4101:8-6-01 Wall construction.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

SECTION 601
GENERAL

601.1 Application. The provisions of this chapter shall control the design and construction of walls and partitions for buildings.

601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed in accordance with Section 301 and of transmitting the resulting loads to the supporting structural elements.

601.2.1 Compressible floor-covering materials. Compressible floor-covering materials that compress more than $1/32$ -inch (0.8 mm) when subjected to 50 pounds (23 kg) applied over 1 inch square (645 mm) of material and are greater than $1/8$ inch (3.2 mm) in thickness in the uncompressed state shall not extend beneath walls, partitions or columns, which are fastened to the floor.

SECTION 602
WOOD WALL FRAMING

602.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

602.1.1 Sawn lumber. Sawn lumber shall be identified by a grade mark of an accredited lumber grading or inspection agency and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certification of inspection issued by *an approved* lumber grading or inspection agency meeting the requirements of this section shall be accepted.

602.1.2 End-jointed lumber. Approved end-jointed lumber identified by a grade mark conforming to Section 602.1 shall be permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required elsewhere in this code to have a

fire-resistance rating shall have the designation "Heat Resistant Adhesive" or "HRA" included in its grade mark.

602.1.3 Structural glued-laminated timbers. Glued-laminated timbers shall be manufactured and identified as required in ANSI A190.1, ANSI 117 and ASTM D3737.

602.1.4 Structural log members. Structural log members shall comply with the provisions of ICC 400.

602.1.5 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

602.1.6 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

602.1.7 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with either ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

602.1.8 Wood structural panels. Wood structural panel sheathing shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O325 or CSA O437. Panels shall be identified for grade, bond classification, and performance category by a grade mark or certificate of inspection issued by an approved agency.

602.1.9 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency.

602.1.10 Fiberboard. Fiberboard shall conform to ASTM C208. Fiberboard sheathing, where used structurally, shall be identified by an approved agency as con- forming to ASTM C208.

602.1.11 Structural insulated panels. Structural insulated panels shall be manufactured and identified in accordance with ANSI/APA PRS 610.1.

602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.
Exception: Bearing studs not supporting floors and non-bearing studs shall be permitted to be utility grade lumber, provided that the studs are spaced in accordance with Table 602.3(5).

602.3 *Exterior walls, design* and construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures 602.3(1) and 602.3(2), or in accordance with AWC NDS. Components of exterior walls shall be fastened in accordance with Tables 602.3(1) through 602.3(4). Wall sheathing shall be fastened directly to framing members and, where placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in Table 301.2(2) adjusted for height and exposure using Table 301.2(3) and shall conform to the requirements of Table 602.3(3). *Exterior walls shall be fireblocked in accordance with Section 602.8.* Wall sheathing used only for exterior wall covering purposes shall comply with Section 703.
Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.
Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables 602.7(1) and 602.7(2).

TABLE 602.3(1)
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists or rafters to top plate	4-8d box (2 $1/2$ ″ × 0.113″) or 3-8d common (2 $1/2$ ″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
2	Ceiling joists to top plate	4-8d box (2 $1/2$ ″ × 0.113″); or 3-8d common (2 $1/2$ ″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section 802.5.2 and Table 802.5.2)	4-10d box (3″ × 0.128″); or 3-16d common (3 $1/2$ ″ × 0.162″); or 4-3″ × 0.131″ nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section 802.5.2 and Table 802.5.2)	Table 802.5.2	Face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING AND LOCATION
	Roof (continued)		
5	Collar tie to rafter, face nail or 1 $\frac{1}{4}$ ″ × 20 ga. ridge strap to rafter	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails	Face nail each rafter
6	Rafter or roof truss to plate	3-16d box nails (3 $\frac{1}{2}$ ″ × 0.135″); or 3-10d common nails (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss [i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d (3 $\frac{1}{2}$ ″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box 3 $\frac{1}{2}$ ″ × 0.135″); or 2-16d common (3 $\frac{1}{2}$ ″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
	Wall		
8	Stud to stud (not at braced wall panels)	16d common (3 $\frac{1}{2}$ ″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
		16d common (3 $\frac{1}{2}$ ″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with $\frac{1}{2}$ ″ spacer)	16d common (3 $\frac{1}{2}$ ″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3 $\frac{1}{2}$″ × 0.135″)	12″ o.c. each edge face nail
11	Continuous header to stud	5-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 4-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 4-10d box (3″ × 0.128″)	Toe nail
12	Top plate to top plate	16d common (3 $\frac{1}{2}$ ″ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	12″ o.c. face nail
13	Double top plate splice	8-16d common (3 $\frac{1}{2}$ ″ × 0.162″); or 12-16d box (3 $\frac{1}{2}$″ × 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 $\frac{1}{2}$ ″ × 0.162″)	16″ o.c. face nail
		16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 2-16d common (3 $\frac{1}{2}$ ″ × 0.162″); or 4-3″ × 0.131″ nails	3 each 16″ o.c. face nail 2 each 16″ o.c. face nail 4 each 16″ o.c. face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING AND LOCATION
Wall (continued)			
16	Top or bottom plate to stud	4-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 3-16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 4-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 2-16d common (3 $\frac{1}{2}$ ″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
17	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common (3 $\frac{1}{2}$ ″ × 0.162″); or 3-3″ × 0.131″ nails	Face nail
18	1″ brace to each stud and plate	3-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 2-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples 1 $\frac{3}{4}$ ″	Face nail
19	1″ × 6″ sheathing to each bearing	3-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 2-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1 3/4″long	Face nail
20	1″ × 8″ and wider sheathing to each bearing	3-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 3-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3 staples, 1″ crown, 16 ga., 1 3/4 ″long Wider than 1″ × 8″ 4-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 3-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., 1 $\frac{3}{4}$ ″ long	Face nail
Floor			
21	Joist to sill, top plate or girder	4-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 3-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2 $\frac{1}{2}$ ″ × 0.113″)	4″ o.c. toe nail
		8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails	6″ o.c. toe nail
23	1″ × 6″ subfloor or less to each joist	3-8d box (2 $\frac{1}{2}$ ″ × 0.113″); or 2-8d common (2 $\frac{1}{2}$ ″ × 0.131″); or 3-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1 3/4 ″ long	Face nail
24	2″ subfloor to joist or girder	3-16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 2-16d common (3 $\frac{1}{2}$ ″ × 0.162″)	Blind and face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING AND LOCATION
Floor (continued)			
25	2″ planks (plank & beam—floor & roof)	3-16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 2-16d common (3 $\frac{1}{2}$ ″ × 0.162″)	At each bearing, face nail
26	Band or rim joist to joist	3-16d common (3 $\frac{1}{2}$ ″ × 0.162″) 4-10 box (3″ × 0.128″), or 4-3″ × 0.131″ nails; or 4-3″ × 14 ga. staples, $\frac{7}{16}$ ″ crown	End nail
27	Built-up girders and beams, 2-inch lumber layers	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	24″ o.c. face nail at top and bottom staggered on opposite sides
		And: 2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Face nail at ends and at each splice
28	Ledger strip supporting joists or rafters	4-16d box (3 $\frac{1}{2}$ ″ × 0.135″); or 3-16d common (3 $\frac{1}{2}$ ″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	At each joist or rafter, face nail
29	Bridging or blocking to joist	2-10d box (3″ × 0.128″), or 2-8d common (2 $\frac{1}{2}$ ″ × 0.131″; or 2-3″ × 0.131″) nails	Each end, toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING OF FASTENERS	
			Edges (inches) [h]	Intermediate supports [c, e] (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table 602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
30	$\frac{3}{8}$ " – $\frac{1}{2}$ "	6d common (2″ × 0.113″) nail (subfloor, wall) [i] 8d common (2 $\frac{1}{2}$ ″ × 0.131″) nail (roof); or RSRS-01 (2 $\frac{3}{8}$ ″ × 0.113″) nail (roof) [j]	6	12 [f]
31	$\frac{19}{32}$ " – 1"	8d common nail (2 $\frac{1}{2}$ ″ × 0.131″); or RSRS-01 (2 $\frac{3}{8}$ ″ × 0.113″) nail (roof) [j]	6	12 [f]
32	1 $\frac{1}{8}$ " – 1 $\frac{1}{4}$ "	10d common (3″ × 0.148″) nail; or 8d (2 $\frac{1}{2}$ ″ × 0.131″) deformed nail	6	12
Other wall sheathing [g]				
33	$\frac{1}{2}$ ″ structural cellulosic fiberboard sheathing	1 $\frac{1}{2}$ ″ galvanized roofing nail, $\frac{7}{16}$ ″ head diameter, or 1 $\frac{1}{4}$ ″ long 16 ga. staple with $\frac{7}{16}$ ″ or 1″ crown	3	6
34	$\frac{25}{32}$ ″ structural cellulosic fiberboard sheathing	1 $\frac{3}{4}$ ″ galvanized roofing nail, $\frac{7}{16}$ ″ head diameter, or 1 $\frac{1}{2}$ ″ long 16 ga. staple with $\frac{7}{16}$ ″ or 1″ crown	3	6

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING AND LOCATION	
Other wall sheathing (continued)				
35	$\frac{1}{2}$ ″ gypsum sheathing [d]	1 $\frac{1}{2}$″ galvanized roofing nail; staple galvanized, 1 $\frac{1}{2}$″ long; 1 $\frac{1}{4}$″ screws, Type W or S	7	7
36	$\frac{5}{8}$ ″ gypsum sheathing [d]	1 $\frac{3}{4}$″ galvanized roofing nail; staple galvanized, 1 5/8″ long; 1 5/8″ screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	$\frac{3}{4}$ " and less	6d deformed (2″ × 0.120″) nail; or 8d common (2 $\frac{1}{2}$ ″ × 0.131″) nail	6	12
38	$\frac{7}{8}$ " – 1"	8d common (2 $\frac{1}{2}$ ″ × 0.131″) nail; or 8d deformed (2 $\frac{1}{2}$ ″ × 0.120″) nail	6	12
39	1 $\frac{1}{8}$ " – 1 $\frac{1}{4}$ "	10d common (3″ × 0.148″) nail; or 8d deformed (2 $\frac{1}{2}$ ″ × 0.120″) nail	6	12
Steel column, posts, and beam attachment				
40	*Beams ending in an open beam pocket, beam clip angles.*	*Clip angles either welded to the beam along each clip angle's entire length or bolted to the beam using a minimum of ½″ diameter bolts. Clip angle attached to the foundation wall using no less than a ½″ diameter anchor.*	--	--
41	*Beams, steel column top plate.*	*Column top plate either welded along the length of the two sides perpendicular to the beam's length or bolted with no less than two ½″ diameter bolts placed diagonally through the top plate.*	--	--
42	*Beams ending over a steel column, steel column top plate.*	*Column top plate bolted to beam with at least four ½″ diameter bolts.*	--	--
43	*Steel column(s) base plate(s) (for beams ending in beam pockets), footing(s).*	*Anchored to concrete footing pad(s) with no less than two ½″ diameter anchors placed diagonally through the base plate(s) of the steel column(s) into the concrete footing pad(s)*	--	--
44	*Steel column base plate (when beam ends over a steel column), footing.*	*Anchored to concrete footing pad with no less than four ½″ diameter anchors through the base plate of the steel column to the concrete footing pad.*	--	--

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.

b. Staples are 16 gage wire and have a minimum 7/16 -inch on diameter crown width.

c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table 602.3(2).

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.

g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.

h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.

i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

TABLE 602.3(2)
ALTERNATE ATTACHMENTS TO TABLE 602.3(1)

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION [a, b] OF FASTENER AND LENGTH (inches)	SPACING [c] OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof [g] and wall sheathing to framing and particleboard wall sheathing to framing [f]			
Up to $\frac{1}{2}$	Staple 15 ga. 1 $\frac{3}{4}$	4	8
	0.097 - 0.099 Nail 2 $\frac{1}{4}$	3	6
	Staple 16 ga. 1 $\frac{3}{4}$	3	6
$\frac{19}{32}$ and $\frac{5}{8}$	0.113 Nail 2	3	6
	Staple 15 and 16 ga. 2	4	8
	0.097 - 0.099 Nail 2 $\frac{1}{4}$	4	8
$\frac{23}{32}$ and $\frac{3}{4}$	Staple 14 ga. 2	4	8
	Staple 15 ga. 1 $\frac{3}{4}$	3	6
	0.097 - 0.099 Nail 2 $\frac{1}{4}$	4	8
	Staple 16 ga. 2	4	8
1	Staple 14 ga. 2 $\frac{1}{4}$	4	8
	0.113 Nail 2 $\frac{1}{4}$	3	6
	Staple 15 ga. 2 $\frac{1}{4}$	4	8
	0.097 - 0.099 Nail 2 $\frac{1}{2}$	4	8
NOMINAL MATERIAL THICKNESS (inches)	**DESCRIPTION [a, b] OF FASTENER AND LENGTH (inches)**	**SPACING [c] OF FASTENERS**	
		Edges (inches)	Body of panel [d] (inches)
Floor underlayment; plywood-hardboard-particleboard [f]-fiber-cement [h]			
Fiber-cement			
$\frac{1}{4}$	3d, corrosion-resistant, ring shank nails (finished flooring other than	3	6
	Staple 18 ga., $\frac{7}{8}$ long, $\frac{1}{4}$ crown (finished flooring other than tile)	3	6
	1 $\frac{1}{4}$ long × .121 shank × .375 head diameter corrosion-resistant (galvanized or stainless steel) roofing nails (for tile finish)	8	8
	1 $\frac{1}{4}$ long, No. 8 × .375 head diameter, ribbed wafer-head screws (for tile finish)	8	8

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION [a, b] OF FASTENER AND LENGTH (inches)	SPACING [c] OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof [g] and wall sheathing to framing and particleboard wall sheathing to framing [f]			
Plywood			
$^1/_4$ and $^5/_{16}$	1 $^1/_4$ ring or screw shank nail-minimum 12 $^1/_2$ ga. (0.099″) shank diameter	3	6
	Staple 18 ga., $^7/_8$, 3/16 crown width	2	5
$^{11}/_{32}$, $^3/_8$, $^{15}/_{32}$, and $^1/_2$	1 $^1/_4$ ring or screw shank nail-minimum 12 $^1/_2$ ga. (0.099″) shank diameter	6	8e
$^{19}/_{32}$, $^5/_8$, $^{23}/_{32}$ and $^3/_4$	1 $^1/_2$ ring or screw shank nail-minimum 12 $^1/_2$ ga. (0.099″) shank diameter	6	8
	Staple 16 ga. 1 $^1/_2$	6	8
Hardboard [f]			
0.200	1 $^1/_2$ long ring-grooved underlayment nail	6	6
	4d cement-coated sinker nail	6	6
	Staple 18 ga., $^7/_8$ long (plastic coated)	3	6
Particleboard			
$^1/_4$	4d ring-grooved underlayment nail	3	6
	Staple 18 ga., $^7/_8$ long, $^3/_{16}$ crown	3	6
$^3/_8$	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1 $^1/_8$ long, $^3/_8$ crown	3	6
$^1/_2$, $^5/_8$	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1 $^5/_8$ long, $^3/_8$ crown	3	6

For SI: 1 inch = 25.4 mm

a. Nail is a general description and shall be permitted to be T-head, modified round head or round head.
b. Staples shall have a minimum crown width of $^7/_{16}$ -inch on diameter except as noted.
c. Nails or staples shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater. Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.
d. Fasteners shall be placed in a grid pattern throughout the body of the panel.
e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.
f. Hardboard underlayment shall conform to CPA/ANSI A135.4
g. Specified alternate attachments for roof sheathing shall be permitted where the ultimate design wind speed is less than 130 mph. Fasteners attaching wood structural panel roof sheathing to gable end wall framing shall be installed using the spacing listed for panel edges.
h. Fiber-cement underlayment shall conform to ASTM C1288 or ISO 8336, Category C.

TABLE 602.3(3)
REQUIREMENTS FOR WOOD STRUCTURAL PANEL
WALL SHEATHING USED TO RESIST WIND PRESSURES [a, b, c]

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		ULTIMATE DESIGN WIND SPEED V $_{ult}$ (mph)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d Common (2.0″ × 0.113″)	1.5	24/0	$^3/_8$	16	6	12	140	115	110
8d Common (2.5″ × 0.131″)	1.75	24/16	$^7/_{16}$	16	6	12	170	140	135
				24	6	12	140	115	110

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.
a. Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with   panel strength axis perpendicular to supports.
b. Table is based on wind pressures acting toward and away from building surfaces in accordance with Section 301.2. Lateral bracing requirements shall be in   accordance with Section 602.10.
c. Wood structural panels with span ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternate to panels with a 24/16 span rating. Wall-16 and Plywood siding 16 o.c. shall be used with studs spaced not   more than 16 inches on center.

TABLE 602.3(4)
ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING [a]
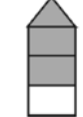
THICKNESS (inch)	GRADE	STUD SPACING (inches)	
		Where siding is nailed to studs	Where siding is nailed to sheathing
$^3/_8$	M-1 Exterior glue	16	—
$^1/_2$	M-2 Exterior glue	16	16

For SI: 1 inch = 25.4 mm.
a. Wall sheathing not exposed to the weather. If the panels are applied horizontally, the end joints of the panel shall be offset so that four panel corners will not meet. Panel edges must be supported. Leave a $^1/_{16}$-inch gap between panels and nail not less than $^3/_8$ -inch from panel edges.

TABLE 602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS [a]

STUD SIZE (inches)	BEARING WALLS					NONBEARING	
	Laterally unsupported stud height [a] (feet)	Maximum spacing where supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Maximum spacing where supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting one floor height [a] (inches)	Laterally unsupported stud height [a] (feet)	Maximum spacing (inches)
2 × 3 [b]	—	—	—	—	—	10	16
2 × 4	10	24 [c]	16 [c]	—	24	14	24

STUD SIZE (inches)	BEARING WALLS					NONBEARING	
	Laterally unsupported stud height [a] (feet)	Maximum spacing where supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Maximum spacing where supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting one floor height [a] (inches)	Laterally unsupported stud height [a] (feet)	Maximum spacing (inches)
3 × 4	10	24	24	16	24	14	24
2 × 5	10	24	24	—	24	16	24
2 × 6	10	24	24	16	24	20	24

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

a.   Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Bearing walls shall be sheathed on not less than one side or bridging shall be installed not greater than 4 feet apart measured vertically from either end of the stud. Increases in unsupported height are permitted where in compliance with Exception 2 of Section 602.3.1 or designed in accordance with accepted engineering practice.

b.   Shall not be used in exterior walls.

c.   A habitable attic assembly supported by 2 × 4 studs is limited to a roof span of 32 feet. Where the roof span exceeds 32 feet, the wall studs shall be increased to 2 × 6 or the studs shall be designed in accordance with accepted engineering practice.

