lbs / 158 lbs / 29.17 ft =			0.9 NAILS / ft
TOENAIL SPACING =	12 / # =	12 / 0.9 =	12 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 4353 lbs / 575 lbs / 29.17 ft =			0.3 PLATES / ft
LTP4 PLATE SPACING =	12 / # =	12 / 0.3 =	46 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 46" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 4353 lbs

RIMBANDS TO BOTTOM / BEARING / TOP PLATE CONNECTION:

V = MAX ENDWALL SHEAR + L_2 x FL_{i-per} / 2 =
V = 4353 lbs + 42.67 ft x 185 plf / 2 — 8300 lbs

# TOENAILS PER FOOT =	V / Z / W = 8300 lbs / 158 lbs / 29.17 ft =			1.8 NAILS / ft
TOENAIL SPACING =	12 / # =	12 / 1.8 =	6 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 8300 lbs / 575 lbs / 29.17 ft =			0.5 PLATES / ft
LTP4 PLATE SPACING =	12 / # =	12 / 0.5 =	24 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) AT 6" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

BEARING PLATE TO CEILING BAND CONNECTION:

# FACENAILS PER FOOT =	V / Z / W = 8300 lbs / 191 lbs / 29.17 ft =		
# FACENAILS PER FOOT =	1.5 NAILS / ft		
FACENAIL SPACING =	12 / # =	12 / 1.5 =	8 " O.C.

USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 8" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 24" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 8300 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

$$\text{SHEAR FORCE (V)} = \frac{R_{end2}}{\Sigma L_i \times C_O} =$$

SECOND FLOOR ENDWALL #1: $V = \frac{4353 \text{ lbs}}{19.17 \text{ ft} * 0.715} =$ 318 plf

SECOND FLOOR ENDWALL #2: $V = \frac{4353 \text{ lbs}}{32.76 \text{ ft} * 0.729} =$ 183 plf

MAXIMUM SECOND FLOOR ENDWALL UNIT SHEAR = 318 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER — Z = 95 lbs

$$\text{\# OF 8d NAILS PER FOOT} = \frac{V}{Z} = \frac{318 \text{ plf}}{95 \text{ lbs / NAIL}}$$

# OF 8d NAILS PER FOOT =	3.35 NAILS PER FOOT		
OVERALL 8d NAIL SPACING =	12 / # =	12 / 3.35 =	3.58 " O.C.
# OF ROWS :	1 ROW(S)		
8d NAIL SPACING WITHIN EACH ROW =	1 " SPACING	1 " 3.58 o.c.	3 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z} = \frac{318 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 3.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 3.35 = 3.58 " O.C.

OF ROWS : 1 ROW(S).

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 3.58 o.c. 3 " O.C.

**USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 318 plf**

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 318 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z} = \frac{318 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}} =$ 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

FIRST FLOOR ENDWALL #1 SHEATHING LENGTH REQUIREMENTS
LIBRARY / LIVING

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	3 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	654 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	66 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.52 ft
SHEAR ADJUSTMENT FACTOR (C_0) =	0.717 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{end1}) = L_1 * $FL_{i\text{-}par}$ / N_{end} + R_{end2} + ADDITIONAL=
R_{end1} = 42.67 ft * 185 plf / 2 + 4353 lbs + 0 lbs = 8300 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 8300 lbs / 654 plf = 12.69 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{sw} / C_0 = 12.69 ft / 0.717 = 17.71 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 17.71 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 19.17 ft**

**ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO**

FIRST FLOOR HORIZONTAL FLOOR DIAPHRAGM CONTINUITY:

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (ALONG MATE LINE)

(DEEP BEAM HORIZONTAL SHEAR)

$V_f = \dfrac{(3 * F_{Lpar} / 4) * L}{2} =$ $\dfrac{3/4 * 185 \text{ plf} * 42.67 \text{ ft}}{2} =$ 2961 lbs

1/2" DIA. THRU BOLT = $\dfrac{V_f}{Z_{1/2\,BOLT}} = \dfrac{2961 \text{ lbs}}{623 \text{ lbs}} =$ 5 BOLTS

USE A MIN. OF (5) 1/2" DIA.THRU BOLTS
TO ATTACH MODULE TO MODULE ALONG MATE LINE

MODULE TO MODULE CONNECTION AT FLOOR RIMBAND: (AT ENDWALLS)

(CHORD FORCE CONTINUITY)

$T = \dfrac{3/4 * F_{Lpara} * W_1^2}{8 * L_1} =$ $\dfrac{3/4 * 126 \text{ plf} * 48.08 \text{ ft}^2}{8 * 42.67 \text{ ft}} =$ 640 lbs

CHECK FASTENERS: 8d NAIL Z = 127.2 lbs
640 lbs / 127.2 lbs / FASTENER = 5.03 FASTENERS
USE (6) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 48.6 lbs
640 lbs / 48.6 lbs / FASTENER = 13.17 FASTENERS
USE (14) 16 ga. STAPLE(S) EACH END

USE A 1.5" x 22 ga. STRAP WITH (6) 8d NAIL(S) EACH END
OR WITH (14) 16 ga. STAPLE(S) EACH END
TO ATTACH MODULE TO MODULE AT EACH ENDWALL
OR CONNECTION TO WITHSTAND A TENSILE FORCE OF 640 lbs

FIRST FLOOR ENDWALL #1: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	19.17 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.717
SHEARWALL REACTION (R_{end1}) =	8300 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE $(U_{E1}) = \dfrac{R_{end1} \times H}{\Sigma L_i \times C_O} + U_{E2} =$

$U_{E1} = \dfrac{8300 \text{ lbs} \times 9 \text{ ft} + 2700 \text{ lbs}}{19.17 \times 0.717} =$ 8135 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL #2 SHEATHING LENGTH REQUIREMENTS
FAMILY / DINING

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR, DOUBLE STUDS
SHEATHING EDGE 8d NAIL SPACING =	2 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	828 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	25.25 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	60 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	9 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.559 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{end}) =	2
ADDITIONAL WALL LOAD FROM DEN =	0 lbs

SHEARWALL REACTION (R_{end1}) = $L_1 * FL_{Lpar} / N_{end} + R_{end2}$ + ADDITIONAL=
R_{end1} = 42.67 ft * 185 plf / 2 + 4353 lbs + 0 lbs = 8300 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{end1} / V = 8300 lbs / 828 plf = 10.02 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (ENDWALL) = L_{SW} / C_O = 10.02 ft / 0.559 =	**17.94 ft**

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 17.94 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 25.25 ft**

ENDWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

PREPARED BY:
BARLOW ENGINEERING, P.C.
6612 SIX FORKS RD, SUITE 104
RALEIGH, NC 27615

FIRST FLOOR ENDWALL #2: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	25.25 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.559
SHEARWALL REACTION (R_{end1}) =	8300 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\dfrac{R_{end1} \times H}{\Sigma L_i \times C_O} + U_{E2}$ =

U_{E1} = $\dfrac{8300 \text{ lbs} \times 9 \text{ ft} + 1550 \text{ lbs}}{25.25 \times 0.559}$ = 6843 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR ENDWALL: SHEAR CONNECTIONS

EFFECTIVE FIRST FLOOR WIDTH (W_1) =	26.25 ft	
FIRST FLOOR LENGTH (L_1) =	42.67 ft	
$FL_{i\text{-}par}$ =	185 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR ENDWALL SHEAR LOAD = 8300 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX ENDWALL SHEAR + L_1 x (3/4 * $FL_{i\text{-}par}$) / 2 + V_{DEN} =
V = 8300 lbs + 42.67 ft x (3/4 * 185 plf) / 2 + 0 lbs — 11260 lbs

# TOENAILS PER FOOT =	V / Z / W = 11260 lbs / 158 lbs / 26.25 ft =		2.7 NAILS / ft	
TOENAIL SPACING =	12 / # =	12 / 2.7 =	4 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 11260 lbs / 575 lbs / 26.25 ft =		0.7 PLATES / ft	
LTP4 PLATE SPACING =	12 / # =	12 / 0.7 =	16 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 4" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 16" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

SILL PLATE TO FOUNDATION CONNECTION:

1/2" ANCHOR BOLTS = V / Z = 11260 lbs / 1056 lbs = 11 BOLTS

BOLT SPACING = (W - 2) / (N - 1) = (26.25 ft - 2) / (11 - 1) = 29 in

USE 1/2" ANCHOR BOLTS @ 29" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

5/8" ANCHOR BOLTS = V / Z = 11260 lbs / 1488 lbs = 8 BOLTS

BOLT SPACING = (W - 2) / (N - 1) = (26.25 ft - 2) / (8 - 1) = 41 in

USE 5/8" ANCHOR BOLTS @ 41" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 11261 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\dfrac{R_{end1}}{\Sigma L_i \times C_O}$ =

FIRST FLOOR ENDWALL #1: V = $\dfrac{8300 \text{ lbs}}{19.17 \text{ ft} \cdot 0.717}$ = 604 plf

FIRST FLOOR ENDWALL #2: V = $\dfrac{8300 \text{ lbs}}{25.25 \cdot 0.559}$ = 589 plf

MAXIMUM FIRST FLOOR ENDWALL UNIT SHEAR = 604 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{604 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 6.36 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 6.36 = 1.88 " O.C.

OF ROWS : 2 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 2 * SPACING 2 * 1.88 o.c. 3 " O.C.

USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{604 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 6.36 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 6.36 = 1.88 " O.C.

OF ROWS : 2 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 2 * SPACING 2 * 1.88 o.c. 3 " O.C.

USE SHEATHING CONNECTION WITH 2 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 604 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 604 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z}$ = $\frac{604 \text{ plf}}{200 \text{ psi} * 12" / \text{ft}}$ = 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

SECOND FLOOR SIDEWALL #1 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #1 & #4

FIRST FLOOR WIDTH (W_1) = 48.08 ft
SECOND FLOOR WIDTH (W_2) = 48.08 ft
FIRST FLOOR LENGTH (L_1) = 42.67 ft
SECOND FLOOR LENGTH (L_2) = 42.67 ft
SHEARWALL TYPE: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING = 6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 384 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.4 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 26.92 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING= 63 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT = 6.83 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.663 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{side}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{side2}) = W_2 * w_{i-para} / N_{side} + ADDITIONAL =
R_{side2} = 48.08 ft * 204 plf / 2 + 0 lbs = 4905 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side2} / V = 4905 lbs / 384 plf = 12.77 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 12.77 ft / 0.663 =	19.27 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 19.27 ft < PERFORATED FULL HEIGHT SHEATHING PROVIDED = 26.92 ft

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR SIDEWALL #1: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 26.92 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) = 0.663
SHEARWALL REACTION (R_{end1}) = 4905 lbs
WALL HEIGHT (H) = 8.5 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{4905 \text{ lbs} \times 8.5 \text{ ft}}{26.92 \text{ ft} \times 0.663} = 2336 \text{ lbs}$$

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR SIDEWALL #2 SHEATHING LENGTH REQUIREMENTS
BEDROOMS #2 & #3

FIRST FLOOR WIDTH (W_1) = 48.08 ft
SECOND FLOOR WIDTH (W_2) = 48.08 ft
FIRST FLOOR LENGTH (L_1) = 42.67 ft
SECOND FLOOR LENGTH (L_2) = 42.67 ft
SHEARWALL TYPE: 7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING = 6 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) = 384 plf
MIN. SHEARWALL SEGMENT LENGTH = 2.4 ft
SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 21.79 ft
2nd FL. PERCENT FULL HEIGHT SHEATHING= 69 %
2nd FL. MAX. UNRESTRAINED OPENING HEIGHT = 6.19 ft
SHEAR ADJUSTMENT FACTOR (C_o) = 0.736 (TABLE 2305.3.7.2, IBC)
2nd FL. NUMBER OF SHEARWALLS (N_{side}) = 2
ADDITIONAL WALL LOAD = 0 lbs

SHEARWALL REACTION (R_{side2}) = W_2 * w_{i-para} / N_{side} + ADDITIONAL=
R_{side2} = 48.08 ft * 204 plf / 2 + 0 lbs = 4905 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side2} / V = 4905 lbs / 384 plf = 12.77 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 12.77 ft / 0.736 =	17.36 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 17.36 ft < PERFORATED FULL HEIGHT SHEATHING PROVIDED = 21.79 ft

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

SECOND FLOOR SIDEWALL #2: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) = 21.79 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) = 0.736
SHEARWALL REACTION (R_{end1}) = 4905 lbs
WALL HEIGHT (H) = 8.5 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} =$$

$$U_{E1} = \frac{4905 \text{ lbs} \times 8.5 \text{ ft}}{21.79 \text{ ft} \times 0.736} = 2600 \text{ lbs}$$

SEE PAGE 23 FOR CONNECTION DESIGN

SECOND FLOOR SIDEWALL: SHEAR CONNECTIONS

SECOND FLOOR WIDTH (W_2) =	48.08 ft	
SECOND FLOOR LENGTH (L_2) =	42.67 ft	
FL_{t-pare} =	126 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
0.162" x 3.5" COMMON NAIL (FACE NAILED)	Z =	191 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM SECOND FLOOR SIDEWALL SHEAR LOAD = 4905 plf

RIMBANDS TO BOTTOM, BEARING & TOP PLATE CONNECTION:

V = MAX SIDEWALL SHEAR + W_2 x FL_{t-pare} / 2 =
V = 4905 lbs + 48.08 ft x 126 plf / 2 — 7934 plf

# TOENAILS PER FOOT =	V / Z / L = 7934 lbs / 158 lbs / 42.67 ft =		1.2 NAILS / ft
TOENAIL SPACING =	12 / # = 12 / 1.2 =	10 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 7934 lbs / 575 lbs / 42.67 ft =		0.3 PLATES / ft
LTP4 PLATE SPACING =	12 / # = 12 / 0.3 =	37 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 10" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

BEARING PLATE TO CEILING BAND CONNECTION:

# FACENAILS PER FOOT =	V / Z / W = 7934 lbs / 191 lbs / 42.67 ft =		
# FACENAILS PER FOOT =	1.0 NAILS / ft		
FACENAIL SPACING =	12 / # = 12 / 1 =	12 " O.C.	(16" MAX)

USE 0.162" x 3.5" COMMON NAIL (FACE NAILED) @ 12" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 37" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 7935 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

$$\text{SHEAR FORCE (V)} = \frac{R_{side2}}{\Sigma L_i \times C_O} =$$

SECOND FLOOR SIDEWALL #1: $V = \frac{4905 \text{ lbs}}{26.92 \text{ ft} * 0.663} =$ 275 plf

SECOND FLOOR SIDEWALL #2: $V = \frac{4905 \text{ lbs}}{21.79 \text{ ft} * 0.736} =$ 306 plf

MAXIMUM SECOND FLOOR SIDEWALL UNIT SHEAR = 306 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

$$\text{\# OF 8d NAILS PER FOOT} = \frac{V}{Z} = \frac{306 \text{ plf}}{95 \text{ lbs / NAIL}}$$

# OF 8d NAILS PER FOOT =	3.23 NAILS PER FOOT	
OVERALL 8d NAIL SPACING =	12 / # = 12 / 3.23 =	3.71 " O.C.
# OF ROWS :	1 ROW(S)	
8d NAIL SPACING WITHIN EACH ROW =	1 * SPACING 1 * 3.71 o.c.	3 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{306 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 3.23 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 3.23 = 3.71 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 3.71 o.c. 3 " O.C.

**USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 3" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 306 plf**

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 306 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z}$ = $\frac{306 \text{ plf}}{200 \text{ psi} * 12\text{"} / \text{ft}}$ = 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

FIRST FLOOR SIDEWALL #1 SHEATHING LENGTH REQUIREMENTS
SUN ROOM / FAMILY

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	4 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	525 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED =	21.67 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	68 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.52 ft
SHEAR ADJUSTMENT FACTOR (C_0) =	0.733 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = $W_1 * FL_{t\text{-}para} / N_{side} + R_{side2}$ + ADDITIONAL =
R_{side1} = 48.08 ft * 126 plf / 2 + 4905 lbs + 0 lbs = 7935 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 7935 lbs / 525 plf = 15.11 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 15.11 ft / 0.733 = 20.62 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 20.62 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 21.67 ft**

**SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO**

FIRST FLOOR SIDEWALL #1: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	21.67 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.733
SHEARWALL REACTION (R_{end1}) =	7935 lbs
WALL HEIGHT (H) =	9 ft

UPLIFT FORCE (U_{E1}) = $\frac{R_{side1} \times H}{\Sigma L_i \times C_O} + U_{E2}$ =

U_{E1} = $\frac{7935 \text{ lbs} \times 9 \text{ ft} + 2336 \text{ lbs}}{21.67 \times 0.733}$ = 6833 lbs

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL #2 SHEATHING LENGTH REQUIREMENTS
LIVING / DINING

FIRST FLOOR WIDTH (W_1) =	48.08 ft
SECOND FLOOR WIDTH (W_2) =	48.08 ft
FIRST FLOOR LENGTH (L_1) =	42.67 ft
SECOND FLOOR LENGTH (L_2) =	42.67 ft
SHEARWALL TYPE:	7/16" OSB EXTERIOR (BLOCKED) w/ 1/2" GWB INTERIOR
SHEATHING EDGE 8d NAIL SPACING =	4 in O.C. (8d NAILS OR EQUIVALENT)
SHEARWALL STRENGTH (V) =	525 plf
MIN. SHEARWALL SEGMENT LENGTH =	2.6 ft
FULL HEIGHT SHEATHING PROVIDED =	21.67 ft
1st FL. PERCENT FULL HEIGHT SHEATHING=	69 %
1st FL. MAX. UNRESTRAINED OPENING HEIGHT =	6.83 ft
SHEAR ADJUSTMENT FACTOR (C_o) =	0.721 (TABLE 2305.3.7.2, IBC)
1st FL. NUMBER OF SHEARWALLS (N_{side}) =	2
ADDITIONAL WALL LOAD =	0 lbs

SHEARWALL REACTION (R_{side1}) = W_1 * FL_{t-para} / N_{side} + R_{side2} + ADDITIONAL =
R_{side1} = 48.08 ft * 126 plf / 2 +4905 lbs + 0 lbs = 7935 lbs

MIN. LENGTH SEGMENTED SHEARWALLS (L_{sw}) = R_{side1} / V = 7935 lbs / 525 plf = 15.11 ft

PERFORATED FULL HEIGHT SHEATHING LENGTH REQUIRED (SIDEWALL) = L_{SW} / C_O = 15.11 ft / 0.721 = 20.97 ft

PERFORATED FULL HEIGHT SHEATHING REQUIRED = 20.97 ft < **PERFORATED FULL HEIGHT SHEATHING PROVIDED = 21.67 ft**

SIDEWALL SHEARWALLS OK
ALL EXTERIOR SHEATHING TO BE BLOCKED UNO

FIRST FLOOR SIDEWALL #2: UPLIFT DUE TO OVERTURNING

SUM OF FULL HEIGHT SHEATHING PROVIDED (ΣL_i) =	21.67 ft
SHEARWALL ADJUSTMENT FACTOR (C_O) =	0.721
SHEARWALL REACTION (R_{end1}) =	7935 lbs
WALL HEIGHT (H) =	9 ft

$$\text{UPLIFT FORCE } (U_{E1}) = \frac{R_{side1} \times H}{\Sigma L_i \times C_O} + U_{E2} =$$

$$U_{E1} = \frac{7935 \text{ lbs} \times 9 \text{ ft} + 2600 \text{ lbs}}{21.67 \times 0.721} = 7171 \text{ lbs}$$

SEE PAGE 23 FOR CONNECTION DESIGN

FIRST FLOOR SIDEWALL : SHEAR CONNECTIONS

FIRST FLOOR WIDTH (W_1) =	48.08 ft	
FIRST FLOOR LENGTH (L_1) =	42.67 ft	
FL_{t-para} =	126 plf	
1/2" ANCHOR BOLT	Z =	1056 lbs
5/8" ANCHOR BOLT	Z =	1488 lbs
0.162" x 3.5" COMMON NAIL (TOENAILED)	Z =	158 lbs
(1) SIMPSON LTP4 PLATE	Z =	575 lbs

MAXIMUM FIRST FLOOR SIDEWALL SHEAR LOAD = 7935 lbs

RIMBAND TO SILL PLATE CONNECTION:

V = MAX SIDEWALL SHEAR + W_1 x (3/4 * FL_{t-para}) / 2 =
V = 7935 lbs + 48.08 ft x (3/4 * 126 plf) / 2 = 10207 lbs

# TOENAILS PER FOOT =	V / Z / L_1 = 10207 lbs / 158 lbs / 42.67 ft =		1.5 NAILS / ft
TOENAIL SPACING =	12 / # = 12 / 1.5 =	7 " O.C.	(16" MAX)
# LTP4 PLATES PER FOOT =	V / Z / W = 10207 lbs / 575 lbs / 42.67 ft =		0.4 PLATES / ft
LTP4 PLATE SPACING =	12 / # = 12 / 0.4 =	28 " O.C.	(72" MAX)

USE 0.162" x 3.5" COMMON NAIL (TOENAILED) @ 7" ON CENTER
OR USE (1) SIMPSON LTP4 PLATE @ 28" ON CENTER
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

SILL PLATE TO FOUNDATION CONNECTION:

1/2" ANCHOR BOLTS = V / Z = 10207 lbs / 1056 lbs = 10 BOLTS

BOLT SPACING = (L - 2) / (N - 1) = (42.67 ft - 2) / (10 - 1) = 54 in

USE 1/2" ANCHOR BOLTS @ 54" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

5/8" ANCHOR BOLTS = V / Z = 10207 lbs / 1488 lbs = 7 BOLTS

BOLT SPACING = (L - 2) / (N - 1) = (42.67 ft - 2) / (7 - 1) = 72 in

USE 5/8" ANCHOR BOLTS @ 72" O.C
ANCHOR BOLTS TO BE A MIN. OF 4" AND A MAX. OF 1'-0" FROM CORNERS
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 10207 lbs

CHECK SHEATHING TO RIMBAND CONNECTION:

UNIT SHEAR CHECK:

SHEAR FORCE (V) = $\frac{R_{side1}}{\Sigma L_i \times C_O}$ =

FIRST FLOOR SIDEWALL #1: V = $\frac{7935 \text{ lbs}}{21.67 \text{ ft} * 0.733}$ = 500 plf

FIRST FLOOR SIDEWALL #2: V = $\frac{7935 \text{ lbs}}{21.67 * 0.721}$ = 508 plf

MAXIMUM FIRST FLOOR SIDEWALL UNIT SHEAR = 508 plf

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{508 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 5.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 5.35 = 2.24 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 2.24 o.c. 2 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf

UNIT UPLIFT CHECK: (EQUAL TO UNIT SHEAR)

CHECK # 8d NAILS REQUIRED FOR SHEATHING CONNECTION:

8d COMMON NAIL (FACE NAILED), 7/16" SIDE MEMBER Z = 95 lbs

OF 8d NAILS PER FOOT = $\frac{V}{Z}$ = $\frac{508 \text{ plf}}{95 \text{ lbs / NAIL}}$

OF 8d NAILS PER FOOT = 5.35 NAILS PER FOOT

OVERALL 8d NAIL SPACING = 12 / # = 12 / 5.35 = 2.24 " O.C.

OF ROWS : 1 ROW(S)

8d NAIL SPACING WITHIN EACH ROW = 1 * SPACING 1 * 2.24 o.c. 2 " O.C.

USE SHEATHING CONNECTION WITH 1 ROW(S) OF 8d NAILS AT 2" O.C.
OR CONNECTION TO WITHSTAND A SHEAR FORCE OF 508 plf

ALTERNATE SHEATHING CONNECTION FOR UNIT UPLIFT (GLUE):

V = 508 plf

200 psi MINIMUM CONSTRUCTION ADHESIVE — Z = 200 psi (FACE)

WIDTH OF GLUE REQUIRED FOR SHEATHING CONNECTION ALONG FLOOR BAND:

WIDTH OF GLUE STRIP REQUIRED = $\frac{V}{Z} = \frac{508 \text{ plf}}{200 \text{ psi} * 12\text{"} / \text{ft}} =$ 1 "

FASTEN SHEATHING TO BAND WITH 1" WIDE STRIP OF 200 psi MINIMUM CONSTRUCTION ADHESIVE

COMBINED CORNER HOLDDOWN REQUIREMENTS

UPLIFT FORCES: (SEE ABOVE FOR CALCULATIONS)

2nd FLOOR ENDWALL #1 UPLIFT FORCE (U_{E2}) =	2700 lbs
2nd FLOOR ENDWALL #2 UPLIFT FORCE (U_{E2}) =	1550 lbs
2nd FLOOR SIDEWALL #1 UPLIFT FORCE (U_{S2}) =	2336 lbs
2nd FLOOR SIDEWALL #2 UPLIFT FORCE (U_{S2}) =	2600 lbs
1st FLOOR ENDWALL #1 UPLIFT FORCE (U_{E1}) =	8135 lbs
1st FLOOR ENDWALL #2 UPLIFT FORCE (U_{E1}) =	6843 lbs
1st FLOOR SIDEWALL #1 UPLIFT FORCE (U_{S1}) =	6833 lbs
1st FLOOR SIDEWALL #2 UPLIFT FORCE (U_{S1}) =	7171 lbs

DEAD LOADS:

EFFECTIVE FIRST FLOOR WIDTH (W_1) =	29.17 ft (MAX: 4 * CEILING HEIGHT)
EFFECTIVE SECOND FLOOR WIDTH (W_2) =	29.17 ft (MAX: 4 * CEILING HEIGHT)
EFFECTIVE FIRST FLOOR LENGTH (L_1) =	21.83 ft (MAX: 4 * CEILING HEIGHT)
EFFECTIVE SECOND FLOOR LENGTH (L_2) =	21.25 ft (MAX: 4 * CEILING HEIGHT)
FIRST FLOOR HEIGHT (H_1) =	9 ft
SECOND FLOOR HEIGHT (H_2) =	8.5 ft
ROOF & CEILING ASSEMBLY DEAD LOAD (RDL) =	15 psf
WALL DEAD LOAD (WDL) =	12 psf
FLOOR DEAD LOAD (FDL) =	10 psf

SIDEWALL SECOND FLOOR CORNER:

ROOF DEAD LOAD =	0.6 * RDL * W_2 * L_2 / 8 =	
ROOF DEAD LOAD =	0.6 * 15 psf * 29.17 ft * 21.25 ft / 8 =	697 lbs
WALL DEAD LOAD =	0.6 * (WDL * H_2 * L_2 / 2) =	
	0.6 * 12 psf * 8.5 ft * 21.25 ft / 2 =	650 lbs
	TOTAL DEAD LOAD = 697 lbs + 650 lbs =	1348 lbs
CORNER STUD CONNECTION LOAD =	MAX WALL UPLIFT - SELF WEIGHT=	
	2600 lbs - 1348 lbs =	1252 lbs

SIDEWALL FIRST FLOOR CORNER:

WALL DEAD LOAD =	0.6 * (WDL * H_1 * L_1 / 2) =	
WALL DEAD LOAD =	0.6 * 12 psf * 9 ft * 21.83 ft / 2 =	707 lbs
2nd FLOOR DEAD LOAD =	0.6 * FDL * W_2 * L_2 / 8 =	
2nd FLOOR DEAD LOAD =	0.6 * 10 psf * 29.17 ft * 21.25 ft / 8 =	465 lbs
1st FLOOR DEAD LOAD =	0.6 * FDL * W_1 * L_1 / 8 =	
1st FLOOR DEAD LOAD =	0.6 * 10 psf * 29.17 ft * 21.83 ft / 8 =	478 lbs
	TOTAL DEAD LOAD = 707 lbs + 465 lbs + 478 lbs =	1650 lbs
CORNER STUD CONNECTION LOAD =	MAX WALL UPLIFT - SELF WEIGHT, INCLUDING ABOVE WALL(S)	
	7171 lbs - 1650 lbs - 1348 lbs =	4173 lbs

ENDWALL SECOND FLOOR CORNER:

WALL DEAD LOAD =	0.6 * (WDL * H_2 * W_2 / 2) =	
WALL DEAD LOAD =	0.6 * 12 psf * 8.5 ft * 29.17 ft / 2 =	893 lbs
GABLE WALL DEAD LOAD =	0.6 * (WDL * (H / 2) * W / 2) =	
GABLE WALL DEAD LOAD =	0.6 * 12 psf * ((9 / 12) * (29.17 ft / 2) / 2) * (29.17 ft) / 2 =	575 lbs
	TOTAL DEAD LOAD = 893 lbs + 575 lbs =	1468 lbs
CORNER STUD CONNECTION LOAD =	MAX WALL UPLIFT - SELF WEIGHT	
	2700 lbs - 1468 lbs =	1232 lbs

ENDWALL FIRST FLOOR CORNER:

WALL DEAD LOAD = $0.6 * (WDL * H_1 * W_1 / 2)$ =
WALL DEAD LOAD = 0.6 * 12 psf * 9 ft * 29.17 ft / 2 = 946 lbs

CORNER STUD CONNECTION LOAD = MAX WALL UPLIFT - SELF WEIGHT, INCLUDING ABOVE WALL(S)
8135 lbs - 946 lbs - 1468 lbs = 5721 lbs

SECOND FLOOR CORNER HOLDDOWNS

UPLIFT FORCE = 2700 lbs (MAX. OF SECOND FLOOR UPLIFT FORCES)

SECOND FLOOR DEAD LOAD (DL_2) = 1348 lbs + 1468 lbs = 2816 lbs

HOLDDOWN FORCE = 2700 lbs - 2816 lbs = 0 lbs

CHECK FASTENERS:

8d NAIL Z = 76.7 lbs
0 lbs / 76.7 lbs / FASTENER = 0 FASTENERS
USE (0) 8d NAIL(S) EACH END

16 ga. STAPLE Z = 49.9 lbs
0 lbs / 49.9 lbs / FASTENER = 0 FASTENERS
USE (0) 16 ga. STAPLE(S) EACH END

NO PHYSICAL HOLDDOWN REQUIRED

SECOND FLOOR CORNER STUD CONNECTION

16d COMMON NAIL ALLOWABLE SHEAR (Z) = 191 lbs

MAX CORNER STUD CONNECTION LOAD = 1252 lbs

NAIL SPACING (2 ROWS) = $\frac{2 * H * Z}{U} = \frac{2 * 8.5\text{ ft} * 191\text{ lbs}}{1252\text{ lbs}}$ = 16 in O.C. (16" MAX)

