DHCD – Division of Building and Fire Regulation
2006 Code Change Cycle

COMPILATION DOCUMENT
(of all code changes received with staff evaluations)

PART II

Code changes beginning with a "C" are to the Virginia Construction Code; with an "M" are to the Virginia Maintenance Code; with an "F" are to the Virginia Statewide Fire Prevention Code; with an "I" are to the Virginia Industrialized Building Safety Regulations; with an "A" are to the Virginia Amusement Device Regulations, and with a "CS" are to the Virginia Certifications Standards. The order is as follows: C – M – F – I – A – CS.

PART I contains page numbers 1 – 99 and code changes C-103.1 – C-310.6(R408.1)
PART II contains page numbers 100 – 199 and code changes C-310.6(R602.3) – C-408.8
PART III contains page numbers 200 – 303 and code changes C-503 – C-2803.1(M701.1)
PART IV contains page numbers 304 – 408 and code changes C-2804.1(FG310.1) – C-3501.1-c
PART V contains page numbers 409 – 502 and code changes C-3501.1-d – F110.1
PART VI contains page numbers 503 – 606 and code changes F-111.1 – CS-41

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VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-310.6(R602.3)

Nature of Change: (text is on code change form)

To change the table in the International Residential Code for stud sizes and spacing to address finished attics.

Proponent: Virginia Building and Code Officials Association (VBCOA)

Staff Comments:

This proposal by the VBCOA IRC Committee is a correlating proposal with Code Change No. C-310.6(R301.5), both utilizing a new "loft" term. As staff noted in the evaluation for correlating proposal, the proposals were not submitted in time to be considered by the workgroup process used in this code change cycle, but since both proposals have been submitted to the International Code Council for the 2009 IRC, one option is for both proposals to be deferred for the 2009 Virginia Construction Code to permit them to be vetted at the national level to address potential concerns.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

Address to submit to:

DHCD, the Jackson Center
501 North Second Street
Richmond, VA 23219-1321

Tel. No. (804) 371 – 7150
Fax No. (804) 371 – 7092
Email: bhcd@dhcd.state.va.us

8/8/07

Document No. C-310.6(R602.3)

Committee Action: ______________

BHCD Action: ________________

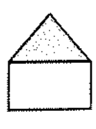
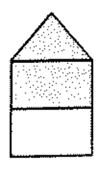
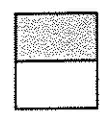
Submitted by:	Chuck Bajnai, Chesterfield County
Representing:	VBCOA - IRC Committee
Address:	9800 Government Parkway, Chesterfield, VA 23832
Phone No.:	(804) 717-6428
Regulation Title:	2006 IRC Table R602.3(5)

STUD TABLE

Proposed Change:

IRC Table 602.3(5): Revise column headings and add footnote "c" as follows:

TABLE R602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS [a]

STUD SIZE (inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height [a] (feet)	Maximum spacing when supporting roof and ceiling **assemblies or a loft assembly [c],** only (inches)	Maximum spacing when supporting one floor, roof and ceiling **assemblies or a loft assembly [c],** (inches)	Maximum spacing when supporting two floors, roof and ceiling **assemblies or a loft assembly [c],** (inches)	Maximum spacing when supporting one floor only (inches)	Laterally unsupported stud height [a] (feet)	Maximum spacing (inches)
							
2× 3[b]	—	—	—	—	—	10	16
2 × 4	10	24	16	—	24	14	24
3 × 4	10	24	24	16	24	14	24
2 × 5	10	24	24	—	24	16	24
2 × 6	10	24	24	16	24	20	24

For SI: 1 inch = 25.4 mm.

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by analysis.

b. Shall not be used in exterior walls.

c. LOFT. A finished or unfinished area, not considered a story, with an occupiable space complying with all of the following requirements:

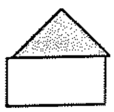
A. **The occupiable floor area is at least 70 sqft, measured between areas that are at least 5 feet tall,**
B. **The occupiable area has headroom of at least 7' clearance for at least 50% of the occupiable floor area,**
C. **The occupiable floor area does not exceed 70% of the total width of the structure,**
D. **The occupiable area is designed to carry a minimum of 30 psf live load,**
E. **The space has no exterior walls, and is enclosed by the knee walls (if applicable) on the sides, and the roof assembly (above) and the floor-ceiling assembly (below),**

A loft assembly shall include loads from the roof rafters and ceiling joists or trusses extended to the perimeter of the structure.

Supporting Statement:

This change is intended to clarify the intention Table R603(5).

I have tried teaching this chapter of the IRC and have not been able to answer questions regarding the intentions or limitations of this table. Accepted construction practice says that there is not a problem, but the table is too exclusive to be practical. This change it intended to provide prescriptive clarification of the Stud Table.



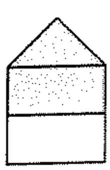
Column3: **"Maximum spacing when supporting roof and ceiling <u>assemblies or a loft assembly only</u>"**

In general the Stud Table R602.3(5) is tacit about how it handles attics, walk-up attics, room trusses, or the infamous attic-finished-off-to-create-another-floor situation, sometimes called a "half story" or "finished attics" (an oxy-moron) or even "residential mezzanines". The Table offers more questions than answers:

1. Should it be assumed that the Stud Table has taken into account attics, or "finished attics"?
2. Should it be assumed that the Stud Table has taken into account truss roof systems?

Solution:

1. "Roof and ceiling assemblies" and "loft assembly" provide a more inclusive language as to what the stud table is intended to carry. It would include truss roof systems that are otherwise not clearly allowed.
2. By introducing the new term "loft assembly" into the category heading and defining "loft" in the footnote, we can solve several situations simultaneously. A "loft assembly" along with the footnote definition of "loft" describes the habitable (or potentially habitable) space above the top floor ceiling – without all of the implications of creating another story. It has the physical properties and design load allowances of "habitable" space, but makes the issue of being finished off now or in the future a moot point.
3. Regardless if the studs are supporting a "roof and ceiling assembly" or a "loft assembly" the typical 2x4 studs at 16" o.c. would agree with common accepted practice.
4. The little icon of the one story house is added to help describe the situation.



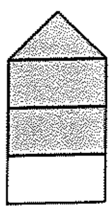
Column 4: **"Maximum spacing when supporting one floor, roof and ceiling <u>assemblies or a loft assembly"</u>**

Under the current IRC, if the two-story house has a "finished attic" it should be treated as a three-story house. That puts the homeowner in a precarious position when he wants to finish off the attic of his two-story house. The plan reviewer would have to treat the finished space as another floor, and the Stud Table would require the homeowner to replace all of the 2x4 first floor studs with 2x6 studs (i.e. going from Column 4 in the Table (supporting one floor plus roof/ceiling) to Column 5 (supporting two floors plus roof/ceiling in the table)).

Similarly, if the two-story house has a roof system constructed with "room trusses" (see attached picture), the truss system then would have to be considered another floor or story with the same issues.

Solution:

1. "Roof and ceiling assemblies" and "loft assembly" provide a more inclusive language of what the stud table was intended to carry. It would include truss roof systems that are otherwise not clearly allowed.
2. Again, by introducing the new term "loft assembly" into the category heading and defining "loft" in the footnote, we can solve several situations simultaneously. By the footnote definition, "loft" would not be considered another story, and therefore would not put extra design requirements on the structure. The first floor studs supporting the second floor and a "loft assembly" could be the typical 2x4 studs at 16" o.c., and would agree with common accepted practice; there is empirical precedence from thousands of homes with two floors, "roof and ceiling assemblies" or "loft assemblies" that prove that these structures do not fail.



Column 5: **"Maximum spacing when supporting two floors, roof and ceiling <u>assemblies or a loft assembly"</u>.**

We also have hundreds of houses with a walkout basement, two stories and "finished attic". This creates several other issues:

1. If the basement is a "story above grade", the house is really a four-story structure. The Table R602.3(5) does not prescribe stud sizes and spacing for four story houses. It is outside the IRC code, and would have to be constructed in accordance with the IBC – which would require the structure to be sprinklered.
2. Virginia law requires the plans of a four story structure to be prepared by a registered design professional.

Solution:

Again the new term "loft" is beneficial. If implemented:

1. The basement would not have to be a story below grade, and hence the issue of a four story structure is moot, AND
2. Table R602.3(5), Column 4 would prescribe 2x4 studs @ 16" o.c. for the first floor walls, consistent with the way contractors are building today, AND
3. Table R602.3(5), Column 5 would prescribe 2x6 studs @16" o.c. for the basement floor walls, consistent with the way contractors are building today.

IMPORTANT NOTE1:

We have run the calculations for wall studs carrying one floor, one exterior wall, and a two-point bearing room truss, and found that 2x4 studs @16" o.c. works for spans up to 32 feet with conventional shingles.

Because the calculations show the 32 feet width (with 5 foot knee walls each side) is about the limit for the studs of a two-story house with trusses, we have the limit of "70% of the total width of the structure" requirement. (i.e. the occupiable space utilizes about 22/32 or 70% of the total width of the structure.).

Wall studs supporting one floor, one exterior wall, and a two-point bearing room truss with longer spans should go the Table column for studs supporting two floors and a loft and use 2x6 @16" o.c..

IMPORTANT NOTE 2:

If the proposed definition of "loft" is accepted by separate submittal, footnote c is not required, and footnote c can be renumbered.

IMPORTANT NOTE 3.

This same change has been submitted to the ICC for consideration for the 2009 IRC.

Job	Truss	Truss Type	Qty	Ply	
CHUCKB	T1	ATTIC	1	1	Job Reference (optional)

BSOP, PETERSBURG, VA 23804, BONNIE LOGAN

6.400 s Sep 7 2006 MiTek Industries, Inc. Tue May 29 13:01:06 2007 Page 1

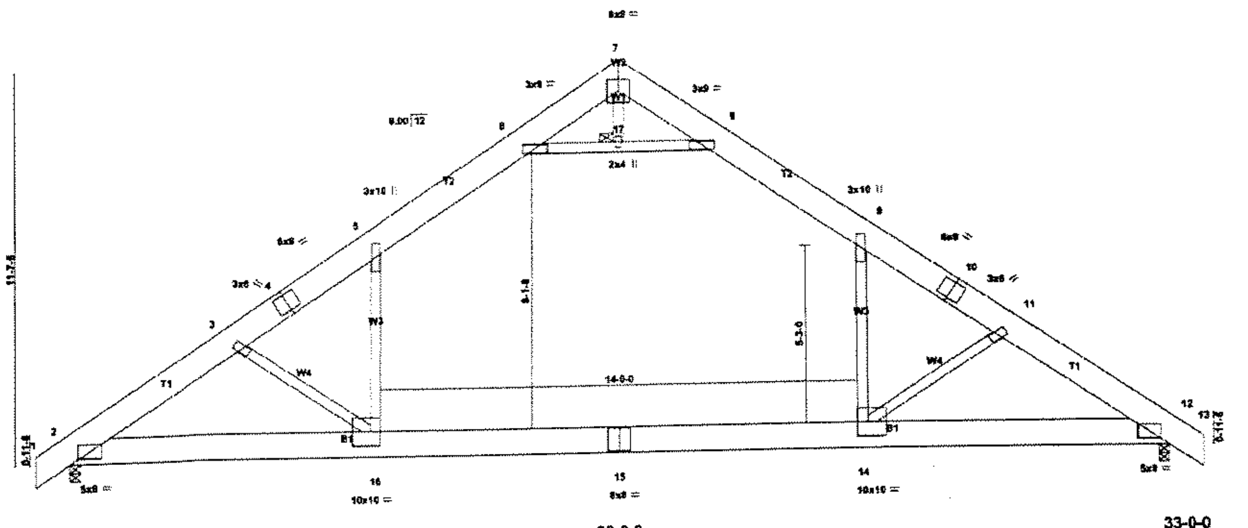


Plate Offsets (X,Y): [14:0-3-8,0-5-0], [16:0-3-8,0-5-0]

LOADING (psf)		SPACING		CSI		DEFL	in	(loc)	l/defl	L/d	PLATES	GRIP
TCLL	20.0	Plates Increase	1.00	TC	0.95	Vert(LL)	-0.42	14-16	>911	360	MT20	244/190
TCDL	10.0	Lumber Increase	1.00	BC	0.78	Vert(TL)	-0.69	14-16	>548	240		
BCLL	0.0 *	Rep Stress Incr	YES	WB	0.42	Horz(TL)	0.05	12	n/a	n/a		
BCDL	10.0	Code IRC2003/TPI2002		(Matrix)		Wind(LL)	0.08	16	>999	240	Weight: 330 lb	

LUMBER
TOP CHORD 2 X 10 SYP No.1
BOT CHORD 2 X 10 SYP No.1
WEBS 2 X 4 SYP No.2 *Except*
W4 2 X 4 SYP No.3, W4 2 X 4 SYP No.3, W2 2 X 4 SYP No.3

BRACING
TOP CHORD Structural wood sheathing directly applied.
BOT CHORD Rigid ceiling directly applied or 10-0-0 oc bracing.
JOINTS 1 Brace at Jt(s): 17

REACTIONS (lb/size) 2=2052/0-3-8, 12=2052/0-3-8
Max Horz 2=-242(load case 2)

FORCES (lb) - Maximum Compression/Maximum Tension
TOP CHORD 1-2=0/31, 2-3=-3392/0, 3-4=-3002/0, 4-5=-2876/0, 5-6=-2075/0, 6-7=0/712, 7-8=0/712, 8-9=-2075/0, 9-10=-2876/0, 10-11=-3002/0, 11-12=-3392/0, 12-13=0/31
BOT CHORD 2-16=0/2699, 15-16=0/2157, 14-15=0/2157, 12-14=0/2699
WEBS 6-17=-3124/0, 8-17=-3124/0, 5-16=0/1444, 9-14=0/1444, 3-16=-765/107, 11-14=-765/109, 7-17=0/433

NOTES
1) Unbalanced roof live loads have been considered for this design.
2) Wind: ASCE 7-02; 90mph; h=0ft; TCDL=6.0psf; BCDL=6.0psf; Category II; Exp C; enclosed; MWFRS; Lumber DOL=1.00 plate grip DOL=1.00.
3) This truss requires plate inspection per the Tooth Count Method when this truss is chosen for quality assurance inspection.
4) * 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 1-0-0 wide will fit between the bottom chord and any other members.
5) Ceiling dead load (5.0 psf) on member(s). 5-6, 8-9, 6-17, 8-17
6) Bottom chord live load (40.0 psf) and additional bottom chord dead load (5.0 psf) applied only to room. 14-16
7) This truss is designed in accordance with the 2003 International Residential Code sections R502.11.1 and R802.10.2 and referenced standard ANSI/TPI 1.

LOAD CASE(S) Standard

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-310.6(R602.10)

Nature of Change: (text is on code change form)

To replace the wall bracing criteria in the International Residential Code with an updated version based on the work of an International Code Council (ICC) Ad Hoc Committee on Wall Bracing.

Proponent: Virginia Building and Code Officials Association (VBCOA)

Staff Comments:

This proposal by the VBCOA IRC Committee was anticipated when the wall bracing provisions were approved for the proposed regulations. The ICC Ad Hoc Committee on Wall Bracing has two representatives from VBCOA and is chaired by the Chesterfield County representative. The committee successfully submitted a number of changes for the 2007 Supplement to the IRC and has submitted additional changes for the 2009 IRC The Virginia committee members have produced a Virginia EZ Read version of the changes recognizing that high seismic design criteria may be omitted for Virginia localities.

A number of additional changes for wall bracing and changes which are affected by the wall bracing provisions have been submitted (Code Change Nos. C-301.6(R301.5), C310.6(R404.1), C310.6(R602.10.1.2)-a, C310.6(R602.10.1.2)-b and C310.6(R802.10.5), found behind this change). Staff urges caution in considering these other changes at this time as many are still being debated at the national level and may actually create conflicts with the more comprehensive Virginia EZ Read change.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

(Use this form to submit changes to building and fire codes)

Address to submit to: DHCD, the Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.state.va.us	8/10/07	Document No. C-310.6(R602.10) Committee Action: __________ BHCD Action: __________

Submitted by:	Chuck Bajnai, Chesterfield Co.	Brian Foley, Fairfax Co.
Representing:	VBCOA IRC Committee	
Address:	9800 Government Parkway Chesterfield, VA 23832	12055 Government Center Parkway Fairfax, VA 22035
Phone No.:	(804) 717-6428	(703) 324-1842
Regulation Title:	2006 IRC Section R602.10	

Proposed Change:

Delete 2006 IRC Section R602.10 in its entirety and substitute new section.

Supporting statement:

Virginia is privileged to have representation on two national committees on wall bracing, the ICC Ad Hoc Committee on Wall Bracing (AHWB) and the IRC Wall Bracing Committee led by Dan Dolan of Washington State University (Dolan Group). These two committees have been meeting for nearly two years and have been charged with making the prescriptive bracing requirements of the IRC both technically correct and easier to understand.

The Dolan Group is charged with setting consistent testing procedures and splitting the wind and seismic requirements that were previously merged when the IRC were created. The various testing agencies, universities and engineering organizations have been sharing results and data to provide the framework for the next generation of wall bracing provisions which are expected to be a departure from the current provisions.

The AHWB committee has two broad goals:

- The first is to evaluate and make recommends for the 2009 IRC to:
  - Address missing areas.
  - Make the provisions easier to understand and implement in the field.
  - Simplify the concepts.
  - Add increased flexibility for designers.
- The second goal for the AHWB is to use the findings from the Dolan Group and produce the next generation of wall bracing provisions.

In this regard, the committees have worked hard to produce a new version of Section R602.10 that was approved in Orlando, and the AHWB committee had further success with additional tweaks and improvements in Rochester. As a result, Virginia, with this proposed change to R602.10, will be able to benefit from these efforts sooner rather than later.

At the request of DHCD, Brian Foley and Chuck Bajnai, members of both nationwide committees, formulated a Virginia version of the improvements and simplifications produced by the AHWB. Affectionately called the Virginia EZ Read, the code section will align the 2006 USBC/IRC with what is hoped to be the eventual wall bracing provisions of the 2009 IRC.

It is expected to take several more years (2012 IRC perhaps?) to establish the sweeping changes Virginians and the rest of the nation are demanding. An ASTM standard is in development, new standardized tests must be conducted, new engineering conclusions must be ratified, and new code language must be drafted. However, until that time, the Virginia EZ Read will provide users with more flexibility in a format that is easier to read and understand.

Scope of Changes to the Virginia EZ Read

- The structure of R602.10 was reconfigured to improve flow and to bring hidden footnotes into actual code provisions.
- Since the design requirements in Virginia are driven by wind, the Virginia EZ Read first and foremost eliminates non-applicable seismic provisions.
- Long code narratives were replaced with single figures and/or tables.
- Tables were simplified and made easier to read.
- Tables were reformulated to reduce the amount of interpolation needed.
- Adjustment factors were incorporated into tables or eliminated altogether.
- New figures were added to better explain definitions and design options.
- New text was added to provide prescriptive solutions to areas that were previously missing and problematic, including: angled walls, credit for reduced panel lengths, and masonry stem walls.
- Approaches to bracing were changed to provide distinction and clarity:
  i. The term "intermittent bracing" was introduced to distinguish continuous sheathing from non-continuous.
  ii. Intermittent methods were expanded to include all related narrow bracing options.
  iii. Continuous sheathing methods (previously treated as exceptions and footnotes) were brought into the code as viable optional methods to allow flexibility for the eventual addition of new materials (i.e., structural fiberboard).
  iv. Method numbers were eliminated to allow better identification and to easily add or remove methods.

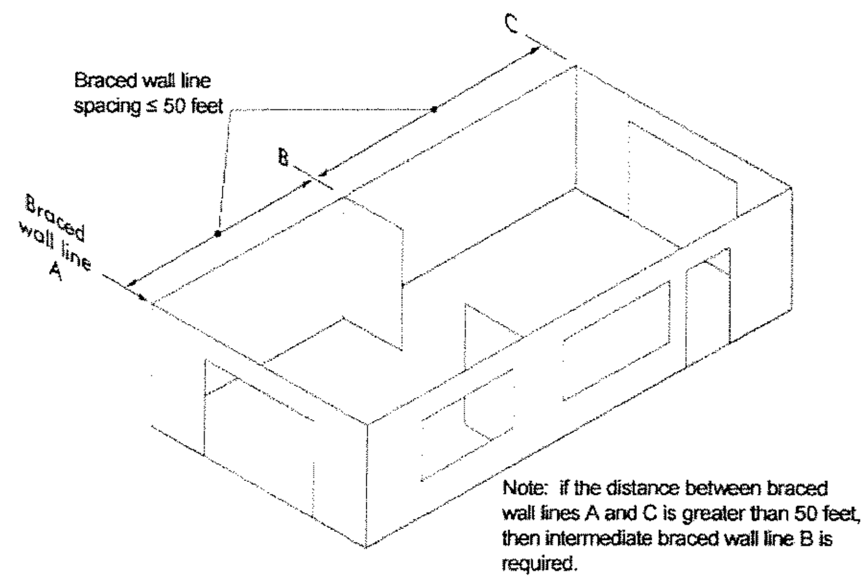
DELETE SECTION R602.10 AND REPLACE WITH THE FOLLOWING:

R602.10 Wall bracing. All new buildings, additions and conversions shall be braced in accordance with this section. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with the International Building Code. For structures in areas where the wind speed from Table R301.2(1) is 110 mph or greater, an engineered design is required.

All method(s) of bracing used shall be identified and located on the construction documents.

R602.10.1 Braced wall lines. Braced wall lines shall be straight lines through the building plan at each level provided with braced wall panels to resist lateral load. The percentage, location and construction of braced wall panels shall be as specified in this section.

R602.10.1.1 Spacing of braced wall lines. In each story, spacing of parallel braced wall lines shall not exceed 50 feet (15 240 mm) as shown in Figure R602.10.1.1. When braced wall lines exceed a spacing of 50 feet (15 240 mm), intermediate braced wall line(s) shall be provided. Each end of a braced wall line shall intersect perpendicularly with other braced wall lines or their projections.



For SI: 1 foot = 305 mm

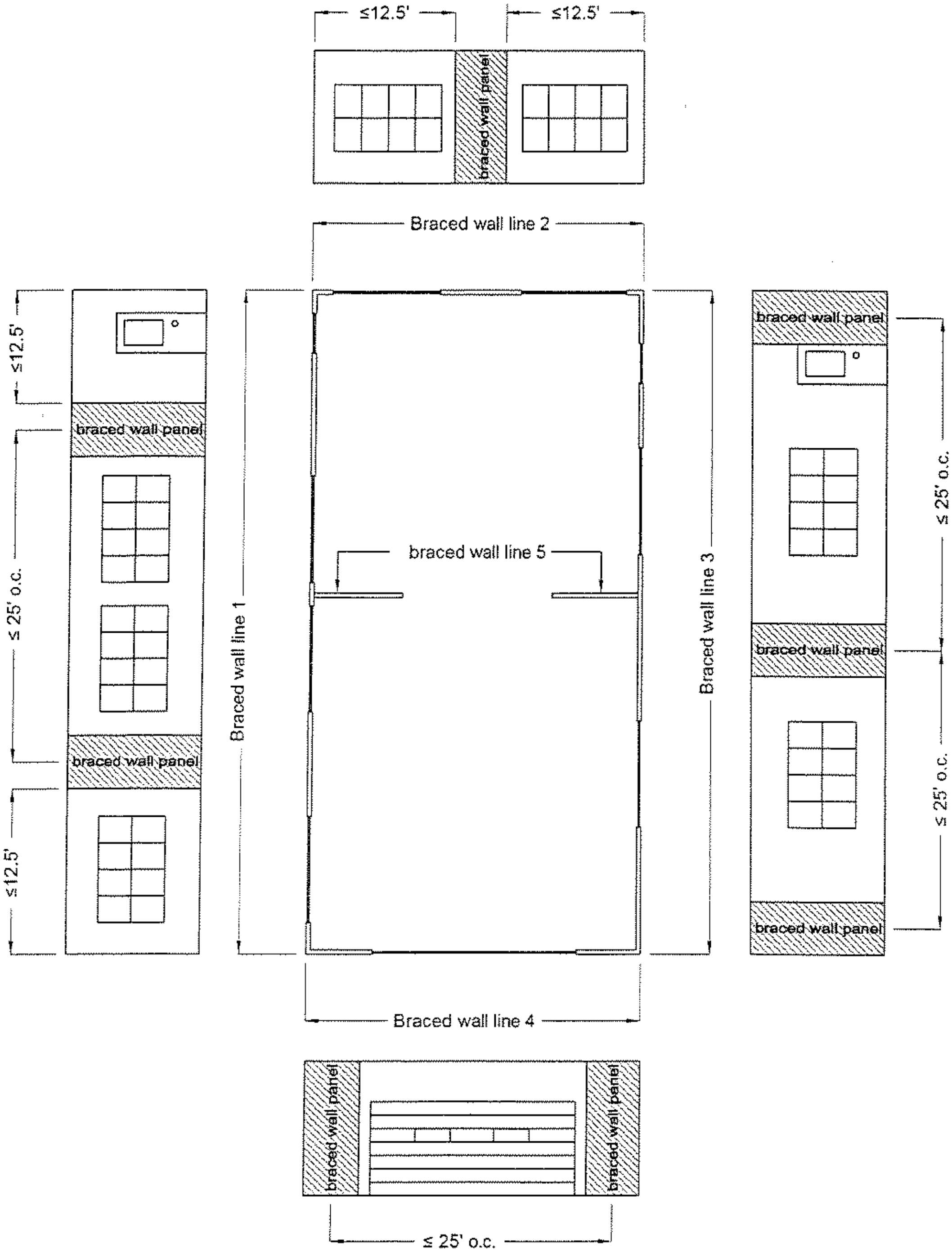
FIGURE R602.10.1.1
BRACED WALL LINE SPACING

R602.10.1.2 Braced wall panels. Braced wall panels shall be full-height sections of wall constructed along a braced wall line to resist lateral loads in accordance with the intermittent bracing methods specified in Section R602.10.2 or the continuous sheathing methods specified in Section R602.10.3. Mixing of bracing methods shall be permitted as follows:

1. Mixing bracing methods from story to story shall be permitted.
2. Mixing bracing methods from braced wall line to braced wall line within a story shall be permitted, except that continuous sheathing methods shall conform to the additional requirements of Section R602.10.3.
3. Mixing intermittent bracing methods along a braced wall line shall be permitted for single-family dwellings in Seismic Design Categories A, B and C and townhouses in Seismic Design Categories A and B. The required percentage of bracing for the braced wall line with mixed methods shall use the higher bracing percentage, per Table R602.10.1.5, of all methods used.

R602.10.1.3 Braced wall panel location. Braced wall panels shall be located at least every 25 feet (7620 mm) on center and shall begin no more than 12.5 feet (3810 mm) from each end of a braced wall line or its projection as shown in Figure R602.10.1.3(1) and Figure R602.10.4, but not less than the percentages given in Table R602.10.1.5. Braced wall lines with continuous sheathing shall conform to the additional requirements of Section R602.10.3.3.

All braced wall panels shall be permitted to be offset out-of-plane from the designated braced wall line up to 4 feet (1219 mm) provided the total out-to-out offset in any braced wall line is not more than 8 feet (2438 mm) as shown in Figure R602.10.1.3(2).