TABLE 602.3(6)
ALTERNATE WOOD BEARING WALL STUD SIZE, HEIGHT AND SPACING

STUD HEIGHT	SUPPORTING	STUD SPACING [a]	ULTIMATE DESIGN WIND SPEED					
			115 mph		130 mph [b]		140 mph [b]	
			Maximum roof/floor span [c]		Maximum roof/floor span [c]		Maximum roof/floor span [c]	
			12 ft.	24 ft.	12 ft.	24 ft.	12 ft.	24 ft.
11 ft.	Roof Only	12 in.	2 × 4	2 × 4	2 × 4	2 × 4	2 × 4	2 × 4
		16 in.	2 × 4	2 × 4	2 × 4	2 × 6	2 × 4	2 × 6
		24 in.	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
	Roof and One Floor	12 in.	2 × 4	2 × 6	2 × 4	2 × 6	2 × 4	2 × 6
		16 in.	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		24 in.	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
12 ft.	Roof Only	12 in	2 × 4	2 × 4	2 × 4	2 × 6	2 × 4	2 × 6
		16 in.	2 × 4	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		24 in.	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
	Roof and One Floor	12 in	2 × 4	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		16 in.	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		24 in.	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	DR

For SI: 1 inch = 25.4mm, 1 foot = 304.8 mm, 1 mph = 0.447 m/s, 1 pound = 4.448 N. DR = Design Required.

a.   Wall studs not exceeding 16 inches on center shall be sheathed with minimum $^{1}/_{2}$ -inch gypsum board on the interior and 3/8 -inch wood structural panel sheathing on the exterior. Wood structural panel sheathing shall be attached with 8d (2.5" x 0.131") nails not greater than 6 inches on center along panel edges and 12 inches on center at intermediate supports, and all panel joints shall occur over studs or blocking.

b.   Where the ultimate design wind speed exceeds 115 mph, studs shall be attached to top and bottom plates with connectors having a minimum 300-pound lateral capacity.

c.   The maximum span is applicable to both single- and multiple-span roof and floor conditions. The roof assembly shall not contain a habitable attic.
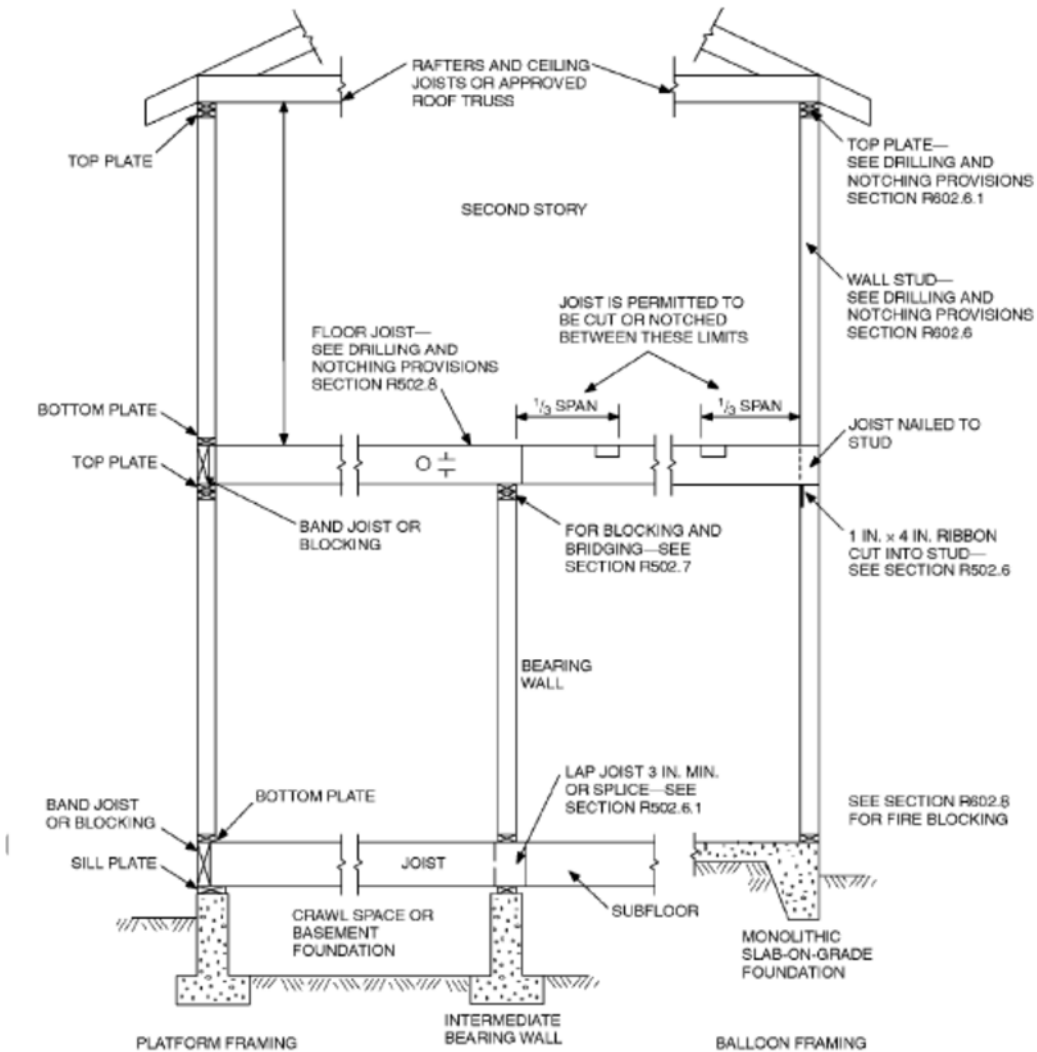
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING

SINGLE OR DOUBLE TOP PLATE

CUT PLATE TIED WITH 16 GAGE STEEL STRAP. SEE SECTION R602.6.1

STAGGER JOINTS 24 IN. OR USE SPLICE PLATES SEE SECTION R602.3.2

FIREBLOCK AROUND PIPE

FULL-HEIGHT STUDS ADJACENT TO HEADER SEE SECTION R602.7.5

HEADER— SEE TABLES R602.7(1) AND R602.7(2)

JACK STUDS OR TRIMMERS

WALL STUDS SEE SECTION R602.3

BOTTOM PLATE

SOLID BLOCKING

FLOOR JOISTS

SUBFLOOR

FOUNDATION CRIPPLE WALL— SEE SECTION R602.9

SILL PLATE

FOUNDATION WALL STUDS

1 IN. BY 4 IN. DIAGONAL BRACE LET INTO STUDS

ANCHOR BOLTS EMBEDDED IN FOUNDATION 6 FT. O.C. MAX.

APPLY APPROVED SHEATHING OR BRACE EXTERIOR WALLS WITH 1 IN. BY 4 IN. BRACES LET INTO STUDS AND PLATES AND EXTENDING FROM BOTTOM PLATE TO TOP PLATE, OR OTHER APPROVED METAL STRAP DEVICES INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. SEE SECTION R602.10.

CORNER AND PARTITION POSTS

NOTE: A THIRD STUD AND/OR PARTITION INTERSECTION BACKING STUDS SHALL BE PERMITTED TO BE OMITTED THROUGH THE USE OF WOOD BACKUP CLEATS, METAL DRYWALL CLIPS OR OTHER APPROVED DEVICES THAT WILL SERVE AS ADEQUATE BACKING FOR THE FACING MATERIALS.

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

FIGURE 602.3(2)
FRAMING DETAILS

602.3.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table 602.3(5).

 Exceptions:
 1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048 mm) for interior nonload-bearing walls.
 2. Where snow loads are less than or equal to 25 pounds per square foot (1.2 kPa), and the ultimate design wind speed is less than or equal to 130 mph (58.1 m/s), 2-inch by 6-inch (38 mm by 140 mm) studs supporting a roof load with not more than 6 feet (1829 mm) of tributary length shall have a maximum height of 18 feet (5486 mm) where spaced at 16 inches (406 mm) on center, or 20 feet (6096 mm) where spaced at 12 inches (305 mm) on center. Studs shall be No. 2 grade lumber or better.
 3. Exterior load-bearing studs not exceeding 12 feet (3658 mm) in height provided in accordance with Table 602.3(6). The minimum number of full-height studs adjacent to openings shall be in accordance with Section 602.7.5. The building shall be located in Exposure B, the roof live load shall not exceed 20 psf (0.96 kPa), and the ground snow load shall not exceed 30 psf (1.4 kPa). Studs and plates shall be No. 2 grade lumber or better.

602.3.2 Top plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset not less than 24 inches (610 mm). Joints in plates need not occur over studs. Plates shall be not less than 2-inches (51 mm) nominal thickness and have a width not less than the width of the studs.

 Exception: A single top plate used as an alternative to a double top plate shall comply with the following:
 1. The single top plate shall be tied at corners, intersecting walls, and at in-line splices in straight wall lines in accordance with Table 602.3.2.
 2. The rafters or joists shall be centered over the studs with a tolerance of not more than 1 inch (25 mm).
 3. Omission of the top plate is permitted over headers where the headers are adequately tied to adjacent wall sections in accordance with Table 602.3.2.

TABLE 602.3.2
SINGLE TOP-PLATE SPLICE CONNECTION DETAILS

CONDITION	TOP-PLATE SPLICE LOCATION			
	Corners and intersecting walls		Butt joints in straight walls	
	Splice plate size	Minimum nails each side of joint	Splice plate size	Minimum nails each side
Structures in *Seismic design category* A-*B*	3" x 6" x 0.036" galvanized steel plate or equivalent	(6) 8d box (2 ½" x 0.113") nails	3' x 12" x 0.036" galvanized steel plate or equivalent	(12) 8d box (2 ½" x 0.113") nails

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

602.3.3 Bearing studs. Where joists, trusses or rafters are spaced more than 16 inches (406 mm) on center and the bearing studs below are spaced 24 inches (610 mm) on center, such members shall bear within 5 inches (127 mm) of the studs beneath.

Exceptions:
1. The top plates are two 2-inch by 6-inch (38 mm by 140 mm) or two 3-inch by 4-inch (64 mm by 89 mm) members.
2. A third top plate is installed.
3. Solid blocking equal in size to the studs is installed to reinforce the double top plate.

602.3.4 Bottom (sole) plate. Studs shall have full bearing on a nominal 2-by (51 mm) or larger plate or sill having a width not less than to the width of the studs.

602.3.5 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 602.3(1) where:
    1.1. The ultimate design wind speed does not exceed 115 mph (51 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.
    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 802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall 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.

3. Wall sheathing and fasteners designed to resist combined uplift and shear forces in accordance with accepted engineering practice.

602.4 Interior load-bearing walls. Interior load-bearing walls shall be constructed, framed and fireblocked as specified for exterior walls *in accordance with Section 602.8.*

602.5 Interior nonbearing walls. Interior nonbearing walls shall be permitted to be constructed with 2 -inch by 3 -inch (51 mm by 76 mm) studs spaced 24 -inches (610 mm) on center or, where not part of a braced wall line, 2 -inch by 4 -inch (51 mm by 102 mm) flat studs spaced at 16 -inches (406 mm) on center. Interior nonbearing walls shall be capped with not less than a single top plate. Interior nonbearing walls shall be fireblocked in accordance with Section 602.8.

602.6 Drilling and notching of studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. Any stud in an exterior wall or bearing partition shall be permitted to be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions shall be permitted to be notched to a depth not to exceed 40 percent of a single stud width.

2. Drilling. Any stud shall be permitted to be bored or drilled, provided that the diameter of the resulting hole is not more than 60 percent of the stud width, the edge of the hole is not *closer* than $^5/_8$ -inch (16 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over 40 percent and up to 60 percent shall be doubled with not more than two successive doubled studs bored. See Figures 602.6(1) and 602.6(2).

    Exception: Use of approved stud shoes is permitted where they are installed in accordance with the manufacturer's recommendations.

TOP PLATES

STUD

BORED HOLE MAX.
DIAMETER 40 PERCENT
OF STUD DEPTH

$^5/_8$ IN. MIN. TO EDGE

$^5/_8$ IN. MIN. TO EDGE

NOTCH MUST NOT EXCEED 25
PERCENT OF STUD DEPTH

BORED HOLES SHALL NOT BE
LOCATED IN THE SAME CROSS
SECTION OF CUT OR NOTCH IN
STUD

IF HOLE IS BETWEEN 40 PERCENT AND
60 PERCENT OF STUD DEPTH, THEN STUD
MUST BE DOUBLE AND NO MORE THAN TWO
SUCCESSIVE STUDS ARE DOUBLED AND SO
BORED
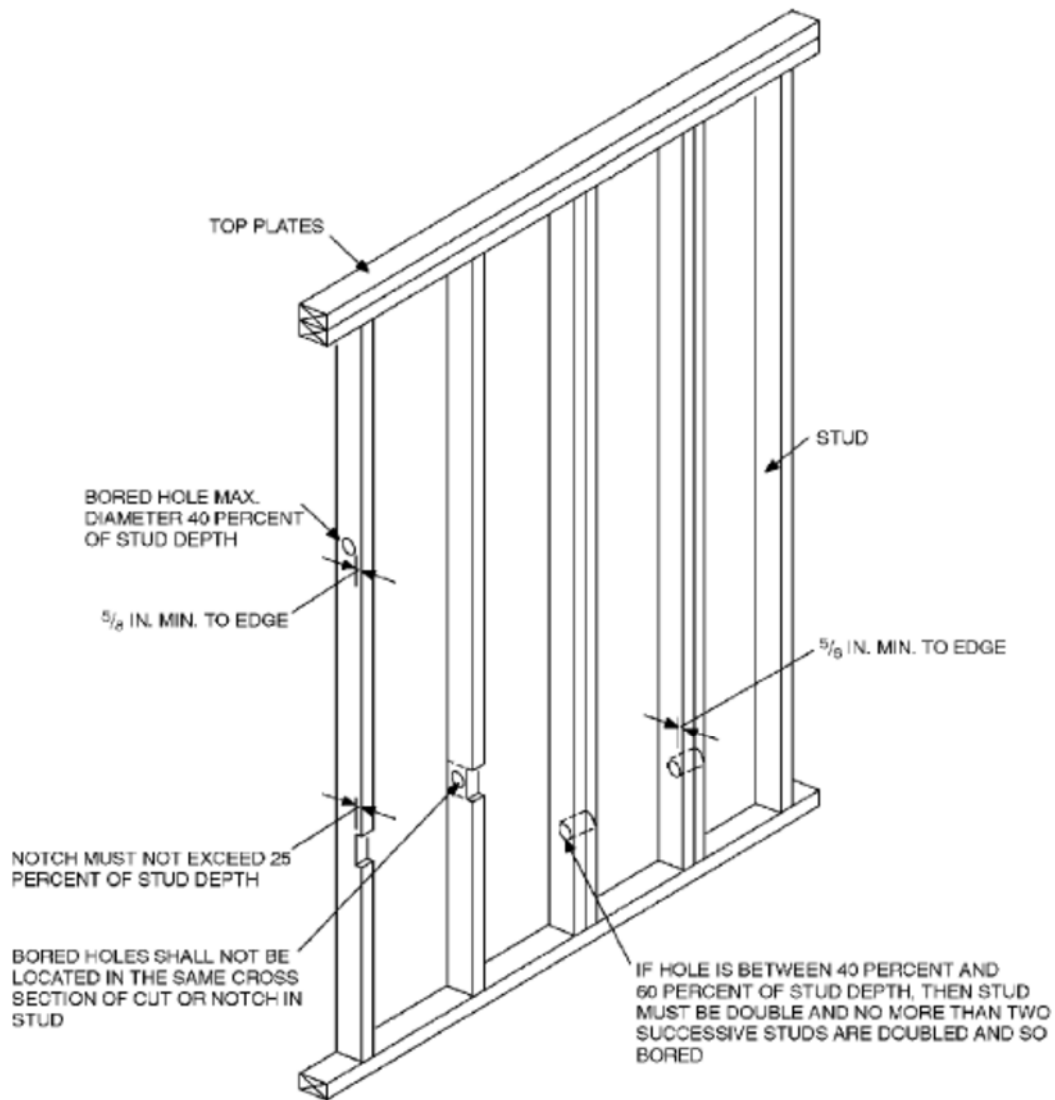
For SI: 1 inch = 25.4 mm.
Note: Condition for exterior and bearing walls.

FIGURE 602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR
EXTERIOR WALLS AND BEARING WALLS

TOP PLATES

STUD

BORED HOLE MAX.
DIAMETER 60 PERCENT
OF STUD DEPTH

$\frac{5}{8}$ IN. MIN. TO EDGE

$\frac{5}{8}$ IN. MIN. TO EDGE

NOTCH MUST NOT EXCEED
40 PERCENT OF STUD DEPTH

BORED HOLES SHALL NOT BE
LOCATED IN THE SAME CROSS
SECTION OF CUT OR NOTCH IN
STUD
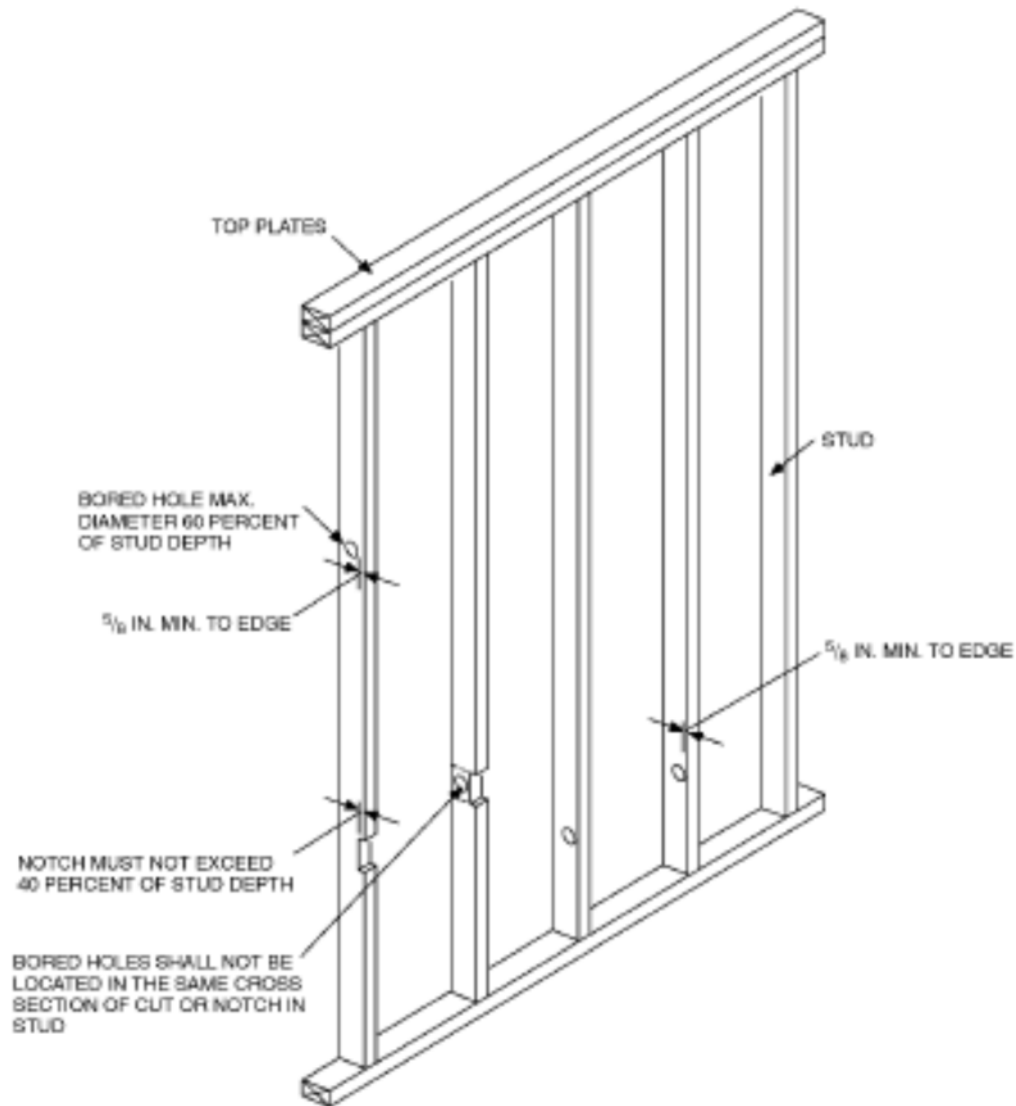
For SI: 1 inch = 25.4 mm.

FIGURE 602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR
INTERIOR NONBEARING WALLS

602.6.1 Drilling and notching of top plate. Where piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie not less than 0.054 inch thick (1.37 mm) (16 ga) and $1\frac{1}{2}$

-inches (38 mm) wide shall be fastened across and to the plate at each side of the opening with not less than eight 10d (0.148 inch diameter) nails having a minimum length of $1^1/_2$ -inches (38 mm) at each side or equivalent. The metal tie must extend not less than 6 inches past the opening. See Figure 602.6.1.

