RB104-09/10

R602.7, R602.7.1 (New), Table R602.7.1 (New), Figures R602.7.1(1)-(2) (New)

Proposed Change as Submitted

Proponent: Joseph Lstiburek, Building Science Corporation

1. Revise as follows:

R602.7 Headers. For header spans see Tables R502.5(1) and R502.5(2). Alternative header applications in accordance with this section shall be permitted.

2. Add new text, table and figures as follows:

R602.7.1 Single member headers in exterior bearing walls. Single member headers in exterior bearing walls shall be permitted in accordance with Table R602.7.1. Single headers shall be framed top and bottom with a flat-wise 2x member. To make up the remaining space, cripples shall be installed above the header. See Figure R602.7.1(1). Alternatively, the header can be sized to fill the space between the wall top plate and a flat-wise 2x member. See Figure R602.7.1(2). The header assembly shall bear on a minimum of one jack stud at each end.

TABLE R602.7.1
SPANS FOR MINIMUM No.2 GRADE SINGLE HEADER
FOR EXTERIOR BEARING WALLS[a,b,c]

SINGLE HEADERS SUPPORTING	SIZE	Wood Species	GROUND SNOW LOAD (psf)								
			≤ 20[d]			30			50		
			Building Width (feet)[e]								
			20	28	36	20	28	36	20	28	36
Roof and Ceiling	2x8	Spruce-Pine-Fir	4-10	4-2	3-8	4-3	3-8	3-3	3-7	3-0	2-8
		Hem-Fir	5-1	4-4	3-10	4-6	3-10	3-5	3-9	3-2	2-10
		Douglas-Fir or Southern Pine	5-3	4-6	4-0	4-7	3-11	3-6	3-10	3-3	2-11
	2x10	Spruce-Pine-Fir	6-2	5-3	4-8	5-5	4-8	4-2	4-6	3-11	3-1
		Hem-Fir	6-6	5-6	4-11	5-8	4-11	4-4	4-9	4-1	3-7
		Douglas-Fir or Southern Pine	6-8	5-8	5-1	5-10	5-0	4-6	4-11	4-2	3-9
	2x12	Spruce-Pine-Fir	7-6	6-5	5-9	6-7	5-8	4-5	5-4	3-11	3-1
		Hem-Fir	7-10	6-9	6-0	6-11	5-11	5-3	5-9	4-8	3-8
		Douglas-Fir or Southern Pine	8-1	6-11	6-2	7-2	6-1	5-5	5-11	5-1	4-6
Roof, ceiling and one center-bearing floor	2x8	Spruce-Pine-Fir	3-10	3-3	2-11	3-9	3-3	2-11	3-5	2-11	2-7
		Hem-Fir	4-0	3-5	3-1	3-11	3-5	3-0	3-7	3-0	2-8
		Douglas-Fir or Southern Pine	4-1	3-7	3-2	4-1	3-6	3-1	3-8	3-2	2-9
	2x10	Spruce-Pine-Fir	4-11	4-2	3-8	4-10	4-1	3-6	4-4	3-7	2-10
		Hem-Fir	5-1	4-5	3-11	5-0	4-4	3-10	4-6	3-11	3-4
		Douglas-Fir or Southern Pine	5-3	4-6	4-1	5-2	4-5	4-0	4-8	4-0	3-7
	2x12	Spruce-Pine-Fir	5-8	4-2	3-4	5-5	4-0	3-6	4-9	3-6	2-10
		Hem-Fir	5-11	4-11	3-11	5-10	4-9	4-2	5-5	4-2	3-4
		Douglas-Fir or Southern Pine	6-1	5-3	4-8	6-0	5-2	4-10	5-7	4-10	4-3
Roof, ceiling and one clear span floor	2x8	Spruce-Pine-Fir	3-5	2-11	2-7	3-4	2-11	2-7	3-3	2-10	2-6
		Hem-Fir	3-7	3-1	2-9	3-6	3-0	2-8	3-5	2-11	2-7
		Douglas-Fir or Southern Pine	3-8	3-2	2-10	3-7	3-1	2-9	3-6	3-0	2-9
	2x10	Spruce-Pine-Fir	4-4	3-7	2-10	4-3	3-6	2-9	4-2	3-4	2-7
		Hem-Fir	4-7	3-11	3-5	4-6	3-10	3-3	4-4	3-9	3-1
		Douglas-Fir or Southern Pine	4-8	4-0	3-7	4-7	4-0	3-6	4-6	3-10	3-5
	2x12	Spruce-Pine-Fir	4-11	3-7	2-10	4-9	3-6	2-9	4-6	3-4	2-7
		Hem-Fir	5-6	4-3	3-5	5-6	4-2	3-3	5-4	3-11	3-1
		Douglas-Fir or Southern Pine	5-8	4-11	4-4	5-7	4-10	4-3	5-6	4-8	4-2

For SI: 1 inch=25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.
b. Table is based on a maximum roof-ceiling dead load of 15 psf.
c. The header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header in lieu of the required jack stud.
d. The 20 psf ground snow load condition shall apply only when the roof pitch is 9:12 or greater. In conditions where the ground snow load is 30 psf or less and the roof pitch is less than 9:12, use the 30 psf ground snow load condition.

e. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

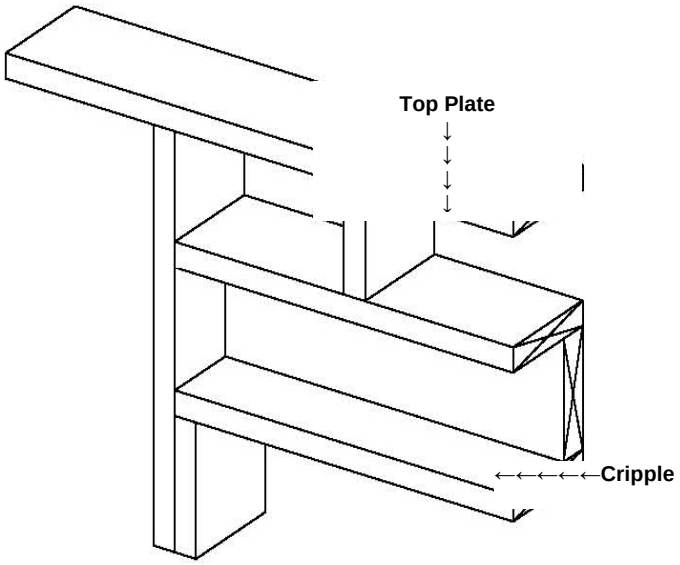


FIGURE R602.7.1(1)
SINGLE MEMBER HEADER IN EXTERIOR BEARING WALL

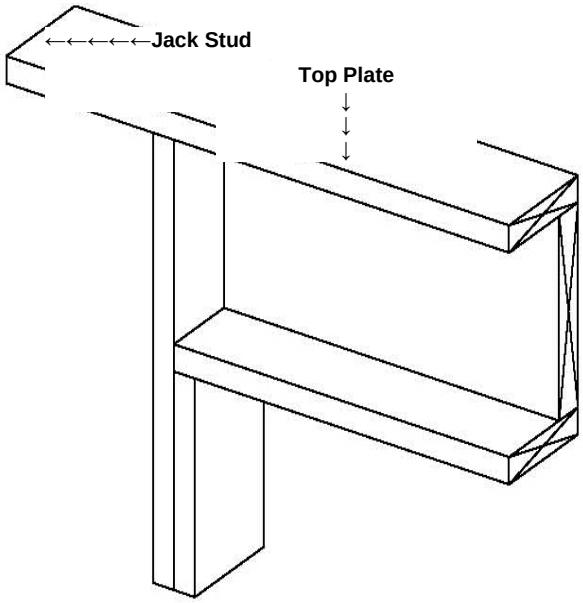


FIGURE R602.7.1(2)
ALTERNATE SINGLE MEMBER HEADER WITHOUT CRIPPLE

Reason: This proposal provides a means of implementing advanced, ←←←←←←Jack Stud ction practices for limited conditions where single headers can be used. Thus, insulation can be placed together with the single header to prevent heat loss through headers which otherwise create a

thermal short-circuit in exterior walls. The table is evaluated in accordance with the NDS-2005 and ASCE 7-05 building loads. For ease-of-use, the table format is consistent with the principle header tables found in Chapter 5 of the code. The single header practice has been used successfully in thousands of homes since originally developed under the optimal value engineering "OVE" banner by the NAHB and HUD in the 1960's and more recently under the HUD/PATH and DOE Build America programs.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: LSTIBUREK-RB-1-R602.7

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

R602.7 Headers. For header spans see Tables R502.5(1) and R502.5(2) and 602.7.1. ~~Alternative header applications in accordance with this section shall be permitted.~~

R602.7.1 Single member headers. ~~in exterior bearing walls.~~ ~~Single member headers in exterior bearing walls shall be permitted in accordance with Table R602.7.1. Single headers shall be framed top and bottom with a flat-wise 2x member. To make up the remaining space, cripples shall be installed above the header. See Figure R602.7.1(1). Alternatively, the header can be sized to fill the space between the wall top plate and a flat-wise 2x member. See Figure R602.7.1(2). The header assembly shall bear on a minimum of one jack stud at each end.~~ Single headers shall be framed with a single flat 2-inch nominal member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures R602.7.1(1) and R602.7.1(2).

TABLE R602.7.1
SPANS FOR MINIMUM No.2 GRADE SINGLE HEADER
~~FOR EXTERIOR BEARING WALLS~~[a,b,c,f]

f. The header shall bear on a minimum of one jack stud at each end.

(Portion of proposal not shown remains unchanged)

Committee Reason: The committee feels this is a good change that provides value engineering of the framing and provides additional energy savings. The detail has been in use and has been tested. The modification simplifies the language and puts it into code format and adds a clarifying note to the table.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Homer Maiel, City of San Jose, CA, representing ICC Tri-Chapter (Peninsula, East Bay, Monterey Bay Chapters), requests Disapproval.

Commenter's Reason: The Tri-Chapter recommends that this code proposal be denied until further structural analysis and evaluation can be performed. The lack of a solid header over wider window and door openings creates significant concerns over excessively "flexibility" around openings in exterior walls. This problem is much more significant when the exterior siding materials are rigid exterior building materials, such as exterior stucco plaster, where the recommended deflection criteria for stucco is limited to a maximum of l/360 (ASTM C926). For example, a single 2x12 header over a large window or door opening with up to an 8'-1" span would appear to fail to meet the deflection limitations for an exterior stucco wall when evaluating the potential bending in the header due to wind loading. As indicated, these "single headers" are only designed for vertical/gravity loading and are oriented in the "weak axis" for out-of-plane wind loading. Further, the allowance of a framing anchor attached to the full-height wall stud in lieu of the required jack stud results in additional problems of out-of-plane bending of the adjacent "single" king studs. For example, a single 2x4 king stud will fail to meet the maximum deflection criteria for out-of-plane bending when evaluating an 8'-0" opening and maximum wind speed and exposure as allowed in the IRC. The jack stud is no longer available to brace the king stud for out-of-plane wind forces. In addition to the out-of-plane bending problems identified above, the additional "flexibility and eccentricity" introduced by the use of "single headers" over wider window and door openings has not been evaluated. Even in minor earthquake and wind events, the additional flexibility around the wider window and door openings allowed in the proposed Table R602.7.1 are likely to result in more building damage due to excessive building movement.

We believe that whatever minimal energy savings is gained by the use of these single headers is more than offset by window failures and water intrusion issues that may result from excessive exterior wall deflection and building movement. We have seen examples of double pane window seals being broken, failure of window and door frames and seals, and water infiltration at door and window openings caused by excessive exterior wall deflection and building movement. The observed damages caused by excessive exterior wall deflection and building movement far exceeded the energy or materials savings that may otherwise result from this proposal.

Final Action: AS AM AMPC____ D

RB105-09/10

Table R602.3(1), R602.3.5 (new), Section R602.10 (including figures and tables), Table R802.11

Proposed Change as Submitted

Proponent: Chuck Bajnai, Chesterfield County, VA, Chairman, ICC Ad-Hoc Committee on Wall Bracing

1. Revise Table R602.3(1) as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a,b,c]	SPACING OF FASTENERS
	Roof		
1	Blocking between joists or rafters to top plate, toe nail	3-8d (2 ½" x 0.113")	--
2	Ceiling joists to plate, toe nail	3-8d (2 ½" x 0.113")	--
3	Ceiling joist not attached to parallel rafter, laps over partitions, face nail	3-10d	--
4	Collar tie to rafter, face nail, or 1-1/4" x 20 gage ridge strap	3-10d (3" x 0.128")	--
5	Rafter to plate, toe nail	2-16d (3 ½ "x 0.135")	--
6	Roof rafters to ridge, valley or hip rafters: toe nail face nail	 4-16d (3 ½" x 0.135") 3-16d (3 ½" x 0.135")	 -- --
	Wall		
7	Built-up ~~corner~~ studs –face nail	10d (3" x 0.128")	24" o.c.
8	Abutting studs at intersecting wall corners, face nail	16d (3 ½" x 0.135")	12"oc
~~8~~ 9	Built-up header, two pieces with ½"spacer	16d (3½" × 0.135")	16" o.c. along each edge
~~9~~ 10	Continued header, two pieces	16d (3½" × 0.135")	16" o.c. along each edge
~~10~~ 11	Continuous header to stud, toe nail	4-8d (2 ½" x 0.113")	-
~~11~~ 12	Double studs, face nail	10d (3" x 0.128")	24" o.c.
~~12~~ 13	Double top plates, face nail	10d (3" x 0.128")	24" o.c.
~~13~~ 14	Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	8-16d (3½" × 0.135")	-
~~14~~ 15	Sole plate to joist or blocking, face nail	16d (3½" × 0.135")	16" o.c.
~~15~~ 16	Sole plate to joist or blocking at braced wall panels	3-16d (3½" × 0.135")	16" o.c.
~~16~~ 17	Stud to sole plate, toe nail	3-8d (2 ½" x 0.113") or 2-16d (3½" × 0.135")	- -
~~17~~ 18	Top or sole plate to stud, end nail	2-16d (3½" × 0.135")	-
~~18~~ 19	Top plates, laps at corners and intersections, face nail	2-10d (3" x 0.128")	-
~~19~~ 20	1" brace to each stud and plate, face nail	2-8d (2 ½" x 0.113") 2 staples 1¾"	- -
~~20~~ 21	1" × 6" sheathing to each bearing, face nail	2-8d (2 ½" x 0.113") 2 staples 1¾"	- -
~~21~~ 22	1" × 8" sheathing to each bearing, face nail	2-8d (2 ½" x 0.113") 3 staples 1¾"	- -
~~22~~ 23	Wider than 1" × 8" sheathing to each bearing, face nail	3-8d (2 ½" x 0.113") 4 staples 1¾"	- -
	Floor		
~~23~~ 24	Joist to sill or girder, toe nail	3-8d (2 ½" x 0.113")	-
~~26~~ 25	Rim joist to top plate, toe nail (roof applications also)	8d (2 ½" x 0.113")	6" o.c.
26	Rim joist or blocking to sill plate, toe nail	8d (2 ½" x 0.113")	6" o.c.
~~24~~ 27	1" × 6" subfloor or less to each joist, face nail	2-8d (2 ½" x 0.113") 2 staples 1¾"	- -
~~25~~ 28	2" subfloor to joist or girder, blind and face nail	2-16d (3½" × 0.135")	-
~~27~~ 29	2" planks (plank & beam – floor & roof)	2-16d (3½" × 0.135")	at each bearing
~~28~~ 30	Built up girders and beams, 2-inch lumber layers	10d (3" x 0.128")	Nail each layer as follows: 32"o.c. at top and bottom and staggered. Two nails at ends and at each splice.
~~29~~ 31	Ledger strip supporting joists or rafters	3-16d (3½" × 0.135")	At each joist or rafter

(Remainder of table unchanged except item numbers)

2. Move existing Section R602.10.1.2.1 to new Section R602.3.5 and revise as follows:

R602.3.5 ~~R602.10.1.2.1~~ Braced wall panel uplift load path. Braced wall panels located at exterior walls that support roof rafters or trusses (including stories below top story) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
   1.1. The basic wind speed does not exceed 90 mph (40 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, or
   1.2. The net uplift value at the top of a wall does not exceed 100 plf (146 N/mm). The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by 40 plf (57 N/mm) for each full wall above and 40 plf (57 N/mm) for each floor platform above.
2. Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing approved uplift framing connectors to provide a continuous load path from the top of the wall to the foundation or to a point where the uplift force is 100 plf (146 N/mm) or less. The net uplift value shall be as determined in Item 1.2 above.
3. Wall sheathing and fasteners designed in accordance with accepted engineering practice to resist combined uplift and shear forces.

3. Delete footnote "f" as follows:

TABLE R802.11
REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS TO RESIST WIND UPLIFT FORCES[a, b, c, e, ~~f~~]
(Pounds per connection)
(No change to table values)

a. through e. *(No change)*

~~f. 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).~~

4. Delete Section R602.10 and replace with the following:

R602.10 Wall bracing. Buildings 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 Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, braced wall lines shall be designated as straight lines on the building plan placed in accordance with this section.

R602.10.1.1 Length of a braced wall line. The length of a braced wall line shall be the distance between its ends. The end of a braced wall line shall be the intersection with a perpendicular braced wall line or an angled braced wall line as permitted in Section R602.10.1.4. In the absence of an intersecting braced wall line, the end shall be the farthest exterior wall of the building as shown in Figure R602.10.1.1.

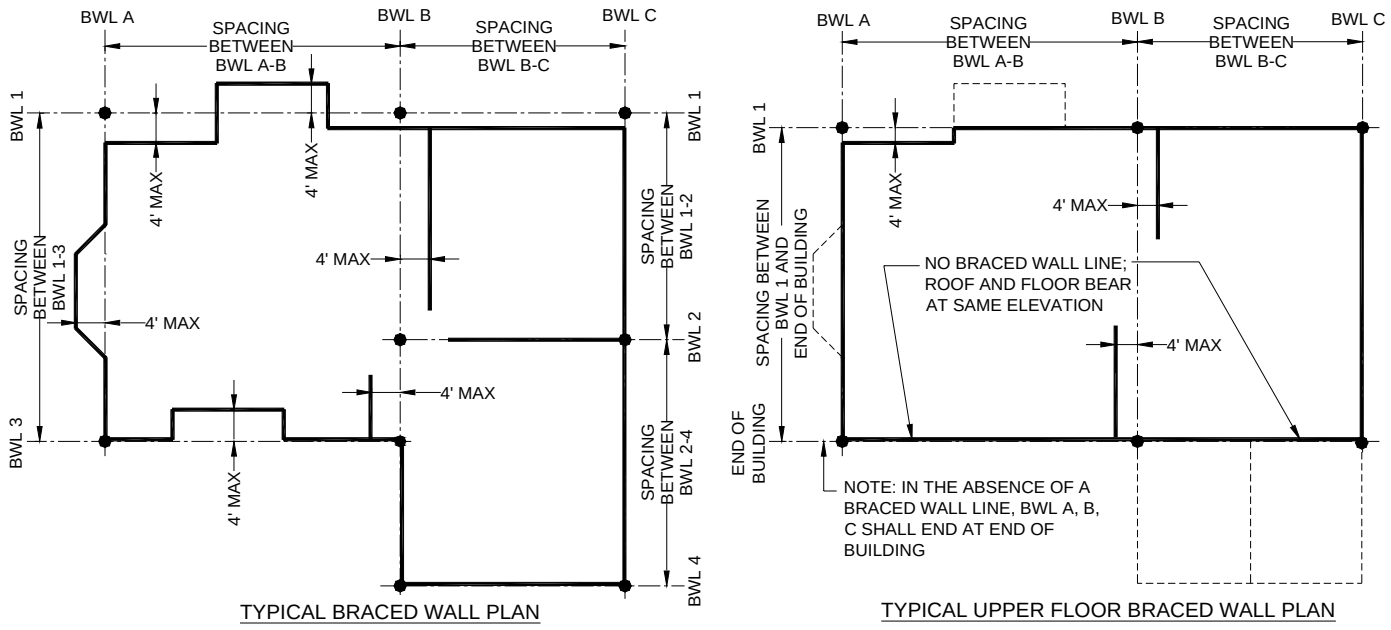


FIGURE R602.10.1.1
BRACED WALL LINES

R602.10.1.2 Offsets along a braced wall line. All exterior walls parallel to a braced wall line shall be permitted to offset up to 4 feet (1219 mm) from the designated braced wall line location as shown Figure R602.10.1.1. Interior walls used as bracing shall be permitted to offset up to 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure R602.10.1.1.

R602.10.1.3 Spacing of braced wall lines. There shall be a minimum of two braced wall lines in both the longitudinal and transverse direction as shown in Figure R602.10.1.1. Intermediate braced wall lines through the interior of the building shall be permitted. The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3.

TABLE R602.10.1.3
BRACED WALL LINE SPACING

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	Exception to Maximum Spacing
Wind bracing	85 mph to <110 mph	Detached, townhouse	60 feet	None
Seismic bracing	SDC A - C	Detached	Use wind bracing	
	SDC A – B	Townhouse	Use wind bracing	
	SDC C	Townhouse	35 feet	Up to 50 feet with adjustment of required length of bracing per Table R602.10.3(4)
	SDC D_0, D_1, D_2	Detached, townhouses, one- and two-story only	25 feet	Up to 35 feet to allow for a single room not to exceed 900 sq ft. Spacing of all other braced wall lines shall not exceed 25 feet.
	SDC D_0, D_1, D_2	Detached, townhouse	25 feet	Up to 35 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4).

For SI: 1 foot = 304.8 mm

R602.10.1.4 Angled walls. Any portion of a wall along 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 a separate braced wall line and shall be braced in accordance with Section R602.10.1.

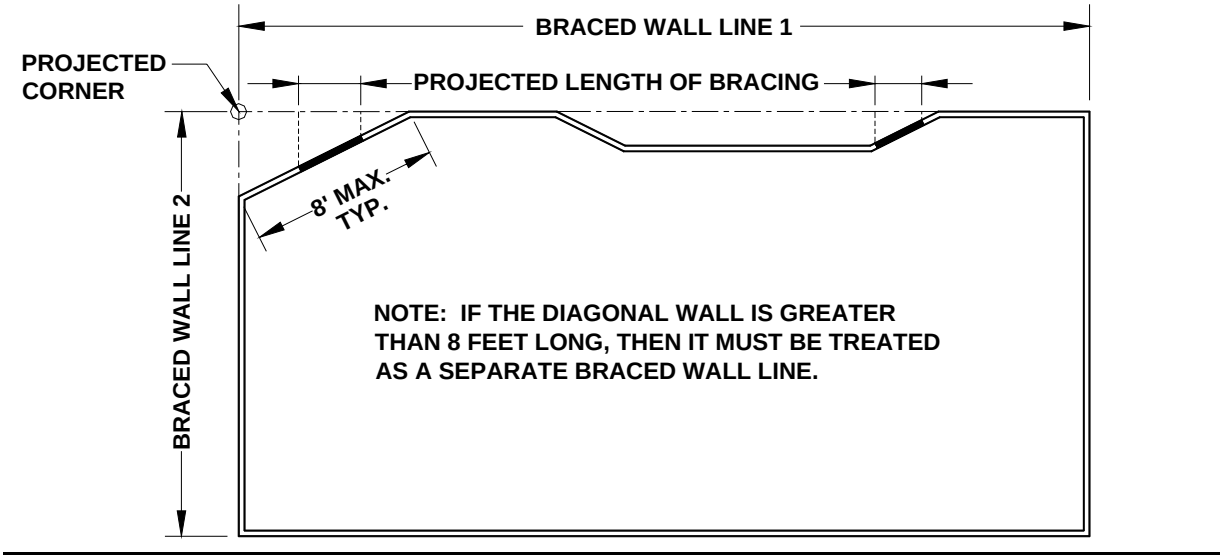


FIGURE R602.10.1.4
ANGLED WALLS

R602.10.2 Braced wall panels. Braced wall panels shall be full-height sections of wall that shall be continuous in the same plane. Braced wall panels shall be constructed and placed along a braced wall line in accordance with this section and the bracing methods specified in Section R602.10.4.

R602.10.2.1 Braced wall panel uplift load path. The bracing lengths in Table R602.10.3(1) apply only when uplift loads are resisted per Section R602.3.5.

R602.10.2.2 Locations of braced wall panels. A braced wall panel shall begin within 10 feet (3810 mm) from each end of a braced wall line as determined in Section R602.10.1.1. The distance between adjacent edges of two braced wall panels shall be no greater than 20 feet (6096 mm) as shown in Figure R602.10.2.2

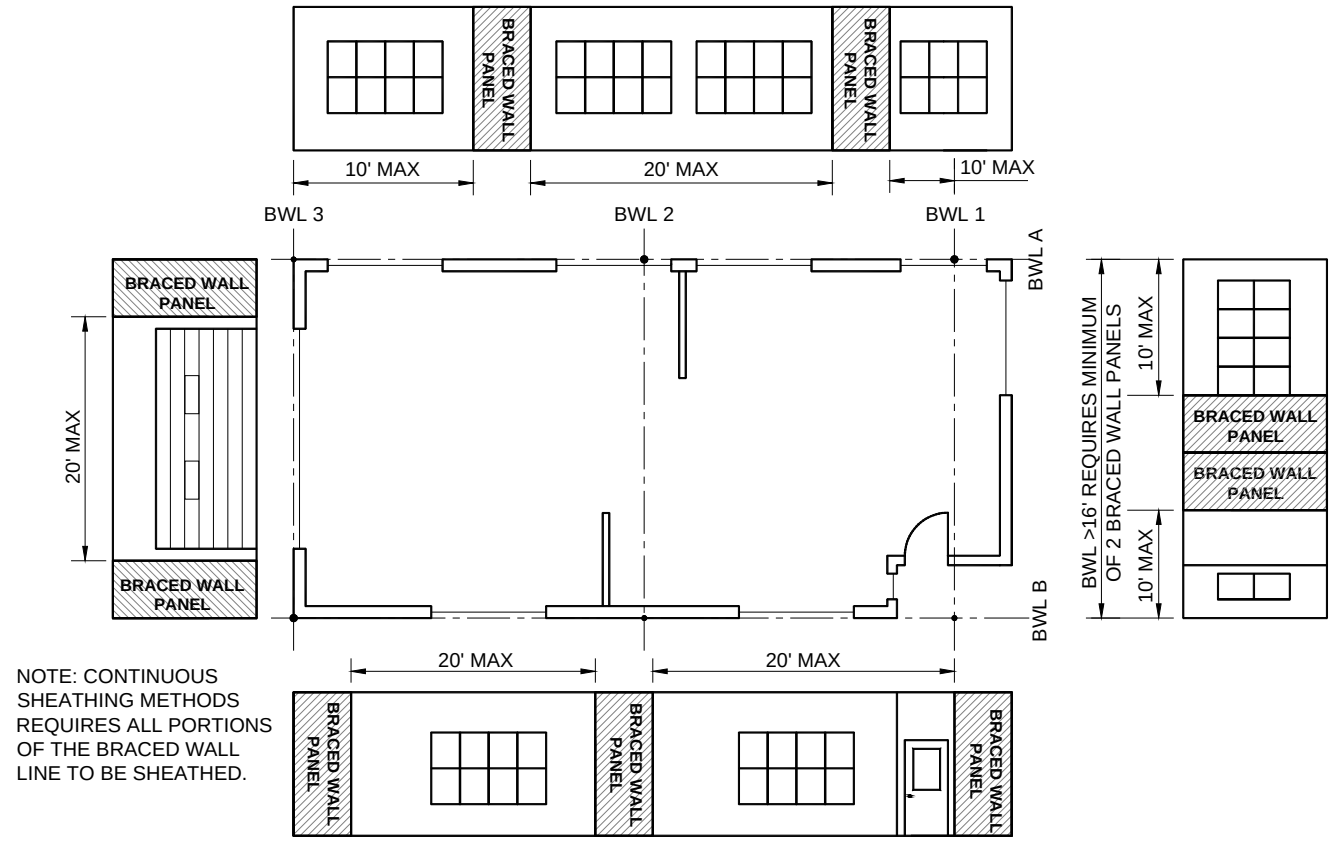


FIGURE R602.10.2.2
LOCATION OF BRACED WALL PANELS

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0, D_1 and D_2. Braced wall panels shall be located at each end of a braced wall line.

Exception: Braced wall panels constructed of Methods WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin no more than 10 feet (3048 mm) from each end of a braced wall line provided each end complies with the following.

1. A minimum 24 in. wide (610 mm) panel for Methods WSP, CS-WSP, CS-G, CS-PF and 32 in. (813 mm) wide panel for Method CS-SFB is applied to each side of the building corner as shown in Condition 4 of Figure R602.10.7.
2. The end of each braced wall panel closest to the end of the braced wall line shall have an 1,800 lb (8 kN) hold-down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below as shown in Condition 5 of Figure R602.10.7.

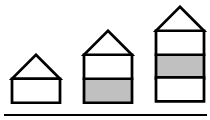
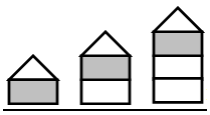
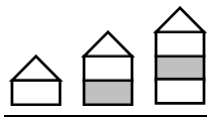
R602.10.2.3 Minimum number of braced wall panels. Braced wall lines with a length of 16 feet (4877 mm) or less shall have a minimum of one braced wall panel. Braced wall lines greater than 16 feet (4877 mm) shall have a minimum of two braced wall panels.

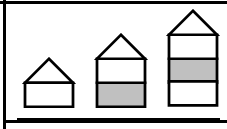
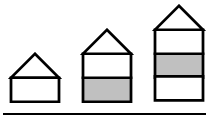
R602.10.3 Required length of bracing. The required length of bracing along each braced wall line shall be determined as follows.

1. All buildings in Seismic Design Categories A and B shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
2. Detached buildings in Seismic Design Category C shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
3. Townhouses in Seismic Design Category C shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4) respectively.
4. All buildings in Seismic Design Categories D_0, D_1 and D_2 shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4) respectively.

Only braced wall panels parallel to the braced wall line shall contribute towards the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length to the braced wall line as shown in Figure R602.10.1.4. Any braced wall panel on an angled wall at the end of a braced wall line shall contribute its projected length for only one of the braced wall lines at the projected corner. In no case shall the required length of bracing along a braced wall line after adjustments be less than 48 inches (1219 mm) total.

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

EXPOSURE CATEGORY B 30 FT MEAN ROOF HEIGHT 10 FT EAVE TO RIDGE HEIGHT 10 FT WALL HEIGHT 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]			
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Method LIB [b]**	**Method GB [c] (Double Sided)**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB [d]**	**Methods CS-WSP, CS-G, CS-PF**
≤ 85 (mph)		10	3.5	3.5	2.0	1.5
		20	6.0	6.0	3.5	3.0
		30	8.5	8.5	5.0	4.5
		40	11.5	11.5	6.5	5.5
		50	14.0	14.0	8.0	7.0
		60	16.5	16.5	9.5	8.0
		10	6.5	6.5	3.5	3.0
		20	11.5	11.5	6.5	5.5
		30	16.5	16.5	9.5	8.0
		40	21.5	21.5	12.5	10.5
		50	26.5	26.5	15.0	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.0	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.0	15.5
		50	NP	39.0	22.5	19.0
		60	NP	46.5	26.5	22.5
≤ 90 (mph)		10	3.5	3.5	2.0	2.0
		20	7.0	7.0	4.0	3.5
		30	9.5	9.5	5.5	5.0
		40	12.5	12.5	7.5	6.0
		50	15.5	15.5	9.0	7.5
		60	18.5	18.5	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	13.0	13.0	7.5	6.5
		30	18.5	18.5	10.5	9.0
		40	24.0	24.0	14.0	12.0
		50	29.5	29.5	17.0	14.5
		60	35.0	35.0	20.0	17.0
		10	NP	10.5	6.0	5.0
		20	NP	19.0	11.0	9.5
		30	NP	27.5	15.5	13.5
		40	NP	35.5	20.5	17.5
		50	NP	44.0	25.0	21.5
		60	NP	52.0	30.0	25.5
≤ 100 (mph)		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.0	19.0	11.0	9.5
		60	22.5	22.5	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.0	8.0
		30	23.0	23.0	13.0	11.0

EXPOSURE CATEGORY B 30 FT MEAN ROOF HEIGHT 10 FT EAVE TO RIDGE HEIGHT 10 FT WALL HEIGHT 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]			
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Method LIB [b]**	**Method GB [c] (Double Sided)**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB [d]**	**Methods CS-WSP, CS-G, CS-PF**
< 110 (mph)		40	29.5	29.5	17.0	14.5
		50	36.5	36.5	21.0	18.0
		60	43.5	43.5	25.0	21.0
		10	NP	12.5	7.5	6.0
		20	NP	23.5	13.5	11.5
		30	NP	34.0	19.5	16.5
		40	NP	44.0	25.0	21.5
		50	NP	54.0	31.0	26.5
		60	NP	64.0	36.5	31.0
		10	5.5	5.5	3.0	3.0
		20	10.0	10.0	6.0	5.0
		30	14.5	14.5	8.5	7.0
		40	18.5	18.5	11.0	9.0
		50	23.0	23.0	13.0	11.5
		60	27.5	27.5	15.5	13.5
		10	10.5	10.5	6.0	5.0
		20	19.0	19.0	11.0	9.5
		30	27.5	27.5	16.0	13.5
		40	36.0	36.0	20.5	17.5
		50	44.0	44.0	25.5	21.5
		60	52.5	52.5	30.0	25.5
		10	NP	15.5	9.0	7.5
		20	NP	28.5	16.5	14.0
		30	NP	41.0	23.5	20.0
		40	NP	53.0	30.5	26.0
		50	NP	65.5	37.5	32.0
		60	NP	77.5	44.5	37.5

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

a. Linear interpolation shall be permitted.
b. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).
c. The length of bracing for Method GB is based on a double sided application. Where GB is used in a one sided application (or in combination of single sided and double sided application), the single sided GB shall only contribute half as much as the double sided GB towards the minimum required length of bracing in this table.
d. Method CS-SFB does not apply where the wind speed is greater than 100 mph.

TABLE R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

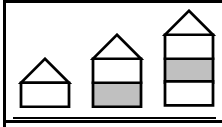
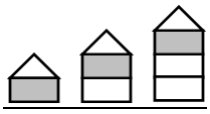
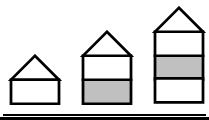
ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] (multiply length from Table R602.10.3(1) by this factor)	APPLICABLE METHODS
Exposure category	One story structure	B	1.00	All methods
		C	1.20	
		D	1.50	
	Two-story structure	B	1.00	
		C	1.30	
		D	1.60	
	Three-story structure	B	1.00	
		C	1.40	
		D	1.70	
Roof eave-to-ridge height	Roof only	≤5 ft	0.70	
		10 ft	1.00	
		15 ft	1.30	
		20 ft	1.60	
	Roof + 1 floor	≤5 ft	0.85	
		10 ft	1.00	
		15 ft	1.15	
		20 ft	1.30	
	Roof + 2 floors	≤5 ft	0.90	
		10 ft	1.00	
		15 ft	1.10	
		20 ft	Not permitted	
Wall height adjustment	Any story	8 ft	0.90	
		9 ft	0.95	
		10 ft	1.00	
		11 ft	1.05	
		12 ft	1.10	
Number of braced wall lines (per plan direction)	Any story	3	1.30	
		4	1.45	
		≥5	1.60	
Additional 800 lb hold-down device	Top story only	Fastened to the end studs of each braced wall panel and to the foundation or framing below	0.80	DWB, WSP, SFB, PBS, PCP, HPS
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.40	DWB, WSP, SFB,PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
Gypsum board fastening	Any story	4 in. o.c.at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB

For SI: 1 foot = 305 mm, 1 lb = 4.48 N.

a. Linear Interpolation shall be permitted.
b. The total adjustment factor is the product of all applicable adjustment factors.

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D [b] • WALL HEIGHT = 10 FT • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD BRACED WALL LINE SPACING ≤ 25 FT			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]				
Seismic Design Category	Story Location	Braced Wall Line Length (ft)	Method LIB [c]	Method GB (Double Sided) [d]	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB [e]	Method WSP	Methods CS-WSP, CS-G,
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6

• SOIL CLASS D [b] • WALL HEIGHT = 10 FT • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD BRACED WALL LINE SPACING ≤ 25 FT			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]				
Seismic Design Category	Story Location	Braced Wall Line Length (ft)	Method LIB [c]	Method GB (Double Sided) [d]	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB [e]	Method WSP	Methods CS-WSP, CS-G,
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7
		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
D_0		10	NP	2.8	2.8	1.8	1.6
		20	NP	5.5	5.5	3.6	3.1
		30	NP	8.3	8.3	5.4	4.6
		40	NP	11.0	11.0	7.2	6.1
		50	NP	13.8	13.8	9.0	7.7
		10	NP	5.3	5.3	3.8	3.2
		20	NP	10.5	10.5	7.5	6.4
		30	NP	15.8	15.8	11.3	9.6
		40	NP	21.0	21.0	15.0	12.8
		50	NP	26.3	26.3	18.8	16.0
		10	NP	7.3	7.3	5.3	4.5
		20	NP	14.5	14.5	10.5	9.0
		30	NP	21.8	21.8	15.8	13.4
		40	NP	29.0	29.0	21.0	17.9
		50	NP	36.3	36.3	26.3	22.3
D_1		10	NP	3.0	3.0	2.0	1.7
		20	NP	6.0	6.0	4.0	3.4
		30	NP	9.0	9.0	6.0	5.1
		40	NP	12.0	12.0	8.0	6.8
		50	NP	15.0	15.0	10.0	8.5
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	8.5	8.5	6.0	5.1
		20	NP	17.0	17.0	12.0	10.2
		30	NP	25.5	25.5	18.0	15.3
		40	NP	34.0	34.0	24.0	20.4
		50	NP	42.5	42.5	30.0	25.5
D2		10	NP	4.0	4.0	2.5	2.1
		20	NP	8.0	8.0	5.0	4.3
		30	NP	12.0	12.0	7.5	6.4
		40	NP	16.0	16.0	10.0	8.5
		50	NP	20.0	20.0	12.5	10.6
		10	NP	7.5	7.5	5.5	4.7
		20	NP	15.0	15.0	11.0	9.4
		30	NP	22.5	22.5	16.5	14.0
		40	NP	30.0	30.0	22.0	18.7
		50	NP	37.5	37.5	27.5	23.4
		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP

For SI: 1 foot 305 mm

a. Linear interpolation shall be permitted.

b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the Seismic Design Categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.5 of the International Building Code.

c. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).

d. The length of bracing for Method GB is based on a double sided application. Where GB is used in a one sided application (or in combination of single sided and double sided application), the single sided GB shall only contribute half as much as the double sided GB towards the minimum required length of bracing in this table.

e. Method CS-SFB applies in SDC C only.

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

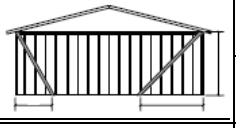
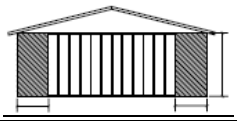
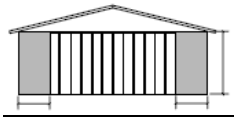
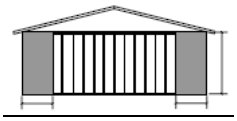
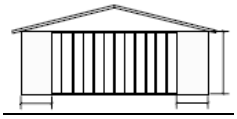
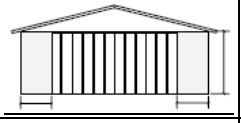
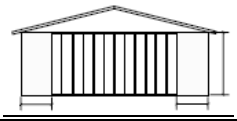
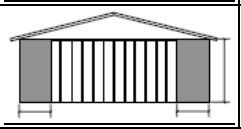
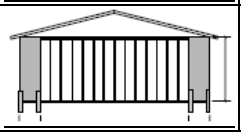
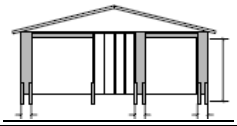
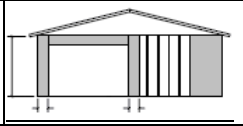
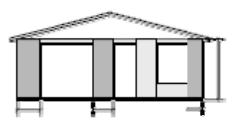
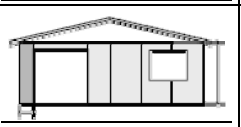
ADJUSTMENT BASED ON:	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] (Multiply length from Table R602.10.3(1) by this factor)	APPLICABLE METHODS
Story height (Section 301.3)	Any story	≤10 ft	1.0	All methods
		>10 ft ≤ 12 ft	1.2	
Braced wall line spacing, townhouses in SDC C	Any story	≤35 ft	1.0	
		>35 ft ≤ 50 ft	1.43	
Braced wall line spacing, in SDC D_0, D_1, D_2[c]	Any story	<25 ft ≤30 ft	1.2	
		>30 ft ≤ 35 ft	1.4	
Wall dead load	Any story	> 8 ft < 15 ft	1.0	
		<8 psf	0.85	
Roof/ceiling dead load for wall supporting	Roof only or roof plus one or two stories	<15 psf	1.0	
	Roof only	>15 psf ≤ 25 psf	1.2	
	Roof plus one or two stories	>15 psf ≤ 25 psf	1.1	
Walls with stone or masonry veneer	Any story	See Section R703.7		
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB

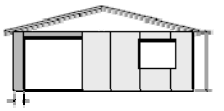
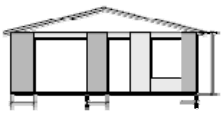
For SI: 1 psf = 47,8 N/m^2.

a. Linear interpolation shall be permitted.
b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.
c. The length-to-width ratio for the floor/roof *diaphragm* shall not exceed 3:1. The top plate lap splice nailing shall be a minimum of 12-16d nails on each side of the splice.

R602.10.4 Construction methods for braced wall panels. Intermittent and continuously sheathed braced wall panels shall be constructed in accordance with this section and the methods listed in Table R602.10.4.