For SI: 1 foot = 305 mm

FIGURE R602.10.1.3(1)
BRACED WALL PANELS AND BRACED WALL LINES

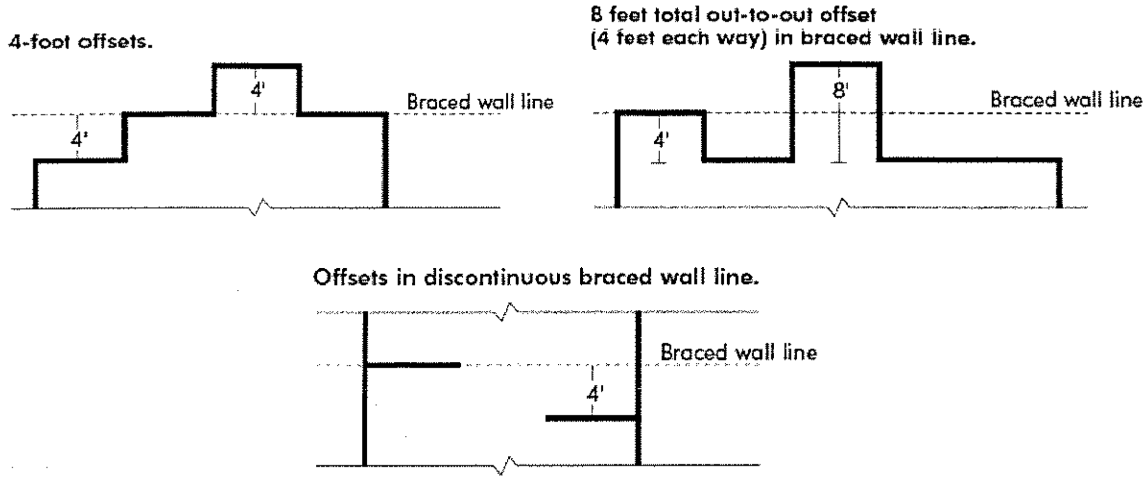
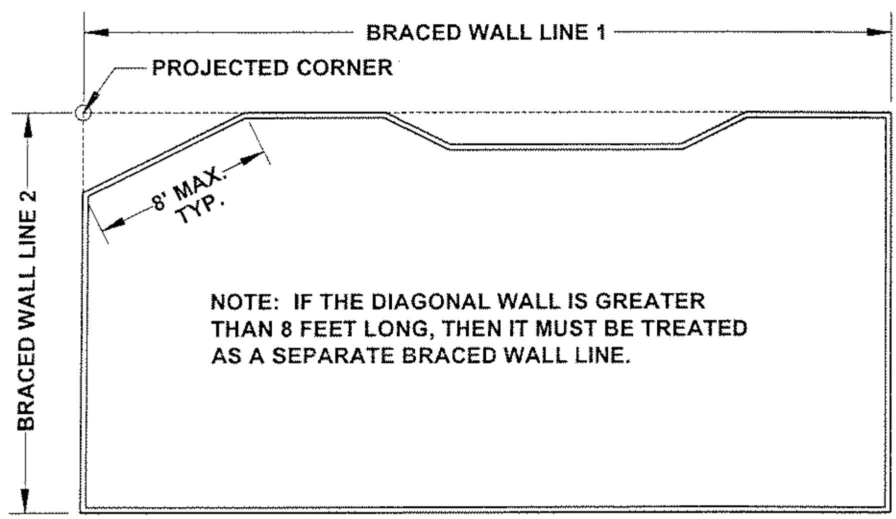


FIGURE R602.10.1.3(2)
OFFSETS PERMITTED FOR BRACED WALL PANELS ALONG A BRACED WALL LINE

R602.10.1.4 Angled walls. The walls of a braced wall line shall be permitted to angle out of plane for a maximum diagonal length of 8 feet (2438 mm). Where the angled wall occurs at a corner, the length of the braced wall line shall be measured from the projected corner as shown in Figure R602.10.1.4. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered its own braced wall line.

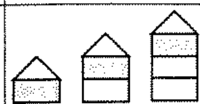
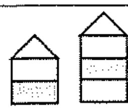
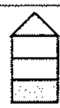
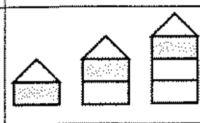
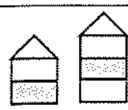
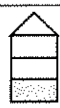


For SI: 1 foot = 305 mm

FIGURE R602.10.1.4
ANGLED CORNERS

R602.10.1.5 Minimum required percentage of bracing. The minimum required percentage of bracing along each braced wall line shall be in accordance with Table R602.10.1.5 and shall be the greater of that required by the Seismic Design Category or the design wind speed.

TABLE R602.10.1.5 [a,b,c]
MINIMUM REQUIRED PERCENTAGE OF WALL BRACING

SEISMIC DESIGN CATEGORY (SDC) OR WIND SPEED	FLOOR		MINIMUM REQUIRED PERCENTAGE OF FULL-HEIGHT BRACING PER WALL LINE			
			Braced wall line spacing less than or equal to 35'		Braced wall line spacing greater than 35' and less than or equal to 50'	
			Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]	Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]
SDC A, B or wind speed ≤ 100 mph		One-story house or top floor of a two- or three-story house.	16%	16%	23%	23%
		First floor of a two-story or second floor of a three-story house.	16%	25%	23%	36%
		First floor of a three-story house	25%	35%	36%	50%
SDC C or wind speed < 110 mph		One-story house or top floor of a two- or three-story house.	16%	25%	23%	36%
		First floor of a two-story or second floor of a three-story house.	30%	45%	43%	64%
		First floor of a three-story house	45%	60%	64%	86%

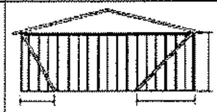
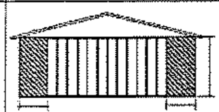
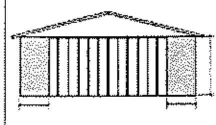
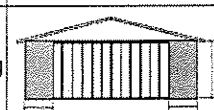
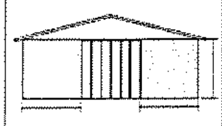
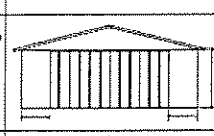
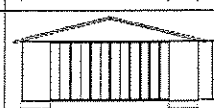
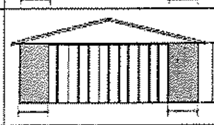
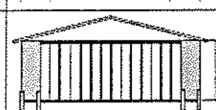
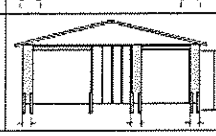
For SI: 1 foot = 305 mm

a. Foundation cripple wall panels shall be braced in accordance with Section R602.10.8.
b. Methods of bracing shall be as described in Sections R602.10.2 and R602.10.3.
c. The total amount of bracing required for a given braced wall line shall be the product of the minimum required percentage and all the applicable adjustment factors described in Sections R602.10.4, R602.10.7 and R602.10.8.
d. For Method GB, the percentage required shall be doubled for one-sided applications.

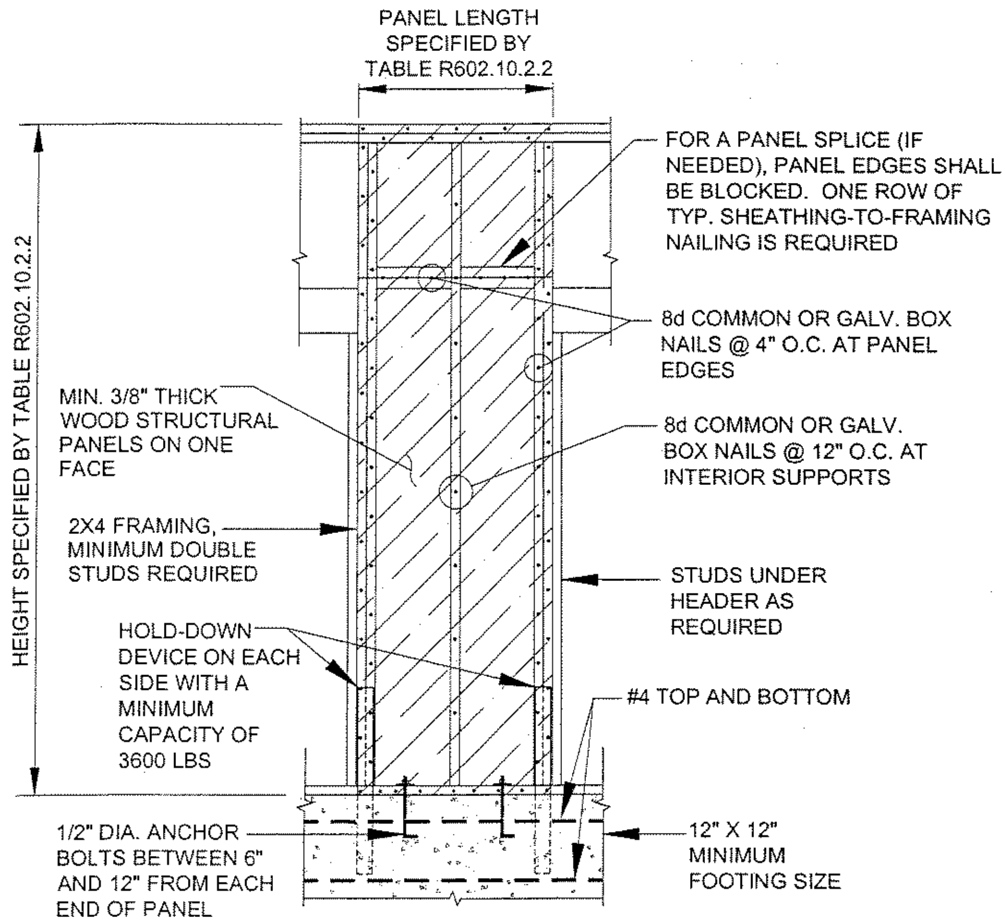
R602.10.2 Intermittent bracing methods. Intermittent braced wall panels shall comply with this section. The location of each panel shall be identified on the construction documents.

R602.10.2.1 Intermittent braced wall panels. Intermittent braced wall panels shall be constructed in accordance with one of the methods listed in Table R602.10.2.1.

TABLE R602.10.2.1
INTERMITTENT BRACING METHODS

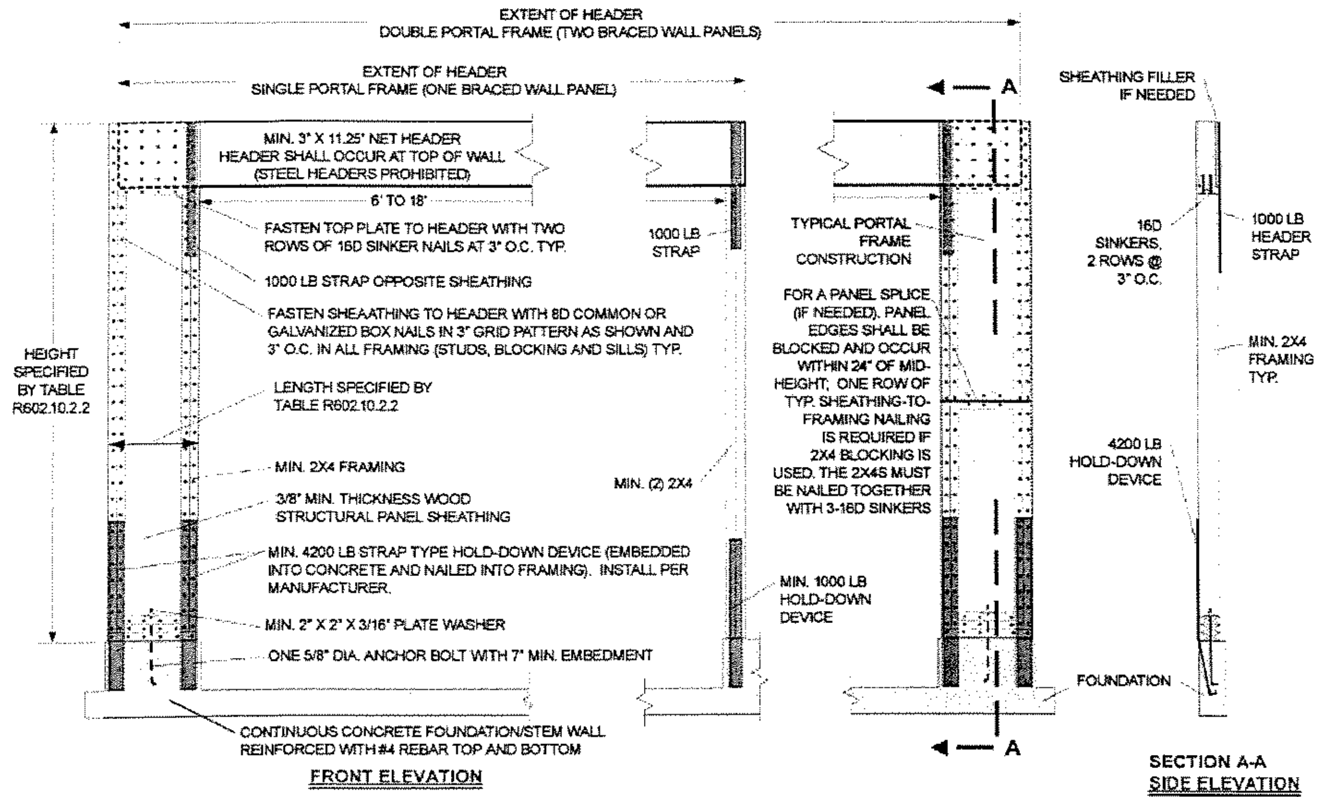
METHOD	MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA
LIB	Let-in-bracing	1x4 wood or approved metal straps at 45° to 60° angles		wood: 2-8d nails per stud metal: per manufacturer
DWB	Diagonal wood boards at 24" spacing	$^{5}/_{8}$"		2-8d (2½" x 0.113") nails or 2 staples, 1¾" per stud
WSP	Wood structural panel	$^{3}/_{8}$"		6d common (2"x0.113") nails at 6" spacing (panel edges) and at 12" spacing (intermediate supports) or 16 ga. x 1-$^{3}/_{4}$ staples: at 3" spacing (panel edges) and 6" spacing (intermediate supports)
SFB	Structural fiberboard sheathing	$^{1}/_{2}$" or $^{25}/_{32}$" for 16" stud spacing only		1½" galvanized roofing nails or 8d common (2½"x0.131) nails at 3" spacing (panel edges) at 6" spacing (intermediate supports)
GB	Gypsum board	$^{1}/_{2}$"		Nails at 7" spacing at panel edges including top and bottom plates; for exterior sheathing nail size, see Table R602.3(1); for interior gypsum board nail size, see Table R702.3.5
PBS	Particleboard sheathing	$^{3}/_{8}$" or $^{1}/_{2}$" for 16" stud spacing only		1½" galvanized roofing nails or 8d common (2½"x0.131) nails at 3" spacing (panel edges) at 6" spacing (intermediate supports)
PCP	Portland cement plaster	See Section R703.6		1$^{1}/_{2}$", 11 gage, $^{7}/_{16}$" head nails at 16" spacing or $^{7}/_{16}$", 16 gage staples at 6" spacing
HPS	Hardboard panel siding	$^{7}/_{16}$"		0.092" dia., 0.225" head nails with length to accommodate 1½" penetration into studs at 4" spacing (panel edges), at 8" spacing (intermediate supports)
ABW	Alternate braced wall	See Figure R602.10.1(1)		See Figure R602.10.2.1(1)
IPF	Intermittent portal frame	See Figure R602.10.2.1(2)		See Figure R602.10.1(2)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm



For SI 1 foot = 304.8 mm, 1 inch = 25.4 mm, 1 pound = 4.45 N

FIGURE R602.10.2.1(1)
METHOD ABW: ALTERNATE BRACED WALL PANEL



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 4.45 N

FIGURE R602.10.2.1(2)
METHOD IPF: INTERMITTENT PORTAL FRAME BRACED WALL PANEL

R602.10.2.2 Minimum length of intermittent braced wall panels. The minimum length of each intermittent braced wall panel shall comply with Table R602.10.2.2. For Methods DWB, WSP, SFB, GB, PBS, PCP and HPS, each panel shall cover at least three studs where studs are spaced 16 inches (406 mm) on center or at least two studs where studs are spaced 24 inches (610 mm) on center. Only those full-height braced wall panels complying with the length requirements of Table R602.10.2.2 shall be permitted to contribute towards the minimum required percentage of bracing.

TABLE R602.10.2.2
MINIMUM LENGTH OF INTERMITTENT BRACED WALL PANELS [a,b]

BRACING METHOD	FLOOR		HEIGHT OF INTERMITTENT BRACED WALL PANEL				
			8'	9'	10'	11'	12'
DWB, WSP, SFB, GB[c], PBS, PCP, HPS	All		48"	48"	48"	53"	58"
ABW	All		28"	32"	34"	38"	42"
IPF		One-story house	16"	16"	16"	18"	20"
		First floor of a two-story house	24"	24"	24"	27"	29"

For SI 1 foot = 304.8 mm, 1 inch = 25.4 mm

a. Interpolation shall be permitted.
b. When determining compliance with the percentage of bracing required by Table R602.10.1.5, the effective length of Method LIB shall be equivalent to 48" (1219 mm) provided it complies with the Table R602.10.2.1.

c. Gypsum board applied to both sides of the braced wall panel; where the gypsum board is applied to one side, the required length shall be doubled.

Exception: For Methods DWB, WSP, SFB, PBS, PCP and HPS, panel lengths less than the dimensions shown in Table R602.10.2.2 shall be permitted provided the effective lengths in accordance with Table R602.10.2.3 are used in place of actual lengths when determining compliance with the percentage of bracing required by Table R602.10.1.5.

TABLE R602.10.2.3
EFFECTIVE LENGTHS FOR BRACE WALL PANELS WHEN DETERMINING PERCENTAGE OF BRACING[a]

ACTUAL LENGTH OF BRACED WALL PANEL	WALL HEIGHT		
	8'	9'	10'
48"	48"	48"	48"
42"	36"	36"	N/A
36"	27"	N/A	N/A

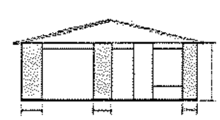
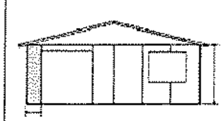
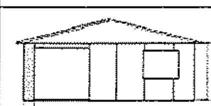
For SI: 1 inch = 25.4 mm
a. Interpolation shall be permitted.

R602.10.2.3 Adhesive attachment of sheathing in Seismic Design Category C. Adhesive attachment of wall sheathing shall not be permitted in Seismic Design Category C.

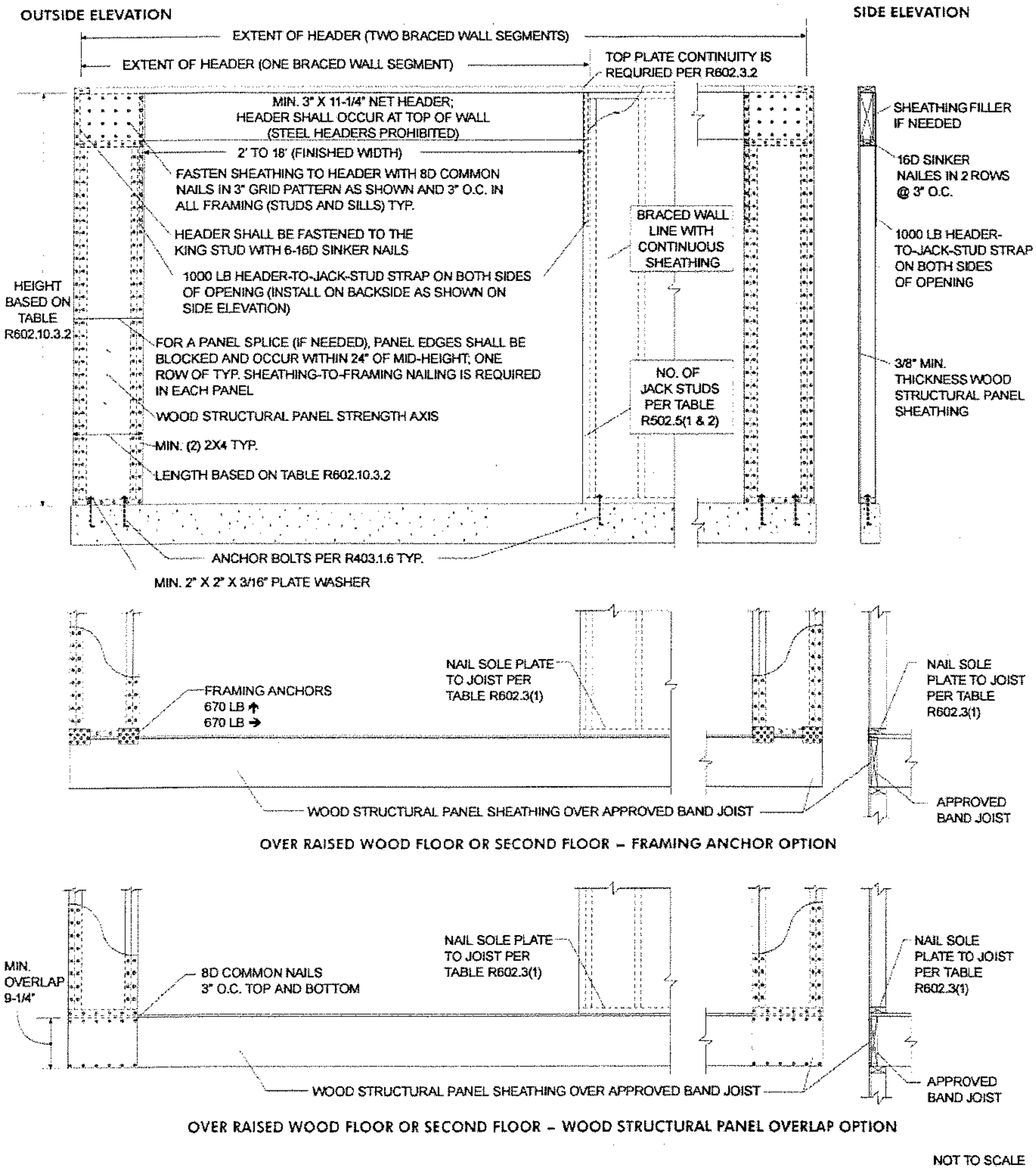
R602.10.3 Continuous sheathing methods. Braced wall lines with continuous sheathing constructed in accordance with this section shall be permitted.

R602.10.3.1 Continuous sheathing braced wall panels. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces of a braced wall line including areas above and below openings and gable end walls. Braced wall panels shall be constructed in accordance with one of the methods listed in Table R602.10.3.1.

TABLE R602.10.3.1
CONTINUOUS SHEATHING METHODS

METHOD	MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA
CS-WSP	Wood structural panel	$^3/_8$"		6d common (2"x0.113") nails at 6" spacing (panel edges) and at 12" spacing (intermediate supports) or 16 ga. x 1-$^3/_4$ staples: at 3" spacing (panel edges) and 6" spacing (intermediate supports)
CS-G[a]	Wood structural panel supporting roof load only adjacent garage openings	$^3/_8$"		See Method CS-WSP
CS-PF[b]	Continuous portal frame	See Figure R602.10.3.1		See Figure R602.10.3.1

For SI: 1 inch = 25.4 mm
a. Applies to one wall of a garage only.
b. The number of continuous portal frame panels in a braced wall line shall not exceed four. Continuous portal frame panels shall not be stacked vertically in multi-story buildings.



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 4.45 N

FIGURE R602.10.3.1
METHOD CS-PF: CONTINUOUS PORTAL FRAME BRACED WALL PANELS

R602.10.3.2 Length of braced wall panels with continuous sheathing. Braced wall panels along a braced wall line with continuous sheathing shall be full-height with a length based on the adjacent clear opening height in accordance with Table R602.10.3.2. Where a panel has an opening on either side of differing heights, the taller opening shall govern when determining the panel length from Table R602.10.3.2. Only those full-height braced wall panels complying with the length requirements of Table R602.10.3.2 shall be permitted to contribute towards the minimum required percentage of bracing per Table R602.10.1.5. For Method CS-PF, wall height shall be measured from the top of the header to the bottom of the bottom plate as shown in Figure R602.10.4.3.1.

TABLE R602.10.3.2
LENGTH REQUIREMENTS FOR BRACED WALL PANELS
IN A BRACED WALL LINE WITH CONTINUOUS SHEATHING [a]

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
CS-WSP	64"	24"	27"	30"	33"	36"
	68"	26"	27"	30"	33"	36"
	72"	28"	27"	30"	33"	36"
	76"	29"	30"	30"	33"	36"
	80"	31"	33"	30"	33"	36"
	84"	35"	36"	33"	36"	36"
	88"	39"	39"	36"	38"	36"
	92"	44"	42"	39"	41"	36"
	96"	48"	45"	42"	43"	39"
	100"		48"	45"	47"	42"
	104"		51"	48"	48'	44"
	108"		54"	51"	51"	47"
	112"			54"	53"	50"
	116"			57"	56"	53"
	120"			60"	58"	55"
	124"				61"	58"
	128"				63"	61"
	132"				66"	64"
	136"					66"
	140"					69"
	144"					72"
CS-G	≤120"	24"	27"	30"	33"	36"
CS-PF	≤120"	16"	18"	20"	22"	24"

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm

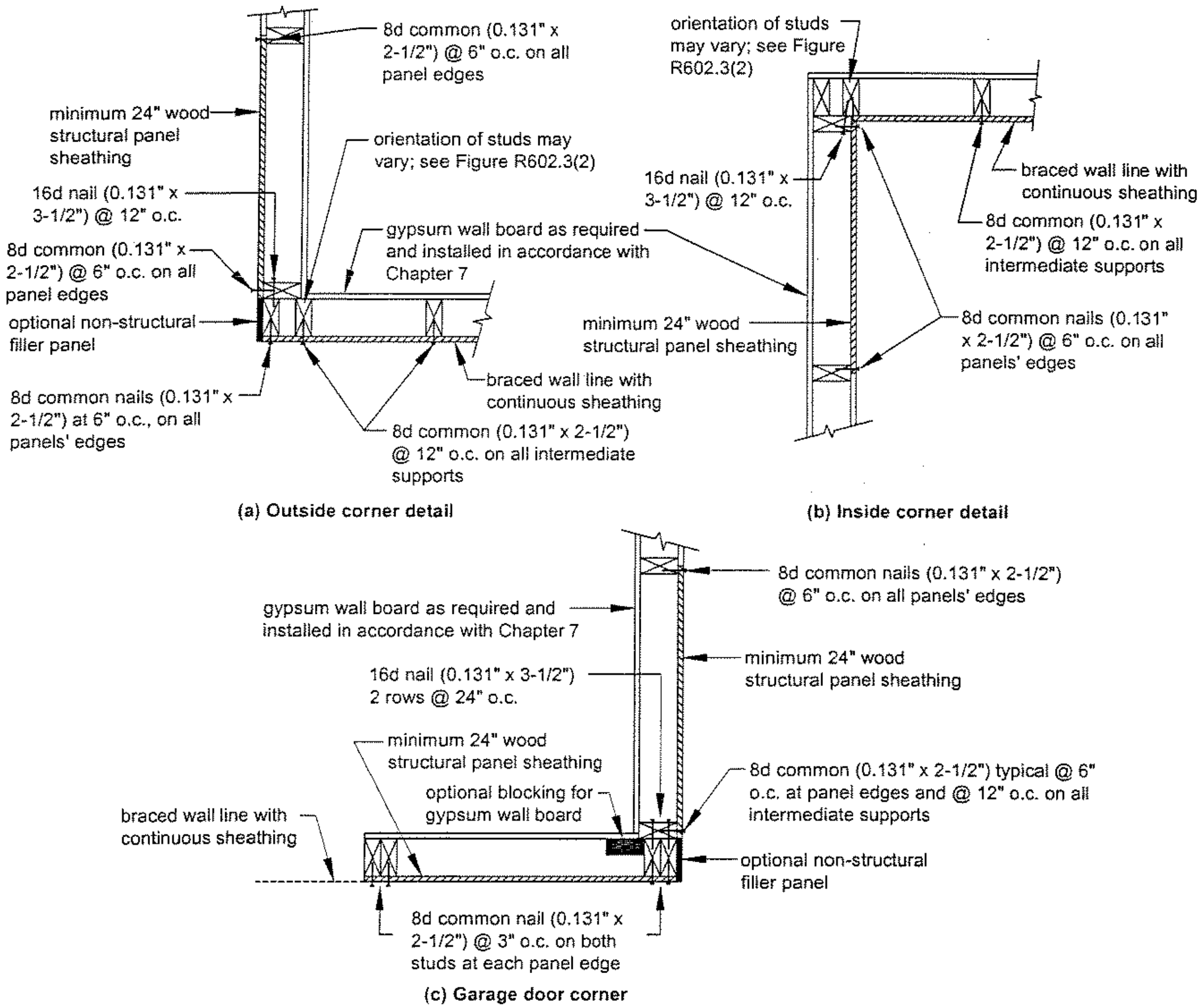
a. Interpolation shall be permitted.