OF 1/4" DIA. LAG SCREW REQUIRED = $\frac{U}{Z} = \frac{1252\text{ lbs}}{224\text{ lbs}}$ = 6 LAG SCREWS (6 MIN)

**FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 16" ON CENTER
OR USE (6) 1/4" DIA. LAG SCREWS**

FIRST FLOOR HOLDDOWNS

UPLIFT FORCE = 8135 lbs (MAX. OF FIRST FLOOR UPLIFT FORCES)

FIRST FLOOR DEAD LOAD (DL_1) = 1650 lbs + 1348 lbs + 1468lbs + 946 lbs = 5412 lbs

HOLDDOWN FORCE = 8135 lbs - 5412 lbs = 2723 lbs

**USE A SIMPSON STHD10RJ AT EACH BUILDING CORNER OR EQUAL
OR CONNECTION TO WITHSTAND AN UPLIFT FORCE OF 2723 lbs**

FIRST FLOOR CORNER STUD CONNECTION

16d COMMON NAIL ALLOWABLE SHEAR (Z) = 191 lbs

MAX CORNER STUD CONNECTION LOAD = 5721 lbs

NAIL SPACING (2 ROWS) = $\frac{2 * H * Z}{U} = \frac{2 * 9\text{ ft} * 191\text{ lbs}}{5721\text{ lbs}}$ = 7 in O.C. (16" MAX)

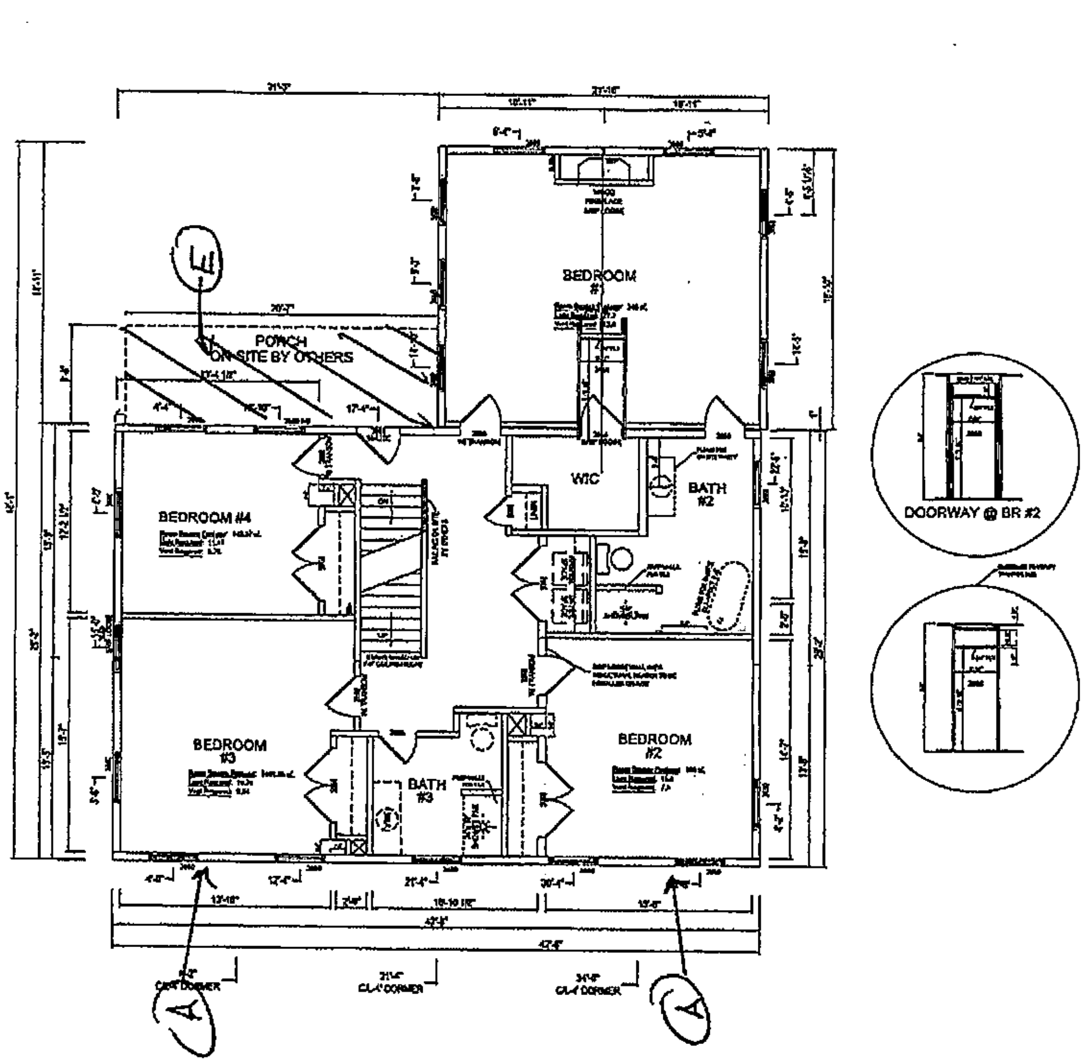
OF 1/4" DIA. LAG SCREW REQUIRED = $\frac{U}{Z} = \frac{5721\text{ lbs}}{224\text{ lbs}}$ = 26 LAG SCREWS (6 MIN)

**FASTEN CORNER STUDS 2 ROWS OF 16d COMMON NAILS @ 7" ON CENTER
OR USE (26) 1/4" DIA. LAG SCREWS**

Section 3
HAND CALCULATIONS

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12



NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION

110376

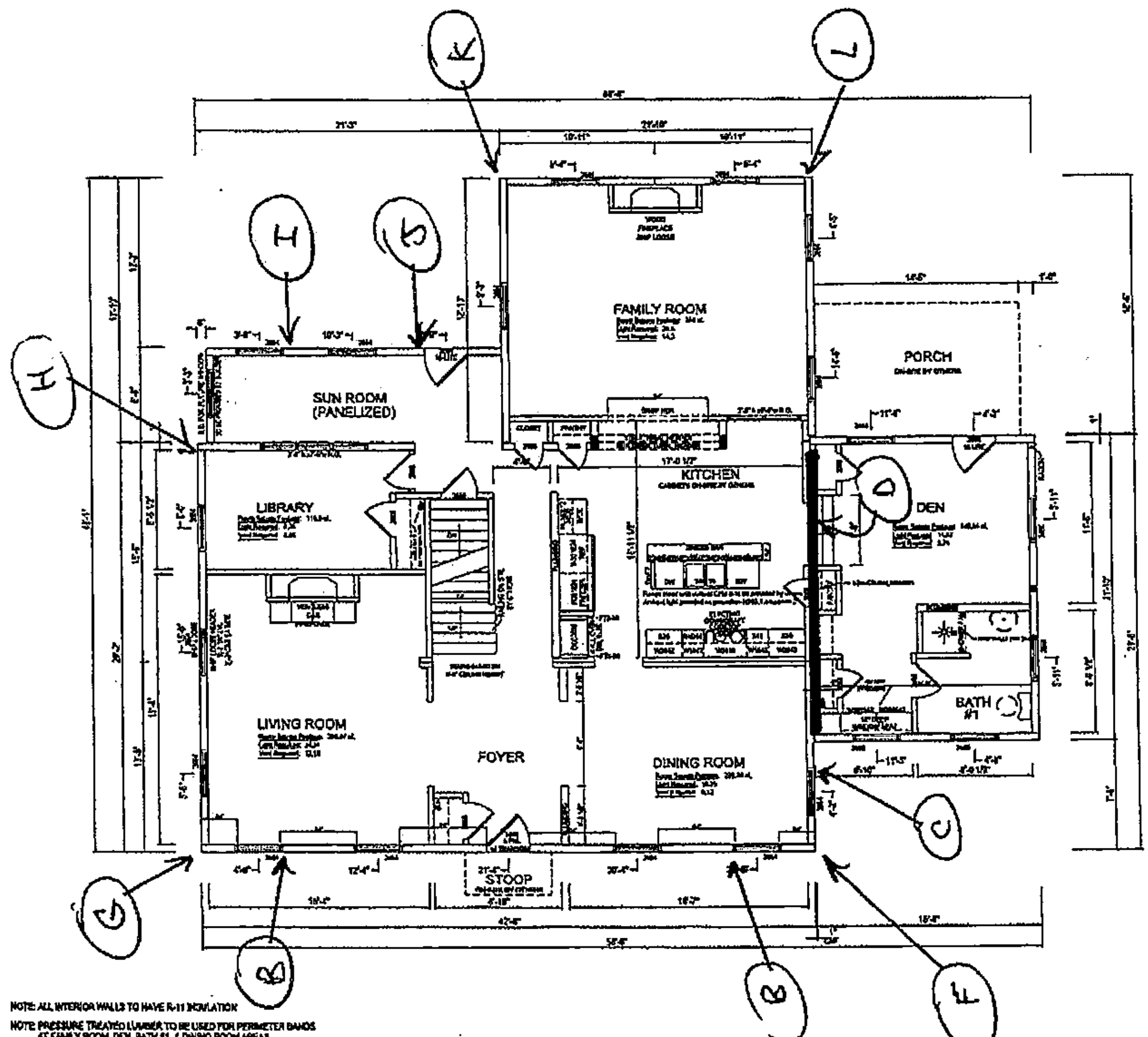
2nd FLOOR
8'-6" CEILING

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION	DATE: 5/24/10	MODEL: CUSTOM 2-STORY	CONTROL NUMBER	SUB-SET	A2
	CUSTOMER: MADISON	DRAWN BY: CDK	Scale: 1/8" = 1'- 0"	C-484709-2		

110376

2

146



▲STATE MODULAR LABEL
■NTA LABEL
●DATA PLATE

NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION
NOTE: PRESSURE TREATED LUMBER TO BE USED FOR PERIMETER BANDS AT FAMILY ROOM, DEN, BATH #1, & DINING ROOM AREAS

DP RATING: 25 MAX.

1st FLOOR
9'-0" CEILING

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION	DATE: 5/24/10	MODEL: CUSTOM 2-STORY	CONTROL NUMBER C-484709-2	SUB-SET	A1
	CUSTOMER: MADISON	DRAWN BY: CDK	Scale: 1/8" = 1'- 0"			

110376
0232nec2011
IBS - C-484709-2

General Holddowns / Connections

Loc.	Load (lbs)	Connection	Cap (lbs)
A	444	(1) 1.5" x 26 ga. strap w/ (6) 8d or (9) 16 ga. staples each end each strap from 2nd level stud to 1st level stud	449
		net U = U - DL = 2600 lbs - 34' / 21.25' x 1348 lbs = 444 lbs	
B	2294	(1) Simpson STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 7171 lbs - 34' / 21.25' x 1348 lbs - 36' / 21.83' x 1650 lbs = 2294 lbs	
C	5171	(2) Simpson STHD14RJ	8860
		or (1) Simpson HDU8-SDS2.5 w/ 7/8" rod. Use (3) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row each stud	5665
		or (2) Simpson MSTCM40 (or 60) from stud to foundation	8440
		net U = U - DL = 6117 lbs - 946 lbs = 5171 lbs	
D	1292	nail Den truss to Main House Endwall #2 framing w/ (2) 16d (0.162" x 3.5") 24" o.c. max	4169
		lag Main House Endwall #2 floor band to blocking in Den Endwall #1 framing w/ a total of (5) 3/8" lags evenly spaced	1440
E	116 plf	1st level ceiling: 7/16" OSB (un-blocked) w/ 8d 6"/12".	296 plf
		Make all shear connections per shearcalc from 2nd level floor band to ceiling band and from ceiling band to Sidewall #1 below	
		v = 6.5' / 21.67' x 7935 lbs / 20.58' = 116 plf	
F	0	No foundation connection required.	N/A
		net U = U - DL = 2600 lbs - 2816 lbs < 0 lbs	
G, H	844	(1) STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 8135 lbs - 34' / 21.25' x 1348 lbs - 1468 lbs - 36' / 21.83' x 1650 lbs - 946 lbs = 844 lbs	
I, J	2847	(1) STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 4497 lbs - 1650 lbs = 2847 lbs	
K, L	1791	(1) STHD10RJ	3230
		or (1) Simpson HDU4-SDS2.5 w/ 5/8" rod. Use (2) studs, nailed w/ (2) rows 16d (0.162" x 3.5") 6" o.c. each row	3285
		or (1) Simpson MSTCM40 (or 60) from stud to foundation	4220
		net U = U - DL = 7667 lbs - 1348 lbs - 34' / 29.17' x 1468 lbs - 1650 lbs - 36' / 29.17' x 946 lbs = 1791 lbs	

Section 4
ALTERNATE CONNECTIONS

COMMONWEALTH OF VIRGINIA
James Joseph
Barlow
Lic. No. 035206
PROFESSIONAL ENGINEER

11/16/12

7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C. = 238 plf
7/16" O.S.B. Sheathing w/ 15 GA. Staples @ 2" O. C. = 270 plf
7/16" O.S.B. Sheathing w/ 14 GA. Staples @ 2" O. C. = 295 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 16 GA. Staples @ 2" O. C. = 476 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 15 GA. Staples @ 2" O. C. = 540 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 14 GA. Staples @ 2" O. C. = 590 plf

Required Sidewall Stud Tie Down
1. 1st Floor Stud to Top Plate
Load = 389 LBS
389 / 2 = 194.5 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

2. 1st Floor Stud to Floor Band
Load = 260 LBS
260 / 2 = 130 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

CONNECTIONS

STAPLE DESIGN VALUES
per ESR-1539 (July 1, 2009)

SPECIES GROUP: III
DESIGN FACTOR: 0.82
SPECIFIC GRAVITY (G): 0.42

STAPLE	MIN OD CROWN (in.)	WIRE DIA (in.)	MINIMUM PENETRATION (in.)	LATERAL STRENGTH (1) (lbs.)	% OF 16 GAGE	WITHDRAWAL STRENGTH (2) (lbs/in PENETRATION)	% OF 16 GAGE
16 GAGE	7/16	0.0625	1	39.80	1.00	20.00	1.00
15 GAGE	7/16	0.072	1	45.00	1.13	23.00	1.15
14 GAGE	7/16	0.08	1	49.20	1.24	25.00	1.25

(1) = TABLE 2, pg. 7 of 45 (2) = TABLE 4, pg. 8 of 45

SHEATHING CONNECTION W/ 7/16" O.S.B.

STAPLE	SPACING (in.)	UPLIFT (plf)
16 GAGE	2	238
15 GAGE	2	270
14 GAGE	2	295

7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C. = 238 plf
7/16" O.S.B. Sheathing w/ 15 GA. Staples @ 2" O. C. = 270 plf
7/16" O.S.B. Sheathing w/ 14 GA. Staples @ 2" O. C. = 295 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 16 GA. Staples @ 2" O. C. = 476 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 15 GA. Staples @ 2" O. C. = 540 plf
7/16" O.S.B. Sheathing w/ (2) Rows of 14 GA. Staples @ 2" O. C. = 590 plf

Required Sidewall Stud Tie Down
1. 2nd Floor Stud to Top Plate
Load = 551 LBS
551 / 2 = 275.5 plf
7/16" O.S.B. Sheathing w/ 14 GA. Staples @ 2" O. C. or
7/16" O.S.B. Sheathing w/ (2) Rows of 16 GA. Staples @ 2" O. C.

2. 2nd Floor Stud to Floor Band – 2nd Floor Band to 1st Floor Ceiling Band
Load = 429 LBS
429 / 2 = 214.5 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

3. 1st Floor Stud to Ceiling Band
Load = 342 LBS
342 / 2 = 171 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

4. 1st Floor Stud to Floor Band
Load = 213 LBS
213 / 2 = 106.5 plf
7/16" O.S.B. Sheathing w/ 16 GA. Staples @ 2" O. C.

CONNECTIONS

STAPLE DESIGN VALUES
per ESR-1539 (July 1, 2009)

SPECIES GROUP: III
DESIGN FACTOR: 0.82
SPECIFIC GRAVITY (G): 0.42

STAPLE	MIN OD CROWN (in.)	WIRE DIA (in.)	MINIMUM PENETRATION (in.)	LATERAL STRENGTH (1) (lbs.)	% OF 16 GAGE	WITHDRAWAL STRENGTH (2) (lbs/in PENETRATION)	% OF 16 GAGE
16 GAGE	7/16	0.0625	1	39.80	1.00	20.00	1.00
15 GAGE	7/16	0.072	1	45.00	1.13	23.00	1.15
14 GAGE	7/16	0.08	1	49.20	1.24	25.00	1.25

(1) = TABLE 2, pg. 7 of 45
(2) = TABLE 4, pg. 8 of 45

SHEATHING CONNECTION W/ 7/16" O.S.B.

STAPLE	SPACING (in.)	UPLIFT (plf)
16 GAGE	2	238
15 GAGE	2	270
14 GAGE	2	295

From: Hunter Madison [huntermadison2002@yahoo.com]
Sent: Tuesday, October 15, 2013 3:01 PM
To: McMahan, Alan (DHCD); Hodge, Vernon (DHCD); Davis, Cindy (DHCD)
Subject: Fw: Madison house

Please include this e-mail exchange as an attachment for the appeal to the July 25, 2013 complaint (September Davis Letter) and as a response/supplement to the letter DHCD received from Simpson Strong Tie, same engineer.

Thank you.

Milari Madison

On Thursday, October 10, 2013 5:50 AM, Hunter Madison <huntermadison2002@yahoo.com> wrote:

On Wednesday, October 9, 2013 10:34 AM, Sam Hensen <shensen@strongtie.com> wrote:
Ms. Madison,

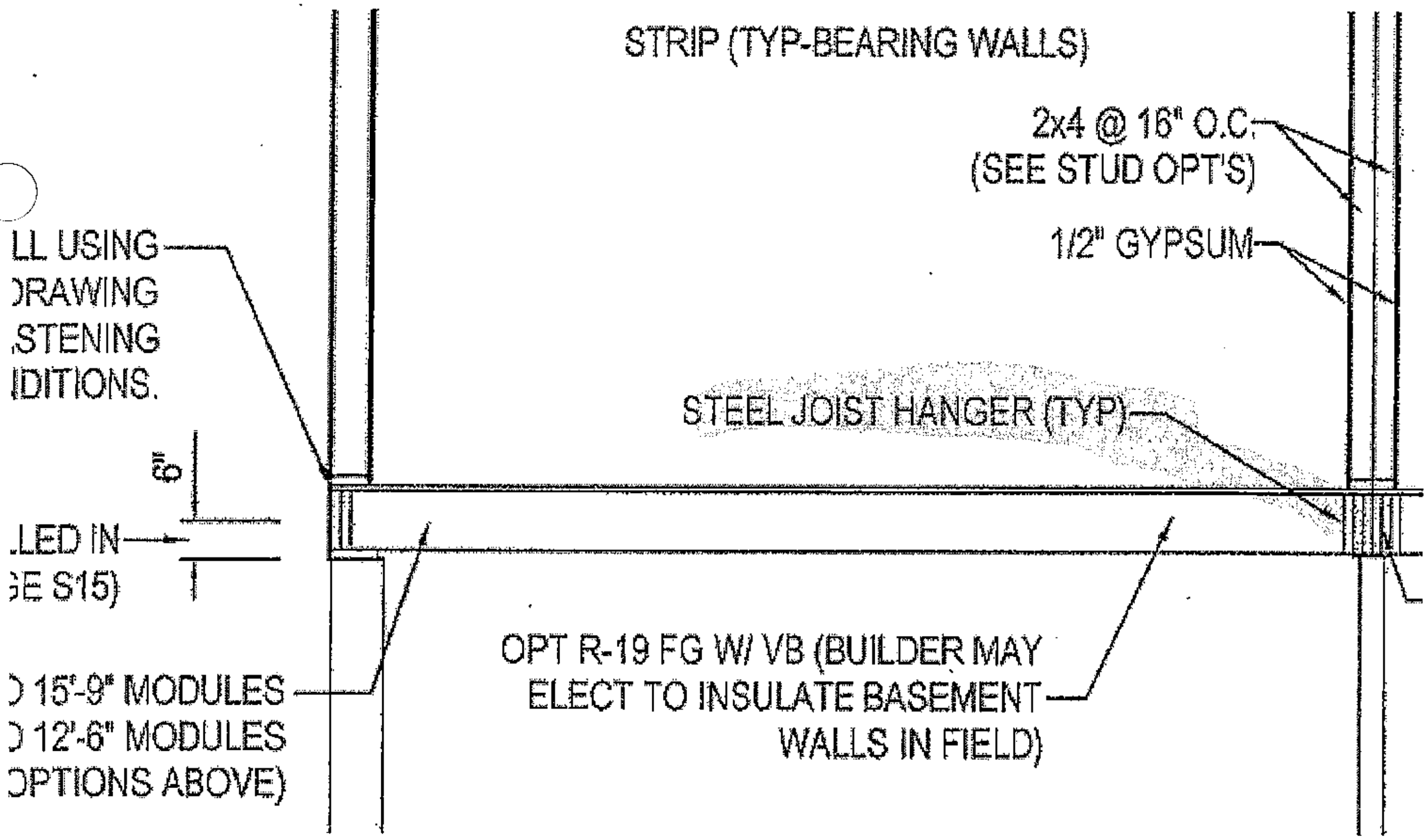
The attachment you sent was for the shearwall calculations. It does not include any information on the hangers in question. However, I see that on the plans you sent earlier, a hanger is called out at the floor joist (see excerpt below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be 20 psf for this application. Thus the total demand load on the hanger is 60 psf, and it would be calculated as follows:

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately 60 psf x 1.33 ft. x 15.75 ft. / 2 = 628 lbs.

The LUS26 hanger is rated for 865 lbs., but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (we do not permit this nail in our hanger), the allowable load for the hanger will drop to 419 lbs. (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. Thus the allowable load for the hanger as installed is less than the demand load. 628 lbs. < 419 lbs.

Hope that information helps. I recommend you hire a forensics engineer to assist you with this issue. Simpson Strong-Tie does not get involved in litigious issues like this situation.



Thank You,

Sam Hensen, P.E. | Engineering Manager, Southeastern US | Simpson Strong-Tie | 2221 Country Lane | McKinney, TX 75069 | 972.439.3027

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Tuesday, October 08, 2013 8:30 AM
To: Sam Hensen; Bobby Sager
Subject: Fw: Madison house

Dear Mr. Hensen,

I received a copy of your letter dated October 7, 2013 regarding the Simpson Strong Ties used in the construction of my house. The house was built in 2011. Page 14-15 of catalog INSTALL09.pdf specifically prohibits the use of joist hangers that are "too short". The "light" U brackets (LUS26) measure 4 and 3/4 and are affixed to 2x10's that measure 9.25", supporting 2 x 10's and attaching to 2x10's. I pulled out one of the nails affixing the U bracket and it measured 1.5 inches. I expressed my concern to DHCD over the 60% rule regarding deflection (my china cabinet shakes and my kitchen floor shakes) and the load capacity. The plan called for "typical joist hangers" but did not specify the size or weight. Contrary to the approved plan, certain portions of the house cantilever over the foundation wall where no joist hanger exists, assuming the load would be absorbed by foundation wall, band board and where the joists met. However, the fact that the house, as built, is different than what the plan called for, I remain concerned that the joist hangers are undersized with respect to the size of the nails utilized to affix the hangers and the size and weight of the joist hangers. DHCD is relying on your letter to dismiss my concern regarding the Simpson

15.2

brackets. I think that it is fair and reasonable to provide you with additional information as to the scope of the concern and the conditions, including the utilized nail size and proposed load calculations (which differ from what was actually built) so that you can provide an opinion.

Thank you.

Milari Madison 540-882-3160

----- Forwarded Message -----
From: Mark Neal <mneal@barlow-engineering.com>
To: 'Hunter Madison' <huntermadison2002@yahoo.com>
Cc: Chris.Thompson@loudoun.gov
Sent: Friday, November 16, 2012 12:36 PM
Subject: RE: Madison house

Mrs. Madison & Mr. Thompson,

Attached is a revised copy of the shearwall calculations we provided to IBS for the C-484709-2 plan. The only revision we made was on the Main House summary sheet showing the roof as a 3rd floor. The calculations were done correctly originally but we didn't call the habitable attic a floor.

I trust this will clarify our portion of the design and I wish you the best in resolving your issues.

Please contact our office with any questions or comments.

Thanks,

Mark Neal
Barlow Engineering, P.C.
6612 Six Forks Rd.
Suite 104
Raleigh, NC 27615
(919) 845-1600

-----Original Message-----
From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Friday, November 16, 2012 10:00 AM
To: mneal@barlow-engineering.com
Subject: Madison house

Chris.Thompson@loudoun.gov

Mark,

As discussed, please send the corrected plan/calc for the third floor shear wall to me and the building code official. PDF is fine.

Thank you.

Milari Madison

COMMONWEALTH of VIRGINIA

Office of the Attorney General

Kenneth T. Cuccinelli, II
Attorney General

900 East Main Street
Richmond, Virginia 23219
804-786-2071
FAX 804-786-1991
Virginia Relay Services
800-828-1120
7-1-1

November 19, 2013

Via E-Mail (alan.mcmahan@dhcd.virginia.gov)
and U.S. Mail
Alan McMahan, Staff
State Building Code Technical Review Board
Virginia Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219

Re: Appeal of Milari Madison to the Review Board (Appeal No. 13-7)

Dear Mr. McMahan:

Enclosed please find the SBCO's Response to the appeal filed by Milari Madison. Thank you for your attention to this matter. Please feel free to call me at (804) 371-7965 if you have any questions or need any additional information.

Very truly yours,

Mike F. Melis,
Assistant Attorney General

cc: Cindy Davis
Milari Madison
Chris Thompson
Gina L. Schaecher
Eric Tompos

VIRGINIA:

BEFORE THE STATE BUILDING CODE
TECHNICAL REVIEW BOARD

IN RE: Appeal of Milari Madison
Appeal No. 13-7

RESPONSE TO APPEAL

The State Building Code Administrative Office, currently known as the State Building Code Office ("SBCO"), of the Virginia Department of Housing and Community Development, states as follows in response to the "Appeal to September 23, 2013 Davis Letter" ("Appeal") filed by Milari Madison.

ISSUES FOR APPEAL

This Response addresses the specific items raised by Ms. Madison in her July 25, 2013, complaint to the SBCO, to which the SBCO responded by letter dated September 23, 2013, ("SBCO Letter") which is now the subject of Ms. Madison's Appeal. The SBCO's positions are based on a site inspection conducted on September 6, 2013, as well as additional review of relevant materials such as the plans for the home. Moreover, the SBCO incorporates by reference its Response to Application for Administrative Appeal in Appeal No. 13-3, specifically with regard to the role and regulation of a CAA such as NTA.

1. No joist hangers under the sunroom.

The sunroom in Ms. Madison's home was not manufactured and shipped as an individual section, module or "box" to be connected or tied to other modules at the home site. Instead, the sunroom was panelized, open construction that was shipped as separate components which were assembled at the home site. A Virginia industrialized building certification seal was not issued for the sunroom. Thus the sunroom portion of Ms. Madison's home is not considered an "industrialized building" as defined by 13 VAC 5-91-10. Any alleged violations regarding the assembly and construction of the sunroom are, therefore, subject to the USBC, not the IBSR.

Ms. Madison argues that Milton "built, assembled, furnished, and attached the sunroom to the industrialized building, and is, therefore, responsible for the lack of joist hangers and any other code violation related to the sunroom." Appeal p. 9. Thus, Ms. Madison concedes that the sunroom was built on site and was not an industrialized building. And even assuming Milton did build, assemble, furnish and attach the sunroom to the industrialized building, such activity by Milton does not make the sunroom subject to the IBSR.

Contrary to Ms. Madison's assertion in her Appeal, 13 VAC 5-91-80 does not state that "the manufacturer of a registered industrialized building is required to remedy violations caused by on-site work under his control or violations involving components and materials furnished by him and included with the registered industrialized building." Appeal p. 9. In making this assertion, Ms. Madison relies on her own strained interpretation of 13 VAC 5-91-80. Her interpretation ignores the plain language of regulations expressly excluding site work from the IBSR and identifying such work as subject to the USBC.

> In accordance with § 36-99 of the Code of Virginia and in accordance with the USBC, *the installation or erection of industrialized buildings and alterations, additions, or repairs to industrialized buildings are regulated by the USBC and not this chapter.* The USBC provides for administrative requirements for permits inspections, and certificates of occupancy for such work.

13 VAC 5-91-20(C) (emphasis added).

> In accordance with § 36-99 of the Code of Virginia and the USBC, *all site work associated with the installation or erection of an industrialized building is subject to the USBC.* In addition, under the USBC, all administrative requirements for permits, inspections, and certificates of occupancy are also applicable.

13 VAC 5-91-100(B) (emphasis added). Thus, the issue of joist hangers under the sunroom, which Ms. Madison concedes was "built, assembled, furnished, and attached" on site, is a matter subject to the USBC, not the IBSR.

2. One of the joist hangers under the den has been improperly fastened to the joist.

The SBCO has identified this issue as a violation of the IBSR and has asked Milton to correct this violation.

3. There is no blocking and no joist hangers where the first floor cantilevers over the foundation.

With respect to the cantilever, the plans and the home, which was built consistent with the plans, comply with the IBSR. Upon further review, the plans for Ms. Madison's home do reflect a cantilever on the first floor and, with regard to the existence of the cantilever, what was built and installed appears to be consistent with the plans and with Ms. Madison's request. *See* Plans, attached as Exhibit A; 4/9/12 E-mail Chain, attached as Exhibit B. Moreover, any deviations from the approved plan due to the construction of the foundation or installation of the home on the foundation are matters subject to the USBC, not the IBSR.

4. According to the Simpson product literature, the joist hangers are undersized. Simpson recommends that the joist hangers be at least 60% of the joist height. The joist hangers in the basement are 4.5". The joist is 9.25".

As noted in the SBCO Letter, inspection did not reveal the joist hangers to be an IBSR violation and communication with Simpson confirms that the joist hangers are not undersized for their purpose. *See* 10/7/13 Simpson Letter, attached as Exhibit C. As for Ms. Madison's claim that nails used in the joint hangers are too short, this claim was not asserted in Ms. Madison's complaint, nor did she bring this issue to the attention of the SBCO inspector on September 6, 2013. But information provided by NTA regarding this issue would support a finding that no IBSR violation exists. *See* 11/11/13 NTA Letter, attached as Exhibit D.