TABLE R602.10.4
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA [a]	
				Fasteners	Spacing
Intermittent Bracing Methods	**LIB** Let-in-bracing	1x4 wood or approved metal straps at 45° to 60° angles for maximum 16" stud spacing		Wood: 2-8d common nails or 3-8d (2 ½" x 0.113") nails	Wood: per stud and top and bottom plates
				Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	¾" (1" nominal) for maximum 24" stud spacing		2-8d (2½" x 0.113") nails or 2 - 1¾" staples	Per stud
	WSP Wood structural panel (See Section R604)	3/8"		Exterior sheathing per Table R602.3(3)	6" edges 12" field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	SFB Structural fiberboard sheathing	1/2" or 25/32" for maximum 16" stud spacing		1½" long x 0.12" dia. (for ½ " thick sheathing) 1 3/4" long x 0.12" dia. (for 25/32" thick sheathing) galvanized roofing nails or 8d common (2½"x0.131) nails	3" edges 6" field
	GB [d] Gypsum board (double sided)	1/2"		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7" edges (including top and bottom plates) 7" field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	3/8" or 1/2" for maximum16" stud spacing		For 3/8", 6d common (2"x0.113) nails For ½", 8d common (2½"x0.131) nails	3" edges 6" field
	PCP Portland cement plaster	See Section R703.6 for maximum 16" stud spacing		1½", 11 gage, 7/16" head nails or 7/16", 16 gage staples	6" o.c. on all framing members
	HPS Hardboard panel siding	7/16" for maximum 16" stud spacing		0.092" dia., 0.225" head nails with length to accommodate 1½" penetration into studs	4" edges 8" field
	ABW Alternate braced wall	3/8"		See Section R602.10.6.1	See Section R602.10.6.1
	PFH Portal frame with hold-downs	3/8		See Section R602.10.6.2	See Section R602.10.6.2
	PFG Portal frame at garage	7/16"		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	3/8"		Exterior sheathing per Table R602.3(3)	6" edges 12" field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	CS-G [b,c] Continuously sheathed wood structural panel adjacent to garage	3/8"		See Method CS-WSP	See Method CS-WSP

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA [a]	
			Fasteners	Spacing
openings				
CS-PF Continuously sheathed portal frame	$^{7}/_{16}$"		See Section R602.10.6.4	See Section R602.10.6.4
CS-SFB Continuously sheathed structural fiberboard	$^{1}/_{2}$" or $^{25}/_{32}$" for maximum 16" stud spacing		1½" long x 0.12" dia. (for ½ " thick sheathing) $1^{3}/_{4}$" long x 0.12" dia. (for $^{25}/_{32}$" thick sheathing) galvanized roofing nails or 8d common (2½"x0.131) nails	3" edges 6" field

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

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.
b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1, and D_2 roof covering dead load may not exceed 3 psf (0.14 kN/m^2).
c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.
d. "Double sided" GB shall mean that a full length/full height panel of GB sheathing is applied to both sides of the stud wall. GB bracing panels are not required to be aligned back to back – they may be offset from each other so long as their length's comply with Table R602.10.5. Where all of the GB is on one side of the studs or where there is a combination of "double sided" GB and "single sided" GB, the single sided GB shall contribute half of its actual length towards the minimum required length (i.e. 96" of single sided GB is equivalent to 48" of double sided GB).

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from braced wall line to braced wall line within a story shall be permitted. Within Seismic Design Categories A, B and C or in regions where the basic wind speed is less than or equal to 100 mph, mixing of intermittent bracing and continuous sheathing methods from braced wall line to braced wall line within a story shall be permitted.
3. Mixing intermittent bracing methods along a braced wall line shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C provided the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a braced wall line shall be permitted.
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a braced wall line with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same braced wall line shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3). The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the braced wall line.

R602.10.4.2 Continuous sheathing methods. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a braced wall line including areas above and below openings and gable end walls and shall meet the requirements of Section R602.10.7.

R602.10.4.3 Braced wall panel interior finish material. Braced wall panels shall have gypsum wall board installed on the side of the wall opposite the bracing material. Gypsum wall board shall be not less than ½ inch (12.7 mm) in thickness and be fastened with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum wall board. Spacing of fasteners at panel edges for gypsum wall board opposite Method LIB bracing shall not exceed 8 inches (203 mm). Interior finish material shall not be glued in Seismic Design Categories D_0, D_1 and D_2.

Exceptions:

1. Interior finish material is not required opposite wall panels that are braced in accordance with Method GB, ABW, PFH, PFG and CS-PF, unless otherwise required by Section R302.6.
2. An approved interior finish material with an in-plane shear resistance equivalent to gypsum board shall be permitted to be substituted, unless otherwise required by Section R302.6.
3. Except for Method LIB, gypsum wall board is permitted to be omitted provided the required length of bracing in Tables R602.10.3(1) and R602.10.3(3) is multiplied by the appropriate adjustment factor in Tables R602.10.3(2) and R602.10.3(4) respectively, unless otherwise required by Section R302.6.

R602.10.5 Minimum length of a braced wall panel. The minimum length of a braced wall panel shall comply with Table R602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table R602.10.5 and Figure R602.10.5. When a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.

R602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Table R602.10.3(1) and R602.10.3(3), the contributing length of each braced wall panel shall be as specified in Table R602.10.5.

TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

METHOD		MINIMUM LENGTH [a] (in) Wall Height					CONTRIBUTING LENGTH (in)
		8 ft	9 ft	10 ft	11 ft	12 ft	
DWG, WSP, SFB, PBS, PCP, HPS, GB [d]		48	48	48	53	58	Actual [b]
LIB		55	62	69	NP		Actual [b]
ABW	SDC A, B and C, wind speed < 110 mph	28	32	34	38	42	48
	SDC D_0, D_1 and D_2, wind speed < 110 mph	32	32	34	NP	NP	
PFH	Supporting roof only	16	16	16	18 [d]	20 [d]	48
	Supporting one story and roof	24	24	24	27 [d]	29 [d]	48
PFG		24	27	30	33 [e]	36 [e]	1.5 x Actual [b]
CS-G		24	27	30	33	36	Actual [b]
CS-PF		16	18	20	22 [f]	24 [f]	Actual [b]
CS-WSP, CS-SFB	Adjacent clear opening height (in)						
	≤ 64	24	27	30	33	36	Actual [b]
	68	26	27	30	33	36	
	72	27	27	30	33	36	
	76	30	29	30	33	36	
	80	32	30	30	33	36	
	84	35	32	32	33	36	
	88	38	35	33	33	36	
	92	43	37	35	35	36	
	96	48	41	38	36	36	
	100		44	40	38	38	
	104		49	43	40	39	
	108		54	46	43	41	
	112			50	45	43	
	116			55	48	45	
	120			60	52	48	
	124				56	51	
	128				61	54	
	132				66	58	
	136					62	
	140					66	
	144					72	

For SI: 1 inch = 25.4 mm
NP = Not permitted

a. Linear interpolation shall be permitted.
b. Use the actual length when it is greater than or equal to the minimum length.
c. As specified in Table R602.10.4, Method GB is intended to be double sided. Where all of the GB is on one side of the studs or where there is a combination of "double sided" GB and "single sided" GB, the single sided GB shall contribute half of its actual length towards the minimum required length (i.e. 96" of single sided GB is equivalent to 48" of double sided GB).
d. Maximum header height for PFH is 10' per Figure R602.10.6.2, but wall height may be increased to 12' with pony wall.
e. Maximum opening height for PFG is 10' per Figure R602.10.6.3, but wall height may be increased to 12' with pony wall.
f. Maximum opening height for CS-PF is 10' per Figure R602.10.6.4, but wall height may be increased to 12' with pony wall

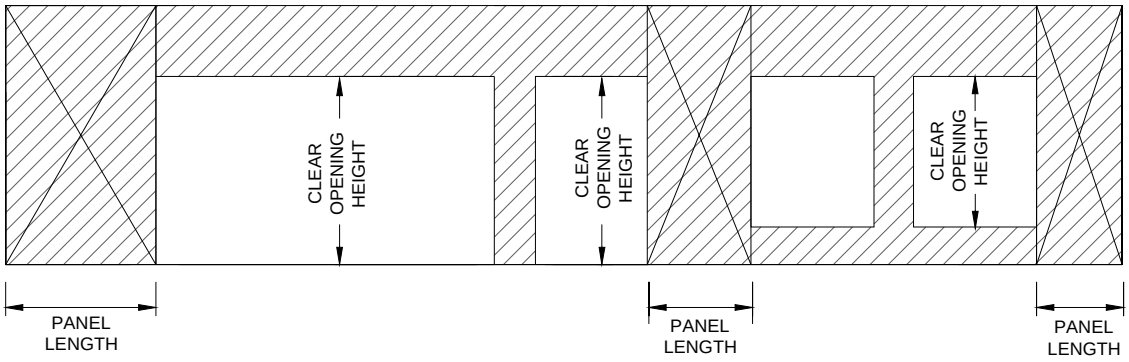


FIGURE R602.10.5
BRACED WALL PANELS WITH CONTINUOUS SHEATHING

R602.10.5.2 Partial credit. For Methods DWB, WSP, SFB, PBS, PCP and HPS in Seismic Design Categories A, B and C, panels between 36 inches and 48 inches in length shall be considered a braced wall panel and shall be permitted to partially contribute towards the required length of bracing in Table R602.10.3(1) and R602.10.3(3), and the contributing length shall be determined from Table R602.10.5.2.

TABLE R602.10.5.2
PARTIAL CREDIT FOR BRACED WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH

Actual Length of Braced Wall Panel (in)	Contributing Length of Braced Wall Panel (in) [a]	
	8 ft Wall Height	9 ft Wall Height
48	48	48
42	36	36
36	27	N/A

For SI: 1 inch = 25.4mm

a. Linear interpolation shall be permitted.

R602.10.6 Construction of Methods ABW, PFH, PFG and CS-PF. Methods ABW, PFH, PFG and CS-PF shall be constructed as specified in Sections R602.10.6.1 through R602.10.6.4.

R602.10.6.1 Method ABW: Alternate braced wall panels. Method ABW braced wall panels shall be constructed in accordance with Figure R602.10.6.1. The hold-down force shall be in accordance with Table R602.10.6.1.

TABLE R602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/STORY	HOLD DOWN FORCE (lb)				
		Height of Braced Wall Panel				
		8 ft	9 ft	10 ft	11 ft	12 ft
SDC A, B and C Wind speed < 110 mph	One story	1800	1800	1800	2000	2200
	First of two story	3000	3000	3000	3300	3600
SDC D_0, D_1 and D_2 Wind speed < 110 mph	One story	1800	1800	1800	NP [a]	NP [a]
	First of two story	3000	3000	3000	NP [a]	NP [a]

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N
NP = Not Permitted.

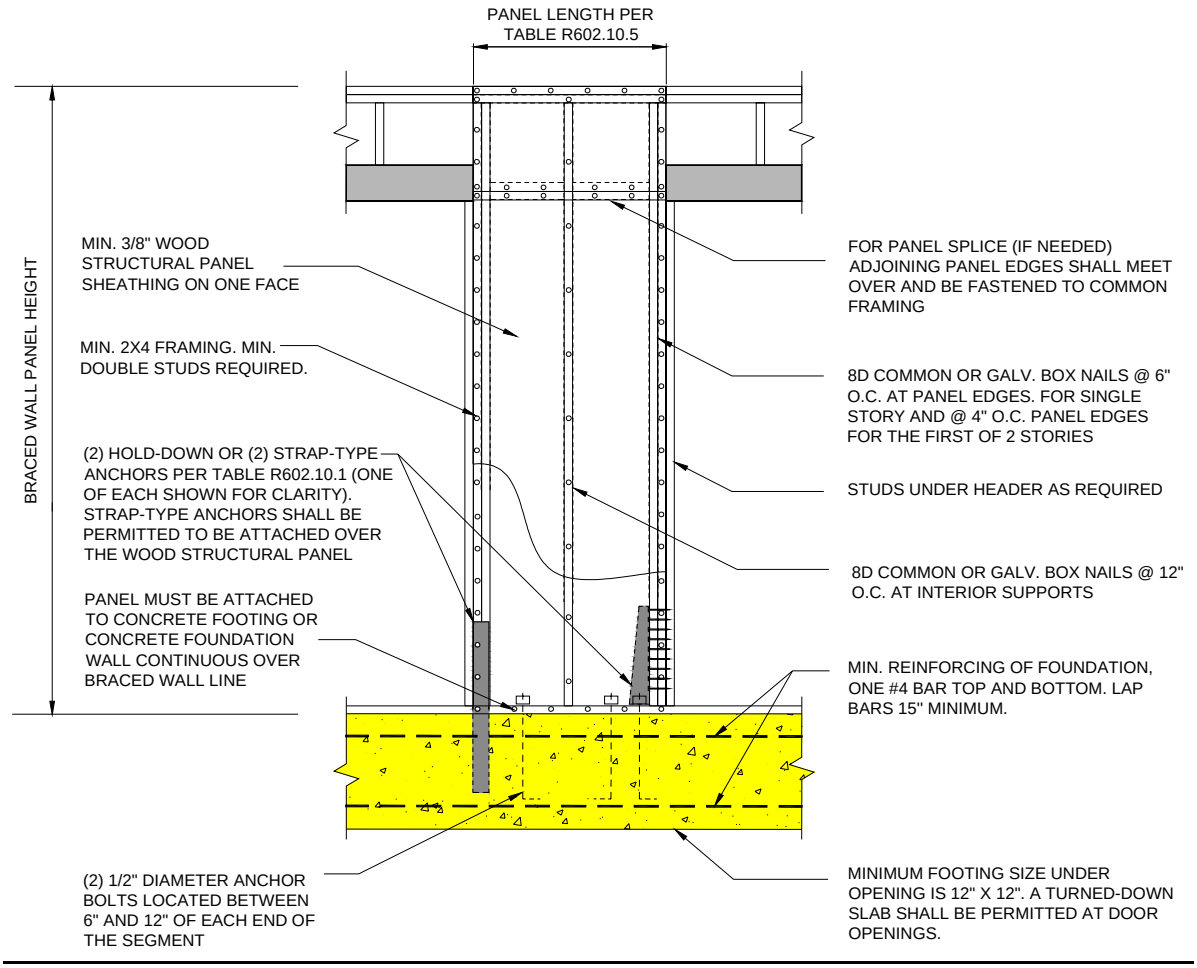
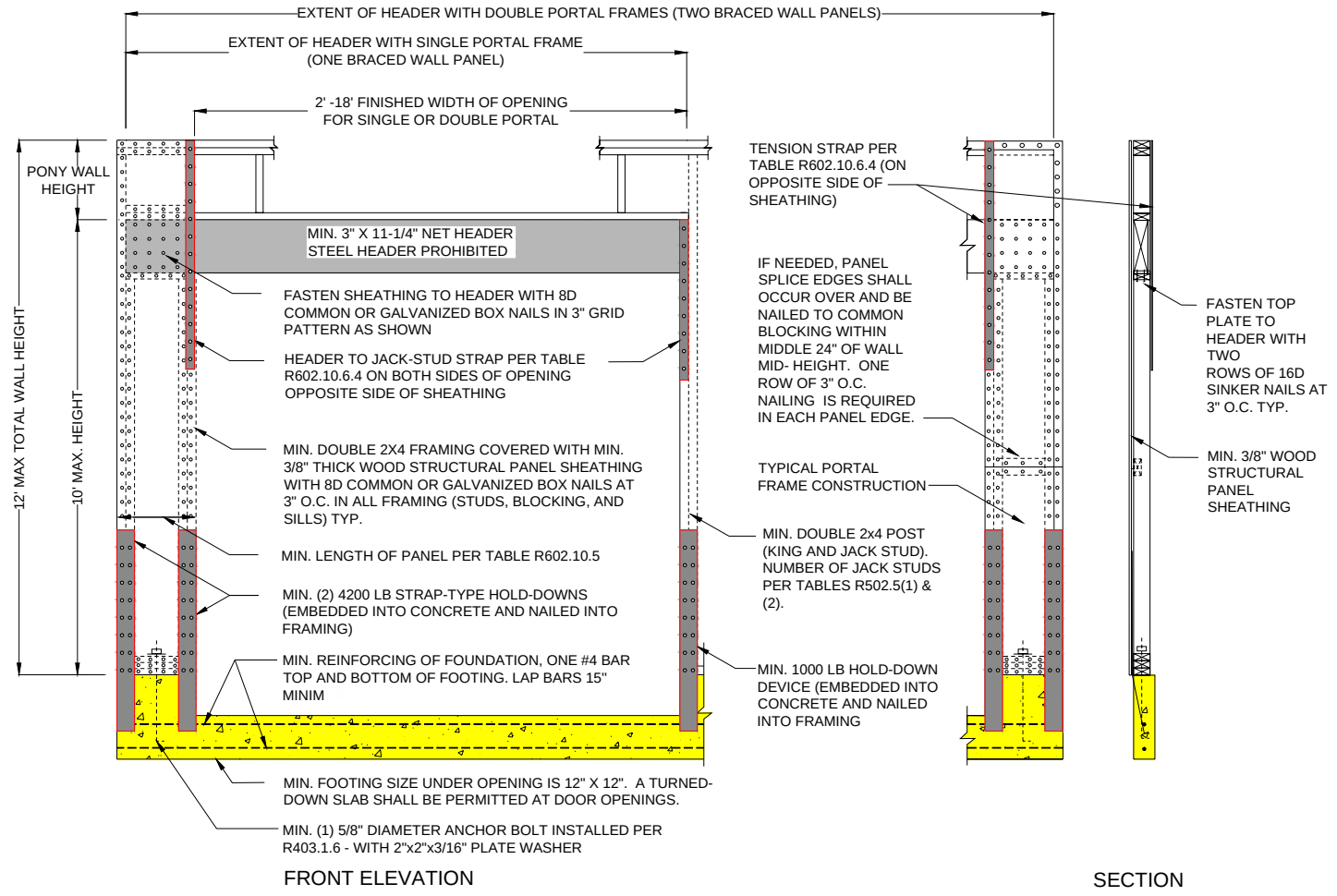


FIGURE R602.10.6.1
METHOD ABW: ALTERNATE BRACED WALL PANEL

R602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH braced wall panels shall be constructed in accordance with Figure R602.10.6.2.



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

FIGURE R602.10.6.2
METHOD PFH: PORTAL FRAME WITH HOLD-DOWNS

R602.10.6.3 Method PFG: Portal frame at garage door openings in Seismic Design Categories A, B and C. Where supporting a roof or one story and a roof, a Method PFG braced wall panel constructed in accordance with Figure R602.10.6.3 is permitted on either side of garage door openings.

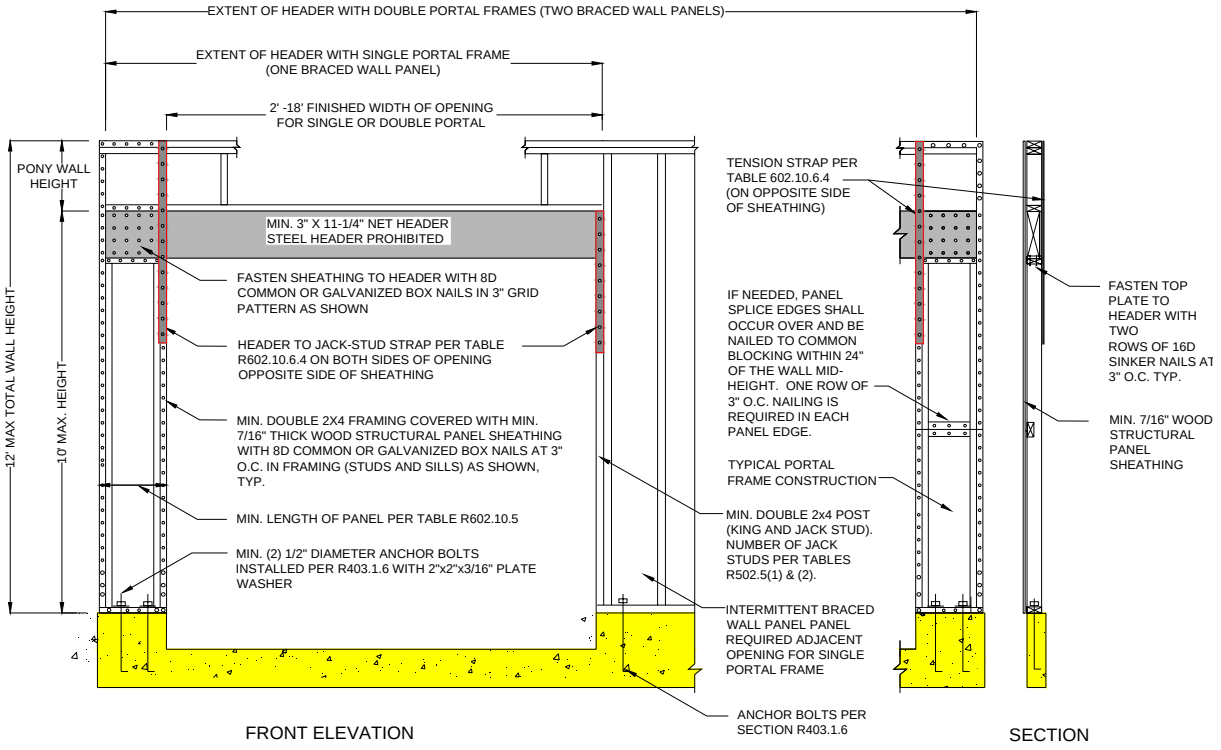


FIGURE R602.10.6.3
METHOD PFG: PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B AND C

R602.10.6.4 Method CS-PF: Continuously sheathed portal frame. Continuously sheathed portal frame braced wall panels shall be constructed in accordance with Figure R602.10.6.4 and Table R602.10.6.4. The number of continuously sheathed portal frame panels in a single braced wall line shall not exceed four.

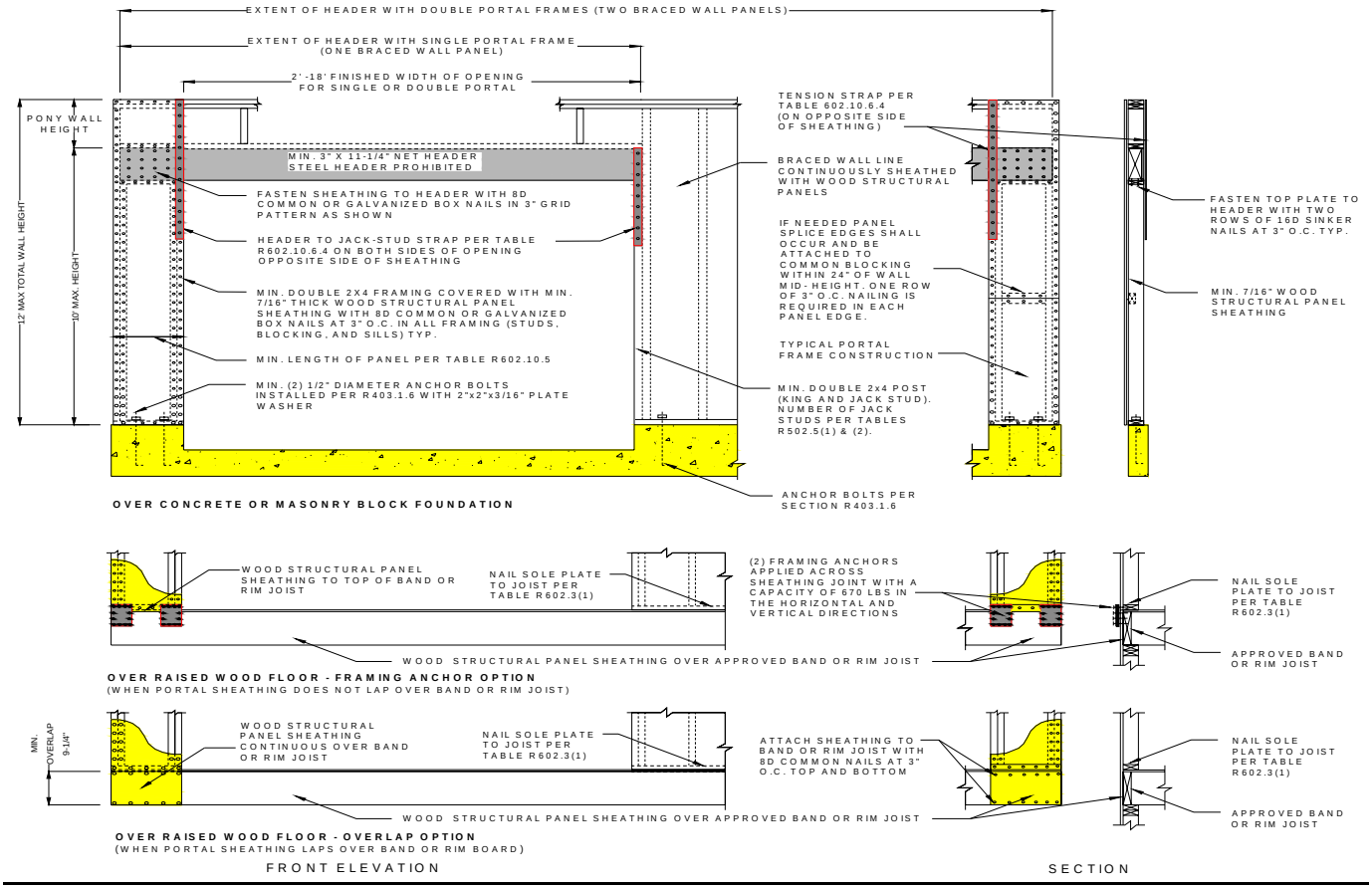
TABLE R602.10.6.4
TENSION STRAP CAPACITY REQUIRED FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHOD PFH, PFG AND CS-PF BRACED WALL PANELS

MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE	MAXIMUM PONY WALL HEIGHT (ft)	MAXIMUM TOTAL WALL HEIGHT (ft)	MAXIMUM OPENING WIDTH (ft)	TENSION STRAP CAPACITY REQUIRED (lb)[a, b]					
				Basic Wind Speed (mph)					
				85	90	100	85	90	100
				Exposure B			Exposure C		
2x4 No. 2 Grade	0	10	18	1000	1000	1000	1000	1000	1000
	1	10	9	1000	1000	1000	1000	1000	1275
			16	1000	1000	1750	1800	2325	3500
			18	1000	1200	2100	2175	2725	DR
	2	10	9	1000	1000	1025	1075	1550	2500
			16	1525	2025	3125	3200	3900	DR
			18	1875	2400	3575	3700	DR	DR
	2	12	9	1000	1200	2075	2125	2750	4000
			16	2600	3200	DR	DR	DR	DR
			18	3175	3850	DR	DR	DR	DR
	4	12	9	1775	2350	3500	3550	DR	DR
			16	4175	DR	DR	DR	DR	DR
2x6 Stud Grade	2	12	9	1000	1000	1325	1375	1750	2550
			16	1650	2050	2925	3000	3550	DR
			18	2025	2450	3425	3500	4100	DR
	4	12	9	1125	1500	2225	2275	2775	3800
			16	2650	3150	DR	DR	DR	DR
			18	3125	3675	DR	DR	DR	DR

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

a. DR = design required

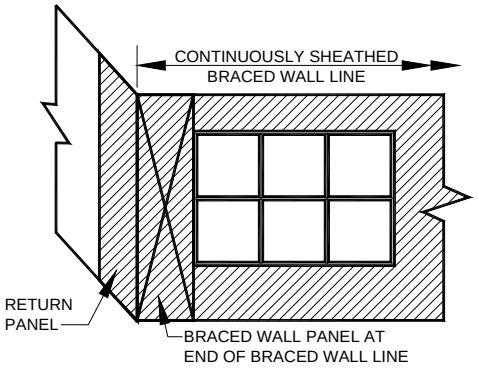
b. Strap shall be installed in accordance with manufacturer's recommendations.



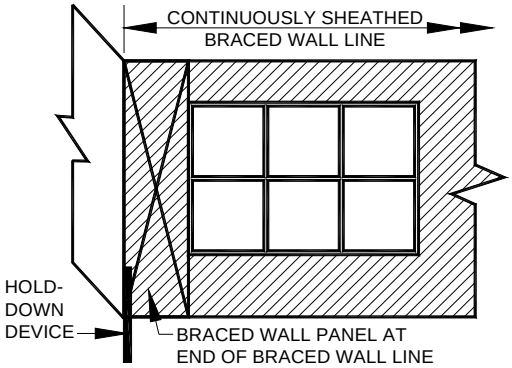
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N

FIGURE R602.10.6.4
METHOD CS-PF: CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

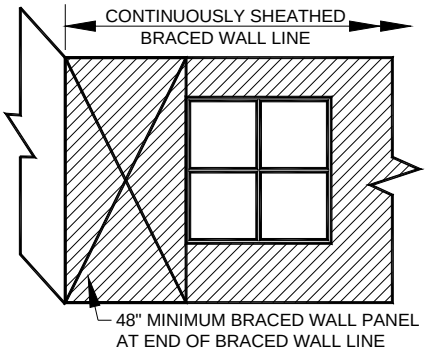
R602.10.7 Ends of braced wall lines with continuous sheathing. Each end of a braced wall line with continuous sheathing shall have one of the conditions shown in Figure R602.10.7.



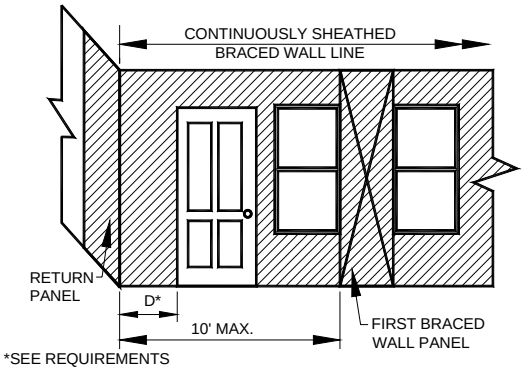
END CONDITION 1



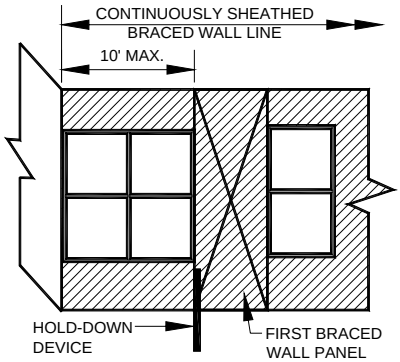
END CONDITION 2



END CONDITION 3



END CONDITION 4



END CONDITION 5

REQUIREMENTS

Return panel: 24" for braced wall lines sheathed with wood structural panels
32" for braced wall lines sheathed with structural fiberboard

Distance D: 24" for braced wall lines sheathed with wood structural panels
32" for braced wall lines sheathed with structural fiberboard

Hold-down device: 800 lbs capacity fastened to the edge of the braced wall panel closest to the corner and to the foundation or floor framing below

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

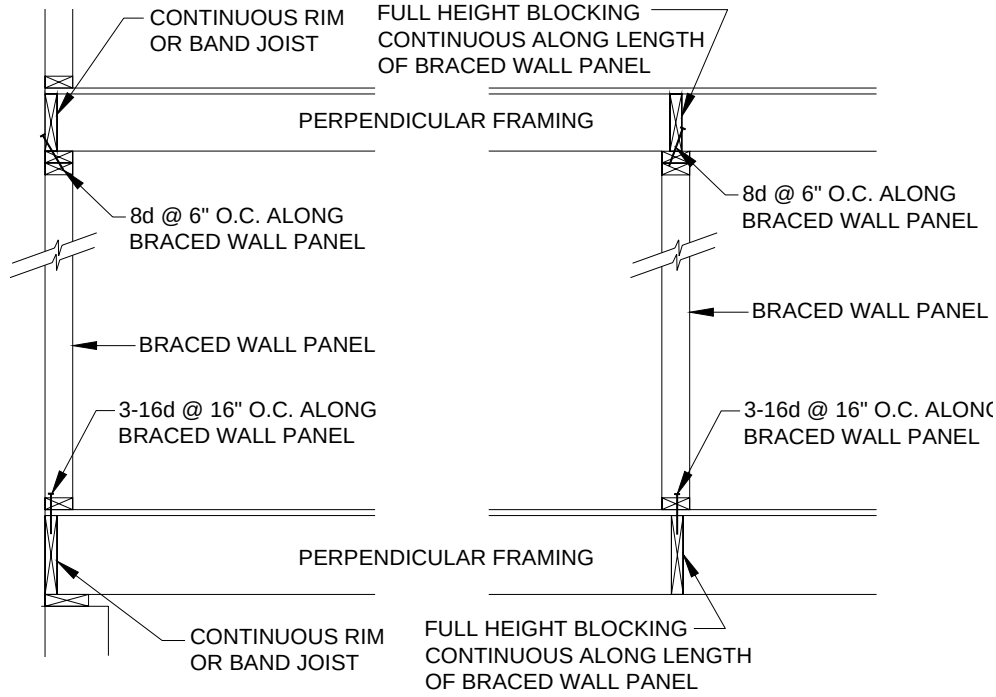
FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

R602.10.8 Braced wall panel connections. Braced wall panels shall be connected to floor framing or foundations as follows:

1. Where joists are perpendicular to a braced wall panel above or below, a rim joist, band joist or blocking shall be provided along the entire length of the braced wall panel in accordance with Figure R602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist and/or blocking shall be in accordance with Table R602.3(1).
2. Where joists are 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 braced wall panel in accordance with Figure R602.10.8(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

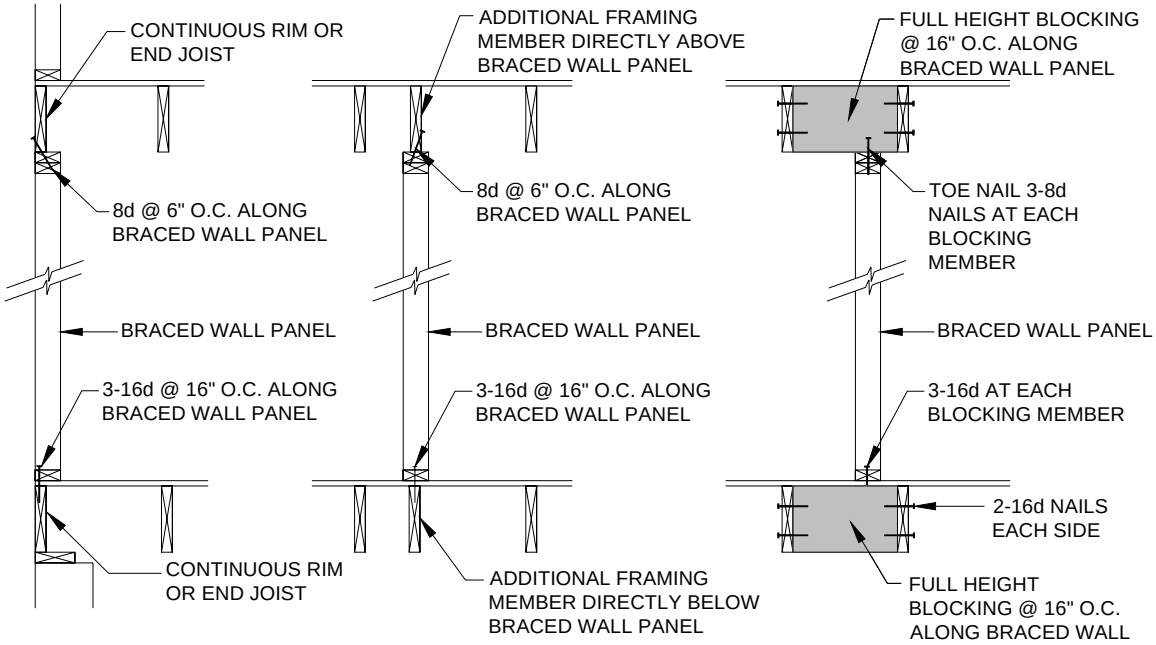
side of the braced wall panel in accordance with Figure R602.10.8(2). Fastening of blocking and wall plates shall be in accordance with Table R602.3(1) and Figure R602.10.8(2).

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 R602.10.8(1)
BRACED WALL PANEL CONNECTION WHEN
PERPENDICULAR TO FLOOR/CEILING FRAMING



For SI: 1 inch = 25.4 mm

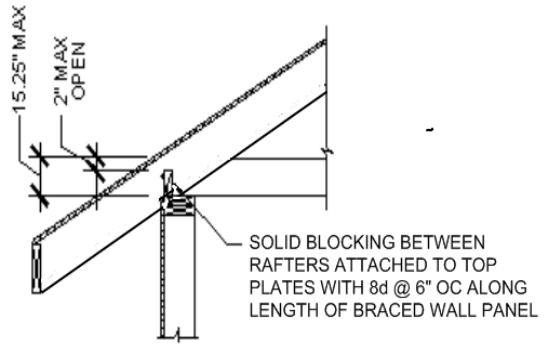
FIGURE R602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN

PARALLEL TO FLOOR/CEILING FRAMING

R602.10.8.1 Braced wall panel connections for Seismic Design Categories D_0, D_1 and D_2. Braced wall panels shall be fastened to required foundations in accordance with Section R602.11.1, and top plate lap splices shall be face-nailed with at least eight 16d nails on each side of the splice.

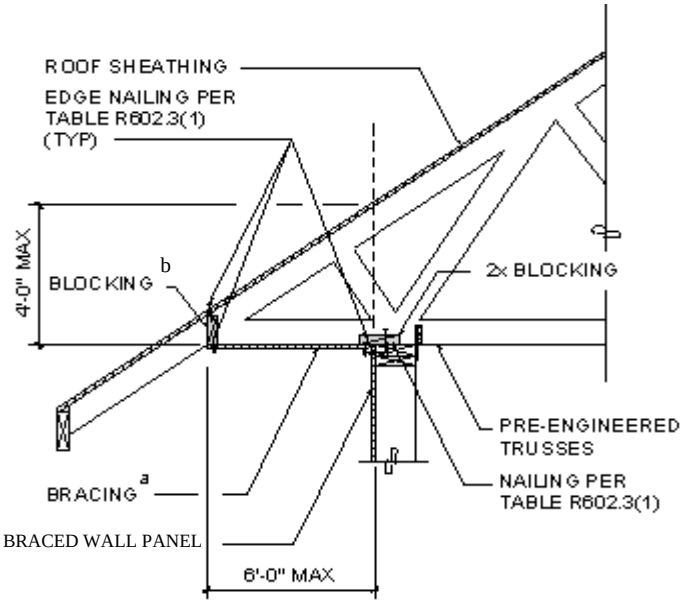
R602.10.8.2 Connections to roof framing. Exterior braced wall panels shall be connected to roof framing as follows.

1. Parallel rafters or roof trusses shall be attached to the top plates of braced wall panels in accordance with Table R602.3(1).
2. For Seismic Design Categories A, B and C and wind speeds less than 100 mph (45 m/s):
   - 2.1. Where the distance from the top of the rafters or roof trusses and perpendicular top plates is 9.25 inches (235 mm) or less, the rafters or roof trusses shall be connected to the top plates of braced wall panels in accordance with Table R602.3(1) and blocking need not be installed.
   - 2.2. Where the distance from the top of the rafters and perpendicular top plates is between 9.25 inches (235 mm) and 15.25 inches (387 mm) the rafters shall be connected to the top plates of braced wall panels with blocking in accordance with Figure R602.10.8.2(1) and attached in accordance with Table R602.3(1).
   - 2.3. Where the distance from the top of the roof trusses and perpendicular top plates is between 9.25 inches (235 mm) and 15.25 inches (387 mm) the roof trusses shall be connected to the top plates of braced wall panels with blocking in accordance with Table R602.3(1).
3. For Seismic Design Categories D_0, D_1 and D_2 or wind speeds of 100 mph (45 m/s) or greater, where the distance between the top of rafters or roof trusses and perpendicular top plates is 15.25 inches (387 mm) or less, rafters or roof trusses shall be connected to the top plates of braced wall panels with blocking in accordance with Figure R602.10.8.2(1) and attached in accordance with Table R602.3(1).
4. For all Seismic Design Categories and wind speeds, where the distance between the top of rafters or roof trusses and perpendicular top plates exceeds 15.25 inches (387 mm), perpendicular rafters or roof trusses shall be connected to the top plates of braced wall panels in accordance with one of the following methods
   - 4.1. In accordance with Figure R602.10.8.2(2),
   - 4.2. In accordance with Figure R602.10.8.2(3),
   - 4.3. With full height engineered blocking panels designed for values listed in American Forest and Paper Association (AF&PA) Wood Frame Construction Manual for One- and Two-Family Dwellings (WFCM). Both the roof and floor sheathing shall be attached to the blocking panels in accordance with Table R602.3(1).
   - 4.4. Designed in accordance with accepted engineering methods.
5. Lateral support for the rafters and ceiling joists shall be provided in accordance with Section R802.8.
6. Lateral support for trusses shall be provided in accordance with Section R802.10.3.



For SI: 1 inch = 25.4 mm

FIGURE R602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS

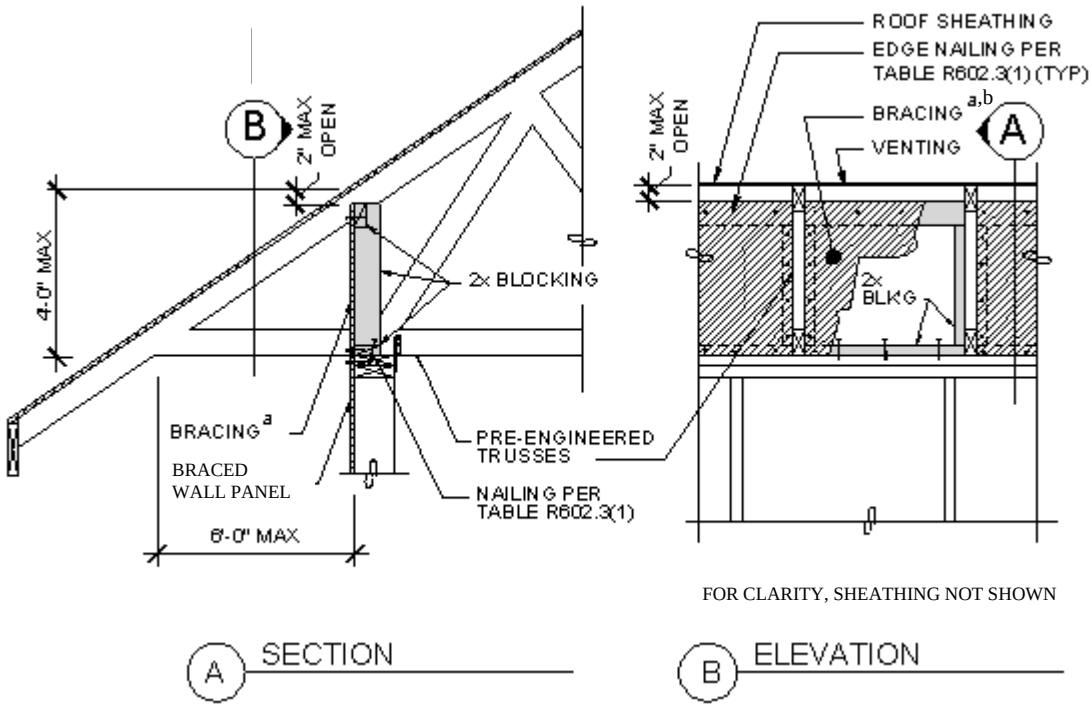


For SI: 1 inch = 25.4 mm

a. Methods of bracing shall be as described in Section R602.10.2 method DWB, WSP, SFB, GB, PBS, PCP OR HPS

b. Provide ventilation (not shown) per Section R806.