R602.10.3.3 Braced wall panel location and corner construction. Full-height wall panels complying with the length requirements of Table R602.10.3.2 shall be located at each end of a braced wall line with continuous sheathing and at least every 25 feet (7620 mm) on center.

A minimum 24 inch (610 mm) wood structural panel corner return shall be provided at both ends of a braced wall line with continuous sheathing in accordance with Figures R602.10.3.3(1) and R602.10.3.3(2). In lieu of the corner return, a hold-down device with a minimum uplift design value of 800 lb (3560 N) shall be fastened to the corner stud and to the foundation or framing below in accordance with Figure R602.10.3.3(3).

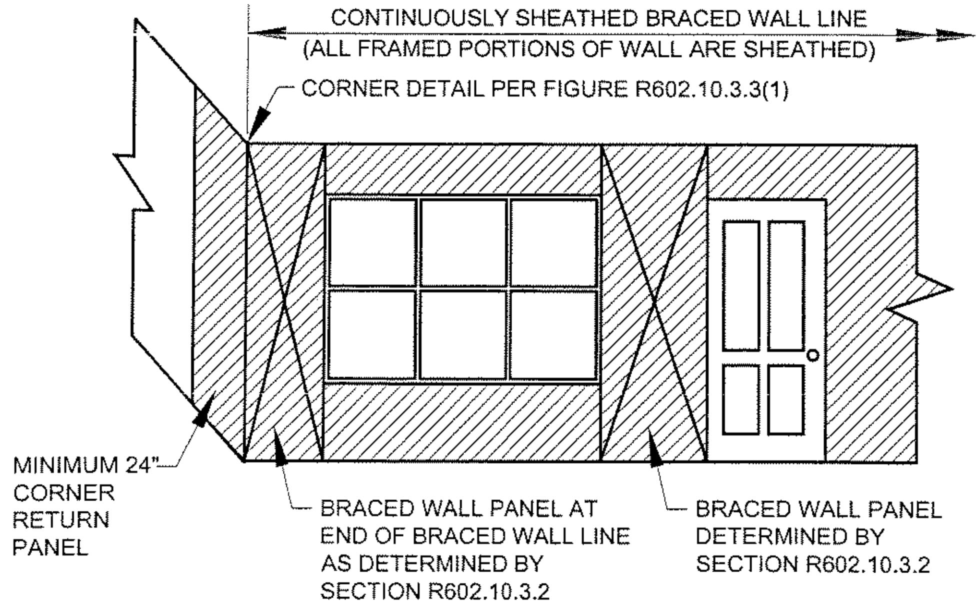
Exception: The first braced wall panel shall be permitted to begin 12.5 feet (3810 mm) from each end of the braced wall line provided one of the following is satisfied:

1. A minimum 24 inch (610 mm) long, full-height wood structural panel is provided at both sides of a corner constructed in accordance with Figures R602.10.3.3(1) and R602.10.3.3(4), or
2. The braced wall panel closest to the corner shall have a hold-down device with a minimum uplift design value of 800 lb (3560 N) fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below in accordance with Figure R602.10.3.3(5).



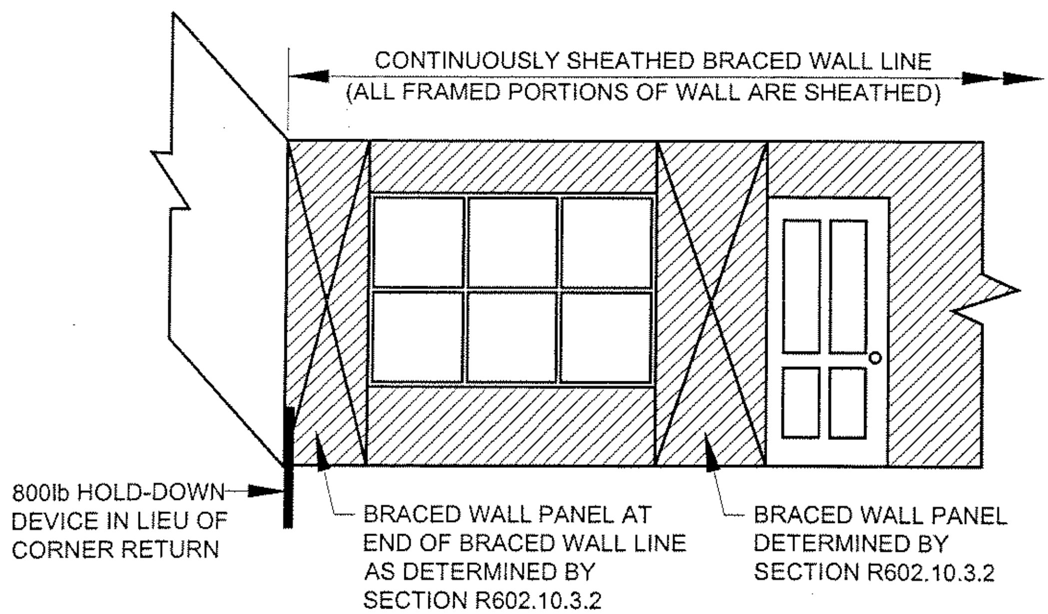
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm

FIGURE R602.10.3.3(1)
TYPICAL EXTERIOR CORNER FRAMING FOR CONTINUOUS SHEATHING



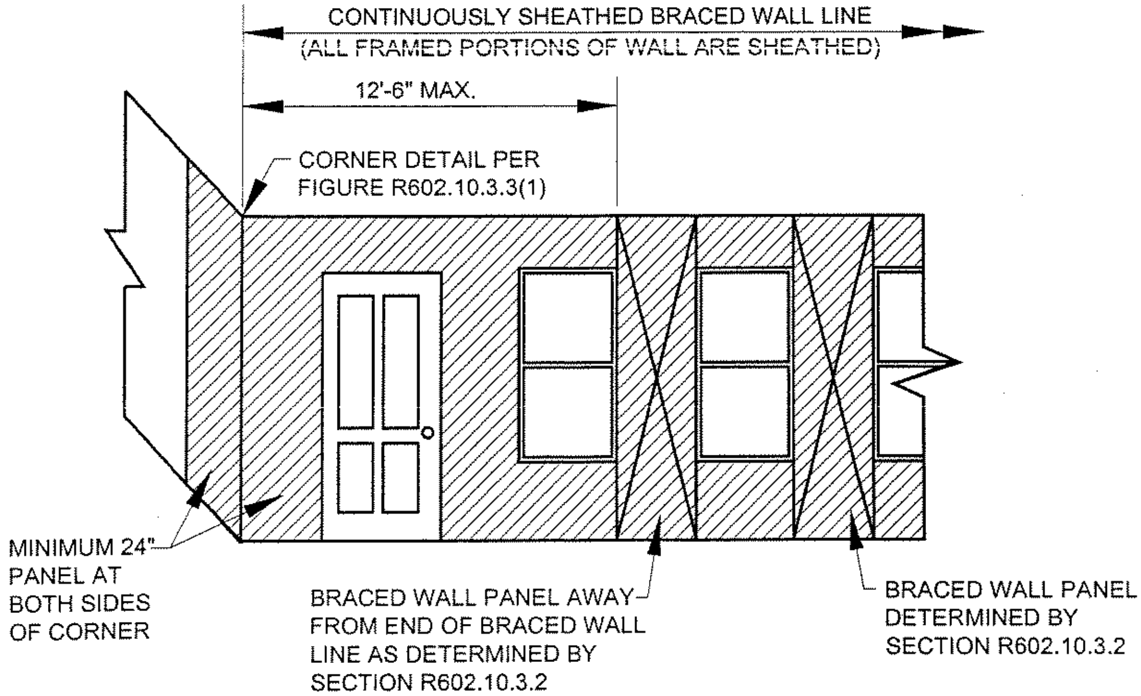
For SI: 1 foot = 305 mm

FIGURE R602.10.3.3(2)
BRACED WALL LINE WITH CONTINUOUS SHEATHING
WITH CORNER RETURN PANEL



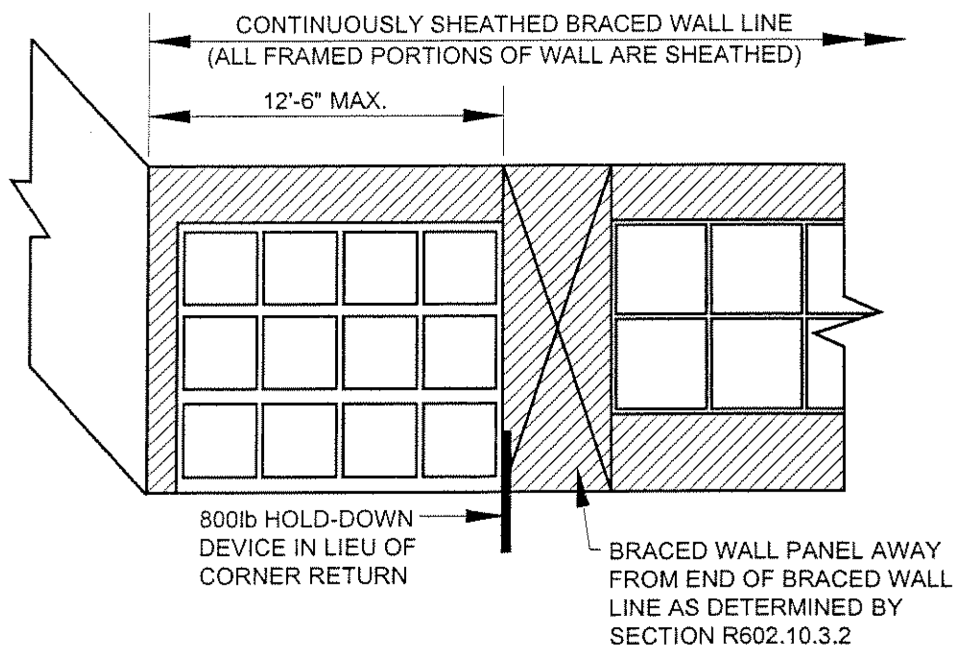
For SI: 1 foot = 305 mm, 1 pound = 4.45 N

FIGURE R602.10.3.3(3)
BRACED WALL LINE WITH CONTINUOUS SHEATHING
WITHOUT CORNER RETURN PANEL



For SI: 1 foot = 305 mm

FIGURE R602.10.3.3(4)
BRACED WALL LINE WITH CONTINUOUS SHEATHING – FIRST BRACED WALL PANEL AWAY FROM END OF WALL LINE WITHOUT HOLD-DOWN



For SI: 1 foot = 305 mm, 1 pound = 4.45 N

FIGURE R602.10.3.3(5)
BRACED WALL LINE WITH CONTINUOUS SHEATHING – FIRST BRACED WALL PANEL AWAY FROM END OF WALL LINE WITH HOLD-DOWN

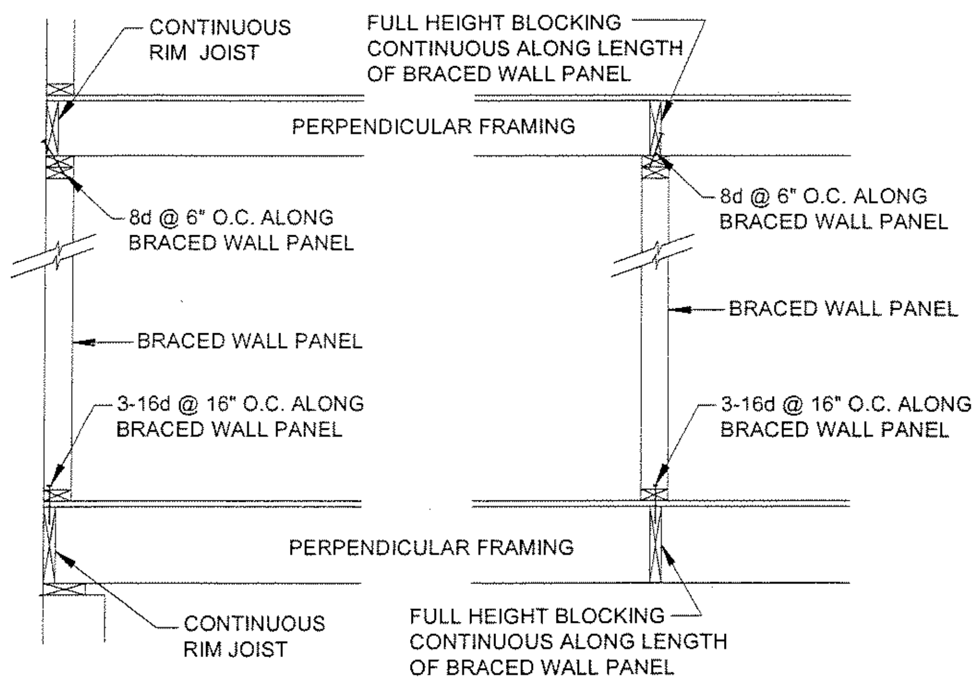
R602.10.4 Braced wall panel finish material. Braced wall panels shall have ½-inch thick gypsum board installed on the side of the wall opposite the bracing material and fastened in accordance with Table R702.3.5.

Exceptions:

1. Braced wall panels that are constructed in accordance with Methods GB, ABW, IPF and CS-PF.
2. When an approved interior finish material with an in-plane shear resistance equivalent to gypsum board is installed.
3. For Methods DWB, WSP, SFB, PBS, PCP, and HPS, interior gypsum board may be partially or entirely omitted provided the minimum required percentage of bracing in Table R602.10.1.5 is multiplied by an adjustment factor of 1.5.

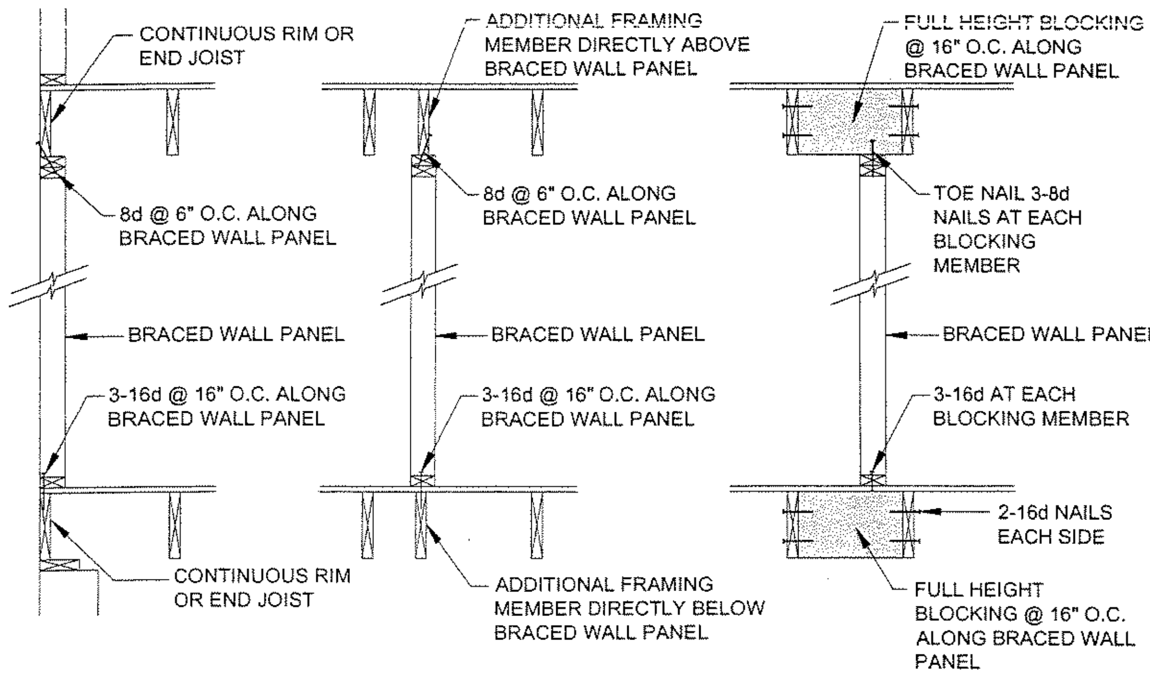
R602.10.5 Braced wall panel connections. Braced wall panels shall be connected to floor/ceiling framing or foundations as follows:

1. Where framing is perpendicular to a braced wall panel above or below, a rim joist or blocking shall be provided along the entire length of the braced wall panel in accordance with Figure R602.10.5(1). Fastening of wall plates to framing, rim joist or blocking shall be in accordance with Table R602.3(1).
2. Where framing is parallel to a braced wall panel above or below, a rim joist, end joist or other parallel framing member shall be provided directly above and below the panel in accordance with Figure R602.10.5(2). Where a parallel framing member cannot be located directly above and below the panel, full-depth blocking at 16 inch (406 mm) spacing shall be provided between the parallel framing members to each side of the braced wall panel in accordance with Figure R602.10.5(2). Fastening of blocking and wall plates shall be in accordance with Table R602.3(1).
3. Connections of braced wall panels to concrete or masonry shall be in accordance with Section R403.1.6.



For SI: 1 inch = 25.4 mm

FIGURE R602.10.5(1)
BRACED WALL PANEL CONNECTION WHEN PERPENDICULAR TO FLOOR/CEILING FRAMING

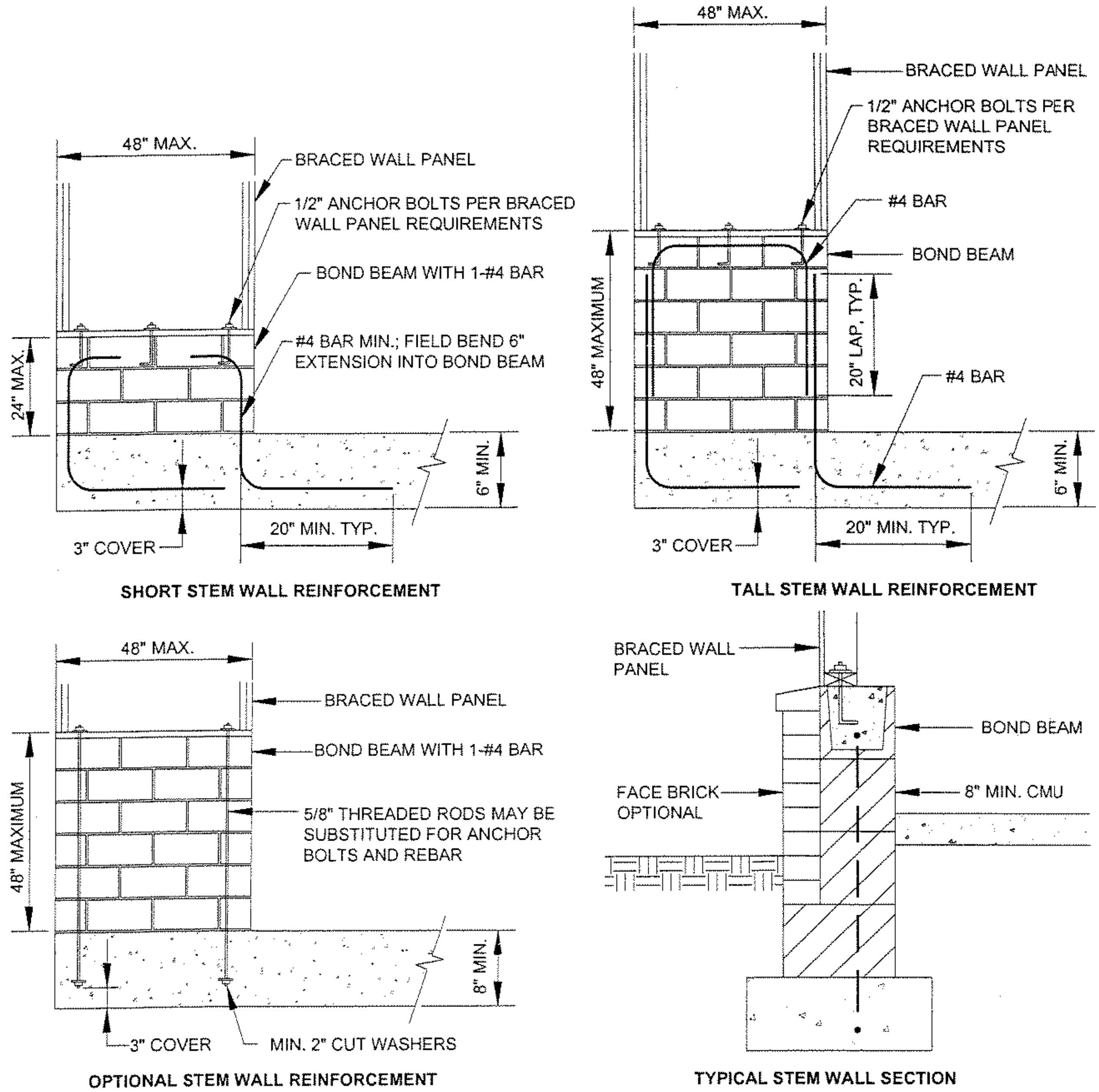


For SI: 1 inch = 25.4 mm

FIGURE R602.10.5(2)
BRACED WALL PANEL CONNECTION WHEN PARALLEL TO FLOOR/CEILING FRAMING

R602.10.6 Braced wall panel support. Braced wall panels shall be supported as follows:

1. Braced wall panels shall be permitted to be supported on cantilevered floor joists meeting the cantilever limits of Section R502.3.3 provided joists are blocked at the nearest bearing wall location.
2. Elevated post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.
3. Masonry stem walls supporting braced wall panels with a length of 48 inches (1220 mm) or less shall be reinforced in accordance with Figure R602.10.6. Masonry stem walls supporting braced wall panels with a length greater than 48 inches (1220 mm) shall be constructed in accordance with Section R403.1. Braced wall panels constructed in accordance with Methods ABW and IPF shall not be permitted to attach to masonry stem walls.



NOTE: GROUT BOND BEAMS AND ALL CELLS WHICH CONTAIN REBAR, THREADED RODS AND ANCHOR BOLTS.

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm

FIGURE R602.10.6
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

R602.10.7 Panel joints. All vertical joints of braced wall panel sheathing shall occur over and be fastened to common studs. Horizontal joints in braced wall panels shall occur over and be fastened to common blocking of a minimum 1-½ inch (38 mm) thickness. Panel joints for Method IPF shall be constructed in accordance with Figure R602.10.2.1(2). Panel joints for Method CS-PF shall be constructed in accordance with Figure R602.10.3.1.

Exception: Blocking at horizontal joints shall not be required in braced wall panels constructed using Methods WSP, SFB, GB, PBS OR HPS where the percentage of bracing required by Table R602.10.1.5 is multiplied by an adjustment factor of 2.0.

R602.10.8 Cripple wall bracing. Cripple walls shall be braced with a percentage and type of bracing as required for the wall above in accordance with Table R602.10.1.5 with the following modifications for cripple wall bracing:

1. The bracing percentage as determined from Table R602.10.1.5 shall be multiplied by an adjustment factor of 1.15, and
2. The wall panel spacing shall be decreased from 25 feet (7620 mm) to 18 feet (5486 mm).

Cripple walls shall be permitted to be redesignated as the first story walls for purposes of determining wall bracing requirements. If the cripple walls are redesignated, the stories above the redesignated story shall be counted as the second and third stories respectively.

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

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Address to submit to: DHCD, the Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.state.va.us		Document No. C-310.6(R301.5) Committee Action: ____________ BHCD Action: ________________

Submitted by: ____Kirk Grundahl, P.E.______ Representing: ___WTCA_____________

Address: __6300 Enterprise Lane, Madison, WI 53719_________ Phone No.: _ 608/274-4849_____________

Regulation Title: __2003 USBC (residential buildings)__________ Section No(s): __Table R305.1_______________

Proposed Change:

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

(Portions of table not shown do not change)

a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.

b. Attics without storage are those where the maximum clear height between joist and rafter is less than 42 inches, or where there are not two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide, or greater, located within the plane of the truss. For attics without storage, this live load need not be assumed to act concurrently with any other live load requirements.

c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.

d. A single concentrated load applied in any direction at any point along the top.

e. See Section R502.2.1 for decks attached to exterior walls.

f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

g. For attics with limited storage and constructed with trusses, this live load need be applied only to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high or greater by 2 feet wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met:

1. The attic area is accessible by a pull-down stairway or framed opening in accordance with Section R807.1; and
2. The truss has a bottom chord pitch less than 2:12.
3. <u>Required insulation depth is less than the bottom chord member depth</u>

<u>The bottom chords of trusses meeting the above criteria for limited storage shall be designed for the greater of the actual imposed dead load or 10 psf, uniformly distributed over the entire span.</u>

h. Attic spaces served by a fixed stair shall be designed to support the minimum live load specified for sleeping rooms.

i. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

Reason:

WTCA offered a code change proposal in the 2009 cycle to the IRC 2006 to address two issues related to Table R301.5. RB49-06/07 which was accepted by the IRC-BE Committee as submitted. We respectfully request that the Virginia Department of Housing and Community Development amend the footnotes to Table R301.5 in concert with what has been accepted by the IRC-BE committee.

The following reason was provided for proposal RB49-06/07:

> **Reason:** To clarify and harmonize IRC requirements regarding the increase in dead load with IBC footnote to Table 1607.1 and with the original BOCA requirements at BOCA Section 1606.2.3. In addition, a criterion has been added in the IRC, to not require the storage load application in areas where the insulation depth precludes the use of the space for storage.
>
> **IBC footnote to Table 1607.1**
>
> j. For attics with limited storage and constructed with trusses, this live load need only be applied to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met:
>
> i. The attic area is accessible by a pull-down stairway or framed opening in accordance with Section 1209.2, and
>
> ii. The truss shall have a bottom chord pitch less than 2:12.
>
> iii. Bottom chords of trusses shall be designed for the greater of actual imposed dead load or 10 psf, uniformly distributed over the entire span.
>
> The minimum ceiling insulation requirement per Table N1102.1 is R30. This typically requires about 9 inches of batt or blown insulation. A storage load applied in trussed areas with insulation will cause collateral damage of the ceiling surface that will prevent the use of the area as a storage area.
>
> **Cost Impact:** The code change proposal will not increase the cost of construction. Truss design software is programmed to include the load evaluation in this manner.

Thank you for your consideration of this public comment. Should you have any questions please contact Richard Zimmerman (608-310-6743) or me.