5. <u>The installer failed to contact the building official before concealment, so it is unknown if the manufacturer's installation procedures were followed where concealments occurred. As visible from the basement and above the master bedroom, there are no through bolts.</u>

As noted above, pursuant to the IBSR, all site work associated with the installation of an industrialized building is subject to the USBC, not the IBSR.

6. <u>Compliance assurance labels have been affixed to the house when the building does not meet code.</u>

This complaint, by itself, does not implicate the IBSR. To the extent Ms. Madison's home in some way is non-compliant with the IBSR - meaning the construction completed at the point of manufacture does not meet the applicable code - the remedy is to request correction of the construction defect, not alteration of the compliance assurance labels.

7. <u>The data plate remains uncorrected and inaccurate specific to the fact the house is three stories not two. The fact that the living space is significantly increased by this space (habitable attic) also makes the data plate incorrect in terms of the R value calculation and the overall square footage.</u>

The data plate is correct in identifying the factory built portion of the home as two stories. The building plans that were reviewed and approved by NTA and submitted for permitting identify the home as "Two-Story". *See* Cover Page and Floor Plans, attached as Exhibit E. The habitable attic is not considered a story under 2009 International Residential Code. Moreover, it was not completed at the point of manufacture and, therefore, not subject to the IBSR. Subsequent to the installation of the home, additional site work was performed in the unfinished attic, including the installation of drywall on the walls and ceiling, finished flooring, electrical outlets and heating and air conditioning. As noted above, all of the work and code requirements related to additional site work are subject to the USBC and are not regulated by the IBSR. Any such additional site work not included as part of the original permit, would have required a second permit, so that specifications on code requirements would be provided to

Loudoun County. These specifications would include any additional required insulation, added electrical work, drywall specifications, use of space, *etc.*

8. <u>The approved plans and what was delivered are not consistent, *i.e.*, width of stairs from kitchen to den; size and height of chimney; knee walls are of unequal height; the overall dimensions of certain walls deviate; basement windows under the den do not fall centered below the windows installed in the den and bathroom, the eave overhangs are of different distances.</u>

As noted above, all site work is subject to the USBC, not the IBSR. The SBCO understands that the stairs from the kitchen to the den and the chimney were built and installed on site and, therefore, not subject to the IBSR. Ms. Madison's issues with regard to the knee walls, dimensions of certain walls, basement windows, and eave overhangs do not constitute violations of the IBSR requiring correction. To the extent Ms. Madison is dissatisfied with certain aesthetic features of her home that implicate neither the USBC nor the IBSR, such complaints are subject to whatever contractual remedies Ms. Madison may have.

9. <u>Collar ties were not installed properly and are lacking.</u>

Ms. Madison concedes that the collar ties were installed on site. *See* Appeal at pp. 21-22. Thus, under the IBSR, such site work is subject to the USBC, regardless of who did the work.

10. <u>The truss manufacturer has indicated that the portions of the roof that were hinged at the factory were possibly the wrong size.</u>

Based on the SBCO inspector's observations on September 6, 2013, the trusses were consistent with those shown on the approved plans. *See* Photo of Roof Trusses, attached as Exhibit F. The trusses were primarily constructed of 2x6 top chords and 2x10 bottom chords. There were no signs of deflection in the trusses. The truss manufacturer's report (May 21 by UFP Parker, LLC a Universal Forest Products Company) referenced by Ms. Madison uses vague, subjective language while providing no engineering support for Ms. Madison's conclusions. Nor does the report identify an IBSR violation.

11. Milton staff cut roof joists to cause an opening from the third floor living space to the storage space above the master bedroom without the engineered stamped approval.

As noted above, all site work is subject to the USBC, not the IBSR.

12. The roof over the main block is lumpy and has a significant roll.

The SBCO inspector visually inspected the exterior of the roof from ground level and from the attic. There were no significant signs of deflection.

13. Other issues - electrical service and floor one to floor two staircase.

The building plans and the electrical calculations for the home that were reviewed and approved by NTA provide for one 200 amp service panel. *See* 5/17/11 Electrical Load Calculation, attached as Exhibit G. It appears that one 200 amp panel was installed specifically for factory installed outlets and fixtures while the second 200 amp panel was shipped separately and provided for site installed outlets and equipment. Milton has acknowledged that the second 200 amp panel was supplied at Ms. Madison's request and was shipped loose for installation on site. An invoice from Billy's Electrical Service verifies such work performed on site. *See* 10/7/11 Invoice, attached as Exhibit H. The SBCO inspector's April 9, 2012, inspection of the home supports this conclusion. *See* Electrical Panel Photos, attached as Exhibit I. Each panel appeared to have been separately installed, which is consistent with the invoice reflecting electrical work on site. Moreover, to the extent any work was done on site by anyone, as noted above, such work is subject to the USBC, not the IBSR.

Regarding the apparent headroom violation at the stairway between the first and second floor, on September 6, 2013, the SBCO inspector took measurements and determined that, in its current condition, the stairway meets code. As such, no IBSR violation exists.

CONCLUSION

For the foregoing reasons, the SBCO respectfully requests that Ms. Madison's appeal be dismissed.

Respectfully submitted,

Department of Housing and Community Development – State Building Code Office

By: ______________________
Counsel

KENNETH T. CUCCINELLI, II
Attorney General

WESLEY G. RUSSELL, JR.
Deputy Attorney General

PETER R. MESSITT
Senior Assistant Attorney General

*MIKE F. MELIS (VSB# 43021)
Assistant Attorney General

Office of the Attorney General
900 East Main Street
Richmond, Virginia 23219
Tel: (804) 371-7965
Fax: (804) 371-2087
mmelis@oag.state.va.us

**Counsel of Record for the State Building Code Office*

CERTIFICATE OF SERVICE

I certify that on November 19th, 2013, a true and accurate copy of the foregoing was forwarded by e-mail and by U.S. mail, first class, postage prepaid, to:

Milari Madison
40153 Janney Street
Post Office Box 302
Waterford, Virginia 20197
huntermadison2002@yahoo.com

Chris Thompson
Loudoun County Code Enforcement Division
1 Harrison Street
SE Mailstop #60b
Post Office Box 7000
Leesburg, Virginia 20177
Chris.Thompson@loudoun.gov

Gina L. Schaecher, Esq.
Rees Broome, PC
1900 Gallows Road, Suite 700
Tysons Corner, Virginia 22182
gschaecher@reesbroome.com

Eric Tompos
NTA, Inc.
305 North Oakland Avenue
Post Office Box 490
Nappanee, Indiana 46550-0490
tompos@ntainc.com

Mike F. Melis

TO:

Eric Leatherbury

The Report does not address the model of the house, only the stones.

Vernon -

For all appeals -

The Report concludes the house does Not meet code with respect to the joist hangers and joists that are visible.

He notes the stories of the house but not the model, 2 story cape.

ENGINEERING

LLM Engineering, PLLC
42996 Brookton Way
Ashburn, Virginia 20147
703-475-5921
703-729-8276 (fax)

December 26, 2013

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

Subject: **Report for Engineering Services**
40153 Janney Street, Waterford, VA 20197

Dear Ms. Madison:

I am pleased to submit this letter report of my structural observation at the subject site. This report includes a brief overview of the project information, a summary of my services, and the results of my evaluations.

Project Information

Project information was initially provided by Ms. Milari Madison on November 8, 2013. The subject site is located on 40153 Janney Street in Waterford, Virginia. A residence of modular construction located on the subject site. Reportedly, the residence was constructed in 2011. Problems associated with the (1) first floor joists and joists hangar, (2) floor vibration in the kitchen and dining room, and (3) house classification has been identified by Ms. Madison. Therefore, Ms. Madison requested that a professional engineer provide an opinion on why these problems exist.

Scope of Services

LLM Engineering, PLLC provided the following services:

1. Conducted two site visits to gather pertinent data and to observe the first floor framing system.
2. Prepared this written letter report which documents my observations and presents my evaluations, conclusions and recommendations.

References

1. Virginia Residential Code (2009)
2. ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, Reston, VA. (2005)
3. National Design Specification for Wood Construction with Commentary and Supplement (2005)
4. Simpson-Strong-tie Catalog, "Wood Construction Connectors 2011-2012" (2011)
5. ATC Design Guide 1 (1999) Minimizing Floor Vibration, Applied Technology Council.
6. Project Drawings approved by NTA, Inc. on July 14, 2011.

Observations

Kitchen Floor Framing

The first floor framing supporting the kitchen consists of ¾" oriented-strand board (OSB) plywood floor sheathing and nominal 2 x 10 wood floor joists spaced at 16 inches on-center spacing. The wood species and grade for the floor joists are Spruce-Pine-Fir (S-P-F), No. 2 (See Photo 1). The floor joists are attached to a 4-ply, 2x10 built-up wood beam at both ends. The built-up beam partially rests on W-section steel beam on one end and a W-section steel beam on the opposite end. The steel beams are supported by steel pipe columns. Simpson Strong-tie LUS-26 connects the floor joists to the built-up beams (See Photo 2).

Dining Area Floor Framing

The first floor framing supporting the dining area consists of ¾" oriented-strand board (OSB) plywood floor sheathing and nominal 2 x 10 wood floor joists spaced at 16 inches on-center spacing. The wood species and grade for the floor joists are a mixture of Spruce-Pine-Fir (S-P-F), No. 2 and Southern Pine (SYP), No. 2. The floor joists are attached to a 4-ply, 2x10 built-up wood beam at one end and a 2x sill plate which rests on a concrete basement wall on the opposite end. The built-up beam partially rests directly on a W-section steel beam. The steel beam is supported by steel pipe columns. Simpson Strong-tie LUS-26 connects the floor joists to the built-up beam.

Floor Vibration

The floor in both the kitchen and dining room was observed to vibrate unacceptably as a result of normal walking.

Residence Construction

The residence was observed to have a below grade basement and two floor stories above grade. A third occupied space was observed in the attic area.

Evaluations

I. Joist and Joist Hangars

An analysis was performed to determine if the first floor joists and joists hangars were adequate for the design loads. A review of the basement framing plan in Reference 6 indicated that the first floor joists are spanning four main areas. The four main areas have design span lengths of 15'-7", 15'-5", 13'-5" and 10'-6". Thus, each span length was investigated to determine if the floor joists and joist hangars are adequate to support the design loads.

1. Design Loading

The minimum design loading was determined by using the load combinations specified in the 2006 Virginia Residential Code and Minimum Design Loads for Buildings and Other Structures. The governing load combination included the dead load (D) and live load (L). The dead and live loads included the following:

A. Dead Load (D)

Hardwood Floor	= 4 PSF (Ref. 2)
¾" OSB Plywood Subflooring	= 3 PSF (Ref. 2)
2x10 Joists at 16" on-center	= 6 PSF (Ref. 2)
Mechanical and Electrical Allowance	= 4 PSF (Ref. 2)
TOTAL DEAD LOAD (D)	= 17 PSF
B. Live Load (L)	= 40 PSF (Ref. 1)

The live load (L) was taken from Table R301.5 (Minimum Uniformly Distributed Live Loads) for Rooms Other than Sleeping Rooms. Thus, the design dead plus live load used in the analysis was 17 + 40 = 57 PSF

2. Material/Component Properties

The material properties for 2x10 first floor joists and joist hangars included:

A. Spruce-Pine-Fir :
Bending Stress (F_b) = 875 PSI
Shear Stress (F_v) = 135 PSI
Modulus of Elasticity (E) = 1,400,000 PSI

The allowable stress values for the Spruce-Pine-Fir were taken from Reference (3). The published value of the allowable bending stress was increased by a repetitive member factor of 1.15 to account for the load distribution to the other floor joists as allowed by the National Design Specification for Wood Construction (Ref. 3).

B. Simpson Strong-Tie LUS-26 Joist Hangar: Allowable Load = 490 pounds (Ref. 4)

3. Capacity Analysis Results

A. Floor Joists

The results of the capacity analysis are listed in the Table 1. The analysis showed that the floor joists are adequate to resist the shear stresses for all four span lengths and the design live load deflection is well within the allowable deflection for each span length. However, the bending stresses for the 15'-7" and 15'-5" spans were approximately 32 and 30 percent greater than the allowable bending stress, respectively. The allowable bending stress for 13'-5" span was only approximately 2 percent greater than the allowable bending stress.

TABLE 1. Capacity Analysis Results

Span Length	f_b (psi)	F'_b (psi)	F_v (psi)	F'_v (psi)	Deflection (in)	Allowable Deflection (in)	Joist Reaction (lb)	Allowable Joist Reaction (lb)
15'-7"	1290	980	64	135	0.38	0.52	592	492
15'-5"	1270	980	63	135	0.37	0.51	586	492
13'-5"	960	980	55	135	0.21	0.45	510	492
10'-6"	590	980	43	135	0.08	0.35	399	492

B. Joist Hangars

As stated earlier, the joist hangars were observed to be LUS-26 and manufactured by Simpson Strong-Tie. The published allowable load for this joist hangar is 740 pounds for joist manufactured from Spruce-Pine-Fir (S-P-F) and if 3-inch long 10D nails are used (Ref. 4). To confirm if the specified nails were used, it was decided to remove one nail from three joist hangars. One joist hangar was selected for span lengths of 15'-7", 15'-5" and 10'-6". The nails were determined to be approximately 1-1/2 inches long. Thus, it was assumed that all the joist hangars were attached with 1-1/2 inch long 10 D nails. Simpson Strong-Tie allows the use of 1-1/2 inch long nails but the allowable load of the joist hangar needs to be reduced by a factor of 0.64. Based on this determination, the allowable load for the LUS-26 joist hangars with 1-1/2 inch long 10D nails is 492 pounds. Therefore, as shown in Table 1, the joist hangars in the 15'-7", 15'-5" and 13'-5" floor spans are not adequate to support the design loads.

<u>II. Floor Vibration</u>

The floor vibration analysis was conducted according to the recommended analysis procedure listed in Reference 5 and published by the Applied Technology Council. This procedure requires that the natural frequency of the floor system be computed. The natural frequency is a function of the downward displacement of the floor joists, supporting girders, and columns, if they are present. Floor Structures which have a natural frequency between 8 and 15 hertz (Hz) can develop unacceptable natural vibration caused by walking (Ref. 5). The unacceptable natural vibrations are displayed by jolts felt by occupants and rattling objects that they hear (Ref. 5). If the floor system is very light, in the case of a wood framed floor and its natural frequency is above 15 Hz, then the natural vibration will dissipate rapidly and the natural vibration can be acceptable (Ref. 5). In our case, the natural frequency for the floor systems supporting both the kitchen area and dining room area was determined to be 11.25 Hz and 14.81 Hz, respectively. Therefore, based on their calculated natural frequencies, unacceptable natural vibration should occur in these two floor areas as previously identified.

III. Residence Identification

It was also requested that the proper designation of the residence be determined. The residence is listed as a "Two Story" on the house plate. However, the house has a habitable space between the roof and second story. The 2009 Virginia Residential Code states that a story is that "portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above". The 2009 Virginia Residential Code also states that a habitable attic can be "finished or unfinished" and is not considered a "story". Also, the habitable attic must have "(1) an occupiable floor area greater than 70 square feet, (2) the ceiling height of the occupiable floor area must be at least 7 feet, and (3) the occupiable space is enclosed by the roof assembly above and the floor-ceiling assembly below". According to Ms. Madison, the space above the second floor was purposely designed to be habitable space. The plan shows an unobstructed staircase delineated as "up", from the second floor to the occupiable space above. Mr. Dave Pumphrey, who works in Loudoun County's Department of Building and Development, was contacted to determine the local jurisdiction's ruling. Mr. Pumphrey stated that if the space meets the requirement of a habitable attic then it cannot be classified as a "story".

Recommendations

Based on my observations, it is recommended that the capacity deficiencies in the floor joist and joist hangars for the identified spans be remedied as soon as possible. Also, based on my conversation with Mr. Dave Pumphrey, the house plate correctly identifies the house as a two story residence.

Limitations

LLM Engineering, PLLC was retained to perform structural observation services for the referenced property. The conclusions and recommendations presented in this report are based on personal interviews of persons knowledgeable about the facility, my field observations and my experience on similar projects. No construction material testing was performed. The discovery of any additional information concerning the referenced property should be reported to me for my review so that I can reassess potential impacts and modify my conclusions and recommendations, if necessary. The use of this report is for the sole use of Ms. Milari Madison. Reliance of this report by a third party requires the execution of a secondary client agreement. No other warranty, express or implied, is made.

Closing

I appreciate the opportunity to present this report. Following your review of this report, if you have questions or if I may be of further assistance, please do not hesitate to contact me.

Sincerely,
LLM Engineering, PLLC

Laurence A. Burley, Jr., Ph.D., P.E.
Principal/Manager

COMMONWEALTH OF VIRGINIA
LAURENCE ALBERT
BURLEY, JR.
Lic. No. 033575
12/26/2013
PROFESSIONAL ENGINEER

RB REES BROOME, PC
ATTORNEYS AT LAW

1602 Village Market Blvd., S.E., Suite 270
Leesburg, Virginia 20175
Phone: (703) 443-6605
Fax: (703) 779-2804
www.reesbroome.com
gschaecher@reesbroome.com

January 13, 2014

VIA ELECTONIC TRANSMISISON
& FIRST CLASS U.S. MAIL

Eric Leatherby
Sr. Construction Inspector II
State Building Codes Office
Department of Housing and Community Development
Main Street Centre
600 East Main Street, Suite 300
Richmond, Virginia 23219

Re: ***Consumer Complaint; Milari Madison v. Integrity Building Systems, Inc.***
Milton Home Systems, Inc.'s Response to January 8, 2014 letter

Dear Mr. Leatherby:

In response to your January 8, 2014 letter concerning Milari Madison's December 1, 2013 complaint ("12/01/13 Complaint"), Milton Home Systems, Inc. ("Milton") consulted with NTA, Inc. which served as the Compliance Assurance Agency with respect to the modular units that were delivered to Ms. Madison at her residence. Milton has reviewed NTA, Inc.'s January 10, 2014 letter to the Department of Housing and Community Development regarding Ms. Madison's December 1, 2013 Complaint and Expert Report dated December 26, 2013 ("NTA Response") and adopts and incorporates the NTA Response to address the allegations contained in the December 1, 2013 Complaint.

Enclosed herewith and incorporated herein by reference is the NTA Response and provided herein in response to your January 8, 2014 letter. We respectfully submit that the NTA Response fully and completely refutes the allegations contained in Ms. Madison's December 2, 2013 Complaint.

Should you have any questions, or should this matter require any further discussion, please kindly contact us at your earliest opportunity.

Respectfully,

Gina L. Schaecher
Counsel for Milton Home Systems, Inc.

GLS:lrw
Enclosure

cc: Milari Madison *via first class U.S. mail w/ enclosure*
Christopher Thompson *via electronic transmission w/ enclosure*
Cindy Davis *via electronic transmission w/ enclosure*
Michael Melis *via electronic transmission w/ enclosure*
Eric Tompos *via electronic transmission w/ enclosure*

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NTA INC.

ENGINEERS
PLANNERS
CONSULTANTS

305 NORTH OAKLAND AVENUE • P.O. BOX 490 • NAPPANEE, INDIANA 46550
WEB: WWW.NTAINC.COM

PHONE: 574-773-7975
FAX: 574-773-5739

January 10, 2014
IBS050213-11c

Department of Housing and Community Development
State building Code Administrative Office
600 East Main Street, Suite 300
Richmond, Virginia 23219

RE: MADISON COMPLAINT (DATED 12/1/2013) AND EXPERT REPORT (DATED 12/26/2013)

Pursuant to the request of the Department of Housing and Community Development, I have reviewed the report prepared by Laurence A. Burley, Jr., Ph.D., P.E., dated December 26, 2013. Based on my review, I have determined that Dr. Burley's findings are based on an evaluation containing numerous errors, and if these errors were corrected the evaluation would show that the floor system in the Madison residence is adequate and no remedial action is required. The errors in Dr. Burley's evaluation are detailed in the list below:

DESIGN SPANS AND APPLIED LOADS

1. Dr. Burley incorrectly determined the design spans of the joists to be 15'-7", 15'-5", 13'-5" and 10'-6". The spans used by Dr. Burley correspond to the module widths, which are greater than the joist span. The modules are constructed with a double 2x band joist on each side, as a result, the design span of the joist is 6-in. less than the module width. The correct spans are 15'-1", 14'-11", 12'-11" and 10'-0", respectively. This error in Dr. Burley's evaluation resulted in an overestimation of the bending stress by up to 10-percent.

2. Dr. Burley incorrectly estimated the dead load of the joists and decking as 9 psf. The dead weight considered by Dr. Burley considers the weight of the structural sheathing *twice* as the tabulated dead load provided in ASCE 7-05, Commentary Table C3-1, (Ref. 2 in the report) includes both the weight of joists, subfloor and underlayment. From the 2005 NDS (Ref. 3 in the report), a 2x10 SPF joist at 16-in. on-center has a dead weight of 2.0 psf. From the *APA D510C, Panel Design Specification*, 3/4-in. thick plywood, 24-in. o.c. rated Sturd-I-Floor (combination subflooring underlayment), has a dead weight of 2.3 psf. The total dead weight of the structural material in the floor system is 4.3 psf (2.0 psf + 2.3 psf), whereas Dr. Burley considers a dead weight of 9 psf for the same materials. This error results in overestimation of the dead weight by 109-percent for these components.

3. Dr. Burley incorrectly adds a "Mechanical and Electrical Allowance" in the dead load calculation. This "allowance" is not required by code and is not warranted in residential construction where the actual weight of the supported mechanical and electrical equipment is very small. Pursuant to ASCE 7-95, Section 3.1.2, "In determining dead loads for purposes of design, the actual weights of materials and constructions shall be used..." As previously determined (Item 2), the actual weight of the structural materials in the floor is 4.3 psf. The original design considers a dead load of 10 psf, which provides 5.7 psf for finish materials, mechanical and electrical.

4. Dr. Burley incorrectly designs the floor for a total uniform load of 57 psf. Standard practice within the modular industry is to design light-framed residential floors in living areas for a 10 psf dead load and a 40 psf live load, which results in a total design load of 50 psf. The overall error in Dr. Burley's design load estimation due to the errors described in Item 2 and Item 3 is an overestimation of the total design load by 14-percent.

FLOOR JOISTS

5. Dr. Burley incorrectly determines the allowable stress for Spruce-Pine-Fire lumber. Pursuant to the *2005 National Design Specification for Wood Construction Supplement* (NDS/Ref. 3 in the report), Table 4A, the *Size Factor*, C_F, for 2x10 SPF No.2 lumber under flexural stress is 1.10. The correct allowable bending strength, F'_b, is 1107 psi (875 psi (F_b) x 1.15 (C_r) x 1.10 (C_F) = 1107 psi). This error results in underestimation of the allowable flexural strength, F_b', by 10-percent.

6. Dr. Burley has a calculation error in "Table 1, Capacity Analysis Results," column "F'_b." The bending stress, F'_b, presented in the table is 980 psi. This value is incorrect and does not correspond to the tabulated bending stress (875 psi) multiplied by the repetitive member factor (1.15), as described the report. Excluding the error described in Item 5, Dr. Burley should have calculated F'_b = 1006 psi (875 psi x 1.15 = 1006 psi). The errors described in Items 5 and 6 result in an underestimation of the allowable bending stress by 11-percent.

7. Dr. Burley incorrectly determines the applied shear load at the ends of the joists in "Table 1, Capacity Analysis Results," column "F_v." Pursuant to the *2005 National Design Specification for Wood Construction Supplement* (NDS/Ref. 3 in the report), Section 3.4.3.1, the "...uniformly distributed loads within a distance from supports equal to the depth of the bending member, d, shall be permitted to be ignored..." Dr. Burley's analysis does not ignore the load within *d* of the supports when determining the shear force. This error results in overestimation of the joist shear stress by up to 24-percent.

8. Dr. Burley has a calculation error in "Table 1, Capacity Analysis Results," column "Deflection." The tabulated deflection values are incorrect and appear to be based on a joist spacing of 12-in. on-center, whereas the joists are installed at 16-in. on-center. This error results in underestimation of the deflections by 25-percent.

9. Dr. Burley incorrectly concludes that the joists are overstressed in bending. Correcting the errors identified in Items 1 through 4, the applied bending stress, fb, is 1064 psi for a joist spanning 15'-1" spaced 16-in. on-center. Correcting the errors identified in Items 5 and 6, the allowable bending stress, F'_b, of a 2x10 SPF, No. 2 is 1107 psi, which is greater than 1064 psi. Therefore, the floor joists in the Madison residence are adequate and no remedial action is required. Alternately, the joists may be justified using the prescriptive tables in the *2009 Virginia Residential Code.* In the code, Table R502.3.1(2) (attached), permits a 16-in. on-center, 2x10 SPF, No. 2, to span 15'-5" under 10 psf dead load and 40 psf live load. The tabulated span permitted by the code exceeds the maximum design span in the Madison residence which is 15'-1"; therefore, the floor joists are acceptable and conform with the *2009 Virginia Residential Code.*

JOIST HANGERS

10. Dr. Burley incorrectly determines the capacity of the Simpson LUS26 joist hanger as 492 lbf. The reduction factor of 0.64, provided in Simpson's catalog (Ref. 4 in the report), does not apply to joist hangers that utilize "double shear nails." As detailed in NTA's letter regarding "Madison Appeal of DHCD 9/23/2013 Letter Item #4," dated 11/11/2013, the installed capacity of the LUS26 joist hanger is 328 lbf. This error in the analysis results in overestimation of the hanger capacity by 50-percent.

11. Dr. Burley incorrectly determines the total strength of the rim joist-to-joist connection. As provided in Milton's design manual, and in accordance with standard construction practice in the modular industry, end-nails were installed at this connection *in addition to* the joist hanger. As detailed in NTA's letter regarding "Madison Appeal of DHCD 9/23/2013 Letter Item #4," dated 11/11/2013, the end-nailing consists of (5) 0.131" x 3" end nails, which provide a strength of 275 lbf *in addition to* the strength of the LUS26 joist hanger. The resulting total connection strength is 603 lbf (275 lbf + 328 lbf = 603 lbf). This error in Dr. Burley's evaluation results in underestimation of the total connection strength by 29-percent.

12. Dr. Burley incorrectly concludes that the joist hangers are not adequate to support the design loads. Correcting the errors identified in Items 1 through 4, the maximum joist end reaction is 509 lbf. Correcting the errors identified in Items 10 and 11, the allowable connection strength is 603 lbf, which exceeds the maximum applied load of 509 lbf; therefore, the joist end connection is adequate.

FLOOR VIBRATION

13. Dr. Burley incorrectly concludes that the joists are unacceptable due to vibration. The vibration analysis performed is not a requirement of the *2009 Virginia Residential Code*. The *2009 Virginia Residential Code*, Table R502.3.1(2), permits a 16-in. on-center, 2x10 SPF, No. 2, to span 15'-5" under 10 psf and dead load and 40 psf live load. The tabulated span permitted by the code exceeds the maximum design span of 15'-1"; therefore, the floor joists are acceptable and conforms with the *2009 Virginia Residential Code*.

DATA PLATE

14. Dr. Burley asserts that "...the house plate correctly identifies the house as a two story residence." This conclusion is correct and in concurrence with NTA opinion on this matter.

As detailed herein, the evaluation performed by Dr. Burley contains numerous errors, which led to incorrect conclusions regarding the adequacy of the floor system. If the errors in Dr. Burley's analysis were corrected, his evaluation would show that the floor system in the Madison residence is adequate and no remedial action is required. The original design documents submitted to NTA, Inc. were justified using the prescriptive span tables found in the *2009 Virginia Residential Code* (attached), which clearly show that the floor system conforms with the code.

Respectfully,

Eric J. Tompos, PE, SE, CBO
NTA, Inc.

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/Δ = 360)[b]

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)
12	Douglas fir-larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas fir-larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas fir-larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas fir-larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	18-5	22-5
	Southern pine	#2	10-9	14-2	18-0	21-9	10-9	14-2	16-11	19-10
	Southern pine	#3	9-4	11-11	14-0	16-8	8-6	10-10	12-10	15-3
	Spruce-pine-fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-pine-fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas fir-larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas fir-larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas fir-larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas fir-larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern pine	#1	9-11	13-1	16-9	20-4	9-11	13-1	16-4	19-6
	Southern pine	#2	9-9	12-10	16-1	18-10	9-6	12-4	14-8	17-2
	Southern pine	#3	8-1	10-3	12-2	14-6	7-4	9-5	11-1	13-2
	Spruce-pine-fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-pine-fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#2	9-4	12-3	$\boxed{15-5}$	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
19.2	Douglas fir-larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas fir-larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas fir-larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas fir-larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern pine	#1	9-4	12-4	15-9	19-2	9-4	12-4	14-11	17-9
	Southern pine	#2	9-2	12-1	14-8	17-2	8-8	11-3	13-5	15-8
	Southern pine	#3	7-4	9-5	11-1	13-2	6-9	8-7	10-1	12-1
	Spruce-pine-fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-pine-fir	#	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas fir-larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas fir-larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas fir-larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas fir-larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10[a]
	Hem-fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-1
	Southern pine	#1	8-8	11-5	14-7	17-5	8-8	11-3	13-4	15-11
	Southern pine	#2	8-6	11-0	13-1	15-5	7-9	10-0	12-0	14-0
	Southern pine	#3	6-7	8-5	9-11	11-10	6-0	7-8	9-1	10-9
	Spruce-pine-fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-pine-fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

a. End bearing length shall be increased to 2 inches.

b. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D_0, D_1, and D_2 shall be determined in accordance with Section R301.2.2.2.1.

Terence R. McAuliffe
Governor

Maurice A. Jones
Secretary of
Commerce and Trade

COMMONWEALTH of VIRGINIA

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

William C. Shelton
Director

January 14, 2014

Ms. Milari Madison
40153 Janney Street
Waterford, VA 20197

Dear Ms. Madison,

I am in receipt of the Industrialized Building Consumer Complaint form that you submitted to this office dated December 1, 2013 and also an engineering report dated December 26, 2012 that you submitted regarding the floor system in your home. According to your complaint, you seek "enforcement of IBSR (36-73) against Integrity Building Systems, Inc., now doing business as Milton Home Systems, Inc. (hereinafter "Milton"). The complaint involves your home which is a Virginia registered industrialized building manufactured by Milton on July 14, 2011.