FIGURE R602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES



For SI: 1 inch = 25.4 mm

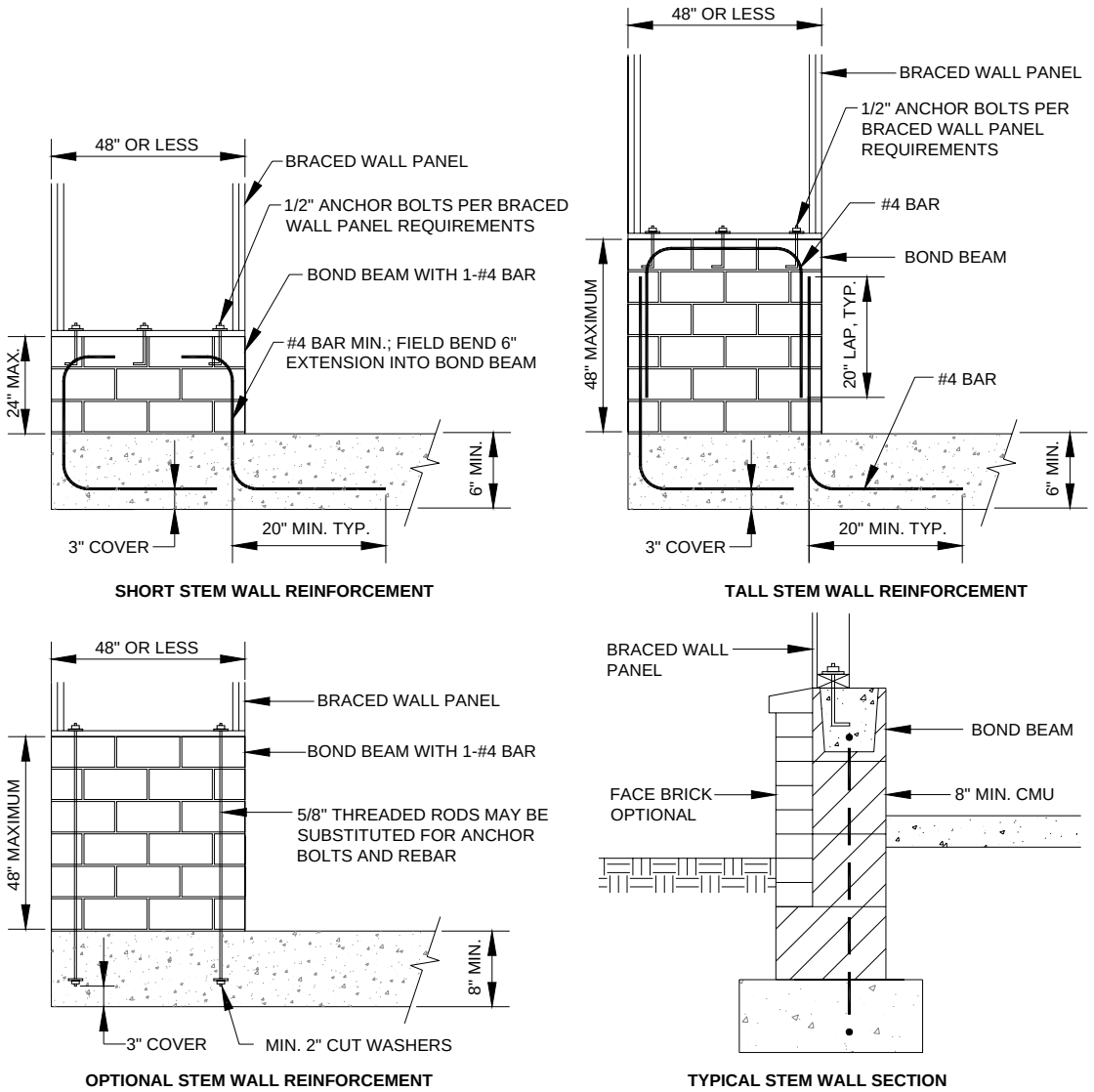
a. Methods of bracing shall be as described in Section R602.10.2 method DWB, WSP, SFB, GB, PBS, PCP OR HPS

b. Provide ventilation (not shown) per Section R608.

FIGURE R602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

R602.10.9 Braced wall panel support. Braced wall panel support shall be provided as follows:

1. Cantilevered floor joists complying with Section R502.3.3 shall be permitted to support braced wall panels.
2. Elevated post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.
3. Masonry stem walls with a length of 48 inches (1220 mm) or less supporting braced wall panels shall be reinforced in accordance with Figure R602.10.9. Masonry stem walls with a length greater than 48 inches (1220 mm) supporting braced wall panels shall be constructed in accordance with Section R403.1 Methods ABW and PFH shall not be permitted to attach to masonry stem walls.
4. Concrete stem walls with a length of 48" or less, greater than 12 inches tall and less than 6 inches thick shall have reinforcement sized and located in accordance with Figure R602.10.9.



For SI: 1 in=305 mm

FIGURE R602.10.9

MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

R602.10.9.1 Braced wall panel support for Seismic Design Category D_2. In one-story buildings located in Seismic Design Category D_2, braced wall panels shall be supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm). In two story buildings located in Seismic Design Category D_2, all braced wall panels shall be supported on continuous foundations.

Exception: Two-story buildings shall be permitted to have interior braced wall panels supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm) provided that:

1. The height of cripple walls does not exceed 4 feet (1219 mm).
2. First-floor braced wall panels are supported on doubled floor joists, continuous blocking or floor beams.
3. The distance between bracing lines does not exceed twice the building width measured parallel to the braced wall line.

R602.10.10 Panel joints. All vertical joints of 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 1-1/2 inch (38 mm) thickness.

Exceptions:

1. Blocking at horizontal joints shall not be required in wall segments that are not counted as braced wall panels.
2. Where the length of bracing provided is at least twice the required length of bracing from Tables R602.10.3(1) and R602.10.3(3) blocking at horizontal joints shall not be required in braced wall panels constructed using Methods WSP, SFB, GB, PBS or HPS.
3. When Method GB panels are installed horizontally, blocking of horizontal joints is not required.

R602.10.11 Cripple wall bracing. In Seismic Design Categories other than D_2, cripple walls shall be braced with a length and type of bracing as required for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3) with the following modifications for cripple wall bracing:

1. The length of bracing as determined from Tables R602.10.3(1) and R602.10.3(3) shall be multiplied by a factor of 1.15, and
2. The wall panel spacing shall be decreased to 18 feet (5486 mm) instead of 25 feet (7620 mm).

R602.10.11.1 Cripple wall bracing in Seismic Design Categories D_0, D_1 and D_2. In addition to the requirements of Section R602.10.11, where braced wall lines at interior walls occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be one and one-half times the length required by Table R602.10.3(3). Where cripple walls braced using Method WSP cannot provide this additional length, the capacity of the sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4 inches (102 mm) on center.

In Seismic Design Category D_2, cripple walls shall be braced in accordance with Tables R602.10.3(3) and R602.10.3(4).

R602.10.11.2 Redesignation of cripple walls. In any Seismic Design Category, 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.

Reason: As the wall bracing section evolved, it has become more universal and flexible, but, as a result, it has grown in size and complexity. After the Ad Hoc committee's "engineering" work was complete and integrated into the 2009 IRC, we heard back from end users that this section of the code was extremely challenging. The committee therefore wanted to focus on making the 2012 IRC easier to read, easier to understand and easier to use.

The *BIG BANG*: To accommodate over 30 separate editorial and technical "simplification" proposals, the Ad Hoc Committee agreed to delete Section R602.10 in its entirety, and replace it with one single change - rather than try to strikeout and insert individual tables, code sections and figures. The decision to integrate all the individual code changes into a single change was due in part to the complexity and interconnectivity of the pieces, and the necessity to "visualize" the final product in its totality. **Everything in this single change had unanimous support among committee members and was deemed to be non-controversial in nature**.

There are several other changes being proposed by committee members that are being submitted independent of this integrated change because of their scope and nature. Some have the unanimous backing of the committee, but may generate discussion from the floor, and others are being offered separately by individual members of the committee because of their content.

Non-technical changes:

Many of the code changes are reorganizational in nature from the 2009 IRC; we moved similar ideas and concepts together to read more smoothly, we merged or deleted unnecessary or duplicated pieces, and made editorial clarifications and improvements.

Technical changes:

The significant technical changes incorporated into this new section are listed below.

Table R602.3(1):

A new row was added to the table that incorporates the nailing requirements of 2009 IRC Figure R602.10.4.4(1) thus eliminating the large and complex figure. All other requirements of the eliminated figure are already covered elsewhere in the IRC. A new requirement for fastening the rim board to sill plate was added to complete the load path from braced wall panels to the foundation.

Section R602.10.1.1:

- A new figure was added to replace several less effective figures: it clarifies offsets, BWL spacing, and explains how to handle the situation when an intersecting braced wall line is not present to define the length of BWL – it now explains that the end of the building will determine its length.

Section R602.10.2.2 and R602.10.2.3:

- For consistency, the distance from the end of a BWL to the first BWP was unified at 10 feet for all SDCs and wind speeds.
- The required summation of end distances was eliminated (2009 IRC Section R602.10.1.4); in its place, braced wall lines up to 16 feet in length may have only one braced wall panel.
- BWP spacing was changed from 25' o.c.to a 20' edge-to-edge spacing to make it easier to measure.
- Another new figure was introduced to better demonstrate how BWPs may be located along the walls of the house.

Section R602.10.3:

- The contribution from BWP on an angled wall was clarified.

Tables R602.10.3(1) and (3):

- Method GB was redefined as a <u>one sided, 4' application only</u>, because of the problem with interpreting what "double sided GB" meant. To compensate, the required length of bracing for a braced wall line with Method GB was doubled in these two tables.
- Method CS-SFB was integrated into the tables as well.

Section R602.10.5:

- Section R602.10.5 was deleted and the provisions for the use of Continuous Sheathing- Structural Fiberboard Sheathing were placed in the appropriate sections
-

Section R602.10.4.1, Item 5:

- The option to mix intermittent and continuous methods on a single braced wall line was provided. When a braced wall line begins on the exterior of the building and continues through the interior, the designer can brace the interior portions with intermittent methods and utilize the advantages of continuous sheathing on the exterior portions.

Figure R602.10.6.2:

- The option for a pony wall atop a PFH portal frame was added so that all portal frames (including PFG and CS-PF) allow the pony wall extension above the header.

Figure R602.10.7:

- A new end condition was added. Condition 3 allows no return panels or hold-downs if a 4 foot braced wall panel is located at the end of the braced wall line.

The uplift load path section, previously R602.10.1.2.1, was clarified, strengthened and moved to become Section R602.3.5.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: LSTIBUREK-RB-1-R602.7

Public Hearing Results

Committee Action: Approved as Modified

Modify the proposal as follows:

R602.3.5 Braced wall panel uplift load path. Braced wall panels located at exterior walls that support roof rafters or trusses (including stories below top story) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
   1.1 The basic wind speed does not exceed 90 mph (40 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, or
   1.2 The net uplift value at the top of a wall does not exceed 100 plf (146 N/mm). The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by ~~40~~ <u>60</u> plf (~~57~~ <u>86</u> N/mm) for each full wall above ~~and 40 plf (57 N/mm) for each floor platform above~~.
2. Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing approved uplift framing connectors to provide a continuous load path from the top of the wall to the foundation or to a point where the uplift force is 100 plf (146 N/mm) or less. The net uplift value shall be as determined in Item 1.2 above.
3. Wall sheathing and fasteners designed in accordance with accepted engineering practice to resist combined uplift and shear forces.

TABLE R802.11
REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS
TO RESIST WIND UPLIFT FORCES[a, b, c, e, f]
(Pounds per connection)
(No change to table values)

a. through e. *(No change)*

f. 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).

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] (Multiply length from Table R602.10.3(1) by this factor)	APPLICABLE METHODS
Story height (Section 301.3)	Any story	≤10 ft	1.0	All methods
		>10 ft ≤ 12 ft	1.2	
Braced wall line spacing, townhouses in SDC C	Any story	≤35 ft	1.0	
		>35 ft ≤ 50 ft	1.43	
Braced wall line spacing, in SDC D_0, D_1, D_2[c]	Any story	≥25 ft ≤30 ft	1.2	
		>30 ft ≤ 35 ft	1.4	
Wall dead load	Any story	> 8 ft < 15 ft	1.0	
		<8 psf	0.85	
Roof/ceiling dead load for wall supporting	Roof only or roof plus one or two stories	<15 psf	1.0	
	Roof only	>15 psf ≤ 25 psf	1.2	
	Roof plus one or two stories	>15 psf ≤ 25 psf	1.1	
Walls with stone or masonry veneer	Any story	See Section R703.7		
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB

R602.10.11 Cripple wall bracing. In Seismic Design Categories other than D_2, cripple walls shall be braced with a length and type of bracing as required for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3) with the following modifications for cripple wall bracing:

1. The length of bracing as determined from Tables R602.10.3(1) and R602.10.3(3) shall be multiplied by a factor of 1.15, and
2. The wall panel spacing shall be decreased to 18 feet (5486 mm) instead of ~~25~~ 20 feet (~~7620~~ mm).

(Portion of proposal not shown remains unchanged)

Committee Reason: The committee feels this is a much needed improvement and adds considerable clarification to the wall bracing provisions while reducing the number of pages from 25 to 23. The modifications corrects for the proper wall load in R602.3.5, item 1.1.2, adds a deleted footnote to Table R802.11, corrects an inequality sign (<25 ft should be >25 ft) in Table R602.10.3(4) and corrects the 25 ft to 20 ft in Section R602.10.11 to comport with Section R602.10.2.2.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Charles S. Bajnai, VBCOA and Chesterfield County, VA, representing ICC Ad-Hoc Committee on Wall Bracing, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R602.10 Wall bracing. Buildings 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 Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, braced wall lines shall be designated as straight lines ~~on~~ in the building plan placed in accordance with this section.

R602.10.1.1 Length of a braced wall line. The length of a braced wall line shall be the distance between its ends. The end of a braced wall line shall be the intersection with a perpendicular braced wall line, ~~or~~ an angled braced wall line as permitted in Section R602.10.1.4 or an exterior wall. ~~In the absence of an intersecting braced wall line, the end shall be the farthest exterior wall of the building~~ as shown in Figure R602.10.1.1.

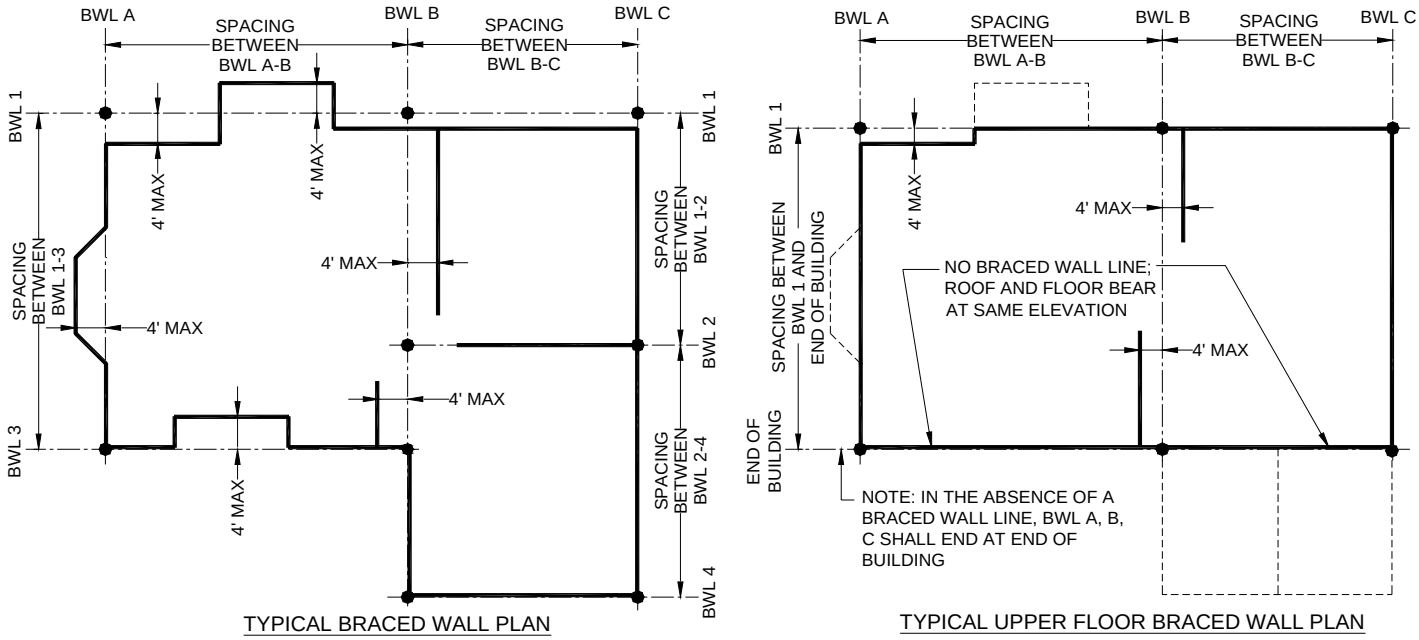


FIGURE R602.10.1.1
BRACED WALL LINES

R602.10.1.2 Offsets along a braced wall line. All exterior walls parallel to a braced wall line shall be permitted to offset up to 4 feet (1219 mm) from the designated braced wall line location as shown Figure R602.10.1.1. Interior walls used as bracing shall be permitted to offset up to 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure R602.10.1.1.

R602.10.1.3 Spacing of braced wall lines. There shall be a minimum of two braced wall lines in both the longitudinal and transverse direction as shown in Figure R602.10.1.1. Intermediate braced wall lines through the interior of the building shall be permitted. The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3.

TABLE R602.10.1.3
BRACED WALL LINE SPACING

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	**Exception to Maximum Spacing**
Wind bracing	85 mph to <110 mph	Detached, townhouse	60 feet	None
Seismic bracing	SDC A - C	Detached	Use wind bracing	
	SDC A – B	Townhouse	Use wind bracing	
	SDC C	Townhouse	35 feet	Up to 50 feet ~~with adjustment of required length of bracing per~~ when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4)
	SDC D_0, D_1, D_2	Detached, townhouses, one- and two-story only	25 feet	Up to 35 feet to allow for a single room not to exceed 900 sq ft. Spacing of all other braced wall lines shall not exceed 25 feet.
	SDC D_0, D_1, D_2	Detached, townhouse	25 feet	Up to 35 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4).

For SI: 1 foot = 304.8 mm

R602.10.1.4 Angled walls. Any portion of a wall along 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 a separate braced wall line and shall be braced in accordance with Section R602.10.1.

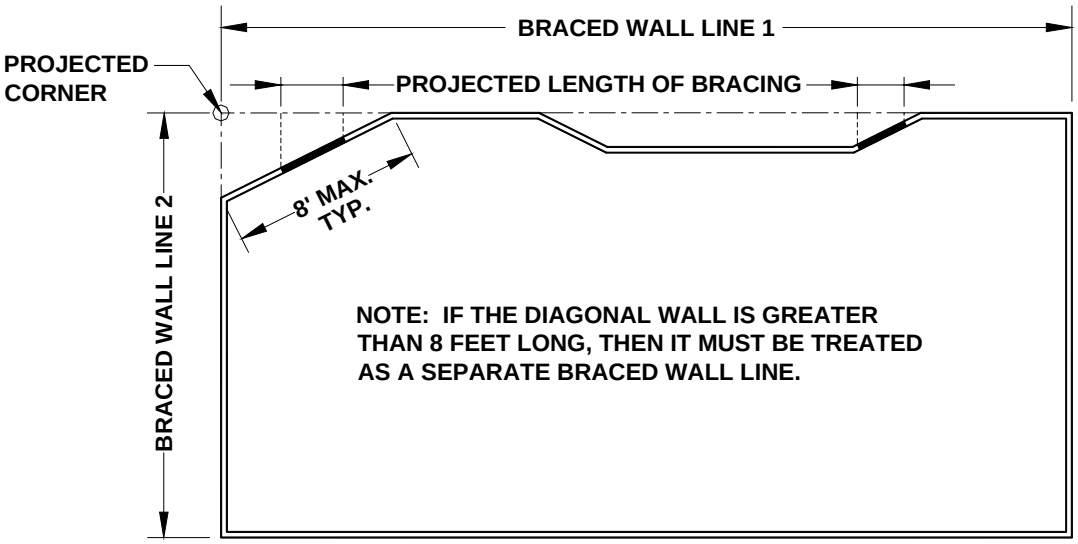


FIGURE R602.10.1.4
ANGLED WALLS

R602.10.2 Braced wall panels. Braced wall panels shall be full-height sections of wall that shall have no vertical or horizontal offsets ~~be continuous in the same plane~~. Braced wall panels shall be constructed and placed along a braced wall line in accordance with this section and the bracing methods specified in Section R602.10.4.

R602.10.2.1 Braced wall panel uplift load path. The bracing lengths in Table R602.10.3(1) apply only when uplift loads are resisted per Section R602.3.5.

R602.10.2.2 Locations of braced wall panels. A braced wall panel shall begin within 10 feet (3810 mm) from each end of a braced wall line as determined in Section R602.10.1.1. The distance between adjacent edges of ~~two~~ braced wall panels along a braced wall line shall be no greater than 20 feet (6096 mm) as shown in Figure R602.10.2.2.

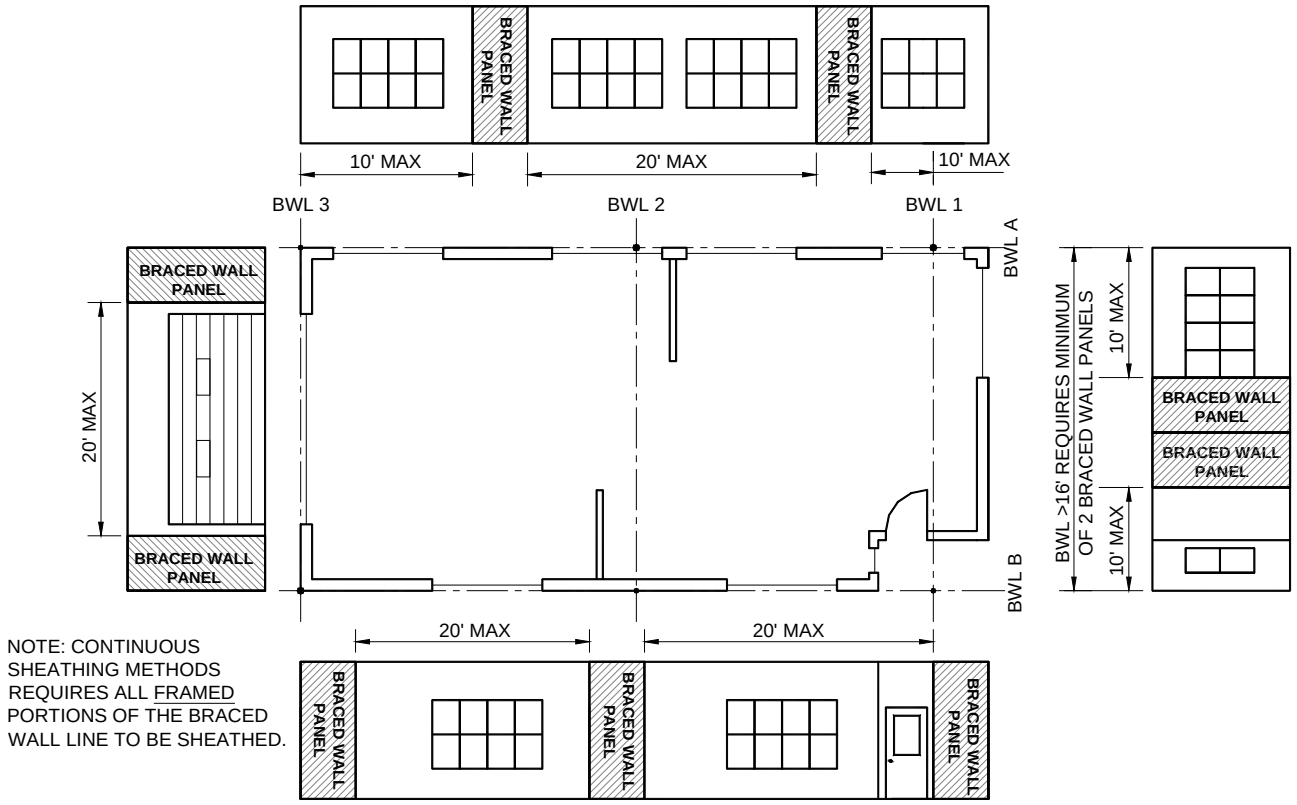


FIGURE R602.10.2.2
LOCATION OF BRACED WALL PANELS

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0, D_1 and D_2. Braced wall panels shall be located at each end of a braced wall line.

Exception: Braced wall panels constructed of Methods WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin no more than 10 feet (3048 mm) from each end of a braced wall line provided each end complies with one of the following.

1. A minimum 24 in. wide (610 mm) panel for Methods WSP, CS-WSP, CS-G, CS-PF and 32 in. (813 mm) wide panel for Method CS-SFB is applied to each side of the building corner as shown in Condition 4 of Figure R602.10.7.
2. The end of each braced wall panel closest to the end of the braced wall line shall have an 1,800 lb (8 kN) hold-down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below as shown in Condition 5 of Figure R602.10.7.

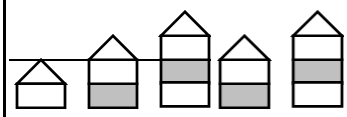
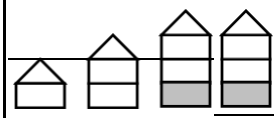
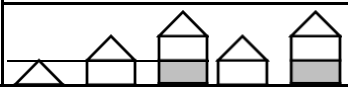
R602.10.2.3 Minimum number of braced wall panels. Braced wall lines with a length of 16 feet (4877 mm) or less shall have a minimum of ~~one~~ two braced wall panels of any length or one braced wall panel equal to 48 inches (1219 mm) or more. Braced wall lines greater than 16 feet (4877 mm) shall have a minimum of two braced wall panels.

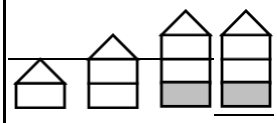
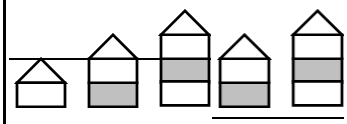
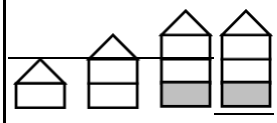
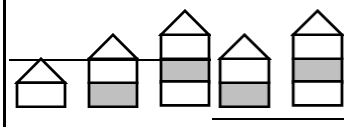
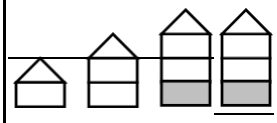
R602.10.3 Required length of bracing. The required length of bracing along each braced wall line shall be determined as follows.

1. All buildings in Seismic Design Categories A and B shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
2. Detached buildings in Seismic Design Category C shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
3. Townhouses in Seismic Design Category C shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4) respectively.
4. All buildings in Seismic Design Categories D_0, D_1 and D_2 shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4) respectively.

Only braced wall panels parallel to the braced wall line shall contribute towards the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length towards the minimum required length of bracing for ~~to~~ the braced wall line as shown in Figure R602.10.1.4. Any braced wall panel on an angled wall at the end of a braced wall line shall contribute its projected length for only one of the braced wall lines at the projected corner. ~~In no case shall the required length of bracing along a braced wall line after adjustments be less than 48 inches (1219 mm) total.~~

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

EXPOSURE CATEGORY B **30 FT MEAN ROOF HEIGHT** **10 FT EAVE TO RIDGE HEIGHT** **10 FT WALL HEIGHT** **2 BRACED WALL LINES**			**MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]**			
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Method LIB [b]**	**Method GB [c] ~~(Double Sided)~~**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB [cd]**	**Methods CS-WSP, CS-G, CS-PF**
≤ 85 ~~(mph)~~		10	3.5	3.5	2.0	1.5
		20	6.0	6.0	3.5	3.0
		30	8.5	8.5	5.0	4.5
		40	11.5	11.5	6.5	5.5
		50	14.0	14.0	8.0	7.0
		60	16.5	16.5	9.5	8.0
		10	6.5	6.5	3.5	3.0
		20	11.5	11.5	6.5	5.5
		30	16.5	16.5	9.5	8.0
		40	21.5	21.5	12.5	10.5
		50	26.5	26.5	15.0	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.0	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.0	15.5
		50	NP	39.0	22.5	19.0
		60	NP	46.5	26.5	22.5
≤ 90 ~~(mph)~~		10	3.5	3.5	2.0	2.0
		20	7.0	7.0	4.0	3.5
		30	9.5	9.5	5.5	5.0
		40	12.5	12.5	7.5	6.0
		50	15.5	15.5	9.0	7.5
		60	18.5	18.5	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	13.0	13.0	7.5	6.5
		30	18.5	18.5	10.5	9.0

EXPOSURE CATEGORY B 30 FT MEAN ROOF HEIGHT 10 FT EAVE TO RIDGE HEIGHT 10 FT WALL HEIGHT 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]			
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Method LIB [b]**	**Method GB [c] ~~(Double Sided)~~**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB [cd]**	**Methods CS-WSP, CS-G, CS-PF**
≤ 100 ~~(mph)~~		40	24.0	24.0	14.0	12.0
		50	29.5	29.5	17.0	14.5
		60	35.0	35.0	20.0	17.0
		10	NP	10.5	6.0	5.0
		20	NP	19.0	11.0	9.5
		30	NP	27.5	15.5	13.5
		40	NP	35.5	20.5	17.5
		50	NP	44.0	25.0	21.5
		60	NP	52.0	30.0	25.5
		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.0	19.0	11.0	9.5
		60	22.5	22.5	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.0	8.0
		30	23.0	23.0	13.0	11.0
		40	29.5	29.5	17.0	14.5
		50	36.5	36.5	21.0	18.0
		60	43.5	43.5	25.0	21.0
		10	NP	12.5	7.5	6.0
		20	NP	23.5	13.5	11.5
		30	NP	34.0	19.5	16.5
		40	NP	44.0	25.0	21.5
		50	NP	54.0	31.0	26.5
		60	NP	64.0	36.5	31.0
< 110 [c] ~~(mph)~~		10	5.5	5.5	3.0	3.0
		20	10.0	10.0	6.0	5.0
		30	14.5	14.5	8.5	7.0
		40	18.5	18.5	11.0	9.0
		50	23.0	23.0	13.0	11.5
		60	27.5	27.5	15.5	13.5
		10	10.5	10.5	6.0	5.0
		20	19.0	19.0	11.0	9.5
		30	27.5	27.5	16.0	13.5
		40	36.0	36.0	20.5	17.5
		50	44.0	44.0	25.5	21.5
		60	52.5	52.5	30.0	25.5
		10	NP	15.5	9.0	7.5
		20	NP	28.5	16.5	14.0
		30	NP	41.0	23.5	20.0
		40	NP	53.0	30.5	26.0
		50	NP	65.5	37.5	32.0
		60	NP	77.5	44.5	37.5

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

a. Linear interpolation shall be permitted.

b. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).

~~c. The length of bracing for Method GB is based on a double sided application. Where GB is used in a one sided application (or in combination of single sided and double sided application), the single sided GB shall only contribute half as much as the double sided GB towards the minimum required length of bracing in this table.~~

c~~d~~. Method CS-SFB does not apply where the wind speed is greater than 100 mph.

Table R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a,b] (multiply length from Table R602.10.3(1) by this factor)	APPLICABLE METHODS
Exposure category	One story structure	B	1.00	All methods
		C	1.20	
		D	1.50	
	Two-story structure	B	1.00	
		C	1.30	
		D	1.60	
	Three-story structure	B	1.00	
		C	1.40	
		D	1.70	
Roof eave-to-ridge height	Roof only	≤5 ft	0.70	
		10 ft	1.00	
		15 ft	1.30	
		20 ft	1.60	
	Roof + 1 floor	≤5 ft	0.85	
		10 ft	1.00	
		15 ft	1.15	
		20 ft	1.30	
	Roof + 2 floors	≤5 ft	0.90	
		10 ft	1.00	
		15 ft	1.10	
		20 ft	Not permitted	
Wall height adjustment	Any story	8 ft	0.90	
		9 ft	0.95	
		10 ft	1.00	
		11 ft	1.05	
		12 ft	1.10	
Number of braced wall lines (per plan direction)[c]	Any story	2	1.00	
		3	1.30	
		4	1.45	
		≥5	1.60	
Additional 800 lb hold-down device	Top story only	Fastened to the end studs of each braced wall panel and to the foundation or framing below	0.80	DWB, WSP, SFB, PBS, PCP, HPS
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.40	DWB, WSP, SFB,PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
Gypsum board fastening	Any story	4 in. o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB

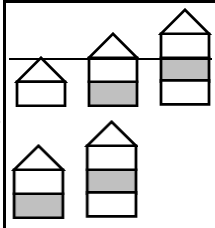
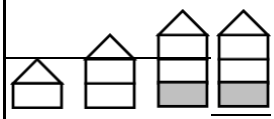
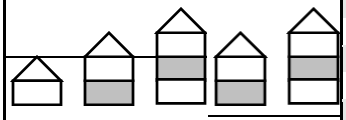
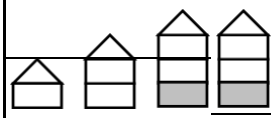
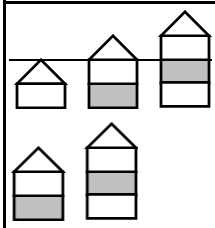
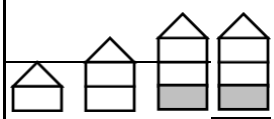
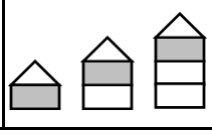
For SI: 1 foot = 305 mm, 1 lb = 4.48 N.

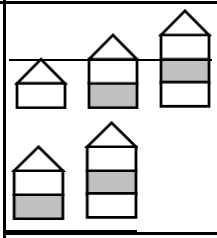
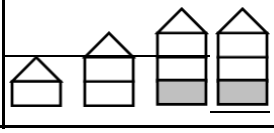
a. Linear Interpolation shall be permitted.

b. The total adjustment factor is the product of all applicable adjustment factors.

c. The adjustment factor is permitted to be 1.0 when determining bracing amounts for intermediate braced wall lines provided the bracing mounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D [b] • WALL HEIGHT = 10 FT • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD BRACED WALL LINE SPACING ≤ 25 FT			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (ft)**	**Method LIB [c]**	**Method GB ~~(Double Sided)~~ [d]**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB [de]**	**Method WSP**	**Methods CS-WSP, CS-G**
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7
		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
D_0		10	NP	2.8	2.8	1.8	1.6
		20	NP	5.5	5.5	3.6	3.1
		30	NP	8.3	8.3	5.4	4.6
		40	NP	11.0	11.0	7.2	6.1
		50	NP	13.8	13.8	9.0	7.7
		10	NP	5.3	5.3	3.8	3.2
		20	NP	10.5	10.5	7.5	6.4
		30	NP	15.8	15.8	11.3	9.6
		40	NP	21.0	21.0	15.0	12.8
		50	NP	26.3	26.3	18.8	16.0
		10	NP	7.3	7.3	5.3	4.5
		20	NP	14.5	14.5	10.5	9.0
		30	NP	21.8	21.8	15.8	13.4
		40	NP	29.0	29.0	21.0	17.9
		50	NP	36.3	36.3	26.3	22.3
D_1		10	NP	3.0	3.0	2.0	1.7
		20	NP	6.0	6.0	4.0	3.4
		30	NP	9.0	9.0	6.0	5.1
		40	NP	12.0	12.0	8.0	6.8
		50	NP	15.0	15.0	10.0	8.5
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	8.5	8.5	6.0	5.1
		20	NP	17.0	17.0	12.0	10.2
		30	NP	25.5	25.5	18.0	15.3
		40	NP	34.0	34.0	24.0	20.4
		50	NP	42.5	42.5	30.0	25.5
D_2		10	NP	4.0	4.0	2.5	2.1
		20	NP	8.0	8.0	5.0	4.3
		30	NP	12.0	12.0	7.5	6.4
		40	NP	16.0	16.0	10.0	8.5
		50	NP	20.0	20.0	12.5	10.6

• SOIL CLASS D [b] • WALL HEIGHT = 10 FT • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD BRACED WALL LINE SPACING ≤ 25 FT			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (ft)**	**Method LIB [c]**	**Method GB ~~(Double Sided)~~ [d]**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB [de]**	**Method WSP**	**Methods CS-WSP, CS-G**
		10	NP	7.5	7.5	5.5	4.7
		20	NP	15.0	15.0	11.0	9.4
		30	NP	22.5	22.5	16.5	14.0
		40	NP	30.0	30.0	22.0	18.7
		50	NP	37.5	37.5	27.5	23.4
		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP

For SI: 1 foot 305 mm

a. Linear interpolation shall be permitted.

b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the Seismic Design Categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.5 of the International Building Code.

c. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).

~~d. The length of bracing for Method GB is based on a double sided application. Where GB is used in a one sided application (or in combination of single sided and double sided application), the single sided GB shall only contribute half as much as the double sided GB towards the minimum required length of bracing in this table.~~

d~~e~~. Method CS-SFB applies in SDC C only.

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] (Multiply length from Table R602.10.3(1) by this factor)	APPLICABLE METHODS
Story height (Section 301.3)	Any story	≤10 ft	1.0	All methods
		>10 ft ≤ 12 ft	1.2	
Braced wall line spacing, townhouses in SDC C	Any story	≤35 ft	1.0	
		>35 ft ≤ 50 ft	1.43	
Braced wall line spacing, in SDC D_0, D_1, D_2[,c]	Any story	> 25 ft ≤30 ft	1.2	
		>30 ft ≤ 35 ft	1.4	
Wall dead load	Any story	> 8 ft < 15 ft	1.0	
		<8 psf	0.85	
Roof/ceiling dead load for wall supporting	Roof only or roof plus one or two stories	~~<~~ ≤15 psf	1.0	
	~~Roof only~~	~~>15 psf ≤ 25 psf~~	~~1.2~~	
	Roof plus one or two stories	>15 psf ≤ 25 psf	1.1	
	Roof only	>15 psf ≤ 25 psf	1.2	
Walls with stone or masonry veneer	Any story	See Section R703.7		
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB

For SI: 1 psf = 47,8 N/m^2.

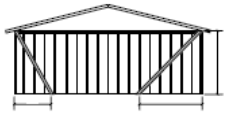
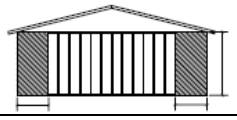
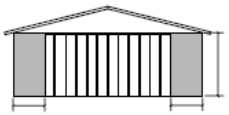
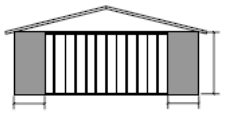
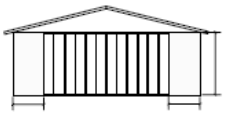
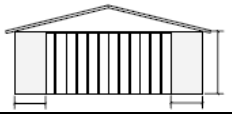
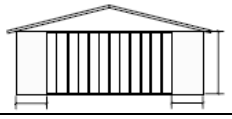
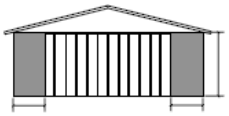
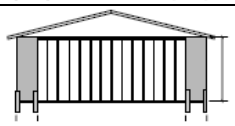
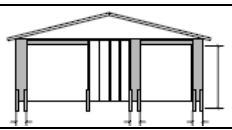
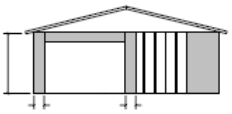
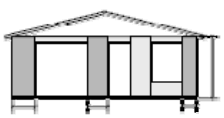
a. Linear interpolation shall be permitted.

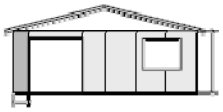
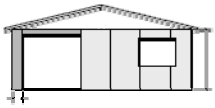
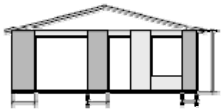
b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.

c. The length-to-width ratio for the floor/roof diaphragm shall not exceed 3:1. The top plate lap splice nailing shall be a minimum of 12-16d nails on each side of the splice.

R602.10.4 Construction methods for braced wall panels. Intermittent and continuously sheathed braced wall panels shall be constructed in accordance with this section and the methods listed in Table R602.10.4.