Respectfully Yours,

Kirk Grundahl, P.E.
Executive Director

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

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Submitted by: _____Kirk Grundahl, P.E.______ Representing: ___WTCA_____________

Address: __6300 Enterprise Lane, Madison, WI 53719_________ Phone No.: _ 608/274-4849_____________

Regulation Title: __2003 USBC (residential buildings)__________ Section No(s): __R404.1 & related Tables_______

Proposed Change:

Delete Section R404.1 and related tables and replace with provisions from IRC-03 as follows:

SECTION R404

FOUNDATION WALLS

R404.1 Concrete and masonry foundation walls. Concrete And masonry foundation walls shall be selected and constructed in accordance with the provisions of this section or in accordance with ACI 318, NCMA TR68-A or ACI 530/ASCE 5/TMS 402 or other approved structural standards. When ACI 318 or ACI 530/ASCE 5/TMS402 or the provisions of this section are used to design concrete or masonry foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

R404.1.1 Masonry foundation walls. Concrete masonry and clay masonry foundation walls shall be constructed as set forth in Tables R404.1.1(1), R404.1.1(2), R404.1.1(3) andR404.1.1(4) and shall also comply with the provisions of this section and the applicable provisions of Sections R606, R607 and R608. In Seismic Design Categories D_1 and D_2, concrete masonry and clay masonry foundation walls shall comply with Section R404.1.4. Rubble stone masonry foundation walls shall be constructed in accordance with Sections R404.1.8 and R606.2.2. Rubble stone masonry walls shall not be used in Seismic Design Categories D_1 and D_2.

R404.1.2 Concrete foundation walls. Concrete foundation walls shall be constructed as set forth in TablesR404.1.1(1), R404.1.1(2), R404.1.1(3) and R404.1.1(4), and shall also comply with the provisions of this section and the applicable provisions of Section R402.2. In Seismic Design Categories D_1 andD_2, concrete foundation walls shall comply with Section R404.1.4.

R404.1.3 Design required. A design in accordance with accepted engineering practice shall be provided for concrete or masonry foundation walls when any of the following conditions exist:

1. Walls are subject to hydrostatic pressure from groundwater.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top and bottom.

REASON:

Code change proposal RB149-06/07 was submitted to address concerns with foundation connection requirements included in the IRC 2006. It was approved as submitted by Assembly Action. We respectfully request that the Virginia Department of Housing and Community Development follow suit and amend section R404.1 and related tables to return to the provisions of the IRC-03.

Proposal RB149-06/07 was offered by an extensive group of interested parties:

> **Proponents:** Lionel Lemay, National Ready Mixed Concrete Association; Ed Sauter, AIA, Concrete Foundation Association; Stephen V. Skalko, P.E., Portland Cement Association; Edgar Sutton, P.E. , National Association of Home Builders; Jason Thompson, P.E., National Concrete Masonry Association

The following reasons were submitted:

> **Reason:** The provisions for laterally supporting basement walls at the top and bottom in the 2000 & 2003 IRC and were previously in the CABO One and Two Family Dwelling Code for many years. Basement walls constructed in accordance with these provisions have performed successfully with no evidence of code deficiencies. Code change S89-04/05 revised the lateral support provisions based on engineering analysis that indicate the 2003 IRC provisions were unconservative. In the reason statement for the code change, the proponent suggested there have been failures of foundation walls built according to these provisions but no detailed data to substantiate these failures was provided. Absent sufficient technical justification for the change, the IBC Structural Committee correctly took action to recommend its disapproval. During the challenge process public comments were submitted requesting that code change S89-05 be approved as modified. These challenges again alluded to foundation wall failures but no data to substantiate a deficiency with the existing provisions was offered. Unfortunately, the challenges to S89-05 were discussed in Detroit very late one evening of the public hearings. With a very small representation of the voting membership present, the action of the IBC Structural Committee was overturned and the foundation provisions revised to include three new tables and additional limitations to be evaluated for applying prescriptive provisions to foundation walls. This proposed change deletes these new tables and additional limitations placed on foundation walls so that the requirements for constructing foundation walls will be permitted to follow the prescriptive provisions that have been in the national model residential codes and performed successfully for many years.

We propose that Virginia adopt the requirements as given in Section R404.1 of the 2003 IRC with related tables, rather than propose a local amendment, until this issue is resolved in the IRC 2009 code process.

Thank you for your consideration of this public comment. Should you have any questions please contact Richard Zimmerman (608-310-6743) or me.

Respectfully Yours,

Kirk Grundahl, P.E.
Executive Director

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

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Submitted by: ____Kirk Grundahl, P.E.______ Representing: ___WTCA____________

Address: __6300 Enterprise Lane, Madison, WI 53719________ Phone No.: _ 608/274-4849____________

Regulation Title: __2003 USBC (residential buildings)_________ Section No(s): __R602.10______________

Proposed Change:

Add a new Section R602.10.1.2 to USBC (following IRC 2006 format) and revise subsequent section numbering as follows:

R602.10.1.2 Braced wall lines containing garage door openings. Walls of attached or detached garages shall be braced in accordance with Section R602.10.1. Where wall segments to either side of a garage opening are too narrow to permit use of bracing methods in Section R602.10.3, the wall line containing the garage opening shall be braced in accordance with Section R602.10.5, R602.10.6, or other approved method.

Exceptions: One of the following exceptions shall be permitted to apply to garage opening wall bracing for attached or detached garages in Seismic Design Categories A-C and where wind speeds are 100 mph or less.

1. When a garage opening wall of an attached garage is a part of a braced wall line that extends along an attached building, such braced wall line shall contain the amount of bracing required by Section R602.10.1 and one of the braced wall panels required to begin within 12.5 feet of each end of the braced wall line shall be permitted to begin no more than 21 feet from the end of the braced wall line containing the garage opening.
2. If a garage opening wall of an attached or detached garage is considered as a separate braced wall line and the width of the garage (measured parallel to the garage opening wall) is at least 0.8 times the depth of the garage, then no bracing shall be required on the garage opening wall line provided the amount of bracing in the rear garage wall line (opposite and parallel to the garage opening) is increased by the amount of bracing that originally would have been required within the garage opening wall line. Amount of bracing in and spacing of wall lines comprising the garage side walls (perpendicular to the garage opening wall line) shall comply with Section R602.10.1 and R602.10.1.1.

WTCA – Representing the Structural Building Components Industry would like to add its support to this code modification as submitted by Jay Crandell on behalf of the Foam Sheathing Coalition.

Thank you for your consideration of this public comment. Should you have any questions please contact Richard Zimmerman (608-310-6743) or me.

Respectfully Yours,

Kirk Grundahl

Kirk Grundahl, P.E.
Executive Director

Supporting Statement:

The treatment of bracing for garage opening wall lines has created some confusion and unnecessary difficulty in complying with the IRC bracing provisions. Therefore, this proposed new section specifically addresses requirements for bracing of wall lines that contain garage door openings. In addition, two exceptions are provided for low hazard conditions that provide acceptable means of achieving the wall bracing intent of the code in a manner that also agrees with past successful practice.

The first exception addresses conditions where the garage opening wall line is part of a braced wall line that extends further along the building (e.g., a street facing building wall with a street facing garage wall that are not offset by more than 4 feet maximum out-to-out of offsets). In this case, required bracing amounts must be provided for the braced wall line, but the corner brace is permitted to be placed up to 21 feet from one end of the braced wall line (based on maximum center to center panel spacing of 25 feet less the minimum 4-foot panel width). This exception does not reduce the total amount of bracing required.

The second exception (see also the Figure below for example) provides a means of bracing a garage as a structural unit and does not require bracing on the garage opening wall line. This requires that the bracing amount is effectively doubled on the rear garage wall (opposite from the garage opening) to provide equivalent resistance to the direct shear load. Because this arrangement creates a torsional loading condition, the side walls must also be adequately braced to resist the torsional or twisting load that is created by way of a "force couple". This is simply achieved by bracing both side walls in compliance with bracing requirements of Section R602.10.1 and by limiting the plan aspect ratio of the garage (depth to width) as described in the proposal. This method is not new and has been in use for some time, but only by way of an engineered solution for individual buildings. Because of its simplicity and common need/use, this approach is more effectively addressed as a prescriptive solution in the code. This exception does not reduce bracing strength but achieves compliance through a different approach to building stability and lateral load analysis that more accurately distributes lateral load based on relative resistance of shear walls through floor and roof systems that act as rigid diaphragms based on whole building testing. The approach is explained and illustrated below.

<u>Analysis Approach and Example for Exception #2</u>:

Consider a garage of width, W, and Depth, D with a garage opening located in the width direction (see Figure below). The lateral load acting parallel to the garage opening and rear walls is resisted directly by wall bracing in the rear garage wall only (bracing value of narrow walls to either side of garage opening is considered negligible). This realistic loading condition creates a force couple or moment that attempts to rotate the garage opening wall about the rear wall that contains all of the shear resistance (bracing). The magnitude of this force couple is V x ½ D where V is the lateral load force (and is equivalent also to the amount of load resistance required in the way of wall bracing). While the direct shear force is resisted by the rear garage wall, the force couple is resisted by the side walls which produce a resisting force couple with a magnitude of Vsw x W. Therefore, to maintain equilibrium of forces Vsw x W must equal or exceed V x ½ D, where Vsw is the bracing resistance provide by the garage sidewalls. Setting these equal and solving for Vsw (required shear resistance in the side walls to resist the load force couple), the following design equation is determined to check equilibrium against the force couple or torsional moment created by this condition:

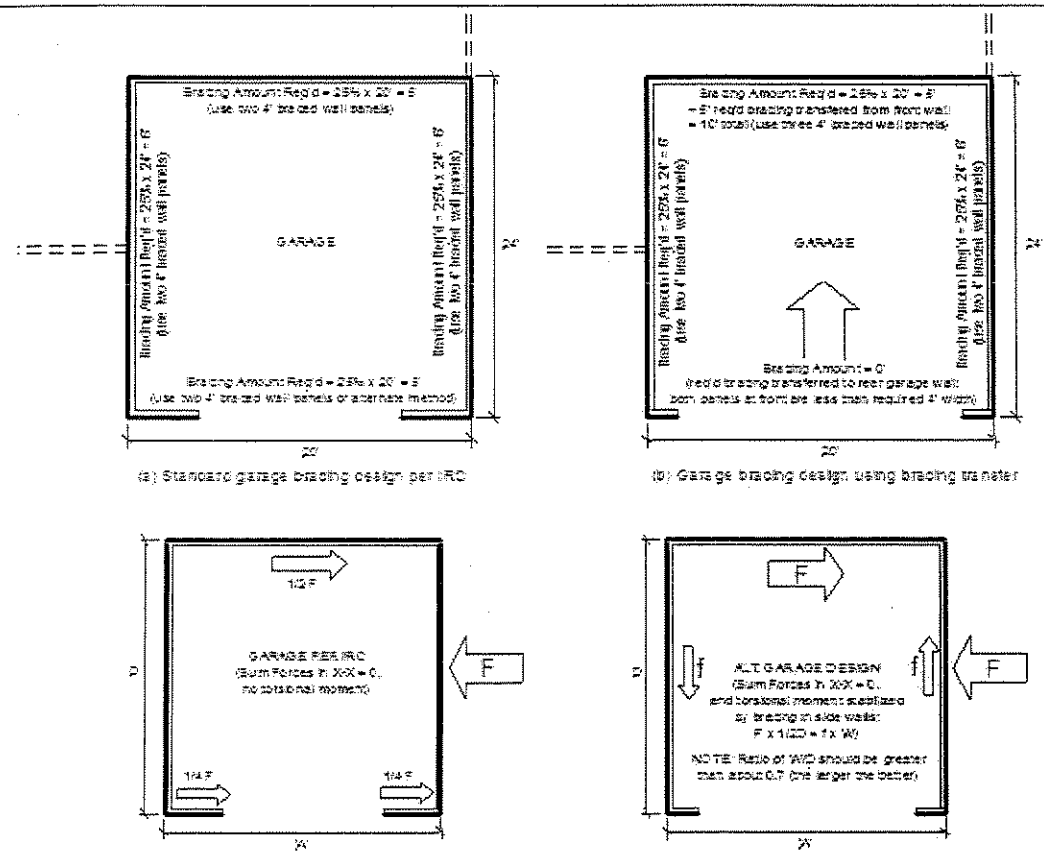
$$V_{sw} \geq \tfrac{1}{2} V \times D/W$$

Given:
Garage supporting one story plus roof (approach also applies to other support conditions)
Wind Speed: <110 mph
Seismic: SDC C
Show use of Method 3 and other bracing methods

Example Garage Plans	Garage Size		D/W	Bracing % Req'd (IRC Table R602.10.1)	Req'd Bracing Length (IRC R602.10.1)		Bracing per Proposed Exception #2			Check Sidewall Bracing for Torsion Load	
	D	W			Sidewalls (D x %)	Rear and Front Walls (W x %)	Side wall (Lsw)	Rear Wall (Lrw)	Front Wall	½ Lrw x D/W	Is Lsw ≥ ½ Lrw x D/W ?
Ex #1	22'	18'	1.2	30% (method 3) 45% (others)	6.6' 9.9'	5.4' 8.1'	6.6' 9.9'	10.8' 16.2'	None None	6.5' 9.7'	6.6'> 6.5' OK 9.9' >9.7' OK
Ex #2	22'	30'	0.7	30% (method 3) 45% (others)	6.6' 9.9'	9' 13.5'	6.6' 9.9'	18' 27'	None None	6.3' 9.5'	6.6'>6.3' OK 9.9'>9.5' OK

Note: Front wall contains the garage opening.

As shown above, when D/W is approximately 1.2 or less, this proposal that permits transfer of bracing from the garage opening wall to the rear garage wall (effectively doubling bracing amount in the rear garage wall) results in a structurally stable building or garage provided side walls area also braced in accordance with the code.



(a) Standard garage bracing design per IRC
(b) Garage bracing design using bracing transfer
(c) Garage lateral forces in equilibrium per IRC standard bracing approach
(d) Equilibrium of lateral force per bracing transfer method (roof/floor diaphragm above garage distributes forces by rotation)

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Submitted by: ____Jay H. Crandell, P.E.______ Representing: ___Foam Sheathing Coalition_____________

Address: __5095 Sudley Rd, West River, MD 20778_________ Phone No.: _ 410-867-9617_____________

Regulation Title: __2003 USBC (residential buildings)__________ Section No(s): __R602.10_______________

Proposed Change:

Add a new Section R602.10.1.2 to USBC (following IRC 2006 format) and revise subsequent section numbering as follows:

R602.10.1.2 Braced wall lines containing garage door openings. Walls of attached or detached garages shall be braced in accordance with Section R602.10.1. Where wall segments to either side of a garage opening are too narrow to permit use of bracing methods in Section R602.10.3, the wall line containing the garage opening shall be braced in accordance with Section R602.10.5, R602.10.6, or other approved method.

Exceptions: One of the following exceptions shall be permitted to apply to garage opening wall bracing for attached or detached garages in Seismic Design Categories A-C and where wind speeds are 100 mph or less.

1. When a garage opening wall of an attached garage is a part of a braced wall line that extends along an attached building, such braced wall line shall contain the amount of bracing required by Section R602.10.1 and one of the braced wall panels required to begin within 12.5 feet of each end of the braced wall line shall be permitted to begin no more than 21 feet from the end of the braced wall line containing the garage opening.
2. If a garage opening wall of an attached or detached garage is considered as a separate braced wall line and the width of the garage (measured parallel to the garage opening wall) is at least 0.8 times the depth of the garage, then no bracing shall be required on the garage opening wall line provided the amount of bracing in the rear garage wall line (opposite and parallel to the garage opening) is increased by the amount of bracing that originally would have been required within the garage opening wall line. Amount of bracing in and spacing of wall lines comprising the garage side walls (perpendicular to the garage opening wall line) shall comply with Section R602.10.1 and R602.10.1.1.

Supporting Statement:

The treatment of bracing for garage opening wall lines has created some confusion and unnecessary difficulty in complying with the IRC bracing provisions. Therefore, this proposed new section specifically addresses requirements for bracing of wall lines that contain garage door openings. In addition, two exceptions are provided for low hazard conditions that provide acceptable means of achieving the wall bracing intent of the code in a manner that also agrees with past successful practice.

The first exception addresses conditions where the garage opening wall line is part of a braced wall line that extends further along the building (e.g., a street facing building wall with a street facing garage wall that are not offset by more than 4 feet maximum out-to-out of offsets). In this case, required bracing amounts must be provided for the braced wall line, but the corner brace is permitted to be placed up to 21 feet from one end of the braced wall line (based on maximum center to center panel spacing of 25 feet less the minimum 4-foot panel width). This exception does not reduce the total amount of bracing required.

The second exception (see also the Figure below for example) provides a means of bracing a garage as a structural unit and does not require bracing on the garage opening wall line. This requires that the bracing amount is effectively doubled on the rear garage wall (opposite from the garage opening) to provide equivalent resistance to the direct shear load. Because this arrangement creates a torsional loading condition, the side walls must also be adequately braced to resist the torsional or twisting load that is created by way of a "force couple". This is simply achieved by bracing both side walls in compliance with bracing requirements of Section R602.10.1 and by limiting the plan aspect ratio of the garage (depth to width) as described in the proposal. This method is not new and has been in use for some time, but only by way of an engineered solution for individual buildings. Because of its simplicity and common need/use, this approach is more effectively addressed as a prescriptive solution in the code. This exception does not reduce bracing strength but achieves compliance through a different approach to building stability and lateral load analysis that more accurately distributes lateral load based on relative resistance of shear walls through floor and roof systems that act as rigid diaphragms based on whole building testing. The approach is explained and illustrated below.

<u>Analysis Approach and Example for Exception #2</u>:

Consider a garage of width, W, and Depth, D with a garage opening located in the width direction (see Figure below). The lateral load acting parallel to the garage opening and rear walls is resisted directly by wall bracing in the rear garage wall only (bracing value of narrow walls to either side of garage opening is considered negligible). This realistic loading condition creates a force couple or moment that attempts to rotate the garage opening wall about the rear wall that contains all of the shear resistance (bracing). The magnitude of this force couple is V x ½ D where V is the lateral load force (and is equivalent also to the amount of load resistance required in the way of wall bracing). While the direct shear force is resisted by the rear garage wall, the force couple is resisted by the side walls which produce a resisting force couple with a magnitude of Vsw x W. Therefore, to maintain equilibrium of forces Vsw x W must equal or exceed V x ½ D, where Vsw is the bracing resistance provide by the garage sidewalls. Setting these equal and solving for Vsw (required shear resistance in the side walls to resist the load force couple), the following design equation is determined to check equilibrium against the force couple or torsional moment created by this condition:

$$V_{sw} \geq \frac{1}{2} V \times D/W$$

Vsw is the required shear resistance of the side walls, V is the applied direct shear load in a direction parallel to the garage opening and rear garage walls, D is the depth of the garage, and W is the width of the garage. It is further realized that when applying the IRC bracing provisions, the amount of bracing required is implicitly equal to the lateral load that must be resisted. Therefore, the length of bracing required may be substituted in the above equation as follows:

$$L_{sw} \geq 1/2\ L_{rw} \times D/W$$

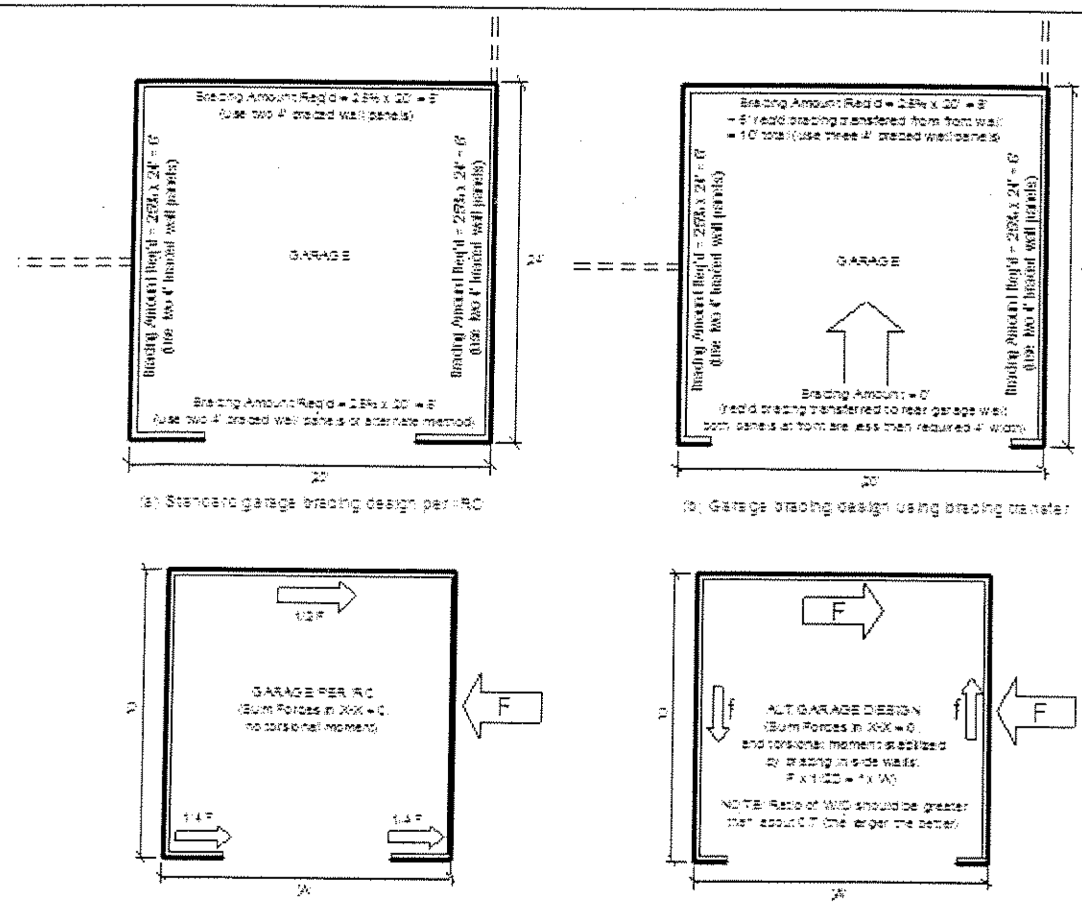
In this form, Lsw is the amount of bracing required to resist the force couple created by placing all of the shear resistance (bracing) in the rear garage wall and Lrw is the length or bracing required in the rear garage wall (effectively double that required by the IRC because the total bracing for the garage opening wall and rear wall is placed in the rear wall only). Finally, the amount of bracing in the side walls, Lsw, required to resist the force couple must be no greater than the amount of bracing that is required in the IRC for the side walls. The application of this approach is illustrated below:

Given:
Garage supporting one story plus roof (approach also applies to other support conditions)
Wind Speed: <110 mph
Seismic: SDC C
Show use of Method 3 and other bracing methods

Example Garage Plans	Garage Size		D/W	Bracing % Req'd (IRC Table R602.10.1)	Req'd Bracing Length (IRC R602.10.1)		Bracing per Proposed Exception #2			Check Sidewall Bracing for Torsion Load	
	D	W			Sidewalls (D x %)	Rear and Front Walls (W x %)	Side wall (Lsw)	Rear Wall (Lrw)	Front Wall	½ Lrw x D/W	Is Lsw ≥ ½ Lrw x D/W ?
Ex #1	22'	18'	1.2	30% (method 3) 45% (others)	6.6' 9.9'	5.4' 8.1'	6.6' 9.9'	10.8' 16.2'	None None	6.5' 9.7'	6.6'> 6.5' OK 9.9' >9.7' OK
Ex #2	22'	30'	0.7	30% (method 3) 45% (others)	6.6' 9.9'	9' 13.5'	6.6' 9.9'	18' 27'	None None	6.3' 9.5'	6.6'>6.3' OK 9.9'>9.5' OK

Note: Front wall contains the garage opening.

As shown above, when D/W is approximately 1.2 or less, this proposal that permits transfer of bracing from the garage opening wall to the rear garage wall (effectively doubling bracing amount in the rear garage wall) results in a structurally stable building or garage provided side walls area also braced in accordance with the code.



(a) Standard garage bracing design per IRC

(b) Garage bracing design using bracing transfer

(c) Garage lateral forces in equilibrium per IRC standard bracing approach

(d) Equilibrium of lateral force per bracing transfer method (roof/floor diaphragm above garage distributes forces by rotation)

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Submitted by: ____Kirk Grundahl, P.E.______ Representing: ___WTCA_____________

Address: __6300 Enterprise Lane, Madison, WI 53719_________ Phone No.: _ 608/274-4849_____________

Regulation Title: __2003 USBC (residential buildings)__________ Section No(s): __R802.10.5 & R802.11_______

Proposed Change:

1. REVISE AS FOLLOWS:

~~**R802.10.5 Truss to wall connection.** Trusses shall be connected towall plates by the use of approved connectors having a resistance to uplift of not less than 175 pounds (779 N) and shall be installed in accordance with the manufacturer's specifications. For roof assemblies subject to wind uplift pressures of 20 pounds per square foot (960 Pa) or greater, as established in TableR301.2(2), adjusted for height and exposure per Table R301.2(3), see section R802.11.~~

R802.11 Roof tie-down.

R802.11.1 Uplift resistance. ~~Roof assemblies which are subject to wind uplift pressures of 20 pounds per square foot (960 Pa) or greater shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in Table R802.11.Wind uplift pressures shall be determined using an effective wind area of 100 square feet (9.3 m2) and Zone 1 in Table R301.2(2), as adjusted for height and exposure per Table R301.2(3).~~

Roof assemblies shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in Table R802.11. Roof ties shall not be required when required strength values per Table R802.11, including applicable adjustments, do not exceed 185 lbs using 2-16d toe-nails per Table R602.3(1) or 280 lbs using 3-16d toe-nails per rafter or truss connection to wall plate.

Exception: For trusses designed per Section R802.10.1, the connections shall resist the uplift force, if any, specified on the Truss Design Drawing or as specified by the registered design professional. The uplift force need not exceed the values in Table R802.11 as applicable to clear span uniformly spaced trusses.

When roof ties are required by this section, ~~A~~a continuous load path shall be provided to transmit the uplift forces from the rafter or truss ties to the foundation in accordance with footnote e of Table R802.11.

2. DELETE TABLE R802.11 AND SUBSTITUTE AS FOLLOWS:

TABLE R802.11
REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS TO RESIST WIND UPLIFT FORCES
(Pounds per connection)

Basic Wind Speed	Roof Uplift Reaction Force (lbs)						
	Roof Span (feet)						
	12	20	24	28	32	36	40
	Roof Slopes <= 4:12						
85	86	115	130	145	160	175	189
90	114	155	176	197	218	239	260
100	174	243	277	311	346	380	414
110	241	339	388	437	486	536	585
	Roof Slope 5:12						
85	35	42	45	48	51	54	57
90	57	73	81	88	96	104	112
100	104	141	159	177	195	213	231
110	156	215	245	274	304	334	363
	Roof Slope 6:12						
85	0	0	0	0	0	0	0
90	8	9	9	10	10	11	11
100	44	62	71	80	89	98	107
110	83	120	138	157	175	194	212
	Roof Slopes >=7:12						
85	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 0.447 m/s, 1 pound/foot = 14.5939 N/m, 1 pound = 0.454 kg.

a. The uplift connection requirements are based on a 30 foot mean roof height located in Exposure B. For Exposures C and D and for other mean roof heights, multiply the above loads by the Adjustment Coefficients in Table R301.2(3).

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection values require a minimum of 10 pounds per square foot of roof/ceiling dead load.

d. The uplift connection requirements account for overhangs not exceeding 24 inches.

e. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 600-pound rated connector is used on the roof framing, a 500-pound rated connector is permitted at the next floor level down).