The State Building Codes Office (SBCO) has been designated by the Virginia Department of Housing and Community Development (DHCD) to enforce the Virginia Industrialized Building Safety Regulations and acts as the building official for registered industrialized buildings.

Specifically the complaint involves the two issues listed below:

1. ***Complaint - "Floor joists under kitchen violate code". "Floor joists are too long for load and for wood species type".***

SBCO response – At the request of the SBCO, the Loudoun County Department of Building and Development performed an inspection of the kitchen floor joists and reported that the joists are 2"x10", #2 Spruce-Pine-Fir (SPF) spaced 16" o.c. and spanning a distance of 15 feet 1 and ¼ inches. Please be advised that Table R502.3.1(2) of the 2009 edition of the Virginia Residential Code (IRC) allows a 2"x10" #2 SPF floor joist spaced 16" o.c. and designed for a live load of 40 psf and a dead load of 10 psf to span 15 feet 5 inches. Please see the attached response from Milton Home Systems, Inc. and the engineering data from NTA, Inc. Based on the above information the SBCO determines the sizing of the floor joists to be in compliance with the IRC.

2. ***Complaint – The Virginia registration seals and the Compliance Assurance Agency (CAA) labels were applied to the home prior to the plans being approved by the CAA.***

SBCO response – It is common in the industrialized building industry to begin construction of a structure prior to the plans being approved by the CAA. In these cases, the plans have already been prepared by the manufacturer and the CAA inspectors use those plans as a basis for conducting inspections during the production process. The modules are red-tagged by the CAA until the plans are approved by the CAA. If discrepancies are noted between the approved plans and the as built structure, the manufacturer is required to take corrective action to bring the structure into compliance with the approved plans.

Please note that the data plate applied to your home identifies the home as being manufactured on July 14, 2011. The CAA approval stamp on the plans is also dated July 14, 2011. The CAA inspection report dated July 13, 2011 identifies the Virginia seals that will be issued for the home. The CAA inspection report dated July 14, 2011 releases the red-tag and notes that plans were approved (see attached). Therefore the SBCO has determined there is no violation in the manner that the modules were inspected and that CAA properly followed procedures for red-tagging the modules prior the plans being approved, and properly released the red-tags when the plans were approved by the CAA.

For the reasons stated above, we have determined that there are no violations of the Industrialized Building Safety Regulations related to this complaint.

Pursuant to section 13 VAC 5-91-70 of the Virginia Industrialized Building Safety Regulations any person aggrieved be the Department of Housing and Community Development's (DHCD) application of this chapter shall be heard by the State Review Board established by §36-108 of the Code of Virginia. Such appeal shall be submitted within 21 calendar days of receipt of DHCD's decision. A copy of the decision of DHCD to be appealed shall be submitted with the application for appeal. Failure to submit an application foe appeal within the time limit established by this section shall constitute acceptance of DHCD's decision. For your convenience, I have enclosed an application.

Please feel free to contact me at 804-371-7150 or by email at cindy.davis@dhcd.virginia.gov if you have any questions regarding this matter.

Sincerely,

Cindy L Davis

Cindy L. Davis, C.B.O., Director
State Building Codes Office
600 E. Main Street – Suite 300
Richmond, VA 23219

cc: Emory Rodgers, Deputy Director
Mike Melis, OAG
Gina L. Schaecher, Counsel to Milton
Eric Tompos, P.E., NTA, Inc.

Milari Madison
40153 Janney Street
Box 302
Waterford, VA 20197
tel 540-882-3160

FEB - 4 2014
AM
OFFICE OF THE ... BOARD

February 2, 2014

Re: Appeal to January 14, 2014 Davis Letter

Comes now, Milari Madison, proceeding *pro se*, and respectfully asks the Review Board ("TRB") to overturn the January 14, 2014 Davis Letter pursuant to § 36-114 and to provide the requested relief.

As stated in *Kenley v. Newport News General & Non-Sectarian Hosp. Ass'n, Inc.*, 227 Va. 39, 44, 314 S.E.2d 52, 55 (1984), the court held that "[T]he 'heart' of a case decision 'is a fact determination respecting compliance with law." Ms. Davis made a fact determination and decided that Milton was in compliance with the law, that no law was violated. In *Randall A. Strawbridge and State Building Code Technical Review Board v. County of Chesterfieild, Virginia. Court of Appeals of Virginia, Richmond* (November 19, 1996), quoting *Daniels v. Truck & Equip. Corp.*, 205 Va. 579, 585, 139 S.E.2d 31 (1964), the Court held "[a] final order is one which disposes of the whole subject, gives all the relief contemplated ... and leaves nothing to be done in the cause....", and as such, "...[t]hat ruling was a final determination." Ms. Madison asserts that the Davis Letter disposed of the whole subject leaving a timely and ripe appeal now filed within the twenty one day time period set forth in the January Davis Letter.

DHCD is responsible for hand-picking Compliance Assurance Agencies ("CAA"), such as NTA, Inc. ("NTA"). In this matter, NTA served as the CAA. 13 VAC 5-91-250 states, in part, that any industrialized building must meet the following requirement to be registered and eligible for a Virginia registration seal: "[T]he design of the building has been found by a compliance assurance agency to be in full compliance with this chapter. Approved designs shall be evidenced by the stamp and date of approval on each design sheet by the compliance assurance agency."

The Madison modular house was shipped with substantive and costly building code violations, ***none*** of which have been corrected utilizing an approved design sheet, evidenced with a stamp, as prepared by an independent CAA (*see* photos at Exhibit 1) by the responsible party. The documented code violations and deviations to the approved plan caused by Milton and NTA include, but are not limited to:

1. inadequate headroom from the second floor to the third floor (no correction to the code violation per an approved plan by a CAA has been completed by Milton);

2. inadequate headroom from the first floor to the second floor (no correction to the code violation per an approved plan by a CAA has been completed by Milton, as agreed);

3. the chimney chute and reinforcement of the floor and roof to support the brick were inadequate, deviate from the correction plan provided by Mr. O'Toole (not a CAA) and without approval by Ms. Madison or the CAA;

4. no joist hangers under portions of the family room were installed, code violation;

5. an improperly installed joist hanger under the den was installed, code violation;

6. a redesign of the west wall to close a 6"- 8" open gap and to support the brick were not approved in writing by Ms. Madison;

7. the redesign of the west eave overhang are without an approved plan for correction by a CAA;

8. the data plate is incorrect, the model is a two story cape, not a two story (*see* Exhibit 2 for comparison), the electric system is misidentified (it is 400 amp, not 200 *see* Exhibit 3), the square footage shown on the data plate is wrong, the R value calculation is wrong;

9. no blocking was installed where the foundation and the first floor meet leaving open gaps to the outside;

10. stairs installed through a factory repair work order from the kitchen to the den did not meet code;

11. the manufacturer's installation instructions were not followed to set the house by the factory;

12. the roof truss system failed to follow the manufacturer's report (*see* Exhibit 4);

13. the chimney chute built by the factory failed to meet code and the fireplace manufacture's installation instructions were not followed, although NTA affirms all manufacturer's installations recommendations will be followed;

14. the west wall along the kitchen to the den is significantly different and has a

bump out in the plane;

15. the interior kitchen pantry door has a header impeding access into the closet;

16. Milton asked in writing for the height of stairway from the kitchen to the den below, unaware of the height that should be obtained from the approved plan (the plan was not followed by Milton and does not accurately reflect actual stair height);

17. the roof eave overhangs are different in length (*see* photos);

18. the width of the kitchen stairs to the lower den are more narrow than shown in the plan;

19. the approved plan states the house meets code but it does not as noted above;

20. the plan does not show openings to the outside where the units cantilever over the foundation, the plan prepared by Milton;

21. the joists and rim band on the plan, under the kitchen show a distance of 181" not the actual distance of 181.25", causing the joists to *not* sit on the steel beam and to cantilever over the steel beam;

22. the roof plans, per the truss manufacturer (*see* report), are different than what was actually built, shipped, installed and corrected by Milton;

23. the chimney chute and reinforcements are inconsistent with the approved plan;

24. the window sizes in bedroom three and the sunroom are different;

25. the transom above the outside door is three pane, but shown as 4 pane on the drawings; and

26. the Approved House Document fails to show humps and rolls in the roof, walls

and floors, but instead straight, level and plumb lines, a deviation.

In short, what is shown in the Approved House Document, as stamped as meeting code, is different than what was built and delivered with deviations caused by Milton and NTA.

Although required under 13 VAC 5-91-10, the CAA is supposed to ensure that buildings are in "full compliance" with the code, and in this case, the CAA failed to do their job. It is unclear why the SBCO has not issued a notice of violation against the CAA as provided within the IBSR. Under Virginia Code § 36-79, the effect of a label of a compliance assurance agency provides that "[a]ny industrialized building shall be deemed to comply with the standards of the Board when bearing the label of a compliance assurance agency". Clearly, both NTA and Milton failed to comply with the standards and procedures, while causing and overlooking building code violations. Ms. Madison filed a lawsuit against Milton, NTA, and Mr. McNutt (Milton's dealer/agent/builder). Ms. Madison has been award a judgment against Mr. McNutt in the amount of $264.609.29. Mr. McNutt, unlicensed and uninsured, while held out by Milton as being well-vetted and performing in compliance with the law, now lives in Texas and appears to have few assets.

In order to serve as a CAA, NTA attests to the state they will "resolve all complaints" but has not. The IBSR requires that NTA be independent. NTA is not only a named defendant in ongoing litigation, their contract with Milton provides NTA with full indemnification. NTA has been utilized by Milton to serve as a consultant for discovery in the immediate litigation and has been identified to possibly appear as Milton's expert at the trial. Instead of resolving all complaints, NTA has sent a number of e-mails that are contrary to the professional work of an independent engineering firm.

David Tompos
To Me Alan.McMahan@dhcd.virginia.govcindy.davis@dhcd.virginia.gov and 4 More...
Oct 25, 2013

To be clear, NTA does not think we are a necessary party.

We are tired of the harassment.

I think we should let the courts decide. **We will not take any action until we are properly directed to do so by the courts.**

Thank you,

David A. Tompos
President
NTA, Inc.
www.ntainc.com
(574) 773-7975 ext 302
(574) 903-9584 cell

David Tompos
To Meralph@cowleslaw.comGSchaecher@reesbroome.com and 7 More...

Nov 11, 2013

Milari,
Please copy Eric Tompos at etompos@ntainc.com on all your emails. Also, please send us a copy of your engineer's report and his license information.

Thank you,
David Tompos

David Tompos

To MeEric Tomposralph@cowleslaw.com and 7 More...
Nov 13, 2013

Milari, do you want us to contact you or not? **It is like you have a split personality.** One day you want our help, which we tried to provide in the beginning, the next you want to bring up criminal charges. What do you want? Today you want our emails.

Please, please send your engineers report. We can't wait.

Sent from my iPhone

David Tompos
To Mebill.shelton@dhcd.virginia.govMike F. and 7 More...
Dec 3, 2013

I'm not conceding anything. As usual, you only hear what you want to hear. I **know the English language is difficult for you**, but that was a question. **I was poking fun at your absurd notion that a paid professional engineering is not independent.** As far as I know all professionals are paid.

You keep bringing up pending litigation. What are you talking about? The only thing pending is that you disagree with the courts decision that you have no case against NTA. I doubt anyone is surprised that you disagree with the courts.

There are no code violations in your home. Until you provide evidence of a code violation I think you should stop harassing us and wasting the states time. We have tried to help you up to this point, but this is getting ridiculous.

I found out yesterday that you verbally threatened Eric Tompos when he was at your home by asking if he had insurance and then saying you would "chase him through the gates of hell"

I can be nice and try to help you until you threaten my family.

David

David Tompos
To MeLeatherby (DHCD)bill.shelton@dhcd.virginia.gov and 8 More...

Dec 18, 2013

Maliri,

Please stop including anyone from NTA or our attorney from any correspondence. We would only like to hear from the state. Any additional communication from you will be considered harassment.

If your attorney would like to contact us he can do so via registered mail.

Merry Christmas,

David Tempos

It should be noted that NTA made unfounded and unsubstantiated statements that are disparaging, including the fact that they tried to help in the beginning. What help? For the purpose of the January 14 Appeal, the SBCO has erroneously relied on a defective report *ab initio* from a defendant. The NTA report violates the requirements prescribed under the law for such documents at 18VAC10-20-760, use of seal. The code requires that "[a]n appropriately licensed or certified professional **shall apply** a seal to final and complete original cover sheets of plans, drawings, plats, **technical reports and specifications** and to each original sheet of plans, drawings or plats, prepared by the professional or someone under his direct control and personal supervision. **The seal of each professional** responsible for each profession **shall be used and shall be on each document that was prepared under the professional's direction and for which that professional is responsible**. Application of the seal and signature indicates acceptance of responsibility for work shown thereon."

For reasons unknown, NTA failed to seal the report in violation of the law. The report from Dr. Burley is sealed and should be considered by the TRB and SBCO.

The NTA report and specifications state a span is 15' 1". The as-built measurement taken by Chris Thompson, with Loudoun County is 181.25", which is a deviation from the House Approval Document and contrary to the length stated by NTA. The additional .25 inch causes the rim band and joist hangers for the module to cantilever over the steel beam although shown to be on the beam in the Approved House Plan.

> Thompson, Chris
> To Leatherby, Eric (DHCD)Davis, Cindy (DHCD)Me
> Jan 3, 2014
>
> Eric,
>
> The floor joists are 15 feet 1 and ¼ quarter inches long. (181.25 inches). I have attached a copy of the Engineers report and a photo of the lumber species.
>
> Thanks,
>
> Chris
>
> Chris Thompson
> Code Enforcement
> Building and Development
> County of Loudoun County
> Virginia
>
> 703-771-5527
> Chris.Thompson@Loudoun.gov

Simpson Strong Tie states the joist hangers used by Milton and approved by NTA are inadequate. In other words, Milton failed to follow the manufacturer's installation guidelines as NTA affirms will be done.

Sam Hensen
To Me

Oct 9, 2013

Ms. Madison,

The attachment you sent was for the shearwall calculations. It does not include any information on the hangers in question. However, I see that on ~~the plans you sent earlier, a hanger is called out at the floor joist (see excerpt~~ below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be 20 psf for this application. Thus the total demand load on the ~~hanger is 60 psf, and it would be calculated as follows:~~

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately 60 psf x 1.33 ft. x 15.75 ft. / 2 = 628 lbs.

The LUS26 hanger is rated for 865 lbs., but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (**we do not permit this nail in our hanger**), the allowable load for the hanger will drop to 419 lbs. (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. **Thus the allowable load for the hanger as installed is less than the demand load. 628 lbs. < 419 lbs.**

Hope that information helps. I recommend you hire a forensics engineer to assist you with this issue. Simpson Strong-Tie does not get involved in litigious issues like this situation.

Thank You,

Sam Hensen, P.E. | Engineering Manager, Southeastern US |
Simpson Strong-Tie | 2221 Country Lane | McKinney, TX
~~75069~~ | 972.439.3027

It has been admitted by Milton and NTA in open court that the house was built without the benefit of an approved plan. The necessary NTA evaluation and testing could therefore not occur utilizing the approved plan because it did not exist. The date of the approved plan and the release date of the units, both allegedly being July 14, 2011. The TRB should subpoena the records to understand the date and time the house was released, when built, and to ascertain whether or not it was physically inspected by NTA, and when.

The Davis Letter assumes that what NTA says in the unlawfully prepared engineering report, is somehow to be believed. By way of background, Milton first told DHCD they were out of business, which DHCD believed and decided not to issue a NOV. Milton told DHCD that the stairs from the second floor to the third floor were installed on-site and therefore were not a violation to the IBSR. After months of proving otherwise, DHCD reluctantly accepted the evidence. NTA stated the house met code but did not and currently does not. Now, we turn to DHCD's reliance on the NTA report procured by Milton, both defendants in lengthy litigation.

NTA overlooked several substantial building code violations. NTA's report is predicated on the fact that additional nailing of the rim joist and joist hangers actually occurred. This is a mere presumption improperly relied upon by the SBCO who did not make such an evaluation herself, nor did she view the conditions. Once again, DHCD has accepted the story as one of truth without supportive documentation and inspection reports that such additional nailing occurred. The TRB is asked to subpoena the records and witnesses from Milton and NTA to ascertain whether the alleged additional nailing occurred, when NTA actually inspected the additional nailing before or after the modules were red-tagged because Milton improperly built them without an approved plan.

The Approved House Document is dated July 14, 2011 and was not approved by Ms. Madison. Under the House Contract and Milton Performance Agreement, the house was to be manufactured, delivered and set, as a "finished building" under the IBSR definition of an industrial building (*see* § 36-71.1).

The Davis Letter states that on July 13, 2011, the NTA inspection report merely "**identifies** the Virginia seals that *will be* issued for your home". **This materially false determination and recasting can be overcome by actually reading the July 13, 2011 NTA Inspection Report** (see Exhibit 5). The report states **"ISSUED FOLLOWING LABELS"**, not will be issued as the Davis Letter improperly advises. Further, according to NTA's own Label Transaction Search, obtained through Discovery, the labels identified for the Madison units were "released" on 6/29/2011 (*see* Exhibit 6, page 5) and entitled as a file called "Labels **Released** to IBS.pdf". 6/29/2011 also contradicts the Davis "will be issued" date.

Worse, on July 13, 2011 at 4:44 p.m., Mr. Richard Rowe, then allegedly co-owner of Integrity Building Systems (now Milton, a shell company to defend the litigation), sends an e-mail to NTA stating, "Ryan, Please email Chris a copy of the cover sheet. I am going to forward him pictures of the repairs so he can release the modules for shipment" (*see* Exhibit 7). It should be noted Chris is/was employed by NTA and is the person identified as having performed the inspections). This correspondence suggests that that Chris Lehman, did not inspect and perform the necessary testing for the module units against the actual Approved House Document of July 14, 2011 but, at best, relied on pictures of "repairs". How could he have released the units based on evaluation and testing as a result of an emailed "cover sheet" and "pictures of repairs". NTA was supposed to evaluate the units based an an entire Approved House Document consisting of 94 pages. The TRB should subpoena Mr. Lehman to understand when and how he allegedly completed testing of the units and released the labels without having the Approved House Document completed to compare against (*see* 13 VAC 5-91-245 which states the manufacturer shall maintain copies of the data plate and reports of inspection, tests and any corrective action taken for a minimum period of 10 years from the date of manufacture of the building). Further, had Mr. Lehman actually inspected the modules, first hand, it would be nothing more than unconscionable to overlook the code violation for the stairs from the second floor to the third floor that ran into the roof. It would be obvious that the house as built is actually a two story cape as previously approved by NTA for Milton to build. The PDF file for Exhibit 8, obtained through a motion to compel from NTA's lawyer on December 23, 2013, is entitled "2 Story cape.pdf". The two story cape properly shows the stairs going from floor two to floor three (*see* Exhibit 8) just as in the Madison house where the stairs from floor two are shown to go "up".

In the Davis Letter, the SBCO states "it is common in the industrialized building industry to begin construction of a structure prior to the plans being approved by the CAA". It may be "common" but it is improper. NTA purports they will ensure that "approved designs will be made available prior to construction" (R-23), that design documents are followed, and that manufacturer's installation instructions and guidelines are met. The SBCO further notes that if there are discrepancies between the approved plan and the as built structure, the manufacturer is required to bring the structure into compliance with the approved plan. Many deviations were not reconciled as seen in the photographs and listed above numbers 1 – 26, nor were the complaints fully resolved.

Requested Relief:

1) The TRB should require that all deviations from the plan agreed to by Ms. Madison, assumed by Milton under the Milton Performance Agreement and the IBSR, are reconciled so the Approved House Document, and the corrections and alterations made by Milton, are an accurate reflection of what was actually built as the SBCO suggest is supposed to be done, and is sealed by an independent CAA;

2) that all code violations are corrected in compliance with an approved plan by an independent CAA and in an acceptable manner to Ms. Madison at the expense of the responsible party;

3) that the data plate is corrected to properly reflect the square footage, amperage serving the house, model of house, and R-value; and

4) that the manufacturer's installation instructions are fully complied with as NTA affirms is the requirement and standard they, as the original CAA, mandates, and in compliance with 13 VAC 5-91-80 (the manufacturer of a registered industrialized building shall be required to remedy violations caused by on-site work under his control) and 13 VAC 5-91-270 (persons or firms erecting registered industrialized buildings shall

install or erect the building in accordance with the manufacturer's instructions).

Respectfully submitted by:

Milari Madison

Exhibit 1


Picture "1" west roof gable

Picture "2" west overhang, after Milton rebuild


Picture "3" west overhang after Milton rebuild

Picture "4" hole in sheathing, roof ZIP board curling, failed to deliver weather tig


Picture "5" misaligned overhang, west wall, hole in sheathing


Picture "6" misaligned overhang, west wall. Inconsistent with Approved House Documer

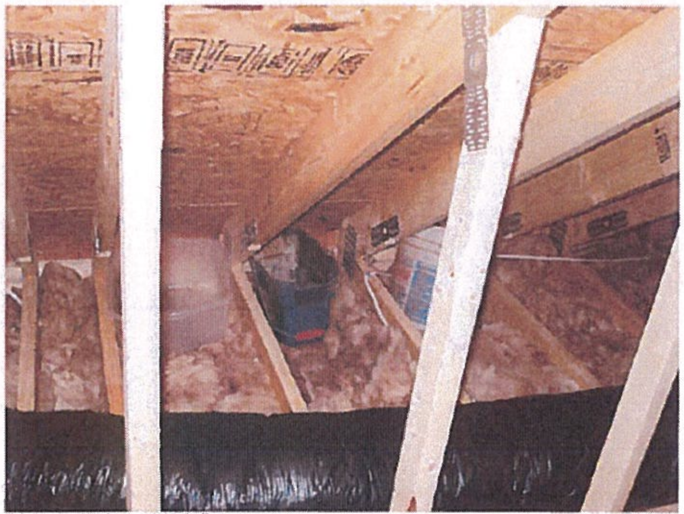
Picture "7" stair opening from second floor to third floor, wall demolished along stair case by Milton, no thermal envelope per Installation Systems and Procedures manual. **CODE VIOLATION** "The stairway to the third floor did not meet the requirement of section R311.5.2 Headroom and R311.5.4 Landings for Stairways. There are temporary guards that do not meet the requirements of section R312.1 Guards" Loudoun County Code Official.

Picture "8" stairs to third floor after **Milton** demolished wall to right without approval or an approved plan by a CAA. Inconsistent with Approved House Document. House as built is a 2 story cape.

Picture "9" third floor, no headroom clearance.

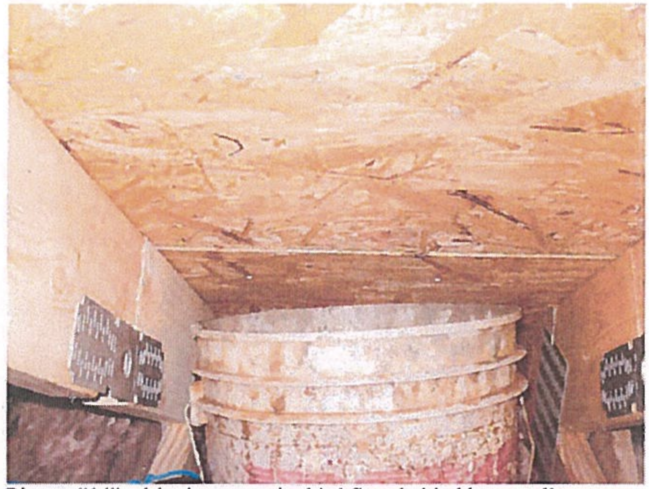
Picture "10" third floor, no thermal envelop, no headroom, unguarded opening. Inconsistent with Approved House Document. House as built is a 2 story cape.

Picture "11" water damage to ceiling and wall below stairs to third floor, temporary guard to stairwell down to first floor installed by Madison to prevent injury. "Decent, safe, and sanitary dwelling" includes, in part, that a dwelling "is weather tight" (§ 36-106).

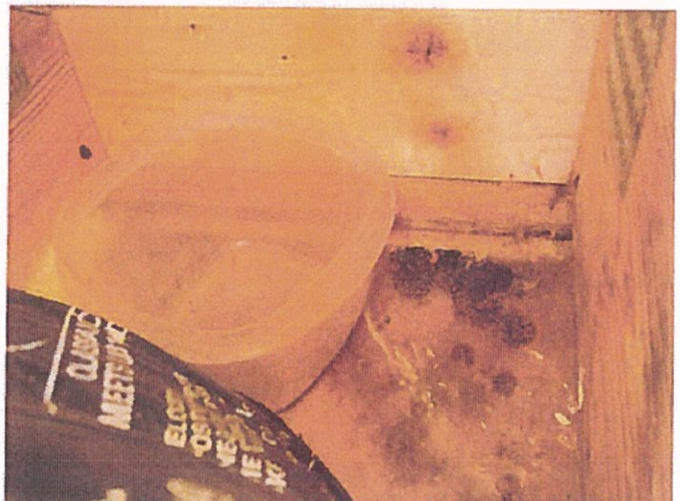


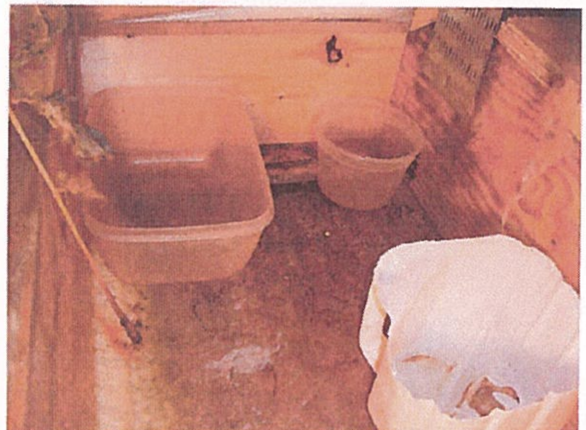
Picture "12" third floor/attic, behind knee wall, no thermal envelope, water containers prior to removal of insulation. "Decent, safe, and sanitary dwelling" includes, in part, that a dwelling "is weather tight" (§ 36-106).

Picture “13” dripping water in third floor, behind knee wall



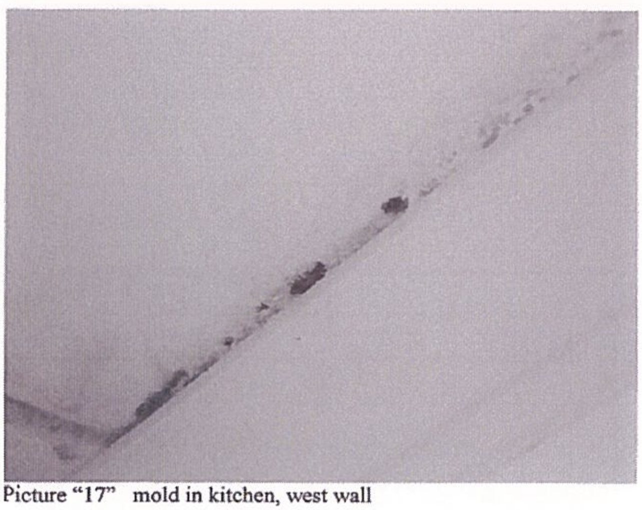
Picture “14” dripping water in third floor behind knee wall



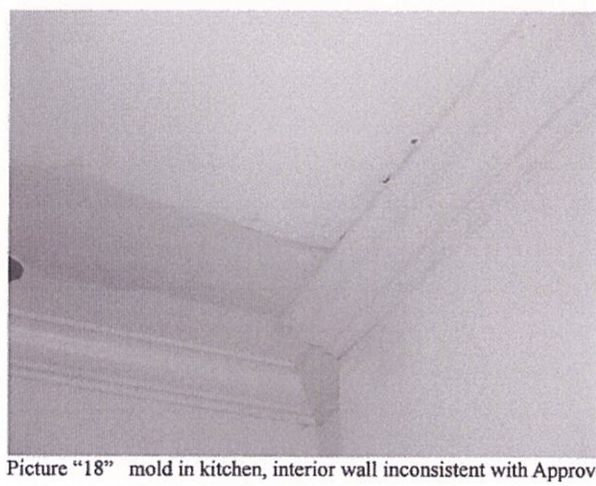


Picture “16” insulation removed from third floor knee wall, mold, above bedroom #2. "Dec safe, and sanitary dwelling" includes, in part, that a dwelling “is weather tight” (§ 36-106).

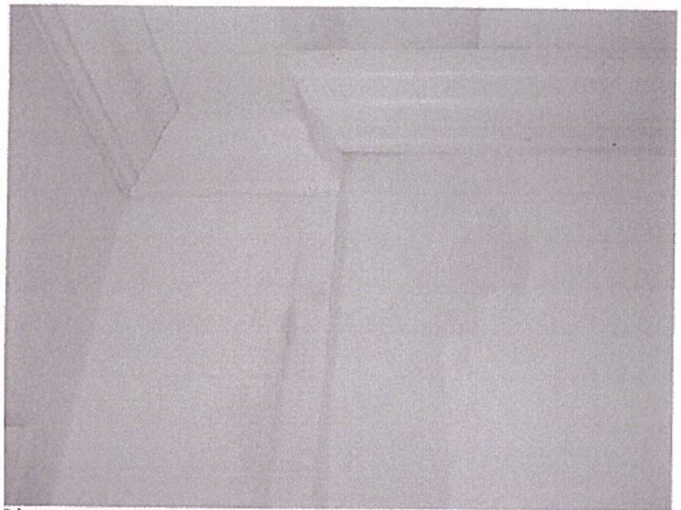
Picture “15” saturated insulation removed from third floor behind knee wall, mold



Picture “17” mold in kitchen, west wall



Picture “18” mold in kitchen, interior wall inconsistent with Approved House Document pla

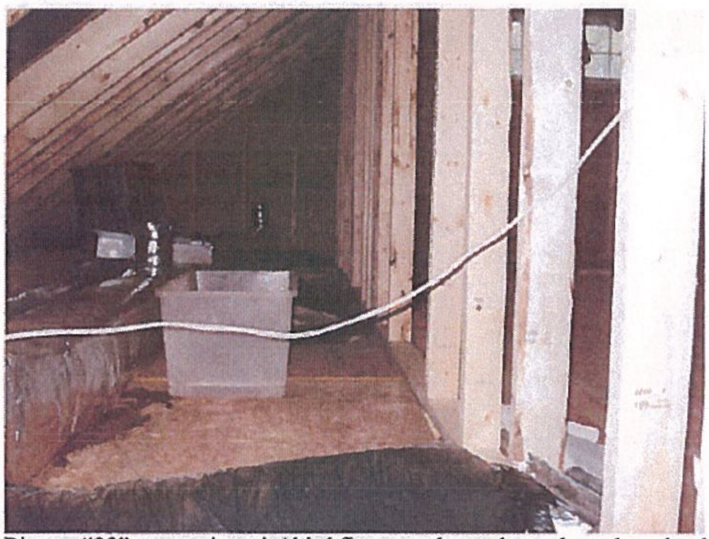


Picture "19" mold in kitchen, west wall bumped out inconsistent with approved plan in violation of contract paragraph 10.