TABLE R602.10.4
BRACING METHODS

	METHODS,MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA [a]	
				Fasteners	Spacing
Intermittent Bracing Methods	**LIB** Let-in-bracing	1x4 wood or approved metal straps at 45° to 60° angles for maximum 16" stud spacing		Wood: 2-8d common nails or 3-8d (2 ½" long x 0.113" dia.) nails	Wood: per stud and top and bottom plates
				Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	¾" (1" nominal) for maximum 24" stud spacing		2-8d (2½" long x 0.113" dia.) nails or 2 - 1¾" long staples	Per stud
	WSP Wood structural panel (See Section R604)	$^3/_8$"		Exterior sheathing per Table R602.3(3)	6" edges 12" field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	SFB Structural fiberboard sheathing	$^1/_2$" or $^{25}/_{32}$" for maximum 16" stud spacing		1½" long x 0.12" dia. (for ½ " thick sheathing) $1^3/_4$" long x 0.12" dia. (for $^{25}/_{32}$" thick sheathing) galvanized roofing nails or 8d common (2½" long x0.131" dia.) nails	3" edges 6" field
	GB [d] Gypsum board ~~(double sided)~~	$^1/_2$"		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7" edges (including top and bottom plates) 7" field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	$^3/_8$" or $^1/_2$" for maximum16" stud spacing		For 3/8", 6d common (2" long x0.113" dia.) nails For ½", 8d common (2½" long x0.131" dia.) nails	3" edges 6" field
	PCP Portland cement plaster	See Section R703.6 for maximum 16" stud spacing		1½" long, 11 gage, $^7/_{16}$" dia. head nails or $^7/_{~~16~~8}$" long, 16 gage staples	6" o.c. on all framing members
	HPS Hardboard panel siding	$^7/_{16}$" for maximum 16" stud spacing		0.092" dia., 0.225" dia. head nails with length to accommodate 1½" penetration into studs	4" edges 8" field
	ABW Alternate braced wall	$^3/_8$"		See Section R602.10.6.1	See Section R602.10.6.1
	PFH Portal frame with hold-downs	$^3/_8$		See Section R602.10.6.2	See Section R602.10.6.2
	PFG Portal frame at garage	$^7/_{16}$"		See Section R602.10.6.3	See Section R602.10.6.3
Sheathing	**CS-WSP** Continuously sheathed wood structural panel	$^3/_8$"		Exterior sheathing per Table R602.3(3)	6" edges 12" field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener

	CS-G [b,c] Continuously sheathed wood structural panel adjacent to garage openings	$^3/_8$"		See Method CS-WSP	See Method CS-WSP
	CS-PF Continuously sheathed portal frame	$^7/_{16}$"		See Section R602.10.6.4	See Section R602.10.6.4
	CS-SFB [d] Continuously sheathed structural fiberboard	$^1/_2$" or $^{25}/_{32}$" for maximum 16" stud spacing		1½" long x 0.12" dia. (for ½ " thick sheathing) $1^3/_4$" long x 0.12" dia. (for $^{25}/_{32}$" thick sheathing) galvanized roofing nails or 8d common (2½" long x0.131" dia.) nails	3" edges 6" field

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

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.

b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1, and D_2, roof covering dead load may not exceed 3 psf (0.14 kN/m^2).

c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.

~~d. "Double sided" GB shall mean that a full length/full height panel of GB sheathing is applied to both sides of the stud wall. GB bracing panels are not required to be aligned back to back – they may be offset from each other so long as their length's comply with Table R602.10.5. Where all of the GB is on one side of the studs or where there is a combination of "double sided" GB and "single sided" GB, the single sided GB shall contribute half of its actual length towards the minimum required length (i.e. 96" of single sided GB is equivalent to 48" of double sided GB).~~

d. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2 and in areas where the wind speed exceeds 100 mph.

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from braced wall line to braced wall line within a story shall be permitted. Within Seismic Design Categories A, B and C or in regions where the basic wind speed is less than or equal to 100 mph, mixing of intermittent bracing and continuous sheathing methods from braced wall line to braced wall line within a story shall be permitted.
3. Mixing intermittent bracing methods along a braced wall line shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C provided the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a braced wall line shall be permitted.
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a braced wall line with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same braced wall line shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the braced wall line.

R602.10.4.2 Continuous sheathing methods. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a braced wall line including areas above and below openings and gable end walls and shall meet the requirements of Section R602.10.7.

R602.10.4.3 Braced wall panel interior finish material. Braced wall panels shall have gypsum wall board installed on the side of the wall opposite the bracing material. Gypsum wall board shall be not less than ½ inch (12.7 mm) in thickness and be fastened with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum wall board. Spacing of fasteners at panel edges for gypsum wall board opposite Method LIB bracing shall not exceed 8 inches (203 mm). Interior finish material shall not be glued in Seismic Design Categories D_0, D_1 and D_2.

Exceptions:

1. Interior finish material is not required opposite wall panels that are braced in accordance with Method GB, ABW, PFH, PFG and CS-PF, unless otherwise required by Section R302.6.
2. An approved interior finish material with an in-plane shear resistance equivalent to gypsum board shall be permitted to be substituted, unless otherwise required by Section R302.6.
3. Except for Method LIB, gypsum wall board is permitted to be omitted provided the required length of bracing in Tables R602.10.3(1) and R602.10.3(3) is multiplied by the appropriate adjustment factor in Tables R602.10.3(2) and R602.10.3(4) respectively, unless otherwise required by Section R302.6.

R602.10.5 Minimum length of a braced wall panel. The minimum length of a braced wall panel shall comply with Table R602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table R602.10.5 and Figure R602.10.5. When a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.

R602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Table R602.10.3(1) and R602.10.3(3), the contributing length of each braced wall panel shall be as specified in Table R602.10.5.

TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

METHOD (See Table R602.10.4)		MINIMUM LENGTH [a] (in) Wall Height					CONTRIBUTING LENGTH (in)
		8 ft	9 ft	10 ft	11 ft	12 ft	
DWG, WSP, SFB, PBS, PCP, HPS~~, GB~~ [a]		48	48	48	53	58	Actual [b]
GB		48	48	48	53	58	Double sided = Actual Single sided = 0.5 x Actual
LIB		55	62	69	NP	NP	Actual [b]
ABW	SDC A, B and C, wind speed < 110 mph	28	32	34	38	42	48
	SDC D_0, D_1 and D_2, wind speed < 110 mph	32	32	34	NP	NP	
PFH	Supporting roof only	16	16	16	18 ~~[d]~~[c]	20 ~~[d]~~[c]	48
	Supporting one story and roof	24	24	24	27 ~~[d]~~[c]	29 ~~[d]~~[c]	48
PFG		24	27	30	33 ~~[e]~~[d]	36 ~~[e]~~[d]	1.5 x Actual [b]
CS-G		24	27	30	33	36	Actual [b]
CS-PF		16	18	20	22 ~~[f]~~[e]	24 ~~[f]~~[e]	Actual [b]
CS-WSP, CS-SFB	Adjacent clear opening height (in)						
	≤ 64	24	27	30	33	36	Actual [b]
	68	26	27	30	33	36	
	72	27	27	30	33	36	
	76	30	29	30	33	36	
	80	32	30	30	33	36	
	84	35	32	32	33	36	
	88	38	35	33	33	36	
	92	43	37	35	35	36	
	96	48	41	38	36	36	
	100		44	40	38	38	
	104		49	43	40	39	
	108		54	46	43	41	
	112			50	45	43	
	116			55	48	45	
	120			60	52	48	
	124				56	51	
	128				61	54	
	132				66	58	
	136					62	
	140					66	
	144					72	

For SI: 1 inch = 25.4 mm

NP = Not permitted

a. Linear interpolation shall be permitted.

b. Use the actual length when it is greater than or equal to the minimum length.

~~c. As specified in Table R602.10.4, Method GB is intended to be double sided. Where all of the GB is on one side of the studs or where there is a combination of "double sided" GB and "single sided" GB, the single sided GB shall contribute half of its actual length towards the minimum required length (i.e. 96" of single sided GB is equivalent to 48" of double sided GB).~~

~~d~~c. Maximum header height for PFH is 10' per Figure R602.10.6.2, but wall height may be increased to 12' with pony wall.

~~e~~d. Maximum opening height for PFG is 10' per Figure R602.10.6.3, but wall height may be increased to 12' with pony wall.

~~f~~e. Maximum opening height for CS-PF is 10' per Figure R602.10.6.4, but wall height may be increased to 12' with pony wall

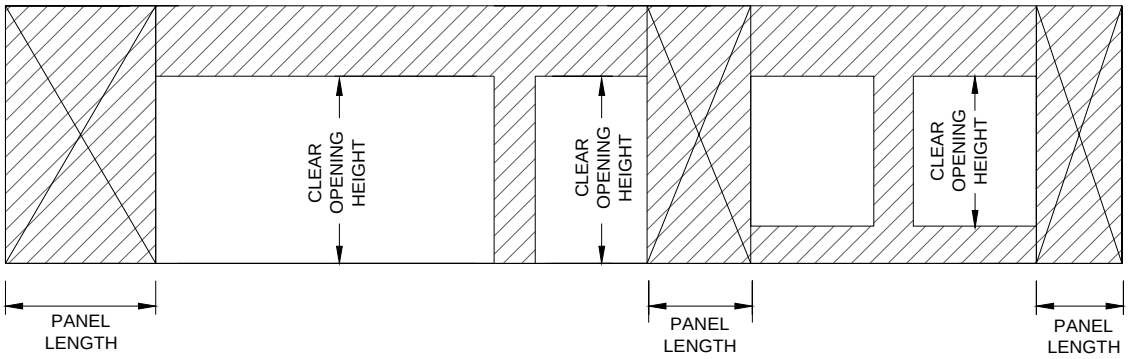


FIGURE R602.10.5
BRACED WALL PANELS WITH CONTINUOUS SHEATHING

R602.10.5.2 Partial credit. For Methods DWB, WSP, SFB, PBS, PCP and HPS in Seismic Design Categories A, B and C, panels between 36 inches and 48 inches in length shall be considered a braced wall panel and shall be permitted to partially contribute towards the required length of bracing in Table R602.10.3(1) and R602.10.3(3), and the contributing length shall be determined from Table R602.10.5.2.

TABLE R602.10.5.2
PARTIAL CREDIT FOR BRACED WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH

Actual Length of Braced Wall Panel (in)	Contributing Length of Braced Wall Panel (in) [a]	
	8 ft Wall Height	9 ft Wall Height
48	48	48
42	36	36
36	27	N/A

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

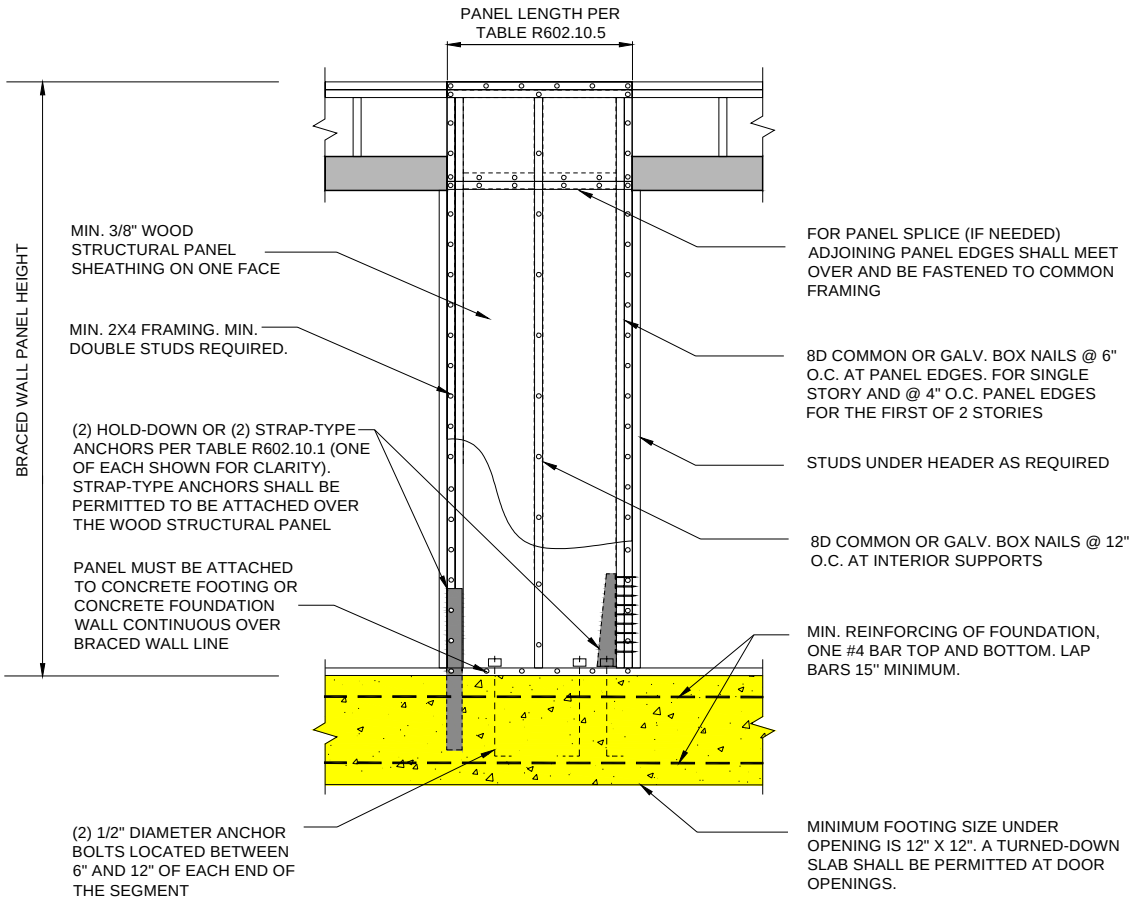
R602.10.6 Construction of Methods ABW, PFH, PFG and CS-PF. Methods ABW, PFH, PFG and CS-PF shall be constructed as specified in Sections R602.10.6.1 through R602.10.6.4.

R602.10.6.1 Method ABW: Alternate braced wall panels. Method ABW braced wall panels shall be constructed in accordance with Figure R602.10.6.1. The hold-down force shall be in accordance with Table R602.10.6.1.

TABLE R602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/STORY	HOLD DOWN FORCE (lb)				
		Height of Braced Wall Panel				
		8 ft	9 ft	10 ft	11 ft	12 ft
SDC A, B and C Wind speed < 110 mph	One story	1800	1800	1800	2000	2200
	First of two story	3000	3000	3000	3300	3600
SDC D_o, D_1 and D_2 Wind speed < 110 mph	One story	1800	1800	1800	NP [a]	NP [a]
	First of two story	3000	3000	3000	NP [a]	NP [a]

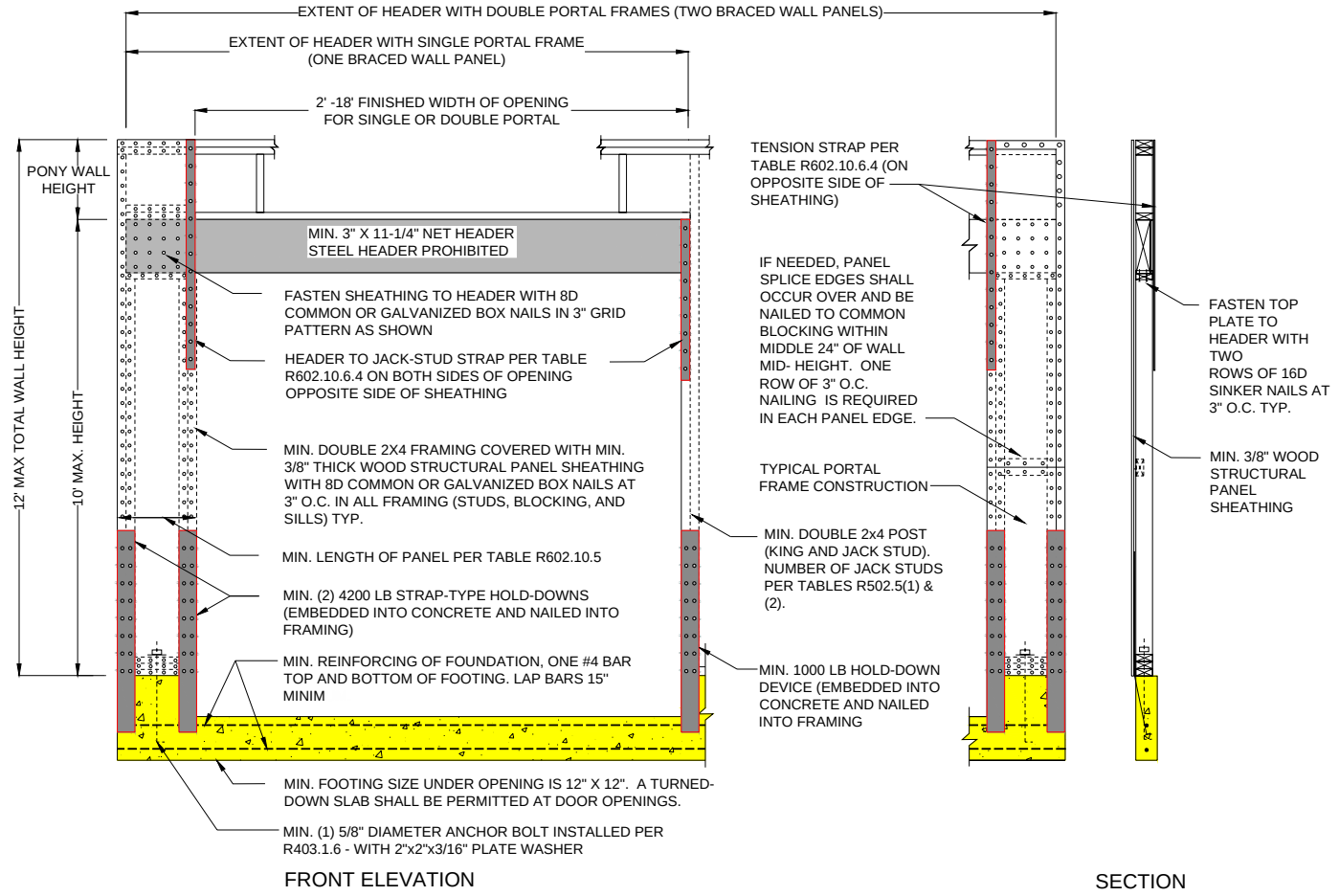
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N
a. NP = Not Permitted.



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

FIGURE R602.10.6.1
METHOD ABW: ALTERNATE BRACED WALL PANEL

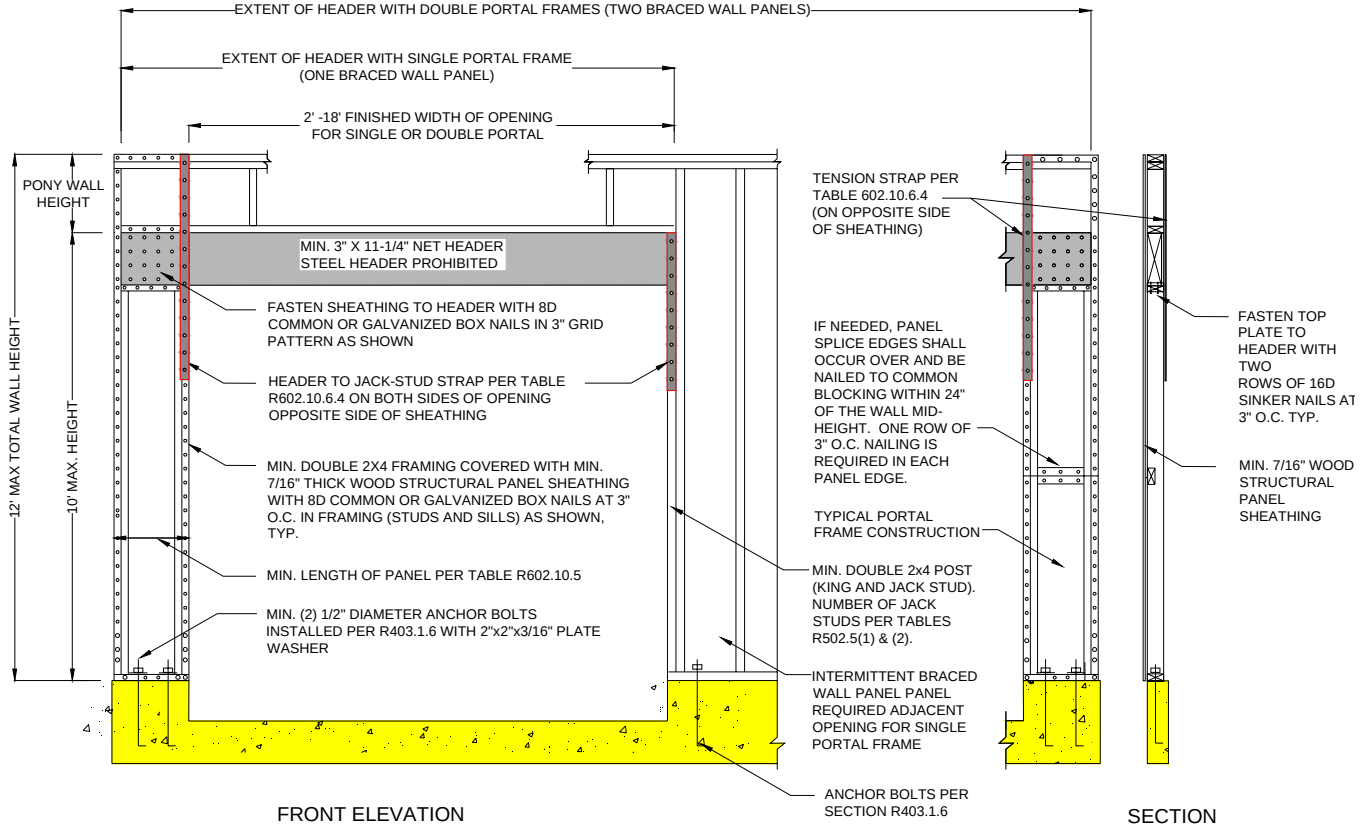
R602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH braced wall panels shall be constructed in accordance with Figure R602.10.6.2.



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

FIGURE R602.10.6.2
METHOD PFH: PORTAL FRAME WITH HOLD-DOWNS

R602.10.6.3 Method PFG: Portal frame at garage door openings in Seismic Design Categories A, B and C. Where supporting a roof or one story and a roof, a Method PFG braced wall panel constructed in accordance with Figure R602.10.6.3 ~~is~~ shall be permitted on either side of garage door openings.



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

FIGURE R602.10.6.3
METHOD PFG: PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B AND C

R602.10.6.4 Method CS-PF: Continuously sheathed portal frame. Continuously sheathed portal frame braced wall panels shall be constructed in accordance with Figure R602.10.6.4 and Table R602.10.6.4. The number of continuously sheathed portal frame panels in a single braced wall line shall not exceed four.

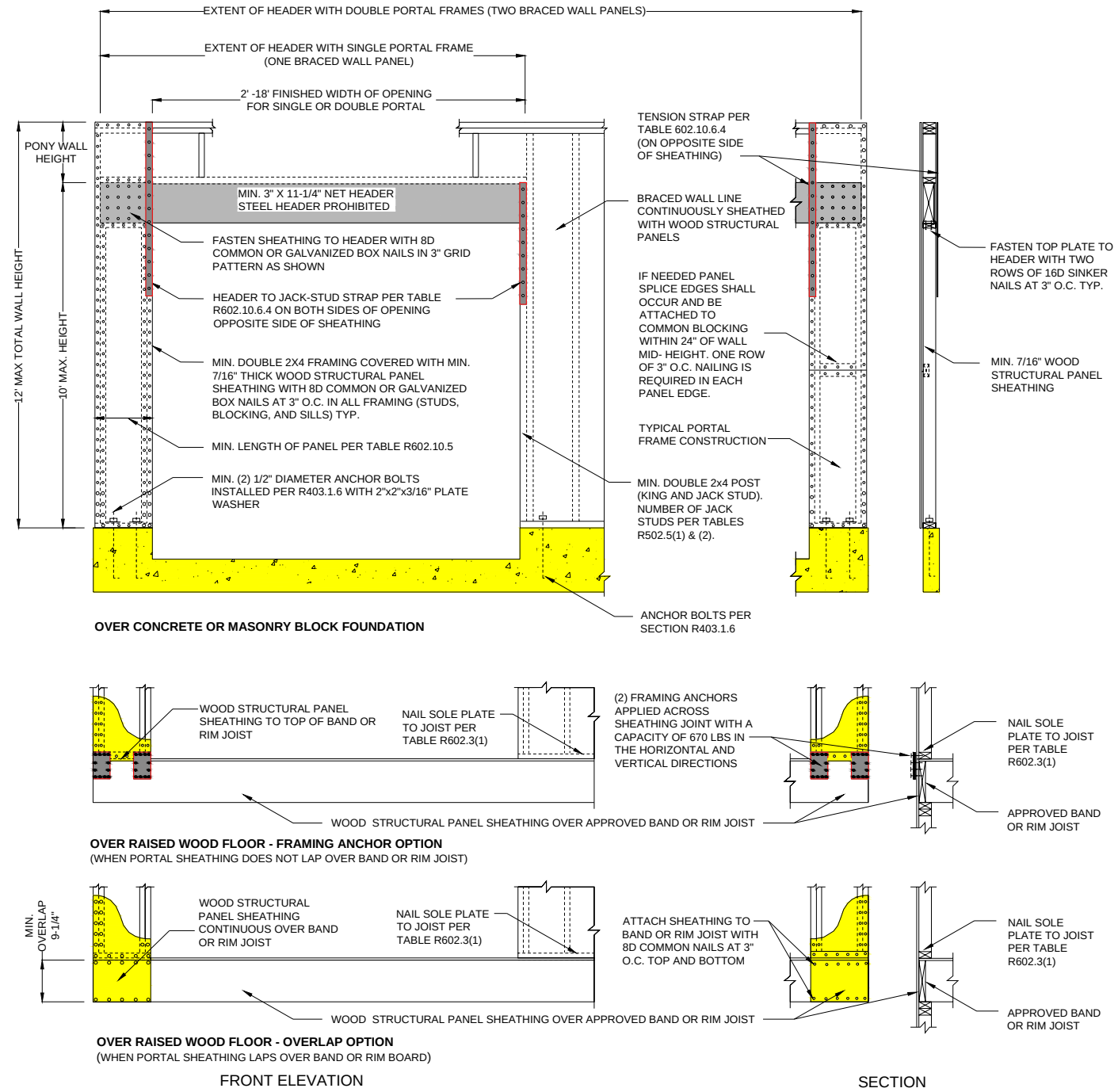
TABLE R602.10.6.4
TENSION STRAP CAPACITY REQUIRED FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHOD PFH, PFG AND CS-PF BRACED WALL PANELS

MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE	MAXIMUM PONY WALL HEIGHT (ft)	MAXIMUM TOTAL WALL HEIGHT (ft)	MAXIMUM OPENING WIDTH (ft)	TENSION STRAP CAPACITY REQUIRED (lb)[a, b]					
				Basic Wind Speed (mph)					
				85	90	100	85	90	100
				Exposure B			Exposure C		
2x4 No. 2 Grade	0	10	18	1000	1000	1000	1000	1000	1000
	1	10	9	1000	1000	1000	1000	1000	1275
			16	1000	1000	1750	1800	2325	3500
			18	1000	1200	2100	2175	2725	DR
	2	10	9	1000	1000	1025	1075	1550	2500
			16	1525	2025	3125	3200	3900	DR
			18	1875	2400	3575	3700	DR	DR
	2	12	9	1000	1200	2075	2125	2750	4000
			16	2600	3200	DR	DR	DR	DR
			18	3175	3850	DR	DR	DR	DR
	4	12	9	1775	2350	3500	3550	DR	DR
			16	4175	DR	DR	DR	DR	DR
2x6 Stud Grade	2	12	9	1000	1000	1325	1375	1750	2550
			16	1650	2050	2925	3000	3550	DR
			18	2025	2450	3425	3500	4100	DR
	4	12	9	1125	1500	2225	2275	2775	3800
			16	2650	3150	DR	DR	DR	DR
			18	3125	3675	DR	DR	DR	DR

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

a. DR = design required

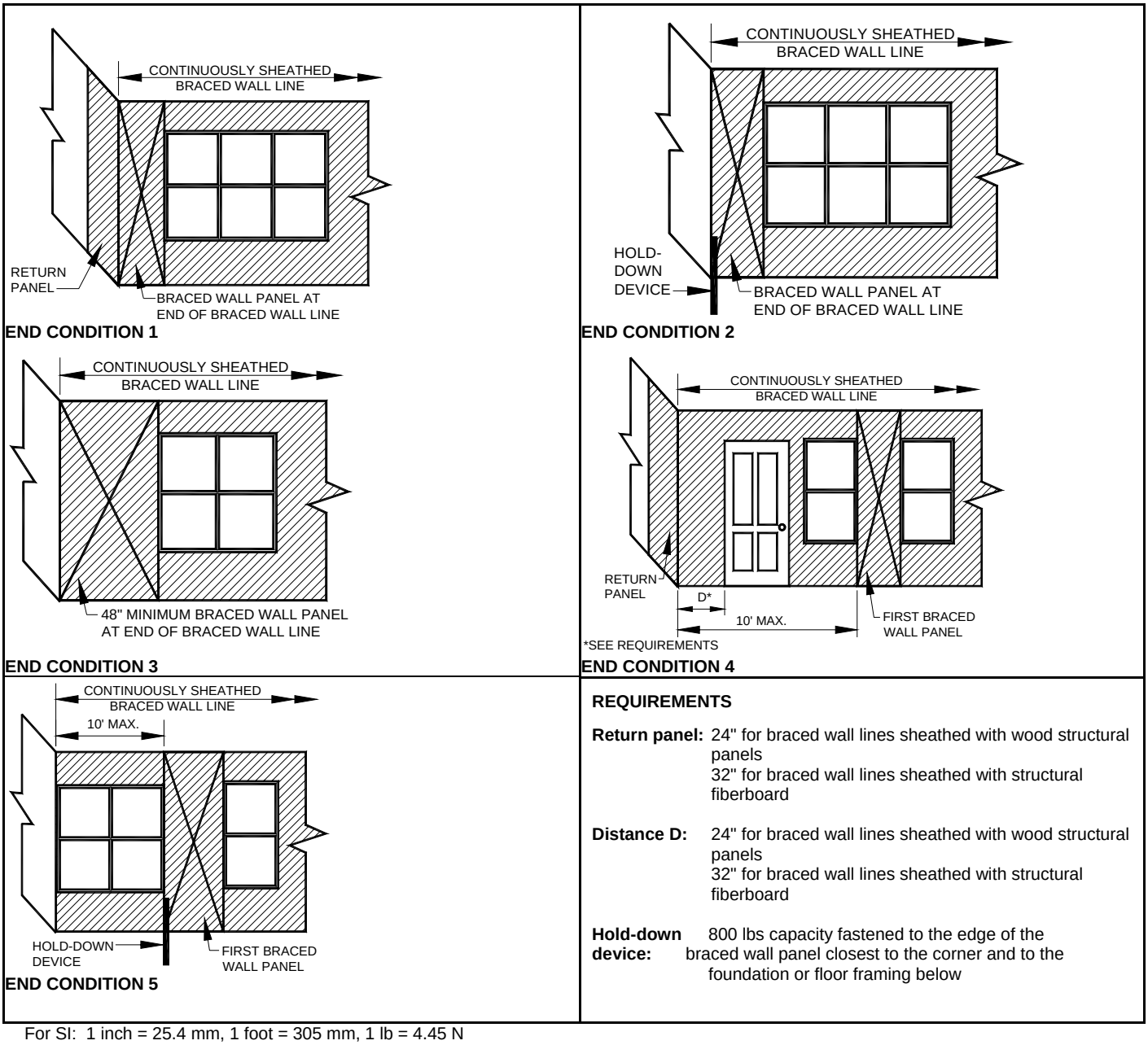
b. Strap shall be installed in accordance with manufacturer's recommendations.



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

FIGURE R602.10.6.4
METHOD CS-PF: CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

R602.10.7 Ends of braced wall lines with continuous sheathing. Each end of a braced wall line with continuous sheathing shall have one of the conditions shown in Figure R602.10.7.

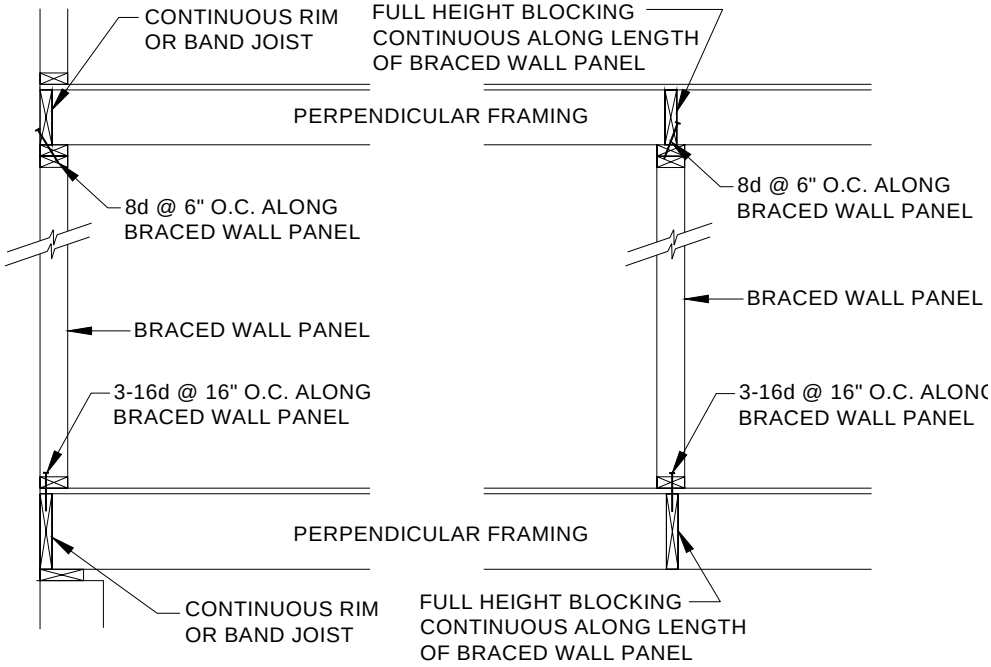


For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N

FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

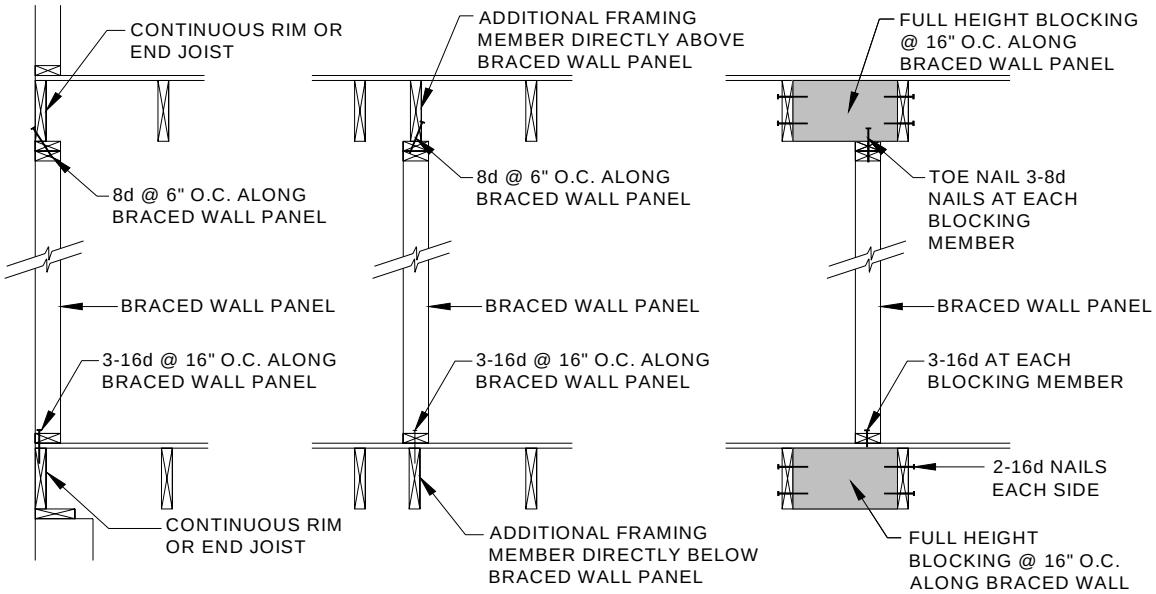
R602.10.8 Braced wall panel connections. Braced wall panels shall be connected to floor framing or foundations as follows:

1. Where joists are perpendicular to a braced wall panel above or below, a rim joist, band joist or blocking shall be provided along the entire length of the braced wall panel in accordance with Figure R602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist and/or blocking shall be in accordance with Table R602.3(1).
2. Where joists are 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 braced wall panel in accordance with Figure R602.10.8(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 R602.10.8(2). Fastening of blocking and wall plates shall be in accordance with Table R602.3(1) and Figure R602.10.8(2).
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 R602.10.8(1)
BRACED WALL PANEL CONNECTION WHEN PERPENDICULAR TO FLOOR/CEILING FRAMING



For SI: 1 inch = 25.4 mm

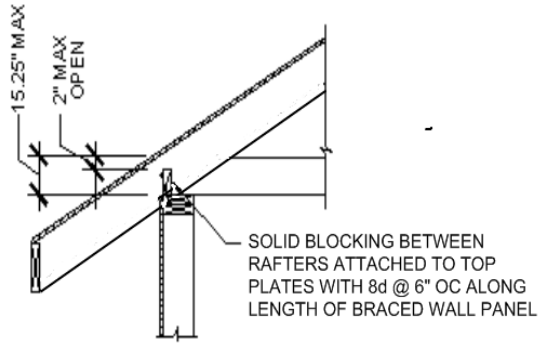
FIGURE R602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN

PARALLEL TO FLOOR/CEILING FRAMING

R602.10.8.1 Braced wall panel connections for Seismic Design Categories D_0, D_1 and D_2. Braced wall panels shall be fastened to required foundations in accordance with Section R602.11.1, and top plate lap splices shall be face-nailed with at least eight 16d nails on each side of the splice.

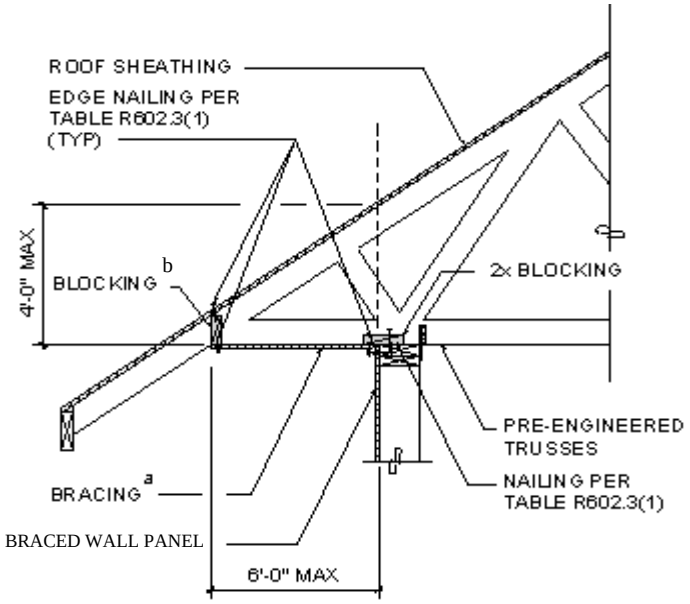
R602.10.8.2 Connections to roof framing. Exterior braced wall panels shall be connected to roof framing as follows.

1. Parallel rafters or roof trusses shall be attached to the top plates of braced wall panels in accordance with Table R602.3(1).
2. For Seismic Design Categories A, B and C and wind speeds less than 100 mph (45 m/s):
   - 2.1 Where the distance from the top of the rafters or roof trusses and perpendicular top plates is 9.25 inches (235 mm) or less, the rafters or roof trusses shall be connected to the top plates of braced wall panels in accordance with Table R602.3(1) and blocking need not be installed.
   - 2.2 Where the distance from the top of the rafters and perpendicular top plates is between 9.25 inches (235 mm) and 15.25 inches (387 mm) the rafters shall be connected to the top plates of braced wall panels with blocking in accordance with Figure R602.10.8.2(1) and attached in accordance with Table R602.3(1).
   - 2.3 Where the distance from the top of the roof trusses and perpendicular top plates is between 9.25 inches (235 mm) and 15.25 inches (387 mm) the roof trusses shall be connected to the top plates of braced wall panels with blocking in accordance with Table R602.3(1).
3. For Seismic Design Categories D_0, D_1 and D_2 or wind speeds of 100 mph (45 m/s) or greater, where the distance between the top of rafters or roof trusses and perpendicular top plates is 15.25 inches (387 mm) or less, rafters or roof trusses shall be connected to the top plates of braced wall panels with blocking in accordance with Figure R602.10.8.2(1) and attached in accordance with Table R602.3(1).
4. For all Seismic Design Categories and wind speeds, where the distance between the top of rafters or roof trusses and perpendicular top plates exceeds 15.25 inches (387 mm), perpendicular rafters or roof trusses shall be connected to the top plates of braced wall panels in accordance with one of the following methods
   - 4.1. In accordance with Figure R602.10.8.2(2),
   - 4.2. In accordance with Figure R602.10.8.2(3),
   - 4.3. With full height engineered blocking panels designed for values listed in American Forest and Paper Association (AF&PA) Wood Frame Construction Manual for One- and Two-Family Dwellings (WFCM). Both the roof and floor sheathing shall be attached to the blocking panels in accordance with Table R602.3(1).
   - 4.4. Designed in accordance with accepted engineering methods.
5. Lateral support for the rafters and ceiling joists shall be provided in accordance with Section R802.8. 6. Lateral support for trusses shall be provided in accordance with Section R802.10.3.