REASON:

WTCA believes that code sections R802.10.5 and R802.11, along with Table R802.11, require improvement and have submitted a comment for consideration at the upcoming ICC Final Action Hearings proposing a similar revision.

The above modifications to RB265 simplify the roof uplift connection provisions, clarify when conventional framing connections provide adequate uplift resistance and load path, increase the nailing required for conventional roof-to-wall connections for added strength, and update uplift resistance requirements based on ASCE 7-05 low-rise building wind load provisions.

The uplift value of 280 lbs for 3-16d toe-nails and 185 lbs for 2-16d toe-nails is based on an evaluation of more than 120 roof assembly uplift tests conducted by State Farm Insurance, Clemson University (FEMA/Project Blue Sky), and USDA Forest Products Laboratory. This data is available and the evaluation of this data (prepared by ARES Consulting, Jay Crandell, P.E.) has been shared with various individuals and proponents of RB264, RB265, and RB268 in relation to the wind uplift issue. The safety margins used to determine these toe-nail values provide a level of safety, considering the system effects observed in the data for the tested roof assemblies, comparable to that required for wood member design. A similar approach was also recommended by NIST in a landmark 1948 study of structural engineering data and practices for the design of residential buildings. If such action had been taken then, we would likely not be debating this issue now. Furthermore, conventional construction would have been efficiently designed and built such that it is not over-designed in low wind regions (as proposed in RB265) or under-designed in high wind regions (as has occurred in past construction). This proposal attempts to finally resolve this issue in a practical manner.

The proposed wind loads are calculated based on the latest provisions of ASCE 7-05 and the low-rise building provisions which accounts for variation in roof slope. The proposed values for the 4:12 roof pitch conditions are similar to those currently in the code. These calculations also are conservative relative to actual field experience. For example, when the required uplift values are scaled up to 150 mph wind speed, a design resistance value of about 980 lbs would be required for a 4:12 pitch, 28 ft span roof with trusses at 24 inches on center (typical south Florida home). In Hurricane Andrew, typical roof tie brackets on homes were sized to about 750 lbs design capacity and failures of correctly installed roof ties in this 160 mph, 300-year event were rare as expected. Therefore, these calculated resistance values are conservative when compared to actual experience.

This public comment is based on feedback from several people regarding code changes RB-264 through RB-268 and our desire to come up with a solution that can meet the needs for everyone. This code change is the result of Richard Zimmermann, WTCA technical staff member and Jay Crandell, ARES Consulting, taking this feedback and crafting language that does its best to meet the needs of everyone involved in the discussions.

Thank you for your consideration of this public comment. Should you have any questions please contact Richard Zimmerman (608-310-6743) or me.

Respectfully Yours,

Kirk Grundahl, P.E.
Executive Director

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-310.6(R613.2)-a

Nature of Change: (text is on code change form)

To modify a new provision in the 2006 International Residential Code (IRC) requiring window sill height at a minimum of 24 inches above the floor.

Proponent: Home Builders Association of Virginia (HBAV)

Staff Comments:

This compromise proposal by HBAV uses the established height for safety glazing to permit the window sill height to be lowered from 24 inches to 18 inches. The proposal was considered by Workgroup 1 and recommended as a consensus change.

An additional change was submitted by a building contracting firm (Code Change No. C-310.6(R613.2)-b, found behind this change) which proposed to delete the 2006 IRC provision altogether, however, the Workgroup 1 members preferred the HBAV proposal.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

(Use this form to submit changes to building and fire codes)

Address to submit to: DHCD, the Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.state.va.us		Document No. C-310.6 (R613.2)-a Committee Action: _________ BHCD Action: _________

Submitted by: Mike Toalson Representing: Home Builders Association of Virginia

Address: 707 East Franklin Street, Richmond, VA 23219 Phone No.: (804) 643-2797

Regulation Title: Proposed 2006 USBC Section No(s): IRC R613.2

Proposed Change:

R613.2 Window sills. In dwelling units, where the opening of an operable window is located more than 72 inches (1829 mm) above the finished grade or surface below, the lowest part of the clear opening of the window shall be a minimum of ~~24 inches (610 mm)~~ 18 inches (457 mm) above the finished floor of the room in which the window is located. Glazing between the floor and ~~24 inches (610 mm)~~ 18 inches (457 mm) shall be fixed or have openings through which a 4-inch-diameter (102 mm) sphere cannot pass.

(Exceptions remain the same)

Supporting Statement:

The change modifies new requirements contained in the 2006 IRC which prohibit window openings lower than 24 inches off of the floor. The modification is to permit window openings to be only six inches lower than the new requirements (from 24 inches to 18 inches). This allowance will permit the placement of windows in a more traditional manner while still providing safeguards against accidents and is consistent with when glazing is considered to be in a hazardous location under the IRC.

C-310.6 (R613.2)-b

RE: 2006 Virginia uniform Statewide Building Code- Recommended Amendment

January 19, 2006

Dear Mr. Hodge,

Winchester Homes, Inc would like to submit the following recommend amendments for consideration and incorporation into the 2006 edition of the Virginia uniform Statewide Building Code. Thank you for your consideration of this matter. If you should need to contact me please don't hesitate to either e-mail me or call me directly at (410) 365-7781.

Sincerely,

Winchester Homes, Inc.
By Randall K. Melvin
Director Codes and Construction Risk

cc: Mr. Denis Mitchell Loudoun County, Virginia
Mr. Lynch Fairfax and Mr. Chris McArtor Fairfax County, Virginia
Mr. Eric Mays Prince William County, Virginia
Mr. Jim Williams NVBIA

Virginiacodeammendmentrequest22006.doc

Issue: **Window Sill Height**

2006 IRC Section: **R613.2 Window sills**

Recommended Amendment: Delete text as follows

~~**R613.2 Window sills.** In dwelling units, where the opening of an operable window is located more than 72 inches (1829mm) above the finished grade or surface below, the lowest part of the clear opening of the window shall be a minimum of 24 inches (610 mm) above the finished floor of the room in which the window is located. Glazing between the floor and 24 inches(610 mm) shall be fixed or have openings through which a 4" diameter (102 mm) sphere cannot pass~~

~~Exceptions:~~

1. ~~Windows whose openings will not allow a 4" diameter (102 mm) sphere to pass through the opening when the opening is in its largest opened position.~~

2. ~~Openings that are provided with window guards that comply with ASTM F 2006 or F 2090.~~

Reason:

This requirement is not based on sound technical information that adequately substantiates that such a requirement will result in any improvement in protecting small children form window falls. There is no documented relationship between center of gravity, window sill height and falls from windows and therefore no basis for establishing what is " too low," what and adequate medium is, the role the window sill height plays, especially in relation to other relevant factors or that there is even a need for such a requirement.

The assumption that a minimum window sill height of 24" will have a significant impact on reducing window falls of infants and younger children is just that-an assumption, and one that is based on limited data to support that assumption. Furthermore, there has been no discussion or apparent consideration for unintended consequences that may result form this requirement, such as encouraging climbing near windows which is a significant factor in window falls involving children.

Of the interests weighing in on the issue such as the National Safety Council, American Association of Pediatrics, consumer Products Safety Commission, the Timothy Healy Foundation, and other national, state and local agencies and organizations, regarding children falling from windows, there has been little to no discussion or concerns raised with respect to window sill height being a significant factor in these falls and no advocacy efforts on their part, that we are aware of, to establish minimum sill heights in building codes. Given the great deal of attention these organizations have given the matter, their omission of window sill height in any of their recommendations is not an oversight. They instead focus on preventive measures that have proven to be very successful such as the use of operable window guards and stops and community outreach and education about window safety.

The international code Council, National Association of Home Builders, National Safety Council and other interests are all currently working together to improve window safety awareness. This course of action will assuredly contribute to reducing the number of falls from window as opposed to setting a minimum requirement with only theoretical gains.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-310.6(R806.4)

Nature of Change: (text is on code change form)

To clarify the existing provisions and to add specific criteria in the International Residential Code for unvented attics and the types of insulation permitted.

Proponent: Icynene Corporation

Staff Comments:

This was considered by Workgroup 1 and is recommended to move forward as a consensus proposal as it was approved at the national level and is contained in the 2007 Supplement to the IRC. It will give local building departments guidance in approving unvented attic design options which are being used in more new homes today for energy conservation purposes and to reduce moisture problems.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

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VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to: DHCD, The Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov	5/14/07	Document No. C-310.6 (R806.4) Committee Action: ___________ BHCD Action: ______________

Submitted by: _John Loyer_______ Representing: __Icynene Corp._________

Address: _5300 Columbia Pike Arlington, VA 22204__________ Phone No. 7036757603____

Regulation Title: __Virginia Construction Code Section No(s): __IRC 202 and 806.4_________

Proposed Change:

Section 202
Definitions
Air-impermeable insulation. An insulation having an air permanence equal to or less than 0.02 L/s-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or E 283.

R806.4 ~~Conditioned~~ Unvented attic assemblies. Unvented ~~conditioned~~ attic assemblies (spaces between the ceiling joists of the top story and the roof rafters) ~~are~~ shall be permitted ~~under~~ if all the following conditions are met:

1. The unvented attic space is completely contained within the building thermal envelope.
2. No interior vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly.

~~2. An air-impermeable insulation is applied in direct contact to the underside/interior of the structural roof deck. "Air-impermeable" shall be defined by ASTM E 283.~~

~~**Exception:** In Zones 2B and 3B, insulation is not required to be air impermeable.~~

~~3. In the warm humid locations as defined in Section N1101.2.1:~~

~~3.1. For asphalt roofing shingles: A 1-perm (5.7 °x10-11 kg/s⁻ m2⁻ Pa) or less vapor retarder (determined using Procedure B of ASTM E 96) is placed to the exterior of the structural roof deck; that is, just above the roof structural sheathing.~~

3.~~2. For~~ Where wood shingles ~~and~~ or shakes are used~~:~~, a minimum ~~continuous~~ ¼ inch (6 mm) vented air space separates the shingles~~/~~ or shakes and the roofing ~~felt placed over~~ underlayment above the structural sheathing.

~~4. In Zones 3 through 8 as defined in Section N1101.2 sufficient insulation shall be installed to maintain the monthly average temperature of the condensing surface above 45°F (7°C). The condensing surface is defined as either the structural roof deck or the interior surface of an air-impermeable insulation applied in direct contact with the underside/interior of the structural roof deck. "Air-impermeable" is quantitatively defined by ASTM E 283. For calculation purposes, an interior temperature of 68°F (20°C) is assumed. The exterior temperature is assumed to be the monthly average outside temperature.~~

4. In climate zones 5, 6, 7 and 8, any air-impermeable insulation shall be a vapor retarder, or shall have a vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Either "a", "b", or "c" shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
   a. Air-impermeable insulation only. Insulation shall be applied in direct contact to the underside of the structural roof sheathing.

b. Air-permeable insulation only. In addition to the air-permeable installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.4 for condensation control.
c. Air-impermeable and air-permeable insulation. The air-impermeable insulation shall be applied in direct contact to the underside of the structural roof sheathing as specified in Table R806.4 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

Table R806.4. Insulation for Condensation Control

Climate Zone	Minimum rigid board or air-impermeable insulation R-Value [a]
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to but does not supersede Chapter 11 energy requirements.

Supporting Statement:

Unvented attics are attics where the insulation and air barrier boundary is moved to be directly above the attic space, instead of on top of the ceiling. Unvented attics eliminate the extreme temperatures of the attic, thereby placing the HVAC, ducts, pipes, and anything in the attic space into a more favorable environment. Unvented attics increase energy efficiency and decrease wear and tear on equipment in the attic.

The committee agreed that unvented attics should be an option. The main \ objection to the existing language in 806.4 was the confusing code language. The successful floor motion at the IRC hearings in Orlando demonstrated the assembly desire to clarify this section of the code.

This Public Comment proposes simpler code text and clarifies what "air impermeable" means by adding a definition. Several minor improvements are made to the language. The overly complicated language of the existing item #4 is replaced with a table to look up of the required R-value for insulated sheathing. The table lookup eliminates the calculation.

If this public comment prevails, the existing IRC806.4 will be simplified. For clarity the resulting R806.4 code text is below:

Section 202, Definitions
Air-impermeable insulation. An insulation material having an air permeance equal to or less than 0.02 L/s-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or E 283.

R806.4 Unvented attic assemblies. Unvented attic assemblies (spaces between the ceiling joists of the top story and the roof rafters) shall be permitted if all the following conditions are met:
1. The unvented attic space is completely contained within the building thermal envelope.
2. No interior vapor retarder is installed on the ceiling side (attic floor) of the unvented attic assembly.
3.Where wood shingles or shakes are used, a minimum ¼ inch (6 mm) vented air space separates the shingles or shakes from the roofing underlayment.
4. In climate zones 5, 6, 7 and 8, any air-impermeable insulation shall be a vapor retarder, or shall have a vapor retarder coating or covering in direct contact with the underside of the insulation.

5. Either "a" or "b" or "c" shall be met, depending on the air permeability of the insulation under the structural roof sheathing.

a. Air-impermeable insulation only. Insulation shall be applied in direct contact to the underside of the structural roof sheathing.

b. Air-permeable insulation only. In addition to air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.4 for condensation control.

c. Air-impermeable and air-permeable insulation. The air-impermeable insulation shall be applied in direct contact to the underside of the structural roof sheathing as specified in Table R806.4 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

Table R806.4. Insulation for Condensation Control

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1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to but does not supersede Chapter 11 energy requirements.

Icynene Corporation

Originally, when the US Dept of Energy drafted the '04 RICC to simplify and modernize the IECC, it placed r-13 and r-19 as the default values for wood framed walls into the R-value and U-factor tables for prescriptive compliance with the code. A broad base of consensus was reached on the RICC as a living document. This consensus included code official and builder groups, industry, and energy experts from the local, state, and national levels. Once the RICC became an actual code proposal in the ICC process, it was hoped that it would create a much simpler and easier to use document with energy savings that were a definite increase from previous versions (e.g. air infiltration rates in the 2006 IECC). At the 11th hour (the night before the hearings), the fiberglass industry, and the non-profit organizations they fund, inserted a modification to the R-values in wood framed walls to r-15 and r-21. The Dept of Energy opposed these values vociferously at the microphone at the hearings on two separate occasions. Despite the large amount of opposition, the IECC committee saw this as an opportunity to increase energy savings, despite the lack of any economic justification showing the efficacy of these higher values.

It is interesting to note at this point, that only the R-value table was amended, and only in the IECC. The U-factor table in the IECC and both the R-value tables in the IRC were unchanged from the originally proposed r-13 and r-19. The IRC committee voted unanimously against the changes, and the fiberglass industry omitted the U-factor table in the IECC in its proposal.

Allow us to illustrate to the State how proprietary in nature those particular R-values actually are to the fiberglass industry and why they proposed them in the first place. Other insulation materials cannot meet that stringent level in 2x4 construction with single component insulation (how most builders build, due to cost and timing issues within their schedules) and the proprietary R-values place a built in barrier to any market penetration of other insulation types, like sprayed foam and cellulose. Moreover, only the glass fiber industry's high-density batts can achieve this level of stringency with single component insulation.

An increase of 2 "R" doesn't save enough energy to pay for a meal and the payback, according to a DOE study on wall insulation, is in the range of 40 to 90 years. This study is included as addendum #1. This study was later pulled due to political pressure, oddly enough from the fiberglass industry. Even the national weatherization programs have proven that controlling air infiltration, and NOT ratcheted R-values, is the most effective way to achieve energy conservation.

A huge grass roots effort was put forth to change the proprietary R-values in the code back to r-13 and r-19. Nationally, sprayed foam manufacturers, cellulose insulation companies, NAHB, the glass block industry, glass manufacturers, DuPont, the Sprayed Polyurethane Foam Association, the American Plywood Association (The APA, engineered wood) and over 20 code officials in testimony at the hearings, brought forth an 82% vote from a super majority of code officials nationwide to change the fiberglass friendly proposals back to r-13 and r-19. This sent a message that these types of proposals that benefited one industry and excluded others were UNACCEPTABLE in a consensus based code development process.

As a second addendum, we are attaching in our written comment a study on the economic thickness of insulation which shows that doubling the insulation thickness (R-value); doubling the cost; only provides a modest 2% increase in heat flow reduction. Based on this observation, it is very difficult to justify the additional cost of adding insulation thickness beyond 5". The Icynene Insulation System® fills any shaped cavity and adheres to almost all materials, thereby, forming an insulation layer with very low air-permeance. Airflow is eliminated and for this reason, conductive heat loss can be used as a sole criterion for establishing insulation thickness with our product.

- The additional expense of increasing the R-value of a 2 x 4 or 2 x 6 wall from R13 to R15 and R19 to R21 was **not** cost effective. DOE reported a payback period of 40 to 90 years with an annual energy savings of $10 to $15 in most of the U.S. This is a very small payback as compared to the initial cost. The increase of wood frame wall R-values by R2 was not supported by the DOE and does not conserve energy consumption to a significant level.

- **These higher R-values contribute to dramatically higher construction costs in meeting braced wall panel requirements while eliminating the options for designing with the IRC:** The IRC currently contains a number of exceptions to the requirement for 48" minimum width bracing panels. These alternative bracings vary from 16 to 32 inches in width, each with their own limitations. These commonly used alternate bracing schemes were designed based on the demand from the public to permit traditional-looking details in modern housing without compromising the structural integrity of the structure. When foam wall sheathing materials are used to meet the additional R2 prescriptive requirements for wood frame walls in Table 402.1 of the IECC 2004 Supplement, none of these alternative bracing methods may be used unless the structure is designed (IBC) or sheathed with both foam and structural sheathing, or proprietary narrow bracing panels are used.

  As an example, If prescriptive methods incorporating wood structural panels are used to provide wall bracing segments as narrow as 16" in width, the cavity insulation must be a high-density fiberglass in order to meet the increased prescriptive wood framed R-values in common wood-frame construction. The DOE's evaluation of the impact from these changes found the cost of wall insulation increased by a minimum of $.10 per square foot. Our investigation has found the additional cost to be in excess of $.15 per square foot in the state of Oregon where the R21 minimum prescriptive wall system requirements have been in place for over a decade.

  Even more important is that the 25% structural wall sheathing permitted by 2004 IECC Supplement Table 402.1 severely limits the use of the bracing tables in the IRC to areas with a design wind of less than 100 mph and Seismic Design Categories A and B. (A single story home **is** permitted in areas of 110 mph and SDC C). In the vast majority of the United States, where construction is booming, residences will have to be built in accordance with the IBC (engineered), utilize high-density batts, double sheathed, or built with 2 x 6 walls. Each of these options put an enormous financial burden on the homebuyer with little or no offset due to energy savings. Note that in computing the payback costs above only the cost of the initial insulation was considered in generating the 40- to 90-year payback. In the majority of the US the actual cost of this proposal would be substantially more than the cost of the foam sheathing alone.

With current trends in residential construction that demands an increased number and size of windows and doors in exterior wall lines, it is critical to builders and homeowners that the structural integrity of the wall systems not be compromised. It is important to understand that the family of codes does not give the option of building a safe structure *or* an energy efficient one. Both criteria must be met.

- **Approval of higher r-values means reduction in home ownership:** R15 batts designed for a 3.5" wall cavity are not available in most parts of the country. A survey by the NAHB of the cost for such batts showed that R15 batts cost up to twice as much as R13 batts. Our own survey of costs in the Pacific Northwest where R21 fiberglass is prescribed by the state building code finds from a 38% to 45% cost increase for R21 over more conventional R19. If 2x6 framework is used to permit the use of cavity insulation to meet the new R15 bracing requirements and still permit code-required bracing (very often far in excess of the 25% that is permitted in Footnote g of IECC Table 402.1), the extra cost for the framing package for a modest home will be more than $700. As stated above, the Dept of Energy projects a payback in 40 to 90 years. Given an energy savings of $15 per year, the DOE apparently places the cost of the increase from $600 – $1350. The NAHB can testify as to the negative impact this will have on home ownership in the US in specific terms how many people are excluded.

- **The higher prescriptive R-values create an unleveled playing field for cavity insulations other than fiberglass:** Neither cellulose nor expanding foam can meet more than R13 levels in 2x4 framing and R19 levels in 2x6 framing. This then requires the builder to use non-structural foam wall sheathing or high density fiber glass batts in order to meet the minimum R15 and R21 requirements for the exterior wall system as noted in the recent DOE report on the impact of these higher prescriptive wall system R-values.

We all have an obligation to make sure that code change benefits are balanced against cost burdens. We are extremely willing to avail ourselves to assist the State in understanding this issue more fully and want to achieve a code that does not discriminate against one product over another. Please let us know if there are any questions we may help answer on this issue and we thank you sincerely for the opportunity to bring our comments forth at this public hearing.

An Analysis of Floor Modifications to IECC Code Change EC48-03/04

February 23, 2005

This report provides an analysis of several changes made to DOE's comprehensive Residential IECC Code-Change (RICC) proposal (EC48-03/04) that became the basis of the residential requirements in the 2004 Supplement to the 2003 IECC. The changes, proposed "from the floor" at the September, 2003, ICC hearings are hereafter called "floor modifications" or "floor mods." This analysis looks at the energy savings and incremental costs of two of the insulation and glazing floor mods as well as their possible impact on product markets and on the code's usability and enforceability. This report is intended only to serve as background data for DOE in assessing the potential impacts of the mods.

Executive Summary

DOE's "RICC" proposal made sweeping changes to the International Energy Conservation Code (IECC) designed to significantly improve its usability and enforceability. A number of modifications to the proposal raised "from the floor" at the September, 2003, Code Development Hearings of the International Code Council (ICC) changed aspects of the DOE RICC proposal. Many of the floor modifications were successfully inserted into DOE's proposal and subsequently approved by the ICC as part of the 2004 Supplement to the 2003 IECC. This reports analyzes two of the more notable floor modifications.

- **Wall R-values were increased**. In climate zones three through six, prescriptive wall cavity insulation requirements were increased from R-13 to R-15 (normally used in 2x4 walls) and from R-19 to R-21 (normally used in 2x6 walls).

- **Glazing trade-off limits**. Limits were imposed (or strengthened) on the maximum values of U-factor and SHGC permitted for glazing products. Unlike most other energy code requirements, these limits can never be exceeded, even if other compensating improvements (trade-offs) are made. The original RICC prohibited glazing U-factors, even in trade-off contexts, higher than 0.55 Btu/hr-sf-F in zones six through eight; the floor modifications lowered that value to 0.4 Btu/hr-sf-F and extended its application to zones four and five. The floor modifications also added an SHGC trade-off limit of 0.5 in zones one through three.

Wall R-value Increases

The **practical effect** of the wall cavity R-value increase was to increase the overall stringency of the thermal efficiency of the building envelope. While the use of R-15 and R-21 high density batt insulation seems to be the most straightforward prescriptive approach to achieving this increase, there are other methods to meet the R-15 and R-21 requirements. In order to avoid narrowing the list of products capable of meeting the prescriptive requirements, insulating sheathing is needed so that other cavity insulation types, including sprayed cellulose and expanding foams, can achieve the R-15 level (in 2x4 walls) or the R-21 level (in 2x6 walls). Use of these products will consequently require a builder to use a "trade-off" path to demonstrate compliance or will require the use of insulating sheathing in addition to structural sheathing and/or engineered cross bracing.

The **primary cost** associated with this floor modification is the cost difference between standard-density and high-density fiberglass batts or the costs associated using insulating sheathing instead of or in addition to other sheathing methods such as OSB sheathing. The incremental costs for the high density fiberglass products can be high in markets where these products are not commonly used—California data reports these at $0.42 to $0.44/ft^2. In Oregon, where the state code requires R-21, the incremental cost of this insulation level is reported at only $0.10/ft^2. There may be little to no cost increase if insulating sheathing is used to obtain the additional R-2 requirement, but many builders prefer not to use insulating sheathing for reasons other than cost.

DOE calculated the **energy cost savings** resulting from this floor modification when fiberglass batts are used. A 2000-sf house was simulated using the DOE-2 energy simulation program in 239 U.S. locations. The calculated energy costs assume a gas price of $0.90/therm and an electricity price of $0.0947/kwh. Overall, the annual energy cost savings from the increased wall R-values average about $15 per home, which amounts to 2% to 3% of HVAC energy costs.

Combining the increased costs and the energy savings of high density batt insulation allows an analysis of the **economic viability** of this floor modification. The simple payback period assuming the higher insulation data (from California) ranges from about 40 years in the northern affected zones to about 90 years in the southern zones. With the much lower Oregon insulation cost data, the simple payback is reduced to 9 to 21 years. Life-cycle cost (LCC—assuming a 50-year life, a 30-year mortgage with a 6% interest rate, a 6% nominal discount rate (3.3% real discount rate), and a 1% property tax) for the higher insulation levels are reduced if the lower insulation cost is assumed, but increase if insulation cost is at the higher estimate.

It is important to once again note that R-2 insulating sheathing can also be used to achieve the higher insulation requirements. However, as will be discussed later, that option involves additional considerations that complicate a direct cost comparison with the high-density batt option.

Glazing Trade-off Limits

The **primary effect** of the glazing trade-off limits is to set an absolute minimum (or maximum) value that can be used in a compliant home. For example, even if energy consumption is shown to be equal to or better than that resulting from the prescriptive code requirements, glazing products cannot be "traded down" beyond the limits. While this floor modification may ultimately result in energy savings, the trade-off limits clearly affect the market by instantly prohibiting products that would otherwise maintain market share interests and could be compliant within the original DOE RICC code change proposal if other energy efficiency measures within the building exceed code requirements.

The U-factor limit of 0.4 Btu/hr-sf-F has the effect of eliminating almost all types of aluminum windows and almost all windows that do not have low-emissivity coatings. The SHGC upper limit of 0.5 has the effect of eliminating almost all windows not containing low-emissivity coatings, tinting, or reflective glass. Since many homeowners may not want tinted or reflective glass, this is expected to lead to the use of low-E insulating glass virtually everywhere the code is adopted. The biggest impact of this limit will be to effectively eliminate single-pane glass, which is still common in Florida and pockets of the south near the Gulf Coast. In mild Zone 3 locations, most notably coastal California, the forced SHGC limit can actually raise energy costs because higher solar gains are advantageous in these chilly climates.

One tangible benefit of the SHGC trade-off limit is a potential **reduction in peak cooling loads** for homes that are otherwise energy-equivalent to a baseline code home. This could prevent a summer peak load increase of about 1 kW per house for certain trade-offs that increase the SHGC well above 0.50 (for example if the improvement allowing the SHGC trade-off is a high efficiency furnace).

Introduction and Background

This white paper summarizes an analysis of several modifications that were made to DOE's proposed (now accepted) rework of the International Energy Conservation Code (IECC). The modifications, proposed by motion "from the floor" at the 2003 Code Development Hearings of the International Code Council (ICC), were accepted by the IECC development committee.

Hereafter we will refer to DOE's change proposal as originally submitted to the ICC as the "original proposal" or, as dubbed during its development, the "RICC" (Residential IECC Code Change). The modifications proposed via floor motion at the Code Development hearings will be called the "floor modifications" or "floor mods." DOE's proposal as modified by the floor modifications will be called the "RICC as modified."

Two of the floor modifications have proven to be most notable among the parties interested in and affected by changes to the IECC. Although the RICC as modified is now officially part of the IECC (the 2004 Supplement), the Department has deemed it necessary to conduct an analysis of the floor modifications to assess the potential impacts of these mods.

A Description of DOE's "RICC" Proposal

The impetus for the original RICC was the frequently-heard comment that the IECC was too complex, hard to understand, and difficult to implement. Having worked for many years on development of energy-efficiency codes and standards, DOE in the mid-1990's added a compliance emphasis to its activities. DOE learned during the last decade of promoting energy codes and developing and deploying code compliance tools is that the energy-saving potential of the IECC was not being fully realized because of the difficulties in understanding, using, and enforcing the code.