Picture "20" mold, bedroom 3. "Decent, safe, and sanitary dwelling" includes, in part, that a dwelling "is weather tight" (§ 36-106).

Picture "21" water dining room floor


Picture "22" left side of wall up to attic/third floor not flush with interior wall and door entry to bedroom # 3. Inconsistent with Approved House Document.


Picture "23" water in attic/third floor, no thermal envelope, hanging hot electric wire from demolished wall by Milton.


Picture "24" water in basement below sunroom


Picture "25" water in sunroom

Picture "26" dormer in attic does not meet roof (black tape not sheathing), no thermal envelope. Inconsistent with Approved House Document.

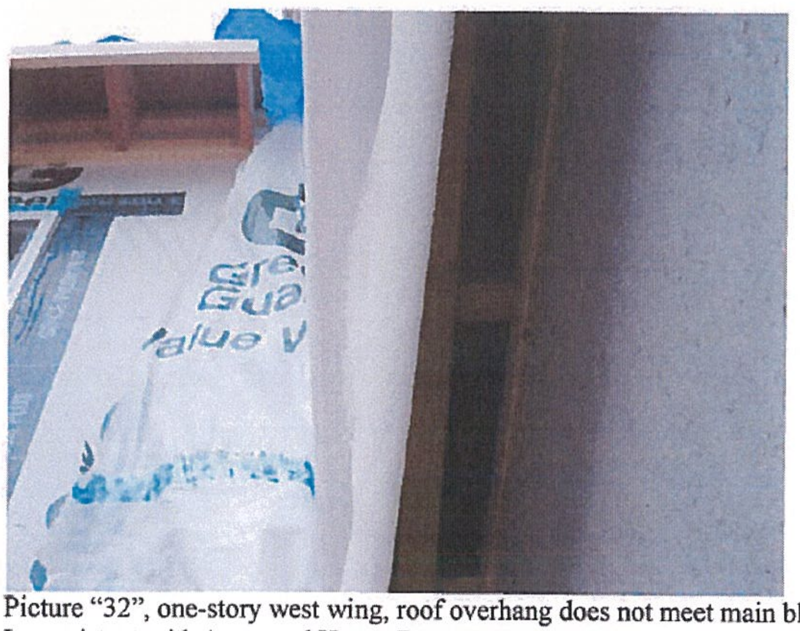
Picture "27" third floor, no thermal envelope, open gap and puncture hole to outside

Picture "28" dormer in attic does not meet roof (tape not sheathing)

Picture "29" no thermal envelope, gap in attic wall to roof, puncture hole

Picture "30" gap from one-story to west wall, inconsistent with Approved House Document. West wing 6" longer than what is shown in Approved House Document.

Picture "31" one-story west wing, roof does not meet main block, gap, area of water intake.



Picture "32", one-story west wing, roof overhang does not meet main block, gap, no blocking. Inconsistent with Approved House Document.

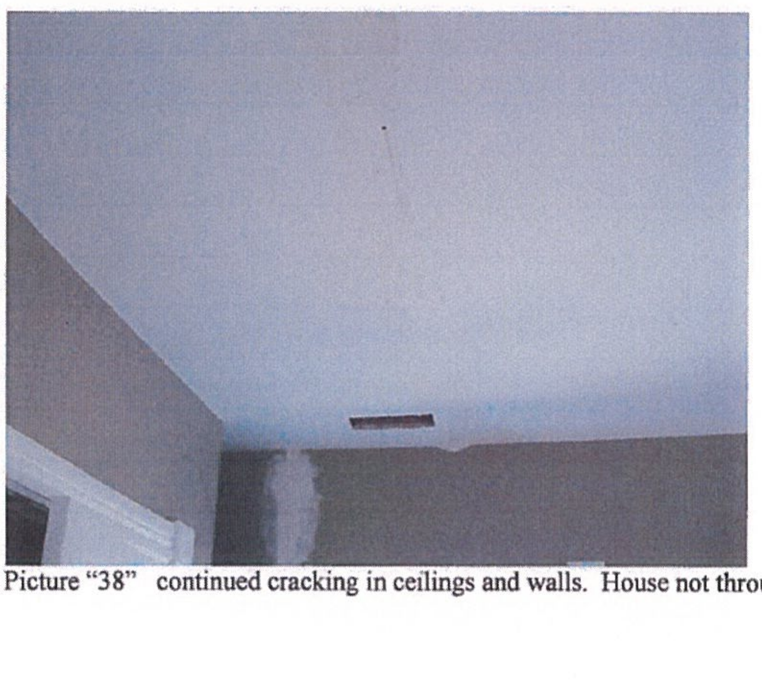
Picture "33" overhang of west side does not line up, contrary to plan, improper engineering, inconsstent with roof truss manufacturing instructions.

Picture "34" one-story west wing not seated on foundation wall. Inconsistent with Approved House Document. No blocking.

Picture "35" west exterior wall, unit boxes as set do not line up, sheathing overhang not flush.

Picture "36" west exterior wall, unit boxes as set do not line up, sheathing not flush. Inconsistent with Approved House Document.

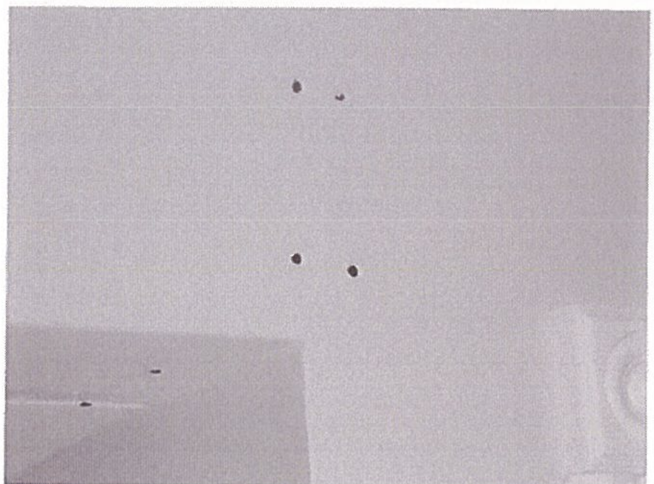
Picture "37" west exterior wall, unit boxes do not line up



Picture "38" continued cracking in ceilings and walls. House not through bolted.

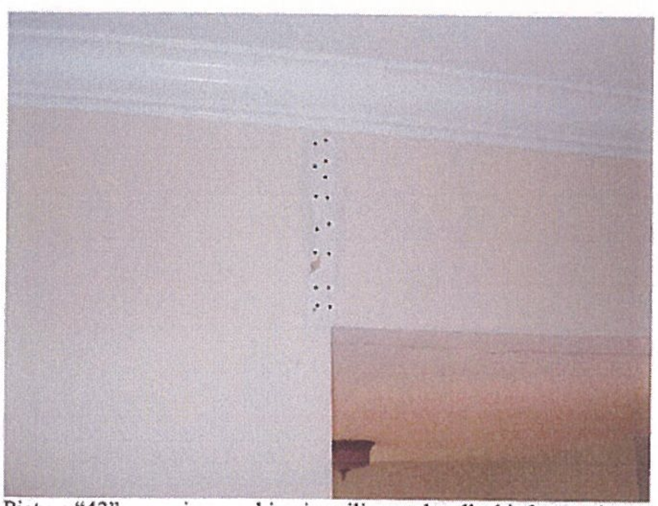
Picture "39" continued cracking in ceilings and walls, bedroom #3

Picture "40" continued cracking in walls and ceiling, bedroom #2



Picture "41" ongoing cracking, kitchen to den, west one-story wing

Picture "42" ongoing cracking in ceiling and walls, kitchen to den, one-story west wing



Picture "43" ongoing cracking in ceiling and walls, kitchen to den, one-story west wing

Picture "44" ongoing cracking in ceiling and walls, kitchen to den

Picture "45" ongoing cracking in walls, kitchen to family room

Picture "46" ¾" gap from wall to stair case trim, not plumb or flush, inconsistent with Approved House Document.

Picture "47" ¾" gap from wall to staircase trim, not plumb

Picture "48" cracked/split door jamb to basement

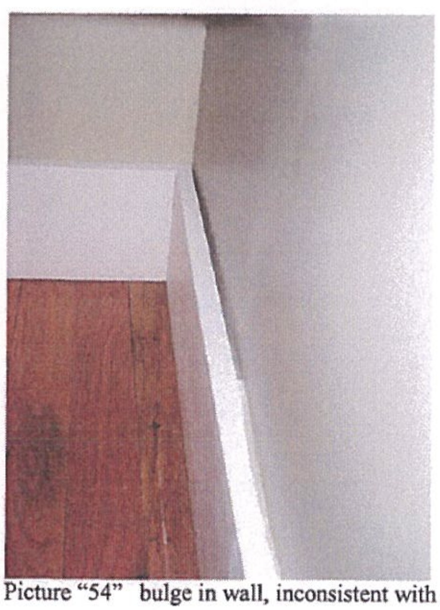
Picture "49" overhang not level. Chimney built out by Milton unlicensed staff. Size altered per Approved House Document. Failed to meet code and manufacturers' installation requirements. No stamped plan for repair work performed by Milton.

Picture "50" no sheathing installed behind wrap, exposed PVC pipe.

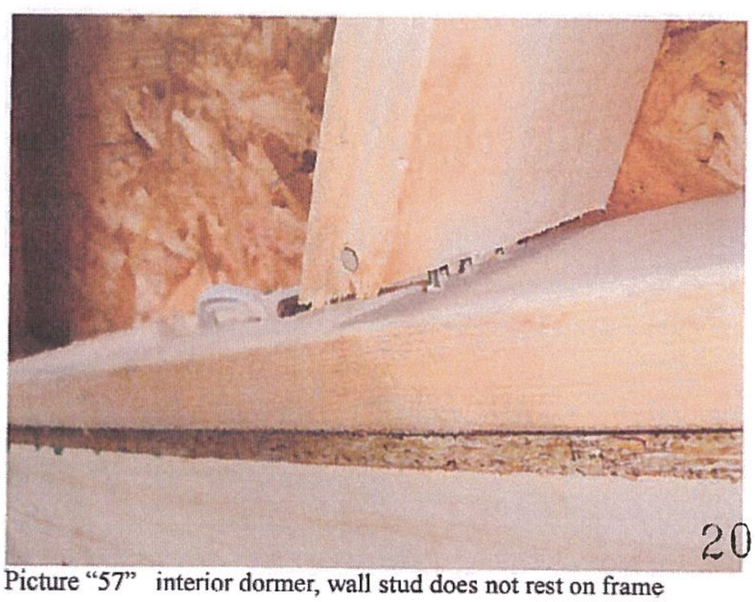
Picture "51" stairs to kitchen code violation, inconsistent with plan. **CODE VIOLATION** "They were the stairs leading to the wing off the kitchen which did not meet the requirements of section R311.5.3.3 Profile. Specifically the treads were temporary and did not meet the profile requirements and had open risers in excess of 4 inches." Loudoun County Code Official. Inconsistent with Approved House Document.

Picture "52" walls not plumb, large gap from molding to wall

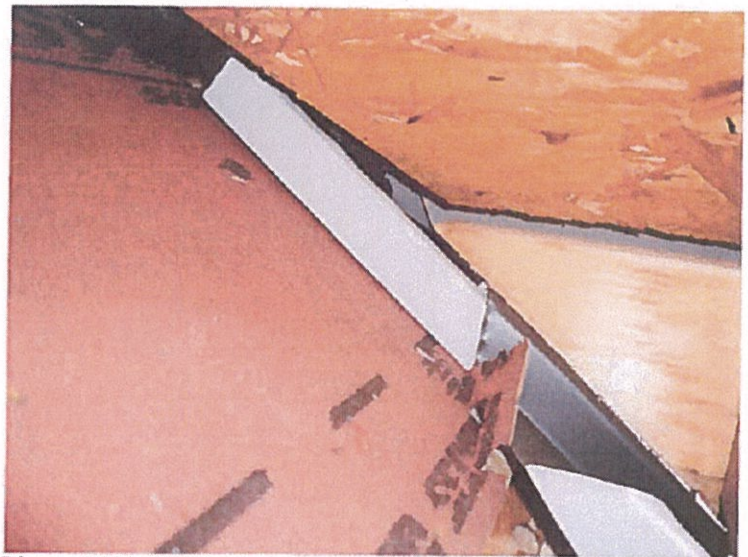
Picture "53" wrong size window, inconsistent with Approved House Document.



Picture "54" bulge in wall, inconsistent with Approved House Document.



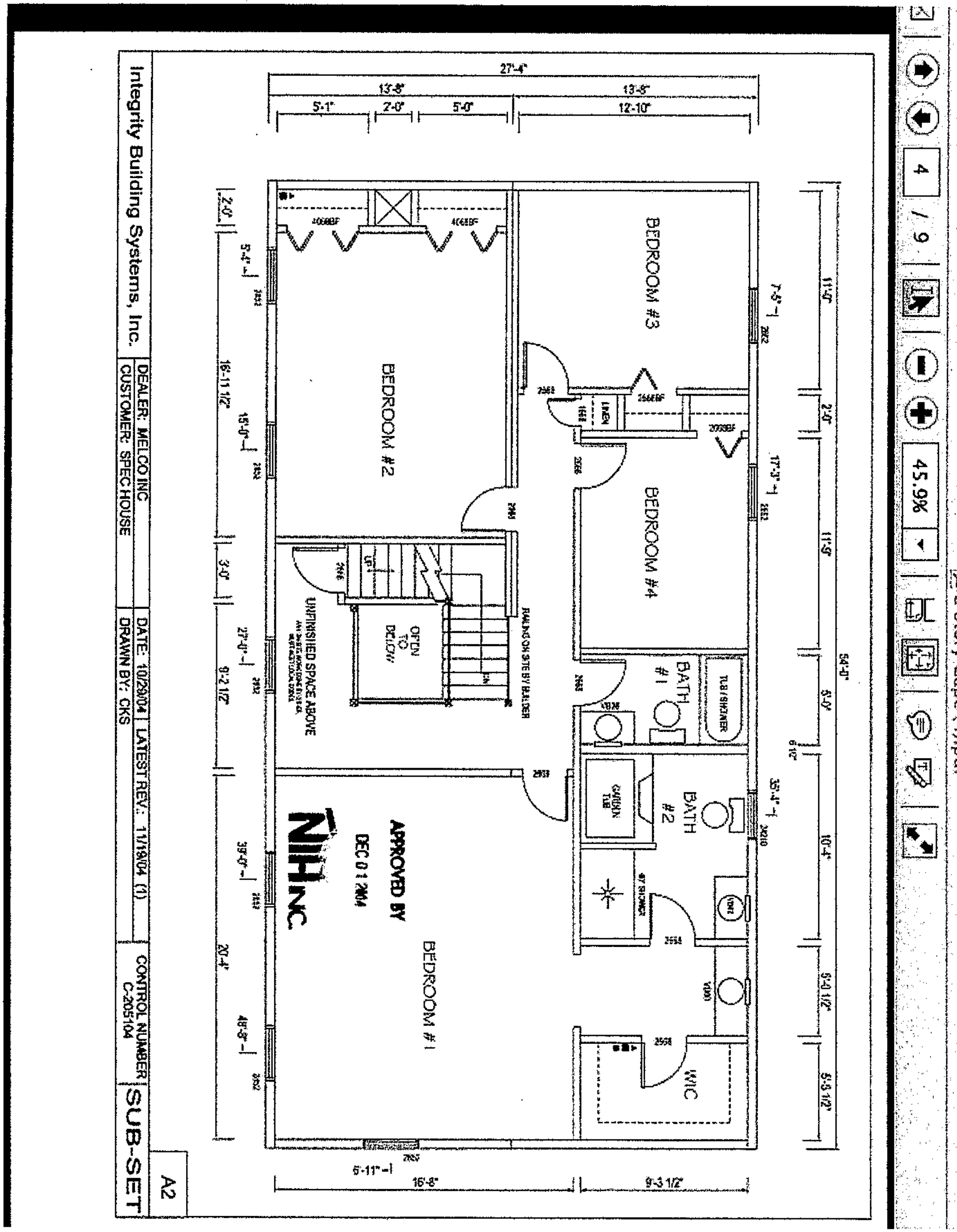
Picture "57" interior dormer, wall stud does not rest on frame



Picture "58" interior dormer, framing does not meet roof sheathing

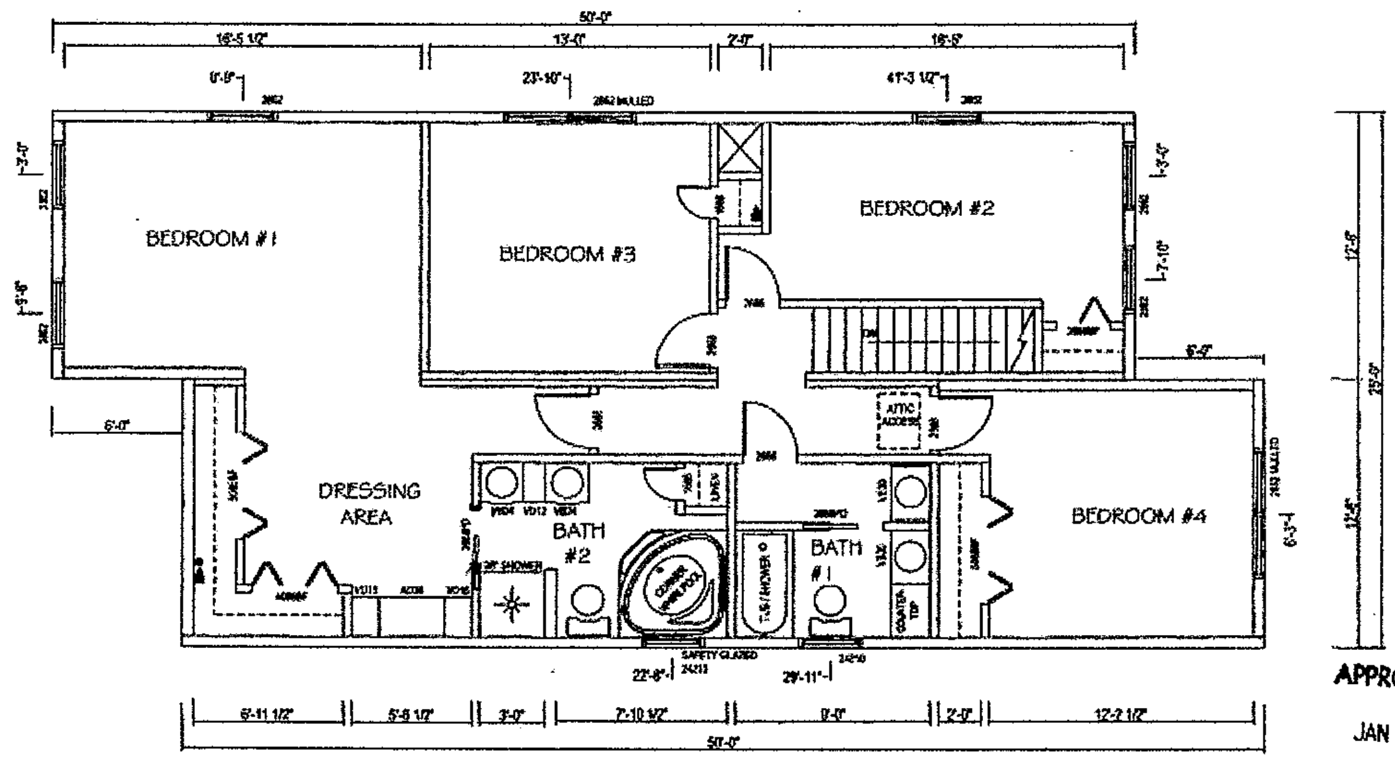
Picture "59" transom does not meet Approved House Plan

Exhibit 2


2 Story Cape (4).pdf
4 / 9
45.9%
27'-4"
13'-8"
13'-8"
5'-1"
2'-0"
5'-0"
12'-10"
54'-0"
BEDROOM #3
BEDROOM #4
BEDROOM #2
BEDROOM #1
BATH #1
BATH #2
WIC
LINEN
TUB / SHOWER
GARDEN TUB
OPEN TO BELOW
UNFINISHED SPACE ABOVE
RAILING ON SITE BY BUILDER
APPROVED BY
DEC 01 2004
NIH INC
16'-8"
9'-3 1/2"
6'-11"
Integrity Building Systems, Inc.
DEALER: MELCO INC
CUSTOMER: SPEC HOUSE
DATE: 10/29/04
LATEST REV.: 11/19/04 (1)
DRAWN BY: CKS
CONTROL NUMBER C-205104
SUB-SET
A2

2 Story (1).pdf

4 / 9 50.3%



APPROVED BY,

JAN 2 4 2005

NTA INC.

A2

Integrity Building Systems, Inc.	DEALER: STATEWIDE CUSTOM MODS. / CUSTOMER: WEBSTER	DATE: 9/21/04 / DRAWN BY: CKS	LATEST REV: 1/6/05 (3)	CONTROL NUMBER C-199504	SUB-SET

213

barlow mark

Milari

Compose

Search results | Delete | Move | Spam | More | Collapse All

Inbox (235)

Drafts (88)

Sent

Spam

Trash (21)

Folders (7)

Recent

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Contacts

Calendar

Notepad

Yahoo Mail for Mobile

• Madison house (13)

Mark Neal
To Me, Chris.Thompson@loudoun.gov

Mrs. Madison & Mr. Thompson,

Attached is a revised copy of the shearwall calculations we provided to IBS for the C-484709-2 plan. The only revision we made was on the Main House summary sheet showing the roof as a 3rd floor. The calculations were done correctly originally but we didn't call the habitable attic a floor.

I trust this will clarify our portion of the design and I wish you the best in resolving your issues.

Please contact our office with any questions or comments.

Thanks,

Mark Neal
Barlow Engineering, P.C.
6612 Six Forks Rd.
Suite 104
Raleigh, NC 27615
(919) 845-1600

-----Original Message-----
From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Friday, November 16, 2012 10:00 AM
To: mneal@barlow-engineering.com
Subject: Madison house

Chris.Thompson@loudoun.gov

Mark,

As discussed, please send the corrected plan/calc for the third floor shear wall to me and the building code official. PDF is fine.

Thank you.

Milari Madison

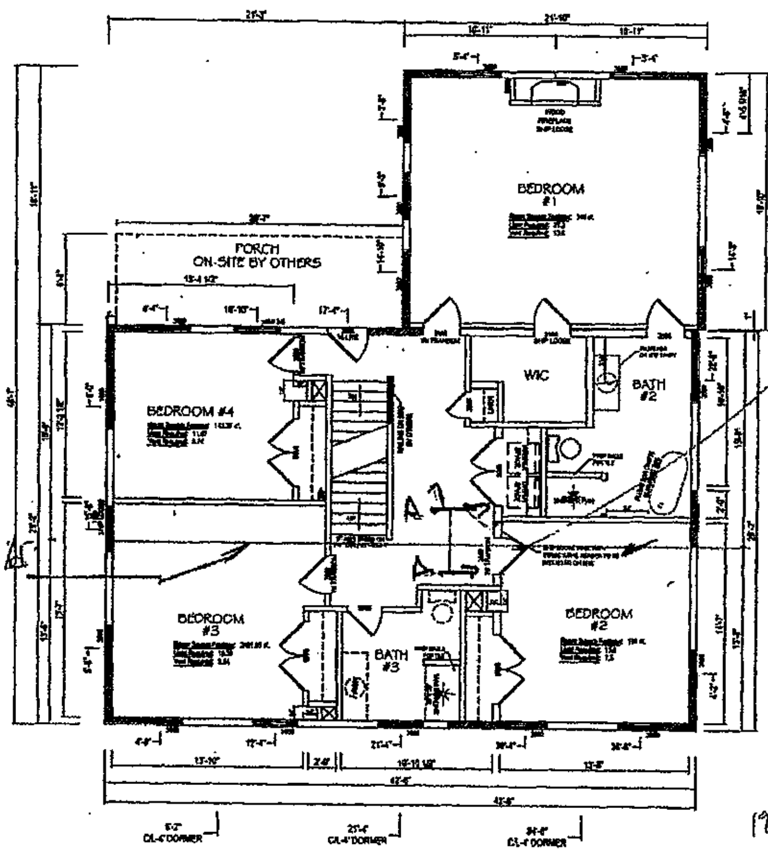
UNIVERSAL-1-4 S... .pdf Download

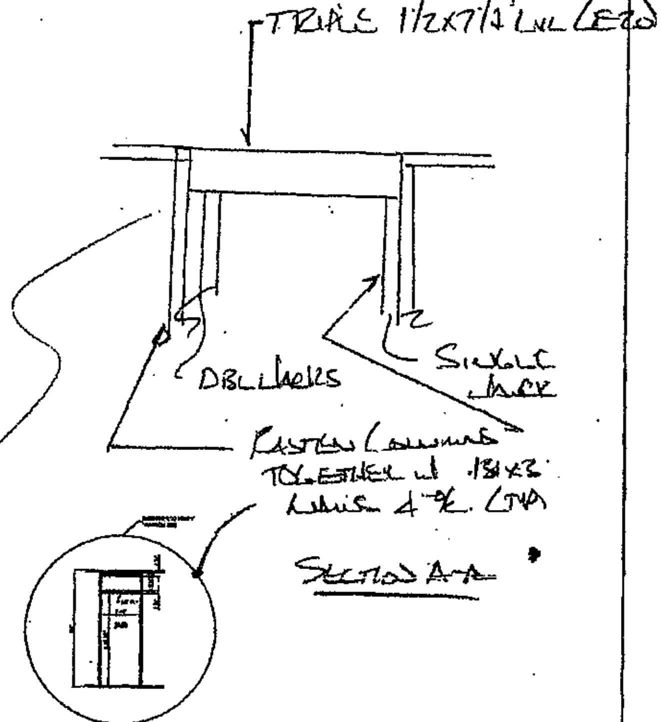
Reply, Reply All or Forward | More

APPROVED BY

JUL 14 2011

NTA INC





2nd FLOOR
8'-6" CEILING

NOTE: ALL INTERIOR WALLS TO HAVE R-11 INSULATION

Integrity Building Systems, Inc.	DEALER: CONVENIENT INSTALLATION CUSTOMER: MADISON	DATE: 5/24/10 MODEL: CUSTOM 2-STORY DRAWN BY: CDK Scale: 1/8" = 1'- 0"	CONTROL NUMBER C-484709-2	SUB-SET A2

215

Exhibit 3

Home Mail News Sports Finance Weather Games Groups Answers Screen Flickr Mobile | More

marty building house 400 amp | Search Mail | Search Web | Milari

Compose

Inbox (235)
Drafts (88)
Sent
Spam
Trash (21)
Folders (7)
Recent

Messenger
Contacts
Calendar
Notepad

Yahoo Mail for Mobile

Search results | Delete | Move | Spam | More | Collapse All

Mtr base sizing, two 200 amp panels (6)

Martin Sickle
To Me

Jun 22, 2011

We are building the house with 2-200 amp service panels

Martin Sickle
V.P.Sales & Marketing
Integrity Building Systems, Inc.
2435 Housels Run Road
Milton, PA 17847
Phone (800) 553-4402 Ext. 3629
Cell Phone (570) 274-3031
Fax: (570) 522-0089
msickle@integritybuild.com
www.integritybuild.com

Success is not what you get; it is what you become

From: Hunter Madison [mailto:huntermadison2002@yahoo.com]
Sent: Wed 6/22/2011 7:48 AM
To: Martin Sickle
Subject: Fw: Mtr base sizing, two 200 amp panels

Marty,

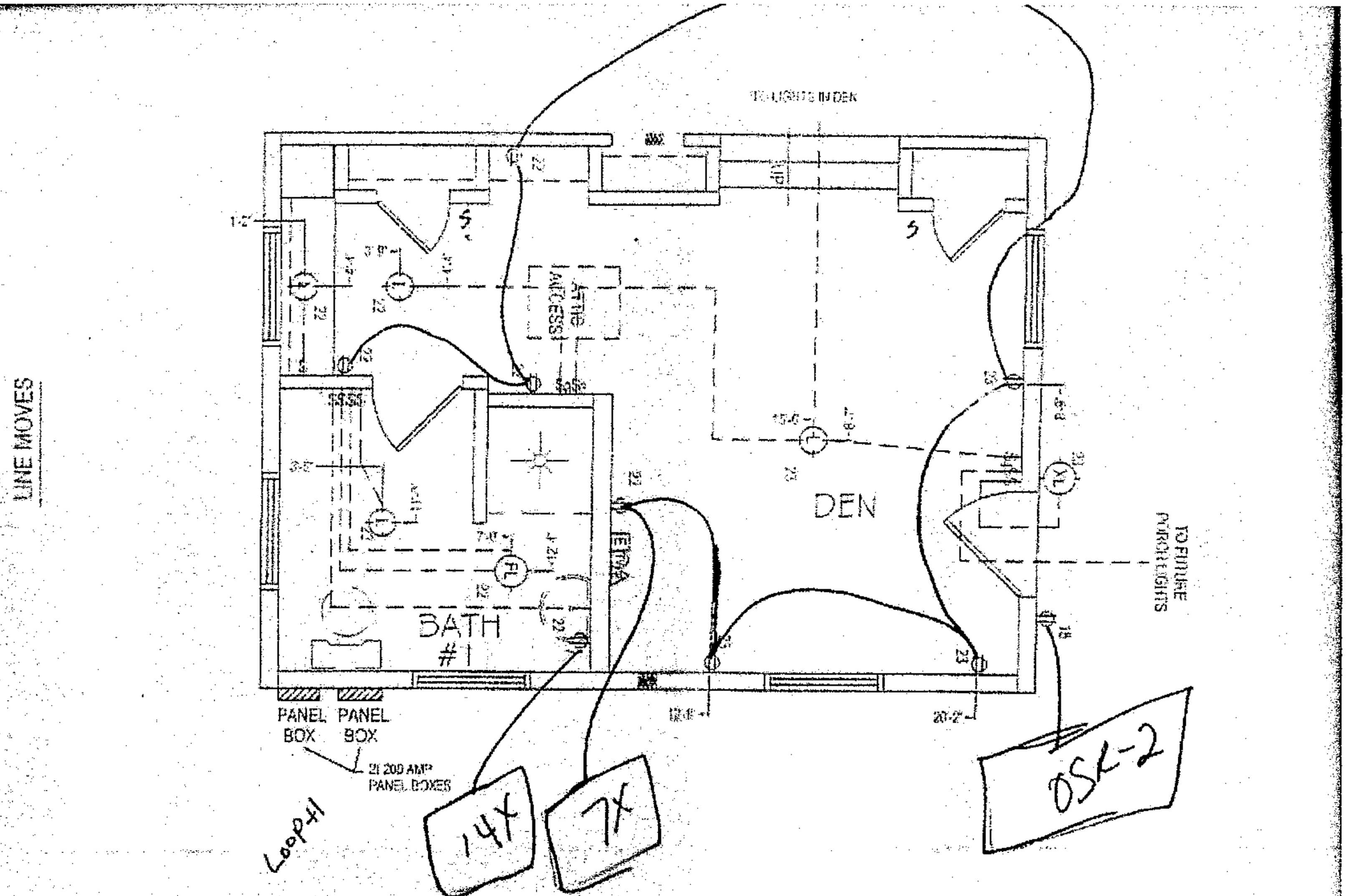
~~The power company maintains that I need two 200 amp panel boxes (see~~ below). Darren said I need 400 amp service too.