   Exception: Where the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.
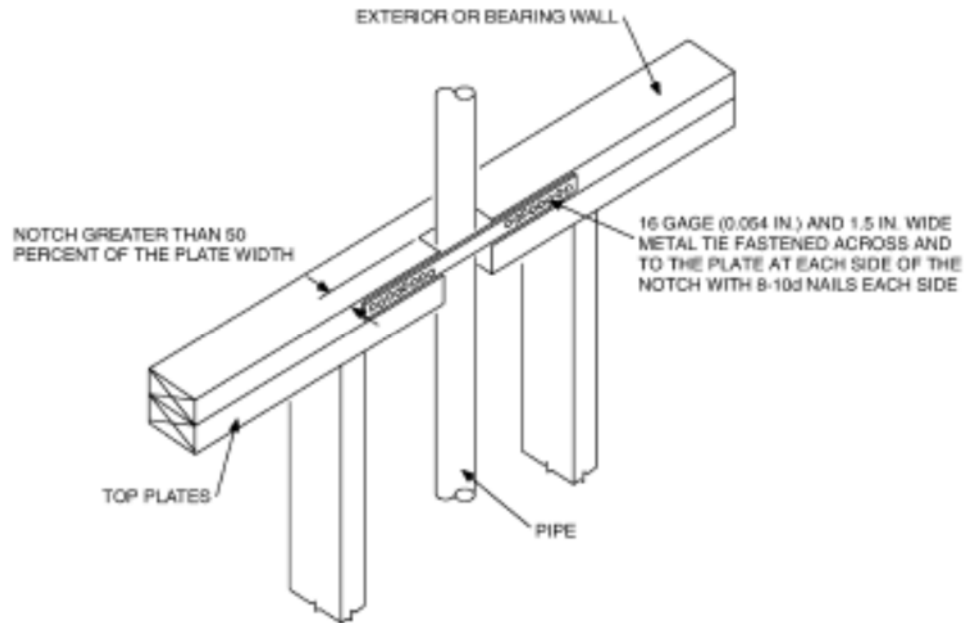
For SI: 1 inch = 25.4 mm.

FIGURE 602.6.1
TOP PLATE FRAMING TO ACCOMMODATE PIPING

602.7 Headers. For header spans, see Tables 602.7(1), 602.7(2) and 602.7(3).

TABLE 602.7(1)
GIRDER SPANS ᵃ AND HEADER SPANS ᵃ FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir ᵇ and required number of jack studs)

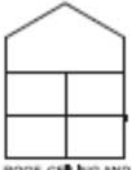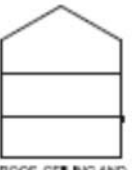| GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) [e]																	
		30						50						70					
		Building width [c] (feet)																	
		12		24		36		12		24		36		12		24		36	
		Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]
Roof and ceiling	1-2 × 6	4-0	1	3-1	2	2-7	2	3-5	1	2-8	2	2-3	2	3-0	2	2-4	2	2-0	2
	1-2 × 8	5-1	2	3-11	2	3-3	2	4-4	2	3-4	2	2-10	2	3-10	2	3-0	2	2-6	3
	1-2 × 10	6-0	2	4-8	2	3-11	2	5-2	2	4-0	2	3-4	3	4-7	2	3-6	3	3-0	3
	1-2 × 12	7-1	2	5-5	2	4-7	3	6-1	2	4-8	3	3-11	3	5-5	2	4-2	3	3-6	3
	2-2 × 4	4-0	1	3-1	1	2-7	1	3-5	1	2-7	1	2-2	1	3-0	1	2-4	1	2-0	1
	2-2 × 6	6-0	1	4-7	1	3-10	1	5-1	1	3-11	1	3-3	2	4-6	1	3-6	2	2-11	2
	2-2 × 8	7-7	1	5-9	1	4-10	2	6-5	1	5-0	2	4-2	2	5-9	1	4-5	2	3-9	2
	2-2 × 10	9-0	1	6-10	2	5-9	2	7-8	2	5-11	2	4-11	2	6-9	2	5-3	2	4-5	2
	2-2 × 12	10-7	2	8-1	2	6-10	2	9-0	2	6-11	2	5-10	2	8-0	2	6-2	2	5-2	3
	3-2 × 8	9-5	1	7-3	1	6-1	1	8-1	1	6-3	1	5-3	2	7-2	1	5-6	2	4-8	2
	3-2 × 10	11-3	1	8-7	1	7-3	2	9-7	1	7-4	2	6-2	2	8-6	1	6-7	2	5-6	2
	3-2 × 12	13-2	1	10-1	2	8-6	2	11-3	2	8-8	2	7-4	2	10-0	2	7-9	2	6-6	2
	4-2 × 8	10-11	1	8-4	1	7-0	1	9-4	1	7-2	1	6-0	1	8-3	1	6-4	1	5-4	2
	4-2 × 10	12-11	1	9-11	1	8-4	1	11-1	1	8-6	1	7-2	2	9-10	1	7-7	2	6-4	2
	4-2 × 12	15-3	1	11-8	1	9-10	2	13-0	1	10-0	2	8-5	2	11-7	1	8-11	2	7-6	2
Roof, ceiling and one center-bearing floor	1-2 × 6	3-3	1	2-7	2	2-2	2	3-0	2	2-4	2	2-0	2	2-9	2	2-2	2	1-10	2
	1-2 × 8	4-1	2	3-3	2	2-9	2	3-9	2	3-0	2	2-6	3	3-6	2	2-9	2	2-4	3
	1-2 × 10	4-11	2	3-10	2	3-3	3	4-6	2	3-6	3	3-0	3	4-1	2	3-3	3	2-9	3
	1-2 × 12	5-9	2	4-6	3	3-10	3	5-3	2	4-2	3	3-6	3	4-10	3	3-10	3	3-3	4
	2-2 × 4	3-3	1	2-6	1	2-2	1	3-0	1	2-4	1	2-0	1	2-8	1	2-2	1	1-10	1
	2-2 × 6	4-10	1	3-9	1	3-3	2	4-5	1	3-6	2	3-0	2	4-1	1	3-3	2	2-9	2
	2-2 × 8	6-1	1	4-10	2	4-1	2	5-7	2	4-5	2	3-9	2	5-2	2	4-1	2	3-6	2
	2-2 × 10	7-3	2	5-8	2	4-10	2	6-8	2	5-3	2	4-5	2	6-1	2	4-10	2	4-1	2
	2-2 × 12	8-6	2	6-8	2	5-8	2	7-10	2	6-2	2	5-3	3	7-2	2	5-8	2	4-10	3
	3-2 × 8	7-8	1	6-0	1	5-1	2	7-0	1	5-6	2	4-8	2	6-5	1	5-1	2	4-4	2
	3-2 × 10	9-1	1	7-2	2	6-1	2	8-4	1	6-7	2	5-7	2	7-8	2	6-1	2	5-2	2
	3-2 × 12	10-8	1	8-5	2	7-2	2	9-10	2	7-8	2	6-7	2	9-0	2	7-1	2	6-1	2
	4-2 × 8	8-10	1	6-11	1	5-11	1	8-1	1	6-4	1	5-5	2	7-5	1	5-11	1	5-0	2
	4-2 × 10	10-6	1	8-3	2	7-0	2	9-8	1	7-7	2	6-5	2	8-10	1	7-0	2	6-0	2
	4-2 × 12	12-4	1	9-8	2	8-3	2	11-4	2	8-11	2	7-7	2	10-4	2	8-3	2	7-0	2
	1-2 × 6	2-11	2	2-3	2	1-11	2	2-9	2	2-1	2	1-9	2	2-7	2	2-0	2	1-8	2
	1-2 × 8	3-9	2	2-10	2	2-5	3	3-6	2	2-8	2	2-3	3	3-3	2	2-6	3	2-2	3
	1-2 × 10	4-5	2	3-5	3	2-10	3	4-2	2	3-2	3	2-8	3	3-11	2	3-0	3	2-6	3
	1-2 × 12	5-2	2	4-0	3	3-4	3	4-10	3	3-9	3	3-2	4	4-7	3	3-6	3	3-0	4
	2-2 × 4	2-11	1	2-3	1	1-10	1	2-9	1	2-1	1	1-9	1	2-7	1	2-0	1	1-8	1
	2-2 × 6	4-4	1	3-4	2	2-10	2	4-1	1	3-2	2	2-8	2	3-10	1	3-0	2	2-6	2

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) [e]																
		30						50						70					
		Building width [c] (feet)																	
		12		24		36		12		24		36		12		24		36	
		Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]	Span	NJ [d]
Roof, ceiling and one clear-span floor	2-2 × 8	5-6	2	4-3	2	3-7	2	5-2	2	4-0	2	3-4	2	4-10	2	3-9	2	3-2	2
	2-2 × 10	6-7	2	5-0	2	4-2	2	6-1	2	4-9	2	4-0	2	5-9	2	4-5	2	3-9	3
	2-2 × 12	7-9	2	5-11	2	4-11	3	7-2	2	5-7	2	4-8	3	6-9	2	5-3	3	4-5	3
	3-2 × 8	6-11	1	5-3	2	4-5	2	6-5	1	5-0	2	4-2	2	6-1	1	4-8	2	4-0	2
	3-2 × 10	8-3	2	6-3	2	5-3	2	7-8	2	5-11	2	5-0	2	7-3	2	5-7	2	4-8	2
	3-2 × 12	9-8	2	7-5	2	6-2	2	9-0	2	7-0	2	5-10	2	8-6	2	6-7	2	5-6	3
	4-2 × 8	8-0	1	6-1	1	5-1	2	7-5	1	5-9	2	4-10	2	7-0	1	5-5	2	4-7	2
	4-2 × 10	9-6	1	7-3	2	6-1	2	8-10	1	6-10	2	5-9	2	8-4	1	6-5	2	5-5	2
	4-2 × 12	11-2	2	8-6	2	7-2	2	10-5	2	8-0	2	6-9	2	9-10	2	7-7	2	6-5	2
Roof, ceiling and two center-bearing floors	1-2 × 6	2-8	2	2-1	2	1-10	2	2-7	2	2-0	2	1-9	2	2-5	2	1-11	2	1-8	2
	1-2 × 8	3-5	2	2-8	2	2-4	3	3-3	2	2-7	2	2-2	3	3-1	2	2-5	3	2-1	3
	1-2 × 10	4-0	2	3-2	3	2-9	3	3-10	2	3-1	3	2-7	3	3-8	2	2-11	3	2-5	3
	1-2 × 12	4-9	3	3-9	3	3-2	4	4-6	3	3-7	3	3-1	4	4-3	3	3-5	3	2-11	4
	2-2 × 4	2-8	1	2-1	1	1-9	1	2-6	1	2-0	1	1-8	1	2-5	1	1-11	1	1-7	1
	2-2 × 6	4-0	1	3-2	2	2-8	2	3-9	1	3-0	2	2-7	2	3-7	1	2-10	2	2-5	2
	2-2 × 8	5-0	2	4-0	2	3-5	2	4-10	2	3-10	2	3-3	2	4-7	2	3-7	2	3-1	2
	2-2 × 10	6-0	2	4-9	2	4-0	2	5-8	2	4-6	2	3-10	3	5-5	2	4-3	2	3-8	3
	2-2 × 12	7-0	2	5-7	2	4-9	3	6-8	2	5-4	3	4-6	3	6-4	2	5-0	3	4-3	3
	3-2 × 8	6-4	1	5-0	2	4-3	2	6-0	1	4-9	2	4-1	2	5-8	2	4-6	2	3-10	2
	3-2 × 10	7-6	2	5-11	2	5-1	2	7-1	2	5-8	2	4-10	2	6-9	2	5-4	2	4-7	2
	3-2 × 12	8-10	2	7-0	2	5-11	2	8-5	2	6-8	2	5-8	3	8-0	2	6-4	2	5-4	3
	4-2 × 8	7-3	1	5-9	1	4-11	2	6-11	1	5-6	2	4-8	2	6-7	1	5-2	2	4-5	2
	4-2 × 10	8-8	1	6-10	2	5-10	2	8-3	2	6-6	2	5-7	2	7-10	2	6-2	2	5-3	2
	4-2 × 12	10-2	2	8-1	2	6-10	2	9-8	2	7-8	2	6-7	2	9-2	2	7-3	2	6-2	2
Roof, ceiling, and two clear- span floors	1-2 × 6	2-3	2	1-9	2	1-5	2	2-3	2	1-9	2	1-5	3	2-2	2	1-8	2	1-5	3
	1-2 × 8	2-10	2	2-2	3	1-10	3	2-10	2	2-2	3	1-10	3	2-9	2	2-1	3	1-10	3
	1-2 × 10	3-4	2	2-7	3	2-2	3	3-4	3	2-7	3	2-2	4	3-3	3	2-6	3	2-2	4
	1-2 × 12	4-0	3	3-0	3	2-7	4	4-0	3	3-0	4	2-7	4	3-10	3	3-0	4	2-6	4
	2-2 × 4	2-3	1	1-8	1	1-4	1	2-3	1	1-8	1	1-4	1	2-2	1	1-8	1	1-4	2
	2-2 × 6	3-4	1	2-6	2	2-2	2	3-4	2	2-6	2	2-2	2	3-3	2	2-6	2	2-1	2
	2-2 × 8	4-3	2	3-3	2	2-8	2	4-3	2	3-3	2	2-8	2	4-1	2	3-2	2	2-8	3
	2-2 × 10	5-0	2	3-10	2	3-2	3	5-0	2	3-10	2	3-2	3	4-10	2	3-9	3	3-2	3
	2-2 × 12	5-11	2	4-6	3	3-9	3	5-11	2	4-6	3	3-9	3	5-8	2	4-5	3	3-9	3
	3-2 × 8	5-3	1	4-0	2	3-5	2	5-3	2	4-0	2	3-5	2	5-1	2	3-11	2	3-4	2
	3-2 × 10	6-3	2	4-9	2	4-0	2	6-3	2	4-9	2	4-0	2	6-1	2	4-8	2	4-0	3
	3-2 × 12	7-5	2	5-8	2	4-9	3	7-5	2	5-8	2	4-9	3	7-2	2	5-6	3	4-8	3
	4-2 × 8	6-1	1	4-8	2	3-11	2	6-1	1	4-8	2	3-11	2	5-11	1	4-7	2	3-10	2
	4-2 × 10	7-3	2	5-6	2	4-8	2	7-3	2	5-6	2	4-8	2	7-0	2	5-5	2	4-7	2
	4-2 × 12	8-6	2	6-6	2	5-6	2	8-6	2	6-6	2	5-6	2	8-3	2	6-4	2	5-4	3

ROOF, CEILING AND ONE FLOOR (CLEAR SPAN)

ROOF, CEILING AND TWO FLOORS (CENTER BEARING)

ROOF, CEILING AND TWO FLOORS (CLEAR SPAN)

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

a. Spans are given in feet and inches.
b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.
c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.
f. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2×8, 2×10, or 2×12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

TABLE 602.7(2)
GIRDER SPANS [a] AND HEADER SPANS [a] FOR INTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir [b] and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING Width [c] (feet)					
		12		24		36	
		Span [e]	NJ [d]	Span [e]	NJ [d]	Span [e]	NJ [d]
One floor only	$2\text{-}2 \times 4$	4-1	1	2-10	1	2-4	1
	$2\text{-}2 \times 6$	6-1	1	4-4	1	3-6	1
	$2\text{-}2 \times 8$	7-9	1	5-5	1	4-5	2
	$2\text{-}2 \times 10$	9-2	1	6-6	2	5-3	2
	$2\text{-}2 \times 12$	10-9	1	7-7	2	6-3	2
	$3\text{-}2 \times 8$	9-8	1	6-10	1	5-7	1
	$3\text{-}2 \times 10$	11-5	1	8-1	1	6-7	2
	$3\text{-}2 \times 12$	13-6	1	9-6	2	7-9	2
	$4\text{-}2 \times 8$	11-2	1	7-11	1	6-5	1
	$4\text{-}2 \times 10$	13-3	1	9-4	1	7-8	1
	$4\text{-}2 \times 12$	15-7	1	11-0	1	9-0	2
Two floors	$2\text{-}2 \times 4$	2-7	1	1-11	1	1-7	1
	$2\text{-}2 \times 6$	3-11	1	2-11	2	2-5	2
	$2\text{-}2 \times 8$	5-0	1	3-8	2	3-1	2
	$2\text{-}2 \times 10$	5-11	2	4-4	2	3-7	2
	$2\text{-}2 \times 12$	6-11	2	5-2	2	4-3	3
	$3\text{-}2 \times 8$	6-3	1	4-7	2	3-10	2
	$3\text{-}2 \times 10$	7-5	1	5-6	2	4-6	2
	$3\text{-}2 \times 12$	8-8	2	6-5	2	5-4	2
	$4\text{-}2 \times 8$	7-2	1	5-4	1	4-5	2
	$4\text{-}2 \times 10$	8-6	1	6-4	2	5-3	2
	$4\text{-}2 \times 12$	10-1	1	7-5	2	6-2	2

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

a. Spans are given in feet and inches.
b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.
c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e.   Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.
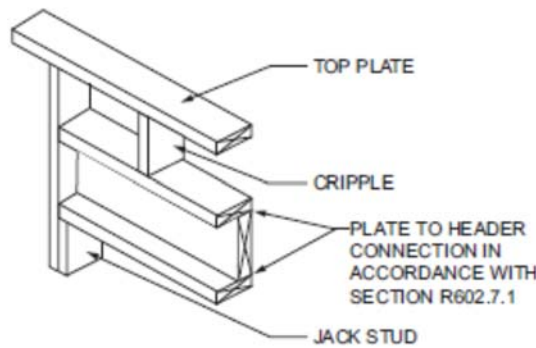
TABLE 602.7(3)
GIRDER AND HEADER SPANS [a] FOR OPEN PORCHES
(Maximum span for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir [b])

SIZE	SUPPORTING ROOF						SUPPORTING FLOOR	
	GROUND SNOW LOAD (psf)							
	30		50		70			
	DEPTH OF PORCH [c] (feet)							
	8	14	8	14	8	14	8	14
2-2 × 6	7-6	5-8	6-2	4-8	5-4	4-0	6-4	4-9
2-2 × 8	10-1	7-7	8-3	6-2	7-1	5-4	8-5	6-4
2-2 × 10	12-4	9-4	10-1	7-7	8-9	6-7	10-4	7-9
2-2 × 12	14-4	10-10	11-8	8-10	10-1	7-8	11-11	9-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a.   Spans are given in feet and inches.

b.   Tabulated values assume No. 2 grade lumber, wet service and incising for refractory species. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

c.   Porch depth is measured horizontally from building face to centerline of the header. For depths between those shown, spans are permitted to be interpolated.

602.7.1 Single member headers. Single headers shall be framed with a single flat 2-inch-nominal (51 mm) member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures 602.7.1(1) and 602.7.1(2) and face nailed to the top and bottom of the header with 10d box nails (3 inches × 0.128 inches) spaced 12 inches on center.