A second impetus for the RICC was the common complaint that the IECC was not structured to adequately accommodate the concerns of cooling-dominated climates.

DOE's RICC addressed these two concerns in ways too numerous to discuss here. However, the bulk of the changes can be summarized in two primary characteristics of the RICC:

1. The climate basis for the IECC's requirements was changed from heating degree-days (HDD) to explicit geographic zones designed to align with county boundaries. As shown in Figure 1, there are eight temperature-oriented zones crossed with three moisture regimes (although not all 24 combinations exist in the U.S.).
2. The IECC's envelope requirements were made independent of window area percentage. In all previous versions of the IECC the minimum insulating requirements for walls and windows varied depending on the fraction of the gross wall area comprised of glazing.

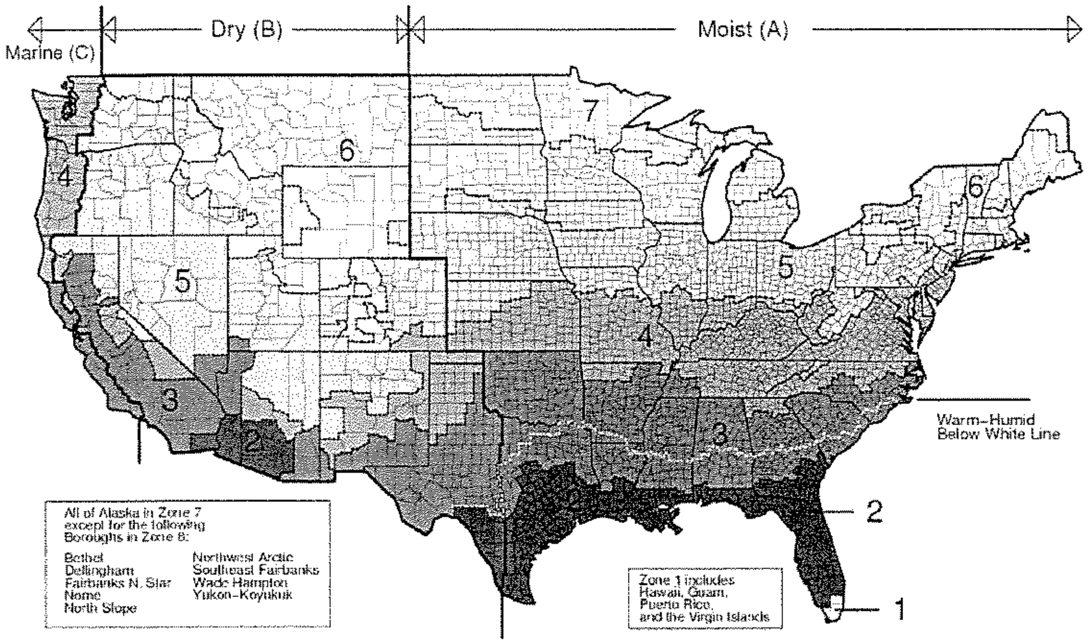

Figure 1 – New Climate Zones in the 2004 Supplement to the 2003 IECC

So that the Department could focus on usability issues without introducing other controversies, the specific envelope requirements of the RICC were designed to result in essentially no change in the code's overall stringency, averaged over all homes. Thus we say the original RICC was "energy neutral" on average. Obviously, some homes (e.g., high window-percentage homes) can be somewhat less efficient under the RICC while others (e.g., low window-percentage homes) will be somewhat more efficient.

The Floor Modifications

In the ICC's Code Development Hearings, minor modifications to submitted change proposals are permitted by motion from the floor. A number of floor motions affecting the RICC were accepted by the IECC committee. Several of those were substantive (as opposed to editorial), technically changing DOE's original proposal. Two floor modifications that noticeably affected stringency or usability are discussed in this paper.

Two primary floor modifications are of interest:

1. The minimum allowable R-values for wall insulation were increased in some zones, and
2. The trade-off limit for glazing U-factors was made more strict and a Solar Heat

Gain Coefficients (SHGC) limit was added

These are discussed in more detail below.

Wall R-value Increases

The floor modifications of interest increased the R-value minimums in climate zones three through six. The RICC's wall R-value requirement in zones three and four (except Marine) was R-13. The floor modifications increased that to R-15. This essentially corresponds to changing a standard fiberglass batt in a 2x4 wall to a high-density batt. Alternately, R-2 insulating sheathing can be added to R-13 framing cavity insulation to meet the requirement.

The RICC's wall requirement in zones four (Marine), five, and six was R-19, with an option of using R-13 between studs plus R-5 sheathing. That nominally allowed a standard fiberglass batt in a 2x6 wall or a standard batt in a 2x4 wall with insulating sheathing. The floor modifications increased those requirements to R-21 in a 2x6 wall or R-15 in a 2x4 wall with R-5 insulating sheathing. Again, the difference is nominally a switch from standard fiberglass batts to high-density batts or the addition of R-2 insulating sheathing.

These changes are summarized in Table 1.

Table 1 -- Summary of Wall-R Changes Due to Floor Modifications

Climate Zone	*Minimum Wood-Frame Wall R-value*
1	13
2	13
3	~~13~~15
4 except Marine	~~13~~15
Marine 4 and 5	~~19~~21 or ~~13~~15+5
6	~~19~~21 or ~~13~~15+5
7 and 8	21

The floor modifications have the effect of requiring insulating wall sheathing in the prescriptive compliance path if non-fiberglass products are used for the cavity insulation. The two prominent examples are cellulose and expanding foam, both of which can meet the R-13/R-19 requirement in 2x4/2x6 walls, respectively, but cannot achieve the R-15/R-21 levels without increasing the stud thickness.

Glazing Trade-off Limits

The RICC included a trade-off limit on glazing U-factor that disallowed windows with a U-factor exceeding 0.55 Btu/hr-ft^2-F in zones six through eight. This provision was intended to prohibit the use of "very inefficient" glazing products even if the energy losses were made up elsewhere in a home, the intent being to avoid moisture condensation and comfort problems (cold spots) in northern climates. The floor modifications lowered the U-factor limit to 0.4 Btu/hr-ft^2-F and extended its applicability to zones four and five as well.

Additionally, the floor modifications added an SHGC trade-off limit (maximum) of 0.5 for windows in zones one through three. Both the U-factor and SHGC trade-off limits apply to the whole-house average, not to individual windows/skylights/doors.

Approach

This analysis focuses on the floor modifications from two angles. First, we calculate the energy and cost impacts of the changes and estimate the differences in life-cycle costs to consumers. Second, we evaluate any significant factors that might impact the usability or enforceability of the code, thereby impacting the number of states willing to adopt it or the number of homes that will actually comply. The latter viewpoint necessarily involves some subjective assessments. These are deemed important because the original purpose of the RICC was not to increase its stringency but to produce a code that would result in more homes actually achieving compliance. Also, because of DOE's usability focus in preparing the RICC, a number of external reviewers were surprised by the floor modifications and have demanded that DOE publish an analysis of those changes.

Energy impact analyses for the wall R-value increases were conducted with the DOE-2 energy simulation program. Energy impacts for the trade-off limits are, by definition, zero. However, we do present some limited assessments of secondary impacts that may impact energy use, again often using somewhat subjective approaches.

Analysis and Discussion

Wall R-value Increases

Energy Efficiency

The wall R-value increases have a straightforward impact on energy efficiency. The new R-values clearly increase the required insulating properties of walls, which results in an improvement in the overall efficiency of a home. Accounting for this improvement in terms of annual energy costs, the wall R-value floor mods result in an energy savings of between 2% and 3% of HVAC (1% to 2% of total) energy costs.

Energy savings estimates for the wall R-value increases are straightforward to generate. Our wall R-value analysis involved hour-by-hour annual energy simulations of a 2000 ft^2 two-story house on a crawlspace foundation. Simulations were run for each of the 239 available TMY2 weather files (although for many locations there is nothing to analyze because the floor modifications affected only zones three through six). The efficiencies of other house components were set equal to the minimum requirements of the 2004 Supplement. Wall insulation was assumed to be fiberglass batt insulation (no insulating sheathing). The effective insulating value of R-19 insulation was assumed to be R-17.8 because R-19 fiberglass batts must be compressed to fit into the cavity left by 2x6 framing.

The major assumptions used in the energy simulations are shown in Table 2.

Table 2. Assumptions in Simulation Analysis of Floor Modifications

Simulation model	DOE-2.1E
House design and size	2-story, 40x25 ft., 2000 ft^2 conditioned floor area
Wall area (excluding windows and doors)	1878 ft^2
HVAC system type	Natural gas furnace, 78% AFUE; 13 SEER
Fuel prices	$0.90 per therm[a], 9.47 cents per kWh[b]. 2.6% inflation rate[c].
Climate Cities	239 TMY2 weather data locations
Aggregation method	City-by-city results weighted by year-2000 housing starts
Wall Construction	Wood frame, 23% framing by area[d]

a. $0.85/therm is the average long-term "reference case" residential rate for 2005 through 2025 in real 2003 dollars from the 2005 Annual Energy Outlook. This was escalated to $0.90/therm to account for inflation from 2003 to 2005. http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html (Table 3)
b. Residential average for August 2004. Source is Electric Power Monthly: http://tonto.eia.doe.gov/ftproot/electricity/epm/02260411.pdf
c. http://www.eia.doe.gov/oiaf/aeo/pdf/aeotab_19.pdf
d. R-19 is assumed to have an effective R-value of 17.8 because of compression. http://www.energy.ca.gov/title24/residential_manual/res_manual_chapter2.PDF

The resulting energy cost savings are shown in Figure 2.

Annual Energy Cost Savings ($) from Increased Wall Insulation

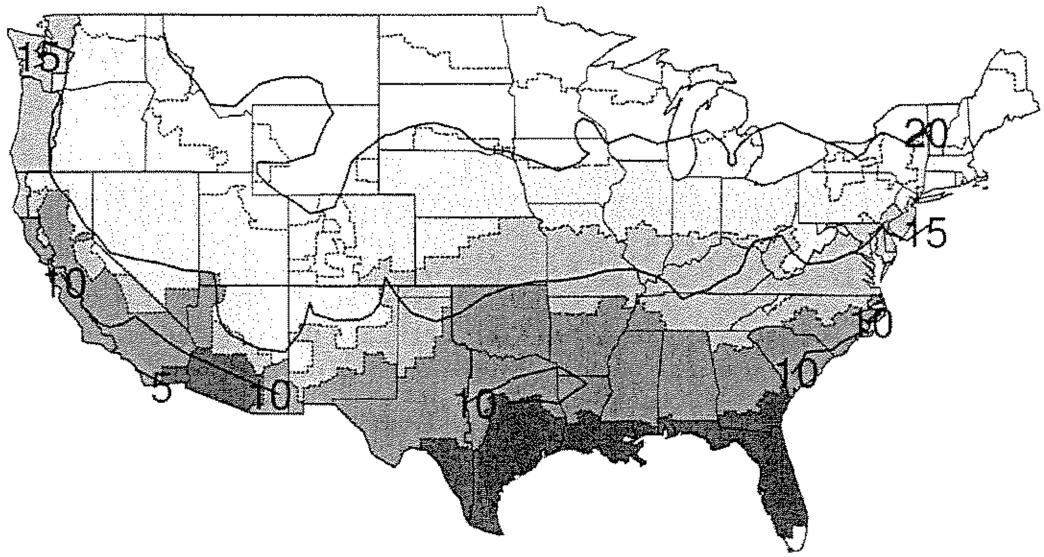

Figure 2 – Annual Energy Cost Savings ($) from Wall-R-Value Increases

Note that annual energy cost savings of the wall R-value increases peak at about $20 in the coldest locations and are between $10 and $15 in most of the U.S. Recall that these savings numbers are for a 2000 ft^2 home. Figure 3 shows the same results as a *percentage* of total annual HVAC costs. For most of the country the energy savings are near 2.5% of HVAC costs.

Percent Energy Cost Savings from Increased Wall Insulation

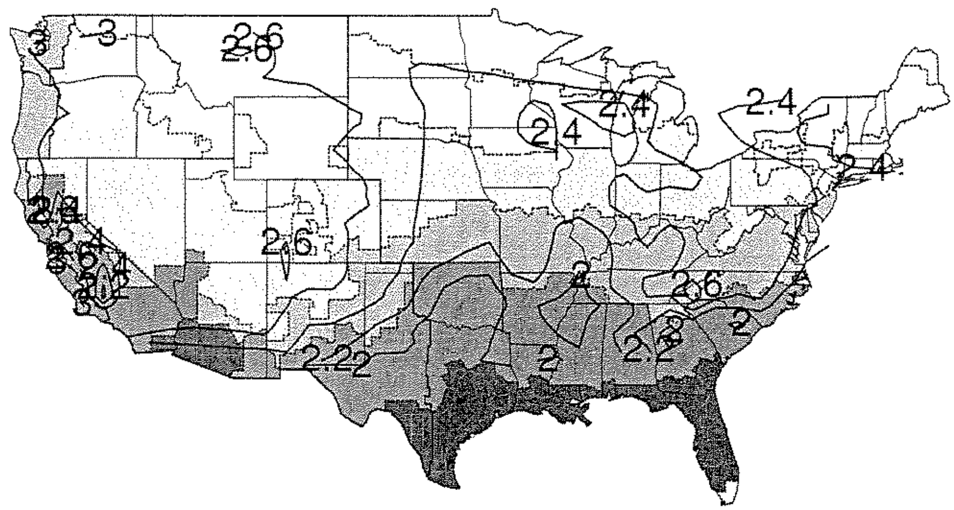

Figure 3 – Annual Energy Cost Savings (as a percentage of HVAC costs) from Wall-R-Value Increases

Measure Costs and Life-Cycle Costs

Addition of R-2 Insulating sheathing

The R-15 and R-21 wall insulation requirements, respectively, can be met with R-13 and R-19 cavity insulation and the addition of R-2 insulating sheathing. Common types of insulating sheathing are polystyrene (either extruded or expanded) and polyisocyanurate. Using extruded polystyrene as an example, insulating sheathing about ½" thick would have to be added to a standard R-13 or R-19 wall to achieve the R15/R21 levels. However, assessing the pros and cons of insulating sheathing as the assumed method of meeting code is complicated because of the variety of factors involved.

Insulating sheathing can often replace other types of sheathing such as OSB or plywood, provided another means of shear bracing is used (this is discussed further below). So a meaningful cost comparison must account for engineered bracing costs, additional skilled labor costs as well as material costs. R.S. Means reports that the total *installed* cost of insulating sheathing is less than that of plywood. Half-inch plywood costs $\$1.15/ft^2$ while a full inch of extruded polystyrene costs $\$0.83/ft^2$. A "Toolbase Technote" from the NAHB Research Center reports the *material* cost of insulating sheathing at about half that of OSB or plywood. Neither of these estimates includes the engineering costs or the additional bracing costs. The use of insulating sheathing in lieu of plywood or OSB can sometimes eliminate the need for an air infiltration barrier ("housewrap") if the joints are properly taped and sealed, as has been demonstrated by DOE's Building America program [Home Energy Magazine 1999]. Insulating sheathing may help prevent moisture condensation in walls by raising the temperatures within the walls and providing a drainage plane, depending on climate and other wall construction details.

Though insulating sheathing has some clear advantages over other sheathing materials, there are drawbacks as well, such as the need for bracing. Shear bracing requirements differ depending on the house type (e.g., one- vs two-story), location (e.g., earthquake and high-wind regions), and design details (e.g., locations of windows and doors). We know empirically that most builders choose not to use insulating sheathing [NAHB Builder Practices Reports, www.nahbrc.org]. Other reasons for this may include a perception of less security (from the lack of a "solid" wall barrier) and the absence of a helpful nailing surface for nails that "miss" the studs. Alternative techniques—such as using one-inch foam sheathing except at building corners where half-inch plywood sandwiched with half-inch foam is used—can resolve some of the issues, but the result has a higher R-value than the R15/R21 target, making cost comparisons difficult. (See the article by Paul Frisette in the web link below for an overview of many of these issues.)

Source:

Home Energy Magazine Online. January/February 1999. *Builders Find New Technologies Paying off.*
http://homeenergy.org/archive/hem.dis.anl.gov/eehem/99/990110.html
R.S. Means 2005 Residential Cost Data. Kingston, Massachusetts
National Association of Home Builders, Research Center. 2003. *Alternatives to Structural Plywood and OSB.*
http://www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=29&DocumentID=3984
Paul Fisette. 2004. *Insulating on the Outside.* University of Massachusetts
http://www.umass.edu/bmatwt/publications/articles/insulating_on_the_outside.html

R-15 and -R21 Fiberglass Batt Insulation

One method of meeting the higher wall R-value requirements is the use of high-density fiberglass batts in lieu of standard batts. However, establishing a confident and universally-applicable estimate of that cost is somewhat difficult. Because high-density batts are relatively uncommon in most areas there is a general lack of good information on marginal costs. The best information available to the Department comes from the California Database for Energy Efficient Resources (DEER) [Xenergy, Inc. 2001]. DOE searched for additional studies and made several requests of interested and affected parties for such information, but none was available at the time of this writing. A few anecdotal suggestions made to the Department were not used because they were unsubstantiated or deemed potentially biased.

California has a long history of tracking efficiency-measure costs and the DEER represents one of the most comprehensive and well-researched databases available. However, the present unpopularity of high-density batts raises the prospect of their costs going down should the national model code result in more widespread use of the high-density material. An example of such a transformed market is the state of Oregon, which has required R-21 in residential walls for some time. A somewhat dated study found the cost difference between R-19 and R-21 in Oregon to be $0.10/sf [Oikos 1994]. Although prices may have changed in the ten intervening years, it is unlikely that inflation would account for much of the four-fold difference between this estimate and DEER's. The remainder is likely attributable to regional price variations and market transformation effects.

The available cost estimates are summarized in Table 3. Note that the Department did not identify a similar transformed market for R-15 batts.

Table 3. Wall Insulation Cost Estimates

Source	Incremental Cost
R-13 to R-15	
California 2001 Database for Energy Efficient Resources	$0.42/ft^2$
R-19 to R-21	
California 2001 Database for Energy Efficient Resources	$0.44/ft^2$
Oregon 1993 Study (Energy Source Builder #34, August 1994)	$0.10/ft^2$

Sources:

Oikos. 1994. Energy Source Builder. Iris Communications, Inc. Lorane, Oregon. http://oikos.com/esb/34/oregoncode.html

Xenergy. 2001. Database for Energy Efficient Resources Update Study: Final Report. Oakland, California. http://www.energy.ca.gov/deer/2001_DEER_Update_Study.PDF

We examined both the high (the California costs) and low (Oregon's $0.10 incremental cost) insulation cost scenarios to bracket the cost impacts. Given those cost estimates, Table 4 shows the simple payback periods (years) of the higher wall insulation levels resulting from the floor modifications by climate zone. Zone averages are the averages of the 239 cities weighted by the housing starts in 2000. At the high cost level the modifications are clearly very long-term investments, with paybacks approaching 100 years in the warmest zone and over 40 years in the colder climates. Payback was much faster with the lower insulation cost, ranging from 9 to 23 years.

Table 4. Simple Payback (years) for Increased Wall Insulation R-Values

Zone	Simple Payback in Years	
	High Insulation Cost	Low Insulation Cost
3	89	21
4	52	12
5	49	11
6	40	9

Assuming a 50-year life, a 30-year mortgage with a 6% interest rate, a 6% discount rate, 2.6% inflation, a 30% income tax rate, and a 1% property tax, we computed the change in life-cycle cost resulting from the floor modifications. These are shown in Table 5. The floor mods increase total costs in the high insulation cost scenario but save money in the low insulation cost scenario.

Table 5. Life-Cycle Cost Savings ($) for Increased Fiberglass Batt Wall R-Values

Zone	Life-Cycle Cost ($)	
	High Insulation Cost	Low Insulation Cost
3	-498	32
4	-400	131
5	-424	162
6	-352	233

Other Factors

As mentioned earlier the purpose of the RICC was not to increase the code's stringency but to achieve energy savings by improving the code's usability. It is therefore important to understand the impact of the floor modifications on the palatability of the code, the probability that it will be adopted by states, and the possibility of secondary impacts that might lower expected energy savings.

One issue of interest is the possibility that the R-15 and R-21 wall insulation requirements will result in a market disadvantage for wall insulation systems other than fiberglass batts. In particular, the Department has received data that, for example, wet-blown cellulose and expanding foam products cannot achieve similar R-values to high-density fiberglass batts but have the advantage of better sealing the wall cavity and hence reducing air infiltration. We reviewed several available studies to determine the magnitude of any such effect.

The Cellulose Insulation Manufacturer's Association website summarizes a 1989-90 study comparing fiberglass and cellulose in two otherwise identical test buildings. The study, which looked at both ceiling and wall insulation, concluded that cellulose can indeed result in a tighter house (36% to 38% tighter in the test buildings). A comparison of overall heat loss values showed improvements of about 26% for cellulose over fiberglass. DOE was not able to obtain a copy of the report on this study, however.

Source:

http://www.cellulose.org/cellulose_benefits.html

In contrast, the North American Insulation Manufacturers Association cites several studies that suggest a smaller infiltration reduction benefit or no benefit for wet-blown cellulose or expanding foam products, based chiefly on the observation that an otherwise well-sealed wall will see little or no benefit from different types of cavity insulation.

Sources:

Field Demonstration of Alternative Wall Insulation Products. Prepared for the U.S. Environmental Protection Agency by NAHB Research Center, Inc., November 1997.

A Field Study of the Effect of Insulation Types on the Air Tightness of Houses. G.K. Yuill, Ph.D., Pennsylvania State University Department of Architectural Engineering, 1996.

Research and Development Project, "Maple Acres," Union Electric, St. Louis, MO. William Conroy, Division Marketing Supervisor, 1995.

This review of available studies suggests that the insulation products may indeed affect infiltration through the wall but the magnitude of the benefit depends on how well-sealed the remainder of the wall is. In other words, if the interior and/or exterior finish is well sealed to framing, and penetrations are well-caulked or gasketed, the marginal benefit of an air-impervious insulation layer is small. Given the often-reported lack of quality control in air-sealing techniques, these insulation types may have some impact on air sealing. However, the available data for infiltration testing in actual houses is not extensive enough to verify or quantify the impacts of different wall insulation types.

Glazing Trade-off Limits

DOE's original RICC proposal included a hard upper bound on glazing U-factor—a limit beyond which no windows would be allowed, even in the context of a compliance trade-off against better features elsewhere in a house. This type of restriction differs from the minimums and maximums typical of most codes' provisions in that it effectively prohibits certain types of products without recourse—in the relevant region, those products are basically illegal.[1]

Energy Savings

By definition, a compliance trade-off is energy-neutral. Therefore, the direct energy impacts of the U-factor and SHGC trade-off limits imposed by the floor modifications are zero.

One indirect exception to this line of thinking relates to SHGC benefits (or lack thereof) in some mild climates. Our energy simulations suggest that in some relatively cool zone-three locations the prohibition of higher SHGC values can actually force a higher annual energy consumption because of increased heating loads. Although the number of locations and magnitudes involved are small, it is philosophically problematic for a code to mandate the higher-energy option.

There are other indirect or secondary impacts that may influence energy consumption. These impacts, which are uncertain and difficult to quantify, are discussed later.

Measure Costs and Life-Cycle Costs

As there is no direct increase in code stringency, the costs of measures related to these floor modifications are likewise zero. These measures may prevent trade-offs that could

[1] Actually, as structured in the 2004 Supplement, the "prohibited" products *can* be used as long as the area-weighted average U-factor (or SHGC) is not beyond the trade-off limit. This permits minor trade-offs to allow, for example, a decorative sidelite or a few small windows that are outside the trade-off bounds. It also permits, for example, half the windows to be worse than the trade-off limit if the other half are sufficiently better.

lower construction costs, however, preventing a builder from finding less costly ways to achieve equivalent energy consumption. But even in this context the costs are difficult or impossible to specify since many trade-offs are done to take advantage of local and/or short-term cost structures.

Secondary Energy Impacts and Other Considerations

Code-imposed trade-off limits require a stronger basis than do simple minimum/maximums that can be circumvented via trade-off. Strictly speaking, a trade-off limit saves no energy, so absent another compelling reason (safety, durability, etc.) it is difficult to justify such restrictions in an energy code.

DOE's intent for the fenestration U-factor trade-off limit in its original RICC proposal was two-fold.

First, placing an upper limit on the U-factor can prevent certain kinds of moisture failures. Specifically, windows with a too-high U-factor in northern locations can experience moisture condensation and even ice formation on the glazing and/or frame. Condensed moisture can find its way into walls where it lessens the effectiveness of insulation or compromises the integrity of the wall itself.

Moisture condensation on windows is a complex function of the indoor temperature and humidity and the outdoor temperature. A summary of the conditions under which condensation can be expected can be viewed at http://www.efficientwindows.org/condensation.cfm.

Second, limiting the installation of high-U-factor glazing can prevent comfort problems. Even if the overall UA of a house is maintained (thereby making a trade-off theoretically energy-neutral), "cold spots" on the exterior walls can make occupants uncomfortably cool because of radiative heat exchange. In the worst case, a too-low "mean radiant temperature" can influence occupants to raise thermostat setpoints, having a deleterious effect on energy consumption. However, there is insufficient research and data to permit reasonable estimation of either the average occurrence of discomfort due to high-U windows or the frequency of thermostat manipulation as a result. Given this lack of hard data, a U-factor of 0.55 was deemed by many parties consulted as a reasonable, but not overly stringent, limit.

Although DOE's original RICC proposal included no SHGC trade-off limits, DOE recognizes the potential rationale for such limits. First, limiting the installation of very-high SHGC windows in southern climates can prevent occupant discomfort from hot spots in the home, even when overall energy consumption is theoretically unaffected. When occupants experience too-warm rooms or radiant heat from solar-heated floors and walls, they may lower thermostat setpoints. However, DOE is unaware of research or data that would quantify this energy impact with sufficient confidence to justify a code restriction. Additionally, the trade-off limit does not credit alternative methods of solar heat control such as roof overhangs in lieu of low-SHGC glazing[2].

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[2] Overhangs are credited in the performance approach but the 0.5 SHGC glazing limit applies regardless of how much solar heat is blocked by the overhang.

Second, limiting the worst-case SHGC of homes in cooling climates can have a beneficial effect on peak loads. Even if a trade-off is energy-neutral, raising SHGC in trade for other improvements can result in higher peak loads in some cases. This can require larger air-conditioning units that will operate at lower part-load ratios for much of the year, indirectly raising energy consumption. Also, high peak loads are increasingly problematic for electric utilities. Although few residential electric customers pay directly for their impacts on peak loads, recent blackouts and brownouts in California and the Northeast have focused much attention on the possibility of billing residential customers for their impacts on system peak.

To evaluate the potential peak-load benefit of restricting SHGC trade-offs, DOE conducted energy simulations using the DOE-2 computer program for each of the available 239 TMY2 weather locations. The worst-case trade-off for peak loads is to reduce cooling-oriented envelope efficiency (i.e., increase SHGC) in trade for better heating performance (e.g., increased AFUE) in climates that have substantial heating. DOE evaluated the peak load impacts of trading the code-mandated 0.4 SHGC up to a hypothetical value of 0.65 and making up the difference with non-cooling-oriented changes. The results, shown in Figure 4, reveal a fairly consistent peak cooling load "potential" of about 1.5 kW resulting from this hypothetical SHGC trade-off. Specific load impacts will depend, of course, on actual window area and orientation (our simulations assume windows equally distributed in the four cardinal directions). Also, though we analyzed the impact of raising SHGC only to 0.65, it is conceivable that higher values could be attained using single-pane glass.