Please confirm that this is done as I am having the power company bring in the line ASAP.

Milari

— On **Tue, 6/14/11, Hunter Madison** ***<huntermadison2002@yahoo.com>*** wrote:

> From: Hunter Madison <huntermadison2002@yahoo.com>
> Subject: Fw: Mtr base sizing
> To: MartyS@integritybuild.com
> Date: Tuesday, June 14, 2011, 2:05 PM
>
> Marty, VA Power says I need 400 amp service
>
> — On **Tue, 6/14/11, Glenn S Rowan** ***<glenn.s.rowan@dom.com>*** wrote:
>
>> From: Glenn S Rowan <glenn.s.rowan@dom.com>
>> Subject: Mtr base sizing
>> To: "Hunter Madison" <huntermadison2002@yahoo.com>
>> Date: Tuesday, June 14, 2011, 8:01 AM
>>
>> Milari,
>> You will need a 400 amp service if you are planning on having the house panel be a 200 amp panel and a 100 amp sub panel. If the house panel is maxed out and you are then adding a sub panel, overloading will be an issue and you will not have enough current to run multiple circuits at the same time without tripping the breakers.
>> I hope this helps. Let me know if you need anything else.
>>
>> Glenn S. Rowan
>> Dominion Virginia Power
>> Customer Projects Designer II
>> Customer Solutions Design - Leesburg
>> Work 703/779/5166
>> Tie-Line 8/748/5166
>> Fax 703/779/5142
>> Glenn.S.Rowan@dom.com
>>
>> All electric services must comply with Dominion's 2007 Blue



"C"

122

...ilding Systems, Inc. | DEALER: CONVENIENT INSTALLATION | DATE: 6/15/11 | MODEL: CUSTOM 2-STORY | CONTR...

Released Order

INTEGRA SERIES - VIRGINIA

Date Typed: 6/3/2011
Serial No.: 1991 Quote No.: MS-01236
Builder: Convenient Installation
Address: 351 Thistle Ridge Lane
City & State: Ranson, WV
Zip: 25438

Integrity Building Systems

Revised 5/19/2011

Date of Quote: 5/3/2011
Ordered by: Darren
Retail Customer Name: Madison
Site Address: 40153 Janney St
City: waterford VA 20197

X	All Interior Partition Walls:	R-11

ELECTRICAL / UTILITY SECTION I of II

Optional	☐ Electric BB Heat ☐ Hot Water BB	
Note	Water Heater ☑ 80 gal ☑ Elect. ☑ Shiploose	
X	Wire & Plumb for Washer ☑ w/ Pan	
X	Wire for Dryer	
X	TV Jacks: 2 are Std ☑ Add 2	
X	Location: Den/ (2) Fr/ Br1	
X	Phone Jacks: 2 are Std	
X	Location: Den/ Library	
X	Wire,switch & supports for 14 can lights	
X	Ethernet Jacks	
X	Locations: Library/ (2) Fr/ Den/ Br1/ Br2/ Br3/ Br4	
X	Wire/ Switch For (3) Future Pendants	
X	ADDT'L 200 AMP PANEL BOX	C/O 9021
X	125 Amp Sub Panel Box	
OMIT	All Interior light fixtures	
X	"PEX" Plumbing T/O	
X	(3) C. O. Detectors	
X	Wire Shelf Over Washer/Dryer	
X	3" PVC Pipe w/J-Box for Radon Vent	
X	Panel Box: under bath #1	

	BETWEEN WALL OVEN CAB + FREEZER	
OMIT	Countertop: ☑ Laminate ☐ Corian	
OMIT	Kitchen Sink & Faucet	
	Appliance Color:	
OMIT	Wire only For Onsite Rangehood no vent	
X	Range: ☑ Wire Only ☑ Elect. ☐ Gas ☐ Elect Self-Clean ☐ Gas Self-Clean ☐ Smooth Top ☐ Calrod Top	
Note	Outlet for refer	
Note	Outlet for freezer	

ELECTRICAL / UTILITY SECTION II of II

X	Wire & Switch For closet lights(10)	C/O 9022
X	Locations: Br2 Closet/ Br3 Closet/ Br4 Closet & Utility	
X	Wire & Switch For (3) Ext. Lights	
X	Attic Fan -wire only	
X	WIRE ONLY FOR EXTERIOR LTS	C/O 9022
	INTERIOR SECTION CON'T	
X	PERMANENTLY FASTEN INT. DOORS W/SCRAP PC'S	C/O 9020
X	ALL INTERIOR PARTITION WALLS TO BE INSULATED	C/O 9020

NOTE	Primer Paint ONLY T/O Interior	
	LABELS & SEALS SECTION	
X	Inspection: ☐ NY ☐ PA ☐ NJ ☑ VA ☐ OH	
X	NTA	
X	Third Party Label	
X	IBS Engineering Fee	
X	PE Sealed Calcs/Prints	
X	Wind Zone:	90 MPH
X	Snow Load:	30 PSF
X	NTA Stamped Plans	

	*INTERIOR SECTION CON'T	
X	ASSEMBLE + SHIPLOOSE FRONT FIREPLACE WALLS (FR/BR1)	C/O 9021
	-GENERAL SECTION CON'T.	
X	BLDR/CUST. RESPONSIBLE FOR WEATHERPROOFING 2ND FLOOR @ SUNROOM -ON-SITE	C/O 9022
X	LEAVE OFF DRYWALL / CBOARD -BATH #1 3' WIDE FLOOR TO CLG. @ PLUMB WALL; ALL OTHER LOCATIONS INSTALL TO CLG.	C/O 9023
X	LEAVE DRYWALL / C-BOARD -BATH #2 3' WIDE FLR TO CLG.	C/O 9023
X	BATH #3 SHOWER AREA THE SAME AS ABOVE- BATH #2	C/O 9023

A 10% deposit is required to accompany this order.

I herby agree to this order, and its accuracy, pursuant and subject to the covenants, terms and conditions as set forth on the Dealer Agre completed our production process, and pay for same with a certified check or ca

If Home is to be Floorplanned: Financial Institution: ______ Contact Person: ______

Builder: X Title: ______ MILTON 000473

Prepared at IBS by: M. Sickle/jldrake

SALES AGREEMENT CHANGE ORDER

Integrity Building Systems, Inc. We build upon our name
2435 Housels Run Road • Milton, PA 17847

Date: 6/20/11

Change Order # 9021

Plant Schedule #

Serial # 1991

Builder: Convenient Installations

Customer: Madison

	Charge	Credit
Add'l. 200 Amp Panel Box - totaling 400 Amps	250	
Add'l. 3164 Marvin Integrity window w/ Sim. Div. lites	635	
FPO R.O. Left Gable - Sunroom		
Ventless fireplace in LR to be: Monessen #GUF36R		
LP Gas		
Assemble + Ship loose front fireplace walls (FR/BR1)		
BR2 Transom R.O. to be 10" H due to header height		
Ship loose (3) IAWN3719 w/ SDL wndws - clarification		

Total Charges or (Credits) for this Change Order: 885

Approved by:

Salesman: M. Sicku Sales Manager: Date: 6/20/11

Purchasing: Accounting: Date: 6/20/11

(White) Production (Green) Accounting (Pink) Purchasing (Blue) Sales

MILTON 000476 220

Exhibit 4

UFP Parker, LLC

A Universal Forest Products Company

May 21, 2013

Mrs. Milari Madison
40153 Janney Street
Waterford, VA 20197

Re: Roof Inspection

Dear Mrs. Madison,

This letter is a follow up to the roof inspection performed on your home on March 6, 2013. We confirmed that the roof trusses supplied by UFP Parker, LLC were built in accordance to proper specifications and quality standards. The manufactured aspects from our facility of the roof trusses match those detailed on the sealed prints CC800501 (plant reference: 159135-9) and CC800701 (plant reference: L2110-9M) and there were no signs of damage from transportation to the site (see attachments 1 and 2 for truss prints).

Although the main focus of the inspection was the areas of the roof with visible concave and convex issues of the roof planes, multiple areas of concern were observed throughout the home. Some of these observations include missing framing members, improper or insufficient framing connections, and inappropriately altered trusses. In my opinion these factors are contributing to the repeatedly cracking wall and ceiling gypsum, separating crown molding (see attachment 3), buckling floor boards (attachment 4 and 5), and interior doors that seem to be increasingly misaligned (attachment 6).

Specifically, my findings include the following:

- A picture of the overhangs during construction suggests that the "ski slope" on the front lower roof plane could be caused by the site applied overhangs being the wrong pitch and/or resting on the brick or lateral runners at an incorrect elevation (attachments 7 and 8).
- The "hump" on the front and back upper portion of roof planes (attachments 9, 10, 11, 12, and 13) could be caused by top flips that were possibly the wrong size as depicted in another one of the pictures taken during the time of construction (attachment 14) or collar ties that are missing and/or improperly fastened (attachments 15 and 16).
- Attic ventilation is also questionable with the absence of ridge vents throughout
- Significant cracking and buckling of walls and floors around windows was present suggesting that structural headers or posts are not adequate or not installed properly.

116 N. River Avenue P.O. Box 310 Parker, PA 16049 724.399.2992 phone 724.399.2480 fax www.ufpi.com

All of the aforementioned subject matter is the basic findings during the inspection and it is my opinion that there are multiple points of interest that could have caused and are causing complex problems in appearance, functionality, and stability of the structure. I believe these issues need attention as soon as possible and eradicated to reduce the possibility of any further damage to property and/or persons, especially if there is current and active undulation which is suspected.

Thank you,

Andrew Muisiner
Manufactured Housing Technician

Job	Truss	Truss Type	Qty	Ply	Integrtiy Building Systems (159135-9)
59672	CC800501	HINGED ATTIC	1	1	29' 2"w 9/12 cape (L316-9M & L2610-9M) Designed by ATM 274

Universal Forest Products Inc., Grand Rapids, MI 49525, Andrew Mulsiner — 7.250 e Jan 10 2011 MiTek Industries, Inc. Thu May 26 10:29:05 2011 Page 1 of 1

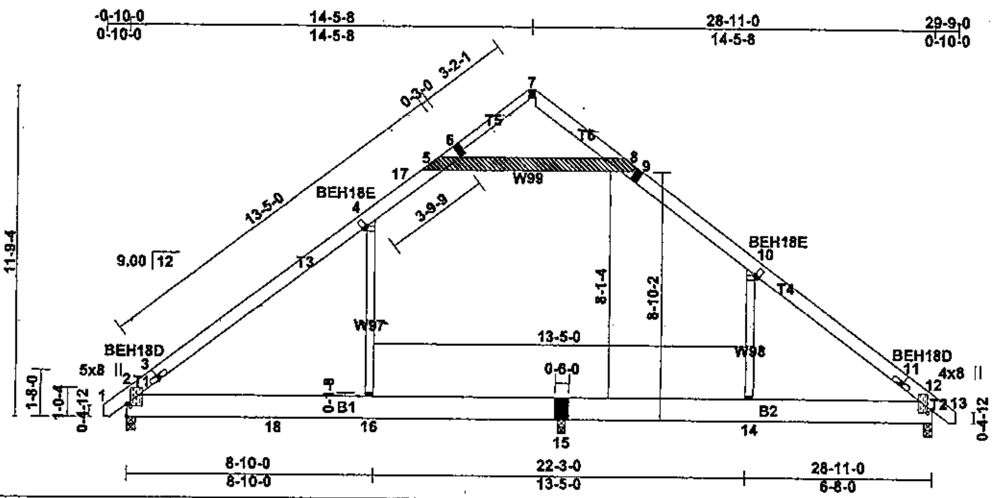


Plate Offsets (X,Y): [2:0-1-1,0-1-9], [3:0-0-11,0-1-2], [4:0-0-11,0-1-2], [10:0-0-11,0-1-2], [11:21-4-10,17-9-10], [12:0-1-1,0-1-13]

SPACING: 2-0-0 LOADING (psf)		SPACING: 1-4-0 LOADING (psf)				CSI		DEFL	in	(loc)	l/defl	L/d	PLATES	GRIP
TCLL	30.8	TCLL	46.2	SPACING	2-0-0	TC	0.85	Vert(LL)	-0.40	2-16	>465	240	MT20	197/144
(Ground Snow=40.0)		(Ground Snow=60.0)		Plates Increase	1.15	BC	0.50	Vert(TL)	-0.59	2-16	>314	180	MII18	141/138
TCDL	7.0	TCDL	10.5	Lumber Increase	1.15	WB	0.57	Horz(TL)	0.01	12	n/a	n/a		
BCLL	0.0 *	BCLL	0.0 *	Rep Stress Incr	YES	(Matrix)		Attic	-0.40	15-16	416	360	Weight: 181 lb	
BCDL	10.0	BCDL	15.0	Code IBC2009/TPI2007									FT = 0%	

LUMBER
TOP CHORD 2 X 6 SPF No.2 *Except*
T5: 2 X 4 SPF No.2
BOT CHORD 2 X 10 SYP DSS
WEBS 2 X 4 SPF No.2 *Except*
W99: 2 X 6 SPF No.2

BRACING
TOP CHORD Structural wood sheathing directly applied or 2-2-0 oc purlins.
BOT CHORD Rigid ceiling directly applied or 6-6-8 oc bracing.

REACTIONS (lb/size) 2=1202/0-3-8 (min. 0-1-15), 12=1125/0-3-8 (min. 0-1-15), 15=936/0-3-0 (min. 0-1-8)
Max Horz 2=453(LC 8)
Max Uplift2=-407(LC 9), 12=-403(LC 10), 15=-226(LC 9)
Max Grav 2=1234(LC 2), 12=1219(LC 16), 15=936(LC 1)

FORCES (lb) - Maximum Compression/Maximum Tension
TOP CHORD 1-2=0/25, 2-3=-1126/321, 3-4=-857/297, 4-17=-845/387, 5-17=-765/400, 5-6=-285/98, 6-7=-189/108, 7-8=-315/100, 8-9=-806/399, 9-10=-1022/385, 10-11=-854/194, 11-12=-1035/211, 12-13=0/25
BOT CHORD 2-18=-90/692, 16-18=-90/692, 15-16=-90/692, 14-15=-90/692, 12-14=-90/692
WEBS 10-14=-552/458, 4-16=-499/423, 5-8=-562/395

REQUIRED FIELD JOINT CONNECTIONS - Maximum Compression (lb)/ Maximum Tension (lb)/ Maximum Shear (lb)/ Maximum Moment (lb-in)
5=562/395/33/0, 6=239/100/125/0, 7=163/109/149/0, 8=564/396/33/0, 9=809/396/184/0, 14=552/458/0/0, 15=90/692/599/0, 16=499/423/0/0

NOTES
1) Wind: ASCE 7-05; 100mph @24in o.c.; TCDL=2.8psf; BCDL=4.0psf; (Alt. 122mph @16in o.c.; TCDL=4.2psf; BCDL=6.0psf); h=30ft; Cat. II; Exp C; enclosed; MWFRS (low-rise) gable end zone and C-C Exterior(2) zone;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60
2) TCLL: ASCE 7-05; Pg=40.0 psf (ground snow); Ps=30.8 psf (roof snow); Category II; Exp C; Partially Exp.; Ct=1.1
3) Roof design snow load has been reduced to account for slope.
4) Unbalanced snow loads have been considered for this design.
5) This truss has been designed for greater of min roof live load of 15.0 psf or 2.00 times flat roof load of 30.8 psf on overhangs non-concurrent with other live loads.
6) This truss has been designed for basic load combinations, which include cases with reductions for multiple concurrent live loads.
7) All plates are MT20 plates unless otherwise indicated.
8) See BEH18 DETAILS for plate placement.
9) Provisions must be made to prevent lateral movement of hinged member(s) during transportation.
10) All additional member connections shall be provided by others for forces as indicated.
11) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
12) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-6-0 tall by 2-0-0 wide will fit between the bottom chord and any other members, with BCDL = 10.0psf.
13) Ceiling dead load (5.0 psf) on member(s). 4-5, 8-10, 5-8
14) Bottom chord live load (30.0 psf) and additional bottom chord dead load (0.0 psf) applied only to room. 15-16, 14-15
15) Provide mechanical connection (by others) of truss to bearing plate capable of withstanding 407 lb uplift at joint 2, 403 lb uplift at joint 12 and 226 lb uplift at joint 15.
16) This truss has been designed in accordance with the 2009 IBC Section 2303.4.6, 2009 IRC Section 802.10.2.
17) Attic room checked for L/360 deflection.
18) If shown, field installed members are an integral part of this design. To ensure proper performance, all field installed members must be installed prior to applying any loading to the truss.
19) Take precaution to keep the chords in plane, any bending or twisting of the hinge plate must be repaired before the building is put into service.
20) Truss has been designed per 2006 IBC Sec. 2303.4.2; 2006 IRC Sec. 802.10.2.

E-signed by Kevin Freeman

5/26/2011

WARNING - *Verify design parameters and READ NOTES*

Universal Forest Products, Inc. 2801 EAST BELTLINE RD, NE
PHONE (616)-364-6161 FAX (616)-365-0060 GRAND RAPIDS, MI 49525

This building component has only been designed for the loads noted on this drawing. Construction and lifting forces have not been considered. The builder is responsible for lifting methods and system design. Builder responsibilities are defined under TPI1. This design is based only upon parameters shown, and is for an individual building component to be installed and loaded vertically. Applicability of design parameters and proper incorporation of component is responsibility of building designer - not truss designer. Bracing shown is for lateral support of individual web members only. Additional temporary bracing to insure stability during construction is the responsibility of the erector. Additional permanent bracing of the overall structure is the responsibility of the building designer. For general guidance regarding fabrication, quality control, storage, delivery, erection and bracing, consult BCSI 1-06 from the Wood Truss Council of America and Truss Plate Institute Recommendation available from WTCA, 6300 Enterprise LN, Madison, WI 53719 J:\support\MitekSupp\templates\ufp.tpe

Job	Truss	Truss Type	Qty	Ply	Integrtiy Building Systems (L2110-9M)
59672	CC800701	HINGED ATTIC	1	1	21' 10" wide 9/12 cape Designed by ATM 274

Universal Forest Products Inc., Grand Rapids, MI 49525, Andrew Muisiner — 7.250 s Jan 10 2011 MiTek Industries, Inc. Thu May 26 10:30:02 2011 Page 1 of 1

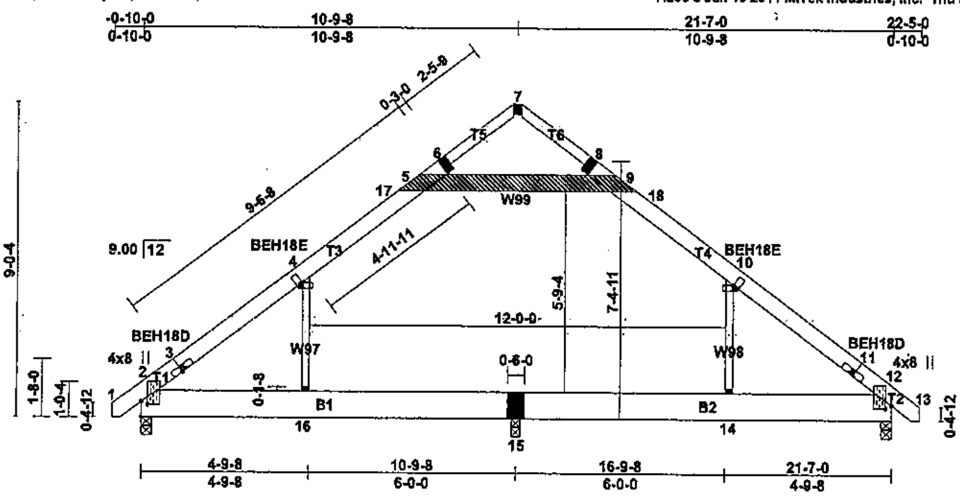


Plate Offsets (X,Y): [2:0-1-1,0-2-1], [3:0-0-11,0-1-2], [4:0-0-11,0-1-2], [10:0-0-11,0-1-2], [11:15-6-4,13-4-13], [12:0-1-1,0-2-1]

SPACING: 2-0-0 LOADING (psf)		SPACING: 1-4-0 LOADING (psf)		SPACING	2-0-0	CSI		DEFL	in	(loc)	l/defl	L/d	PLATES	GRIP
TCLL	30.8	TCLL	46.2	Plates Increase	1.15	TC	0.49	Vert(LL)	-0.12	15-16	>999	240	MT20	197/144
(Ground Snow=40.0)		(Ground Snow=60.0)		Lumber Increase	1.15	BC	0.56	Vert(TL)	-0.18	15-16	>693	180	MII18	141/138
TCDL	7.0	TCDL	10.5	Rep Stress Incr	YES	WB	0.27	Horz(TL)	0.01	12	n/a	n/a		
BCLL	0.0 *	BCLL	0.0 *	Code IBC2009/TPI2007		(Matrix)		Attic	-0.12	15-16	1220	360	Weight: 114 lb	
BCDL	10.0	BCDL	15.0										FT = 0%	

LUMBER
TOP CHORD 2 X 6 SPF No.2 *Except*
T5,T6: 2 X 4 SPF No.2
BOT CHORD 2 X 10 SPF No.2
WEBS 2 X 3 SPF Stud *Except*
W99: 2 X 6 SPF No.2

BRACING
TOP CHORD Structural wood sheathing directly applied or 6-0-0 oc purlins.
BOT CHORD Rigid ceiling directly applied or 10-0-0 oc bracing.

REACTIONS (lb/size) 2=916/0-3-8 (min. 0-1-8), 12=916/0-3-8 (min. 0-1-8), 15=654/0-3-0 (min. 0-1-8)
Max Horz 2=-344(LC 7)
Max Uplift2=-348(LC 9), 12=-349(LC 10), 15=-82(LC 9)
Max Grav 2=972(LC 2), 12=972(LC 2), 15=667(LC 14)

FORCES (lb) - Maximum Compression/Maximum Tension
TOP CHORD 1-2=0/25, 2-3=-872/285, 3-4=-722/270, 4-17=-782/341, 5-17=-641/354, 5-6=-233/69, 6-7=-127/78, 7-8=-125/77, 8-9=-237/69, 9-18=-636/354, 10-18=-783/341, 10-11=-722/269, 11-12=-872/283, 12-13=0/25
BOT CHORD 2-16=-130/588, 15-16=-126/586, 14-15=-126/586, 12-14=-124/588
WEBS 10-14=-449/373, 4-16=-453/374, 5-9=-485/367

REQUIRED FIELD JOINT CONNECTIONS - Maximum Compression (lb)/ Maximum Tension (lb)/ Maximum Shear (lb)/ Maximum Moment (lb-in)
5=485/367/27/0, 6=190/72/94/0, 7=102/79/93/0, 8=192/71/95/0, 9=485/367/27/0, 14=449/373/0/0, 15=126/586/400/0, 16=453/374/0/0

NOTES
1) Wind: ASCE 7-05; 100mph @24in o.c.; TCDL=2.8psf; BCDL=4.0psf; (Alt. 122mph @16in o.c.; TCDL=4.2psf; BCDL=6.0psf); h=30ft; Cat. II; Exp C; enclosed; MWFRS (low-rise) gable end zone and C-C Exterior(2) zone;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60
2) TCLL: ASCE 7-05; Pg=40.0 psf (ground snow); Ps=30.8 psf (roof snow); Category II; Exp C; Partially Exp.; Ct=1.1
3) Roof design snow load has been reduced to account for slope.
4) Unbalanced snow loads have been considered for this design.
5) This truss has been designed for greater of min roof live load of 15.0 psf or 2.00 times flat roof load of 30.8 psf on overhangs non-concurrent with other live loads.
6) This truss has been designed for basic load combinations, which include cases with reductions for multiple concurrent live loads.
7) All plates are MT20 plates unless otherwise indicated.
8) See BEH18 DETAILS for plate placement.
9) Provisions must be made to prevent lateral movement of hinged member(s) during transportation.
10) All additional member connections shall be provided by others for forces as indicated.
11) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
12) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-6-0 tall by 2-0-0 wide will fit between the bottom chord and any other members.
13) Ceiling dead load (5.0 psf) on member(s). 4-5, 9-10, 5-9
14) Bottom chord live load (30.0 psf) and additional bottom chord dead load (0.0 psf) applied only to room. 15-16, 14-15
15) Provide mechanical connection (by others) of truss to bearing plate capable of withstanding 348 lb uplift at joint 2, 349 lb uplift at joint 12 and 82 lb uplift at joint 15.
16) This truss has been designed in accordance with the 2009 IBC Section 2303.4.6, 2009 IRC Section 802.10.2.
17) Attic room checked for L/360 deflection.
18) If shown, field installed members are an integral part of this design. To ensure proper performance, all field installed members must be installed prior to applying any loading to the truss.
19) Take precaution to keep the chords in plane, any bending or twisting of the hinge plate must be repaired before the building is put into service.
20) Truss has been designed per 2006 IBC Sec. 2303.4.2; 2006 IRC Sec. 802.10.2.

E-signed by Kevin Freeman

5/26/2011

WARNING - *Verify design parameters and READ NOTES*

Universal Forest Products, Inc. 2801 EAST BELTLINE RD, NE
PHONE (616)-364-6161 FAX (616)-365-0060 GRAND RAPIDS, MI 49525

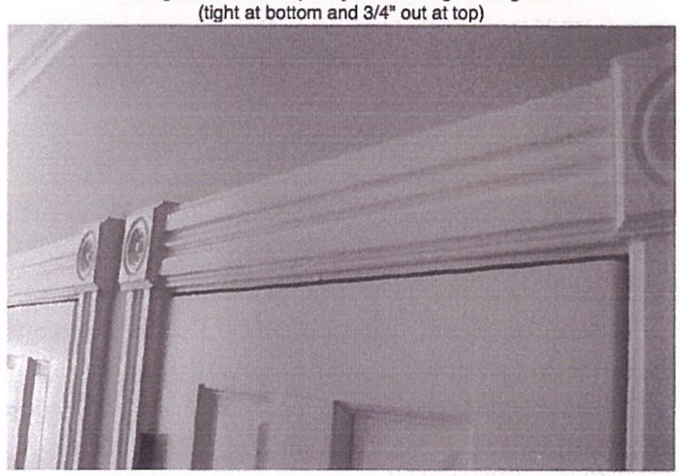
This building component has only been designed for the loads noted on this drawing. Construction and lifting forces have not been considered. The builder is responsible for lifting methods and system design. Builder responsibilities are defined under TPI1. This design is based only upon parameters shown, and is for an individual building component to be installed and loaded vertically. Applicability of design parameters and proper incorporation of component is responsibility of building designer - not truss designer. Bracing shown is for lateral support of individual web members only. Additional temporary bracing to insure stability during construction is the responsibility of the erector. Additional permanent bracing of the overall structure is the responsibility of the building designer. For general guidance regarding fabrication, quality control, storage, delivery, erection and bracing, consult BCSI 1-06 from the Wood Truss Council of America and Truss Plate Institute Recommendation available from WTCA, 6300 Enterprise LN, Madison, WI 53719 J:\support\MitekSupp\templates\ufp.tpe

Attachment 3
Separated crown molding example

Attachment 4
Main marriage wall beam at Bedroom 2 (buckled floor boards)

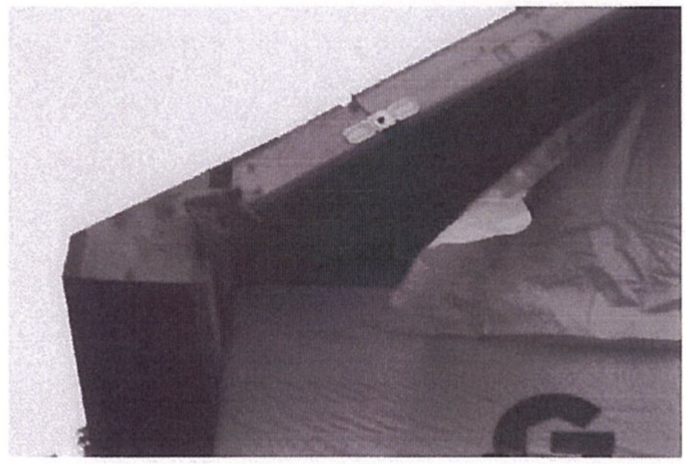
Attachment 5
Separated, buckling floor at kitchen/family room

Attachment 6
Misaligned closet and pantry doors along marriage wall
(tight at bottom and 3/4" out at top)



Attachment 7
Main roof plane (front) - overhang close-up

Attachment 8
Close up of site applied overhang during construction

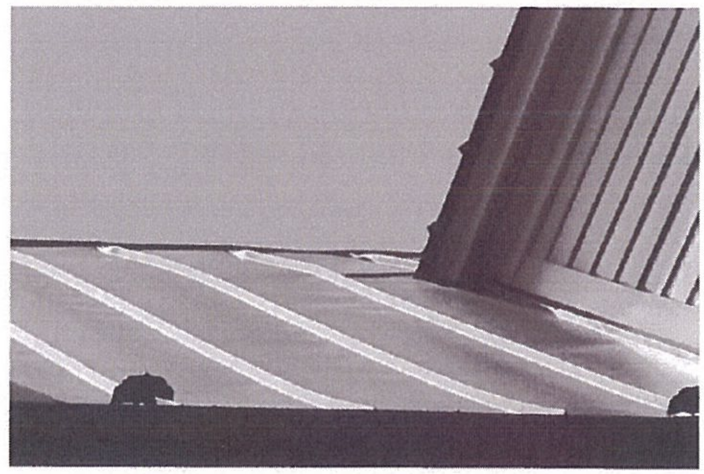


Attachment 9
Main roof plane (rear) - inconsistent hump

Attachment 10
Main roof plane (front) - view of undulation at center dormer

Attachment 11
Main roof plane (front) - close up of dip at overhang right of center dormer

Attachment 12
Main roof plane (front) - close up of undulation right of center dormer

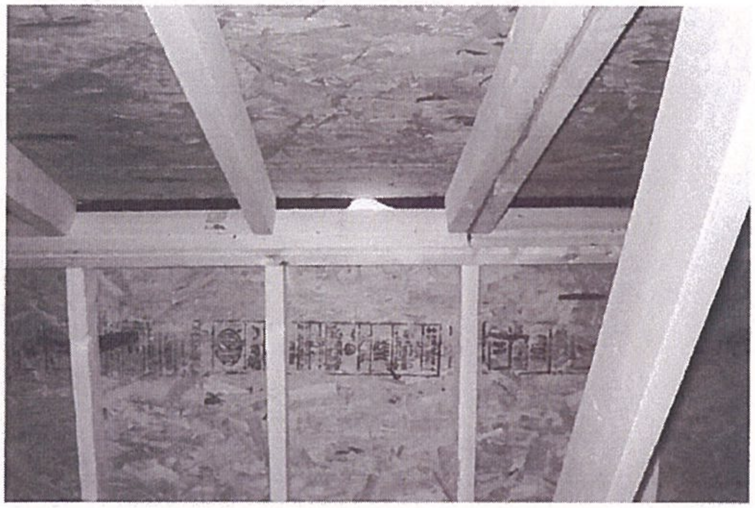


Attachment 13
Main roof plane (front) - close up of undulation right of center dormer

Attachment 14
Site applied top flip during construction - wrong size?