FIGURE 602.7.1(1)
SINGLE-MEMBER HEADER IN EXTERIOR BEARING WALL

TOP PLATE

PLATE TO HEADER
CONNECTION IN
ACCORDANCE WITH
SECTION R602.7.1

JACK STUD
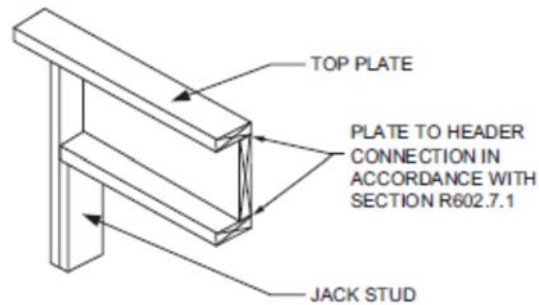
FIGURE 602.7.1(2)
ALTERNATIVE SINGLE-MEMBER HEADER WITHOUT CRIPPLE

602.7.2 Rim board headers. Rim board header size, material and span shall be in accordance with Table 602.7(1). Rim board headers shall be constructed in accordance with Figure 602.7.2 and shall be supported at each end by full-height studs. The number of full-height studs at each end shall be not less than the number of studs displaced by half of the header span based on the maximum stud spacing in accordance with Table 602.3(5). Rim board headers supporting concentrated loads shall be designed in accordance with accepted engineering practice.
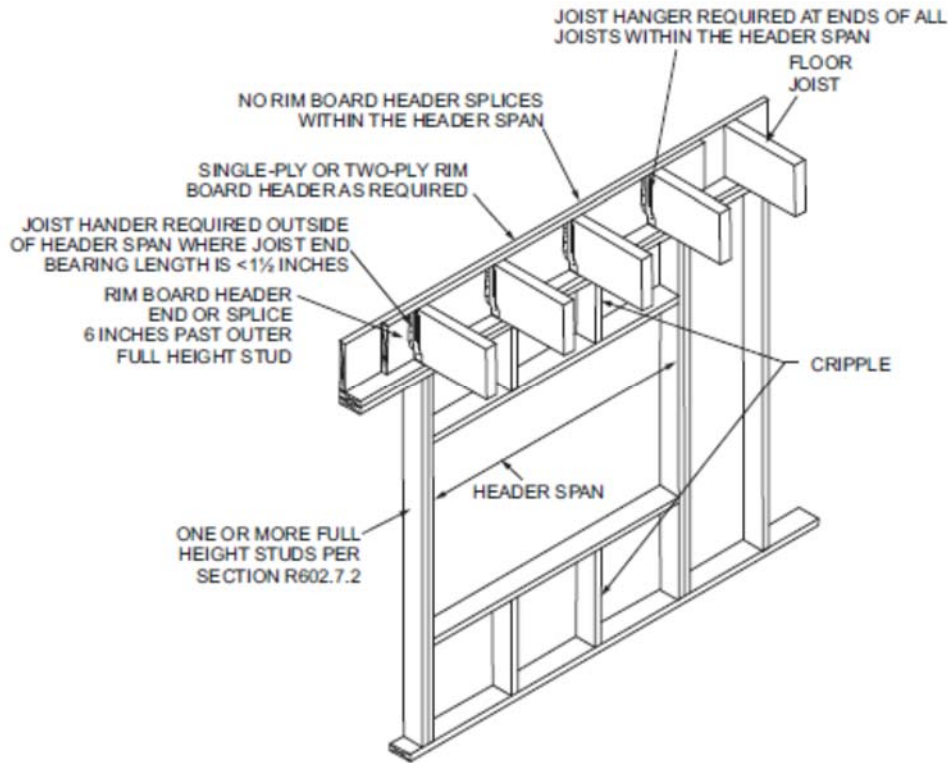
For SI: 25.4 mm = 1 inch.

FIGURE 602.7.2
RIM BOARD HEADER CONSTRUCTION

602.7.3 Wood structural panel box headers. Wood structural panel box headers shall be constructed in accordance with Figure 602.7.3 and Table 602.7.3.

TABLE 602.7.3
MAXIMUM SPANS FOR WOOD STRUCTURAL PANEL BOX HEADERS [a]

HEADER CONSTRUCTION [b]	HEADER DEPTH (inches)	HOUSE DEPTH (feet)				
		24	26	28	30	32
Wood structural panel–one side	9	4	4	3	3	—
	15	5	5	4	3	3
Wood structural panel–both sides	9	7	5	5	4	3
	15	8	8	7	7	6

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

a. Spans are based on single story with clear-span trussed roof or two story with floor and roof supported by interior-bearing walls.

b. See Figure 602.7.3 for construction details.
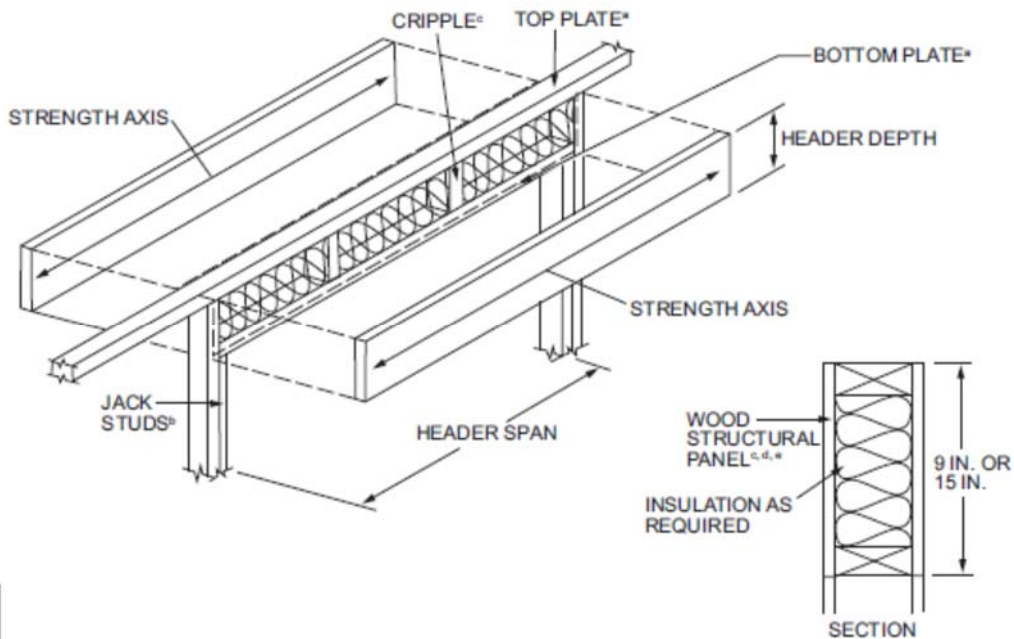
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

NOTES:

a. The top and bottom plates shall be continuous at header location.
b. Jack studs shall be used for spans over 4 feet.
c. Cripple spacing shall be the same as for studs.
d. Wood structural panel faces shall be single pieces of $^{15}/_{32}$ -inch-thick Exposure 1 (exterior glue) or thicker, installed on the interior or exterior or both sides of the header.
e. Wood structural panel faces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 3 inches on center, staggering alternate nails ½ -inch. Galvanized nails shall be hot-dipped or tumbled.

FIGURE 602.7.3
TYPICAL WOOD STRUCTURAL PANEL BOX HEADER CONSTRUCTION

602.7.4 Nonbearing walls. Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat 2-inch by 4-inch (51 mm by 102 mm) member shall be permitted to be used as a header in interior or exterior non-bearing walls for openings up to 8 feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches (610 mm). For such nonbearing headers, cripples or blocking are not required above the header.

602.7.5 Supports for headers. Headers shall be supported on each end with one or more jack studs or with approved framing anchors in accordance with Table 602.7(1) or 602.7(2). The full-height stud adjacent to each end of the header shall be end nailed to each end of the header with four-16d nails (3.5

inches × 0.135 inches). The minimum number of full-height studs at each end of a header shall be in accordance with Table 602.7.5.

TABLE 602.7.5
MINIMUM NUMBER OF FULL-HEIGHT
STUDS AT EACH END OF HEADERS IN
EXTERIOR WALLS [a]

MAXIMUM HEADER SPAN (feet)	ULTIMATE DESIGN WIND SPEED AND EXPOSURE CATEGORY	
	< 140 mph, Exposure B or < 130 mph, Exposure C	≤115 mph, Exposure B[b]
4	1	1
6	2	1
8	2	1
10	3	2
12	3	2
14	3	2
16	4	2
18	4	2

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.
a. For header spans between those given, use the minimum number of full-height studs associated with the larger header span.
b. The tabulated minimum number of full-height studs is applicable where jack studs are provided to support the header at each end in accordance with Table 602.7(1). Where a framing anchor is used to support the header in lieu of a jack stud in accordance with Note d of Table 602.7(1), the minimum number of full-height studs at each end of a header shall be in accordance with requirements for wind speed < 140 mph, Exposure B.

602.8 Fireblocking required. Fireblocking shall be provided in accordance with Section 302.11.

602.9 Cripple walls. Foundation cripple walls shall be framed of studs not smaller than the studding above. Where 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 one side with wood structural panels fastened to both the top and bottom plates in accordance with Table 602.3(1), or the cripple walls shall be constructed of solid blocking.
   Cripple walls shall be supported on continuous foundations.

602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section 602.12. 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 301.1.

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

602.10.1.1 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, an angled braced wall line as permitted in Section 602.10.1.4 or an exterior wall as shown in Figure 602.10.1.1.
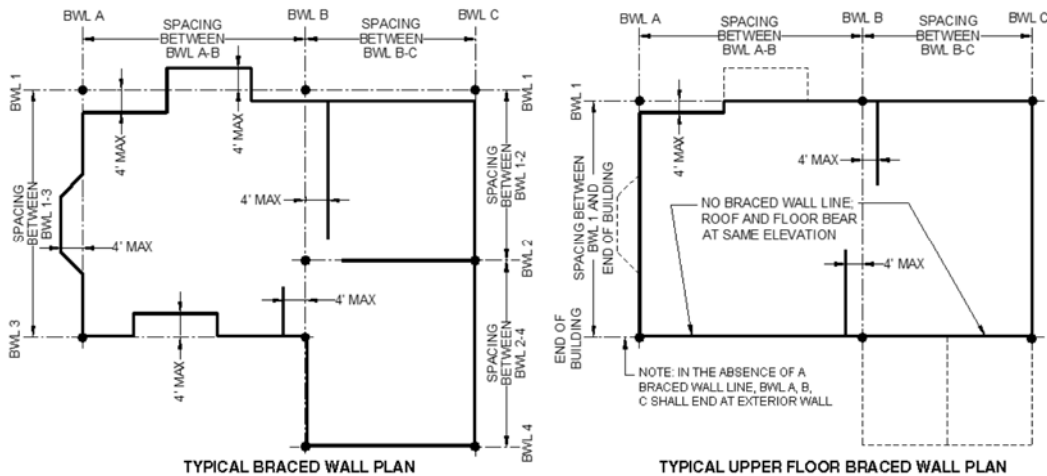
For SI: 1 foot = 304.8 mm.

**FIGURE 602.10.1.1
BRACED WALL LINES**

602.10.1.2 Offsets along a braced wall line. Exterior walls parallel to a braced wall line shall be offset not more than 4 feet (1219 mm) from the designated braced wall line location as shown in Figure 602.10.1.1. Interior walls used as bracing shall be off- set not more than 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure 602.10.1.1.

602.10.1.3 Spacing of braced wall lines. The spacing between parallel braced wall lines shall be in accordance with Table 602.10.1.3. Intermediate braced wall lines through the interior of the building shall be permitted.

TABLE 602.10.1.3
BRACED WALL LINE SPACING

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum	Exception to Maximum Spacing
Wind bracing	Ultimate design wind speed 100 mph to < 140 mph	*Dwellings or buildings with four or more dwelling units*	60 feet	None
Seismic bracing	SDC A – C	Detached *dwellings*		Use wind bracing
	SDC A – B	*Buildings with four or more dwelling units*		
	SDC C	*Buildings with four or more dwelling units*	35 feet	Up to 50 feet when length of required bracing per Table 602.10.3(3) is adjusted in accordance with Table 602.10.3(4).

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 0.447 m/s.

602.10.1.4 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 602.10.1.4. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered to be a separate braced wall line and shall be braced in accordance with Section 602.10.1.
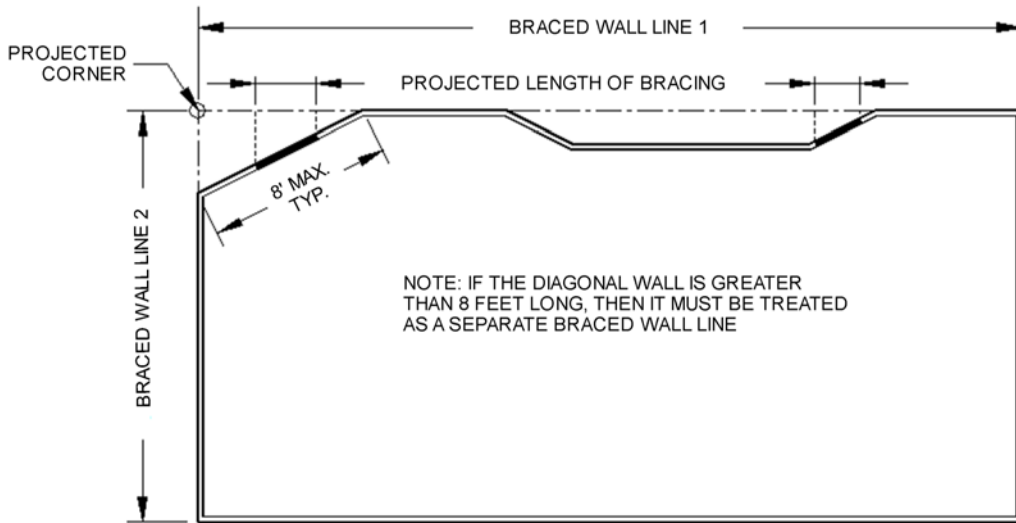
For SI: 1 foot = 304.8 mm.

FIGURE 602.10.1.4
ANGLED WALLS

602.10.2 Braced wall panels. Braced wall panels shall be full-height sections of wall that shall not have vertical or horizontal offsets. 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 602.10.4.

602.10.2.1 Braced wall panel uplift load path. The bracing lengths in Table 602.10.3(1) apply only when uplift loads are resisted in accordance with Section 602.3.5.

602.10.2.2 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 602.10.1.1. The distance between adjacent edges of braced wall panels along a braced wall line shall be not greater than 20 feet (6096 mm) as shown in Figure 602.10.2.2.
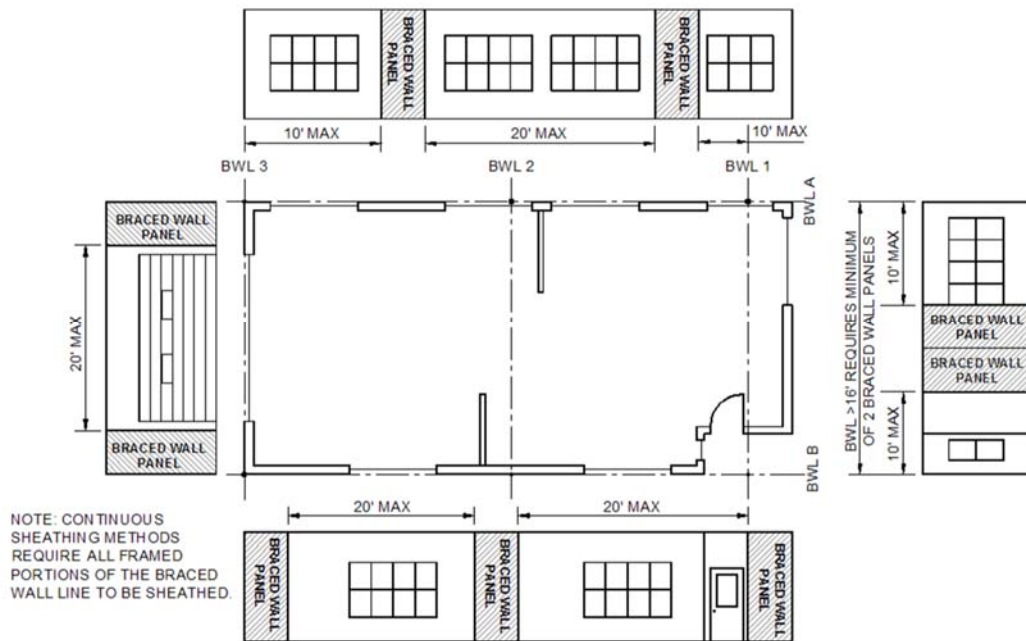
For SI: 1 foot = 304.8 mm.

FIGURE 602.10.2.2
LOCATION OF BRACED WALL PANELS

602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D$_0$, D$_1$ and D$_2$. *Deleted*

602.10.2.3 Minimum number of braced wall panels. Braced wall lines

with a length of 16 feet (4877 mm) or less shall have not less than 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 not less than two braced wall panels.
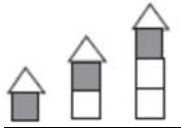
602.10.3 Required length of bracing. The required length of bracing along each braced wall line shall be determined as follows:
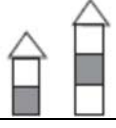
1. All buildings in Seismic Design Categories A and B shall use Table 602.10.3(1) and the applicable adjustment factors in Table 602.10.3(2).
2. Detached buildings in Seismic Design Category C shall use Table 602.10.3(1) and the applicable adjustment factors in Table 602.10.3(2).
3. *Building with four or more dwelling units* in Seismic Design Category C shall use the greater value determined from Table 602.10.3(1) or 602.10.3(3) and the applicable adjustment factors in Table 602.10.3(2) or 602.10.3(4), respectively.
4. *Deleted*

Only braced wall panels parallel to the braced wall line shall contribute toward the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of Tables 602.10.5 and 602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the braced wall line as shown in Figure 602.10.1.4. 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.

Exception: *Deleted*

TABLE 602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing [c] (feet)	Method LIB [b]	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFG, CS-SFB	Methods CS-WSP, CS-G, CS-PF
≤115		10	3.5	3.5	2.0	2.0
		20	6.5	6.5	3.5	3.5
		30	9.5	9.5	5.5	4.5
		40	12.5	12.5	7.0	6.0
		50	15.0	15.0	9.0	7.5
		60	18.0	18.0	10.5	9.0
		10	7.0	7.0	4.0	3.5

- EXPOSURE CATEGORY B 30-FOOT MEAN ROOF HEIGHT 10-FOOT WALL HEIGHT 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a]			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing [c] (feet)	Method LIB [b]	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFG, CS-SFB	Methods CS-WSP, CS-G, CS-PF
≤115	(upper/two-story diagram)	20	12.5	12.5	7.5	6.5
		30	18.0	18.0	10.5	9.0
		40	23.5	23.5	13.5	11.5
		50	29.0	29.0	16.5	14.0
		60	34.5	34.5	20.0	17.0
	(lower/one-story diagram)	10	NP	10.0	6.0	5.0
		20	NP	18.5	11.0	9.0
		30	NP	27.0	15.5	13.0
		40	NP	35.0	20.0	17.0
		50	NP	43.0	24.5	21.0
		60	NP	51.0	29.0	25.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s. NP = Not Permitted.

a. Linear interpolation shall be permitted.

b. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table 602.3(1) for exterior sheathing or Table 702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

c. Where three or more parallel braced wall lines are present and the distances between adjacent braced wall lines are different, the average dimension shall be permitted to be used for braced wall line spacing.

TABLE 602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a, b] [multiply length from Table 602.10.3(1) by this factor]	APPLICABLE METHODS
1	Exposure category[d]	One-story structure	B C D	1.00 1.20 1.50	All methods
		Two-story structure	B C D	1.00 1.30 1.60	
		Three-story structure	B C D	1.00 1.40 1.70	
2	Roof eave-to-ridge height	Roof only	≤ 5 feet 10 feet 15 feet 20 feet	0.70 1.00 1.30 1.60	
		Roof + 1 floor	≤ 5 feet	0.85	

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ITEM NUMBER	ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a, b] [multiply length from Table 602.10.3(1) by this factor]	APPLICABLE METHODS
			10 feet	1.00	
			15 feet	1.15	
			20 feet	1.30	
		Roof + 2 floors	≤ 5 feet	0.90	
			10 feet	1.00	
			15 feet	1.10	
			20 feet	Not permitted	
3	Story height (Section R301.3)	Any story	8 feet	0.90	
			9 feet	0.95	
			10 feet	1.00	
			11 feet	1.05	
			12 feet	1.10	
4	Number of braced wall lines (per plan direction)[c]	Any story	2	1.00	
			3	1.30	
			4	1.45	
			≥ 5	1.60	
5	Additional 800-pound 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
6	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
7	Gypsum board fastening	Any story	4 inches o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB
8	Horizontal blocking	Any story	Horizontal block is omitted	2.0	WSP, CS-WSP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 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 amounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.
d. The same adjustment factor shall be applied to all braced wall lines on all floors of the structure, based on the worst-case exposure category.