For SI: 1 inch = 25.4 mm

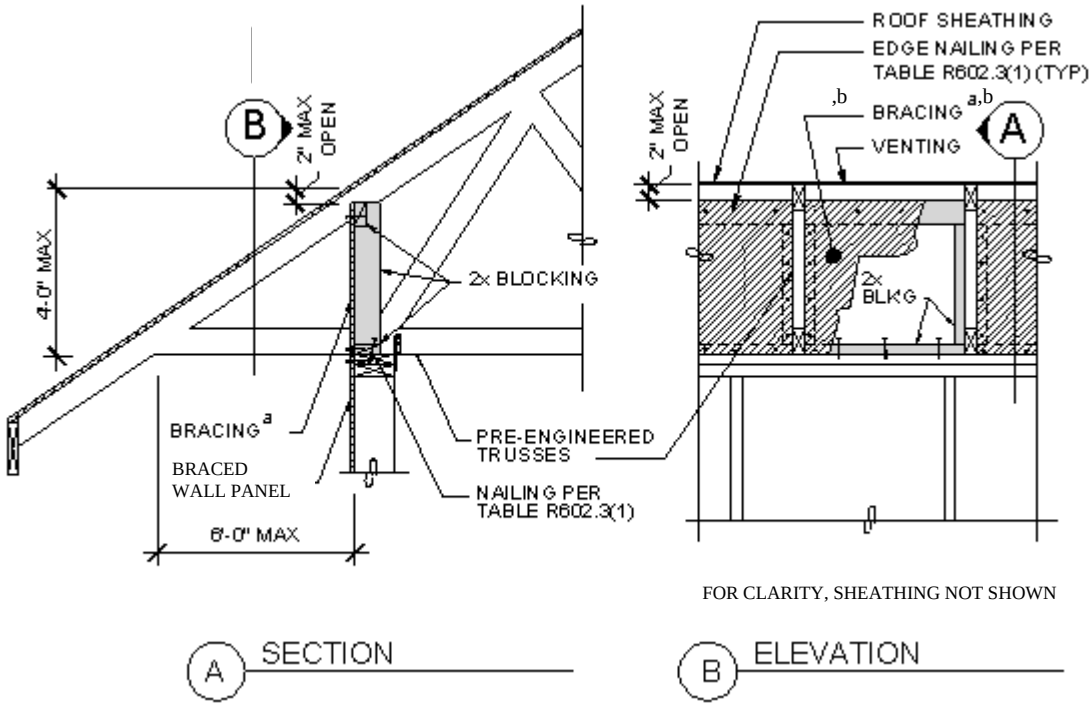
FIGURE R602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS



For SI: 1 inch = 25.4 mm

a. Methods of bracing shall be as described in Section R602.10.2 method DWB, WSP, SFB, GB, PBS, PCP OR HPS
b. Provide ventilation (not shown) per Section R806.

FIGURE R602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES



For SI: 1 inch = 25.4 mm

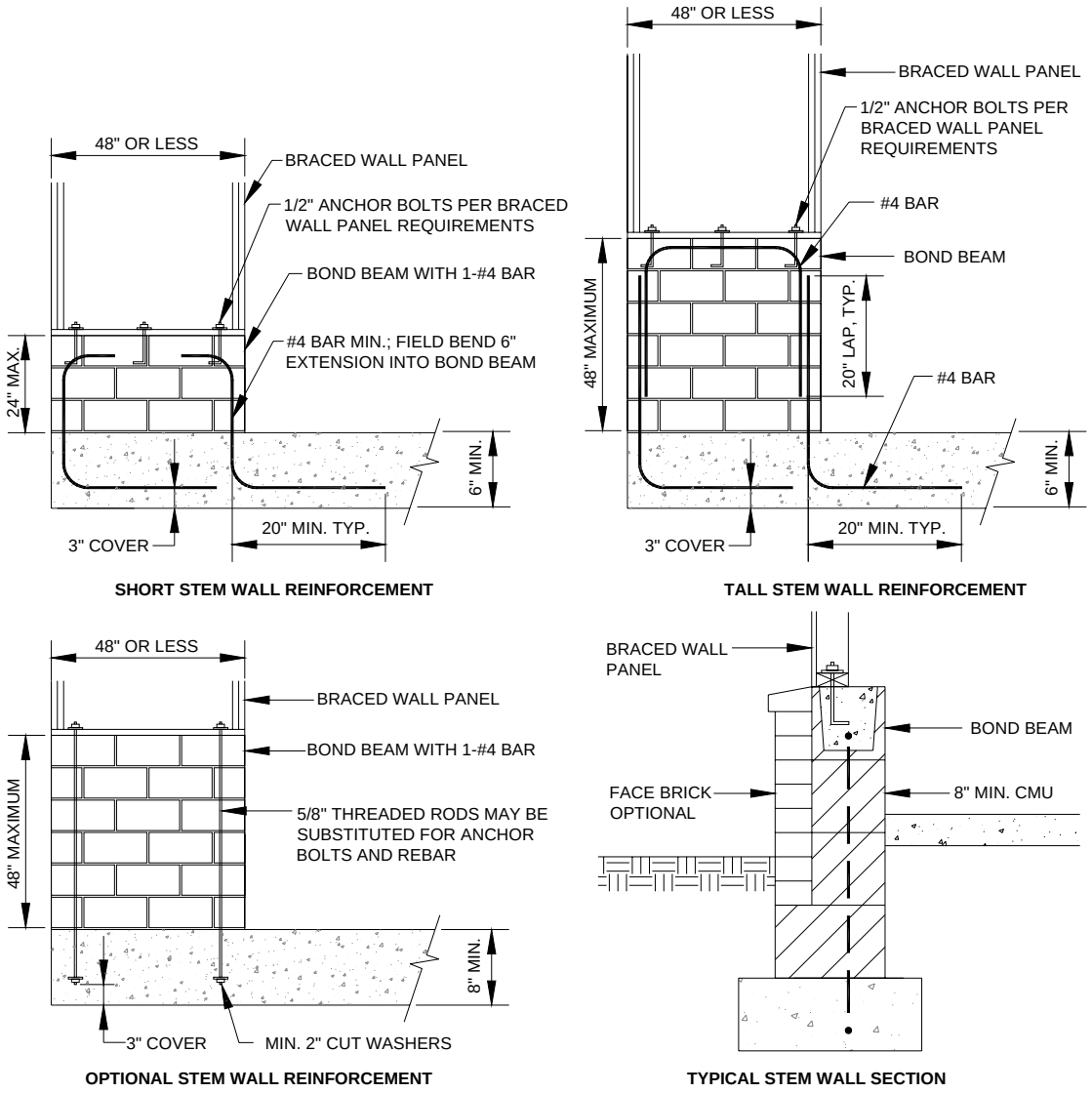
a. Methods of bracing shall be as described in Section R602.10.2 method DWB, WSP, SFB, GB, PBS, PCP OR HPS
b. Provide ventilation (not shown) per Section R806.

FIGURE R602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

R602.10.9 Braced wall panel support. Braced wall panel support shall be provided as follows:

1. Cantilevered floor joists complying with Section R502.3.3 shall be permitted to support braced wall panels.
2. Elevated post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.

3. Masonry stem walls with a length of 48 inches (1220 mm) or less supporting braced wall panels shall be reinforced in accordance with Figure R602.10.9. Masonry stem walls with a length greater than 48 inches (1220 mm) supporting braced wall panels shall be constructed in accordance with Section R403.1 Methods ABW and PFH shall not be permitted to attach to masonry stem walls.
4. Concrete stem walls with a length of 48" or less, greater than 12 inches tall and less than 6 inches thick shall have reinforcement sized and located in accordance with Figure R602.10.9.



For SI: 1 in=305 mm

FIGURE R602.10.9
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

R602.10.9.1 Braced wall panel support for Seismic Design Category D_2. In one-story buildings located in Seismic Design Category D_2, braced wall panels shall be supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm). In two story buildings located in Seismic Design Category D_2, all braced wall panels shall be supported on continuous foundations.

Exception: Two-story buildings shall be permitted to have interior braced wall panels supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm) provided that:

1. The height of cripple walls does not exceed 4 feet (1219 mm).
2. First-floor braced wall panels are supported on doubled floor joists, continuous blocking or floor beams.
3. The distance between bracing lines does not exceed twice the building width measured parallel to the braced wall line.

R602.10.10 Panel joints. All vertical joints of 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 1-1/2 inch (38 mm) thickness.

Exceptions:

1. Blocking at horizontal joints shall not be required in wall segments that are not counted as braced wall panels.
2. Where the length of bracing provided is at least twice the required length of bracing from Tables R602.10.3(1) and R602.10.3(3) blocking at horizontal joints shall not be required in braced wall panels constructed using Methods WSP, SFB, GB, PBS or HPS.
3. When Method GB panels are installed horizontally, blocking of horizontal joints is not required.

R602.10.11 Cripple wall bracing. In Seismic Design Categories other than D_2, cripple walls shall be braced with a length and type of bracing as required for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3) with the following modifications for cripple wall bracing:

1. The length of bracing as determined from Tables R602.10.3(1) and R602.10.3(3) shall be multiplied by a factor of 1.15, and
2. ~~The wall panel spacing shall be decreased to 18 feet (5486 mm) instead of 20 feet (7620 mm)~~ The distance between adjacent edges of braced wall panels shall be reduced from 20 feet (6096 mm) to 14 feet (4267 mm).

R602.10.11.1 Cripple wall bracing in Seismic Design Categories D_0, D_1 and D_2. In addition to the requirements of Section R602.10.11, where braced wall lines at interior walls occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be one and one-half times the length required by Table R602.10.3(3). Where cripple walls braced using Method WSP cannot provide this additional length, the capacity of the sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4 inches (102 mm) on center.

In Seismic Design Category D_2, cripple walls shall be braced in accordance with Tables R602.10.3(3) and R602.10.3(4).

R602.10.11.2 Redesignation of cripple walls. In any Seismic Design Category, 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.

Commenter's Reason: The proposed amendments sharpen and clarify the intent of the original RB105 by moving provisions to more accessible sections and strengthening language to avoid misinterpretations. Other housekeeping included replacing story location figures, moving a requirement in footnotes to a more prominently location providing, clarifying nail/staple lengths and diameters and correcting typographical errors.

Public Comment 2:

Randall Shackelford, Simpson Strong-Tie Company requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R602.10.1.2 Offsets along a braced wall line. All exterior walls parallel to a braced wall line shall be ~~permitted to~~ offset ~~up to~~ not more than 4 feet (1219 mm) from the designated braced wall line location as shown Figure R602.10.1.1. Interior walls used as bracing shall be ~~permitted to~~ offset ~~up to~~ not more than 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure R602.10.1.1.

R602.10.1.3 Spacing of braced wall lines. ~~There shall be a minimum of two braced wall lines in both the longitudinal and transverse direction as shown in Figure R602.10.1.1. Intermediate braced wall lines through the interior of the building shall be permitted.~~ The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3. Intermediate braced wall lines through the interior of the building shall be permitted.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This Public Comment clarifies that all exterior walls must be part of, or within 4 feet of, a braced wall line. This is to carry on the traditional wall bracing requirement that all exterior walls must be braced. The language is cleaned up to remove "permitted" language in favor of mandatory language.

When the first section is clarified to require all exterior walls to be part of a braced wall line, the first sentence of R602.10.1.3 is unnecessary, so it is deleted.

The text regarding braced wall lines at building interior is relocated to the last part of the paragraph because the primary purpose of this paragraph is to provide spacing requirements, so that should come first.

Public Comment 3:

Randall Shackelford, Simpson Strong-Tie Company, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R602.10 Wall bracing. Buildings 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 Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, braced wall lines shall be designated as straight lines ~~on~~ in the building plan placed in accordance with this section. All exterior walls of a building shall be part of a braced wall line.

R602.10.1.1 Length of a braced wall line. The length of a braced wall line shall be the distance between its ends. The end of a braced wall line shall be the intersection with a perpendicular braced wall line, ~~or~~ an angled braced wall line as permitted in Section R602.10.1.4 or an exterior wall. ~~In the absence of an intersecting braced wall line, the end shall be the farthest exterior wall of the building~~ as shown in Figure R602.10.1.1. The end of the braced wall line shall be chosen so that the maximum length results.

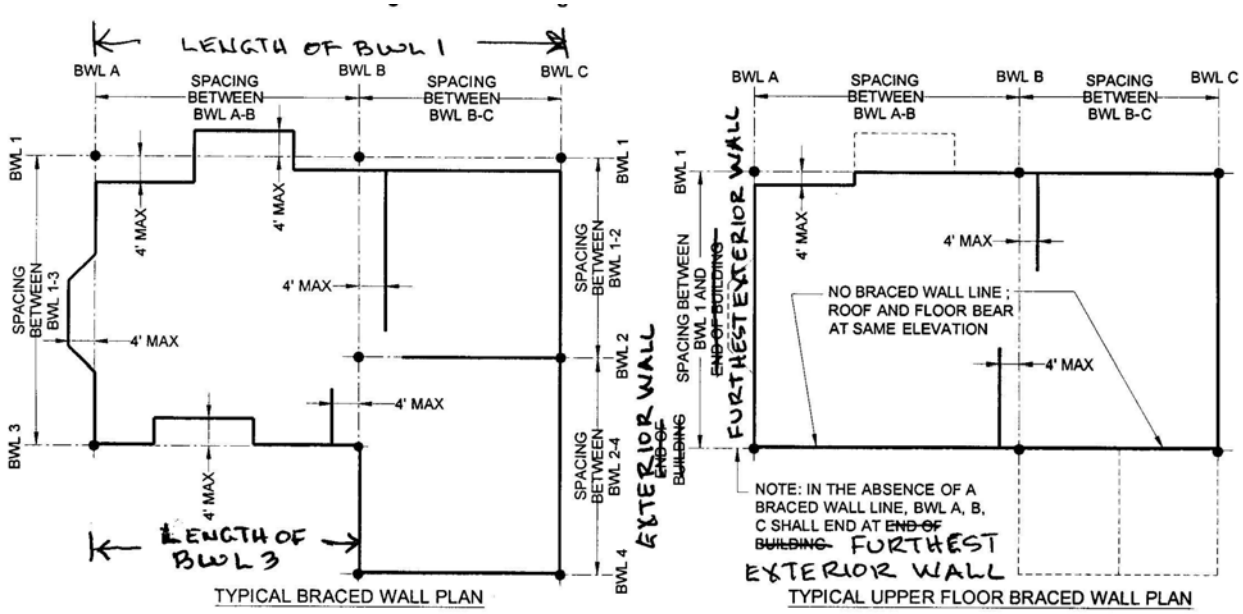


FIGURE R602.10.1.1
BRACED WALL LINES

R602.10.1.2 Offsets along a braced wall line. All exterior walls parallel to a braced wall line shall be permitted to offset up to 4 feet (1219 mm) from the designated braced wall line location as shown Figure R602.10.1.1. Interior walls used as bracing shall be permitted to offset up to 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure R602.10.1.1. Walls that are offset in accordance with this section are permitted to count as a single braced wall line.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This Public Comment achieves 4 things.

1. It maintains the requirements from past wall bracing provisions that all exterior walls shall be braces. Somehow in the drafting of the new provisions, this explicit requirement has been lost. While it may be argued that R602.10.1.2 implies that exterior walls have to have a braced wall line within 4 feet, it does not come out and say that directly. This will clarify the wall bracing provisions.
2. It clarifies that the length of the braced wall line has to be chosen so that the maximum length results. The amount of seismic bracing is still based on the length of the braced wall line, so the length of the braced wall line has to be chosen correctly. This wording ensures that the user will not choose the length of an exterior braced wall line as the intersection with in interior braced wall line when the line actually continues to the end of the wall.
3. Figure R602.10.1.1 is clarified in several ways. First, this figure supposedly goes with Section R602.10.1.1, which describes the length of braced wall lines, but the figure does not say anything about the length of braced wall lines. Two dimensions are added to illustrate choosing the length of braced wall lines. Second, the wording "End of building" is changed to "Exterior Wall" and "Furthest Exterior Wall" to be consistent with the wording in the Section.
4. Language is added to the offset section to clarify that walls that meet the offset requirement are permitted to count as one wall. Otherwise, the user could count two walls with an offset of less than 8 feet as two single walls, when the intent is to count them as one wall.

Public Comment 4:

Maureen Traxler, City of Seattle Department of Planning & Development, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR a,b (Multiply length from Table R602.10.3(1) by this factor)	APPLICABLE METHODS
Story height (Section 301.3)	Any story	≤ 10 ft	1.0	All methods
		>10 ft and ≤ 12 ft	1.2	
Braced wall line spacing, townhouses in SDC C	Any story	≤ 35 ft	1	
		>35 ft and ≤ 50 ft	1.43	

Braced wall line spacing, in SDC D0, D1, D2[c]	Any story	>25 ft and ≤ 30 ft	1.2	
		>30 ft and ≤ 35 ft	1.4	
Wall dead load	Any story	> 8 ft and < 15 ft	1	
		<8 psf	0.85	
Roof/ceiling dead load for wall supporting	Roof only or roof plus one or two stories	<15 psf	1.0	
	Roof only	>15 psf and ≤ 25 psf	1.2	
	Roof plus one or two stories	>15 psf and ≤ 25 psf	1.1	
Walls with stone or masonry veneer	Any story	See Section R703.7		
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB

(Portions of proposal not shown remain unchanged)

Commenter's Reason: Editorial clarification to show lower and upper limits must both be satisfied.

Final Action: AS AM AMPC____ D

RB106-09/10

R602.9, Table R602.10.1.2(2), R602.10.9, R602.10.9.1, R602.10.9.2, R602.10.9.3, R602.11.2

Proposed Change as Submitted

Proponent: Chuck Bajnai, Chesterfield County, VA, Chairman, ICC Ad-Hoc Committee on Wall Bracing

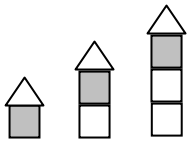
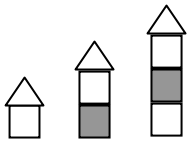
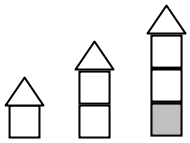
1. Revise as follows:

R602.9 Cripple walls. Foundation cripple walls shall be framed of studs not smaller than the studding above. When exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional *story*.

Cripple walls with a stud height less than 14 inches (356 mm) shall be continuously sheathed on ~~at least~~ one side with ~~a~~ wood structural panels ~~that is~~ fastened to both the top and bottom plates in accordance with Table R602.3(1), or the cripple walls shall be constructed of solid blocking.

All cripple walls shall be supported on continuous foundations.

TABLE R602.10.1.2(2)[a, b, c]
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY
(AS A FUNCTION OF BRACED WALL LINE LENGTH)

SOIL CLASS D[a] WALL HEIGHT = 10 FT 10 PSF FLOOR DEAD LOAD 15 PSF ROOF/CEILING DEAD LOAD BRACED WALL LINE SPACING ≤ 25 FT			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE			
SEISMIC DESIGN CATEGORY (SDC)	**STORY LOCATION**	**BRACED WALL LINE LENGTH**	**METHOD LIB**	**METHODS DWB, SFB, GB, PBS, PCP, HPS**	**METHOD WSP**	**CONT. SHEATHING**
SDC D2		10	NP	4.0	2.5	2.1
		20	NP	8.0	5.0	4.3
		30	NP	12.0	7.5	6.4
		40	NP	16.0	10.0	8.5
		50	NP	20.0	12.5	10.6
		10	NP	7.5	5.5	4.7
		20	NP	15.0	11.0	9.4
		30	NP	22.5	16.5	14.0
		40	NP	30.0	22.0	18.7
		50	NP	37.5	27.5	23.4
		10	NP	NP	NP	NP
		20	NP	NP	NP	NP
		30	NP	NP	NP	NP
		40	NP	NP	NP	NP
		50	NP	NP	NP	NP

SOIL CLASS D[a] WALL HEIGHT = 10 FT 10 PSF FLOOR DEAD LOAD 15 PSF ROOF/CEILING DEAD LOAD BRACED WALL LINE SPACING ≤ 25 FT			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE			
SEISMIC DESIGN CATEGORY (SDC)	**STORY LOCATION**	**BRACED WALL LINE LENGTH**	**METHOD LIB**	**METHODS DWB, SFB, GB, PBS, PCP, HPS**	**METHOD WSP**	**CONT. SHEATHING**
SDC D2	Cripple wall below one- or two-story dwelling	10	NP	NP	7.5	6.4
		20	NP	NP	15.0	12.8
		30	NP	NP	22.5	19.1
		40	NP	NP	30.0	25.5
		50	NP	NP	37.5	31.9

(Portions of table not shown remain unchanged)

R602.10.9 Cripple wall bracing. ~~In Seismic Design Categories other than D2, cripple walls shall be braced with a length and type of bracing as required for the wall above in accordance with Tables R602.10.1.2(1) and R602.10.1.2(2) with the following modifications for cripple wall bracing:~~ Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.1.2(1) and R602.10.1.2(2), except that the length of cripple wall bracing shall be multiplied by a factor of 1.15.

~~1. The length of bracing as determined from Tables R602.10.1.2(1) and R602.10.1.2(2) shall be multiplied by a factor of 1.15, and~~
~~2. The wall panel spacing shall be decreased to 18 feet (5486 mm) instead of 25 feet (7620 mm).~~

2. Delete and substitute as follows:

~~**R602.10.9.1 Cripple wall bracing in Seismic Design Categories D0, D1 and D2.** In addition to the requirements of Section R602.10.9, where *braced wall lines* at interior walls occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be 11/2 times the length required by Tables R602.10.1.2(1) and R602.10.1.2(2). Where cripple walls braced using Method WSP of Section R602.10.2 cannot provide this additional length, the capacity of the sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4 inches (102 mm) on center. In Seismic Design Category D2, cripple walls shall be braced in accordance with Tables R602.10.1.2(1) and R602.10.1.2(2).~~

R602.10.9.1 Cripple wall bracing for Seismic Design Categories D_0, D_1 and townhouses in Seismic Design Category C. In addition to the requirements in Section R602.10.9, braced wall panels for cripple walls shall be located no more than 18 feet (5486 mm) on center along a braced wall line.

Where braced wall lines at interior walls are not supported on a continuous foundation below, the adjacent parallel cripple walls, where provided, shall be braced with Method WSP per Section R602.10.2 or Method CS-WSP per Section R602.10.4. The length of bracing required per Table R602.10.1.2(2) for the cripple walls shall be multiplied by 1.5. Where the cripple walls do not have sufficient length to provide the required bracing, the spacing of panel edge fasteners shall be reduced to 4 inches (102 mm) on center and the required bracing length adjusted by 0.7. If the required length can still not be provided, the cripple wall shall be designed in accordance with accepted engineering practice.

R602.10.9.2 Cripple wall bracing for Seismic Design Category D_2. In Seismic Design Category D_2, cripple walls shall be braced in accordance with Tables R602.10.1.2(1) and R602.10.1.2(2).

3. Revise as follows:

R602.10.9.2~~3~~ Redesignation of cripple walls. ~~In any Seismic Design Category,~~ Where all cripple wall segments along a braced wall line do not exceed 48 inches in height, the cripple walls shall be permitted to be redesignated as ~~the~~ a first *story* wall~~s~~ for purposes of determining wall bracing requirements. Where any cripple wall segment in a braced wall line exceeds 48 inches in height, the entire cripple wall shall be counted as an additional story. If the cripple walls are redesignated, the stories above the redesignated *story* shall be counted as the second and third stories, respectively.

R602.11.2 Stepped foundations in Seismic Design Categories D_0, D_1 and D_2. In all buildings located in Seismic Design Categories D_0, D_1 or D_2, where the height of a required *braced wall line* that extends from foundation to floor above varies more than 4 feet (1219 mm), the *braced wall line* shall be constructed in accordance with the following:

1. Where the lowest floor framing rests directly on a sill bolted to a foundation not less than 8 feet (2440 mm) in length along a line of bracing, the line shall be considered as braced. The double plate of the cripple stud wall beyond the segment of footing that extends to the lowest framed floor shall be spliced by extending the upper top plate a minimum of 4 feet (1219 mm) along the foundation. Anchor bolts shall be located a maximum of 1 foot and 3 feet (305 and 914 mm) from the step in the foundation. See Figure R602.11.2.
2. Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements of Sections R602.10.9, ~~and~~ R602.10.9.1 and R602.10.9.2 shall apply.
3. Where only the bottom of the foundation is stepped and the lowest floor framing rests directly on a sill bolted to the foundations, the requirements of Sections R403.1.6 and R602.11.1 shall apply.

Reason: This proposal clarifies and coordinates the basic cripple wall provisions in Section R602.9 and the cripple wall bracing provisions in Section R602.10.9.

The changes to Section R602.9 are largely editorial. The apparent intent of the provisions for cripple walls shorter than 14" is to require solid blocking or continuous sheathing. However, the current language calls for "a structural panel". Taken literally, that calls for one single sheet of plywood or OSB to be placed on the wall. The language is revised to clarify the apparent intent. Also, the continuous foundation requirement is moved to its own paragraph, as it clearly is intended to apply to all cripple walls, not just 14" and shorter ones.

The 75% minimum WSP bracing requirement for cripple walls in SDC D2 was mistakenly deleted from the reformatted seismic bracing table and is restored to Table R602.10.1.2(2). Consistent with the revisions last cycle, the percentage is converted into a foot length. The 15% reduction for continuous sheathing is also applied.

Section R602.10.9 and R609.10.9.1 are revised to divide the requirements into low-seismic (i.e. governed by wind) and high-seismic sections. The same calculation method and spreadsheet the ICC Ad-Hoc Wall Bracing Committee used to define the wind bracing table, was used to verify that the 1.15x multiplier is accurate for the wind bracing case as well as the seismic bracing case. The 18 foot braced wall panel spacing limit is applied only for high-seismic. There is no documentation of cripple wall failures in wind events, as there is for seismic events. Thus there is no technical justification to apply the additional limit for wind bracing.

The provisions regarding braced wall lines on interior walls not supported on continuous foundations are clarified. The 50% increase in bracing is applied to the adjacent cripple walls. It is noted these walls could potentially be either exterior or interior walls. Also, a complex house plan may have exterior cripple walls that are not adjacent to the unsupported wall (e.g. on an attached garage, den, or other feature) and do not inherit seismic loads from the unsupported wall. It would not then make sense to increase the bracing for those walls. Furthermore, it is clarified that the bracing for

the adjacent cripple walls can be either Method WSP or Method CS-WSP. Finally, a specific factor is provided for the increased strength provided by the reduction to 4" edge nailing. Of course, for some plans, the reduction may still result in a required bracing length that exceeds the total length of the cripple wall. Obviously, an engineered solution would be required in that case,

The provision on re-designation of cripple walls is amended to require exterior cripple walls exceeding 48" in height to be considered a story. This is consistent with the calculation performed above to verify the 1.15 multiplier. The increase in bracing for taller cripple walls would begin to approach, and finally equal, the difference in bottom-floor bracing from the addition of a story. Thus, it would make sense to automatically re-designate these taller cripple walls as a story. This will also help clarify the determination of bracing for houses on sloped sites, where figuring out the bracing for the cripple walls occurring on the walls parallel to the slope has been an issue.

Finally, the section references in R602.11.2 are revised to include R602.10.9.2.

Cost Impact: The code change proposal may increase the cost of construction for houses with cripple walls exceeding 48" in height..

ICCFILENAME: BAJNAI-AHWB-RB-3-R602.9-R602.10-R602.11

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: This change adds needed changes and adds clarifying changes to the cripple wall bracing section and into the table for bracing requirements based on Seismic Design Categories.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Charles S. Bajnai, VBCOA and Chesterfield County, VA, representing ICC Ad-Hoc Committee on Wall Bracing, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R602.10.9.1 Cripple wall bracing for Seismic Design Categories D_0, D_1 and townhouses in Seismic Design Category C. In addition to the requirements in Section R602.10.9, the distance between adjacent edges of braced wall panels for cripple walls along a braced wall line shall be 14 feet (4267 mm) maximum ~~located no more than 18 feet (5486 mm) on center along a braced wall line~~.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The ICC Ad-Hoc Wall Bracing Committee determined that using a maximum distance between adjacent edges of braced wall panels on a braced wall line as the controlling limit for braced wall panel spacing is easier to apply and enforce than using a maximum center-to-center distance. Using the distance between adjacent edges better accommodates braced wall segments greater than 48" in length. The revised language above mirrors the language in Section R602.10.2.2 of RB105-09/10 that was approved at the Baltimore hearings.

Final Action: AS AM AMPC____ D

RB109-09/10

R602.10.6.2, Figure R602.10.6.2(2), Figure R602.10.6.2(3)

Proposed Change as Submitted

Proponent: Gary Ehrlich, National Association of Home Builders (NAHB)

1. Revise as follows:

R602.10.6.2 Connections to roof framing. ~~Exterior *braced wall panels* shall be connected to roof framing as follows.~~

1. ~~Parallel rafters or roof trusses shall be attached to the top~~ Top plates of exterior *braced wall panels* shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of *braced wall panels* and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim, or header joist or roof truss parallel to the *braced wall panels* shall be permitted to replace the blocking required by this section.

Blocking shall not be required over openings in continuously-sheathed *braced wall lines*. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with R806.1. .

~~2~~ 1. For SDC A, B and C and wind speeds less than 100 miles per hour (45 m/s), where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses above ~~and perpendicular top plates~~ is 91/4 inches (235 mm) or less, ~~the rafters or roof trusses shall be connected to the top plates of *braced wall lines* in accordance with Table R602.3(1) and~~ blocking between rafters or roof trusses shall ~~need~~ not be ~~installed~~ required. Where the distance from the top of the *braced wall panel* to the top of the rafters above ~~and perpendicular top plates~~ is between 91/4 inches (235 mm) and 151/4 inches (387 mm) ~~the rafters shall be connected to the top plates of *braced wall panels* with~~ blocking between rafters shall be provided above the *braced wall panel* in accordance with Figure R602.10.6.2(1) ~~and attached in accordance with Table R602.3(1)~~. Where the distance from the top of the *braced wall panel* to the top of the roof trusses ~~and perpendicular top plates~~ above is between 91/4 inches (235 mm) and 151/4 inches (387 mm) ~~the roof trusses shall be connected to the top plates of *braced wall panels* with blocking in accordance with Table R602.3(1)~~ lateral load transfer shall be provided in accordance with Section R802.10.3.

~~3~~ 2. For SDC D_0, D_1 and D_2 or wind speeds of 100 miles per hour (45 m/s) or greater, where the distance ~~between~~ from the top of the *braced wall panel* to the top of the rafters or roof trusses ~~and perpendicular top plates~~ is 151/4 inches (387 mm) or less, ~~rafters or roof trusses shall be connected to the top plates of *braced wall panels* with~~ blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.6.2(1) ~~and attached in accordance with Table R602.3(1)~~.

~~4~~ 3. ~~For all seismic design categories and wind speeds,~~ Where the distance ~~between~~ from the top of the *braced wall panel* to the top of the rafters or roof trusses ~~and perpendicular top plates~~ exceeds 151/4 inches (387 mm), ~~perpendicular rafters or roof trusses shall be connected to~~ the top plates of the *braced wall panels* shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:

~~4~~ 3.1. Soffit blocking panels constructed in accordance with Figure R602.10.6.2(2),

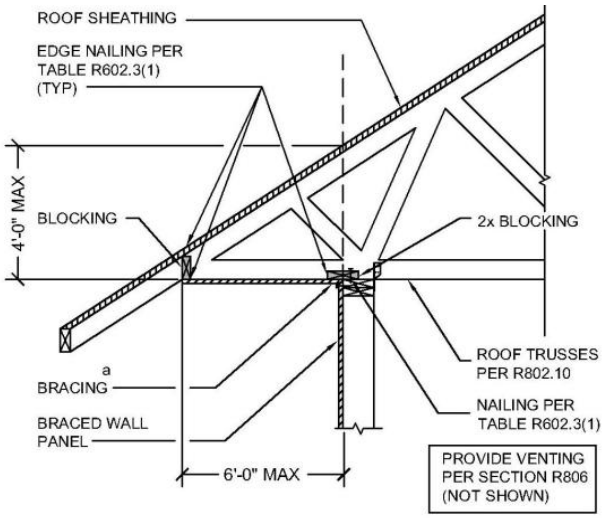
~~4~~ 3.2. Vertical blocking panels constructed in accordance with Figure R602.10.6.2(3),

~~4~~ 3.3. ~~With f~~Full ~~-~~height engineered blocking panels designed ~~for values listed in~~ per the AF&PA WFCM ~~American Forest and Paper Association (AF&PA) Wood Frame Construction Manual for One- and Two-Family Dwellings (WFCM). Both the roof and floor sheathing shall be attached to the blocking panels in accordance with Table R602.3(1)~~.

~~4~~ 3.4. Blocking, blocking panels, or other methods of lateral load transfer ~~Designed~~ designed in accordance with accepted engineering ~~methods~~ practice.

~~Lateral support for the rafters and ceiling joists shall be provided in accordance with Section R802.8. Lateral support for trusses shall be provided in accordance with Section R802.10.3. Ventilation shall be provided in accordance with Section R806.1.~~

Replace Figure R602.10.6.2(2) with the following:



a. Methods of bracing shall be as described in Section R602.10.1.1~~R602.10.2 method DWB, WSP, SFB, GB, PBS, PCP OR HPS~~
For SI: 1 inch = 25.4 mm.

FIGURE R602.10.6.2(2)

BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

3. Replace Figure R602.10.6.2(3) with the following:

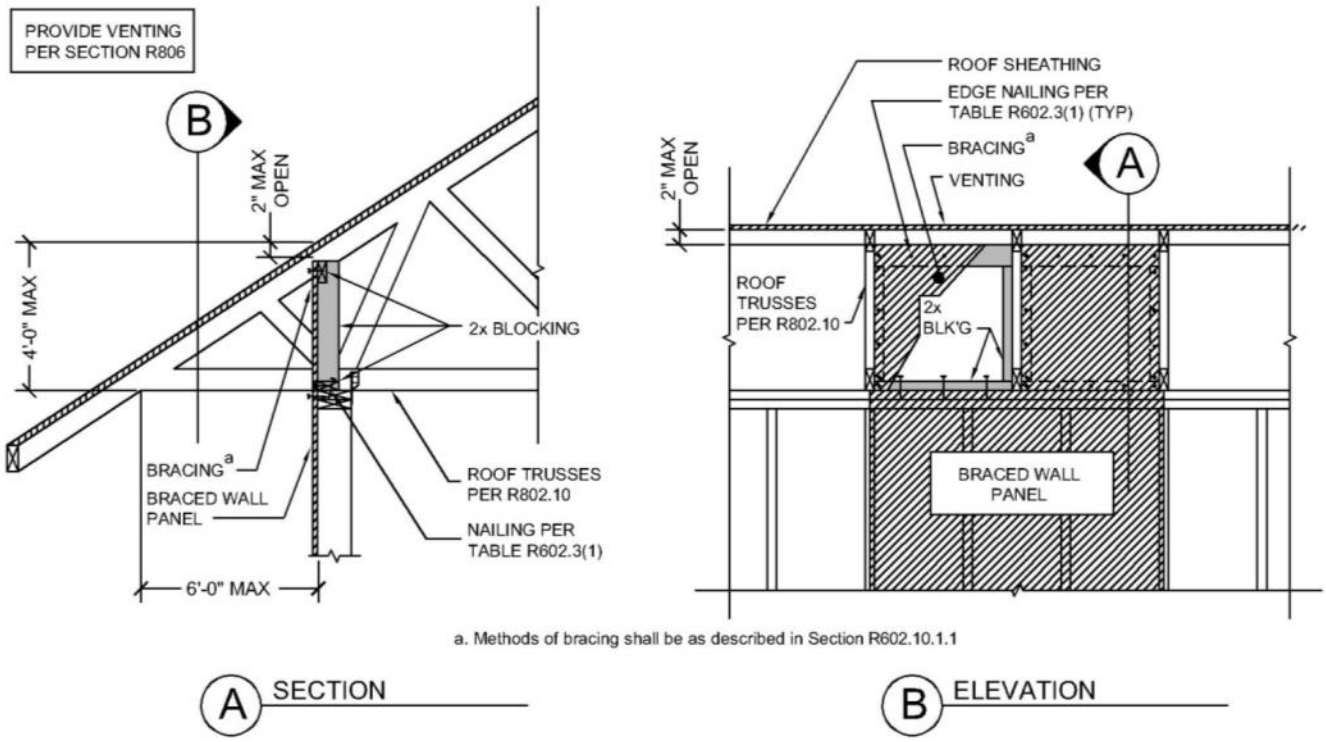


FIGURE R602.10.6.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

Reason: The purpose of this proposal is to amend and simplify the language for blocking between roof rafters and trusses over braced wall panels added during the 2007-2008 Code Development Cycle. The 2009 IRC language is incomprehensible and will create an enforcement nightmare. The change is primarily editorial, although minor technical changes have been introduced.

The terminology in the original code change is often unclear. Terms such as "parallel rafters or roof trusses" and "perpendicular top plates" leave it unclear as to what the framing members or top plates are parallel or perpendicular to. The statement that "blocking need not be installed" is permissive language. The text can even be taken to read that the BLOCKING is what's used to connect the rafter/truss to the top plate. To simplify the requirements, all of the references to "parallel" or "perpendicular" are removed, and the multiple references to Table R602.3(1) replaced with one comprehensive reference in the opening paragraph. Further, since this is the wall section, the blocking requirements and triggers are flipped so the braced wall panel is the point of reference, not the roof framing.

Language allowing a continuous rim board, rim joist, or truss in lieu of the blocking is added. This allows the distinction between "parallel" and "perpendicular" to be removed throughout the proposal, since providing a continuous member over the braced wall panels will be the obvious solution where roof framing direction is parallel to the panels and the framing depth is deep enough to require blocking.

Figures R602.10.6.2(2) and R602.10.6.2(3) are extensively revised. The details are clarified to indicate the blocking panel is only required at the braced wall panels, not along the entire braced wall line. The list of allowable methods is revised to point to Section R602.10.1.1, which includes all the allowable intermittent and continuous bracing methods, including the various alternate narrow wall panels and portal frames. Finally, the reference to "pre-engineered trusses" is replaced with a reference to R802.10, since roof trusses under the IRC are not required to be designed by an engineer.

NAHB asks for your support of this proposal.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: EHRLICH-RB-12-R602.10.6.2

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

R602.10.6.2 Connections to roof framing. Top plates of exterior *braced wall panels* shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of *braced wall panels* and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim, or header joist or roof truss parallel to the *braced wall panels* shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously-sheathed *braced wall lines*. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists

in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with R806.1.

1. For SDC A, B and C and wind speeds less than 100 miles per hour (45 m/s), where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses above is 91/4 inches (235 mm) or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses above is between 91/4 inches (235 mm) and 151/4 inches (387 mm) blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.6.2(1). ~~Where the distance from the top of the braced wall panel to the top of the roof trusses above is between 9 1/4 inches and 15 1/4 inches lateral load transfer shall be provided in accordance with Section R802.10.3.~~
2. For SDC D_0, D_1 and D_2 or wind speeds of 100 miles per hour (45 m/s) or greater, where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses is 151/4 inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.6.2(1).
3. Where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses exceeds 151/4 inches (387 mm), the top plates of the *braced wall panel*~~s~~ shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:
   3.1. Soffit blocking panels constructed in accordance with Figure R602.10.6.2(2),
   3.2. Vertical blocking panels constructed in accordance with Figure R602.10.6.2(3),
   3.3. Full -height engineered blocking panels designed in accordance with the AF&PA WFCM.
   3.4. Blocking, blocking panels, or other methods of lateral load transfer designed in accordance with accepted engineering practice.

(Portions of proposal not shown remain unchanged)

Committee Reason: The committee feels this change simplifies the language and addresses the requirements for rafters and trusses. The modification aligns the blocking requirements for trusses with the blocking requirement for rafters.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Steven Winkel, FAIA, P.E., and Kelly Cobeen, P.E., S.E., Building Seismic Safety Council of the National Institute of Building Sciences, representing Federal Emergency Management Agency/Building Seismic Safety Council Code Resource Support Committee (FEMA/BSSC CRSC), request Approval as Modified by this Public Comment.

Further modify the proposal as follows:

R602.10.6.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of braced wall panels and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim, or header joist or roof truss parallel to the braced wall panels shall be permitted to replace the blocking required by this section.
Blocking shall not be required over openings in continuously-sheathed braced wall lines. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with R806.1.

1. For SDC A, B and C and wind speeds less than 100 miles per hour (45 m/s), where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is 91/4 inches (235 mm) or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is between 91/4 inches (235 mm) and 151/4 inches (387 mm) blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.6.2(1)
2. For SDC D0, D1 and D2 or wind speeds of 100 miles per hour (45 m/s) or greater, where the distance from the top of the braced wall panel to the top of the rafters or roof trusses is 151/4 inches (387 mm) or less, blocking between rafters or roof trusses shall be provided over the full length of the braced wall line ~~above the braced wall panel~~ in accordance with Figure R602.10.6.2(1).
3. Where the distance from the top of the braced wall panel to the top of the rafters or roof trusses exceeds 151/4 inches (387 mm), the top plates of the braced wall panels shall be connected to perpendicular rafters or roof trusses over the full length of the braced wall line ~~above~~ in accordance with one or more of the following methods:
   3.1. Soffit blocking panels constructed in accordance with Figure R602.10.6.2(2),
   3.2. Vertical blocking panels constructed in accordance with Figure R602.10.6.2(3),
   3.3. Full -height engineered blocking panels designed in accordance with the AF&PA WFCM.
   3.4. Blocking, blocking panels, or other methods of lateral load transfer designed in accordance with accepted engineering practice.

(Portion of proposal not shown remain unchanged)

Commenter's Reason: The purpose of these blocking panels is to transfer seismic and wind loads from the roof to the wall below. The addition of a 2-inch gap between the top of blocking and the roof sheathing above reduces the strength and capacity of the roof system and the connection. There is not adequate research available to demonstrate that the reduced strength and stiffness are sufficient when blocking is limited to the length of the braced wall panel. Extension of the blocking over the full wall line length replicates common existing construction that has a history of adequate performance.

Final Action: AS AM AMPC____ D

RB111-09/10
R602.10, R602.12 (New)

Proposed Change as Submitted

Proponent: Chuck Bajnai, Chesterfield County, VA, Chairman, ICC Ad-Hoc Committee on Wall Bracing

1. Revise as follows:

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. 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 Section R301.1.

Exception: Detached one- and two-family *dwellings* located in Seismic Design Category C are exempt from the seismic bracing requirements of this section. Wind speed provisions for bracing shall be applicable to detached one- and two-family *dwellings*.

2. Add new section as follows:

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed below shall be permitted to be braced in accordance with this section as an alternate to the requirements of Section R602.10.