Attachment 15

Main roof ridge - missing collar ties/misaligned ridge



Attachment 16

Den roof - missing collar ties

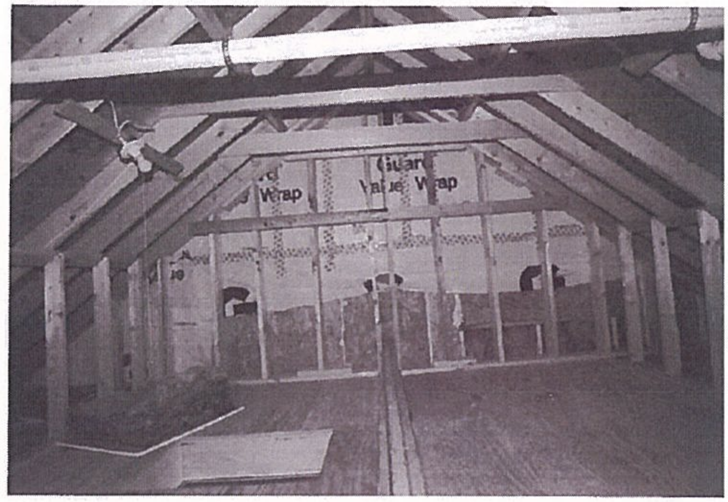


Exhibit 5

DATE: 7-13-11

NTA INC INSPECTION REPORT

Page 5 of 5

Manufacturer: INTEGRITY BUILDING SYSTEMS
Prod. Rate 2
Address: MILTON, PA
Time in 6:30 Time out 9:30
Inspector: CHRIS LEHMAN I-198
Factory Rep: BILL SEAGRIST

Station No. Serial No. Operation	Item No.	Observations / Violations	Code No.	NTA Label State / Federal Label No.
		ISSUED FOLLOWING LABELS		
1991-	A	336766 VA- 2011-0695		
VA	B	336767 2011-0696		
	C	336768 2011-0697		
	D	336769 2011-0698		
	E	336770 2011-0699		
	F	336771 2011-0700		
	G	336772 2011-0701		
	H	336773 2011-0702		
	I	336774 2011-0703		
		WILL NEED TO ISSUE LABELS		
		TO FOLLOWING -		
		2001, 2002, 2000, 2002, 2005		
		1999, 2006, 2007		
PA AUDIT	1	VERIFIED START DATE NOTED		
FOLLOW-UP		ON CHECKLISTS ON LINE		
	2	& NM CABLE INSTALLATION ON		
		MATE WALL STUDS OK		

I acknowledge that I have read this inspection report and will correct all items listed before labeled units are shipped.

MANUFACTURER'S REP [signature]

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Reviewed by CL

FORM ISQA 3.3e Inspection Report

DATE: 6-27-11

NTA INC INSPECTION REPORT

Page 3 of 4

Manufacturer: INTEGRITY BUILDING SYSTEMS

Prod. Rate 2

Address: MILTON, PA

Time in 10:15 Time out 2:00

Inspector: CHRIS LEHMAN I-198

Factory Rep: BILL SEAGRIST

Station No. Serial No. Operation	Item No.	Observations / Violations	Code No.	NTA Label State / Federal Label No.
1996	NY	VERIFIED ALL HANGERS INSTALLED WHERE REQUIRED. RELEASED R/TAG		
1993 - B	PA	VERIFIED FIRE SEPARATION RATING OF DOOR BETWEEN GARAGE / LIVING AREA. RELEASED R/TAG.		
1898 - B	NY	ALL 10 ITEMS REQUIRED TO BE VERIFIED PER C. OSTERDAY. NTA R/TAG RELEASED. SEE ATTACHED.		
		FLOORS STACKED IN STATION 1A.		
2002 -	PA	VERIFIED PA EXEMPT NOTES,		
2000 -	PA	BRACED WALL LAYOUT IS PART OF APPROVALS. RESCHECK CORRECT.		
1991 -	VA	LACK APPROVALS ISSUED R/TAG		
PA AUDIT FOLLOW-UP	1	VERIFIED ALL CHECKLISTS ON LINE THE LINE ITEM FOR THE START DATE IS BEING COMPLETE.		
	2	NO ISSUE'S NOTED WITH THE NM CABLE INSTALLATION ON STUDS (PROTECTION)		
NC FOLLOW-UP		NO ISSUE'S NOTED FOR ROOF TRUSS BEARING.		

I acknowledge that I have read this inspection report and will correct all items listed before labeled units are shipped.

MANUFACTURER'S REP [signature] 231

Reviewed by CL

DATE: 6-27-11 **NTA INSPECTION REPORT** Page 2 of 4

MANUFACTURER: INTEGRITY BUILDING SYSTEMS Production Rate 2

Address: MILTON, PA Inspection Type Scheduled X Increased ___ Special ___

Inspector: CHRIS LEHMAN I-198 Time in 10:45 Time out 2:00

Sta # 1D Serial # 1991-F	Sta # Serial #	Sta # Serial #
Model #	Model #	Model #
Approval Date: R/T	Approval Date:	Approval Date:
HUD / State # VA	HUD / State #	HUD / State #
NTA# N/C yes No	NTA# N/C yes No	NTA# N/C yes No
WIND ZONE/ SPEED 90	WIND ZONE/ SPEED	WIND ZONE/ SPEED
Sta # 1C Serial # 1991-G	Sta # Serial #	Sta # Serial #
Model #	Model #	Model #
Approval Date: R/T	Approval Date:	Approval Date:
HUD / State # VA	HUD / State #	HUD / State #
NTA# N/C yes No	NTA# N/C yes No	NTA# N/C yes No
WIND ZONE/ SPEED 90	WIND ZONE/ SPEED	WIND ZONE/ SPEED
Sta # 1B Serial # 1991-H/I	Sta # Serial #	Sta # Serial #
Model #	Model #	Model #
Approval Date: R/T	Approval Date:	Approval Date:
HUD / State # VA	HUD / State #	HUD / State #
NTA# N/C yes No	NTA# N/C yes No	NTA# N/C yes No
WIND ZONE/ SPEED 90	WIND ZONE/ SPEED	WIND ZONE/ SPEED
Sta # 1A Serial # 2002-A/B	Sta # Serial #	Sta # Serial #
Model # C-540011	Model #	Model #
Approval Date: 6-2-11	Approval Date:	Approval Date:
HUD / State # PA 40RF	HUD / State #	HUD / State #
NTA# N/C yes No	NTA# N/C yes No	NTA# N/C yes No
WIND ZONE/ SPEED 90	WIND ZONE/ SPEED	WIND ZONE/ SPEED
Sta # 1A Serial # 2002-C/D	Sta # Serial #	Sta # Serial #
Model #	Model #	Model #
Approval Date:	Approval Date:	Approval Date:
HUD / State # PA	HUD / State #	HUD / State #
NTA# N/C yes No	NTA# N/C yes No	NTA# N/C yes No
WIND ZONE/ SPEED 90	WIND ZONE/ SPEED	WIND ZONE/ SPEED

Manufacturers Rep [signature]

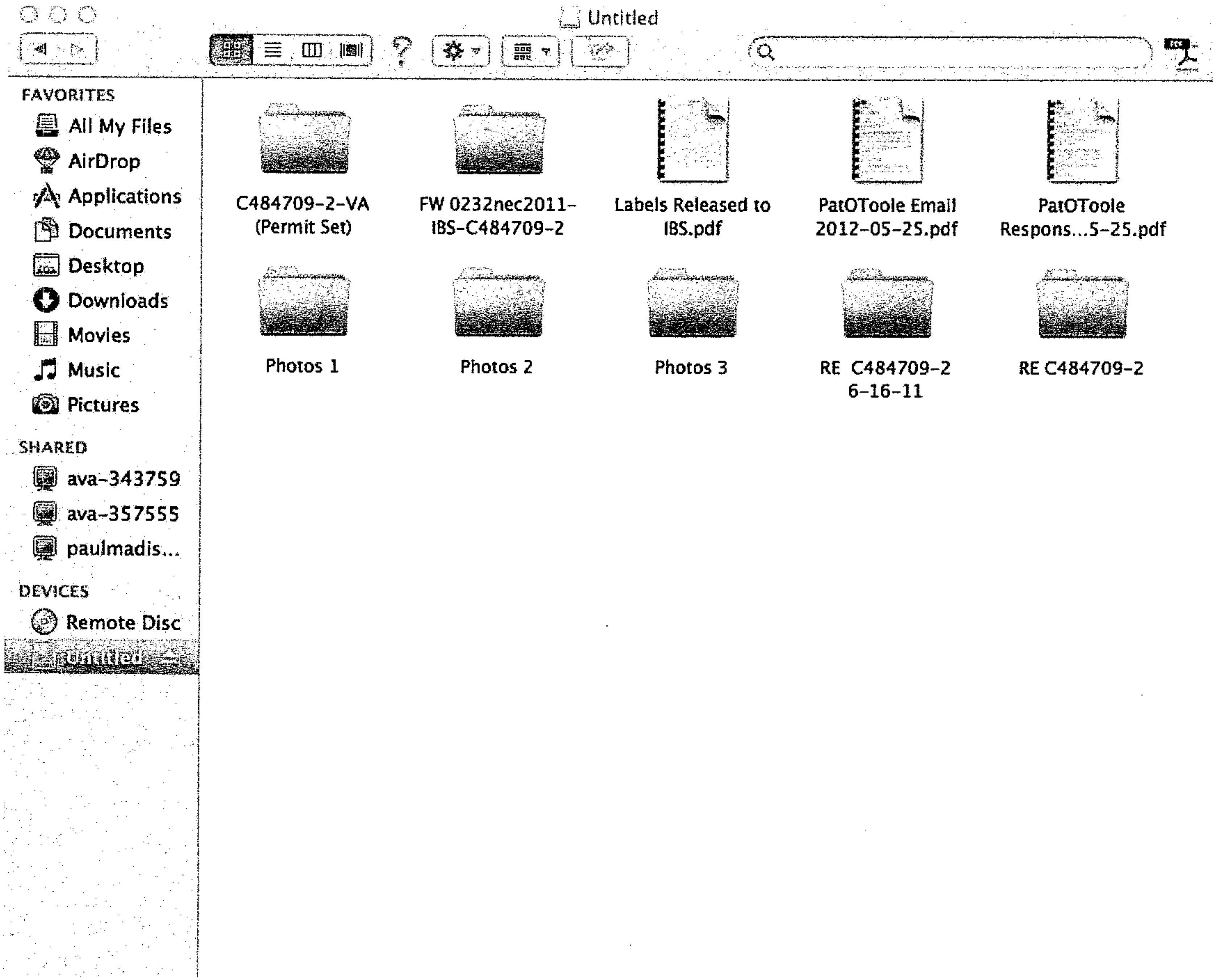
Reviewed by CL

232

FORM ISQA 3.3 Inspection Report
Form Prepared by: Tina Ramon
Form Reviewed Approved by: David Tompos

Issued/Revised: 11/07/2007

Exhibit 6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All My Files
AirDrop
Applications
Documents
Desktop
Downloads
Movies
Music
Pictures
SHARED
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paulmadis...
DEVICES
Remote Disc
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Labels Released to IBS.pdf
PatOToole Email 2012-05-25.pdf
PatOToole Respons...5-25.pdf
Photos 1
Photos 2
Photos 3
RE C484709-2 6-16-11
RE C484709-2

Label Transaction Seach

Internal ID	* Date	Name	Account	Item	Serial/Lot Numbers
721	3/17/2008	Integrity Building Systems	1720 Label Inventory	Label - IBC	13892 13893 13894 13895 13896 13897 13898 13899 13900 13901 13902 13903 13904 13905 13906 13907 13908 13909 13910 13911
2959	5/7/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	299142 299143 299144 299145 299146 299147 299148 299149 299150 299151 299152 299153 299154 299155 299156 299157 299158 299159 299160 299161 299162 299163 299164 299165 299166 299167 299168 299169 299170 299171 299172 299173 299174 299175 299176 299177 299178 299179 299180 299181 299182 299183 299184 299185 299186 299187 299188 299189 299190 299191
3007	5/7/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	301365 301366 301367 301368 301369 301370 301371 301372 301373 301374 301375 301376 301377 301378 301379 301380 301381 301382 301383 301384 301385 301386 301387 301388 301389 301390 301391 301392 301393 301394 301395 301396 301397 301398 301399 301400 301401 301402 301403 301404 301405 301406 301407 301408 301409 301410 301411 301412 301413 301414 301415 301416 301417 301418 301419 301420 301421 301422 301423 301424
3216	5/7/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	302865 302866 302867 302868 302869 302870 302871 302872 302873 302874 302875 302876 302877 302878 302879 302880 302881 302882 302883 302884 302885 302886 302887 302888 302889 302890 302891 302892 302893 302894 302895 302896 302897 302898 302899 302900 302901 302902 302903 302904 302905 302906 302907 302908 302909 302910 302911 302912 302913 302914 302915 302916 302917 302918 302919 302920 302921 302922 302923 302924
3335	5/7/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	304102 304103 304104 304105 304106 304107 304108 304109 304110 304111 304112 304113 304114 304115 304116 304117 304118 304119 304120 304121 304122 304123 304124 304125 304126 304127 304128 304129 304130 304131 304132 304133 304134 304135 304136 304137 304138 304139 304140 304141 304142 304143 304144 304145 304146 304147 304148 304149 304150 304151 304152 304153 304154 304155 304156 304157 304158 304159 304160 304161
4447	5/12/2008	Integrity Building Systems	1720 Label Inventory	Label - IBC	14053 14054 14055 14056 14057 14058 14059 14060 14061 14062 14063 14064 14065 14066 14067 14068 14069 14070 14071 14072
4491	5/12/2008	Integrity Building Systems	1720 Label Inventory	Label - Maryland	43240 43241 43242 43243 43244 43245 43246 43247 43248 43249 43250 43251 43252 43253 43254 43255 43256 43257 43258 43259
11181	6/12/2008	Integrity Building Systems	1720 Label Inventory	Label - Massachusetts	112685 112686 112687 112688 112689 112690 112691 112692 112693 112694
11702	6/18/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	306465 306466 306467 306468 306469 306470 306471 306472 306473 306474 306475 306476 306477 306478 306479 306480 306481 306482 306483 306484 306485 306486 306487 306488 306489 306490 306491 306492 306493 306494 306495 306496 306497 306498 306499 306500 306501 306502 306503 306504 306505 306506 306507 306508 306509 306510 306511 306512 306513 306514 306515 306516 306517 306518 306519 306520 306521 306522 306523 306524
12156	6/24/2008	Integrity Building Systems	1720 Label Inventory	Label - IBC	14154 14155 14156 14157 14158 14159 14160 14161 14162 14163 14164 14165 14166 14167 14168 14169 14170 14171 14172 14173
13780	7/21/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	308077 308078 308079 308080 308081 308082 308083 308084 308085 308086 308087 308088 308089 308090 308091 308092 308093 308094 308095 308096 308097 308098 308099 308100 308101 308102 308103 308104 308105 308106 308107 308108 308109 308110 308111 308112 308113 308114 308115 308116 308117 308118 308119 308120 308121 308122 308123 308124 308125 308126 308127 308128 308129 308130 308131 308132 308133 308134 308135 308136
14106	7/25/2008	Integrity Building Systems	1720 Label Inventory	Label - New Hampshire	32353 32354 32355 32356 32357 32358 32359 32360
15692	8/19/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	309490 309491 309492 309493 309494 309495 309496 309497 309498 309499 309500 309501 309502 309503 309504 309505 309506 309507 309508 309509 309510 309511 309512 309513 309514 309515 309516 309517 309518 309519 309520 309521 309522 309523 309524 309525 309526 309527 309528 309529 309530 309531 309532 309533 309534 309535 309536 309537 309538 309539 309540 309541 309542 309543 309544 309545 309546 309547 309548 309549
15824	8/21/2008	Integrity Building Systems	1720 Label Inventory	Label - IBC	14248 14249 14250 14251 14252 14253 14254 14255 14256 14257 14258 14259 14260 14261 14262 14263 14264 14265 14266 14267 14268 14269 14270 14271 14272

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Internal ID	*	Date	Name	Account	Item	Serial/Lot Numbers
15878		8/22/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	309658 309659 309660 309661 309662 309663 309664 309665 309666 309667 309668 309669 309670 309671 309672 309673 309674 309675 309676 309677 309678 309679 309680 309681 309682 309683 309684 309685 309686 309687 309688 309689 309690 309691 309692 309693 309694 309695 309696 309697 309698 309699 309700 309701 309702 309703 309704 309705 309706 309707 309708 309709 309710 309711 309712 309713 309714 309715 309716 309717
15918		8/22/2008	Integrity Building Systems	1720 Label Inventory	Label - Kentucky	6003
15987		8/25/2008	Integrity Building Systems	1720 Label Inventory	Label - Massachusetts	113449 113450 113451 113452 113453 113454 113455 113456 113457 113458
16175		8/27/2008	Integrity Building Systems	1720 Label Inventory	Label - Maryland	43553 43554 43555 43556 43557 43558 43559 43560 43561 43562 43563 43564 43565 43566 43567 43568 43569 43570 43571 43572 43573 43574 43575 43576 43577
18878		10/15/2008	Integrity Building Systems	1720 Label Inventory	Label - IBC	14382 14383 14384 14385 14386 14387 14388 14389 14390 14391 14392 14393 14394 14395 14396 14397 14398 14399 14400 14401
19639		10/28/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	312272 312273 312274 312275 312276 312277 312278 312279 312280 312281 312282 312283 312284 312285 312286 312287 312288 312289 312290 312291 312292 312293 312294 312295 312296 312297 312298 312299 312300 312301 312302 312303 312304 312305 312306 312307 312308 312309 312310 312311
21413		11/21/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	313430 313431 313432 313433 313434 313435 313436 313437 313438 313439 313440 313441 313442 313443 313444 313445 313446 313447 313448 313449 313450 313451 313452 313453 313454 313455 313456 313457 313458 313459 313460 313461 313462 313463 313464 313465 313466 313467 313468 313469 313470 313471 313472 313473 313474 313475 313476 313477 313478 313479
22842		12/26/2008	Integrity Building Systems	1720 Label Inventory	Label - IBC	14438 14439 14440 14441 14442 14443 14444 14445 14446 14447 14448 14449 14450 14451 14452 14453 14454 14455 14456 14457 14458 14459 14460 14461 14462 14463 14464 14465 14466 14467 14468 14469 14470 14471 14472 14473 14474 14475 14476 14477
22931		12/29/2008	Integrity Building Systems	1720 Label Inventory	Label - F2	314093 314094 314095 314096 314097 314098 314099 314100 314101 314102 314103 314104 314105 314106 314107 314108 314109 314110 314111 314112 314113 314114 314115 314116 314117 314118 314119 314120 314121 314122 314123 314124 314125 314126 314127 314128 314129 314130 314131 314132 314133 314134 314135 314136 314137 314138 314139 314140 314141 314142
25887		2/16/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	314760 314761 314762 314763 314764 314765 314766 314767 314768 314769 314770 314771 314772 314773 314774 314775 314776 314777 314778 314779 314780 314781 314782 314783 314784 314785 314786 314787 314788 314789 314790 314791 314792 314793 314794 314795 314796 314797 314798 314799
26135		2/19/2009	Integrity Building Systems	1720 Label Inventory	Label - IBC	14482 14483 14484 14485 14486 14487 14488 14489 14490 14491 14492 14493 14494 14495 14496 14497 14498 14499 14500 14501
27727		3/23/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	315467 315468 315469 315470 315471 315472 315473 315474 315475 315476 315477 315478 315479 315480 315481 315482 315483 315484 315485 315486 315487 315488 315489 315490 315491 315492 315493 315494 315495 315496 315497 315498 315499 315500 315501 315502 315503 315504 315505 315506 315507 315508 315509 315510 315511 315512 315513 315514 315515 315516 315517 315518 315519 315520 315521 315522 315523 315524 315525 315526
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27915		3/25/2009	Integrity Building Systems	1720 Label Inventory	Label - Maryland	44103 44104 44105 44106 44107 44108 44109 44110 44111 44112
33206		6/29/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	317757 317758 317759 317760 317761 317762 317763 317764 317765 317766 317767 317768 317769 317770 317771 317772 317773 317774 317775 317776 317777 317778 317779 317780 317781 317782 317783 317784 317785 317786 317787 317788 317789 317790 317791 317792 317793 317794 317795 317796
34987		7/29/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	318532 318533 318534 318535 318536 318537 318538 318539 318540 318541 318542 318543 318544 318545 318546 318547 318548 318549 318550 318551 318552 318553 318554 318555 318556 318557 318558 318559 318560 318561 318562 318563 318564 318565 318566 318567 318568 318569 318570 318571

Internal ID	*	Date	Name	Account	Item	Serial/Lot Numbers
36350		8/24/2009	Integrity Building Systems	1720 Label Inventory	Label - New Hampshire	32436 32437 32438 32439
37336		9/10/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	320067 320068 320069 320070 320071 320072 320073 320074 320075 320076 320077 320078 320079 320080 320081 320082 320083 320084 320085 320086 320087 320088 320089 320090 320091 320092 320093 320094 320095 320096 320097 320098 320099 320100 320101 320102 320103 320104 320105 320106 320107 320108 320109 320110 320111 320112 320113 320114 320115 320116
39129		10/12/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	321219 321220 321221 321222 321223 321224 321225 321226 321227 321228 321229 321230 321231 321232 321233 321234 321235 321236 321237 321238 321239 321240 321241 321242 321243 321244 321245 321246 321247 321248 321249 321250 321251 321252 321253 321254 321255 321256 321257 321258
39731		10/20/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	321436 321437 321438 321439 321440 321441 321442 321443 321444 321445
41206		11/12/2009	Integrity Building Systems	1720 Label Inventory	Label - F2	322084 322085 322086 322087 322088 322089 322090 322091 322092 322093 322094 322095 322096 322097 322098 322099 322100 322101 322102 322103 322104 322105 322106 322107 322108 322109 322110 322111 322112 322113 322114 322115 322116 322117 322118 322119 322120 322121 322122 322123
42388		12/7/2009	Integrity Building Systems	1720 Label Inventory	Label - Maine	19305.0
43688		1/4/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	323278 323279 323280 323281 323282 323283 323284 323285 323286 323287 323288 323289 323290 323291 323292 323293
45578		2/3/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	323840 323841 323842 323843 323844 323845 323846 323847 323848 323849 323850 323851 323852 323853 323854 323855 323856 323857 323858 323859 323860 323861 323862 323863 323864 323865 323866 323867 323868 323869 323870 323871 323872 323873 323874 323875 323876 323877 323878 323879
48429		3/22/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	324991 324992 324993 324994 324995 324996 324997 324998 324999 325000 325001 325002 325003 325004 325005 325006 325007 325008 325009 325010
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50518		4/23/2010	Integrity Building Systems	1720 Label Inventory	Label - Maryland	44846 44847 44848 44849
50586		4/26/2010	Integrity Building Systems	1720 Label Inventory	Label - IBC	14956 14957 14958 14959 14960
50588		4/26/2010	Integrity Building Systems	1720 Label Inventory	Label - IBC	14961 14962 14963 14964 14965 14966
50591		4/26/2010	Integrity Building Systems	1720 Label Inventory	Label - IBC	14996 14997 14998 14999 15000 15001 15002 15003 15004 15005
51000		5/3/2010	Integrity Building Systems	1720 Label Inventory	Label - Maryland	35466 35467 35468 35469 35471 35472 35473
51628		5/12/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	326554 326555 326556 326557 326558 326559 326560 326561 326562 326563 326564 326565 326566 326567 326568 326569 326570 326571 326572 326573 326574 326575 326576 326577 326578 326579 326580 326581 326582 326583 326584 326585 326586 326587 326588 326589 326590 326591 326592 326593
51998		5/18/2010	Integrity Building Systems	1720 Label Inventory	Label - Maryland	44929 44930 44931 44932 44933 44934 44935 44936 44937 44938 44939 44940 44941
52250		5/24/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	326720 326721 326722 326723

Internal ID	*	Date	Name	Account	Item	Serial/Lot Numbers
53516		6/11/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	327872 327873 327874 327875 327876 327877 327878 327879 327880 327881 327882 327883 327884 327885 327886 327887 327888 327889 327890 327891 327892 327893 327894 327895 327896 327897 327898 327899 327900 327901 327902 327903 327904 327905 327906 327907 327908 327909 327910 327911
53606		6/14/2010	Integrity Building Systems	1720 Label Inventory	Label - IBC	15095 15096 15097 15098 15099 15100
53912		6/18/2010	Integrity Building Systems	1720 Label Inventory	Label - Massachusetts	117213 117214 117215 117216 117217 117218
56597		7/27/2010	Integrity Building Systems	1720 Label Inventory	Label - IBC	15158 15159 15160 15161 15162 15163 15164 15165 15166 15167
58435		8/24/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	330085 330086 330087 330088 330089 330090 330091 330092 330093 330094
58649		8/27/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	330224 330225 330226 330227 330228 330229 330230 330231 330232 330233
58782		8/30/2010	Integrity Building Systems	1720 Label Inventory	Label - IBC	15199 15200 15201 15202 15203 15204 15205 15206 15207 15208 15209 15210 15211 15212 15213 15214 15215 15216 15217 15218
58891		8/31/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	330389 330390 330391 330392 330393 330394 330395 330396 330397 330398 330399 330400 330401 330402 330403 330404 330405 330406 330407 330408
60081		9/21/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	330820 330821 330822 330823 330824 330825 330826 330827 330828 330829 330830 330831 330832 330833 330834 330835 330836 330837 330838 330839
61424		10/13/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	331386 331387 331388 331389 331390 331391 331392 331393 331394 331395 331396 331397 331398 331399 331400 331401 331402 331403 331404 331405
62900		11/5/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	331857 331858 331859 331860 331861 331862 331863 331864 331865 331866 331867 331868 331869 331870 331871 331872 331873 331874 331875 331876 331877 331878 331879 331880 331881 331882 331883 331884 331885 331886 331887 331888 331889 331890 331891 331892 331893 331894 331895 331896
63684		11/17/2010	Integrity Building Systems	1720 Label Inventory	Label - Maryland	45438 45439 45440 45441 45442 45443 45444 45445 45446
64884		12/13/2010	Integrity Building Systems	1720 Label Inventory	Label - F2	332729 332730 332731 332732 332733 332734 332735 332736 332737 332738 332739 332740 332741 332742 332743 332744 332745 332746 332747 332748 332749 332750 332751 332752 332753 332754 332755 332756 332757 332758 332759 332760 332761 332762 332763 332764 332765 332766 332767 332768
67727		1/19/2011	Integrity Building Systems	1720 Label Inventory	Label - IBC	15372 15373 15374 15375 15376 15377 15378 15379 15380 15381 15382 15383 15384 15385
69540		2/25/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	334150 334151 334152 334153 334154 334155 334156 334157 334158 334159 334160 334161 334162 334163
70299		3/11/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	334327 334328 334329 334330 334331 334332 334333 334334 334335 334336 334337 334338 334339 334340 334341 334342 334343 334344 334345 334346 334347 334348 334349 334350 334351
73478		5/10/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	335792 335793 335794 335795 335796 335797 335798 335799 335800 335801 335802 335803 335804 335805 335806 335807 335808 335809 335810 335811 335812 335813 335814 335815 335816 335817 335818 335819 335820 335821 335822 335823 335824 335825 335826 335827 335828 335829 335830 335831
73799		5/16/2011	Integrity Building Systems	1720 Label Inventory	Label - IBC	15560 15561 15562 15563 15564 15565 15566 15567 15568 15569 15570 15571 15572 15573 15574 15575 15576 15577 15578 15579 15580 15581 15582 15583 15584 15585 15586 15587 15588 15589 15590 15591

Internal ID	*	Date	Name	Account	Item	Serial/Lot Numbers
74146		5/23/2011	Integrity Building Systems	1720 Label Inventory	Label - Maine	19785.0
75044		6/8/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	336710 336711 336712 336713 336714 336715 336716 336717 336718 336719 336720 336721 336722 336723 336724 336725 336726 336727 336728 336729 336750 336751 336752 336753 336754 336755 336756 336757 336758 336759 336760 336761 336762 336763 336764 336765 336766 336767 336768 336769 336770 336771 336772 336773 336774 336775 336776 336777 336778 336779
76443		6/29/2011	Integrity Building Systems	1720 Label Inventory	Label - Virginia	695 696 697 698 699 700 701 702 703
77573		7/21/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	338167 338168 338169 338170 338171 338172 338173 338174 338175 338176 338177 338178 338179 338180 338181 338182 338183 338184 338185 338186 338187 338188 338189 338190 338191 338192 338193 338194 338195 338196 338197 338198 338199 338200 338201 338202 338203 338204 338205 338206 338207 338208 338209 338210 338211 338212 338213 338214 338215 338216
80479		9/7/2011	Integrity Building Systems	1720 Label Inventory	Label - Virginia	1364 1365 1366 1367 1368 1369 1370 1371
81611		9/26/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	340606 340607 340608 340609 340610 340611 340612 340613 340614 340615 340616 340617 340618 340619 340620
81681		9/27/2011	Integrity Building Systems	1720 Label Inventory	Label - Maryland	45855 45856 45857 45858
81790		9/28/2011	Integrity Building Systems	1720 Label Inventory	Label - IBC	15926 15927 15928 15929
83071		10/14/2011	Integrity Building Systems	1720 Label Inventory	Label - Virginia	1754 1755 1756 1757
84627		10/20/2011	Integrity Building Systems	1720 Label Inventory	Label - IBC	16294 16295 16296 16297 16298 16299 16300 16301 16302 16303 16304 16305
85948		10/25/2011	Integrity Building Systems	1720 Label Inventory	Label - F2	341360 341361 341362 341363 341364 341365 341366 341367 341368 341369 341370 341371 341372 341373 341374 341375 341376 341377 341378 341379 341380 341381 341382 341383 341384 341385 341386 341387 341388 341389 341390 341391

Exhibit 7

Ralph Rinaldi

From: Richard Rowe [DickR@integritybuild.com]
Sent: Wednesday, July 13, 2011 4:44 PM
To: Ryan Boring; modular@ntainc.com
Subject: FW: 0232nec2011-IBS-C484709-2
Attachments: C484709-2-VA.dwg; 0232nec2011-IBS-C484709-2 Details-rev1.pdf; 0232nec2011-IBS-C484709-2 Calculations-rev1.pdf

Ryan:

Please email Chris a copy of the cover sheet. I am going to forward him pictures of the repairs so that he can release modules for shipment.