TABLE 602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

· SOIL CLASS D [b] · WALL HEIGHT = 10 FEET · 10 PSF FLOOR DEAD LOAD · 15 PSF ROOF/CEILING DEAD LOAD · BRACED WALL LINE SPACING £ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE [a, f]				
Seismic Design Category	Story Location	Braced Wall Line Length (feet)[c]	Method LIB[d]	Method GB	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[e]	Method WSP	Methods CS-WSP, CS-G, CS-PF
		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
C (building with four or more dwelling units only)		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

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

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.*3* of the *Ohio Building Code*.

c.   Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.

d.   Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table 602.3(1) for exterior sheathing or Table 702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

e.   *Deleted*

f.   Where more than one bracing method is used, mixing methods shall be in accordance with Section 602.10.4.1.

TABLE 602.10.3(4)
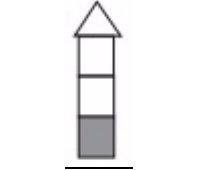## SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY	CONDITION	ADJUSTMENT FACTOR [a, b] [Multiply length from Table 602.10.3(3) by this factor]	APPLICABLE METHODS
1	Story height (Section 301.3)	Any story	≤ 10 feet > 10 feet and ≤ 12 feet	1.0 1.2	All methods
2	Braced wall line spacing, *building with*	Any story	≤ 35 feet	1.0	
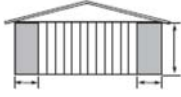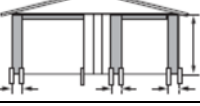
ITEM NUMBER	ADJUSTMENT BASED ON	STORY	CONDITION	ADJUSTMENT FACTOR [a, b] [Multiply length from Table 602.10.3(3) by this factor]	APPLICABLE METHODS
	four or more dwelling units in SDC C		> 35 feet and ≤ 50 feet	1.43	
3	Deleted				
4	Wall dead load	Any story	> 8 psf and < 15 psf < 8 psf	1.0 0.85	
5	Roof/ceiling dead load for wall supporting	1-, 2- or 3-story building	≤15 psf	1.0	
		2- or 3-story building	> 15 psf and ≤ 25 psf	1.1	
		1-story building or top story	> 15 psf and ≤ 25 psf	1.2	
6	Walls with stone or masonry veneer, *buildings with four or more dwelling units* in SDC C[d, e]			1.0	
				1.5	
				1.5	
7	Deleted				
8	Deleted				
9	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
10	Horizontal blocking	Any story	Horizontal blocking omitted	2.0	WSP, CS-WSP

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
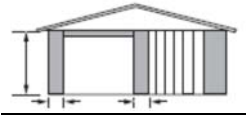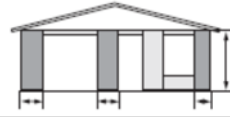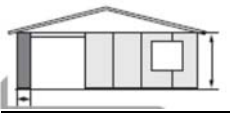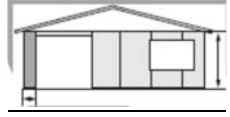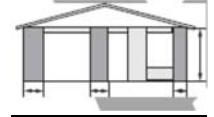
a.   Linear interpolation shall be permitted.

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.

d.   Applies to stone or masonry veneer exceeding the first story height.

e.   The adjustment factor for stone or masonry veneer shall be applied to all exterior braced wall lines and all braced wall lines on the interior of the building,   backing or perpendicular to and laterally supporting veneered walls.

f.   See Section 602.10.6.5 for requirements where stone or masonry veneer does not exceed the first-story height.

TABLE 602.10.4
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA [a]	
				Fasteners	Spacing
	LIB Let-in-bracing	1 × 4 wood or approved metal straps at 45° to 60° angles		Wood: 2-8d common nails or 3-8d (2 $\frac{1}{2}$ ″ long x 0.113″ dia.) nails	Wood: per stud and top and bottom plates

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA [a]	
			Fasteners	Spacing
	for maximum 16″ stud spacing		Metal strap: per manufacturer	Metal: per manufacturer
DWB Diagonal wood boards	$3/4″$ (1″ nominal) for maximum 24″ stud spacing		2-8d (2 $1/2″$ long × 0.113″ dia.) nails or 2 – 1 $3/4″$ long staples	Per stud
WSP Wood structural panel (See Section 604)	$3/8″$		Exterior sheathing per Table 602.3(3)	6″ edges 12″ field
			Interior sheathing per Table 602.3(1) or 602.3(2)	Varies by fastener
BV-WSP [e] Wood structural panels with stone or masonry veneer (See Section 602.10.6.5)	*Deleted*			
SFB Structural fiberboard sheathing	$1/2″$ or $25/32″$ for maximum 16″ stud spacing		1 $1/2″$ long × 0.12″ dia. (for $1/2″$ thick sheathing) 1 $3/4″$ long × 0.12″ dia. (for $25/32″$ thick sheathing) galvanized roofing nails	3″ edges 6″ field
GB Gypsum board	$1/2″$		Nails or screws per Table 602.3(1) for exterior locations	For all braced wall panel locations: 7″ edges (including top and bottom plates) 7″ field
			Nails or screws per Table 702.3.5 for interior locations	
PBS Particleboard sheathing (See Section 605)	$3/8″$ or $1/2″$ for maximum 16″ stud spacing		For $3/8″$, 6d common (2″ long × 0.113″ dia.) nails For $1/2″$, 8d common (2 $1/2″$ long × 0.131″ dia.) nails	3″ edges 6″ field
PCP Portland cement plaster	See Section 703.7 for maximum 16″ stud spacing		1 $1/2″$ long, 11 gage, $7/16″$ dia. head nails or $7/8″$ long, 16 gage staples	6″ o.c. on all framing members
HPS Hardboard panel siding	$7/16″$ for minimum 16″ stud spacing		0.092″ dia., 0.225″ dia. head nails with length to accommodate 1 $1/2″$ penetration into studs	4″ edges 8″ field
ABW Alternate braced wall	$3/8″$		See Section 602.10.6.1	See Section 602.10.6.1
PFH Portal frame with hold-downs	$3/8″$		See Section 602.10.6.2	See Section 602.10.6.2

Intermittent Bracing Methods

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA [a]	
				Fasteners	Spacing
Intermittent Bracing	**PFG** Portal frame at garage	$^7/_{16}''$		See Section 602.10.6.3	See Section 602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	$^3/_8''$		Exterior sheathing per Table 602.3(3)	6″ edges 12″ field
				Interior sheathing per Table 602.3(1) or 602.3(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 602.10.6.4	See Section 602.10.6.4
	CS-SFB[d] Continuously sheathed structural fiberboard	$^1/_2''$ or $^{25}/_{32}''$ for maximum 16" stud spacing		1 $^1/_2''$ long × 0.12″ dia. (for $^1/_2''$ thick sheathing) 1 $^3/_4''$ long × 0.12″ dia. (for $^{25}/_{32}''$ thick sheathing) galvanized roofing nails	3″ edges 6″ field

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.

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

b.   Applies to panels next to garage door opening where supporting gable end wall or roof load only. Shall only be used on one wall of the garage.

c.   Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table 602.7(1). A full-height clear opening shall not be permitted adjacent to a Method CS-G panel.

d.   *Deleted*

e.   *Deleted*

602.10.4 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 602.10.4.

602.10.4.1 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. In regions within Seismic Design Categories A, B and C where the ultimate design wind speed is less than or equal to 130 mph (58m/s), 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 that the length of required bracing in accordance with Table 602.10.3(1) or 602.10.3(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. Intermittent methods ABW, PFH and PFG shall be permitted to be used along a braced wall line with continuous sheathed methods, provided that the length of required bracing for that braced wall line is determined in accordance with Table 602.10.3(1) or 602.10.3(3) using the highest value of the bracing methods used.

5. In Seismic Design Categories A and B, and for detached 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 602.10.3(1) or 602.10.3(3) as adjusted by Tables 602.10.3(2) and 602.10.3(4), respectively. The requirements of Section 602.10.7 shall apply to each end of the continuously sheathed portion of the braced wall line.

602.10.4.2 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 602.10.7.

602.10.4.3 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 602.3(1) for exterior sheathing or Table 702.3.5 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).
   Exceptions:

1. Interior finish material is not required opposite wall panels that are braced in accordance with Methods GB, ABW, PFH, PFG and CS-PF, unless otherwise required by Section 302.6.
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 302.6.
3. Except for Method LIB, gypsum wall board is permitted to be omitted provided that the required length of bracing in Tables 602.10.3(1) and 602.10.3(3) is multiplied by the appropriate adjustment factor in Tables 602.10.3(2) and 602.10.3(4), respectively, unless otherwise required by Section 302.6.

602.10.4.4 Panel joints. Vertical joints of panel sheathing shall occur over and be fastened to common studs. Horizontal joints of panel sheathing in braced wall panels shall occur over and be fastened to common blocking of a thickness of $1^1/_2$ inches (38 mm) or greater.

Exceptions:
1. For methods WSP and CS-WSP, blocking of horizontal joints is permitted to be omitted when adjustment factor No. 8 of Table 602.10.3(2) or No. 9 of Table 602.10.3(4) is applied.
2. Vertical joints of panel sheathing shall be permitted to occur over double studs, where adjoining panel edges are attached to separate studs with the required panel edge fastening schedule, and the adjacent studs are attached together with two rows of 10d box nails [3 inches by 0.128 inch (76.2 mm by 3.25 mm)] at 10 inches o.c. (254 mm).
3. Blocking at horizontal joints shall not be required in wall segments that are not counted as braced wall panels.
4. Where Method GB panels are installed horizontally, blocking of horizontal joints is not required.

602.10.5 Minimum length of a braced wall panel. The minimum length of a braced wall panel shall comply with Table 602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table 602.10.5 and Figure 602.10.5. Where a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.
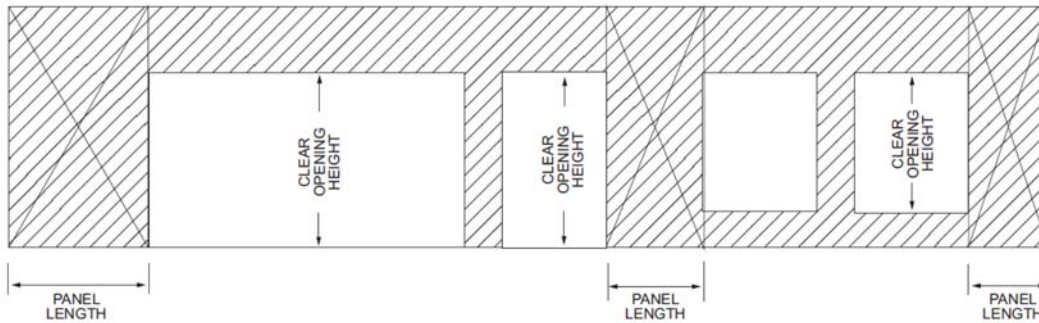
FIGURE 602.10.5
BRACED WALL PANELS WITH CONTINUOUS SHEATHING

TABLE 602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

METHOD (See Table 602.10.4)		MINIMUM LENGTH[a] (inches) Wall Height					CONTRIBUTING LENGTH (inches)
		8 feet	9 feet	10 feet	11 feet	12 feet	
DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP		48	48	48	53	58	Actual [b]
GB		48	48	48	53	58	Double sided = Actual Single sided = 0.5 × Actual
LIB		55	62	69	NP	NP	Actual [b]
ABW	SDC A, B and C ultimate design wind speed < 140 mph	28	32	34	38	42	48
	Deleted						
CS-G		24	27	30	33	36	Actual [b]
CS-WSP, CS-SFB	Adjacent clear opening height (inches)						
	≤ 64	24	27	30	33	36	
	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	Actual [b]
	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	

METHOD (See Table 602.10.4)		MINIMUM LENGTH[a] (inches) Wall Height					CONTRIBUTING LENGTH (inches)
		8 feet	9 feet	10 feet	11 feet	12 feet	
	124	—	—	—	56	51	
	128	—	—	—	61	54	
	132	—	—	—	66	58	
	136	—	—	—	—	62	
	140	—	—	—	—	66	
	144	—	—	—	—	72	
METHOD (See Table 602.10.4)		Portal header height					
		8 feet	9 feet	10 feet	11 feet	12 feet	
PFH	Supporting roof only	16	16	16	Note c	Note c	48
	Supporting one story and roof	24	24	24	Note c	Note c	
	PFG	24	27	30	Note d	Note d	1.5 × Actual [b]
CS-PF	SDC A, B and C	16	18	20	Note e	Note e	1.5 × Actual [b]
	Deleted						

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s. NP = Not Permitted.

a. Linear interpolation shall be permitted.

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

c. Maximum header height for PFH is 10 feet in accordance with Figure 602.10.6.2, but wall height shall be permitted to be increased to 12 feet with pony wall.

d. Maximum header height for PFG is 10 feet in accordance with Figure 602.10.6.3, but wall height shall be permitted to be increased to 12 feet with pony wall.

e. Maximum header height for CS-PF is 10 feet in accordance with Figure 602.10.6.4, but wall height shall be permitted to be increased to 12 feet with pony wall.

602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Tables 602.10.3(1) and 602.10.3(3), the contributing length of each braced wall panel shall be as specified in Table 602.10.5.

602.10.5.2 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 (914 mm and 1219 mm) in length shall be considered a braced wall panel and shall be permitted to partially contribute toward the required length of bracing in Tables 602.10.3(1) and 602.10.3(3), and the contributing length shall be determined from Table 602.10.5.2.

TABLE 602.10.5.2
PARTIAL CREDIT FOR BRACED WALL PANELS
LESS THAN 48 INCHES IN ACTUAL LENGTH

ACTUAL LENGTH OF BRACED WALL PANEL (inches)	CONTRIBUTING LENGTH OF BRACED WALL PANEL (inches) [a]	
	8-foot Wall Height	9-foot Wall Height
48	48	48
42	36	36

36	27	NA

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm. NA = Not Applicable.

a.   Linear interpolation shall be permitted.

602.10.6 Construction of Methods ABW, PFH, PFG, *and CS-PF*. Methods ABW, PFH, PFG, *and CS-PF* shall be constructed as specified in Sections 602.10.6.1 through 602.10.6.5.

602.10.6.1 Method ABW: Alternate braced wall panels. Method ABW braced wall panels shall be constructed in accordance with Figure 602.10.6.1. The hold-down force shall be in accordance with Table 602.10.6.1.

TABLE 602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR
METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/ STORY	HOLD-DOWN FORCE (pounds)				
		Height of Braced Wall Panel				
		8 feet	9 feet	10 feet	11 feet	12 feet
SDC A, B and C Ultimate design wind speed < 140 mph	One story	1,800	1,800	1,800	2,000	2,200
	First of two stories	3,000	3,000	3,000	3,300	3,600
Deleted						

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.45 N, 1 mile per hour = 0.447 m/s. NP = Not Permitted.

PANEL LENGTH PER
TABLE R602.10.5

BRACED WALL PANEL HEIGHT

MIN. 3/8" WOOD
STRUCTURAL PANEL
SHEATHING ON ONE FACE

MIN. 2 X 4 FRAMING MIN.
DOUBLE STUDS REQUIRED.

(2) HOLD-DOWN OR (2) STRAP-TYPE
ANCHORS PER TABLE R602.10.6.1 (ONE
OF EACH SHOWN FOR CLARITY).
STRAP-TYPE ANCHORS SHALL BE
PERMITTED TO BE ATTACHED OVER
THE WOOD STRUCTURAL PANEL

PANEL MUST BE ATTACHED
TO CONCRETE FOOTING OR
CONCRETE FOUNDATION
WALL CONTINUOUS OVER
BRACED WALL LINE

(2) 1/2" DIAMETER ANCHOR
BOLTS LOCATED BETWEEN
6" AND 12" OF EACH END OF
THE SEGMENT

FOR PANEL SPLICE (IF NEEDED)
ADJOINING PANEL EDGES SHALL MEET
OVER AND BE FASTENED TO COMMON
FRAMING

8D COMMON OR GALV. BOX NAILS @ 6"
O.C. AT PANEL EDGES. FOR SINGLE
STORY AND @ 4" O.C. PANEL EDGES
FOR THE FIRST OF 2 STORIES

STUDS UNDER HEADER AS REQUIRED

8D COMMON OR GALV. BOX NAILS @ 12"
O.C. AT INTERIOR SUPPORTS

MIN. REINFORCING OF FOUNDATION,
ONE #4 BAR TOP AND BOTTOM. LAP
BARS 15" MINIMUM.

MINIMUM FOOTING SIZE UNDER
OPENING IS 12" X 12". A TURNED-DOWN
SLAB SHALL BE PERMITTED AT DOOR
OPENINGS.

For SI: 1 inch = 25.4 mm.

FIGURE 602.10.6.1
METHOD ABW—ALTERNATE BRACED WALL PANEL

602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH braced wall panels shall be constructed in accordance with Figure 602.10.6.2.

EXTENT OF HEADER WITH DOUBLE PORTAL FRAMES (TWO BRACED WALL PANELS)

EXTENT OF HEADER WITH SINGLE PORTAL FRAME (ONE BRACED WALL PANEL)

2'-18' FINISHED WIDTH OF OPENING FOR SINGLE OR DOUBLE PORTAL

PONY WALL HEIGHT

12' MAX. TOTAL WALL HEIGHT

10' MAX. HEIGHT

MIN. 3"x11¼" NET HEADER STEEL HEADER PROHIBITED IF ½" SPACER IS USED, PLACE ON BACK-SIDE OF HEADER

FASTEN SHEATHING TO HEADER WITH 8D COMMON OR GALVANIZED BOX NAILS IN 3" GRID PATTERN AS SHOWN

HEADER TO JACK-STUD STRAP PER TABLE R602.10.6.4 ON BOTH SIDES OF OPENING OPPOSITE SIDE OF SHEATHING

MIN. DOUBLE 2x4 FRAMING COVERED WITH MIN. ⅜" THICK WOOD STRUCTURAL PANEL SHEATHING WITH 8D COMMON OR GALVANIZED BOX NAILS AT 3" O.C. IN ALL FRAMING (STUDS, BLOCKING, AND SILLS) TYP.

MIN. LENGTH OF PANEL PER TABLE R602.10.5

MIN. (2) 3500 LB STRAP-TYPE HOLD-DOWNS (EMBEDDED INTO CONCRETE AND NAILED INTO FRAMING)

MIN. REINFORCING OF FOUNDATION, ONE #4 BAR TOP AND BOTTOM OF FOOTING. LAP BARS 15" MIN.

MIN. FOOTING SIZE UNDER OPENING IS 12"x12". A TURNED-DOWN SLAB SHALL BE PERMITTED AT DOOR OPENINGS.

MIN. (1) ⅝" DIAMETER ANCHOR BOLT INSTALLED PER SECTION R403.1.6 - WITH 2"x 2" x³⁄₁₆" PLATE WASHER

TENSION STRAP PER TABLE R602.10.6.4 (ON OPPOSITE SIDE OF SHEATHING)

IF NEEDED, PANEL SPLICE EDGES SHALL OCCUR OVER AND BE NAILED TO COMMON BLOCKING WITHIN THE MIDDLE 24" OF THE PORTAL-LEG HEIGHT. ONE ROW OF 3" O.C. NAILING IS REQUIRED IN EACH PANEL EDGE.

TYPICAL PORTAL FRAME CONSTRUCTION

MIN. DOUBLE 2x4 POST (KING AND JACK STUD). NUMBER OF JACK STUDS PER TABLES R602.7(1) & (2).

MIN. 1000 LB. HOLD-DOWN DEVICE (EMBEDDED INTO CONCRETE AND NAILED INTO FRAMING).

FASTEN KING STUD TO HEADER WITH 6 16D SINKERS

FASTEN TOP PLATE TO HEADER WITH TWO ROWS OF 16D SINKER NAILS AT 3" O.C. TYP.