1. A rectangle circumscribing the entire enclosed building, as shown in Figure R602.12.3, shall have no side longer than 60 feet (18 288 mm), and the ratio between the long side and short side shall be a maximum of 3:1.
2. There shall be no more than two stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
3. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
4. Wall height shall not be greater than 10 feet (2743 mm).
5. Interior walls shall not contribute toward bracing required in this section.
6. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
7. All exterior walls shall have gypsum board with a minimum thickness of 1/2 inches (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
8. The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A or B.
9. The structure shall be located in Seismic Design Category of A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
10. Cripple walls shall not be permitted in two-story buildings.

When the bracing described in this section is used, the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

R602.12.1 Sheathing materials. The following sheathing materials installed on the exterior side of exterior walls shall be used to construct a bracing unit as defined in Section R602.12.2. Mixing materials is prohibited.

1. Wood structural panels with a minimum thickness of 3/8 inch (9.5 mm) fastened in accordance with Table R602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of 1/2 inch (12.7 mm) fastened in accordance with Table R602.3(1).

R602.12.2 Bracing unit. A bracing unit shall be a full-height sheathed segment of the exterior wall with no openings and a minimum length as specified below.

1. When all framed portions of all exterior walls are continuously sheathed in accordance with Section R602.12.1, Including areas between bracing units, above and below openings and on gable end walls, the minimum length of a bracing unit shall be 3 feet (914 mm).
2. When the exterior walls are braced with intermittent sheathing in accordance with Section R602.12.1 and infilled with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

R602.12.2.1 Multiple bracing units. Segments of wall compliant with Section R602.12.2 and longer than the minimum bracing unit length shall be considered as multiple bracing units. The number of bracing units shall be determined by dividing the wall segment length by the minimum bracing unit length. The number of bracing units provided by one or more compliant wall segments shall be added together and rounded down to the nearest whole number. Full-height sheathed segments of wall shorter than the minimum bracing unit length shall not contribute toward a bracing unit except as specified in Section R602.12.6.1.

R602.12.3 Number of bracing units. The number of bracing units required along each side of a building shall be determined by circumscribing a rectangle around the entire enclosed building for each story level as shown in Figure R602.12.3. Each side of the rectangle shall have, at a minimum, the number of bracing units per Table R602.12.3 placed on the parallel exterior walls facing the side of the rectangle. Bracing units shall then be placed using the distribution requirements specified in Section R602.12.4. Mixing intermittent and continuous sheathing shall not be permitted.

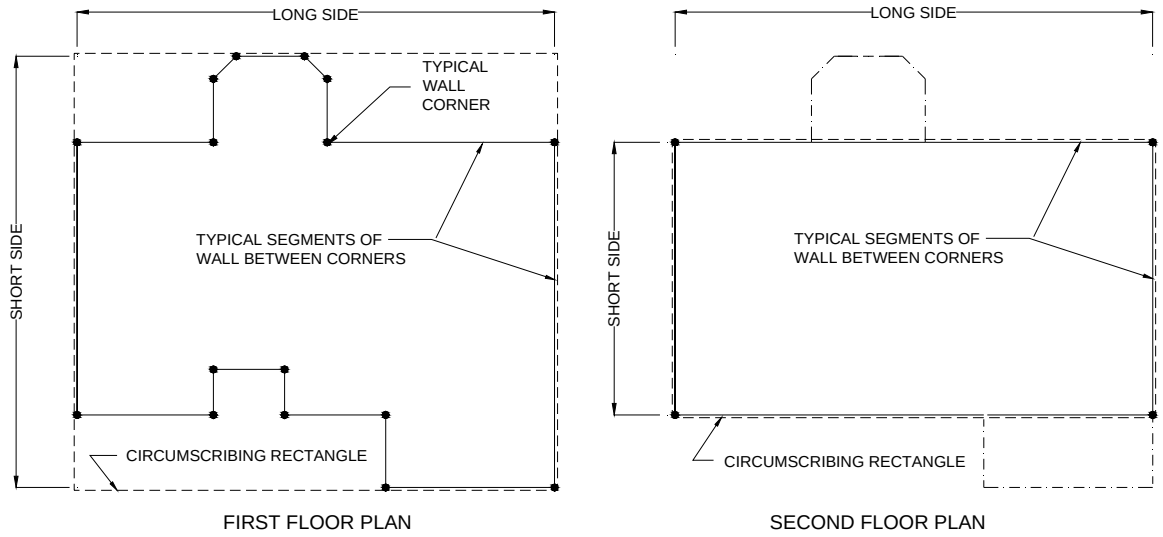
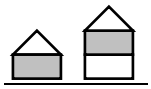
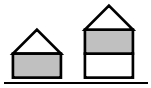


FIGURE R602.12.3
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING

TABLE R602.12.3
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF A CIRCUMSCRIBED RECTANGLE

STORY LEVEL		EAVE-TO RIDGE HEIGHT (FEET)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b] Length of short side (ft) [c]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b] Length of long side (ft) [c]					
			10	20	30	40	50	60	10	20	30	40	50	60
	One-story house or second floor of a two-story	10	1	2	2	2	3	3	1	2	2	2	3	3
	First floor of a two-story house		2	3	3	4	5	6	2	3	3	4	5	6
	One-story house or second floor of a two-story	15	1	2	3	3	4	4	1	2	3	3	4	4
	First floor of a two-story house		2	3	4	5	6	7	2	3	4	5	6	7

For SI: 1 ft = 304.8 mm

a. Interpolation shall not be permitted.

b. Cripple walls or wood-framed basement walls in a walk-out condition of a one-story structure shall be designed as the first floor of a two-story house.

c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.

R602.12.4 Distribution of bracing units. The placement of bracing units on exterior walls shall meet all of the following requirements as shown in Figure R602.12.4.

1. A bracing unit shall begin no more than 12 feet (3658 mm) from any wall corner.
2. The distance between adjacent edges of two bracing units shall be no greater than 20 feet (6096 mm).
3. Segments of wall greater than 8 feet (2438 mm) in length shall have a minimum of one bracing unit.

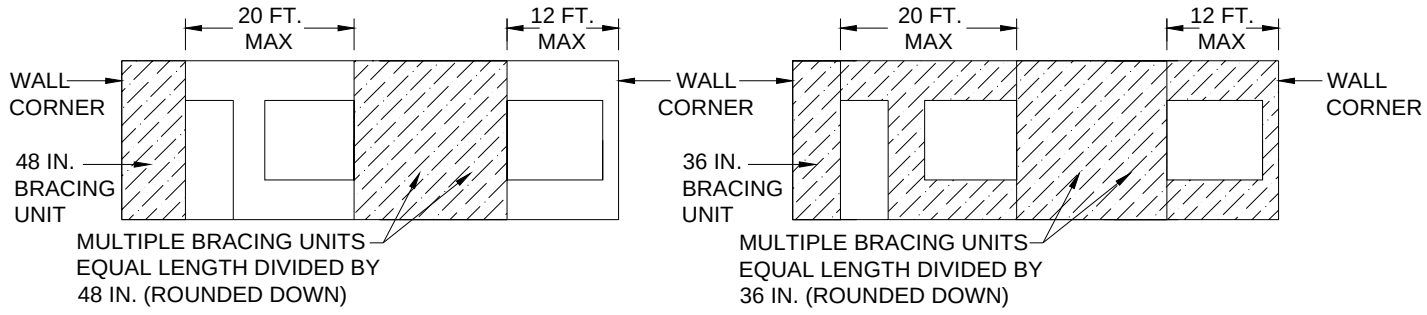


FIGURE R602.12.4
BRACING UNIT DISTRIBUTION

R602.12.5 Narrow panels. The bracing methods referenced in Section R602.10 and specified in Sections R602.12.5.1 through R602.12.5.3 shall be permitted when using simplified wall bracing.

R602.12.5.1 Method CS-G. Braced wall panels constructed as Method CS-G in accordance with Tables R602.10.4.1. and R602.10.4.2 shall be permitted for single story garages when all framed portions of all exterior walls are sheathed

with wood structural panels. Each CS-G panel shall be equivalent to 0.5 of a bracing unit. Segments of wall which include a Method CS-G panel shall meet the requirements of Section R602.10.4.4.

R602.12.5.2 Method CS-PF. Braced wall panels constructed as Method CS-PF in accordance with Section R602.10.4.1.1 shall be permitted when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal 0.5 bracing units. A maximum of four CS-PF panels shall be permitted on all the segments of walls parallel to each side of the circumscribed rectangle. Segments of wall which include a Method CS-PF panel shall meet the requirements of Section R602.10.4.4.

R602.12.5.3 Methods PFH and PFG. Braced wall panels constructed as Method PFH and PFG shall be permitted when bracing units are constructed using wood structural panels. Each PFH and panel shall equal one bracing unit, and each PFG shall be equal to 0.75 bracing units.

R602.12.6 Lateral support. For bracing units located along the eaves, the vertical distance from the outside edge of the top wall plate to the roof sheathing above shall not exceed 9.25 inches (235 mm) at the location of a bracing unit unless lateral support is provided in accordance with Section R602.10.6.2.

R602.12.7 Stem walls. Masonry stem walls with a height and length of 48 inches (1219 mm) or less supporting a bracing unit or a Method CS-G, CS-PF or PFG braced wall panel shall be constructed in accordance with Figure R602.10.7. Concrete stem walls with a length of 48" or less, greater than 12 inches tall and less than 6 inches thick shall be reinforced sized and located in accordance with Figure R602.10.7

Reason: As the wall bracing section evolved, it has become more universal and flexible, but, as a result, it has grown in size and complexity. After the Ad Hoc committee's "engineering" work was complete and integrated into the 2009 IRC, we heard back from end users that this section of the code was extremely challenging. The committee therefore wanted to focus on making the 2012 IRC easier to read, easier to understand and easier to use.

The Ad Hoc committee strove to provide an easy, prescriptive procedure that would serve most users throughout the country. We defined the "majority of the country" as users in the 90 mph and SDC A and B areas.

The Committee developed a quick, prescriptive approach for those homes that fall within certain limitations. This simplified approach:

1. Eliminated all of the extra text provisions required for high seismic areas,
2. Eliminated the requirement for braced wall lines,
3. Quantified the amount of bracing using a simple table, and
4. Eliminated from the text the less-often utilized (and frequently the most verbose) bracing methods and concentrated on the most common bracing materials.

Simplified wall bracing incorporates intermittent and continuous sheathing methods (wood structural panels and structural fiberboard), but defines a braced wall panel and its minimum length as a "bracing unit." The minimum number of bracing units is determined by first drawing a rectangle around the building and then using its dimensions to select the total bracing from Table R602.12.3. Bracing units are also required to be placed per the distribution requirements in Section R602.12.4

This simplified method is intended as one easier to use option. Where homes do not qualify because they are located in higher wind or seismic zones, or are more complex in structure, or if the builder simply prefers it, the traditional "long" approach can still be used.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: BAJNAI-AHWB-RB-2-R602.10-R602.12

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The committee feels this is a much needed simplified wall bracing method for structures in low seismic areas and as stated in the proponent's published reason..

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Charles S. Bajnai, VBCOA and Chesterfield County, VA, representing ICC Ad-Hoc Committee on Wall Bracing, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed below shall be permitted to be braced in accordance with this section as an alternate to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

~~1.~~ ~~A rectangle circumscribing the entire enclosed building, as shown in Figure R602.12.3, shall have no side longer than 60 feet (18 288 mm), and the ratio between the long side and short side shall be a maximum of 3:1.~~

1~~2~~. There shall be no more than two stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.

2~~3~~. Floors shall not cantilever more then 24 inches (607 mm) beyond the foundation or bearing wall below.

3~~4~~. Wall height shall not be greater than 10 feet (2743 mm).

~~5.~~ ~~Interior walls shall not contribute toward bracing required in this section.~~

4~~6~~. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.

5~~7~~. All exterior walls shall have gypsum board with a minimum thickness of $^1/_2$ inches (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.

6~~8~~. The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A or B.

7~~9~~. The structure shall be located in Seismic Design Category of A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.

8~~10~~. Cripple walls shall not be permitted in two-story buildings.

~~When the bracing described in this section is used, the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.~~

R602.12.1 Circumscribed rectangle. The bracing required for each building shall be determined by circumscribing a rectangle around the entire building on each floor as shown in Figure R602.12.1. The rectangle shall surround all enclosed offsets and projections such as sunrooms and attached garages. Open structures, such as carports and decks shall be permitted to be excluded. The rectangle shall have no side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be a maximum of 3:1.

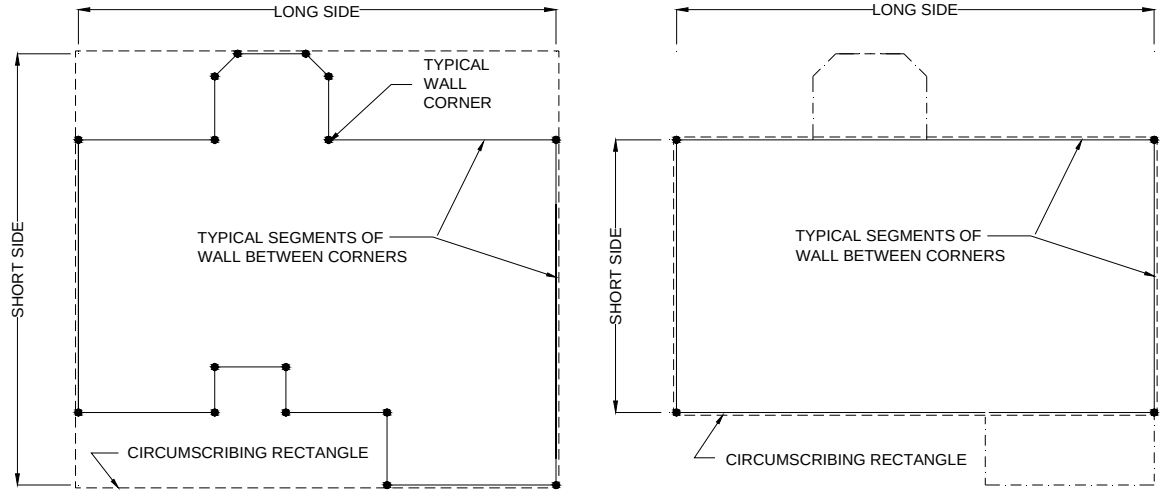


FIGURE R602.12.1
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING

~~**R602.12.1**~~ **R602.12.2 Sheathing materials.** The following sheathing materials installed on the exterior side of exterior walls shall be used to construct a bracing unit as defined in Section R602.12.3~~2~~. Mixing materials is prohibited.

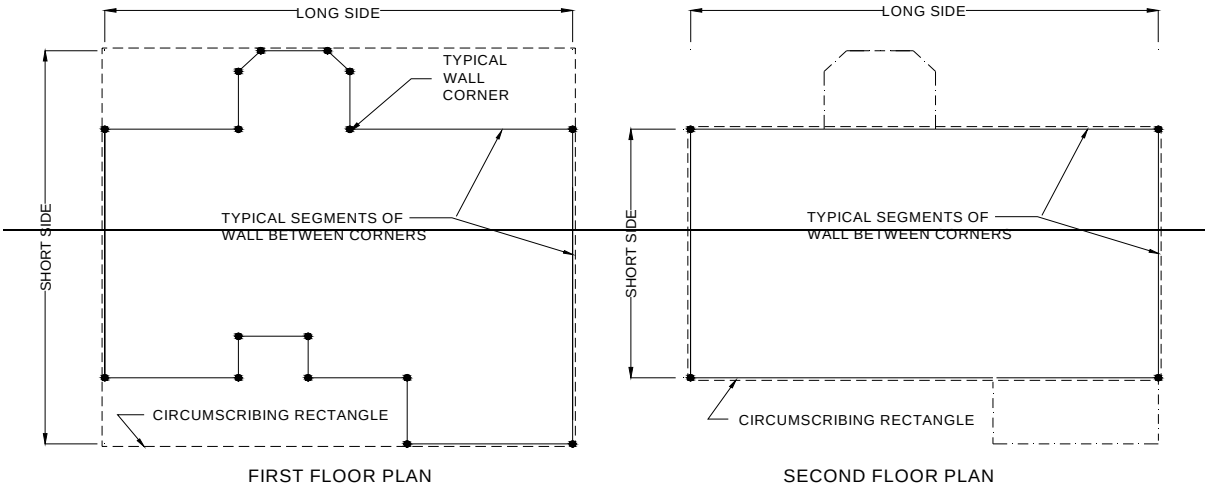
1. Wood structural panels with a minimum thickness of $^3/_8$ inch (9.5 mm) fastened in accordance with Table R602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of $^1/_2$ inch (12.7 mm) fastened in accordance with Table R602.3(1).

~~**R602.12.2** **R602.12. 3Bracing unit.**~~ A bracing unit shall be a full-height sheathed segment of the exterior wall with no openings or vertical or horizontal offsets and a minimum length as specified below. Interior walls shall not contribute toward the amount of required bracing. Mixing of Items 1 and 2 below is prohibited on the same story.

1. ~~When~~Where all framed portions of all exterior walls are ~~continuously~~ sheathed in accordance with Section ~~R602.12.1~~, R602.12.2 ~~Including~~ including wall areas between bracing units, above and below openings and on gable end walls, the minimum length of a bracing unit shall be 3 feet (914 mm).
2. ~~When~~Where the exterior walls are braced with ~~intermittent~~ sheathing panels in accordance with Section ~~R602.12.1~~ R602.12.2 and areas between bracing units are ~~infilled~~covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

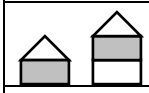
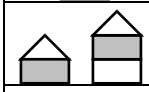
~~**R602.12.2.1**~~ **R602.12.3.1 Multiple bracing units.** Segments of wall compliant with Section R602.12.2 and longer than the minimum bracing unit length shall be considered as multiple bracing units. The number of bracing units shall be determined by dividing the wall segment length by the minimum bracing unit length. ~~The number of bracing units provided by one or more compliant wall segments shall be added together and rounded down to the nearest whole number.~~ Full-height sheathed segments of wall ~~shorter~~ narrower than the minimum bracing unit length shall not contribute toward a bracing unit except as specified in Section R602.12.6~~.1~~.

~~**R602.12.3**~~ **R602.12.4 Number of bracing units.** ~~The number of bracing units required along each side of a building shall be determined by circumscribing a rectangle around the entire enclosed building for each story level as shown in Figure R602.12.3.~~ Each side of the circumscribed rectangle, as shown in Figure R602.12.1, shall have, at a minimum, the number of bracing units per Table R602.12.4~~3~~ placed on the parallel exterior walls facing the side of the rectangle. Bracing units shall then be placed using the distribution requirements specified in Section R602.12.5~~4~~. ~~Mixing intermittent and continuous sheathing shall not be permitted.~~



~~**FIGURE R602.12.3**~~
~~**RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING**~~

TABLE ~~R602.12.3~~ R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF ~~A~~ THE CIRCUMSCRIBED RECTANGLE

STORY LEVEL		EAVE-TO RIDGE HEIGHT (FEET)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b]					
			Length of short side (ft) [c]						Length of long side (ft) [c]					
			10	20	30	40	50	60	10	20	30	40	50	60
	~~One-story house or second floor of a two-story~~	10	1	2	2	2	3	3	1	2	2	2	3	3
	~~First floor of a two-story house~~		2	3	3	4	5	6	2	3	3	4	5	6
	~~One-story house or second floor of a two-story~~	15	1	2	3	3	4	4	1	2	3	3	4	4
	~~First floor of a two-story house~~		2	3	4	5	6	7	2	3	4	5	6	7

For SI: 1 ft = 304.8 mm
a Interpolation shall not be permitted.
b Cripple walls or wood-framed basement walls in a walk-out condition of a one-story structure shall be designed as the first floor of a two-story house.
c Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.

~~R602.12.4~~ R602.12.5 Distribution of bracing units. The placement of bracing units on exterior walls shall meet all of the following requirements as shown in Figure ~~R602.12.4~~ R602.12.5.

1. A bracing unit shall begin no more than 12 feet (3658 mm) from any wall corner.
2. The distance between adjacent edges of ~~two~~ bracing units shall be no greater than 20 feet (6096 mm).
3. Segments of wall greater than 8 feet (2438 mm) in length shall have a minimum of one bracing unit.

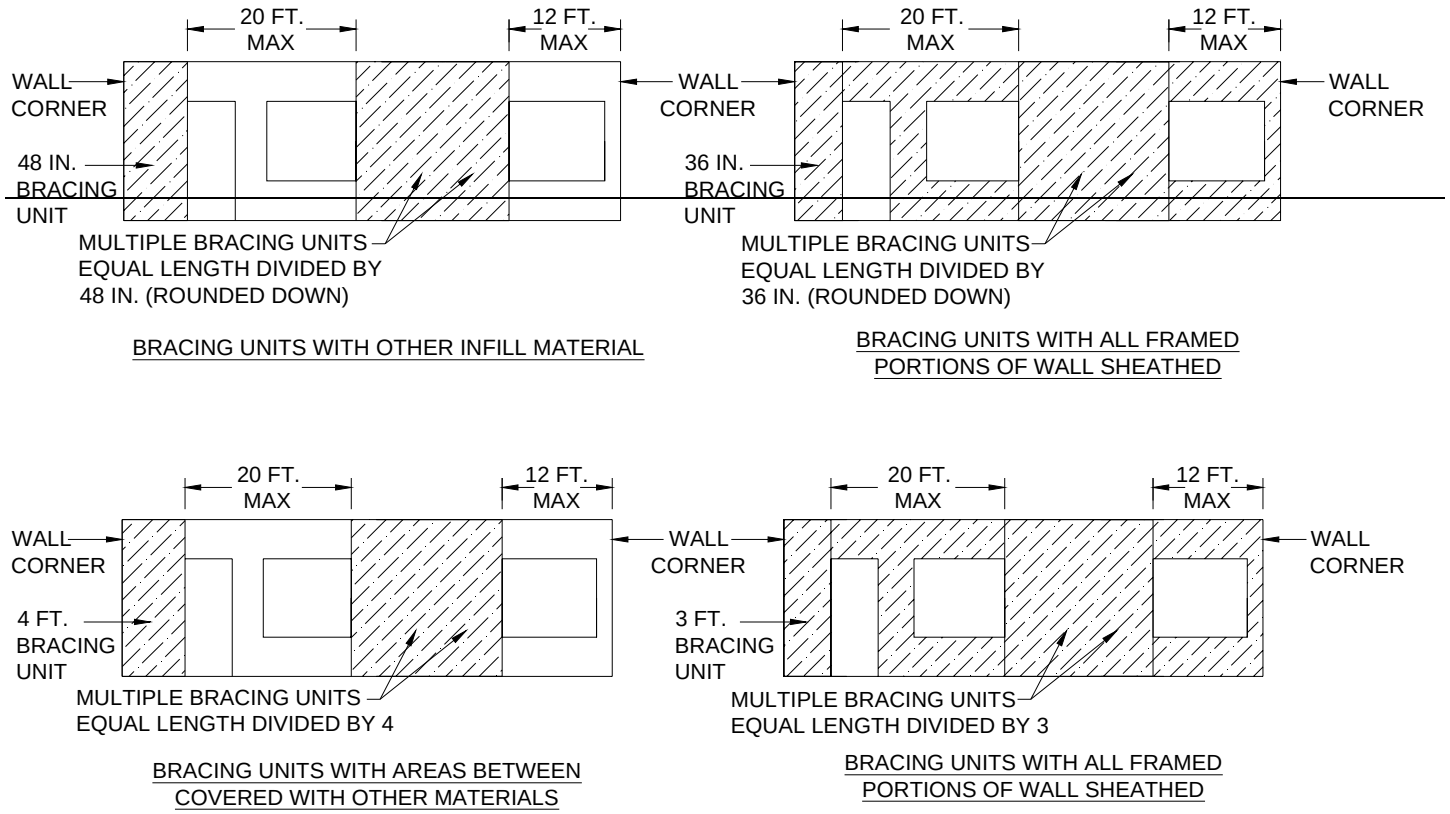


FIGURE ~~R602.12.4~~ R602.12.5
BRACING UNIT DISTRIBUTION

~~R602.12.5~~ R602.12.6 Narrow panels. The bracing methods referenced in Section R602.10 and specified in Sections R602.12.6.1 through R602.12.6.3 shall be permitted when using simplified wall bracing.

~~R602.12.5.1~~ R602.12.6.1 Method CS-G. Braced wall panels constructed as Method CS-G in accordance with Tables R602.10.4.1. and R602.10.4.2 shall be permitted for ~~single~~ one-story garages when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-G panel shall be equivalent to 0.5 of a bracing unit. Segments of wall which include a Method CS-G panel shall meet the requirements of Section R602.10.4.4.

~~R602.12.5.2~~ R602.12.6.2 Method CS-PF. Braced wall panels constructed as Method CS-PF in accordance with Section R602.10.4.1.1 shall be permitted when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal 0.5 bracing units. A maximum of four CS-PF panels shall be permitted on all the segments of walls parallel to each side of the circumscribed rectangle. Segments of wall which include a Method CS-PF panel shall meet the requirements of Section R602.10.4.4.

~~R602.12.5.3~~ R602.12.6.3 Methods PFH and PFG. Braced wall panels constructed as Method PFH and PFG shall be permitted when bracing units are constructed using wood structural panels. Each PFH and panel shall equal one bracing unit and each PFG shall be equal to 0.75 bracing units.

~~R602.12.6~~ R602.12.7 Lateral support. For bracing units located along the eaves, the vertical distance from the outside edge of the top wall plate to the roof sheathing above shall not exceed 9.25 inches (235 mm) at the location of a bracing unit unless lateral support is provided in accordance with Section R602.10.6.2.

~~R602.12.7~~ R602.12.8 Stem walls. Masonry stem walls with a height and length of 48 inches (1219 mm) or less supporting a bracing unit or a Method CS-G, CS-PF or PFG braced wall panel shall be constructed in accordance with Figure R602.10.7. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall be reinforced sized and located in accordance with Figure R602.10.7.

Commenter's Reason: The proposed amendments, which are housekeeping in nature, clarify the simplified approach and further defines bracing units and their material requirements.

Final Action: AS AM AMPC____ D

RB112-09/10

R602.12, R603.12.1, R602.12.1.3, Table R602.12(1), Table R602.12(2), Figure R602.12, R703.7, Table R703.7(1), Table R703.7(2)

Proposed Change as Submitted

Proponent: Charles Clark, Brick Industry Association, representing the Masonry Alliance for Codes and Standards (MACS)

Revise as follows:

R602.12 Wall bracing and stone and masonry veneer. Where stone and masonry veneer is installed in accordance with Section R703.7, wall bracing on exterior *braced wall lines*, and *braced wall lines* on the interior of the building, shall comply with this section. In Seismic Design Categories D_0, D_1 and D_2, cripple walls shall not be permitted, and required *braced wall lines* on the interior of the building shall be supported on continuous foundations.

For all buildings in Seismic Design Categories A and~~,~~ B, ~~and~~ for townhouses in Seismic Design Category C, and for one- or two-family dwellings in Seismic Design Category D_0, wall bracing ~~at exterior and interior *braced wall lines*~~ shall be in accordance with Section R602.10 and the additional requirements of Table R602.12(1).

For townhouses in Seismic Design Category D_0 and detached one- or two-family *dwellings* in Seismic Design Categories D_0, D_1 and D_2, wall bracing and hold downs ~~at exterior and interior *braced wall lines*~~ shall be in accordance with Sections R602.10 and R602.11 and the additional requirements of Section R602.12.1, ~~and~~ Table R602.12(2) and Figure R602.12. ~~In Seismic Design Categories D_0, D_1 and D_2, cripple walls are not permitted, and required interior *braced wall lines* shall be supported on continuous foundations.~~

R602.12.1 Townhouses in Seismic Design Category D_0 and one- or two-family dwellings in Seismic Design Categories ~~D_0,~~ D_1 and D_2. Wall bracing where stone and masonry veneer exceeds the first story height for townhouses in Seismic Design Category D_0 and one- or two-family dwellings in Seismic Design Categories ~~D_0,~~ D_1 and D_2 shall conform to the requirements of Sections R602.10 and R602.11 and ~~the following requirements~~ Sections R602.12.1.1 to R602.12.1.6.

R602.12.1.3 Braced wall panel construction. *Braced wall panels* shall be constructed of wood structural panel sheathing with a thickness of not less than 7/16 inch (11 mm) nailed with 8d common nails spaced 4 inches (102 mm) on center at all panel edges and 12 inches (305 mm) on center at intermediate supports. The end of each *braced wall panel* shall have a hold down device in accordance with Table R602.12(2) installed at each end. Size, height and spacing of wood studs shall be in accordance with Table R602.3(5).

TABLE R602.12(1)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS USING TABLE R602.10.1.2(2), ~~WOOD OR STEEL FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C~~

STRUCTURE TYPE AND SEISMIC DESIGN CATEGORY	NUMBER OF ~~WOOD FRAMED~~ STORIES	~~WOOD FRAMED~~ STORY	MINIMUM ~~SHEATHING AMOUNT~~ BRACED WALL PANEL LENGTH ~~(length of braced wall line length)~~ [ab]
All Structures in SDC A or B and Detached one- and two-family dwellings in SDC C	1, 2 or 3	all	Table R602.10.1.2(2)
Townhouses in SDC C and Detached one- and two-family dwellings in SDC D_0 [a]	1	1 only	Table R602.10.1.2(2)
	2	top	Table R602.10.1.2(2)
		bottom	1.5 times length required by Table R602.10.1.2(2)
	3	top	Table R602.10.1.2(2)
		middle	1.5 times length required by Table R602.10.1.2(2)
		bottom	1.5 times length required by Table R602.10.1.2(2)

a. In Seismic Design Category D_0, cripple walls shall not be permitted and required braced wall lines on the interior of the building shall be supported on a continuous foundation.

b.~~a.~~ Applies to exterior ~~and interior~~ braced wall lines~~,~~ and braced wall lines on the interior of the building.

TABLE R602.12(2)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS
USING 7/16 INCH WOOD STRUCTURAL PANEL SHEATHING~~,~~
~~ONE- AND TWO-FAMILY DETACHED DWELLINGS, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2~~

STRUCTURE TYPE AND SEISMIC DESIGN CATEGORY	NUMBER OF STORIES [a]	STORY	MINIMUM ~~SHEATHING AMOUNT~~ BRACED WALL PANEL (percent ~~length~~ of braced wall line length) [b]	MINIMUM BRACED WALL PANEL SHEATHING THICKNESS AND FASTENING	SINGLE STORY HOLD DOWN FORCE (lb) [c]	CUMULATIVE HOLD DOWN FORCE (lb) [d]
Townhouses in SDC D_0	1	1 only	35	7/16-inch wood structural panel sheathing with 8d common nails spaced at 4 inches on center at panel edges, 12 inches on center at intermediate supports; 8d common nails at 4 inches on center at braced wall panel end posts with hold down attached	N/A	---
	2	top	35		1900	---
		bottom	45		3200	5100
	3	top	40		1900	---
		middle	45		3500	5400
		bottom	60		3500	8900
One- or two-family dwellings in SDC D_1	1	1 only	~~45~~ 35		2100	---
	2	top	~~45~~ 35		2100	---
		bottom	~~45~~ 40		3700	5800
	3	top	~~45~~ 35		2100	---
		middle	~~45~~ 40		3700	5800
		bottom	60		3700	9500
One- or two-family dwellings in SDC D_2	1	1 only	~~55~~ 50		2300	---
	2	top	~~55~~ 50		2300	---
		bottom	55		3900	6200

a. Cripple walls ~~are~~ shall not be permitted in Seismic Design Categories D_0, D_1 or D_2.
b. Applies to exterior ~~and interior~~ braced wall lines~~,~~ and braced wall lines on the interior of the building. Required braced wall lines on the interior of the building shall be supported on a continuous foundation.
c. Comply with Figure R602.12. Hold down force is minimum allowable stress load for connector providing uplift tie from wall framing at end of braced wall panel at the noted story to wall framing at end of braced wall panel at the story below, or to foundation or foundation wall. Use single story hold down force where edges of braced wall panels do not align; a continuous load path to the foundation shall be maintained. ~~[See Figure R602.12].~~
d. Comply with Figure R602.12. Where hold down connectors from stories above align with stories below, use cumulative hold down force size middle and bottom story hold down connectors. ~~(See Figure R602.12)~~

FIGURE R602.12
~~HOLD DOWNS AT EXTERIOR AND INTERIOR BRACED WALL PANELS~~
STONE OR MASONRY VENEER WALL BRACING HOLD-DOWN REQUIREMENTS FOR SEISMIC DESIGN

(No change to figure)

R703.7 Stone and masonry veneer, general. Stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4 and Figure R703.7. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first *story* above-grade and shall not exceed 5 inches (127 mm) in thickness. See Section R602.12 for wall bracing requirements for masonry veneer for wood framed construction and Section R603.9.5 for wall bracing requirements for masonry veneer for cold-formed steel construction.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.
2. For all buildings in Seismic Design Category D_0 and for detached one- or two-family *dwellings* in Seismic Design Categories ~~D_0,~~ D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

TABLE R703.7(1)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, WOOD OR STEEL FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

SEISMIC DESIGN CATEGORY	NUMBER OF WOOD OR STEEL FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL[a] (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)[b]	~~WOOD OR STEEL FRAMED STORY~~
A or B	Steel: 1 or 2 Wood: 1, 2 or 3	30	5	50	~~All~~
C	1	30	5	50	~~1 only~~
	2	30	5	50	~~top~~
					~~bottom~~
	Wood only: 3	30	5	50	~~top~~
					~~middle~~
					~~bottom~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa.

a. An additional 8 feet ~~is~~ shall be permitted for gable end walls. ~~See also~~ Comply with story height limitations of Section R301.3.

b. Maximum weight ~~is~~ shall be installed weight and shall include~~s~~ weight of mortar, grout, lath and other materials used for installation. Where veneer is placed on both faces of a wall, the combined weight shall not exceed that specified in this table.

TABLE R703.7(2)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, ~~ONE- AND TWO-FAMILY DETACHED DWELLINGS,~~ WOOD FRAMING, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2

STRUCTURE TYPE AND SEISMIC DESIGN CATEGORY	NUMBER OF WOOD FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)
All buildings in SDC D_0	1	20[c]	4	40
	2	20[c]	4	40
	3	30[d]	4	40
One- and two-family dwellings in SDC D_1	1	20[c]	4	40
	2	20[c]	4	40
	3	20[c]	4	40
One- and two-family dwellings in SDC D_2	1	20[c]	3	30
	2	20[c]	3	30

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.

a. Cripple walls ~~are~~ shall not be permitted in Seismic Design Categories D_0, D_1 and D_2.

b. Maximum weight ~~is~~ shall be installed weight and shall include~~s~~ weight of mortar, grout and lath, and other materials used for installation.

c. The veneer shall not exceed 20 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls, or 30 feet in height with an additional 8 feet for gable end walls where the lower 10 feet has a backing of concrete or masonry wall. ~~See also~~ Comply with story height limitations of Section R301.3.

d. The veneer shall not exceed 30 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls. ~~See also~~ Comply with story height limitations of Section R301.3.

Reason: This code change adjusts the overly conservative special wall bracing requirements for houses with masonry veneer in moderate to high-seismic regions. This adjustment is based on full-scale whole-building shake-table testing that has demonstrated that the in-plane shear performance of anchored masonry veneer can resist a portion its own seismically-induced load. It showed that the shear capacity of the veneer is significant and can effectively carry a portion of its load directly to the foundation. (Bibliography References 3 & 4 below)

This testing is substantiated by other full-scale tests on whole-houses in the United States, Australia, England, Japan and New Zealand. One study in the United States reported that a two-story split foyer dwelling had a maximum deflection of 0.04 inches (1 mm) at a uniform wind pressure of 25 psf. This deflection was significantly less than that predicted by conventional analysis. Numerous whole-house tests have also been conducted in Australia. These tests demonstrated that conventional residential construction (only slightly different than that in the United States) withstood 2.4 times to 4.75 times its intended design load without failure. In England, researchers have determined that shear loads transferred from veneer to wood-framed shear walls in a full brick-veneered building were reduced by as much as 45% for wind loads. In New Zealand, tests demonstrated that for masonry veneer on conventional wood-stud framing, the veneer can take up to 50% of the lateral in-plane load.

This code change effectively reduces the special wall bracing requirements for wood-stud framing behind masonry veneer in recognition that the veneer carries a significant portion of its own load in-plane.

Bibliography:

1. Johnson, Eric N., McGinley, W. Mark, The In Plane Shear Performance of Brick Veneer and Wood Stud Walls, Ninth *North American Masonry Conference*, June, 2003.
2. Johnson, Eric N., The In-Plane Shear Performance of Brick Veneer and Wood Stud Walls, Master of Science Thesis, North Carolina A & T State University, Greensboro, North Carolina, 2003.

3. Klingner, Richard E., Shing, P. Benson, McGinley, Mark W., McLean, David I., Okail, Hussein, and Jo, Seongwoo, "NSF NEES Small-Group Project on Performance-based Design of Masonry and Masonry Veneer: Overview and Preliminary Results," *TMS Journal*, The Masonry Society, Boulder, Colorado, December 2008 (date submitted for publication).
4. Klingner, Richard E., "Behavior of Anchored Masonry Veneer with Light Wood Stud-Framing or Masonry Backing in Full-Scale Whole-Building Shaking-Table Tests," *TMS Journal*, The Masonry Society, Boulder, Colorado, June 2009 (date submitted for publication).
5. Thurston,S.J., Beattie, G. J., "Seismic performance of New Zealand two-storey brick veneer houses," *2009 New Zealand Society for Earthquake Engineering Conference Proceedings*, Wellington, New Zealand, April, 2009.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: CLARK-RB-5-R602.12

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee agrees with the intent and this is a needed addition, however the Final Report or the full-scale shake-table test is needed in order to further evaluate this issue.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Charles Clark, Brick Industry Association, representing Masonry Alliance for Codes and Standards (MACS), requests Approval as Modified by this Public Comment.

Modify proposal as follows:

602.12 Wall bracing and stone and masonry veneer. Where stone and masonry veneer is installed in accordance with Section R703.7, wall bracing on exterior *braced wall lines*, and *braced wall lines* on the interior of the building, shall comply with this section. In Seismic Design Categories D_0, D_1 and D_2, cripple walls shall not be permitted, and required *braced wall lines* on the interior of the building shall be supported on continuous foundations.

For all buildings in Seismic Design Categories A ~~and~~ , B, ~~for townhouses in Seismic Design Category~~ and C, and for detached one- or two-family dwellings in Seismic Design Category D_0, wall bracing shall be in accordance with Section R602.10 and the additional requirements of Table R602.12(1).

For townhouses in Seismic Design Category D_0 and detached one- or two-family *dwellings* in Seismic Design Categories D_0, D_1 and D_2, wall bracing and hold downs shall be in accordance with Sections R602.10 and R602.11 and the additional requirements of Section R602.12.1, Table R602.12(2) and Figure R602.12.

TABLE R602.12(2)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS USING 7/16 INCH WOOD STRUCTURAL PANEL SHEATHING

STRUCTURE TYPE AND SEISMIC DESIGN CATEGORY	NUMBER OF STORIES [a]	STORY	MINIMUM BRACED WALL PANEL (percent of braced wall line length) [b]	MINIMUM BRACED WALL PANEL SHEATHING THICKNESS AND FASTENING	SINGLE STORY HOLD DOWN FORCE (lb) [c]	CUMULATIVE HOLD DOWN FORCE (lb) [d]
Townhouses in SDC D_0	1	1 only	35	7/16-inch wood structural panel sheathing with 8d common nails spaced at 4 inches on center at panel edges, 12 inches on center at intermediate supports; 8d common nails at 4 inches on center at braced wall panel end posts with hold down attached	N/A	---
	2	top	35		1900	---
		bottom	45		3200	5100
	3	top	40		1900	---
		middle	45		3500	5400
		bottom	60		3500	8900
Detached One- or two-family dwellings in SDC D_1	1	1 only	35		2100	---
	2	top	35		2100	---
		bottom	40		3700	5800
	3	top	35		2100	---
		middle	40		3700	5800
		bottom	60		3700	9500
Detached One- or two-family dwellings in SDC D_2	1	1 only	50		2300	---
	2	top	50		2300	---
		bottom	55		3900	6200

a. Cripple walls are shall not be permitted in Seismic Design Categories D_0, D_1 or D_2.
b. Applies to exterior and interior braced wall lines, and braced wall lines on the interior of the building. Required braced wall lines on the interior of the building shall be supported on a continuous foundation.
c. Comply with Figure R602.12. Hold down force is minimum allowable stress load for connector providing uplift tie from wall framing at end of braced wall panel at the noted story to wall framing at end of braced wall panel at the story below, or to foundation or foundation wall. Use single story hold down force where edges of braced wall panels do not align; a continuous load path to the foundation shall be maintained. [See Figure R602.12].
d. Comply with Figure R602.12. Where hold down connectors from stories above align with stories below, use cumulative hold down force size middle and bottom story hold down connectors. (See Figure R602.12)

TABLE R703.7(2)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, WOOD FRAMING, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2

STRUCTURE TYPE AND SEISMIC DESIGN CATEGORY	NUMBER OF WOOD FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)
All buildings in SDC D_0	1	20[c]	4	40
	2	20[c]	4	40
	3	30[d]	4	40
Detached One- and two-family dwellings in SDC D_1	1	20[c]	4	40
	2	20[c]	4	40
	3	20[c]	4	40
Detached One- and two-family dwellings in SDC D_2	1	20[c]	3	30
	2	20[c]	3	30

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.
a. Cripple walls are shall not be permitted in Seismic Design Categories D_0, D_1 and D_2.
b. Maximum weight is shall be installed weight and shall includes weight of mortar, grout and lath, and other materials used for installation.
c. The veneer shall not exceed 20 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls, or 30 feet in height with an additional 8 feet for gable end walls where the lower 10 feet has a backing of concrete or masonry wall. See also Comply with story height limitations of Section R301.3.
d. The veneer shall not exceed 30 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls. See also Comply with story height limitations of Section R301.3.