The floor modifications cap the SHGC at 0.5, eliminating a sizable fraction of the SHGC-induced peak load potential.

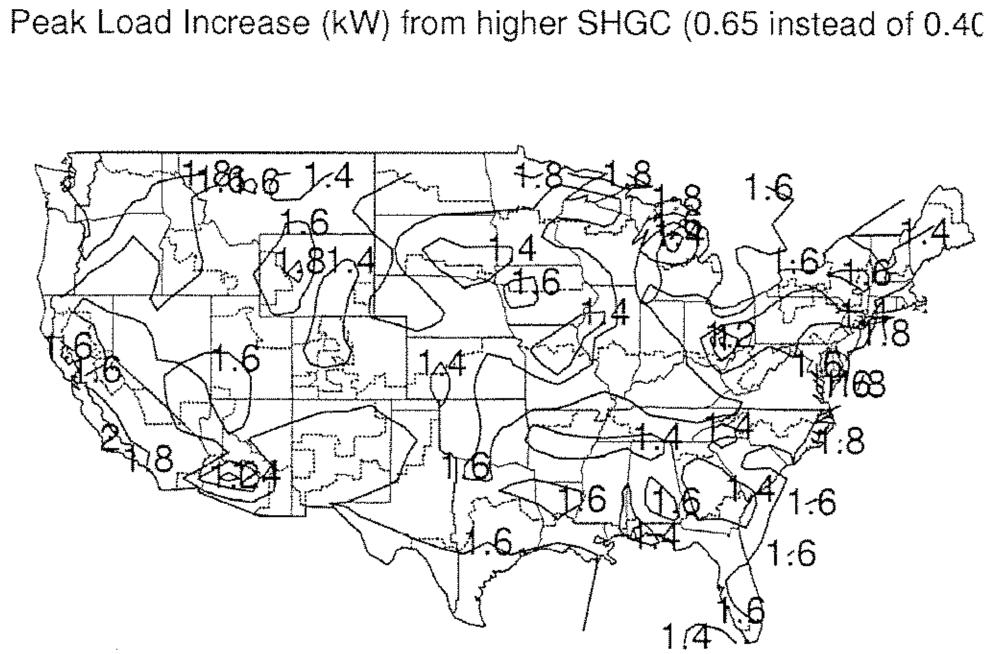

Figure 4 – Peak Load Increase (kW) from Raising SHGC from 0.4 to 0.65.

Market Influences

To assess the effect of the mods or product choices and options, the relatively simple trade-off limits imposed by the floor mods were evaluated against the range of window options available in the 2001 NFRC database (an electronic version of a more current database could not be obtained from NFRC).

Figure 5 shows the distribution of U-factor options in the NFRC database. Only double-pane options are included because single-pane options are rarely used in the northern tier states. The histogram clearly shows the bi-modal distribution of double-pane U-factors, the leftmost mode representing low-E glazing options and the right mode representing non-low-E options.

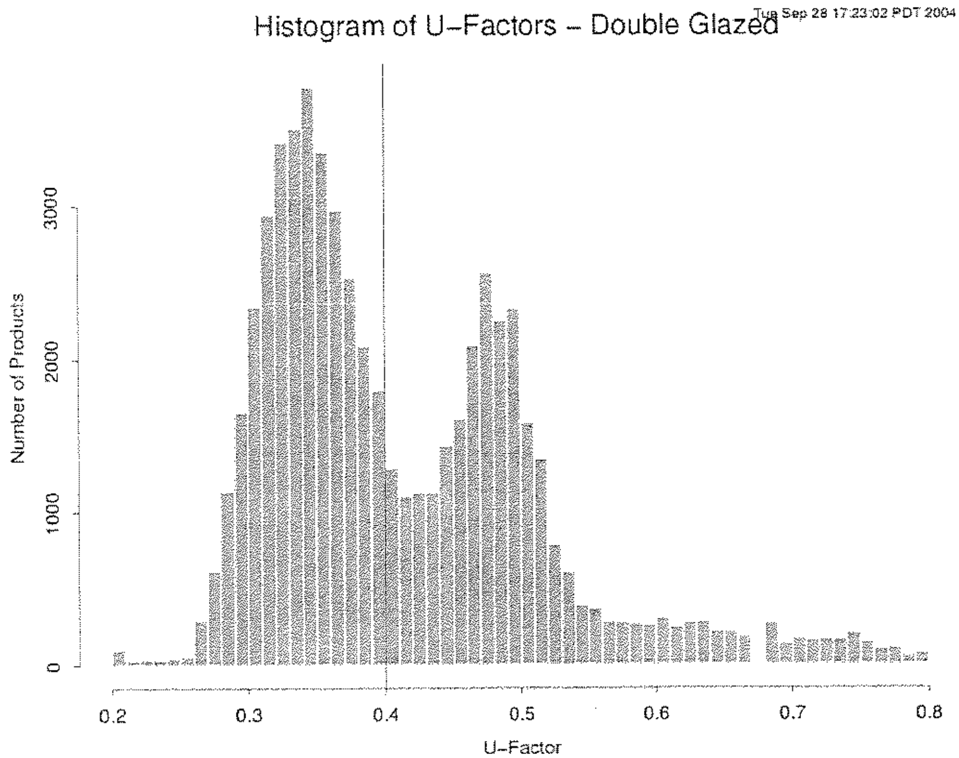

Figure 5 – Distribution of Rated U-Factors of Double-Pane Windows

Figure 6 shows the distribution of SHGC values among window options available in the NFRC database. This graphic includes both single- and double-pane units. Unlike the U-factor distribution, the SHGC distribution is single-mode, indicating no clear performance distinctions resulting from technology differences. What is not evident from the graphic, however, is that most of the windows to the left of the 0.5-SHGC cutoff achieve a low SHGC by either a low-E coating or some form of tinted or reflective coating. Low-E windows are expected to be the predominant method of meeting the 0.5 SHGC requirement in zones one through three. This would practically eliminate the single-pane window market.

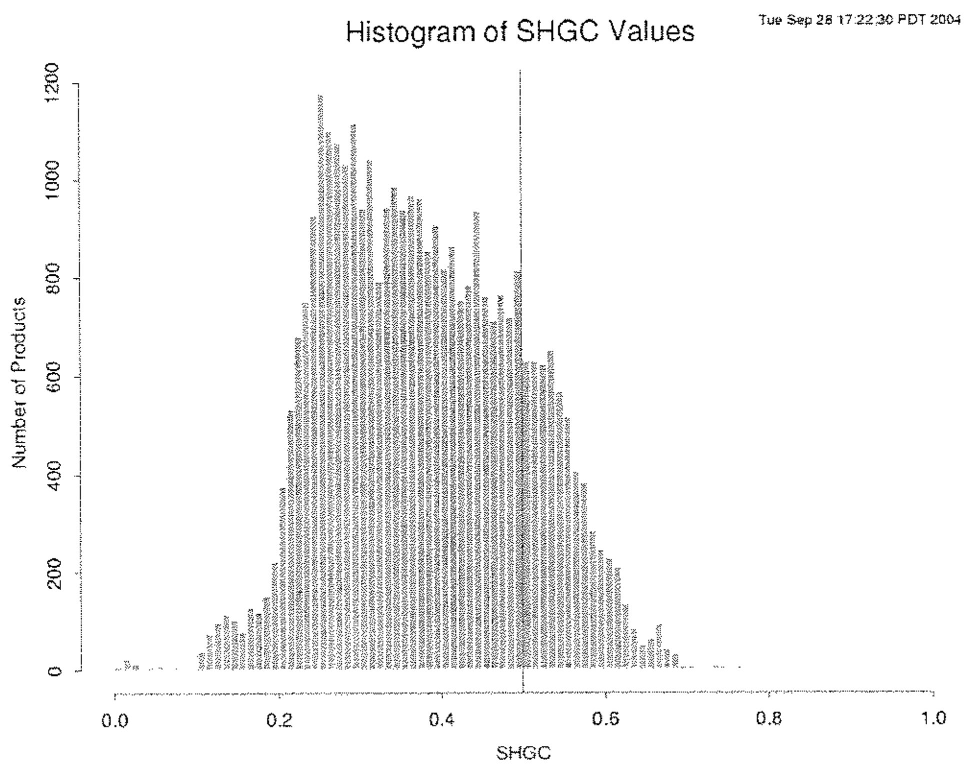

Figure 6 – Distribution of Rated SHGCs

The Economic Thickness of Thermal Insulation

The conventional method of evaluating the performance of insulation is to measure the R-value, the conductive heat flow resistance of the material.

The measurement of conductive heat flow resistance is made using the heat flow meter apparatus. This test procedure (ASTM C-518) measures the thermal conductivity of insulation material. In this test, one side of the specimen is heated to a specific temperature and after steady state heat flow has been reached, the temperature on the opposite side is measured. Through this temperature measurement the R-value is calculated. The outside surface of the test apparatus and the specimen is sealed and insulated to minimize the heat loss through the edge and eliminate the effects of any convection or radiant heat flow. This measurement solely defines the conductive heat flow resistance of the insulation material, the R-value.

Once the R-value of an insulation material is determined, the heat flow through it can be calculated using Fourier's steady-state heat flow equation.

$$Q = \frac{A \times \Delta T}{R}$$

Where:

Q = Rate of heat flow, BTU/hr
A = Area, ft^2
ΔT = Temperature differential, °F
R = Resistance to heat flow, $hr.ft^2$ °F/BTU

This equation is used to calculate the benefit of increasing the thickness of any type of insulation as long as there is no air movement (convective heat transfer) through the insulation.

As an example, consider 1000 ft^2 of insulated area with a temperature differential of 40°F. Let us include the outside air film at R-0.2 and the inside air film at R-0.7. The total R-value before the application of any insulation is 0.9. Increasing the insulation thickness by 1" increments at R-3.6/inch provides the following heat flow rates as shown in Figure 1.1 & 1.2.

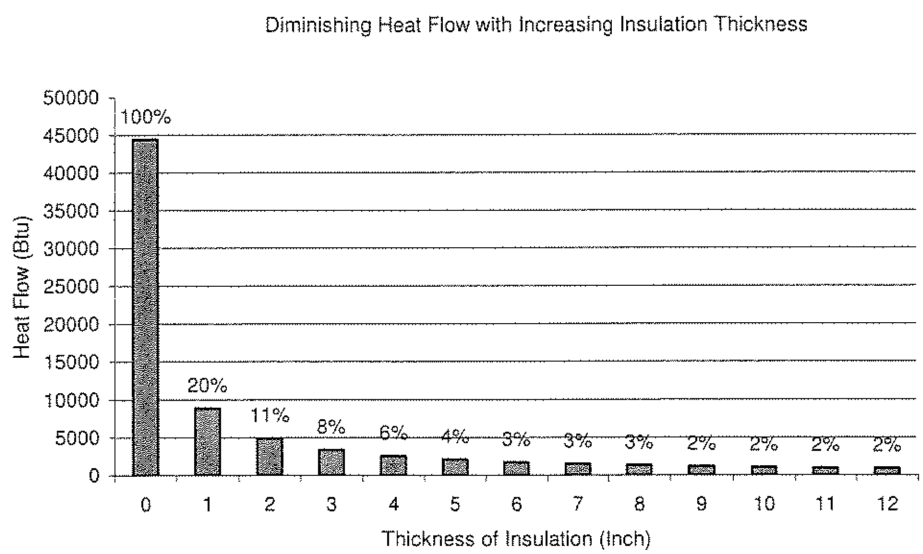

Figure 1.1: Percentage of total heat flow

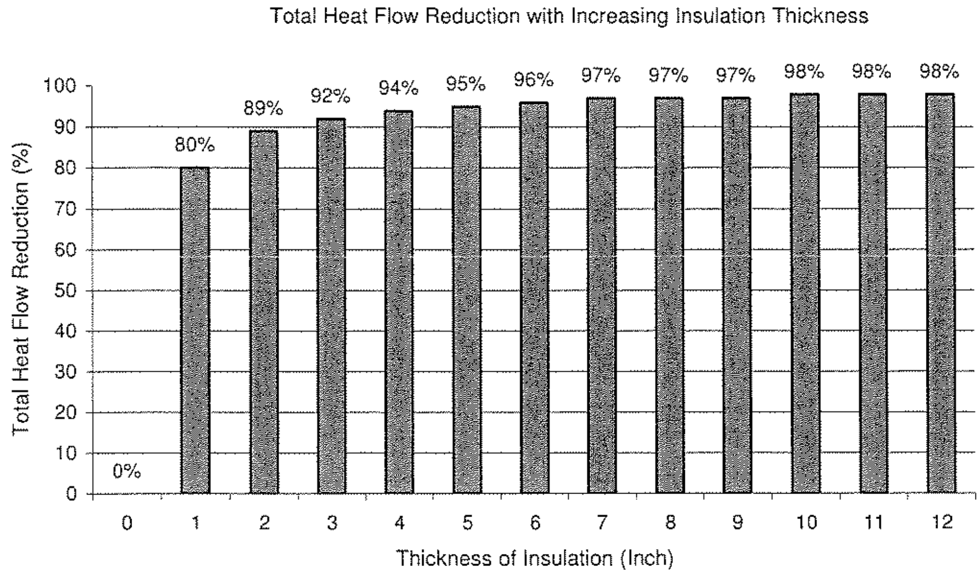

Figure 1.2: Percentage of total heat flow reduction

In Figure 1.1, we can see that the first 1" of insulation reduces the heat flow to 20% of the total and at 5" of thickness, the heat flow is reduced further, down to 5% of the total. In looking at Figure 1.2, we see that increasing the insulation thickness from 6" to 12" only provides an additional heat flow reduction of 2%. Doubling the insulation thickness (R-value); doubling the cost; only provides a modest 2% increase in heat flow reduction. Based on this observation, it is very difficult to justify the additional cost of adding insulation thickness beyond 5".

The Icynene Insulation System® fills any shaped cavity and adheres to almost all materials, thereby, forming an insulation layer with very low air permeance. Air flow is eliminated and for this reason, conductive heat loss can be used as a sole criterion for establishing insulation thickness with Icynene.

As shown in Figure 1.2, insulation material with R-value of 3.6 per inch blocks out 95% of conductive heat flow within the first 5 inches of the material. Thickness beyond this point would bring more reduction in heat flow but it would not be economically justified since the returns on additional R-value have greatly diminished.

REDUCE AIR INFILTRATION - REDUCE ENERGY USE REDUCE EQUIPMENT SIZE

In the case of insulation material with significant air permeance, conductive heat loss should not be the only criterion used for establishing insulation thickness. Convective heat loss must be considered as well, particularly when a substantial latent load is involved.

Oak Ridge National Laboratory (ORNL) conducted an experiment[1] to determine the efficiency of a roof assembly insulated with low density, loose-fill fiberglass insulation and discovered that up to 50% of the heat loss occurred as a result of convection; air circulation through the insulation. This result showed that the air-permeable insulation had lost its anticipated thermal performance level by half and that convective heat transfer had a significant negative impact on insulation performance.

[1] ORNL's Building Envelope Center: Fighting the Other Cold War
URL: http://www.ornl.gov/ORNLReview/rev26-2/text/usemain.html

The importance of reducing air infiltration can be easily demonstrated by analyzing the energy consumption for heating and cooling houses that have different R-values and air infiltration rates. The following evaluation was generated using the REM/Design energy analysis software. This evaluation deals with three identical houses, located in different North American cities with three different levels of insulation and air-infiltration. The house design is fully detached, has approximately 3,500 sq.ft. conditioned area with two stories and a fully conditioned basement.

The first is a **Typical** house with an air permeable insulation installed at R-19 in the walls & R-30 in the ceiling according to the general building code requirements and an air infiltration rate of 0.6 ACH at natural pressure.

The second house has the same insulation material with a **Higher R-value**, R-43 in the ceiling & R-19 in the walls and an air infiltration rate is kept at 0.6 ACH at natural pressure.

The third is an **Icynene** house with R-11 in the walls, R- 18 in the ceiling and an air infiltration of 0.1ACH at natural pressure.

Heating and cooling costs and the required heating and cooling equipment capacities for each house are plotted on the following graphs. The utility rates are set at $0.08 per kWh for electricity and $0.50 per Therm for natural gas.

Figure 2.1 shows the energy costs for heating in several different cities throughout North America. The heating costs are compared for the three different insulation systems. It can be seen that savings on heating cost reached up to 40%~50% with Icynene® when compared to the **"Typical"** and **"Higher R-Value"** insulation system. Also, the graph indicates that the colder the climate, the greater the heating cost savings are with Icynene.

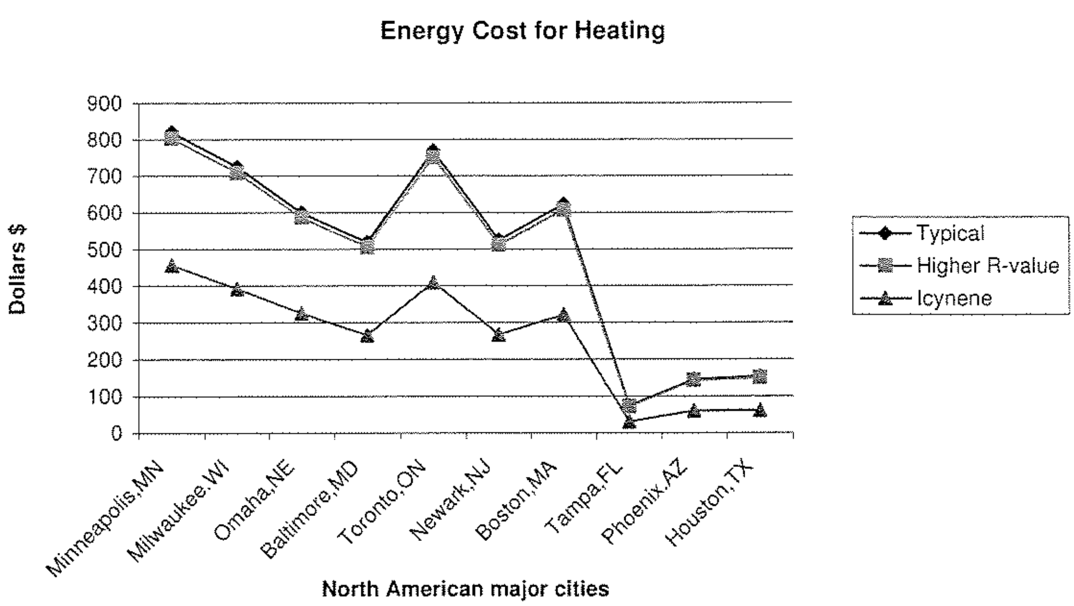

Figure 2.1

Figure 2.2 shows savings on cooling costs with Icynene. They provide savings of 25%~40% over the **"Typical"** and **"Higher R-Value"** insulation system. The cities in a hot & humid climate show greater savings due to the higher cooling demand and latent load.

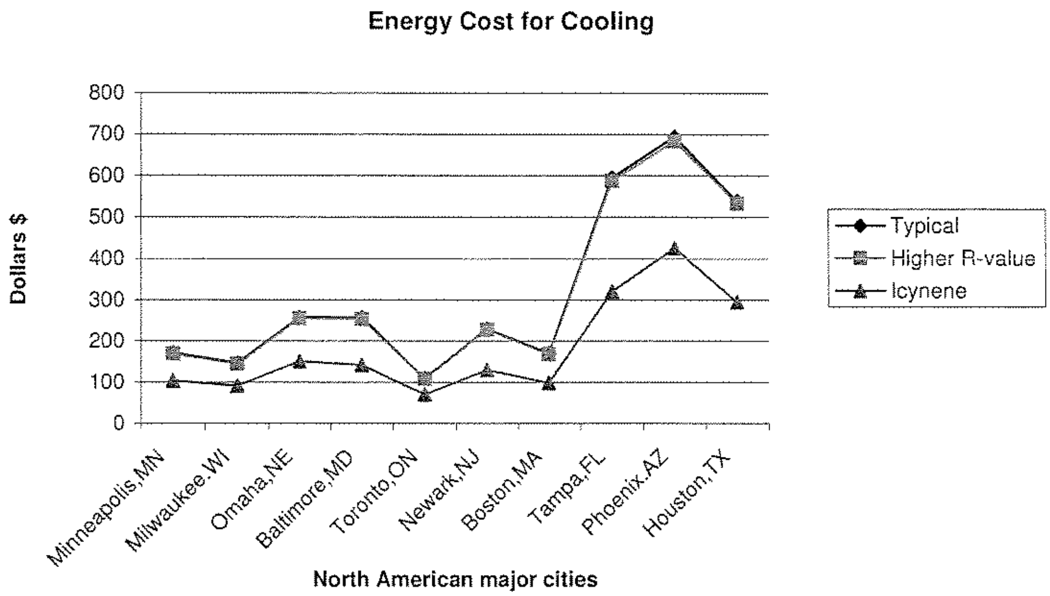

Figure 2.2

As far as sizing heating and cooling equipment is concerned, Icynene provides a significant reduction in both heating & cooling load due to its air sealing property. Figures 2.3 & 2.4 show the equipment size required in these houses for heating and cooling. The graphs show that there is a significant reduction in required capacity for both heating and cooling relative to **"Typical"** and **"Higher R-Value"** systems. Often with Icynene, size reduction for heating equipment can reach up to 50% and for cooling, it can be up to 40%.

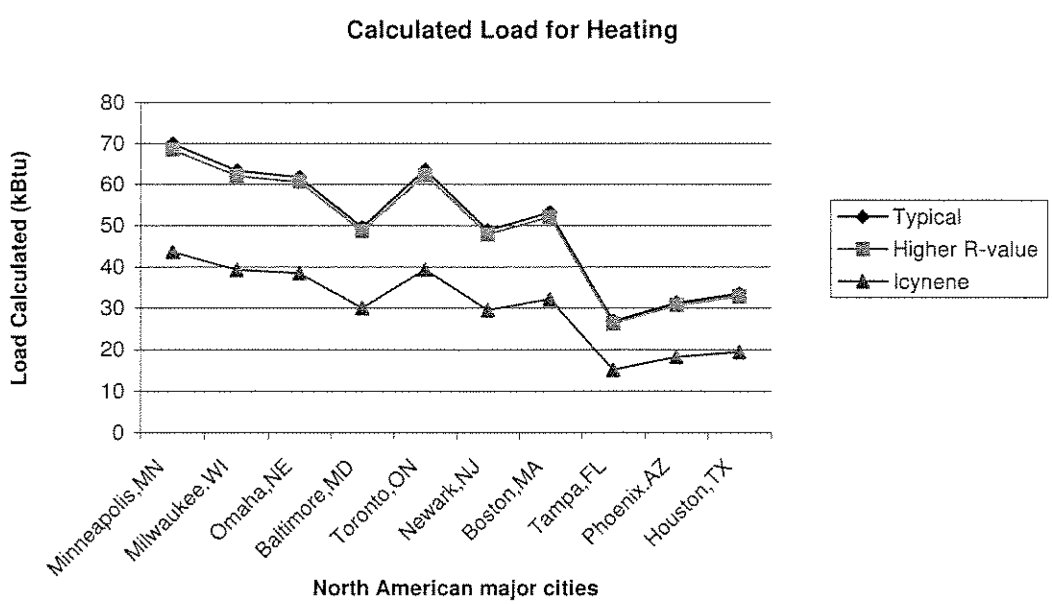

Figure 2.3

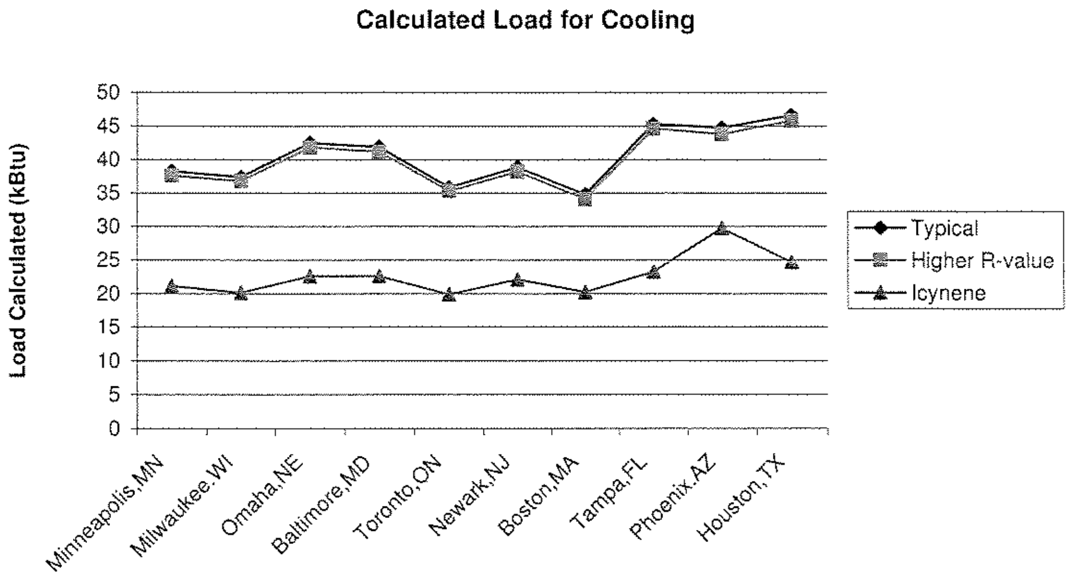

Figure 2.4

Icynene's air seal capability virtually eliminates convective heat transfer within the insulation and reduces unwanted air leakage through the building envelope. This feature improves the efficiency of the building envelope thereby reducing the heating and cooling costs and reducing the size of HVAC equipment as outlined in figures 2.1 through 2.4. As a result lower operating costs are realized and the cost of the operating equipment is reduced.

Often, air permeable insulation at twice the R-value gets used and still comes short of the desired energy savings as shown in Figures 2.1 and 2.2.

The on-site spray applied application of Icynene provides an excellent air seal that ensures a low air infiltration rate for the building envelope. This quality improves energy efficiency of the building as demonstrated through the graphs above and in addition, the overall performance of the building resulting in better sound attenuation, healthier indoor environment and enhanced thermal comfort.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-310.6(RM1701.1)

Nature of Change: (text is on code change form)

To eliminate unneeded provisions in the International Residential Code (IRC) for the installation of liquid- and solid-fuel-burning appliances.