MIN. ⅜" WOOD STRUCTURAL PANEL SHEATHING

FRONT ELEVATION   SECTION

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

FIGURE 602.10.6.2
METHOD PFH—PORTAL FRAME WITH HOLD-DOWNS

602.10.6.3 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 602.10.6.3 shall be permitted on either side of garage door openings.
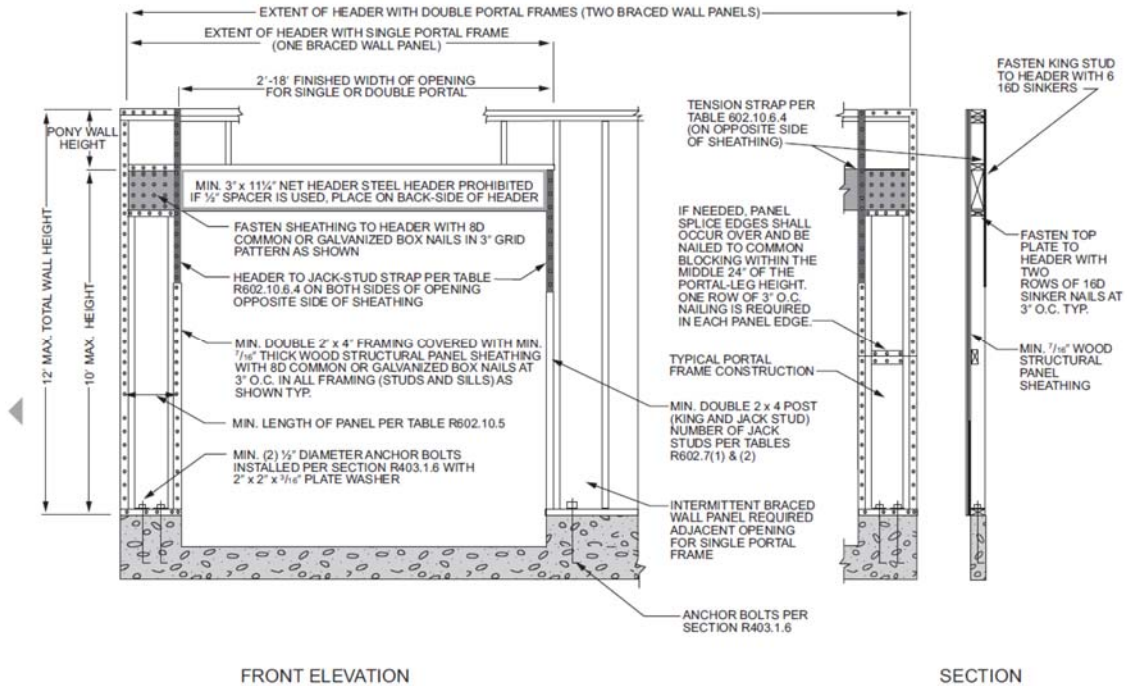
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 602.10.6.3
METHOD PFG—PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B and C

602.10.6.4 Method CS-PF: Continuously sheathed portal frame. Continuously sheathed portal frame braced wall panels shall be constructed in accordance with Figure 602.10.6.4 and Table 602.10.6.4. The number of continuously sheathed portal frame panels in a single braced wall line shall not exceed four.
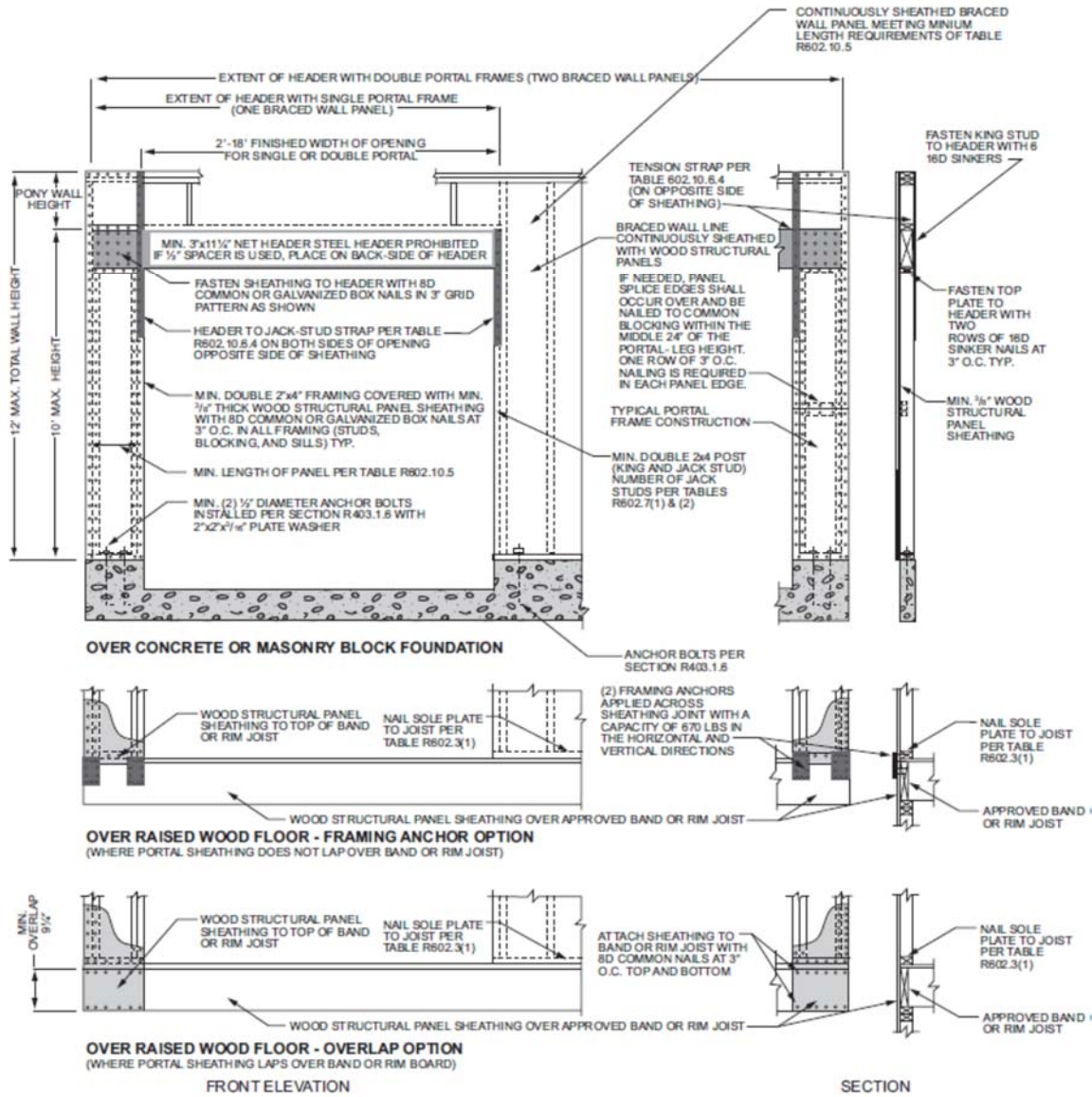
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 602.10.6.4
METHOD CS-PF—CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

TABLE 602.10.6.4
TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHODS PFH, PFG AND CS-PF BRACED WALL PANELS [a]

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

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s. DR = Design Required.
a. Straps shall be installed in accordance with manufacturer's recommendations.

602.10.6.5 Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D_0, D_1 and D_2. *Deleted*

Figure Deleted
FIGURE 602.10.6.5
METHOD BV-WSP—WALL BRACING FOR DWELLINGS WITH STONE AND MASONRY VENEER IN SEISMIC DESIGN CATEGORIES D_0, D_1 and D_2

TABLE 602.10.6.5
METHOD BV-WSP WALL BRACING REQUIREMENTS
Delete Table

602.10.6.5.1 Length of bracing. *Deleted*

602.10.7 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 602.10.7.
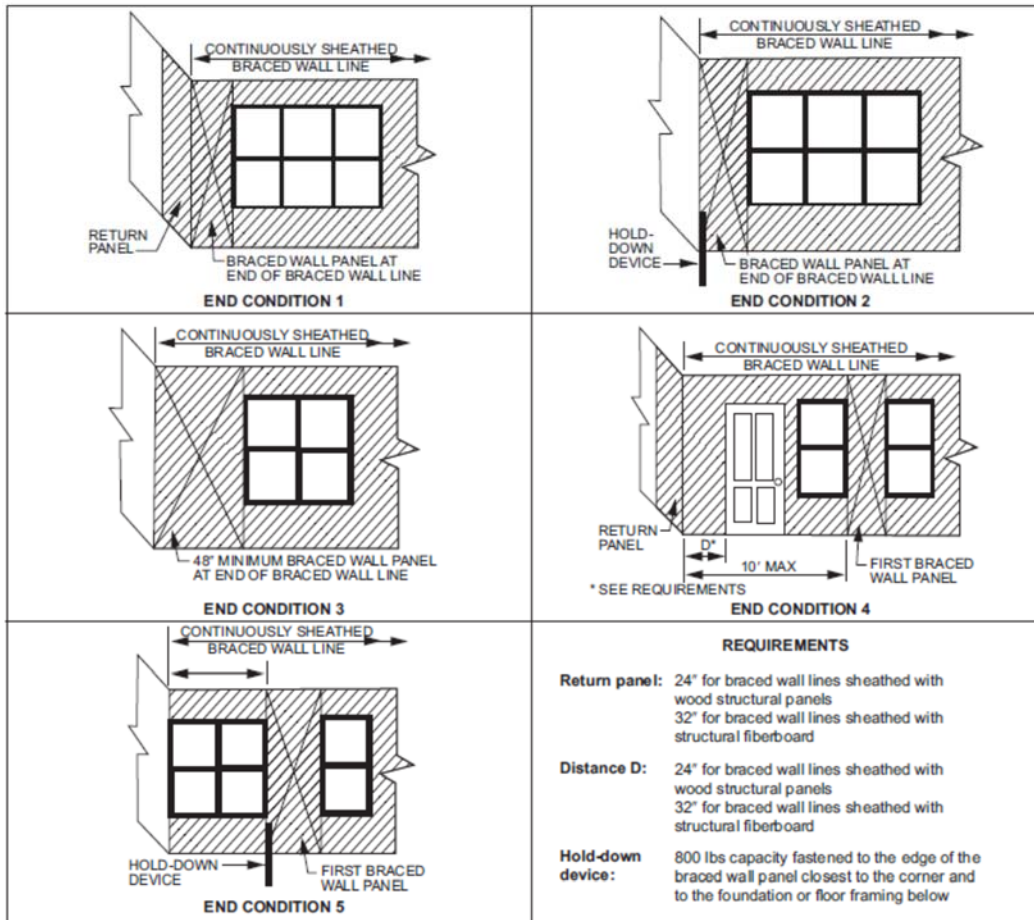
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.45 N.

FIGURE 602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH
CONTINUOUS SHEATHING

602.10.8 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 602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist or blocking shall be in accordance with Table 602.3(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 602.10.8(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 602.10.8(2). Fastening of blocking and wall plates shall be in accordance with Table 602.3(1) and Figure 602.10.8(2).

3. Connections of braced wall panels to concrete or masonry shall be in accordance with Section 403.1.6.
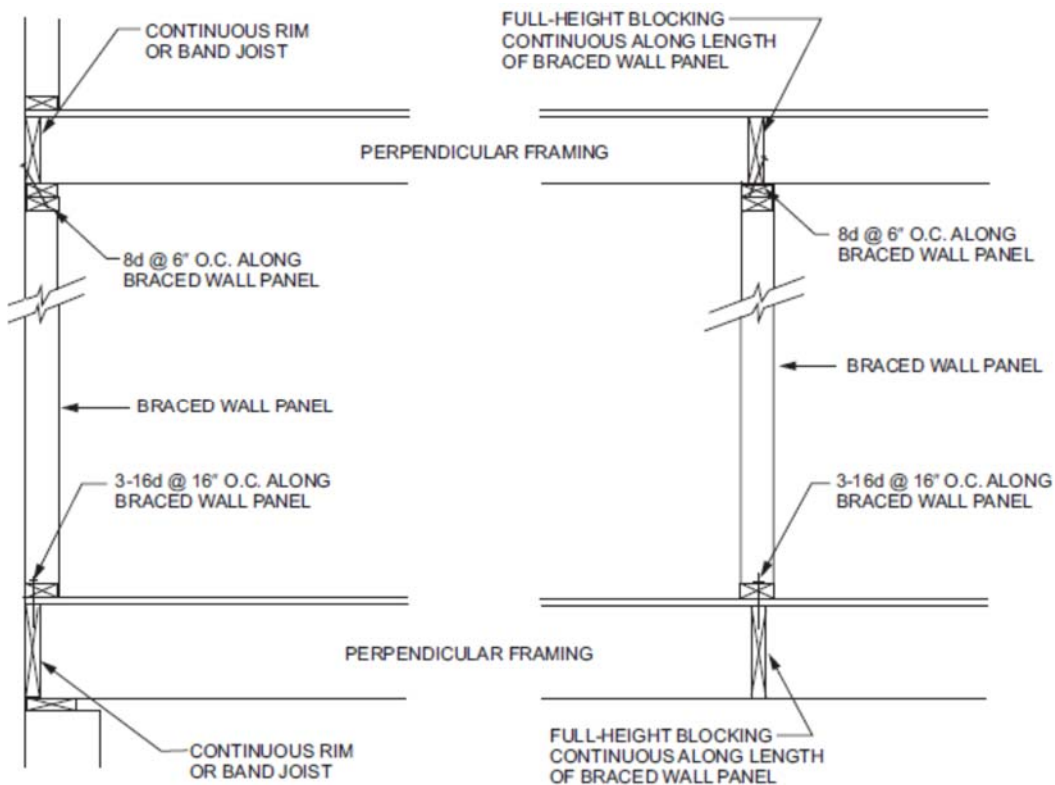
For SI: 1 inch = 25.4 mm.

FIGURE 602.10.8(1)
BRACED WALL PANEL CONNECTION WHEN
PERPENDICULAR TO FLOOR/CEILING FRAMING
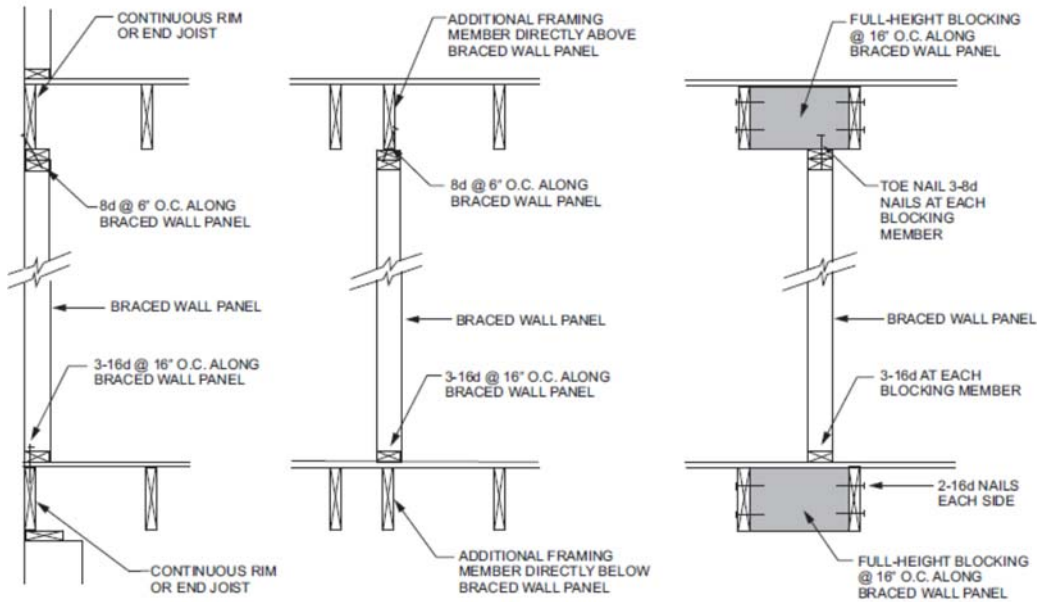
For SI: 1 inch = 25.4 mm.

FIGURE 602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN
PARALLEL TO FLOOR/CEILING FRAMING

602.10.8.1 Braced wall panel connections for Seismic Design Categories D$_0$, D$_1$ and D$_2$. *Deleted*

602.10.8.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table 602.3(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 602.3(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 802.8 and for trusses in accordance with Section 802.10.3. Roof ventilation shall be provided in accordance with Section 806.1.

1. For Seismic Design Categories A, B and C, where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is 9^1/$_4$ -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 $9^1/_4$ -inches (235 mm) and $15^1/_4$ -inches (387 mm), blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure 602.10.8.2(1).

    Exception: Where the outside edge of truss vertical web members aligns with the outside face of the wall studs below, wood structural panel sheathing extending above the top plate as shown in Figure 602.10.8.2(3) shall be permitted to be fastened to each truss web with three-8d nails ($2^1/_2$ -inches x 0.131 inch) and blocking between the trusses shall not be required.

2. *Deleted*

3. Where the distance from the top of the braced wall panel to the top of rafters or roof trusses exceeds $15^1/_4$ -inches (387 mm), the top plates of the braced wall panel 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 602.10.8.2(2).

    3.2. Vertical blocking panels constructed in accordance with Figure 602.10.8.2(3).

    3.3. Blocking panels provided by the roof truss manufacturer and designed in accordance with Section 802.

    3.4. Blocking, blocking panels or other methods of lateral load transfer designed in accordance with the AWC WFCM or accepted engineering practice.

SOLID BLOCKING BETWEEN RAFTERS ATTACHED TO TOP PLATES WITH 8d @ 6" O.C. ALONG LENGTH OF BRACED WALL PANEL

15.25" MAX

2" MAX OPEN
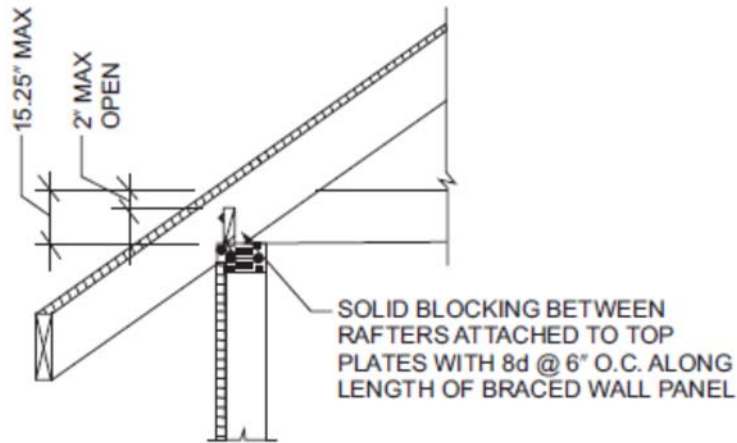
For SI: 1 inch = 25.4 mm.

FIGURE 602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO
PERPENDICULAR RAFTERS
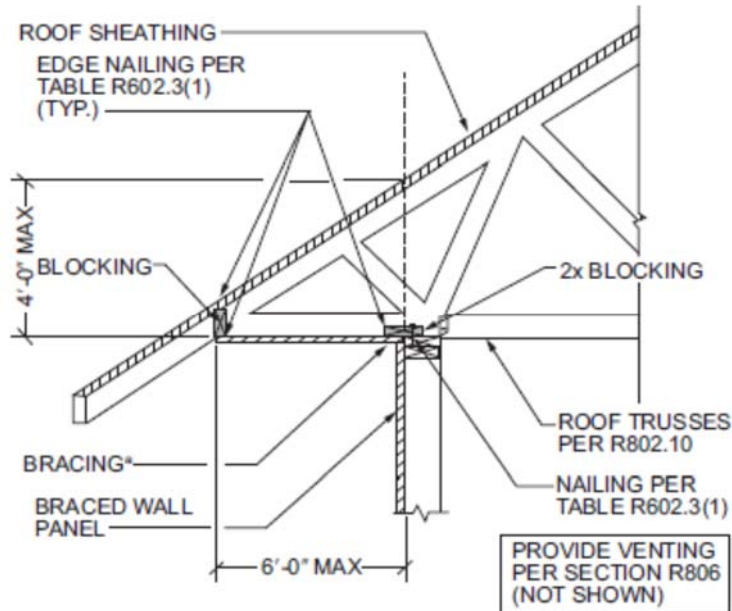
ROOF SHEATHING

EDGE NAILING PER TABLE R602.3(1) (TYP.)