Commenter's Reason: This public comment is filed anticipating the release of a report documenting the full-scale whole-building shaking-table tests conducted as a part of the NFS NEES Small-Group Project on masonry veneer. Preliminary reports from the testing show that the in-plane shear performance of anchored masonry veneer can resist a portion its own seismically-induced load. It shows that the shear capacity of the veneer is significant and can effectively carry a portion of its load directly to the foundation.

This code change adjusts the overly conservative special wall bracing requirements for houses with masonry veneer in moderate to high seismic regions. This code change effectively reduces the special wall bracing requirements for wood-stud framing behind masonry veneer in recognition that the veneer carries a significant portion of its own load in-plane.

The test results from the NFS NEES Small-Group Project are substantiated by other full-scale tests on whole-houses in the United States, Australia, England, Japan and New Zealand. One study in the United States reported that a two-story split foyer dwelling had a maximum deflection of 0.04 inches (1 mm) at a uniform wind pressure of 25 psf. This deflection was significantly less than that predicted by conventional analysis. Numerous whole-house tests have also been conducted in Australia. These tests demonstrated that conventional residential construction (only slightly different than that in the United States) withstood 2.4 times to 4.75 times its intended design load without failure. In England, researchers have determined that shear loads transferred from veneer to wood-framed shear walls in a full brick-veneered building were reduced by as much as 45% for wind loads. In New Zealand, tests demonstrated that for masonry veneer on conventional wood-stud framing, the veneer can take up to 50% of the lateral in-plane load.

Final Action: AS AM AMPC____ D

RB113-09/10
R602.12, Table R602.12(1), Table R602.12(2)

Proposed Change as Submitted

Proponent: Gary Ehrlich, National Association of Home Builders (NAHB)

Revise as follows:

R602.12 Wall bracing and stone and masonry veneer. Where stone and masonry veneer is installed in accordance with Section R703.7, wall bracing on exterior *braced wall lines*, and *braced wall lines* on the interior of the building, perpendicular to veneered walls shall comply with this section.

For all buildings in Seismic Design Categories A, B and C, wall bracing ~~at exterior and interior *braced wall lines*~~ shall be in accordance with Section R602.10 and the additional requirements of Table R602.12(1).

For detached one- or two-family *dwellings* in Seismic Design Categories D0, D1 and D2, wall bracing and hold downs ~~at exterior and interior *braced wall lines*~~ shall be in accordance with Sections R602.10 and R602.11 and the additional requirements of Section R602.12.1 and Table R602.12(2). In Seismic Design Categories D0, D1 and D2, cripple walls are not permitted, and required ~~interior~~ *braced wall lines* on the interior of the building shall be supported on continuous foundations.

TABLE R602.12(1)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS, WOOD ~~OR STEEL~~ FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

SEISMIC DESIGN CATEGORY	NUMBER OFWOOD FRAMED STORIES	WOOD FRAMED STORY	MINIMUM SHEATHING AMOUNT ~~(length of braced wall line length)~~ [a]
A or B	1, 2 or 3	all	Table R602.10.1.2(2)
C (detached one- and two-family dwellings)	1, 2 or 3	all	Table R602.10.1.2(2)
C (townhouses)	1	1 only	Table R602.10.1.2(2)
	2	top	Table R602.10.1.(2)
		bottom	1.5 times length required by Table R602.10.1.2(2)
	3	top	Table R602.10.1(1)
		middle	1.5 times length required by Table R602.10.1.2(2)
		bottom	1.5 times length required by Table R602.10.1.2(2)

a. Applies to exterior ~~and interior~~ braced wall lines, and braced wall lines on the interior of the building, perpendicular to veneered walls.

TABLE R602.12(2)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS, ONE- AND TWO-FAMILY DETACHED DWELLINGS, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2

SEISMIC DESIGN CATEGORY	NUMBER OF STORIES[a]	STORY	MINIMUM SHEATHING AMOUNT (percent ~~length~~ of braced wall line length) [b]	MINIMUM SHEATHING THICKNESS AND FASTENING	SINGLE STORY HOLD DOWN FORCE (lb)[b~~c~~]	CUMULATIVE HOLD DOWN FORCE (lb)[c~~d~~]

b. Applies to exterior ~~and interior~~ braced wall lines, and braced wall lines on the interior of the building, perpendicular to veneered walls.

(Portions of table and footnotes not shown remain unchanged)

FIGURE R602.12
~~HOLD DOWNS AT EXTERIOR AND INTERIOR BRACED WALL PANELS~~
STONE OR MASONRY VENEER WALL BRACING HOLD-DOWN REQUIREMENTS, ONE- AND TWO-FAMILY DETACHED DWELLINGS, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2

(No change to figure)

Reason: The purpose of this proposal is to revise the overly conservative special wall bracing requirements for dwellings with stone or masonry veneer in moderate and high-seismic regions. A common application is for only the front wall of a dwelling to be provided with stone or masonry veneer. However, the provisions as currently stated require the specified bracing length to be increased for every braced wall in the dwelling (both exterior and on the interior), and in high-seismic conditions for hold-downs to be provided on every segment of every braced wall panel in the dwelling.

In recent testing at the University of Texas and UC San Diego, masonry veneer on individual wood-framed wall segments and on a full wood-framed building did not fail until subjected to peak ground accelerations well above the ground motions characteristic of Seismic Design Category D2. Thus, failure did not occur until well beyond the seismic limits of the IRC. Additionally, the major failure mode is veneer falling off the segments and building, rather than any damage to the wood framing back-up.

Additionally, testing at BRANZ in New Zealand of conventionally-braced structure with masonry veneer has shown that the masonry itself is capable of taking as much as 50% of the lateral load delivered in-plane to the wall. Further, the veneer showed good performance up to deflections of an inch. The allowable design capacities for bracing in the IRC result in deflections of around ½-inch, well within the range of good performance seen in the BRANZ tests.

There are no documented racking failures of a properly-braced house with stone or masonry veneer due to a seismic event. (Obviously, lack of veneer reinforcing and ties is an entirely different issue). Based on that fact and the UT, UCSD and BRANZ testing, the current requirement is not technically justified and clearly an onerous burden on masonry veneer construction. The proposed revisions will limit the increases in bracing and vertical load-path connections to just those walls that need to resist the seismic loads imparted to the structure by the masonry veneer.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: EHRLICH-RB-8-R602.12

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee feels that a truly quantified result is not available that would allow this change, based on the previous action on RB112-09/10.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Gary J. Ehrlich, National Association of Home Builders, requests Approval as Modified by this Public Comment.

Modify the proposal as:

R602.12 Wall bracing and stone and masonry veneer. Where stone and masonry veneer is installed in accordance with Section R703.7, wall bracing on exterior *braced wall lines*, and *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supporting veneered walls shall comply with this section.

For all buildings in Seismic Design Categories A, B and C, wall bracing shall be in accordance with Section R602.10 and the additional requirements of Table R602.12(1).

For detached one- or two-family *dwellings* in Seismic Design Categories D0, D1 and D2, wall bracing and hold downs shall be in accordance with Sections R602.10 and R602.11 and the additional requirements of Section R602.12.1 and Table R602.12(2). In Seismic Design Categories D0, D1 and D2, cripple walls shall not be permitted, and required *braced wall lines* on the interior of the building shall be supported on continuous foundations.

TABLE R602.12(1)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS, WOOD FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

SEISMIC DESIGN CATEGORY	NUMBER OFWOOD FRAMED STORIES	WOOD FRAMED STORY	MINIMUM SHEATHING AMOUNT
A or B	1, 2 or 3	all	Table R602.10.1.2(2)
~~C (detached one- and two-family dwellings)~~	~~1, 2 or 3~~	~~all~~	~~Table R602.10.1.2(2)~~
C (townhouses)	1	1 only	Table R602.10.1.2(2)
	2	top	Table R602.10.1.(2)
		bottom	1.5 times length required by Table R602.10.1.2(2)
	3	top	Table R602.10.1(1)
		middle	1.5 times length required by Table R602.10.1.2(2)
		bottom	1.5 times length required by Table R602.10.1.2(2)

a. Applies to exterior braced wall lines, and braced wall lines on the interior of the building, backing or perpendicular to and laterally supporting veneered walls.

TABLE R602.12(2)
STONE OR MASONRY VENEER WALL BRACING REQUIREMENTS, ONE- AND TWO-FAMILY DETACHED DWELLINGS, SEISMIC DESIGN CATEGORIES D0, D1 AND D2

b. Applies to exterior braced wall lines, and braced wall lines on the interior of the building, backing or perpendicular to and laterally supporting veneered walls.

(Remainder of table and footnotes remain unchanged)

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The purpose of this public comment is to incorporate the modification that was ruled out-of-order during the Public Hearings in Baltimore. This modification accomplishes two things. First, by adding the phrase "backing or", the requirement for a wood-framed wall providing backup for masonry veneer to be braced using these special seismic bracing provisions is maintained. Second, by adding the phrase "laterally supporting", the intent of the proposal to remove the bracing requirement from walls not seeing load from the veneer is maintained. An example of a wall meeting this provision would be the outermost wall of a one-story garage constructed without masonry veneer but attached to a veneered or partially-veneered two-story house.

This proposal does not reduce the required amount of bracing on any wall backing masonry veneer, or on any wall perpendicular to and laterally supporting a masonry veneer wall. These are the walls that will see seismic loads imposed on them due to the masonry and need the additional bracing. What this proposal is trying to address is walls such as the back wall of a house with masonry only on the front wall that will see little, if any,

additional force due to the presence of the veneer. These walls should not have to be transformed into fully-restrained shear walls with hold-downs or subject to increased bracing lengths simply because there is masonry veneer on the opposite side of the house.

For SDC D0, D1 and D2, the walls that are exempted from the special bracing provisions by this change still need to be braced using one of the eight standard intermittent bracing methods, with the standard 48" minimum braced wall panel length required. This is consistent with the rules which forbid mixing of intermittent and continuous bracing methods on the same story in high-seismic regions. Similarly, the "partial-credit" provision for intermittent panels between 36" and 48" is also prohibited in high-seismic regions. Thus, the total amount of bracing which would be provided on the walls not subject to the special increases will likely be greater than the total amount which would be provided if the dwelling had no veneer. Therefore, concerns about potential torsional effects or deformation compatibility do not apply. The performance of the bracing will be equivalent regardless of whether the braced wall panels have veneer and/or hold-downs on them or not.

Final Action: AS AM AMPC____ D

RB116-09/10
R606.6.1

Proposed Change as Submitted

Proponent: Gary Ehrlich, PE, National Association of Home Builders (NAHB)

Revise as follows:

R606.6.1 Pier cap. Hollow piers shall be capped with 4 inches (102 mm) of *solid masonry* or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout, unless a sill plate of 2-inch (51 mm) minimum nominal thickness and bearing on two face shells is provided. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 865 square mm). ~~or other *approved* methods.~~

Reason: The purpose of this proposal is to provide additional options for providing bearing at the top of masonry piers. No guidance is currently provided in the code for the common condition where the top of a masonry pier does not match the bottom of the floor framing. Even if the pier has been properly constructed with solid masonry or grouted cells, the code does not clearly require direct bearing, and this gap is often filled with shims or small blocks that are not adequate to transfer the reaction from the beam or girder to the pier. Language previously included in Section 1804.6.4 of the 1999 SBC requiring a nominal section of sill plate is added to R606.6.1. Also, a reference to a masonry cap block (or "FHA block") is added. These blocks have a solid top surface over hollow cores and are intended to be used at the top courses of masonry piers or walls. However, the "cap" is not 4" thick, hence the need for a separate reference.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: EHRLICH-RB-9-R606.6.1

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on the committee's previous action on RB80-09/10 and the proponent's request for disapproval with intent to rework and bring back to Final Action.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Gary J. Ehrlich, PE, National Association of Home Builders, request Approval as Modified by this Public Comment

Modify the proposal as:

R502.6 Bearing. The ends of each joist, beam or girder shall have not less than 1.5 inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) on masonry or concrete except where supported on a 1-inch-by-4-inch (25.4 mm by 102 mm) ribbon strip and nailed to the adjacent stud or by the use of *approved* joist hangers. The bearing on masonry or concrete shall be direct, or a sill plate of 2-inch (51 mm) minimum nominal thickness shall be provided under the joist, beam or girder. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 865 square mm).

R606.6.1 Pier cap. Hollow piers shall be capped with 4 inches (102 mm) of *solid masonry* or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout~~, unless a sill plate of 2-inch (51 mm) minimum nominal thickness and bearing on two face shells is provided. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 865 square mm)~~.

R802.6 Bearing. The ends of each rafter or ceiling joist shall have not less than 1 1/2 inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) on masonry or concrete. The bearing on masonry or concrete shall be direct, or a sill plate of 2-inch (51 mm) minimum nominal thickness shall be provided under the rafter or ceiling joist. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 865 square mm).

Commenter's Reason: The purpose of this public comment is to address concerns raised during testimony regarding the ability of the sill plate to provide sufficient bearing and load transfer across a hollow cell. While this is not an issue for many typical spans and load conditions, it could be for long spans, three-story dwellings and dwellings in areas of high snow loads. In recognition of these possible conditions, and to keep the code as simple as possible, we have agreed to delete the hollow-cell option.

The need still exists to address the condition where a gap does occur, for whatever reason, between the top of a pier and the floor or roof framing. For this reason, the sill plate language must be retained. Otherwise, a dowel or pile of shims filling the gap would be acceptable as long as the dowel or shims are at least three inches long. A sill plate segment will provide stronger and more stable bearing. The sill plate requirement is removed from R606.6.1 and moved to the end of Sections R502.6 and R802.6 where it is more appropriate.

Final Action: AS AM AMPC____ D

RB119-09/10
R612.1, R703.8

Proposed Change as Submitted

Proponent: Jeff Lowinski, representing the Window and Door Manufacturers Association (WDMA)

Revise as follows:

R612.1 General. This section prescribes performance and construction requirements for exterior window and door assemblies installed in walls. Windows and doors shall be installed ~~and flashed~~ in accordance with the fenestration manufacturer's written installation instructions. Window and door openings shall be flashed in accordance with Section R703.8. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

R703.8 Flashing. ~~*Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:~~ Penetrations and openings in exterior walls shall be flashed or sealed in such a manner that will inhibit entry of water into the wall cavity or penetration of water to the building structural framing components. Flashing components shall be applied shingle fashion and shall direct water to the surface of the exterior wall finish. Material and components used to flash penetrations and openings shall be water-resistant and corrosion-resistant. Self-adhered membranes used as flashing shall comply with AAMA 711. The following locations shall be flashed:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Exterior wall plumbing penetrations shall be in accordance with Section P2606.

Reason: The revisions proposed for Chapter 6 clarify that it is window and door assemblies that are installed in walls, and removes the inappropriate flashing text in this chapter since flashing requirements for windows and doors are explicit in Chapter 7.

In Chapter 7, the proposed is intended to be editorial and improves the charging language for flashing. The proposal also directs the reader to the requirements in Section P2606 for exterior wall plumbing penetrations.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: LOWINSKI-RB-4-R612.1-R703.8

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee feels that this change does not clearly define who is responsible for the instructions, the manufacturer or the code. ASTM E 2112 needs to be brought into compliance and brought into the code and that would resolve these issues. It is not clear that this is adequate for all openings.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jeff Inks, Window and Door Manufacturer's Association, requests Approval as Modified by this Public Comment.

Replace proposal as follows:

R612.1 General. This section prescribes performance and construction requirements for exterior windows and doors installed in walls. Windows and doors shall be installed in accordance with the fenestration manufacturer's written installation instructions. Window and door openings shall be flashed in accordance with Section R703.8. Written installation instructions shall be provided by the fenestration manufacturer. ~~for each window or door~~.

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   - 1.1. The fenestration manufacturer's written flashing instructions.
   - 1.2. For applications not addressed in the fenestration manufacturer's written instructions, in accordance with the flashing manufacturer's written instructions.
   - 1.3 In accordance with the flashing method of a registered design professional.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Exterior wall plumbing penetrations shall be in accordance with Section P2606.

Commenter's Reason: The intent of the original proposal is to clarify that the installation of windows is part of the design and construction of walls and partitions as provided for in Chapter 6, and that flashing is part of the design and construction of the exterior wall covering as provided for in Chapter 7, which is not disputed. In addition the intent was to clarify the respective Chapter 7 language accordingly.

The modification proposed for 703.8 by this public comment addresses the Committee's reason for rejecting the original proposal by clearly defining who is responsible for the (flashing) instructions, while also clarifying that door and window installation is to be in accordance with manufacturer's instructions as part of the design and construction of walls and partitions provided for in Chapter 6, and window and door flashing in accordance with 703.8 as part of the design and construction of the exterior wall covering which is already explicitly provided for in Chapter 7. Amending the sections in this way will help to avoid any confusion over how the IRC window and door installation and flashing requirements are to apply to doors and windows.

The requirement that instructions be provided for every single window and door is deleted from the last sentence in Section 612.1 because it is simply not necessary. Manufacturers are required to provide written instructions and they do, but there is no reason why the same set of printed instructions needs to be provided with every window and door when the products are identical. Duplicative copies are not needed, not used, and simply wasted at the jobsite. Complete manufacturer's instructions are readily available to builders, designers and installers in many ways. Requiring a separate set for every window and door is an unnecessary waste of resources.

This modification also addresses the Committee's other comment noting ASTM E 2112 as one way of providing a comprehensive set of installation and flashing instructions that the IRC could rely upon. At this time, E 2112 is undergoing significant revision and does not currently fully meet ICC criteria for referenced standards and therefore cannot be referenced by the IRC until revised. The above modification provides an acceptable alternative and one that the Committee agreed with in their consideration of RB-145.

While a window and door manufacturer's installation and flashing instructions do cover a wide variety of wall and project conditions, they simply cannot account for every conceivable project specific condition that may need to be considered given the virtually limitless set of conditions that are possible in residential construction, or for when a builder or design professional wants to employ a proven flashing method that may not be covered by a particular manufacturer's instructions. The IRC therefore needs to provide some flexibility at the local level to allow for flashing alternatives that

are compliant with the performance requirements of 703.8, but may not be expressly provided for in the manufacturer's instructions. This modification serves that purpose while still maintaining the requirement that manufacturer's must provide instructions in accordance with Section 612.1, but also provides the noted flexibility that is needed by builders and design professionals.

Final Action: AS AM AMPC____ D

RB122-09/10, Part I
R612.2

Proposed Change as Submitted

Proponent: Paul K. Heilstedt, PE, FAIA, Chair, representing ICC Code Technology Committee (CTC)

PART I – IRC BUILDING/ENERGY

Revise as follows:

R612.2 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~~ 36 inches (610 mm) above the finished floor of the room in which the window is located. Operable sections of windows shall not permit openings that allow passage of a 4 inch (102 mm) diameter sphere where such openings are located within ~~24~~ 36 inches (610 mm) of the finished floor.

Exceptions:

1. Windows whose openings will not allow a 4-inch 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 fall prevention devices that comply with Section R612.3.
3. Openings that are provided with fall prevention devices that comply with ASTM F 2090.
4. Windows that are provided with opening limiting devices that comply with Section R612.4.

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as "areas of study". Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/cc/ctc/index.html. Since its inception in April/2005, the CTC has held seventeen meetings - all open to the public.

This proposed change is a result of the CTC's investigation of the area of study entitled "Child Window Safety". The scope of the activity is noted as:

> Study the incidence and mechanisms of falls from open windows by children and to investigate the necessity and suitability of potential safeguards and/or revisions to the current codes.

The intent of IBC Section 1405.13.2 and IRC Section R612.2 is clearly to provide safety mechanisms to reduce the possibility of children falling through a window. The CTC has determined that this can be realized in the code in three ways: window fall prevention devices; window opening control devices; or reducing the possibility of accessing the window by increasing the minimum sill height. The purpose of this code change is to reduce the potential hazard by increasing the sill height from 24 inches to 36 inches.

In response to the CTC studying the Climbability of Guards, the National Ornamental & Miscellaneous Metals Association (NOMMA) commissioned a paper entitled "Review of Fall Safety of Children Between the Ages of 18 months and 4 Years in Relation to Guards and Climbing in the Built Environment", referred to in this code change as "NOMMA paper". This paper is posted on the CTC website as noted below. The paper provides a summary of the building code requirements, a critical review of relevant per-reviewed scientific literature on guard research and injury data and includes a section entitled "Children's Interaction with the Built Environment". Included in this section is an analysis of falls from windows where it is noted that "Falls from windows are among the most common types of unintended injuries to children and they are a major health concern" (NOMMA paper page 30). The study efficiently places within a few pages the data on window fall incidents and the means of reducing the number of incidents.

U.S. Fall Injury Data

NOMMA report page 7: The 1,421,137 injuries reported by NEISS between 2002 and 2005, inclusive, correspond to a national average of 51,217,603 based on weighting data included with the record data. The average over the four years is 12,804,401. The weighted estimate of 1,117,278 incidents on average annually for children between the ages of 18 months and 4 years represents 8.7 percent of these incidents. For all the incidents to children between the ages of 18 months and 4 years, 5.6 percent involved stairs, 1.22 percent involved windows, and 0.87 percent involved porches, balconies, open-sided floors, and floor openings.

NOMMA paper page 30 – 33. The paper further cites reports which have been compiled in the table below:

Study	Location	Falls	% fatalities
Vish et al. (2005)	Chicago	11/yr	
Istre et al. (2003)	Dallas county	17/yr	
Benoit et al. (2002)	L.A. county	12/yr (11%)	4% (4 yrs old or less)
Stone et al. (2000)	Cincinnati	12/yr (6.3%)	4.7%
Benoit et al. (2000)	Northern Virginia	11/yr (11%)	

Center of Gravity
NOMMA paper page 11, Table 2: The standing center of gravity of children aged 2 to 3.5 years is 24.1 inches (50^{th} percentile is 22.2 inches) and of children aged 3.5 to 4.5 is 25.2 (50^{th} percentile is 23.6).

A reasonable expectation for the Code is that, absent any fall protection in the window opening, a minimum sill height will be required to reduce the ability of a child to climb onto the sill enabling the fall through the opening. Using a child target age of up to 4 years of age and the associated center of gravity, the code mandated height of 24" is not adequate. A child need only extend themselves on their toes, stand on modest stack of books or blocks or hoist themselves a matter of a few inches with their arms to be able to flop onto the sill and expose themselves to the window opening and the associated risk of falling.

The hazards associated with child window falls cannot be understated as evidenced by the following CPSC Press release dated May 15, 2008:

NEWS from CPSC
U.S. Consumer Product Safety Commission
Office of Information and Public Affairs Washington, DC 20207

FOR IMMEDIATE RELEASE
May 15, 2008
Release #08-270

CPSC Hotline: (800) 638-2772
CPSC Media Contact: (301) 504-7908

Window Falls Prompts CPSC to Issue Warning
WASHINGTON, D.C. - With the arrival of the warmer spring weather, families across the nation are opening their windows to let the fresh air in. This pleasant feeling can quickly turn tragic in households with small children. In recent weeks, several children have fallen from windows. The U.S. Consumer Product Safety Commission is warning parents and caregivers to take precautions to keep children from falling from windows.
"CPSC staff is aware of at least 18 falls from windows through media reports, including two deaths, involving small children since April," said CPSC Acting Chairman Nancy Nord. "We are issuing this warning so parents will take the necessary steps to prevent these incidents from happening."

These deaths and injuries frequently occur when kids push themselves against window screens or climb onto furniture located next to an open window.

From 2002-2004, CPSC staff received an average of 25 reports a year of fatalities associated with falls from windows. Children younger than five years of age account for approximately one-third of these reported fatalities. For all age categories, more males died from window falls than females.

To help prevent injuries and tragedies, CPSC recommends the following safety tips:
* Safeguard your children by using window guards or window stops.
* Install window guards to prevent children from falling out of windows. (For windows on the 6th floor and below, install window guards that adults and older children can open easily in case of fire.)
* Install window stops so that windows open no more than 4 inches.
* Never depend on screens to keep children from falling out of windows.
* Whenever possible, open windows from the top -- not the bottom.
* Keep furniture away from windows, to discourage children from climbing near windows.

To see this release on CPSC's web site, please go to:
http://www.cpsc.gov/cpscpub/prerel/prhtml08/08270.html

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: HEILSTEDT-RB-2-R612-IBC 1405.13.2

Public Hearing Results

PART I – IRC

Committee Action: **Disapproved**

Committee Reason: The committee feels the 24 inch height has not been in use long enough to accumulate needed data to justify a change to 36 inches.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Paul K. Heilstedt, P.E., Hon. AIA, Chair, ICC Code Technology Committee (CTC), requests Approval as Submitted.

Commenter's Reason: This code change proposal included two parts, one to the IRC (part 1) and one to the IBC (part 2), to increase the minimum sill height for windows from 24" to 36". Part 2 to the IBC was approved. In approving the code change to the IBC, the committee noted "…increasing the current 24 inch sill height requirement to 36 inches was justified by the data submitted by the proponent."

This public comment coordinates the requirements between the IRC and the IBC. The focus of this change is to provide for the safety of children that are accidentally injured and killed each year due to falls through windows. The window industry has illustrated its ability to provide the type of barrier that can easily offer the level of protection needed to prevent such accidents. CTC does not pretend that this will prevent children from falling from windows that are higher than this 36" threshold because they or others provide opportunities to climb. This doesn't mean we shouldn't establish rational thresholds that would avoid the accidental fall from windows as we have with guards.

Public Comment 2:

Gregory R. Istre, M.D., Injury Prevention Center of Greater Dallas, requests Approval as Submitted.

Commenter's Reason: I am writing in support of the proposal to change "RB 122" to set a minimum height of 36" for window sills in dwelling units. Our organization (the Injury Prevention Center of Greater Dallas), in collaboration with the Texas Department of Health, undertook a three-year study of children who had fallen from heights, in Dallas, Texas, and the data from that study support a mandate for a minimum height of window sills[1]. We found that 89% of the children who fell from a window had fallen directly out of a window whose sill was within 3 feet of the floor. In each case the windows were open and most had a screen, but the screens did not prevent the fall. Also, in almost every case, we found that a parent had been supervising the child but they could not prevent the fall. Our study concludes that most of the falls could have been prevented if either the window sills had been higher off the floor or if the windows had been manufactured to not open far enough to allow a child to pass through the opening.

I am aware that the current number in the code since 2006 is 24", which will go a long way toward decreasing window fall-related injuries to children. By our calculations from our data, ~75% of these falls may be prevented by having minimum sill height of 24", which is the current building standard, and an additional ~15% of falls could be prevented by raising the minimum sill height requirement to 36".

I am aware of Mr. Sealy's work for the past several years and have studied his current proposal, and am convinced that implementation of this code change will go a long way in preventing window fall-related injuries to children.-Gregory Istre, M.D.2/8/2010

Bibliography:

1) Istre, et al. "Childhood injuries due to falls from apartment windows and balconies" *Injury Prevention* 2003;9:349-352.

Public Comment 3:

Jim. W. Sealy, FAIA representing self, requests Approval as Submitted.

Commenter's Reason: This process began for me in early 2000 when I became involved in a legal action involving a toddler falling from an open window in his third floor apartment. During the course of my work I did a lot of research in window placement and falls from windows involving children. As a result of my work, I submitted a proposed change to both the IBC and IRC whereby windowsills would be required to be a minimum distance (36") above the finished floor of the room in which the window is located.

All of the technical requirements in my proposals were based on existing code language and none of it was arbitrary or contrived. My first proposals were submitted in 2002 and both failed because of objections from the window industry and homebuilders and building designers; with the 36" sill height being the major concern on their part. In the following cycle, I resubmitted both proposals and ultimately made concessions to the opposition and I accepted a sill height of 24". However, that height had no logical basis and had not been researched or studied – it was merely a concession on my part.

Both committees approved the section with the 24" height in the first part of the cycle and they were also approved in the final hearings held in Overland Park, Kansas. HOWEVER,

in order t delay the section from going into the 2003 edition of the codes, one of the opponents filed a “formal challenge”. I continued my mission and I ultimately received approval of the modified section and it was printed in the 2006 edition of he codes.

Subsequently the ICC Code Technology Committee (CTC) began to study the sections dealing with this issue and they submitted code changes to resurrect my original proposals on the windowsills being positioned at 36” above the floor. They concluded that logic and outside studies confirmed my original premise and they have been successful in getting the 36” height passed by the IBC committee at the hearings in Baltimore. However, the IRC committee is still reluctant to accept logic and stated that the 24” height has not been in the codes long enough to determine its effectiveness.

The 24” dimension was purely arbitrary and was nothing more than a concession made to get something in the code. The 36” dimension, on the other hand, was and still is based on logic and has been proven in the codes for decades. In summary, the 36” height is justifiable and no lengthy study or research is necessary. It has been in the codes for decades and has not been challenged. In my opinion, this is proof that the 24” height is unacceptable in addressing the problem of children falling from windows and further proof that Approval As Submitted is the correct action for RB 122 09/10 Part 1.

Final Action: AS AM AMPC____ D

RB122-09/10, Part II

IBC 1405.13.2

Proposed Change as Submitted

Proponent: Paul K. Heilstedt, PE, FAIA, Chair, representing ICC Code Technology Committee (CTC)

PART II – IBC FIRE SAFETY

Revise as follows:

1405.13.2 Window sills. In Occupancy Groups R-2 and R-3, one- and two-family and multiple-family dwellings, where the opening of the sill portion of an operable window is located more than 72 inches (1829 mm) above the finished grade or other surface below, the lowest part of the clear opening of the window shall be at a height not less than ~~24~~ 36 inches (610 mm) above the finished floor surface of the room in which the window is located. Glazing between the floor and a height of ~~24~~ 36 inches (610 mm) shall be fixed or have openings through which a 4-inch (102 mm) diameter sphere cannot pass.

Exception: Openings that are provided with window guards that comply with ASTM F 2006 or F 2090.

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as “areas of study”. Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/cc/ctc/index.html. Since its inception in April/2005, the CTC has held seventeen meetings - all open to the public.

This proposed change is a result of the CTC’s investigation of the area of study entitled “Child Window Safety”. The scope of the activity is noted as:

> Study the incidence and mechanisms of falls from open windows by children and to investigate the necessity and suitability of potential safeguards and/or revisions to the current codes.

The intent of IBC Section 1405.13.2 and IRC Section R612.2 is clearly to provide safety mechanisms to reduce the possibility of children falling through a window. The CTC has determined that this can be realized in the code in three ways: window fall prevention devices; window opening control devices; or reducing the possibility of accessing the window by increasing the minimum sill height. The purpose of this code change is to reduce the potential hazard by increasing the sill height from 24 inches to 36 inches.

In response to the CTC studying the Climbability of Guards, the National Ornamental & Miscellaneous Metals Association (NOMMA) commissioned a paper entitled “Review of Fall Safety of Children Between the Ages of 18 months and 4 Years in Relation to Guards and Climbing in the Built Environment”, referred to in this code change as “NOMMA paper”. This paper is posted on the CTC website as noted below. The paper provides a summary of the building code requirements, a critical review of relevant per-reviewed scientific literature on guard research and injury data and includes a section entitled “Children’s Interaction with the Built Environment”. Included in this section is an analysis of falls from windows where it is noted that “Falls from windows are among the most common types of unintended injuries to children and they are a major health concern” (NOMMA paper page 30). The study efficiently places within a few pages the data on window fall incidents and the means of reducing the number of incidents.

U.S. Fall Injury Data

NOMMA report page 7: The 1,421,137 injuries reported by NEISS between 2002 and 2005, inclusive, correspond to a national average of 51,217,603 based on weighting data included with the record data. The average over the four years is 12,804,401. The weighted estimate of 1,117,278 incidents on average annually for children between the ages of 18 months and 4 years represents 8.7 percent of these incidents. For all the incidents to children between the ages of 18 months and 4 years, 5.6 percent involved stairs, 1.22 percent involved windows, and 0.87 percent involved porches, balconies, open-sided floors, and floor openings.

NOMMA paper page 30 – 33. The paper further cites reports which have been compiled in the table below:

Study	Location	Falls	% fatalities
Vish et al. (2005)	Chicago	11/yr	
Istre et al. (2003)	Dallas county	17/yr	
Benoit et al. (2002)	L.A. county	12/yr (11%)	4% (4 yrs old or less)
Stone et al. (2000)	Cincinnati	12/yr (6.3%)	4.7%
Benoit et al. (2000)	Northern Virginia	11/yr (11%)	

Center of Gravity
NOMMA paper page 11, Table 2: The standing center of gravity of children aged 2 to 3.5 years is 24.1 inches (50^{th} percentile is 22.2 inches) and of children aged 3.5 to 4.5 is 25.2 (50^{th} percentile is 23.6).

A reasonable expectation for the Code is that, absent any fall protection in the window opening, a minimum sill height will be required to reduce the ability of a child to climb onto the sill enabling the fall through the opening. Using a child target age of up to 4 years of age and the associated center of gravity, the code mandated height of 24" is not adequate. A child need only extend themselves on their toes, stand on modest stack of books or blocks or hoist themselves a matter of a few inches with their arms to be able to flop onto the sill and expose themselves to the window opening and the associated risk of falling.

The hazards associated with child window falls cannot be understated as evidenced by the following CPSC Press release dated May 15, 2008:

NEWS from CPSC
U.S. Consumer Product Safety Commission
Office of Information and Public Affairs Washington, DC 20207

FOR IMMEDIATE RELEASE
May 15, 2008
Release #08-270

CPSC Hotline: (800) 638-2772
CPSC Media Contact: (301) 504-7908

Window Falls Prompts CPSC to Issue Warning
WASHINGTON, D.C. - With the arrival of the warmer spring weather, families across the nation are opening their windows to let the fresh air in. This pleasant feeling can quickly turn tragic in households with small children. In recent weeks, several children have fallen from windows. The U.S. Consumer Product Safety Commission is warning parents and caregivers to take precautions to keep children from falling from windows.

"CPSC staff is aware of at least 18 falls from windows through media reports, including two deaths, involving small children since April," said CPSC Acting Chairman Nancy Nord. "We are issuing this warning so parents will take the necessary steps to prevent these incidents from happening."

These deaths and injuries frequently occur when kids push themselves against window screens or climb onto furniture located next to an open window.

From 2002-2004, CPSC staff received an average of 25 reports a year of fatalities associated with falls from windows. Children younger than five years of age account for approximately one-third of these reported fatalities. For all age categories, more males died from window falls than females.

To help prevent injuries and tragedies, CPSC recommends the following safety tips:
* Safeguard your children by using window guards or window stops.
* Install window guards to prevent children from falling out of windows. (For windows on the 6th floor and below, install window guards that adults and older children can open easily in case of fire.)
* Install window stops so that windows open no more than 4 inches.
* Never depend on screens to keep children from falling out of windows.
* Whenever possible, open windows from the top -- not the bottom.
* Keep furniture away from windows, to discourage children from climbing near windows.

To see this release on CPSC's web site, please go to:
http://www.cpsc.gov/cpscpub/prerel/prhtml08/08270.html

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: HEILSTEDT-RB-2-R612-IBC 1405.13.2

Public Hearing Results

PART II - IBC Fire Safety

Committee Action: **Approved as Submitted**

Committee Reason: The committee agreed that increasing the current 24 inch sill height requirement to 36 inches was justified by the data submitted by the proponent.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jeff Inks, Window and Door Manufacturer's Association, requests Disapproval.

Commenter's Reason: First, the ICC CTC has determined that the intent of 1405.13.2 can be met in three ways: window fall prevention devices; window opening control devices; or reducing the possibility of accessing the window by increasing the minimum sill height.

All three of those ways are already provided for in the current code as a result of the long debate that lead to the inclusion of the 24" requirement in the 2006 edition of the IBC. There is no adequate justification to further increase the height of the sills other than what we believe is a subjective determination by the CTC based upon a paper – not actual research -- that did not focus on window sill heights, but rather on climbable guards.

The "NOMMA paper" cited as the justification for proposing a minimum 36" sill height is in fact just a review which is clearly declare by its authors in the abstract that the paper who state that the paper, "*provides a summary of the building code requirements, a critical review of relevant peer-reviewed scientific literature on guard research and injury data related to children's climbing, and an analysis of the latest injury statistics*."

The paper was not commissioned nor is it intended to serve as the bases for building code requirements and there is nothing to suggest that it should. This too is clearly declared by the authors who expressly stated in the Executive Summary that the "*Results from either the research studies or the injury data are neither specific enough nor consistent enough to constitute a solid basis for building code requirements*."

The authors go even further with respect to the injury data in the report by stating that "*Caution should be used in applying the NEISS data to assign causation of an event. The designations provided in the NEISS reporting system focus on "product codes" and not on the mechanism or physical environment surrounding the injury.*" A copy of the report is available at http://www.iccsafe.org/cs/CTC/Documents/guards/resource/NOMMA_Final_Report_20080506R_May_08.pdf

If the authors of the report that is being used as the basis for approving this code change are adding such caveats for their own work, we believe that makes it clear that the report is not intended to serve as the basis for establishing building code requirements.

Second, the proponents reason statement goes on to state that with respect to the current 24" requirement "*a child need only extend themselves on their toes, stand on modest stack of books or blocks or hoist themselves a matter of a few inches with their arms to be able to flop onto the sill and expose themselves to the window opening and the associated risk of falling*." All of the factors cited in that statement as contributing to falls are factors that don't go away by raising the sill height, and there is no sound data to substantiate that raising the sill height further than 24" will result in a reduction of child falls. Equally concerning is the lack of consideration given to the potential for higher sill heights to actually encourage the placement of climbable/stepable objects or furniture near or under the window making the sill even more accessible. One can equally conclude from intuitive reasoning that there is a greater likelihood of this occurring the higher the sill height is. In fact, this could also encourage a child to climb to see out the window regardless of whether there are climbable/stepable objects available.

Regardless, those factors are precisely why most child safety advocacy organizations focus their fall prevention guidance on things such as keeping windows closed in rooms where children play, ensuring appropriate supervision, opening windows from the top, avoiding the placement of furniture and other climbable objects near the window, etc.

All of those factors are outside the control of the building code. We therefore do not believe that increasing the sill height to 36" will have a meaningful impact on reducing child falls. Promoting window safety awareness does however have a proven, meaningful impact versus a minimum 36" sill height and we therefore urge disapproval of it.

Public Comment 2:

Tim Pate, representing, City & County of Broomfield, CO, representing Colorado Chapter of ICC, requests Disapproval.

Commenter's Reason: This public comment is asking for the membership to overturn the IBC Fire Safety Committee and disapprove this code change. The IRC-Building/Energy Committee disapproved this same code change due to lack of any substantial data to show that the requirement for this sill height at 24" minimum which was put into the 2006 IBC and IRC has been effective in stopping child falls out of windows.

We need to wait until there is sufficient data to show that the 24" is not working (or even helping) before raising the number any higher. The original proponent himself stated that a child need only extend themselves on their toes, stand on modest stack of books or blocks or hoist themselves a matter of a few inches with their arms to be able to flop onto the sill and expose themselves to the window opening and the associated risk of falling.

Raising the window sill to 36" will only require the same child to stack up a higher stack of books or blocks and potentially fall out. There would even be a potentially higher risk of having an end table pushed up to the exterior wall in these locations and therefore make it even easier for child to get on top of and potentially fall out. Nowhere in the CPSC list of recommendations that the proponent has shown in original reason statement does it say to have a higher window sill. It does say to keep furniture away and use window stops and guards.

Public Comment 3:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturer's Association, requests Disapproval.

Commenter's Reason: RB122, Part II raises the minimum height required to the lowest part of the clear opening of an operable window from 24 inches to 36 inches in the IBC. The stated intent of doing so, by the proponent, is to reduce the risk of children falling through the open window. AAMA opposes this increase in the minimum sill height requirements of the IBC for the following reasons:

1. No evidence has been presented that establishing any minimum sill height, or raising that height, will prevent or reduce the number of **children who fall through windows each year.** The proponent of RB122 points to a study that was conducted by the National Ornamental and Miscellaneous Metals Association (NOMMA) regarding the ability of children to climb over guard rails as evidence of the need to raise the minimum sill height. The results of that study, which was conducted for NOMMA by the National Association of Home Builders Research Center, were published in a paper entitled ""Review of Fall Safety of Children Between the Ages of 18 months and 4 Years in Relation to Guards and Climbing in the Built Environment".

The study itself does not make any recommendations regarding an effective barrier height for young children. In fact, the Executive Summary includes the following statement. "Results from either the research studies or the injury data are neither specific enough nor consistent enough to constitute a solid basis for building code requirements."

Another result from the study, however, was consistent with a viewpoint that the fenestration industry has expressed many times as the dialog regarding the establishment of minimum sill heights has continued. That view is that children climb. The specific statement from the Executive Summary of the NOMMA report is: "Research shows that climbing plays an important role in the physical, cognitive, and social development of the young child, and that this is encouraged in many situations, such as playgrounds and school gymnasia."

Within the body of the report, the topic of children's climbing abilities is further expanded. "Children begin to practice climbing skills early in life. Many children learn rudimentary climbing before they begin to walk and climbing has been observed as early as 8 months of age (McGraw, 1935, cited in Readdick and Park, 1998). By around one year a child is able to pull himself up onto a ledge or table. By the age of 13 months many children have started walking unaided. By 14 months 25 percent of children are climbing, and this rises to 50 percent by 17 months (Readdick and Park, 1998). At 21 months 75 percent of children are climbing and 90 percent or more are climbing by 22 months of age (ibid.). By 4 years of age boys have started to develop greater upper body strength than girls. By the age of 6 years many children can begin to climb in a manner similar to an adult (van Herrewegen, Molenbroek and Goossens, 2004). As a consequence of these developmental processes, the acquisition of climbing skills mostly occurs between 3 and 6 years of age (van Herrewegen et al., 2004)."

Given children's documented ability to climb, it would not be realistic to expect a barrier of any height to be sufficient to prevent a child from going over it, unless the establishment of such a barrier were accompanied by a ban on the placement of any object adjacent to that barrier that might facilitate climbing, at any time during the occupancy of the building. This of course would be unenforceable. A previous review of window fall reports received from the Consumer Product Safety Commission indicates that in some instances children move objects, such as toys, Styrofoam coolers, pillows and small pieces of furniture, to enable themselves to climb to the sill height. It then becomes obvious that the establishment of a barrier of any height could still be overcome by a child who wishes to satisfy their own curiosity about what is going on outside the room they are in.