Thanks

From: Northeast Consulting 1 [mailto:neconsult01@epix.net]
Sent: Wednesday, July 13, 2011 4:34 PM
To: Richard Rowe; Jeff Bower
Cc: 'Rick Grassley'
Subject: 0232nec2011-IBS-C484709-2

Dick and Jeff,

Attached are the requested revised calculations, details and CAD file for 0232nec2011-IBS-C484709-2.

Please call with any questions.

Thank you,

John Reedy
Project Manager
NorthEast Consulting & Construction Management, Inc.
4397 Red Rock Road
Benton, PA 17814
Phone (570) 925-6133
Fax (570) 925-6124
Email neconsult01@epix.net

Exhibit 8

Home Mail News Sports Finance Weather Games Groups Answers Screen Flickr Mobile | More

ralph rinaldi chris lehman | Search Mail | Search Web | Milari

Compose
Inbox (234)
Drafts (88)
Sent
Spam
Trash (21)
Folders (7)
Recent

Messenger
Contacts
Calendar
Notepad

Yahoo Mail for Mobile

Search results | Delete | Move | Spam | More | Collapse All

Additional NTA Document Production (4)

Ralph Rinaldi Dec 23, 2010
To Me, 'Gina L. Schaecher'

Milari:

Although the discovery order has apparently not yet been entered, I attach the additional Milton house plans that NTA has produced per Judge Horne's decision in this case.

As for contact information for the NTA inspector who inspected your home, it is:

Chris Lehman, 730 Ehrhorn Street, Lebanon, PA 17046
Cell PH: (574) 354-2401: e-mail: clehman@ntainc.com

I remain willing to discuss the language of the disputed discovery order, in the hope that some agreement can be reached.
I should be available later this week (12/26, 12/27).

Ralph D. Rinaldi, Esq.
Cowles, Rinaldi, Judkins & Korjus, Ltd.
10521 Judicial Drive, Suite 204
Fairfax, Virginia 22030
703-385-9060
703-385-4353 (fax)

2 Attachments | View all | Download all

* → 2 Story Cape.pdf Download

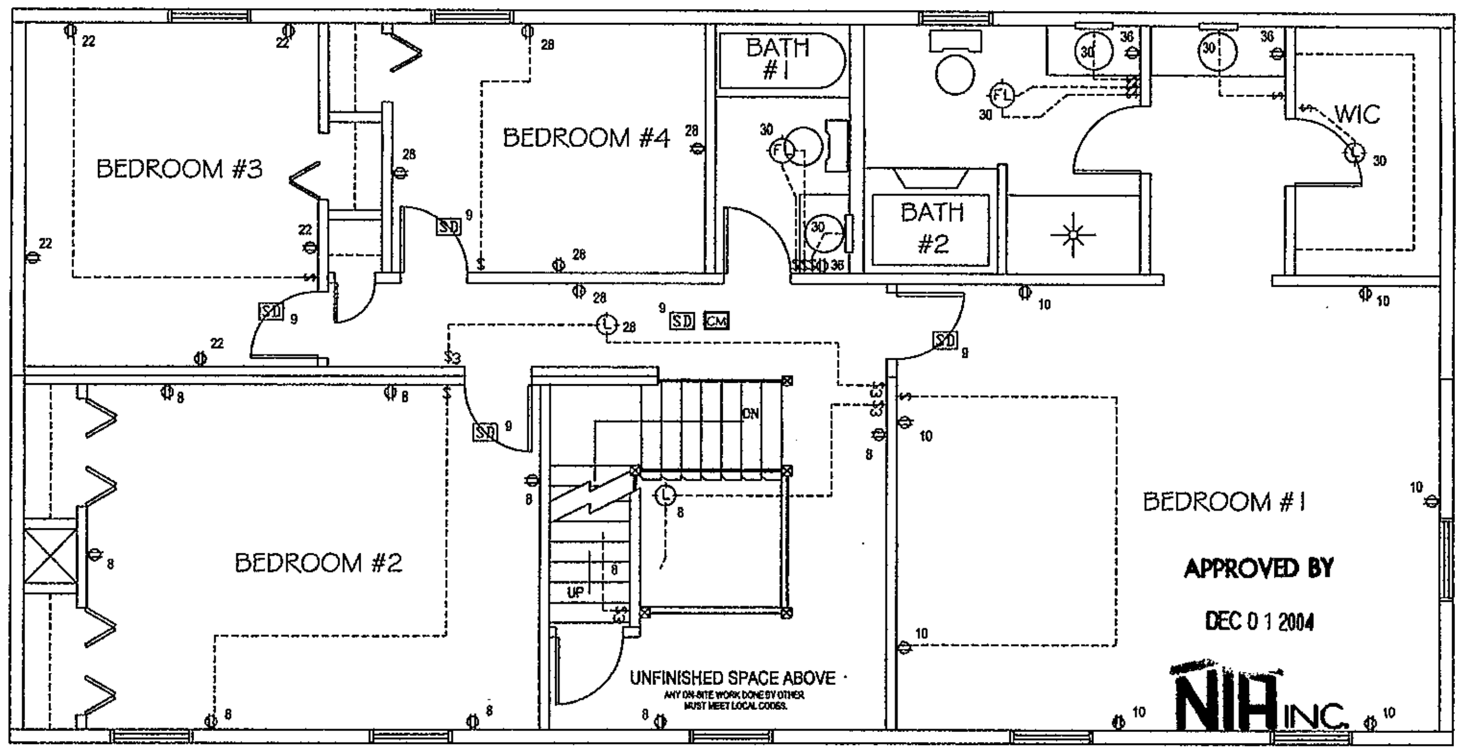
2 Story.pdf Download

Reply, Reply All or Forward | More

Me Ralph, I have a few questions and concer Dec 26, 2010

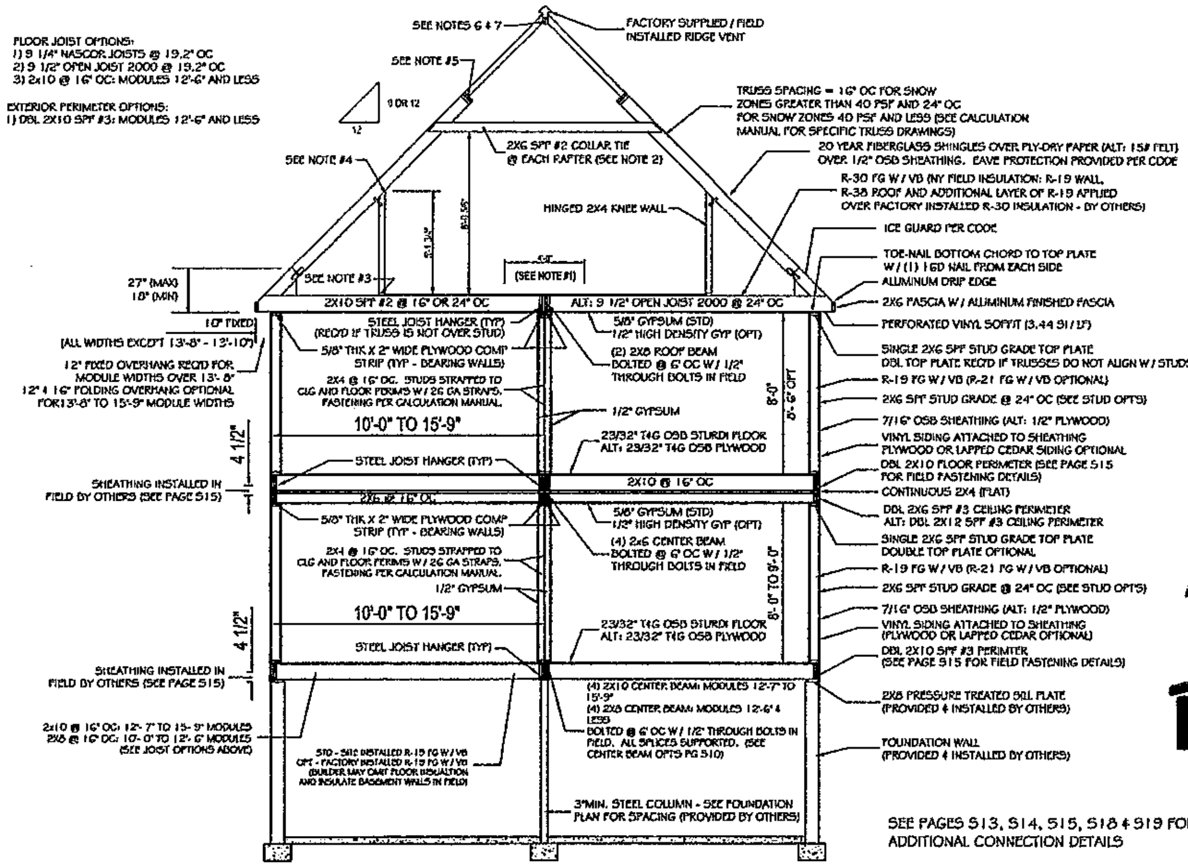
Me Dear Mr. Melis and Mr. Hodge, I intend to Dec 29, 2010

Melis, Mike F. The Office of the Attorney Gen Dec 29, 2010



Integrity Building Systems, Inc.	DEALER: MELCO INC / CUSTOMER: SPEC HOUSE	DATE: 10/29/04 · LATEST REV.: 11/19/04 (1) / DRAWN BY: CKS	CONTROL NUMBER C-205104 · SUB-SET · E2

ALL FRAMING LUMBER SHALL BE SPF #1/#2 UNLESS NOTED OTHERWISE



SEE PAGES 513, 514, 515, 518 & 519 FOR ADDITIONAL CONNECTION DETAILS

MARRIAGE WALLS FIRESTOPPED IN FIELD BY OTHERS DURING INSTALLATION
(SEE SET MANUAL PAGS 3, 3A & 21)

FIELD FASTENING NOTES:
1) 4' SHEET OF 23/32" PLYWOOD FASTENED OVER SEAM W / (8) 10D NAILS EACH SIDE OF SEAM. ALT: 1/2" THROUGH BOLTS
2) FASTEN COLLAR TIE TO RAFTER W / (8)
3) TOE NAIL BOTTOM PLATE TO BOTTOM SIDE @ EACH TRUSS (2 TOTAL)
4) FASTEN KNEE WALL TO TOP CHORD W / (1) 20D NAIL DIRECT @ EACH KNEE WALL
5) FASTEN TOP PANEL BOTTOM PLATE TO TRUSS HEADER W / (3) 16D NAILS PER RAFTER SPACE
6) TOE NAIL RIDGE BEAMS W / 16D NAILS @ 6" OC
7) STRAP RAFTER PANELS TO EACH OTHER W / 26 GA STRAPS. FASTEN STRAP LEG W / ONE STRAP PER RAFTER SPACING.

APPROVED BY

DEC 0 1 2004

NIH INC.

S1

Integrity Building Systems, Inc.	DEALER: MELCO INC	DATE: 10/29/04	LATEST REV.: 11/19/04 (1)	CONTROL NUMBER C-205104	SUB-SET
	CUSTOMER: SPEC HOUSE	DRAWN BY: CKS			

Appeal of Milari Madison
v. State Building Code Office
Appeal Nos. 13-3, 13-7 and 14-2

ADDITIONAL DOCUMENTS SUBMITTED
BY NTA, INC.

NTA INC.

ENGINEERS
PLANNERS
CONSULTANTS

305 NORTH OAKLAND AVENUE • P.O. BOX 490 • NAPPANEE, INDIANA 46550
WEB: WWW.NTAINC.COM

PHONE: 574-773-7975
FAX: 574-773-5739

November 11, 2013
IBS050213-11b

State Building Code Technical Review Board
State Building Code Office
Division of Building & Fire Regulation
Department of Housing & Community Development
600 East Main Street, Suite 300
Richmond, Virginia 23219

RE: MADISON APPEAL OF DHCD 9/23/2013 LETTER ITEM #4

Simpson's recommendation that the height of a joist hanger is at least 60% of the joist height has no effect on the final installed strength or performance of the hanger. This recommendation applies to the installation of hangers in conventional construction where construction workers may walk on the joists *prior to the attachment of sheathing*. The factory built construction process does not require workers to walk on joists prior to attachment of the floor sheathing and, as a result, this recommendation does not apply.

The "metal hanger" requirements cited by Mrs. Madison, under Section 2304.10.2 of the *2009 International Building Code*, are applicable only to "Heavy Timber Construction" and do not apply to light-framed conventional construction built under the *2009 International Residential Code* (2009 IRC). Joist hangers are not required where at least 1.5-inches of bearing is provided (2009 IRC, R502.6).

With respect to the rim joist-to-joist connection, it is standard practice in the modular industry to make this connection using end-nailing in lieu of or in addition to a ledger strip or joist hanger. The use of this attachment method, with or without a ledger strip or joist hanger, is permitted under 2009 IRC, Section R104. In Mrs. Madison's home, this connection consists of (5) 0.131"x3" end nails, which provide a capacity of 275 lbf by itself or in addition to any additional connection hardware, such as a joist hanger.

Regarding the email provided by Mrs. Madison from Simpson's engineer, Mr. Sam Hensen, PE, the analysis contained in the email contains several incorrect assumptions and omissions. Most notably, the analysis considers an excessive dead load while omitting the additional strength of the aforementioned end nailing. A corrected calculation is attached which justifies that the band joist-to-joist connection is adequate to support the required loads.

Respectfully,

Eric J. Tompos, PE, SE, CBO
NTA, Inc.

COMMONWEALTH OF VIRGINIA
ERIC J. TOMPOS
Lic. No. 42814
02/21/2014
PROFESSIONAL ENGINEER

Attachment A
Corrected Calculation

From: Hunter Madison <huntermadison2002@yahoo.com>
Date: October 10, 2013 5:50:55 AM EDT
Subject: Fw: Madison house
Reply-To: Hunter Madison <huntermadison2002@yahoo.com>

On Wednesday, October 9, 2013 10:34 AM, Sam Hensen <shensen@strongtie.com> wrote:
Ms. Madison,

The attachment you sent was for the shearwall calculations. It does not include any information on the hangers in question. However, I see that on the plans you sent earlier, a hanger is called out at the floor joist (see excerpt below). Section 1607.1 of the building code requires residential floor framing be designed to resist 40 lbs. per square foot (psf) of live loads (furniture, people, etc.) and the dead loads (weight of the building materials) which may typically be ~~20 psf~~ 10 psf for this application. Thus the total demand load on the hanger is ~~60 psf~~ 50 psf, and it would be calculated as follows:

Spacing of the floor joist in feet 16" on center = 1.33 ft.
½ the span of the floor joist = 12'-7" to 15'-9" noted on this drawing. You would use the actual length, but I will assume the longest here.

Load on the LUS26 hanger is approximately ~~60 psf~~ 50 psf x 1.33 ft. ~~x 15.75~~ 15.3 ft. / 2 = ~~628 lbs.~~ 509 lbf

The LUS26 hanger is rated for ~~865 lbs.~~ 740 lbf (SPF/HF), but requires full length 10d common nails (0.148" diameter x 3" long). If a 1 ½" long nail was used (we do not permit this nail in our hanger), the allowable load for the hanger will drop to ~~419 lbs.~~ 396 lbf (SPF/DF) (and zero uplift carrying allowable load, which isn't an issue for a floor joist). The load is even less if 8d (0.131" diameter nails) were used. Thus the allowable load for the hanger as installed is less than the demand load. ~~628 lbs.~~ < 419 lbs.
509 lbf < 603 lbf OK

(4) 0.131" x 1.5" NAILS
328 lbf
HANGER ALONE

Hope that information helps. I recommend you hire a forensics engineer to assist you with this issue. Simpson Strong-Tie does not get involved in litigious issues like this situation.

Thank You,

Sam Hensen, P.E. | Engineering Manager, Southeastern US | Simpson Strong-Tie |
2221 Country Lane | McKinney, TX 75069 | 972.439.3027

ENTIRE CONNECTION CAPACITY:
(5) 0.131" X 3" END NAIL RIM-TO-JOIST = 55 lbf x 5 = 275 lbf
(4) 0.131" x 1.5" FACE NAIL HANGER-TO-RIM = 82 lbf x 4 = 328 lbf
603 lbf

∴ INSTALLED CAPACITY 603 lbf EXCEEDS REQUIRED LOAD OF 509 lbf

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NTA INC.

ENGINEERS
PLANNERS
CONSULTANTS

305 NORTH OAKLAND AVENUE • P.O. BOX 490 • NAPPANEE, INDIANA 46550
WEB: WWW.NTAINC.COM

PHONE: 574-773-7975
FAX: 574-773-5738

January 10, 2014
IBS050213-11c

Department of Housing and Community Development
State building Code Administrative Office
600 East Main Street, Suite 300
Richmond, Virginia 23219

RE: MADISON COMPLAINT (DATED 12/1/2013) AND EXPERT REPORT (DATED 12/26/2013)

Pursuant to the request of the Department of Housing and Community Development, I have reviewed the report prepared by Laurence A. Burley, Jr., Ph.D., P.E., dated December 26, 2013. Based on my review, I have determined that Dr. Burley's findings are based on an evaluation containing numerous errors, and if these errors were corrected the evaluation would show that the floor system in the Madison residence is adequate and no remedial action is required. The errors in Dr. Burley's evaluation are detailed in the list below:

DESIGN SPANS AND APPLIED LOADS

1. Dr. Burley incorrectly determined the design spans of the joists to be 15'-7", 15'-5", 13'-5" and 10'-6". The spans used by Dr. Burley correspond to the module widths, which are greater than the joist span. The modules are constructed with a double 2x band joist on each side, as a result, the design span of the joist is 6-in. less than the module width. The correct spans are 15'-1", 14'-11", 12'-11" and 10'-0", respectively. This error in Dr. Burley's evaluation resulted in an overestimation of the bending stress by up to 10-percent.

2. Dr. Burley incorrectly estimated the dead load of the joists and decking as 9 psf. The dead weight considered by Dr. Burley considers the weight of the structural sheathing *twice* as the tabulated dead load provided in ASCE 7-05, Commentary Table C3-1, (Ref. 2 in the report) includes both the weight of joists, subfloor and underlayment. From the 2005 NDS (Ref. 3 in the report), a 2x10 SPF joist at 16-in. on-center has a dead weight of 2.0 psf. From the *APA D510C, Panel Design Specification*, 3/4-in. thick plywood, 24-in. o.c. rated Sturd-I-Floor (combination subflooring underlayment), has a dead weight of 2.3 psf. The total dead weight of the structural material in the floor system is 4.3 psf (2.0 psf + 2.3 psf), whereas Dr. Burley considers a dead weight of 9 psf for the same materials. This error results in overestimation of the dead weight by 109-percent for these components.

3. Dr. Burley incorrectly adds a "Mechanical and Electrical Allowance" in the dead load calculation. This "allowance" is not required by code and is not warranted in residential construction where the actual weight of the supported mechanical and electrical equipment is very small. Pursuant to ASCE 7-95, Section 3.1.2, "In determining dead loads for purposes of design, the actual weights of materials and constructions shall be used…" As previously determined (Item 2), the actual weight of the structural materials in the floor is 4.3 psf. The original design considers a dead load of 10 psf, which provides 5.7 psf for finish materials, mechanical and electrical.

4. Dr. Burley incorrectly designs the floor for a total uniform load of 57 psf. Standard practice within the modular industry is to design light-framed residential floors in living areas for a 10 psf dead load and a 40 psf live load, which results in a total design load of 50 psf. The overall error in Dr. Burley's design load estimation due to the errors described in Item 2 and Item 3 is an overestimation of the total design load by 14-percent.

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FLOOR JOISTS

5. Dr. Burley incorrectly determines the allowable stress for Spruce-Pine-Fire lumber. Pursuant to the *2005 National Design Specification for Wood Construction Supplement* (NDS/Ref. 3 in the report), Table 4A, the *Size Factor,* C_F, for 2x10 SPF No.2 lumber under flexural stress is 1.10. The correct allowable bending strength, F'_b, is 1107 psi (875 psi (F_b) x 1.15 (C_r) x 1.10 (C_F) = 1107 psi). This error results in underestimation of the allowable flexural strength, F_b', by 10-percent.

6. Dr. Burley has a calculation error in "Table 1, Capacity Analysis Results," column "F'$_b$." The bending stress, F'_b, presented in the table is 980 psi. This value is incorrect and does not correspond to the tabulated bending stress (875 psi) multiplied by the repetitive member factor (1.15), as described the report. Excluding the error described in Item 5, Dr. Burley should have calculated F'_b = 1006 psi (875 psi x 1.15 = 1006 psi). The errors described in Items 5 and 6 result in an underestimation of the allowable bending stress by 11-percent.

7. Dr. Burley incorrectly determines the applied shear load at the ends of the joists in "Table 1, Capacity Analysis Results," column "F$_v$." Pursuant to the *2005 National Design Specification for Wood Construction Supplement* (NDS/Ref. 3 in the report), Section 3.4.3.1, the "...uniformly distributed loads within a distance from supports equal to the depth of the bending member, d, shall be permitted to be ignored..." Dr. Burley's analysis does not ignore the load within *d* of the supports when determining the shear force. This error results in overestimation of the joist shear stress by up to 24-percent.

8. Dr. Burley has a calculation error in "Table 1, Capacity Analysis Results," column "Deflection." The tabulated deflection values are incorrect and appear to be based on a joist spacing of 12-in. on-center, whereas the joists are installed at 16-in. on-center. This error results in underestimation of the deflections by 25-percent.

9. Dr. Burley incorrectly concludes that the joists are overstressed in bending. Correcting the errors identified in Items 1 through 4, the applied bending stress, *fb*, is 1064 psi for a joist spanning 15'-1" spaced 16-in. on-center. Correcting the errors identified in Items 5 and 6, the allowable bending stress, F'_b, of a 2x10 SPF, No. 2 is 1107 psi, which is greater than 1064 psi. Therefore, the floor joists in the Madison residence are adequate and no remedial action is required. Alternately, the joists may be justified using the prescriptive tables in the *2009 Virginia Residential Code.* In the code, Table R502.3.1(2) (attached), permits a 16-in. on-center, 2x10 SPF, No. 2, to span 15'-5" under 10 psf dead load and 40 psf live load. The tabulated span permitted by the code exceeds the maximum design span in the Madison residence which is 15'-1"; therefore, the floor joists are acceptable and conform with the *2009 Virginia Residential Code.*

JOIST HANGERS

10. Dr. Burley incorrectly determines the capacity of the Simpson LUS26 joist hanger as 492 lbf. The reduction factor of 0.64, provided in Simpson's catalog (Ref. 4 in the report), does not apply to joist hangers that utilize "double shear nails." As detailed in NTA's letter regarding "Madison Appeal of DHCD 9/23/2013 Letter Item #4," dated 11/11/2013, the installed capacity of the LUS26 joist hanger is 328 lbf. This error in the analysis results in overestimation of the hanger capacity by 50-percent.

11. Dr. Burley incorrectly determines the total strength of the rim joist-to-joist connection. As provided in Milton's design manual, and in accordance with standard construction practice in the modular industry, end-nails were installed at this connection *in addition to* the joist hanger. As detailed in NTA's letter regarding "Madison Appeal of DHCD 9/23/2013 Letter Item #4," dated 11/11/2013, the end-nailing consists of (5) 0.131" x 3" end nails, which provide a strength of 275 lbf *in addition to* the strength of the LUS26 joist hanger. The resulting total connection strength is 603 lbf (275 lbf + 328 lbf = 603 lbf). This error in Dr. Burley's evaluation results in underestimation of the total connection strength by 29-percent.

12. Dr. Burley incorrectly concludes that the joist hangers are not adequate to support the design loads. Correcting the errors identified in Items 1 through 4, the maximum joist end reaction is 509 lbf. Correcting the errors identified in Items 10 and 11, the allowable connection strength is 603 lbf, which exceeds the maximum applied load of 509 lbf; therefore, the joist end connection is adequate.

FLOOR VIBRATION

13. Dr. Burley incorrectly concludes that the joists are unacceptable due to vibration. The vibration analysis performed is not a requirement of the *2009 Virginia Residential Code*. The *2009 Virginia Residential Code*, Table R502.3.1(2), permits a 16-in. on-center, 2x10 SPF, No. 2, to span 15'-5" under 10 psf and dead load and 40 psf live load. The tabulated span permitted by the code exceeds the maximum design span of 15'-1"; therefore, the floor joists are acceptable and conforms with the *2009 Virginia Residential Code*.

DATA PLATE

14. Dr. Burley asserts that "...the house plate correctly identifies the house as a two story residence." This conclusion is correct and in concurrence with NTA opinion on this matter.

As detailed herein, the evaluation performed by Dr. Burley contains numerous errors, which led to incorrect conclusions regarding the adequacy of the floor system. If the errors in Dr. Burley's analysis were corrected, his evaluation would show that the floor system in the Madison residence is adequate and no remedial action is required. The original design documents submitted to NTA, Inc. were justified using the prescriptive span tables found in the *2009 Virginia Residential Code* (attached), which clearly show that the floor system conforms with the code.

Respectfully,

COMMONWEALTH OF VIRGINIA
ERIC J. TOMPOS
Lic. No. 41814
2/21/2014
PROFESSIONAL ENGINEER

Eric J. Tompos, PE, SE, CBO
NTA, Inc.

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/Δ = 360)[b]

JOIST SPACING (inches)	SPECIES AND *GRADE*		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)	(ft - in.)
12	Douglas fir-larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas fir-larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas fir-larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas fir-larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	18-5	22-5
	Southern pine	#2	10-9	14-2	18-0	21-9	10-9	14-2	16-11	19-10
	Southern pine	#3	9-4	11-11	14-0	16-8	8-6	10-10	12-10	15-3
	Spruce-pine-fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-pine-fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas fir-larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas fir-larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas fir-larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas fir-larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern pine	#1	9-11	13-1	16-9	20-4	9-11	13-1	16-4	19-6
	Southern pine	#2	9-9	12-10	16-1	18-10	9-6	12-4	14-8	17-2
	Southern pine	#3	8-1	10-3	12-2	14-6	7-4	9-5	11-1	13-2
	Spruce-pine-fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-pine-fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
19.2	Douglas fir-larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas fir-larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas fir-larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas fir-larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern pine	#1	9-4	12-4	15-9	19-2	9-4	12-4	14-11	17-9
	Southern pine	#2	9-2	12-1	14-8	17-2	8-8	11-3	13-5	15-8
	Southern pine	#3	7-4	9-5	11-1	13-2	6-9	8-7	10-1	12-1
	Spruce-pine-fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-pine-fir	#	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas fir-larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas fir-larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas fir-larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas fir-larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10[a]
	Hem-fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-1
	Southern pine	#1	8-8	11-5	14-7	17-5	8-8	11-3	13-4	15-11
	Southern pine	#2	8-6	11-0	13-1	15-5	7-9	10-0	12-0	14-0
	Southern pine	#3	6-7	8-5	9-11	11-10	6-0	7-8	9-1	10-9
	Spruce-pine-fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-pine-fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

a. End bearing length shall be increased to 2 inches.

b. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D_0, D_1, and D_2 shall be determined in accordance with Section R301.2.2.2.1.

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