4'-0" MAX

BLOCKING

2x BLOCKING

ROOF TRUSSES PER R802.10

NAILING PER TABLE R602.3(1)

BRACING*

BRACED WALL PANEL

6'-0" MAX

PROVIDE VENTING PER SECTION R806 (NOT SHOWN)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
a. Methods of bracing shall be as described in Section 602.10.4.

FIGURE 602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION TO
PERPENDICULAR RAFTERS OR ROOF TRUSSES
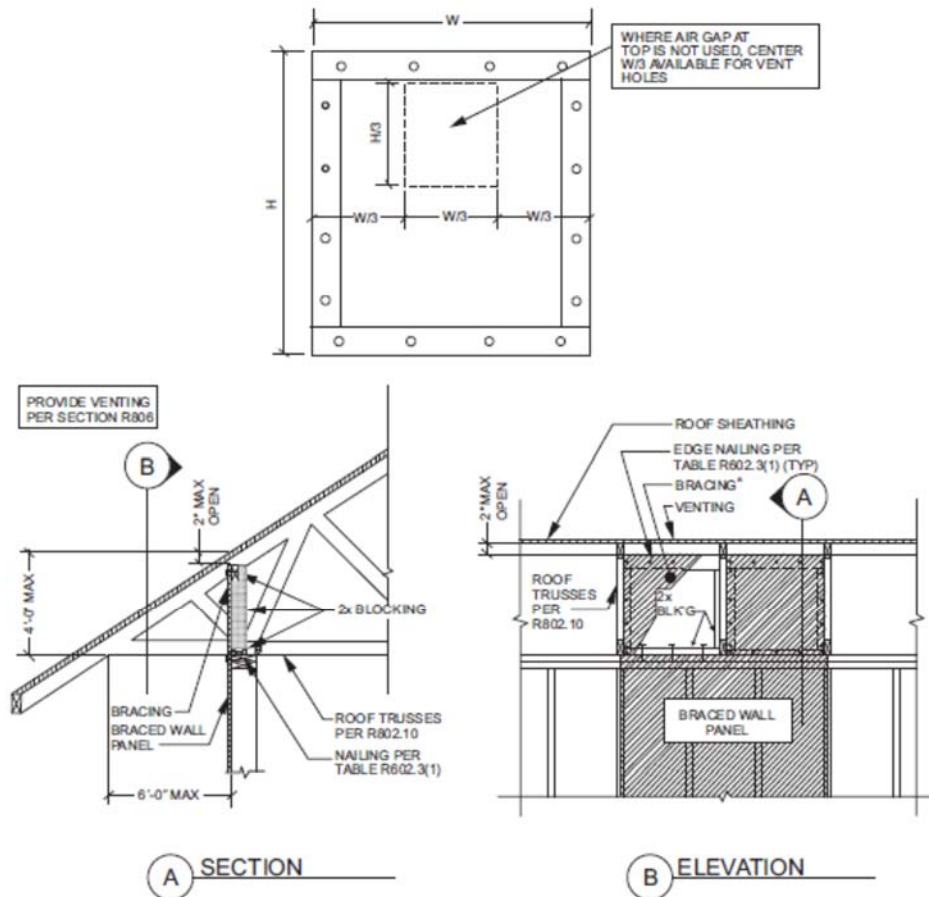
For SI: 1 inch = 25.4 mm, 1 foot =304.8 mm

a.   Methods of bracing shall be as described in Section 602.10.4.

FIGURE 602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO
PERPENDICULAR RAFTERS OR ROOF TRUSSES

602.10.9 Braced wall panel support. Braced wall panel support shall be provided as follows:

1. Cantilevered floor joists complying with Section 502.3.3 shall be permitted to support braced wall panels.
2. Raised floor system 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 (1219 mm) or less supporting braced wall panels shall be reinforced in accordance with

Figure 602.10.9. Masonry stem walls with a length greater than 48 inches (1219 mm) supporting braced wall panels shall be constructed in accordance with Section 403.1 Methods ABW and PFH shall not be permitted to attach to masonry stem walls.

4. 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 have reinforcement sized and located in accordance with Figure 602.10.9.
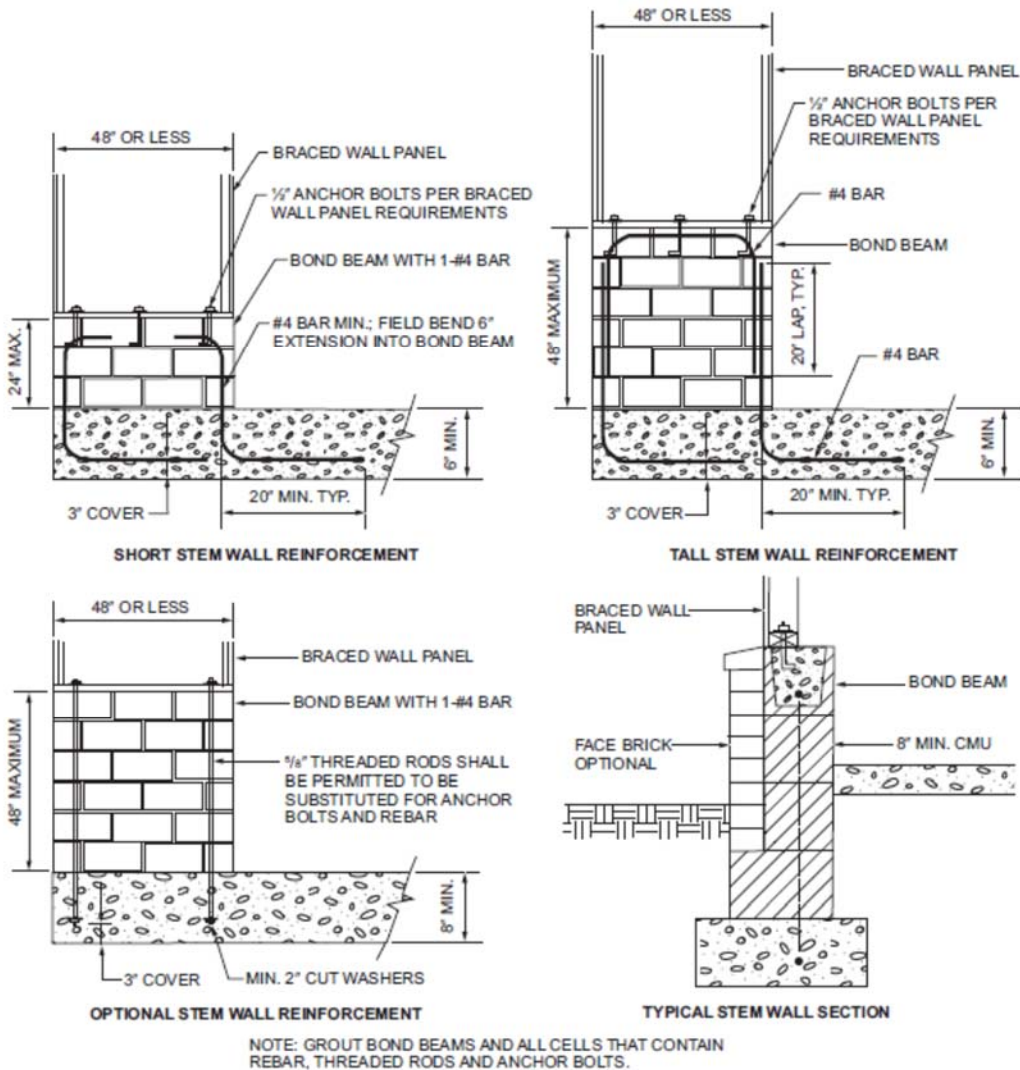
For SI: 1 inch = 25.4 mm.

FIGURE 602.10.9
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

602.10.9.1 Braced wall panel support for Seismic Design Categories D_0, D_1 and D_2. *Deleted*

602.10.10 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section 602.9 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 602.10.3(1) and 602.10.3(3), and the applicable adjustment factors in Table 602.10.3(2) or 602.10.3(4), respectively, except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. Where gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables 602.10.3(2) and 602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase.

602.10.10.1 Cripple wall bracing for *buildings with four or more dwelling units* in Seismic Design Category C. In addition to the requirements in Section 602.10.10, the distance between adjacent edges of braced wall panels for cripple walls along a braced wall line shall be 14 feet (4267 mm) maximum.

   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 or Method CS-WSP in accordance with Section 602.10.4. The length of bracing required in accordance with Table 602.10.3(3) 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.

602.10.10.2 Cripple wall bracing for Seismic Design Category D_2. *Deleted.*

602.10.10.3 Redesignation of cripple walls. Where all cripple wall segments along a braced wall line do not exceed 48 inches (1219 mm) in height, the cripple walls shall be permitted to be redesignated as a first-story wall for purposes of determining wall bracing requirements. Where any

cripple wall segment in a braced wall line exceeds 48 inches (1219 mm) 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.

602.11 Wall anchorage. Braced wall line sills shall be anchored to concrete or masonry foundations in accordance with Sections 403.1.6 and 602.11.1.

602.11.1 Wall anchorage for *buildings with four or more dwelling units* in Seismic Design Category C. Plate washers, not less than 0.229 inch by 3 inches by 3 inches (5.8 mm by 76 mm by 76 mm) in size, shall be provided between the foundation sill plate and the nut except where approved anchor straps are used. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $^3/_{16}$ inch (5 mm) larger than the bolt diameter and a slot length not to exceed $1^3/_4$ inches (44 mm), provided a standard cut washer is placed between the plate washer and the nut.

602.11.2 Stepped foundations in Seismic Design Categories D$_0$, D$_1$ and D$_2$. *Deleted*
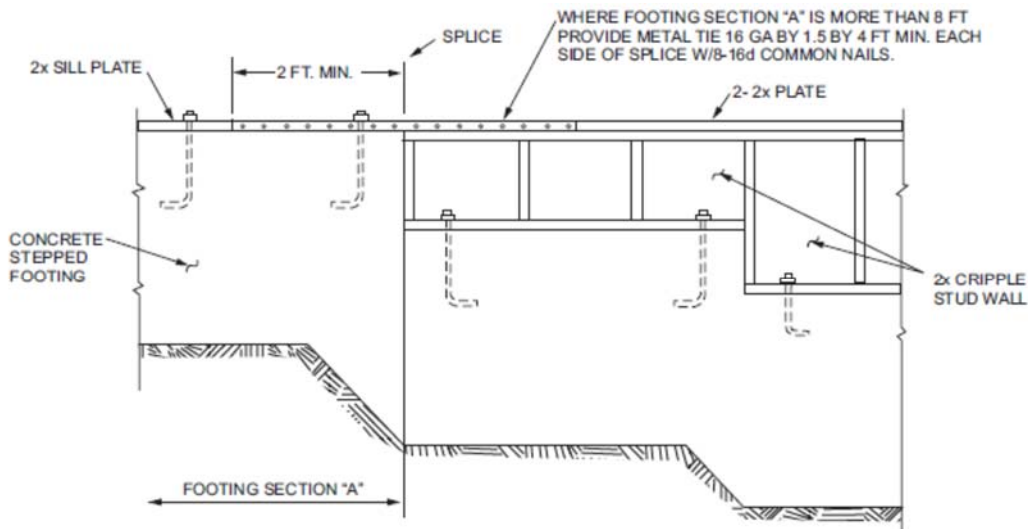
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
Note: Where footing Section "A" is less than 8 feet long in a 25-foot-long wall, install bracing at cripple stud wall.

FIGURE 602.11.2
STEPPED FOUNDATION CONSTRUCTION

602.12 Simplified wall bracing. Buildings meeting all of the following conditions shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section 602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of Section 602.10, except as specified herein, shall not be permitted.

1. There shall be not more than three stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (3048 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. Exterior walls shall have gypsum board with a minimum thickness of $^1/_2$ inch (12.7 mm) installed on the interior side fastened in accordance with Table 702.3.5.
6. The structure shall be located where the ultimate design wind speed is less than or equal to 130 mph (58 m/s), and the exposure category is B or C.
7. The structure shall be located in Seismic Design Category A, B or C for detached one-, two- *and three*-family dwellings or Seismic Design Category A or B for *buildings with four or more dwelling units.*
8. Cripple walls shall not be permitted in three-story buildings.

602.12.1 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 602.12.1. 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 not have a side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be not greater than 3:1.

602.12.2 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 602.12.3. Mixing materials is prohibited.

1. Wood structural panels with a minimum thickness of $^3/_8$ inch (9.5 mm) fastened in accordance with Table 602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of $^1/_2$ inch (12.7 mm) fastened in accordance with Table 602.3(1).

602.12.3 Bracing unit. A bracing unit shall be a full-height sheathed segment

of the exterior wall without openings or vertical or horizontal offsets and a minimum length as specified herein. Interior walls shall not contribute toward the amount of required bracing. Mixing of Items 1 and 2 is prohibited on the same story.

1. Where all framed portions of all exterior walls are sheathed in accordance with Section 602.12.2, 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. Where the exterior walls are braced with sheathing panels in accordance with Section 602.12.2 and areas between bracing units are covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

602.12.3.1 Multiple bracing units. Segments of wall compliant with Section 602.12.3 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. Full-height sheathed segments of wall narrower than the minimum bracing unit length shall not contribute toward a bracing unit except as specified in Section 602.12.6.

602.12.4 Number of bracing units. Each side of the circumscribed rectangle, as shown in Figure 602.12.1, shall have, at a minimum, the number of bracing units in accordance with Table 602.12.4 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 602.12.5.
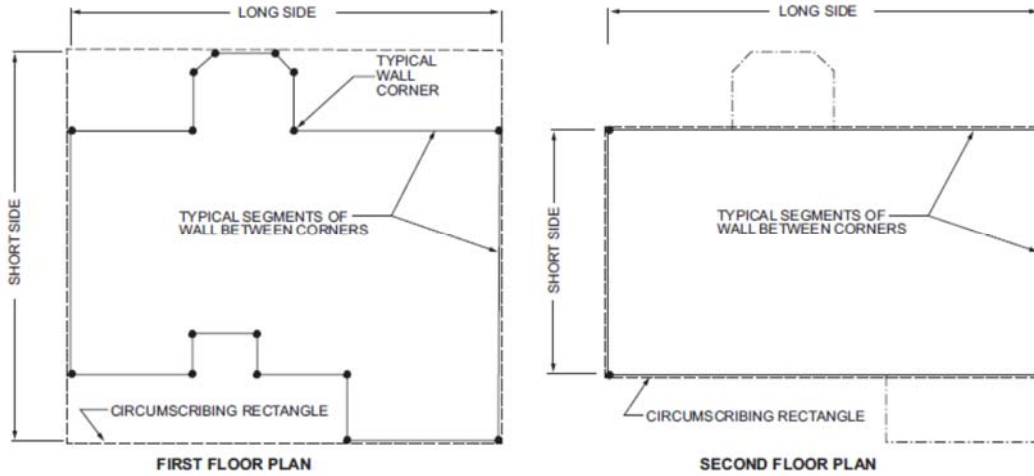
FIGURE 602.12.1
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING

TABLE 602.12.4
MINIMUM NUMBER OF BRACING UNITS ON
EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

ULTIMATE DESIGN WIND SPEED (mph)	STORY LEVEL	EAVE-TO-RIDGE HEIGHT (feet)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE[a, b, d]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE[a, b, d]					
			Length of short side (feet)[c]						Length of long side (feet)[c]					
			10	20	30	40	50	60	10	20	30	40	50	60
115		10	1	2	2	2	3	3	1	2	2	2	3	3
			2	3	3	4	5	6	2	3	3	4	5	6
			2	3	4	6	7	8	2	3	4	6	7	8
		15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9

130		10	1	2	2	3	3	4	1	2	2	3	3	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	7	8	10	2	4	5	7	8	10
		15	2	3	3	4	4	6	2	3	3	4	4	6
			3	4	6	7	8	10	3	4	6	7	8	10
			3	6	7	10	11	13	3	6	7	10	11	13

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

a.   Interpolation shall not be permitted.

b.   Cripple walls or wood-framed basement walls in a walk-out condition shall be designated as the first story and the stories above shall be redesignated as the second and third stories, respectively, and shall be prohibited in a three-story structure.

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

d.   For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building and 1.40 for a three-story building.

602.12.5 Distribution of bracing units. The placement of bracing units on exterior walls shall meet all of the following requirements as shown in Figure 602.12.5.

1. A bracing unit shall begin not more than 12 feet (3658 mm) from any wall corner.
2. The distance between adjacent edges of bracing units shall be not greater than 20 feet (6096 mm).
3. Segments of wall greater than 8 feet (2438 mm) in length shall have not less than one bracing unit.
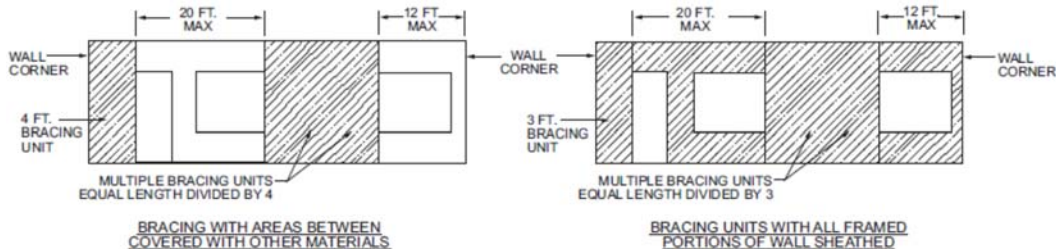
For SI: 1 foot = 304.8 mm.

FIGURE 602.12.5

BRACING UNIT DISTRIBUTION

602.12.6 Narrow panels. The bracing methods referenced in Section 602.10 and specified in Sections 602.12.6.1 through 602.12.6.3 shall be permitted where using simplified wall bracing.

602.12.6.1 Method CS-G. Braced wall panels constructed as Method CS-G in accordance with Tables 602.10.4 and 602.10.5 shall be permitted for one-story garages where 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 that include a Method CS-G panel shall meet the requirements of Section 602.10.4.2.

602.12.6.2 Method CS-PF. Braced wall panels constructed as Method CS-PF in accordance with Section 602.10.6.4 shall be permitted where all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal 0.75 bracing units. Not more than four CS-PF panels shall be permitted on all segments of walls parallel to each side of the circumscribed rectangle. Segments of wall that include a Method CS-PF panel shall meet the requirements of Section 602.10.4.2.

602.12.6.3 Methods ABW, PFH and PFG. Braced wall panels constructed as Method ABW, PFH and PFG shall be permitted where bracing units are con- structed using wood structural panels applied either continuously or intermittently. Each ABW and PFH panel shall equal one bracing unit and each PFG panel shall be equal to 0.75 bracing unit.

602.12.7 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 602.10.8.2.

602.12.8 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 602.10.9. 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 602.10.9.

SECTION 603
COLD-FORMED STEEL WALL FRAMING

603.1 General. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel wall framing members shall be in accordance with the requirements of this section.

603.1.1 Applicability limits. The provisions of this section shall control the construction of exterior cold-formed steel wall framing and interior load-bearing cold-formed steel wall framing for buildings not more than 60 feet (18 288 mm) long perpendicular to the joist or truss span, not more than 40 feet (12 192 mm) wide parallel to the joist or truss span, and less than or equal to three stories above grade plane. Exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), exposure category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3.35 kPa).

603.1.2 In-line framing. Load-bearing cold-formed steel studs constructed in accordance with Section 603 shall be located in-line with joists, trusses and rafters in accordance with Figure 603.1.2 and the tolerances specified as follows:

1. The maximum tolerance shall be $^3/_4$ -inch (19 mm) between the centerline of the horizontal framing member and the centerline of the vertical framing member.