2. Raising the sill height could have the effect of raising the height from which children fall. Since we understand that children can and will climb, if we raise the height of the sill we are in essence raising the height they need to climb to if their objective is to see outside the window. By doing so, we also raise the height from which they may fall, both to the exterior of the building, and to the interior. This obviously increases the risk of injury to the child, rather than reducing it.

3. Raising the sill height would definitely make it more difficult for other occupants of the building to egress from the building through an open window. Although children can climb over barriers of great height, relative to their own, other occupants of the building may have difficulty doing so. This is particularly true of elderly, or the disabled. The likelihood of this, and the percentage of the population who could not overcome a barrier, increases as the height of the barrier does. Therefore, establishing any minimum sill height merely puts in place a barrier that may not reduce the number of children that fall through the window while increasing the likelihood that other occupants of the building will not be able to egress the building through that opening. Raising the height makes that situation worse – it does not improve it.

Final Action: AS AM AMPC____ D

RB123-09/10-PART II

IBC 1405.13.2, 1405.13.2.1 (New)

NOTE: PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA. PART I IS REPRODUCED ONLY FOR INFORMATIONAL PURPOSES ONLY FOLLOWING ALL OF PART II.

Proposed Change as Submitted

Proponent: Paul K. Heilstedt, PE, FAIA, Chair, representing ICC Code Technology Committee (CTC)

PART II – IBC FIRE SAFETY

1. Revise as follows:

1405.13.2 Window sills. In Occupancy Groups R-2 and R-3, one- and two-family and multiple-family dwellings, where the opening of the sill portion of an operable window is located more than 72 inches (1829 mm) above the finished grade or other 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 surface of the room in which the window is located. ~~Glazing between the floor and a height of 24 inches (610 mm) shall be fixed or have openings such that a 4-inch (102 mm) diameter sphere cannot pass through.~~ Operable sections of windows shall not permit openings that allow passage of a 4 inch diameter sphere where such openings are located within 24 inches of the finished floor.

Exceptions:

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

1. Windows whose openings will not allow a 4-inch-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 fall prevention devices that comply with ASTM F 2090.
3. Windows that are provided with window opening control devices that comply with Section 1405.13.2.1..

2. Add new text as follows:

1405.13.2.1 Window opening control devices. When required elsewhere in this code, window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1029.2. The device or any portion thereof shall not project more than 1 inch into the required net clear opening for a length not exceeding 3 inches when the window is in the fully open position.

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as "areas of study". Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/cc/ctc/index.html. Since its inception in April/2005, the CTC has held seventeen meetings - all open to the public. This proposed change is a result of the CTC's investigation of the area of study entitled "Child Window Safety". The scope of the activity is noted as:

> Study the incidence and mechanisms of falls from open windows by children and to investigate the necessity and suitability of potential safeguards and/or revisions to the current codes.

This code change is a follow-up to code change RB173-07/08 last cycle. At the Final Action Hearings in Minneapolis, the membership approved RB 173-07/08 Part 1 (Public Comment 2) to the IRC to include prescriptive provisions for window opening limiting devices but failed to approve the corresponding and identical provisions to the IBC. The proposal corrects this inconsistent action as well as replaces the prescriptive provisions with a reference to a consensus standard which has been updated to specifically address these devices.

IRC/IBC coordination: The result of this two part code change will be consistency between the IBC and IRC in terms of requirements. Updated standard ASTM F2090 – 08: Both the IBC and IRC currently reference the 2007 edition of the standard entitled "Specification for Window Fall Prevention Devices with Emergency Escape (Egress Release Mechanisms". This standard was updated in 2008 to address window opening control devices. However, it was not updated in time to be included by reference in the 2009 IBC and IRC. This standard includes the necessary window operational criteria which results in the window not being able to be opened beyond the 4 inch performance threshold which is currently found in IRC Section R612.4.1. This control device can be released to allow the window to be fully opened in order to comply with the emergency escape provisions in both the IBC (1029.2) and IRC (R310.1.1)

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: HEILSTEDT-RB-1-R612-IBC 1405.13.2

Public Hearing Results

PART II - IBC Fire Safety
Committee Action: **Approved as Modified**

Modify the proposal as follows:

1405.13.2.1 Window opening control devices. ~~When required elsewhere in this code, w~~Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1029.2. ~~The device or any portion thereof shall not project more than 1 inch into the required net clear opening for a length not exceeding 3 inches when the window is in the fully open position.~~

(Portions of the proposal not shown remain unchanged)

Committee Reason: The committee agreed that it was appropriate to have consistency between the IRC and the IBC with respect to the provisions for window sills and window opening control devices. The modification appropriately removes projection requirements that have not been justified.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jeff Inks, Window and Door Manufacturer's Association, requests Approved as Modified by this public comment.

Modify the proposal as follows:

1405.13.2 Window sills. In Occupancy Groups R-2 and R-3, one- and two-family and multiple-family dwellings, where the opening of the sill portion of an operable window is located more than 72 inches (1829 mm) above the finished grade or other 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 surface of the room in which the window is located. Operable sections of windows shall not permit openings that allow passage of a 4 inch diameter sphere where such openings are located within 24 inches of the finished floor.

Exceptions:

1. Windows whose openings will not allow a 4-inch-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 fall prevention devices that comply with ASTM F 2090.
3. Windows that are provided with window opening control devices that comply with Section ~~1405.13.2.1~~ 1405.13.3.

~~**1405.13.2.1**~~ **1404.13.3 Window opening control devices.** Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1029.2.

Commenter's Reason: This change in the section number formatting is intended to ensure that all window opening control devices, regardless of whether or not they are used to serve as an exception to the sill height requirement, meet ASTM F2090.

Final Action: AS AM AMPC____ D

NOTE: PART I REPRODUCED FOR INFORMATIONAL PURPOSES ONLY – SEE ABOVE

PART I – IRC BUILDING/ENERGY

1. Revise as follows:

R612.2 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) above the finished floor of the room in which the window is located. Operable sections of windows shall not permit openings that allow passage of a 4 inch diameter sphere where such openings are located within 24 inches of the finished floor.

Exceptions:

1. Windows whose openings will not allow a 4-inch-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 fall prevention devices that comply with Section R612.3.~~
3. Openings that are provided with window fall prevention devices that comply with ASTM F 2090.
4. Windows that are provided with window opening ~~limiting~~ control devices that comply with ~~Section R612.4.~~ R612.3.

2. Delete without substitution:

~~**R612.3 Window fall prevention devices.** Window fall prevention devices and window guards, where provided, shall comply with the requirements of ASTM F 2090.~~

3. Renumber and revise Section R612.4 as follows:

~~**R612.4**~~ **R612.3 Window opening ~~limiting~~ control devices.** When required elsewhere in this code, window opening ~~limiting~~ control devices shall comply with ~~the provisions of this section.~~ ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section R 310.1.1. The device or any portion thereof shall not project more than 1 inch into the required net clear opening for a length not exceeding 3 inches when the window is in the fully open position.

4. Delete without substitution:

~~**R612.4.1 General requirements**. Window opening limiting devices shall be self- acting and shall be positioned so as to prohibit the free passage of a 4.0-in. (102-mm) diameter rigid sphere through the window opening when the window opening limiting device is installed in accordance with the manufacturer's instructions.~~

~~**R612.4.2 Operation for Emergency Escape.** Window opening limiting devices shall be designed with release mechanisms to allow for emergency escape through the window opening without the need for keys, tools or special knowledge. Window opening limiting devices shall comply with all of the following:~~

1. ~~Release of the window opening limiting device shall require no more than 15 lbf (66 N) of force.~~
2. ~~The window opening limiting device release mechanism shall operate properly in all types of weather.~~
3. ~~Window opening limiting devices shall have their release mechanisms clearly identified for proper use in an emergency.~~
4. ~~The window opening limiting device shall not reduce the minimum net clear opening area of the window unit below what is required by Section R310.1.1 of the code.~~

PART I - IRC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

R612.3 Window opening control devices. ~~When required elsewhere in this code,~~ Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section R 310.1.1. ~~The device or any portion thereof shall not project more than 1 inch into the required net clear opening for a length not exceeding 3 inches when the window is in the fully open position.~~

(Portions of proposal not shown remain unchanged)

Committee Reason: The committee feels this is a good change and the ICC CTC and industry has reached a consensus for a solution to the window opening control devices and achieves consistency with the IBC. The modification requires all window opening control devices to comply with the standard and eliminate the proposed language about hardware projection.

Assembly Action: **None**

RB127-09/10
R612.8, Chapter 44 (New)

Proposed Change as Submitted

Proponent: Jeff Burton, Director of Codes and Standards, representing Association of Millwork Distributors

1. Revise as follows:

R612.8 Other exterior window and door assemblies. Exterior windows and door assemblies not included within the scope of Section R612.6 or Section R612.7 shall be tested in accordance with ASTM E 330 or AMD SHEDS. Glass in assemblies covered by this exception shall comply with Section R308.5.

2. Add new standard to Chapter 44 as follows:

AMD Association of Millwork Distributors
10047 Robert Trent Jones Boulevard
Port Richey, FL 34655

SHEDS Side Hinged Exterior Door Standard

Reason: The code change proposal adds an additional requirement (option) to the code in that it includes a structural component interchangeability methodology that is prevalent in the side hinged exterior door (SHED) industry but is not addressed in the building codes or its current referenced standards. The addition of the AMD SHEDS (Side Hinged Exterior Door Standard), which is designed in accordance with the current industry ASTM E330 static pressure test, adds that needed structural component interchangeability option.

The current minimum code requirements for SHEDs adequately address concerns with public safety and protection of property, in that, to date, no empirical evidence or testimony has been provided to the ICC code development process proving that SHEDs are a significant failure relating to variable pressure from hurricanes force or high winds, in fact, the foremost leading post hurricane/building code experts provide no significant evidence of actual failures relating to SHEDs*. This lack of evidence supports current regulation and commonly used industry practices (component interchange) in place today. The current code is too restrictive in that it references SHED “system only” test standards and should allow for a SHEDs component interchange option similar to its allowances relating to fire rated doors.

*__Bibliography__
Rainwater Management Performance of Newly Constructed Residential Building Enclosures During August and September 2004 by Dr. Joe Lstiburek of the Building Science Corp., the Home Builders Association of Metro Orlando and the Florida Home Builders Association

The Benefits of Modern Wind Resistant Building Codes on Hurricane Claim Frequency and Severity-A Summary Report by Dr. Timothy Reinhold at the Institute for Business and Home Safety

Post 2004 Hurricane Field Survey-an Evaluation of the Relative Performance of the Standard Building Code and the Florida Building Code by Dr. Kurt Gurley of the University of Florida.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AMD SHEDS, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: BURTON-RB-1-R612.8

Public Hearing Results

Note: The following analysis was not in the Code Change Monograph:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did not comply with ICC standards criteria, Section 3.6.3.1.

Committee Action: **Approved as Submitted**

Committee Reason: The committee feels this is a needed change and reflects industry practice as stated in the proponent's published reason. The new reference standard is in draft form and must be available by Final Action.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jonathan Humble, ICC Reference Standards Committee, requests Disapproval.

Commenter's Reason: The ICC Reference Standards Committee is a committee that was organized "to support the codes development committees through the review of reference standards for the International Codes." We submit this code challenge to provide an opinion regarding code change.

It is the reference standards committee's view that the proposal currently lacks sufficient information concerning the promulgation process. We would preface this opinion that it is not our view to state that the proposed document is technically deficient or that the proposal does not have technical merit, but rather to state that the document development process and maintenance process do not comply with ICC Council Policy 28, specifically Section 3.6.3, which requires standards be completed and readily available.

We therefore request Disapproval.

Public Comment 2:

Jeff Inks, Window and Door Manufacturer's Association, requests Disapproval.

Commenter's Reason: The first and foremost reason we are requesting disapproval is because as of submission of this public comment, the document is still in drafting stages and has not yet undergone even an initial public review.

While component interchangeability is not new, it is complex and must be carefully considered. Although we appreciate the efforts of the proponent to include a standard that can address the issue, approval of a draft standard such as that proposed by RB127 is not justified and does not meet ICC criteria for referenced standards**.**

Public Comment 3:

Julie Ruth: JRuth Code Consulting, representing American Architectural Manufacturer's Association, requests Disapproval.

Commenter's Reason: RB127 adds a new standard to the IRC, Association of Millwork Distributor's *Side Hinged Exterior Door Standard (SHEDS)*, for the determination of the design pressure rating of exterior side hinged doors. The proposal would permit the use of the component interchangeability methodology provided in AMD SHEDs as an alternative to the current code requirement for full system testing of side hinged doors in accordance with ASTM E330.

AAMA seeks the disapproval of RB127 for several reasons:

1. The standard is not yet complete. The IRC Building and Energy Committee approved a draft of AMD SHEDs during the 2009 Code Development Hearings without knowledge of what the final content of the standard would be. For example, there were several instances in the draft edition of the standard that was approved where actual values had not yet been determined, and the value "x" or "xx" only was stated. Two such examples were Section 8.3.3, which stated "Determine change in length from original measurement and record percentage. The lineal shrinkage

shall not exceed XX%" and Section 8.4.3, which stated "Determine change in height and record percentage. The change in functional height shall not exceed XX%."

Obviously, a document that contains such language is not enforceable, and should not be approved for reference in the IRC, or any other International Code.

Furthermore, although AMD indicated during the Code Development Hearing it was their intent to seek approval of AMD SHEDs from the American National Standards Institute, they had not yet begun the process to achieve such approval at that time. Although ICC procedures do not require standards to be approved by ANSI to be referenced in International Codes, it does require they be developed in an open, consensus process such as ANSI or ASTM. If approval of the standard by ANSI has not been received by the Final Action Hearings on RB proposals in May 2010, then compliance with the requirement for development of the standard through an open, consensus process should be demonstrated in some other manner. As of the date of this submittal, evidence of compliance with the requirements of the ICC procedures has not been provided.

2. The provisions of the standard are inadequate. The members of the American Architectural Manufacturers Association (AAMA) Door Council have been working towards the development of a component interchangeability methodology for the rating of exterior side hinged doors for several years now. What we have found is that even just rating these products for structural design pressure (not even including consideration of resistance to air infiltration or water penetration) is significantly complicated. Analysis of an exterior door subject to a uniform design pressure perpendicular to the door is the analysis of a flat plate subject to a uniform load. Such analysis is difficult even if the plate is uniform in composition and symmetrically supported within the opening. An exterior door is not uniform in composition in that some sections of the door consist of door skins over framing, some sections consist of door skins over insulation, some sections consist of glazing, with or without its own framing, and some sections include hardware. The door is also not uniformly supported. One long edge will typically be supported against design pressure perpendicular to the plane of the door by three or four hinges that are varying distances from the corner of the door. The other long edge is typically supported by one lock/latch that is located somewhere along the edge, but usually not quite centered on it, and which in some cases anchors into a door jamb, and in other cases, anchors into the long edge of another door. This may be coupled by bolts on the top or bottom of the door that anchor it further at those corners, or it may not.

Overall, the analysis of what happens to that door (both the slab itself, and the hardware securing it to the opening) when subjected to structural loads is extremely complex. AAMA has been certifying fenestration products for structural performance, as well as resistance to air and water infiltration, for almost 50 years. Drawing upon the experience gained through that, and in an attempt to begin to address this complexity, a series of preliminary tests were conducted. Significant, unexpected inconsistencies in overall design pressures (ranging from 2.5 to 45 psf) resulted during door system testing using doors of like panel, frame and glazing constructions that would have otherwise been anticipated to have consistent results.

The door systems tested were provided by three different manufacturers and were produced with the following commonalities: overall size, type and gauge of skin material, stile material, insulating material, glass make-up, and identical lock/deadbolt. Some variables included hinges, frame/stop design, density of insulating material, and IG sealants.

The test results demonstrated that even with predominately common elements in the construction of the door, variation of single components such as the hinges, the frame/stop design, the density of the insulation material, and the sealants on the Insulating Glass (IG) units could provide dramatically different results with regards to the doors ability to withstand uniform pressure.

The methodology provided by AMD in their SHED does not address this variation in the overall door assemblies' ability to withstand structural load.

3. Validation test data from proponents of AMD SHEDs has not been made available for review. Confirmation of the validity of a proposed new testing and rating method, either through peer review, round robin testing, or some other method of verifying the validity of the results, is the hallmark of meaningful standards development. The need for it should not be dismissed or lightly set aside.

AAMA intends to continue to conduct research, including both testing and structural analysis, to develop the appropriate method to be used for interchangeability of components in door systems. We believe it can be done, and we intend to draw upon our years of experience in testing and certification of fenestration products to do that. But we also know the approach taken by AMD in their SHEDs is not the correct approach. It is premature and inadequate. Its use will result in erroneously rated door systems that will not perform as anticipated, hoped or needed when subjected to high wind events.

4. Use of the proposed referenced standard would significantly weaken the current requirements of the IRC. During the committee discussion on RB127 there seemed to be some confusion with regards to the current requirements of the IRC. Some parties seemed to be of the impression that there currently are no requirements for side hinged doors in the IRC, and that adding reference to AMD SHEDs would "at least be better than nothing."

In actuality, the 2009 IRC does have requirements for determining the resistance of side hinged exterior doors to design wind pressure. It requires doors such as these, which are not within the scope of AAMA/WDMA/CSA 101/I.S.2/A440, to be tested in accordance with ASTM E330. ASTM E330 requires a full scale test of the entire assembly being evaluated. Testing individual components and then compiling those components into an assembly under the methodology presented in AMD SHEDs does not provide an equivalent amount of information with regards to the performance of the completed assembly as a full scale test conducted in accordance with ASTM E330 does. Whether or not AMD SHEDs is "better than nothing" could be argued one way or the other, but it is very clear that AMD SHEDs is not better than the current code requirement for full scale testing in accordance with ASTM E330, or even equivalent.

Public Comment 4:

Thomas Meyers, City of Central City, CO, representing Colorado Chapter of ICC, requests Disapproval.

Commenter's Reason: The IRC building and energy committee approved the SHEDS standards with the understanding that the standard would be finalized and published prior to the final action hearings. This proposal is intended to provide a means to disapprove the standard should the SHEDS standards body fail to have the document completed in time for testimony in Dallas, TX.

Analysis: The standard proposed for reference in the code, AMD SHEDS was not completed and readily available at the time of the Code Development Hearings in Baltimore. ICC Council Policy CP#28-05, Code Development, Section 3.6.3.1, required that the standard must be completed and readily available at the time of these Final Action Hearings in order to be considered for inclusion in the code.

Final Action: AS AM AMPC____ D

RB129-09/10
R613.7

Proposed Change as Submitted

Proponent: Edward L. Keith, representing APA – The Engineered Wood Association

Revise as follows:

R613.7 Drilling and notching. The maximum vertical chase penetration in SIPs shall have a maximum side dimension of 2 inches (51 mm) centered in the panel core. Vertical chases shall have a minimum spacing of 24-inches (610 mm) on center. Maximum of two horizontal chases shall be permitted in each wall panel - one at 14 inches (360 mm) from the bottom of the panel and one at mid-height of the wall panel. The maximum allowable penetration size in a wall panel shall be circular or rectangular with a maximum dimension of 12 inches (300 mm). The minimum wall length for such a penetration shall be 20 feet (6100 mm) and only one such penetration shall be permitted in each full 20 foot (6100 mm) length of wall. Where multiple penetrations are to be located in a single wall line, they shall be placed no closer together than 20 feet (6100 mm) measured between adjacent edges of two penetrations. Overcutting of holes in facing panels shall not be permitted.

Reason: The existing R613.7 provides no limitation on the field-placement of these holes up to 12" x 12" in size. As such, the proposed language is added to clarify the limitation proposed in the original code proposal in 2006. From an engineering perspective, a hole this size will have minimal impact on the capacity of the wall system as long as the wall or the spacing between holes is sufficiently long (20 feet or longer).

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: KEITH-RB-1-R613.7

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The SIP Panels are an engineered product and the code cannot provide a prescriptive requirement. The penetration will have to be approved by the manufacturer and will be shown on the engineered drawings.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Edward L. Keith, APA- The Engineered Wood Association, requests Approval as Submitted.

Commenter's Reason: I ask that the body overturn the Committee's recommendation and accept the proposal as submitted. While it is true that SIP panels are delivered with a set of construction documents that have window and door openings "engineered" on the drawings, it is not uncommon that, during construction, the need arises for small field-applied openings that are not shown on the drawings. Some typical examples would be plumbing penetrations, "wet" room vents, or through-wall vented zero-clearance fire places, etc.

This proposal was developed on behalf of the Structural Insulated Panel Association to provide for some guidance for the builder and/or inspector on what size and how often such small openings can be installed without an engineering analysis by the manufacturer. The prescriptive limits of this proposal were determined as being appropriate by the technical staffs of the SIP manufacturers.

Another purpose of this proposal is to provide guidance for building officials in the evaluation of remodeling permits in the future that require small through-wall penetrations. Note that the maximum 12-inch by 12-inch hole size was specified as this is the size of the through-wall vent (with thermal protection) most commonly specified for the installation of high-efficiency zero-clearance fire places.

Final Action: AS AM AMPC____ D

RB135-09/10
Table R703.4

Proposed Change as Submitted

Proponent: Jay H. Crandell, PE, d/b/a ARES Consulting, representing the Foam Sheathing Coalition

Revise table as follows:

TABLE R703.4
WEATHER–RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (INCHES)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS [b,c,d]					
				WOOD OR WOOD STRUCTURAL PANEL SHEATHING INTO STUD	FIBERBOARD SHEATHING INTO STUD	GYPSUM SHEATHING INTO STUD	FOAM PLASTIC SHEATHING INTO STUD	DIRECT TO STUDS	NUMBER OR SPACING OF FASTENERS

(Portions of table not shown remain unchanged)

a. through c. *(No change)*

d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where ~~for~~ fiberboard, ~~or~~ gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, nails shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.

e. through z. *(No change)*

Reason: For many cases with siding attached over wood or wood structural panel sheathing, insufficient fastener penetration is provided if siding nails required by Table R703.4 are driven only into the sheathing. Only in cases where specific fastening instructions are provided for use of sheathing as a nail base should such a practice be permitted. In general, this will require a closer fastener spacing than currently required in Table R703.4 to account for the reduced withdrawal resistance of the siding nails installed in sheathing only (which may be no thicker than 3/8"). The change to the column heading for 'wood or wood structural panel sheathing' and footnote 'd' in Table R703.4 is needed to address this issue and avoid a common source of confusion resulting in potentially inadequate siding installations.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: CRANDELL-RB-4-T. R703.4

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, ~~nails~~ fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.

(Portions of proposal not shown remains unchanged)

Committee Reason: The committee feels this provides further clarity to the code and gives options where not nailed into studs. This helps to bring new products into the code. The modification changes the word "nails" to "fasteners" and will add flexibility to the code.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Dennis Pitts, American Wood Council, American Forest & Paper Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE R703.4

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b,c,d]					
				Wood or wood structural panel sheathing ~~into stud~~	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number of spacing of fasteners
(Remainder of table unchanged)									

a. through c. *(No change)*

d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard,gypsum, or foam plastic sheathing ~~backing~~ is used as backing material to support siding. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs ~~unless otherwise permitted to be driven into~~ or sheathing in accordance with the provisions of this code or in accordance with the siding manufacturer's installation instructions.

e. through z. *(No change)*

Commenter's Reason: The original change raised the point that some proprietary siding products have special provisions for attaching the siding material to wood structural panels in order to meet higher wind load ratings. The proposed solution eliminated the option of attaching siding to wood structural panels to avoid any misapplication. However, this solution only corrects the misapplication of proprietary siding while eliminating a common application permitted in the IRC such as wood shakes and shingles (703.5.3) and exterior plaster (R703.6.1). The proposed modifications recognizes that attachment of siding directly to wood structural panel sheathing is desirable and often recommended in the IRC while still highlighting the problem identified by the previous proposal.

Public Comment 2:

Edward L. Keith, APA-The Engineered Wood Association, request Disapproval.

Commenter's Reason: I request that the body overturn the Committee's recommendation for approval as submitted and disapprove the original code change proposal.

This code change reverses the way the IRC and legacy One and Two Family Dwelling Codes have dealt with nailable structural panel wall sheathing. Since 1995, the One and Two Family Dwelling Codes has recognized wood structural panels as a nailable sheathing in essentially the same table as Table R703.4 in the 2009 IRC. As such, the heading of the fifth column from the left ("Wood or Wood Structural Panel Sheathing") for the last 15 years has permitted nailing into wood or wood structural panel sheathing and not required nailing into the studs unless specifically recommended by the siding manufacturer.

Testimony was heard from the vinyl siding industry that they do currently have recommendations for nailing into studs as well as additional nailing into the wood structural panel sheathing for increased wind performance. This change makes the code's minimum recommendations more stringent than the manufacturer's!

Note also that "Wood Structural Panel Lap Siding" in this same table requires nailing into the nailable sheathing in that it requires nails along bottom edge at 8 inches on center. With the change as proposed, this lap siding could only be applied over studs at 8 inches on center, which is not only impractical, but is not supported by the good performance history of the current code provisions known to every jurisdiction in this country.

The proposed change will also eliminate the installation of siding products over structural insulated panels (SIPs) as recognized in Section R613.

Elimination of the recognition of wood or wood structural panel as a nailable sheathing may have numerous unintended consequences besides those mentioned above. Remember there are 17 different kinds of siding listed in the table and each with traditional attachment methods. Altering the code to not permit nailing into wood structural panel sheathing has the potential to make the accepted installation practices for numerous types of siding (in addition to vinyl siding and wood structural panel lap siding) no longer valid.

For over 15 years – it will be 17 years by the time the 2012 IRC is published – wood structural panels have been recognized as nailable sheathing. The current attachment provisions have performed adequately in the past and are the appropriate minimum attachment standard. For all these years, if a manufacturer has had more stringent attachment recommendations, these specific requirements have always controlled over the code minimum recommendations. This is not going to change in the 2012 IRC. This code change proposal reverses the way the code reads. It treats wood and wood structural panel sheathing like the non-structural sheathings and essentially sets a maximum attachment standard when wood structural panel sheathing is used.

The purpose of this code change proposal is not fire and life safety and was accompanied with no technical justification. This proposal ignores the 17 year history of good performance history by wood structural panels as nailable sheathing and will ignore significant advantages for components and cladding installed in conjunction with wood structural panels. Please reverse the Committee's decision by disapproving the proposed changes.

Final Action: AS AM AMPC____ D

RB137-09/10
R703.7

Proposed Change as Submitted

Proponent: Kimdolyn Boone, representing DuPont Building Innovations

Revise as follows:

R703.7 Stone and masonry veneer, general. Stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4, ~~and~~ Figure R703.7, Section R703.6.3 and Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS-402. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first *story* above-grade and shall not exceed 5 inches (127 mm) in thickness. See Section R602.12 for wall bracing requirements for masonry veneer for wood framed construction and Section R603.9.5 for wall bracing requirements for masonry veneer for cold-formed steel construction.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.
2. For detached one- or two-family *dwellings* in Seismic Design Categories D0, D1 and D2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

Reason: Clarification of current requirement of the code. The requirements are currently listed in the Table 703.4 and footnotes. Adding the reference to the text makes both the table & text agree.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: BOONE-RB-1-R703.7

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on the proponent's request for disapproval. The committee feels the proponent should work with interested parties on a consensus of what is required for anchored and adhered veneer and bring this back to Final Action.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Kimdolyn Boone, DuPont Building Innovations, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R703.7 Stone and masonry veneer, general. Stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4~~,~~ and Figure R703.7~~, Section R703.6.3 and Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS-402~~. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first *story* above-grade and shall not exceed 5 inches (127 mm) in thickness. See Section R602.12 for wall bracing requirements for masonry veneer for wood framed construction and Section R603.9.5 for wall bracing requirements for masonry veneer for coldformed steel construction.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.
2. For detached one- or two-family *dwellings* in Seismic Design Categories D_0, D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

R703.12 Adhered masonry veneer installation. Adhered masonry veneer shall be installed in accordance with the manufacturer's instructions, Section R703.6.3 and Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS-402.

Commenter's Reason: This modification was developed with interested parties within industry in response to the technical committee's direction to *"work with interested parties on a consensus of what is required for anchored and adhered veneer and bring this back to Final Action".*

The purpose of the original code change was to clarify and make explicitly clear the existing provisions to install adhered masonry veneer. Currently, these provisions reside in Table R703.4 under "adhered veneer", footnote "w" of Table R703.4 and Section R703.12 on adhered masonry veneer installation. Section R703.7 addresses anchored masonry veneer and is not appropriate for adhered masonry veneer.

This change adds footnote "w" of Table R703.4 to the adhered masonry veneer installation provisions found in Section R703.12. In this way, it is explicitly clear that adhered masonry veneer must not only comply with the manufacturer's instructions, but also that it be installed in accordance with Section R703.6.3 and the requirements of Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS 402. By not including this text in Section R703.12, the User may not install the water-resistive barrier required by Section R703.6.3 and may weigh more than 15 lb/ft^2 as required by Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS 402.

This change is necessary in order to ensure that adhered masonry veneer is installed correctly. It does this by having all the adhered masonry veneer requirements included in the code text.

Final Action: AS AM AMPC____ D

RB140-09/10

R703.7.4, R703.7.4.2, R703.7.4.3, Table R703.7.4 (New)

Proposed Change as Submitted

Proponent: Charles Clark, Brick Industry Association, representing the Masonry Alliance for Codes and Standards (MACS)

1. Revise as follows:

R703.7.4 Anchorage. Masonry veneer shall be anchored to the supporting wall with corrosion-resistant metal ties embedded in mortar or grout and extending into the veneer a minimum of 11/2 inches (38 mm), with not less than 5/8 inch (15.9 mm) mortar or grout cover to outside face. Masonry veneer shall conform to Table R703.7.4. ~~Where veneer is anchored to wood backings by corrugated sheet metal ties, the distance separating the veneer from the sheathing material shall be a maximum of a nominal 1 inch (25 mm). Where the veneer is anchored to wood backings using metal strand wire ties, the distance separating the veneer from the sheathing material shall be a maximum of 41/2 inches (114 mm). Where the veneer is anchored to cold-formed steel backings, adjustable metal strand wire ties shall be used. Where veneer is anchored to cold-formed steel backings, the distance separating the veneer from the sheathing material shall be a maximum of 41/2 inches (114 mm).~~

2. Delete without substitution:

~~**R703.7.4.2 Air space.** The veneer shall be separated from the sheathing by an air space of a minimum of a nominal 1 inch (25 mm) but not more than 41/2 inches (114 mm).~~

3. Revise as follows:

R703.7.4. 3 Mortar or grout fill. As an alternate to the air space required by ~~Section R703.7.4.2~~ Table R703.7.4, mortar or grout shall be permitted to fill the air space .When the air space is filled with mortar, a water-resistive barrier is required over studs or sheathing. When filling the air space, replacing the sheathing and water-resistive barrier with a wire mesh and *approved* water-resistive barrier or an *approved* water-resistive barrier-backed reinforcement attached directly to the studs is permitted.

4. Add new table as follows:

TABLE R703.7.4
TIE ATTACHMENT AND AIR SPACE REQUIREMENTS

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER [A]	MINIMUM AIR SPACE	MAXIMUM AIR SPACE
Wood Backing with Corrugated Sheet Metal	22 U.S. gage (0.0299 in.) x 7/8 in. wide	8d common nail [b]	Nominal 1 in. between sheathing and veneer	Nominal 1 in. between sheathing and veneer
Wood Backing with Metal Strand Wire	W1.7 (No. 9 U.S. gage; 0.148 in.) with hook embedded in mortar joint	8d common nail [b]	Nominal 1 in. between sheathing and veneer	4½ in. between backing and veneer
Cold-Formed Steel Backing with Adjustable Metal Strand Wire	W1.7 (No. 9 U.S. gage; 0.148 in.) with hook embedded in mortar joint	No. 10 screw	Nominal 1 in. between sheathing and veneer	4½ in. between backing and veneer

For SI: 1 inch = 25.4 mm.

a. In Seismic Design Category D_0, D_1 or D_2, the minimum tie fastener shall be an 8d ring-shank nail or a No. 10 screw, 2 ½ inches long.
b. All fasteners shall have rust inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

Reason: This code change adds a table to the anchored masonry veneer provisions that accomplishes the following:
1) Makes the code easier to use by having minimum requirements for tie and tie fastener in a tabular form. The table also includes minimum and maximum air space requirements.
2) Footnote a) adds a requirement that a ring-shank nail is to be used when the veneer is constructed in a Seismic Design Category D_0, D_1 or D_2. Recent full-scale building shaking-table testing conducted at the University of California San Diego found that "fasteners on one side of the specimen failed by extraction of nails under dynamic tensile loads, at levels of shaking less than the Design Basis Earthquake (DBE). This behavior is not consistent with performance objectives for veneer. Current IRC requirements for the attachment of connectors to wood-stud backing need improvement in Seismic Design Category D_0 and above. (See references in Bibliography below)
3) Footnote b) requires that the fasteners be able to resist corrosion. This text is very similar to existing text in Section R603.2.4 on fastening requirements.

Bibliography:

1. Klingner, Richard E., Shing, P. Benson, McGinley, Mark W., McLean, David I., Okail, Hussein, and Jo, Seongwoo, "NSF NEES Small-Group Project on Performance-based Design of Masonry and Masonry Veneer: Overview and Preliminary Results," *TMS Journal*, The Masonry Society, Boulder, Colorado, December 2008 (date submitted for publication).
2. Klingner, Richard E., "Behavior of Anchored Masonry Veneer with Light Wood Stud-Framing or Masonry Backing in Full-Scale Whole-Building Shaking-Table Tests," *TMS Journal*, The Masonry Society, Boulder, Colorado, June 2009 (date submitted for publication).

Cost Impact: The code change proposal may slightly increase the cost of anchored masonry veneer construction in Seismic Design Categories D_0, D_1 and D_2.

ICCFILENAME: CLARK-RB-4-R703.7.4

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on the proponent's request for disapproval. The committee feels the proponent should work with interested parties on a consensus of what is required for anchored and adhered veneer and bring this back to Final Action.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Charles Clark, AIA, PE, of the Brick Industry Association, representing the Masonry Alliance for Codes and Standards (MACS); Steven Winkel, FAIA, PE, and J. Daniel Dolan, PhD, PE, representing the Federal Emergency Management Agency/Building Seismic Safety Council Code Resource Support Committee (FEMA/BSSCCRSC); Bonnie Manley, American Iron and Steel Institute (AISI), representing The Steel Framing Alliance (SFA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

R703.7.4 Anchorage. Masonry veneer shall be anchored to the supporting wall studs with corrosion-resistant metal ties embedded in mortar or grout and extending into the veneer a minimum of 1 ½ inches (38 mm), with not less than 5/8 inch (15.9 mm) mortar or grout cover to outside face. Masonry veneer shall conform to Table R703.7.4.

TABLE R703.7.4
TIE ATTACHMENT AND AIR SPACE REQUIREMENTS

Backing and Tie	Minimum Tie	Minimum Tie Fastener [a]	~~Minimum Air Space~~	~~Maximum Air Space~~
			Air Space	
Wood Stud Backing with Corrugated Sheet Metal	22 U.S. gage (0.0299 in.) x 7/8 in. wide	8d common nail [b] (2 ½ in. x 0.131 in.)	~~Nominal 1 in. between sheathing and veneer~~	~~Nominal 1 in. between sheathing and veneer~~
			Nominal 1 in. between sheathing and veneer	
Wood Stud Backing with Metal Strand Wire	W1.7 (No. 9 U.S. gage; 0.148 in.) with hook embedded in mortar joint	8d common nail [b] (2 ½ in. x 0.131 in.)	Minimum ~~N~~nominal 1 in. between sheathing and ~~veneer~~	Maximum 4½ in. between backing and ~~veneer~~
Cold-Formed Steel Stud Backing with Adjustable Metal Strand Wire	W1.7 (No. 9 U.S. gage; 0.148 in.) with hook embedded in mortar joint	No. 10 screw extending through the steel framing a minimum of three exposed threads	Minimum ~~N~~nominal 1 in. between sheathing and veneer	Maximum 4½ in. between backing and veneer

For SI: 1 inch = 25.4 mm.

a. In Seismic Design Category D_0, D_1 or D_2, the minimum tie fastener shall be an 8d ring-shank nail (2 ½ in. x 0.131 in.) or a No. 10 screw~~, 2 ½ inches long.~~ extending through the steel framing a minimum of three exposed threads.
b. All fasteners shall have rust inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

(Portions of proposal not shown remain unchanged)

Commenter's' Reason: While the IRC Building/Energy Committee recommended that this code change be Approved as Submitted (AS), they also indicate in their Committee Reason statement that the change needs more work and the proponent should work with interested parties and bring back in a public comment the modification that was ruled out of order. The proposed modification submitted with this Public Comment complies with the committee's request and adds further clarity to the provisions.

Specifically, the modification accomplishes four things:

1) Clarifies that the air space requirements in the table are either minimums or maximums depending on the situation.
2) Includes the dimensions of the nails to be used for wood construction.
3) Specifies the minimum penetration for acceptable performance of screws used with steel framing.
4) Specifies that the ties are required to be attached to the studs and not the sheathing.

Final Action: AS AM AMPC____ D

RB145-09/10
R703.8

Proposed Change as Submitted

Proponent: Jeff Lowinski, representing the Window and Door Manufacturers Association (WDMA)

1. Add new definition as follows:

PAN FLASHING. Corrosion-resistant flashing at the base of an opening that is integrated into the building exterior wall to direct water to the exterior and is pre-manufactured, fabricated, formed or applied at the job site.

2. Revise as follows:

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   - 1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
   - 1.2. In accordance with the flashing design or method of a registered design professional.
   - 1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Reason: This proposal identifies alternate flashing methods for windows and doors that complement the requirements of Section R703.8 and includes mandatory options for window and door flashing depending on the conditions of the project.

Window and door manufactures are required, by Section R613.1, to provide installation instructions for each window and door. Most window and door manufacturers require installation per their instructions and many window and door manufacturers are incorporate a pan flashing in their window and door installation instructions. Window and door manufacturers create installation and flashing instructions for a wide variety of wall conditions but are unable to create installation instructions for every conceivable wall condition. The 2nd and 3rd flashing methods identified in this proposal allows necessary flexibility while retaining the performance requirements of Section R703.8.

This proposal also introduces a definition of pan flashing into the code.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: LOWINSKI-RB-5-R703.8

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee feels this is close but needs more work. Item 1.1 is confusing and should be a list rather than text. Also, the term "other approved methods" needs to be defined.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jeff Inks, Window and Door Manufacturer's Association, requests Approval as Modified by this Public Comment.

Replace proposal as follows:

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1 The fenestration manufacturer's installation and flashing instructions.
   1.2 For applications not addressed in the fenestration written manufacturer's instructions, in accordance with the flashing manufacturer's written instructions, or flashing method of a registered design professional.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Commenter's Reason: As noted by the Committee in their reason statement, they agreed with the intent of the original proposal which is to respond to the need for providing the flexibility to use alternative flashing methods that are compliant with the requirements in section R703.8, if there are project specific conditions that are not covered by the manufacturer's installation instructions. However, the Committee recommended that the provisions in item 1.1 in the original proposal be listed instead of combined in a single paragraph and that item 1.4 "Other approved methods" be defined if it was to be included.

The modification proposed by this comment addresses the Committee's concerns and actually further simplifies the section. Pan flashing language was removed because it can be covered by items 1.1 & 1.2 as proposed in this comment, and "Other approved methods" was removed because it is not necessary. Manufacturers are still required by Section 612.1 to provide written instructions, which they do. However, while a manufacturer's instructions do cover a wide variety of wall and project conditions, they simply cannot account for every conceivable project specific condition that may need to be considered given the virtually limitless set of conditions that are possible in residential construction. The IRC therefore needs to provide some flexibility at the local level to allow for flashing alternatives that are compliant with the performance requirements of 703.8, but may not be expressly provided for in the manufacturer's instructions. Item 1.2 covers that situation.

Final Action: AS AM AMPC____ D

RB146-09/10
R703.8

Proposed Change as Submitted

Proponent: Mike Rice, Maplewood, MN, representing the Association of Minnesota Building Officials

Revise as follows:

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.

6. At wall and roof intersections. Kick out flashing shall be installed where the lower portion of a sloped roof stops within the plane of an intersecting wall cladding in such a manner as to divert or kick out water away from the assembly.
7. At built-in gutters.

Reason: This change would complement the current code addressing wall and roof intersections and further prevent water from entering the wall cavity or penetrating to the structural building components. Step flashing at wall and roof intersections is incomplete without the kick out flashing, where the lower portion of a sloped roof stops within the plane of an intersecting wall. The water must be diverted away or it will find a way behind the water-resistive barrier and the siding or, in some cases, it will go through the siding. The benefit of adding the kick out flashing would far exceed the cost, as the cost would be little.

Cost Impact: The code change proposal will increase the cost of construction.

ICCFILENAME: RICE-RB-2-R703.8

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee feels this needs to be addressed but it belongs in Chapter 9. The proponent needs to rework and bring this back. This needs a detail or definition of "kick out flashing".

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Scott Dornfeld, City of Delano, requests Approval as Modified by this Public Comment.

Modify the proposal as:

R703.8 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashing shall be installed at all of the following locations:

1. Exterior window and openings. Flashing at exterior window openings shall extend to the surface of the wall finish or to the water-restive barrier for subsequent drainage.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood framed construction.
6. At wall and roof intersections. ~~Kick out~~ A flashing shall be installed to divert the water away from where the eave ~~lower portion~~ of a sloped roof ~~stops within the plane of an intersecting~~ intersects a vertical sidewall ~~wall cladding in such a manner as to divert or kick out water away from the assembly~~.
7. At built-in gutters.

Commenter's Reason: When this was brought forward at the Baltimore hearings, the idea was very good. The committee thought that there were some terms that needed work, in order to move forward I have been in contact with other concerned parties, I believe that this language will now make it clear on where the flashing at the eaves edge needs to be placed to prevent the water damage to the structure that we have been seeing for many years.

Final Action: AS AM AMPC____ D