Proponent: Virginia Building and Code Officials Association (VBCOA) and Virginia Plumbing and Mechanical Inspectors Association (VPMIA)

Staff Comments:

This proposal by VBCOA and VPMIA is to clarify that the National Fire Protection Association (NFPA)'s Standard No. 31 is to be used for the installation of liquid- and solid-fuel-burning appliances thereby enabling the deletion of existing IRC text for such appliances. In addition, the proposal removes definitions which are no longer necessary since the applicable text has been deleted. The proposal was considered by Workgroup 1 and is recommended to move forward as a consensus proposal as it was approved at the national level and is contained in the 2007 Supplement to the IRC.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM
(Use this form to submit changes to building and fire codes)

Address to submit to: DHCD, the Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.state.va.us	1/16/07	Document No. C-310.6 (RM1701.1) Committee Action: ______ BHCD Action: ______

Submitted by: Guy Tomberlin, Fairfax County Representing: VA Building and Code Officials Association (VBCOA) and VA Plumbing and Mechanical Inspectors Association (VPMIA)

Address:12055 Government Center Pkwy., Suite 630 Fairfax, VA 22030 Phone No.:703-324-1611

Regulation Title: Part I Construction USBC Section No(s): Technical amendments to the IRC

Proposed Change:

Proposal:

Delete these definitions and terms with out substitution:

~~**CONFINED SPACES.** A space having a volume less than 50 cubic feet per 1,000 British thermal units per hour (Btu/h) (4.8 m^3/kW) of the aggregate input rating of all appliances installed in that space.~~

~~**UNCONFINED SPACE.** A space having a volume not less than 50 cubic feet per 1,000 Btu/h (4.8m^3/kW) of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.~~

~~**UNUSUALLY TIGHT CONSTRUCTION.** Construction meeting the following requirements:~~
~~1. Walls exposed to the outdoor atmosphere having a continuous water vapor retarder with a rating of 1 perm [57 ng/ (s · m^2 · Pa)] or less with openings gasketed or sealed;~~
~~2. Openable windows and doors meeting the air leakage requirements of the *International Energy Conservation Code*, Section 402.4.2; and~~
~~3. Caulking or sealants are applied to areas, such as joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines and at other openings.~~

SECTION M1701

GENERAL

M1701.1 ~~Air supply~~ Scope. Liquid- and solid-fuel-burning appliances shall be provided with a supply of air for fuel combustion, draft hood dilution and ventilation of the space in which the appliance is installed, in accordance with the appliance manufactures installation instructions and NFPA 31. ~~Section M1702 or Section M1703.~~ The methods of providing combustion air in this chapter do not apply to fireplaces, fireplace stoves and direct-vent appliances. This chapter shall not apply to natural gas or liquefied petroleum applications. the requirements for combustion and dilution air for gas-fired appliances shall be in accordance with *Chapter 24*.

DELETE THE REMAINING TEXT OF THE ENTIRE CHAPTER 17

Supporting Statement:

This proposal was approved as submitted at the Public Hearings in FL.

These definitions have been deleted from Chapter 24 by way of the IFGC. They were used to determine if a structure needed the addition of outdoor air for combustion air.
Testing from the fuel gas industry has determined that "unusually tight", "unconfined space", and "confined space", are not factors of any relevance when determining if combustion air needs to be obtained from outdoors.
The provisions found in Chapter 17 are based on fuel gas provisions which are not germane to liquid or solid fuel appliances. NFPA 31 is already a reference document in the IRC so there is not an increased cost to construction. NFPA 31 is a maintained document that contains the relevant information for liquid and solid fuel appliances. As always the manufactures installation instructions are part of code requirements.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change Nos. C-310.6(RP3007.1) and C-310.6(RP3301.1)

Nature of Change: (text is on code change forms)

To replace the provisions in the International Residential Code (IRC) for sewage pumps and ejectors with the current provisions in the International Plumbing Code (IPC) and to add new provisions for storm drainage, subsoil drains and sump pits, also from the IPC.

Proponent: Virginia Building and Code Officials Association (VBCOA) and Virginia Plumbing and Mechanical Inspectors Association (VPMIA)

Staff Comments:

These two proposals by VBCOA and VPMIA are to replace deficient provisions in the IRC with the more comprehensive provisions of the IPC for the installation of building subdrains, sump pumps, sewage pumps and sewage ejectors. The proposals were considered by Workgroup 1 and are recommended to move forward as consensus proposals as they were approved at the national level and are contained in the 2007 Supplement to the IRC.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

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Submitted by: Guy Tomberlin, Fairfax County Representing: VA Building and Code Officials Association (VBCOA) and VA Plumbing and Mechanical Inspectors Association (VPMIA)

Address:12055 Government Center Pkwy., Suite 630 Fairfax, VA 22030 Phone No.:703-324-1611

Regulation Title: Part I Construction USBC Section No(s): Technical amendments to the IRC

Proposed Change:

Proposal:

Delete and substitute as follows

~~**P3007.1 Sewage ejectors or sewage pumps.** A sewage ejector, sewage pump, or grinder pump receiving discharge from a water closet shall have minimum discharge velocity of 1.9 feet per second (0.579 m/s) throughout the discharge piping to the point of connection with a gravity building drain, gravity sewer or pressure sewer system. A nongrinding pump or ejector shall be capable of passing a $1\frac{1}{2}$-inch-diameter (38 mm) solid ball, and the discharge piping shall be not less than 2 inches (51 mm) in diameter. The discharge piping of grinding pumps shall be not less than $1\frac{1}{4}$ inches (32 mm)in diameter. A check valve and a gate valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.~~

~~**Exception:** Macerating toilet systems shall be permitted to have the discharge pipe sized in accordance with manufacturer's instructions, but not less than 0.75 inch (19 mm) in diameter.~~

~~**P3007.2 Building drains below sewer (building subdrains).** Building drains which cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump from which the contents shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment.~~

~~**P3007.2.1 Drainage piping.** The system of drainage piping belowthe sewer level shall be installed and vented in a manner similar to that of the gravity system. Only such drains that must be lifted for discharge shall be discharged into sumps. All other drains shall be discharged by gravity.~~

~~**Exception:** Macerating toilet systems shall be permitted as an alternate to the sewage pump or ejector system. The macerating toilet shall comply with ASME A112.3.4 or CSA B45.9 and shall be installed in accordance with manufacturers' instructions.~~

P3007.1 Building subdrains. Building subdrains that cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump from which the liquid shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment or other approved method. In other than existing structures, the sump shall not receive drainage from any piping within the building capable of being discharged by gravity to the building sewer.

P3007.2 Valves required. A check valve and a full open valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section P3007.3.2 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

P3007.3 Sump design. The sump pump, pit and discharge piping shall conform to the requirements of Sections P3007.3.1 through P3007.3.5.

P3007.3.1 Sump pump. The sump pump capacity and head shall be appropriate to anticipated use requirements.

P3007.3.2 Sump pit. The sump pit shall be not less than 18 inches (457 mm) in diameter and 24 inches (610 mm) deep, unless otherwise approved. The pit shall be accessible and located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, concrete, steel, plastic or other approved materials. The pit bottom shall be solid and provide permanent support for the pump. The sump pit shall be fitted with a gas-tight removable cover adequate to support anticipated loads in the area of use. The sump pit shall be vented in accordance with Chapter 31.

P3007.3.3 Discharge piping. Discharge piping shall meet the requirements of Section P3307.2.

P3007.3.4 Maximum effluent level. The effluent level control shall be adjusted and maintained to at all times prevent the effluent in the sump from rising to within 2 inches (51 mm) of the invert of the gravity drain inlet into the sump.

P3007.3.5 Ejector connection to the drainage system. Pumps connected to the drainage system shall connect to the building sewer or shall connect to a wye fitting in the building drain a minimum of 10 feet (3048 mm) from the base of any soil stack, waste stack or fixture drain. Where the discharge line connects into horizontal drainage piping, the connectoion shall be made through a wye fitting into the top of the drainage piping.

P3007.4 Sewage pumps and sewage ejectors. A sewage pump or sewage ejector shall automatically discharge the contents of the sump to the building drainage system.

P3007.5 Macerating toilet systems. Macerating toilet systems shall comply with CSA B45.9 or ASME A112.3.4 and shall be installed in accordance with the manufacturer's installation instructions.

P3007.6 Capacity. A sewage pump or sewage ejector shall have the capacity and head for the application requirements. Pumps or ejectors that receive the discharge of water closets shall be capable of handling spherical solids with a diameter of up to and including 2 inches (51 mm). Other pumps or ejectors shall be capable of handling spherical solids with a diameter of up to and including 1 inch (25.4 mm). The minimum capacity of a pump or ejector based on the diameter of the discharge pipe shall be in accordance with Table 3007.6.

Exceptions:

1. Grinder pumps or grinder ejectors that receive the discharge of water closets shall have a minimum discharge opening of 1.25 inches (32 mm).
2. Macerating toilet assemblies that serve single water closets shall have a minimum discharge opening of 0.75 inch (19 mm).

TABLE 3007.6
MINIMUM CAPACITY OF SEWAGE PUMP OR SEWAGE EJECTOR

DIAMETER OF THE DISCHARGE PIPE (inches)	CAPACITY OF PUMP OR EJECTOR (gpm)
2	21
2 1/2	30
3	46

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

Supporting Statement:

This proposal was approved as submitted at the Public Hearings in FL.

These are the provisions from the IPC on sewage ejectors and sumps. They are much more complete and detailed than the current IRC text. This provides more complete guidance for the user.

Note: The following items are required to be included:
Purpose: The proponent shall clearly state the purpose of the proposed code change (e.g., clarify the Code; revise outdated material; substitute new or revised material for current provision of the Code; add new requirements to the Code; delete current requirements, etc.)
Reasons: The proponent shall justify changing the current code provisions, stating why the proposal is superior to the current provisions of the Code. Proposals that add or delete requirements shall be supported by a logical explanation which clearly shows why the current Code provisions are inadequate or overly restrictive, specifies the shortcomings of the current Code provisions and explains how such proposals will improve the Code.
Substantiation: The proponent shall substantiate the proposed code change based on technical information and substantiation. Substantiation provided which is reviewed in accordance with Section 4.2 and determined as not germane to the technical issues addressed in the proposed code change shall be identified as such. The proponent shall be notified that the proposal is considered an incomplete proposal in accordance with Section 4.3, and the proposal shall be held until the deficiencies are corrected. The proponent shall have the right to appeal this action in accordance with the policy of the ICC Board. The burden of providing substantiating material lies with the proponent of the code change proposal. A minimum of two copies of all substantiating information shall be submitted. (3.4)
Bibliography: The proponent shall submit a bibliography of any substantiating material submitted with the code change proposal. The bibliography shall be published with the code change and the proponent shall make the substantiating materials available for review at the appropriate ICC office and during the public hearing.

DEPT. OF HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM

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Address to submit to: DHCD, the Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.state.va.us	1/10/07	Document No. C-310.6(RP3301.1) Committee Action: ____________ BHCD Action: ______________

Submitted by: Guy Tomberlin, Fairfax County Representing: VA Building and Code Officials Association (VBCOA) and VA Plumbing and Mechanical Inspectors Association (VPMIA)

Address:12055 Government Center Pkwy., Suite 630 Fairfax, VA 22030 Phone No.:703-324-1611

Regulation Title: Part I Construction USBC Section No(s): Technical amendments to the IRC

Insert RP 27 – 06/07

CHAPTER 33
STORM DRAINAGE

SECTION 3301
GENERAL

P3301.1 Scope. The provisions of this chapter shall govern the materials, design, construction and installation of storm drainage.

SECTION 3302
SUBSOIL DRAINS

3302.1 Subsoil drains. Subsoil drains shall be open-jointed, horizontally split or perforated pipe conforming to one of the standards listed in Table3302.1 Such drains shall not be less than 4 inches (102 mm) in diameter. Where the building is subject to backwater, the subsoil drain shall be protected by an accessibly located backwater valve. Subsoil drains shall discharge to a trapped area drain, sump, dry well or approved location above ground. The subsoil sump shall not be required to have either a gas-tight cover or a vent. The sump and pumping system shall comply with Section 3303.

TABLE 3302.1
SUBSOIL DRAIN PIPE

MATERIAL	STANDARD
Asbestos-cement pipe	ASTM C 508
Cast-iron pipe	ASTM A 74; ASTM A 888; CISPI 301
Polyethylene (PE) plastic pipe	ASTM F 405; CSA B182.1; CSA B182.6; CSA B182.8
Polyvinyl chloride (PVC) Plastic pipe (type sewer pipe, PS25, PS50 or PS100)	ASTM D 2729; ASTM F 891; CSA B182.2; CSA B182.4
Stainless steel drainage systems, Type 316L	ASME A112.3.1
Vitrified clay pipe	ASTM C 4; ASTM C 700

SECTION 3303
SUMPS AND PUMPING SYSTEMS

3303.1 Pumping system. The sump pump, pit and discharge piping shall conform to Sections 3303.1.1 through 3303.1.4.

3303.1.1 Pump capacity and head. The sump pump shall be of a capacity and head appropriate to anticipated use requirements.

3303.1.2 Sump pit. The sump pit shall not be less than 18 inches (457 mm) in diameter and 24 inches (610 mm) deep, unless otherwise approved. The pit shall be accessible and located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, steel, plastic, cast-iron, concrete or other approved material, with a removable cover adequate to support anticipated loads in the area of use. The pit floor shall be solid and provide permanent support for the pump.

3303.1.3 Electrical. Electrical outlets shall meet the requirements of Chapters 34 through 43.

3303.1.4 Piping. Discharge piping shall meet the requirements of Sections 3002.1, 3002.2, 3002.3 and 3003. Discharge piping shall include an accessible full flow check valve. Pipe and fittings shall be the same size as, or larger than, pump discharge tapping.

SECTION R202
DEFINITIONS

SUBSOIL DRAIN. A drain that collects subsurface water or seepage water and conveys such water to a place of disposal.

2. Add standards to Chapter 43 as follows:

ASTM

C508-00	Specification for Asbestos-Cement Underdrain Pipe
F405-97	Specification for Corrugated Polyethylene (PE) Tubing and Fittings
D2729-96a	Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
C4-03	Specification for Clay Drain Tile and Perforated Clay Drain Tile

CSA

B182.1-02	Plastic Drain and Sewer Pipe and Pipe Fittings
B182.6-02	Profile Polyethylene Sewer Pipe and Fittings for Leak-Proof Sewer Applications
B182.8-02	Profile Polyethylene Storm Sewer and Drainage Pipe and Fittings

Reason: Current IRC is lacking the provisions for sumps, pumps, and any related equipment. These common items are found in residential construction across the US. These are vital provisions that will help ensure properly installed systems. This information was extracted from the IPC and modified as appropriate for residential applications.

Supporting Statement:

This proposal was approved as submitted at the Public Hearings in FL.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-407.8

Nature of Change: (text is on code change form)

To add a requirement for emergency generators to be required in new Group I-2 hospitals, nursing homes and hospice facilities licensed by the Virginia Department of Health.

Proponent: Virginia Department of Health

Staff Comments:

While typically these types of facilities must have emergency power to comply with federal licensing requirements, if a designer is not aware of the federal requirement, then the facilities will be constructed without the wiring necessary for emergency power and the facility will have the added expense of retrofitting the facility prior to obtaining the license to operate. Since the facilities need emergency power to obtain a license, having the requirement in the USBC will prevent costly retrofits after construction. Staff was working with the Health Department on this change and it was conceptually considered at the April 9, 2007 Stakeholder's meeting with discussions leading to the present form of the code change. The final version was not received in time to be considered by the workgroups used in this code change process.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to: DHCD, The Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov	6/27/07	Document No. C-407.8 Committee Action: ____ BHCD Action: ____

Submitted by: Carrie Eddy Representing: Va. Dept. of Health

Address: 3600 W. Broad Street, Richmond, VA Phone No. 804-367-2157

Regulation Title: 2006 USBC Section No(s): 40.8 and 2702.2

Proposed Change:

Add USBC Section 407.8 to read:

407.8 Emergency power systems. Emergency power shall be provided for medical life support equipment, operating, recovery, intensive care, emergency rooms, fire detection and alarms systems in any I-2 facility licensed by the Virginia Department of Health as a hospital, nursing home, or hospice facility.

Change USBC Section 2702.2.17 to read:

[F] 2702.2 Where required. Emergency and standby power systems shall be provided where required by Sections 2702.2.1 through 2702.2.20.

(No changes to Section 2702.2.1 through 2702.2.16)

[F] 2702.2.17Group I-2 and I-3 occupancies. Emergency power shall be provided in accordance with Section 407.8 for I-2 occupancies licensed by the Virginia Department of Health as a hospital, nursing, or hospice facility. Emergency power shall be provided for doors in Group I-3 occupancies in accordance with Section 408.4.2.

(No changes to Section 2702.2.18 through 2702.2.20)

Supporting Statement:

This change is coordinated with federal standards to require similar emergency power supply sources in those facilities that are not required to comply with federal standards.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-408.2

Nature of Change: (text is on code change form)

To clarify existing text in the International Building Code (IBC) relating to occupancies other than Group I-3 within jail or prison facilities.

Proponent: Virginia Department of Corrections (DOC)

Staff Comments:

This proposal was not received in time to be considered by the workgroups used in this code change cycle, however, staff did meet with DOC and the Virginia Department of General Services, the state agency responsible for the oversight of construction of state prison facilities, and the change was discussed conceptually. DOC has submitted this change to the International Code Council for the 2009 IBC.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to:

DHCD, The Jackson Center
501 North Second Street
Richmond, VA 23219-1321

Tel. No. (804) 371 – 7150
Fax No. (804) 371 – 7092
Email: bhcd@dhcd.virginia.gov

Document No. C-408.2

Committee Action: ____________

BHCD Action: ______________

Submitted by: A. Brooks Ballard Representing: Va. Dept of Corrections

Address: A&D Unit, 6900 Atmore Drive, Richmond, VA 23225 Phone No. (804) 674-3102 ext. 1221

Regulation Title: VUSBC, International Building Code 2006 Section No(s): 408.2

Proposed Change:

408.2 ~~Mixed~~ Other occupancies. Buildings or ~~P~~portions of buildings ~~with an occupancy in Group I-3 that are classified~~ in Group I-3 ~~detention or correctional~~ occupancies where security operations necessitate the locking of required means of egress shall be permitted to be classified as a different occupancy. Occupancies classified as other than I-3, shall meet the applicable requirements of this code for ~~such~~ that occupancy, ~~occupancies . Where security operations necessitate the locking of required means of egress,~~ provided provisions ~~shall be~~ are made for the release of occupants at all times. Where the provisions of this code for ~~such different occupancies~~ occupancies other than Group I-3 are more restrictive than the provisions for Group I-3 occupancies, the Group I-3 occupancy provisions shall be permitted to be used.

Supporting Statement:

The purpose of the change is to clarify the existing provision to make it clear that buildings or portions of buildings in detention and correctional facilities where the doors are locked but otherwise the classification would be a different occupancy (Groups A, E, F, S, B, etc.) may be classified as the occupancy they fall under provided the occupants can exit in an emergency. The IBC Commentary and ICC Interpretation No. 2/308/98 already state this is the intent of the provision. New language is added to permit the use of any Group I-3 provisions which are less restrictive than the provisions of the occupancy in which the building is classified, with the caveat that such provisions may be prohibited from being used by other provisions of the code. While there are no specific prohibitions currently in the code, several proposals being submitted in conjunction with this proposal would provide specific prohibitions, such as the proposal to allow security glazing in smoke barriers in Group I-3 occupancies. Language was added to that proposal to limit its application to only occupancies associated with Group I-3 and not permit it to apply to other occupancies in the Code.

The proposal is necessary to permit building and portions of buildings in detention and correctional facilities which do not otherwise fall into the Group I-3 classification to be constructed at the least possible cost while providing the necessary safeguards and security to assure the safety of the occupants.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Changes No. C-408.3.4 and C-1009.10

Nature of Changes: (text is on code change form)

To add requirements for "ship ladders" to the International Building Code (IBC) for limited use in jail or prison facilities.

Proponent: Virginia Department of Corrections (DOC)

Staff Comments:

This proposal was not received in time to be considered by the workgroups used in this code change cycle, however, staff did meet with DOC and the Virginia Department of General Services, the state agency responsible for the oversight of construction of state prison facilities, and the change was discussed and it was noted that ship ladders are currently being approved using the USBC modification process. DOC has submitted this change to the International Code Council for the 2009 IBC.

Staff suggests that the requirements be placed entirely in Chapter 4 of the IBC instead of split between Chapter 4 and Chapter 10 since the requirements are only applicable to Group I-3 facilities.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to: DHCD, The Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov		Document No. C-407.3.4 Committee Action: ________ BHCD Action: ________

Submitted by: A. Brooks Ballard Representing: Va. Dept. of Corrections

Address: A&D Unit, 6900 Atmore Drive, Richmond, VA 23225 Phone No. (804) 674-3102 ext.1221

Regulation Title: VUSBC, International Building Code 2006 Section No(s): 408.3.4

Proposed Change:

(add new section and change subsequent numbers)

408.3.4 Ships ladders in accordance with Section 1009.10 shall be permitted for egress from facility observation or control rooms.

Supporting Statement:

Applicable to Use Group I-3, allows spaces that are normally occupied by a small number of staff persons to have stairways with greater riser height and narrower tread depth than the standard 7-11 riser/tread requirements. In order to provide the 360-degree visibility and maximum mobility necessary for guard observation stations, the size of the base of such elevated stations must be kept to a minimum. Security is increased without risk to either the general public or the inmates, since access to these spaces is restricted to prison staff personnel.

Ships ladders are easier and safer to maneuver than are alternating tread stairs in conditions related to I-3 functions which require carrying items necessary for occupation.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to:		Document No. C-1009.10
DHCD, The Jackson Center		Committee Action:
501 North Second Street Richmond, VA 23219-1321		BHCD Action:
Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov		

Submitted by: A. Brooks Ballard   Representing: Va. Dept. of Corrections

Address: A&D Unit, 6900 Atmore Drive, Richmond, VA 23225 Phone No. (804) 674-3102 ext.1221

Regulation Title: VUSBC, International Building Code 2006   Section No(s): 1009.10

Proposed Change:

(add new section and change subsequent numbers)

1009.10 Ships Ladders. Ships ladders are permitted as an element of a means of egress to and from facility observation or control rooms not more than 250 SF (23sq m) in area which serves not more than 3 occupants and for access to unoccupied roofs.

Ships ladders shall have a minimum projected tread of 5 inches (127 mm), a minimum tread depth of 8.5 inches (216 mm), a minimum tread width of 15 inches (612 mm) and a maximum riser height of 9.5 inches (241 mm)

Handrails shall be provided on both sides of ships ladders.

Supporting Statement:

Applicable to Use Group I-3, allows spaces that are normally occupied by a small number of staff persons to have stairways with greater riser height and narrower tread depth than the standard 7-11 riser/tread requirements. In order to provide the 360-degree visibility and maximum mobility necessary for guard observation stations, the size of the base of such elevated stations must be kept to a minimum. Security is increased without risk to either the general public or the inmates, since access to these spaces is restricted to prison staff personnel.

Ships ladders are easier and safer to maneuver than are alternating tread stairs in conditions related to I-3 functions which require carrying items necessary for occupation.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-408.3.7

Nature of Change: (text is on code change form)

To add a provision to the International Building Code (IBC) to permit a hatch or trap door for accessing guard towers within a jail or prison facility.

Proponent: Virginia Department of Corrections (DOC)

Staff Comments:

This proposal was not received in time to be considered by the workgroups used in this code change cycle, however, staff did meet with DOC and the Virginia Department of General Services, the state agency responsible for the oversight of construction of state prison facilities, and the change was considered and determined to be appropriate. DOC has submitted this change to the International Code Council for the 2009 IBC.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to: DHCD, The Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov	Document No. C-408.3.7 Committee Action: __________ BHCD Action: __________

Submitted by: A. Brooks Ballard Representing: Va. Dept of Corrections

Address: A&D Unit, 6900 Atmore Drive, Richmond, VA 23225 Phone No. (804) 674-3102 ext.1221

Regulation Title: VUSBC, International Building Code 2006 Section No(s): 408.3.7

Proposed Change:

408.3.7 Guard tower doors. A hatch or trap door not less than 16 square feet (.929 m^2) in area through the floor and having minimum dimensions of not less than 2 feet (609.6 mm) in any direction shall be permitted to be used to access guard towers.

Supporting Statement:

This provision is necessary to allow the use of trap doors in the floor of an observation point with limited size access and occupancy as a means of ingress and egress. In order to provide the 360-degree visibility and maximum mobility necessary for guard observation stations, the size of the base of such elevated stations must be kept to a minimum. Security is increased without risk to either the general public or the inmates, since access to these spaces is restricted to prison staff personnel.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-408.5.1

Nature of Change: (text is on code change form)

To add a provision to the International Building Code (IBC) to clarify that plumbing chases do not have to have rated enclosures on floors where other vertical openings are permitted in the residential areas of jail or prison facilities.

Proponent: Virginia Department of Corrections (DOC)

Staff Comments:

This proposal was not received in time to be considered by the workgroups used in this code change cycle, however, staff did meet with DOC and the Virginia Department of General Services, the state agency responsible for the oversight of construction of state prison facilities, and the change was considered and determined to be appropriate. DOC has submitted this change to the International Code Council for the 2009 IBC.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to:

DHCD, The Jackson Center
501 North Second Street
Richmond, VA 23219-1321

Tel. No. (804) 371 – 7150
Fax No. (804) 371 – 7092
Email: bhcd@dhcd.virginia.gov

Document No. C-408.5.1

Committee Action: ___________

BHCD Action: ______________

Submitted by: A. Brooks Ballard Representing: Va. Dept. of Corrections

Address: A&D Unit, 6900 Atmore Drive, Richmond, VA 23225 Phone No. (804) 674-3102 ext.1221

Regulation Title: VUSBC, International Building Code 2006 Section No(s): 408.5.1

Proposed Change:

408.5.1 Noncombustible shaft openings in communicating floor levels. Where vertical openings are permitted without enclosure protection in accordance with Section 408.5, noncombustible shafts such as plumbing chases shall also be permitted without enclosure protection. Where additional stories are located above or below, the shaft shall be permitted to continue with fire and smoke damper protection provided at the fire resistance rated floor/ceiling assembly between the non-communicating stories.

Supporting Statement:

Section 408.5 permits floor openings between floor levels of residential housing areas without enclosure protection between the levels provided the areas are open and egress capacity is sufficient. In such areas, it makes no sense to require a plumbing or mechanical chase to have to meet the shaft requirements as the floor areas are already open to each other. This proposal simply adds a subsection which recognizes that there is no need for such shafts to be protected at those levels. Should the chase continue to other floors which are not open to each other, this new subsection would require protection at the rated floor/ceiling assembly separating the non-communicating floors.

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-408.8

Nature of Change: (text is on code change form)

To clarify the application of the smoke control provisions of the International Building Code (IBC) in windowless buildings in jail or prison facilities.

Proponent: Virginia Department of Corrections (DOC)

Staff Comments:

This proposal was not received in time to be considered by the workgroups used in this code change cycle, however, staff did meet with DOC and the Virginia Department of General Services, the state agency responsible for the oversight of construction of state prison facilities, and the change was considered and determined to be appropriate. DOC has submitted this change to the International Code Council for the 2009 IBC.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to:	Document No. C-408.8
DHCD, The Jackson Center 501 North Second Street Richmond, VA 23219-1321	Committee Action: ________ BHCD Action: ________
Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov	

Submitted by: A. Brooks Ballard Representing: Va. Dept of Corrections

Address: A&D Unit, 6900 Atmore Drive, Richmond, VA 23225 Phone No. (804) 674-3102 ext.1221

Regulation Title: VUSBC, International Building Code 2006 Section No(s): 408.8

Proposed Change:

408.8 Windowless Building. For the purposes of this section, a windowless building or portion of a building is one with nonopenable windows, windows not readily breakable or without windows. Windowless buildings shall be provided with an engineered smoke control system to provide ~~ventilation (mechanical or natural)~~ a tenable environment for exiting from the smoke compartment in the area of fire origin in accordance with Section 909 for each windowless smoke compartment.

Supporting Statement:

This section applies only to I-3 facilities. Because of the security requirements of jails and prisons, safety for both inmates and the public requires a 'defend in place' philosophy. This change is necessary for the safety of the public, of the facility employees and the inmates themselves. In an incident, doors/locks must be opened by administrative action for the inmates to be moved. Employees may have to go into the area of origin to rescue inmates, to break up fights or to release door locks. Of the three engineered smoke control systems indicated in Section 909, only Section 909.8, Exhaust Method, requires a tenable environment in the area of origin. A tenable environment is necessary for the safety and liability issues innate to I-3 occupancies.