2. Where the centerline of the horizontal framing member and bearing stiffener is located to one side of the centerline of the vertical framing member, the maximum tolerance shall be $^1/_8$ inch (3 mm) between the web of the horizontal framing member and the edge of the vertical framing member.
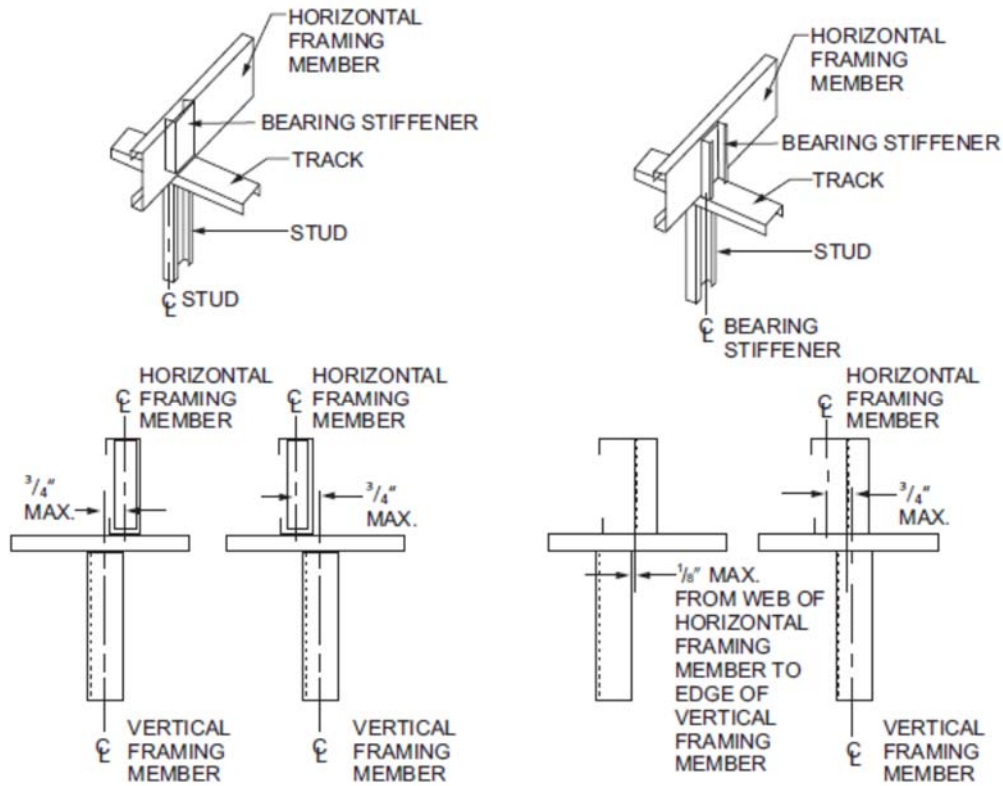
For SI: 1 inch = 25.4 mm,

**FIGURE 603.1.2
IN-LINE FRAMING**

603.2 Structural framing. Load-bearing cold-formed steel wall framing members shall be in accordance with this section.

603.2.1 Material. Load-bearing cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of ASTM A1003: Structural Grades 33 Type H and 50 Type H.

603.2.2 Corrosion protection. Load-bearing cold- formed steel framing shall have a metallic coating complying with ASTM A1003 and one of the following:
1. Not less than G 60 in accordance with ASTM A653.
2. Not less than AZ 50 in accordance with ASTM A792.

603.2.3 Dimension, thickness and material grade. Load-bearing cold-formed

steel wall framing members shall comply with Figure 603.2.3(1) and with the dimensional and thickness requirements specified in Table 603.2.3. Additionally, C-shaped sections shall have a minimum flange width of 1 $^5/_8$ - inches (41 mm) and a maximum flange width of 2 inches (51 mm). The minimum lip size for C-shaped sections shall be $^1/_2$ -inch (12.7 mm). Track sections shall comply with Figure 603.2.3(2) and shall have a minimum flange width of 1 $^1/_4$ -inches (32 mm). Minimum Grade 33 ksi steel shall be used wherever 33 mil and 43 mil thicknesses are specified. Minimum Grade 50 ksi steel shall be used wherever 54 and 68 mil thicknesses are specified.
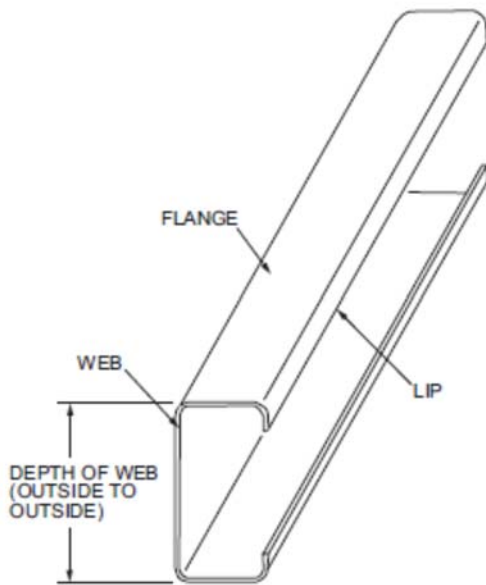
FIGURE 603.2.3(1)
C-SHAPED SECTION
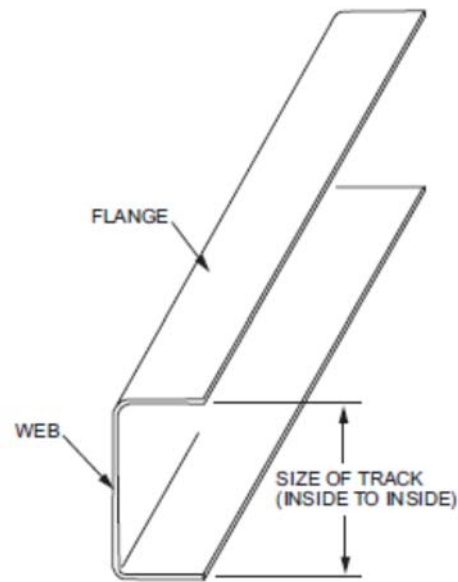
FIGURE 603.2.3(2)
TRACK SECTION

TABLE 603.2.3
LOAD-BEARING COLD-FORMED STEEL STUD SIZES AND THICKNESSES

MEMBER DESIGNATION [a]	WEB DEPTH (inches)	MINIMUM BASE STEEL THICKNESS mil (inches)
350S162-t	3.5	33 (0.0329), 43 (0.0428), 54 (0.0538)
550S162-t	5.5	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)

For SI: 1 inch = 25.4 mm; 1 mil = 0.0254 mm.

a.   The member designation is defined by the first number representing the member depth in hundredths of an inch, "S" representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils.

603.2.4 Identification. Load-bearing cold-formed steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:
1. Manufacturer's identification.
2. Minimum base steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (MPa).

603.2.5 Fastening. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^1/_2$ -inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C1513. Structural sheathing shall be attached to cold-formed steel studs with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws for attaching structural sheathing to cold-formed steel wall framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^3/_8$ -inch (9.5 mm). Gypsum board shall be attached to cold-formed steel wall framing with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with a bugle-head style and shall be installed in accordance with Section 702. For connections, screws shall extend through the steel not fewer than three exposed threads. 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.

603.2.6 Web holes, web hole reinforcing and web hole patching. Web holes, web hole reinforcing and web hole patching shall be in accordance with this section.

603.2.6.1 Web holes. Web holes in wall studs and other structural members shall comply with all of the following conditions:
1. Holes shall conform to Figure 603.2.6.1.
2. Holes shall be permitted only along the centerline of the web of the framing member.
3. Holes shall have a center-to-center spacing of not less than 24 inches (610 mm).
4. Holes shall have a web hole width not greater than 0.5 times the member depth, or $1^1/_2$ -inches (38 mm).
5. Holes shall have a web hole length not exceeding $4^1/_2$ -inches (114 mm).
6. Holes shall have a minimum distance between the edge of the bearing surface and the edge of the web hole of not less than 10

inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be reinforced in accordance with Section 603.2.6.2, patched in accordance with Section 603.2.6.3 or designed in accordance with accepted engineering practice.
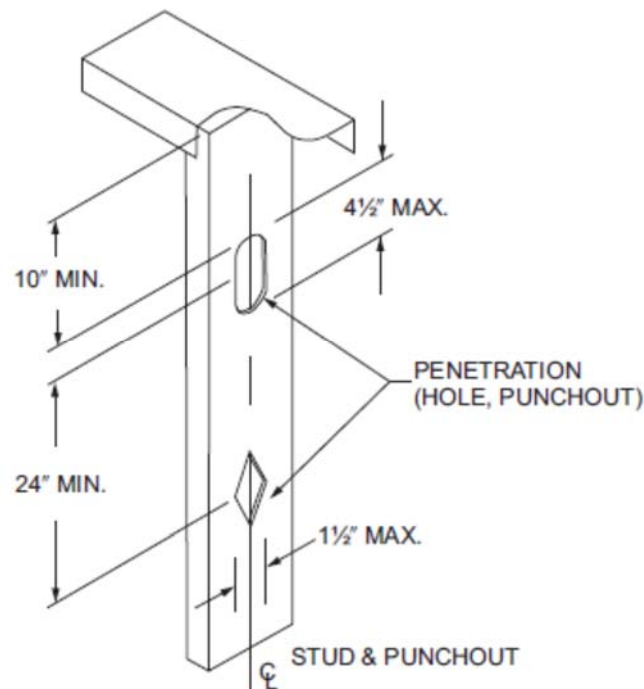
For SI: 1 inch = 25.4 mm.

FIGURE 603.2.6.1
WALL STUD WEB HOLES

603.2.6.2 Web hole reinforcing. Web holes in gable endwall studs not conforming to the requirements of Section 603.2.6.1 shall be permitted to be reinforced if the hole is located fully within the center 40 percent of the span and the depth and length of the hole does not exceed 65 percent of the flat width of the web. The reinforcing shall be a steel plate or C-shaped section with a hole that does not exceed the web hole size limitations of Section 603.2.6.1 for the member being reinforced. The steel reinforcing shall be the same thickness as the receiving member and shall extend not less than 1 inch (25 mm) beyond all edges of the hole. The steel rein-

forcing shall be fastened to the web of the receiving member with No. 8 screws spaced not more than 1 inch (25 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ -inch (12.7 mm).

603.2.6.3 Hole patching. Web holes in wall studs and other structural members not conforming to the requirements in Section 603.2.6.1 shall be permitted to be patched in accordance with either of the following methods:

1. Framing members shall be replaced or designed in accordance with accepted engineering practice where web holes exceed the following size limits:
   1.1. The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web.
   1.2. The length of the hole measured along the web exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.
2. Web holes not exceeding the dimensional requirements in Section 603.2.6.3, Item 1, shall be patched with a solid steel plate, stud section or track section in accordance with Figure 603.2.6.3. The steel patch shall, as a minimum, be the same thickness as the receiving member and shall extend not less than 1 inch (25 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No. 8 screws spaced not more than 1 inch (25 mm) center-to-center along the edges of the patch with a minimum edge distance of $^1/_2$ -inch (12.7 mm).
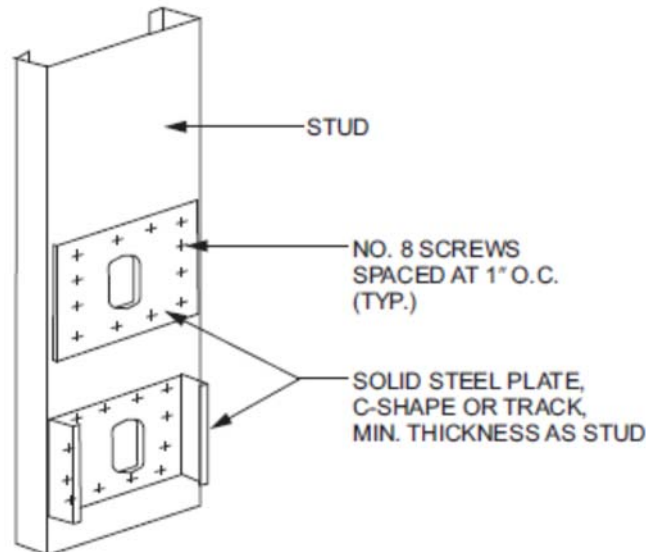
For SI: 1 inch = 25.4 mm.

FIGURE 603.2.6.3
WALL STUD WEB HOLE PATCH

603.3 Wall construction. Exterior cold-formed steel framed walls and interior load-bearing cold-formed steel framed walls shall be constructed in accordance with the provisions of this section.

603.3.1 Wall to foundation or floor connection. Cold-formed steel framed walls shall be anchored to foundations or floors in accordance with Table 603.3.1 and Figure 603.3.1(1), 603.3.1(2), 603.3.1(3) or 603.3.1(4). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Anchor bolts shall extend not less than 15 inches (381 mm) into masonry or 7 inches (178 mm) into concrete. Foundation anchor straps shall be permitted, in lieu of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.

TABLE 603.3.1
WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS [a, b]

FRAMING CONDITION			ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)					
			115 B	**120 B**	**130 B or 115 C**	**< 140 B or 120 C**	**130 C**	**< 140 C**
Wall bottom track to floor per Figure 603.3.1(1)			1-No. 8 screw at 12″ o.c.	1-No. 8 screw at 8″ o.c.	2-No. 8 screws at 8″ o.c.	2-No. 8 screws at 6″ o.c.	3-No. 8 screws at 8″ o.c.	3-No. 8 screws at 6″ o.c.
Wall bottom track to foundation per Figure 603.3.1(2) [d]			$\frac{1}{2}$″ minimum diameter anchor bolt at 6′ o.c.	$\frac{1}{2}$″ minimum diameter anchor bolt at 6′ o.c.	$\frac{1}{2}$″ minimum diameter anchor bolt at 4′ o.c.	$\frac{1}{2}$″ minimum diameter anchor bolt at 4′ o.c.	$\frac{1}{2}$″ minimum diameter anchor bolt at 3′-4″ o.c.	$\frac{1}{2}$″ minimum diameter anchor bolt at 2′-8″ o.c.
Wall bottom track to wood sill per Figure 603.3.1(3)			Steel plate spaced at 4′ o.c., with 4-No. 8 screws and 4- 10d or 6- 8d common nails	Steel plate spaced at 4′ o.c., with 4-No. 8 screws and 4- 10d or 6- 8d common nails	Steel plate spaced at 3′ o.c., with 4-No. 8 screws and 4- 10d or 6- 8d common nails	Steel plate spaced at 3′ o.c., with 4-No. 8 screws and 4- 10d or 6- 8d common nails	Steel plate spaced at 2′ o.c., with 4-No. 8 screws and 4- 10d or 6- 8d common nails	Steel plate spaced at 1′-4″ o.c., with 4-No. 8 screws and 4- 10d or 6- 8d common nails
Wind uplift connector strength (lbs) [c,e]	Stud Spacing (inches)	Roof Span (feet)						
	16	24	NR	NR	NR	NR	NR	NR
		28	NR	NR	NR	NR	NR	339
		32	NR	NR	NR	NR	NR	382
		36	NR	NR	NR	NR	333	426
		40	NR	NR	NR	NR	368	470
	24	24	NR	NR	NR	NR	343	443
		28	NR	NR	NR	NR	395	508
		32	NR	NR	NR	330	447	573

FRAMING CONDITION		ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)					
		115 B	120 B	130 B or 115 C	< 140 B or 120 C	130 C	< 140 C
	36	NR	NR	NR	371	500	639
	40	NR	NR	345	411	552	704

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 pound = 4.45 N.

a.   Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks, such as at door openings or corners. Bolts are to extend not less than 15 inches into masonry or 7 inches into concrete.

b.   All screw sizes shown are minimum.

c.   NR = Uplift connector not required.

d.   Foundation anchor straps are permitted in place of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and   installed in accordance with manufacturer's requirements.

e.   See Figure 603.3.1(4) for details.
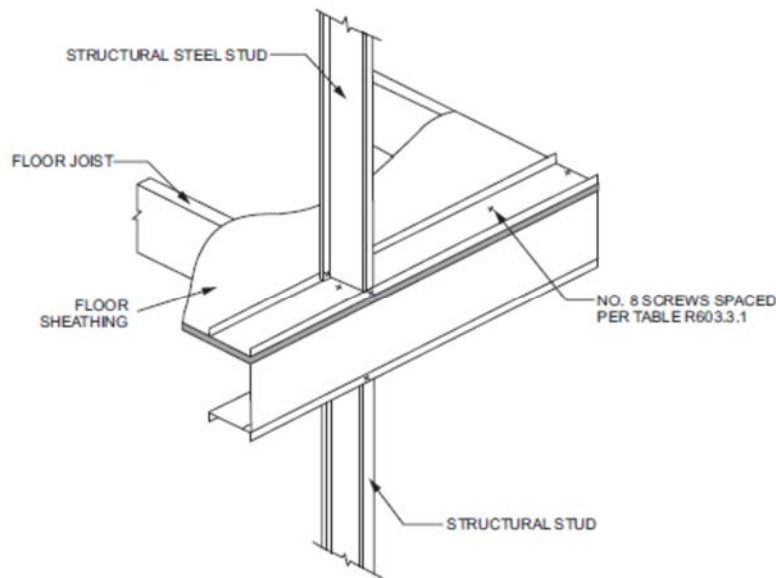
FIGURE 603.3.1(1)
WALL TO FLOOR CONNECTION

STUD

6" MINIMUM

TRACK

NO. 8 SCREW THROUGH EACH FLANGE

4 NO. 8 SCREWS THROUGH EACH FLANGE

STUD BLOCKING INSIDE WALL TRACK (MINIMUM THICKNESS OF STUD)

ANCHOR BOLT OR OTHER CONNECTION AS REQUIRED

FOUNDATION OR SLAB ON GRADE

SILL SEALER AS REQUIRED
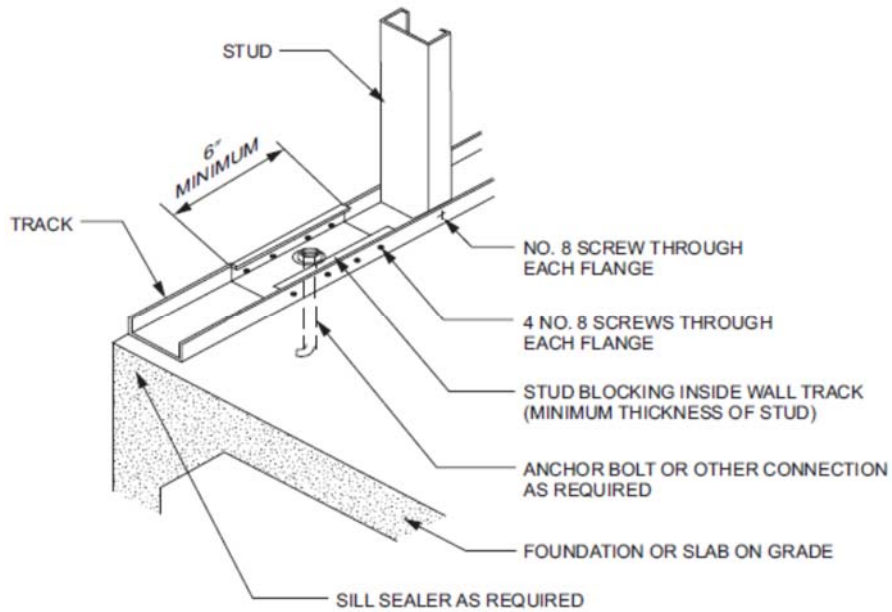
For SI: 1 inch = 25.4 mm.

FIGURE 603.3.1(2)
WALL TO FOUNDATION CONNECTION

SPACING OF PLATES

STUD

MINIMUM 3" x 4" x 33 MIL METAL PLATE

TRACK

4-10d OR 6-8d COMMON NAIL

NO. 8 SCREW THROUGH EACH FLANGE

MINIMUM 4 NO. 8 SCREWS

ANCHOR BOLT THROUGH WOOD SILL OR OTHER CONNECTION AS REQUIRED

WOOD SILL

FOUNDATION OR SLAB ON GRADE
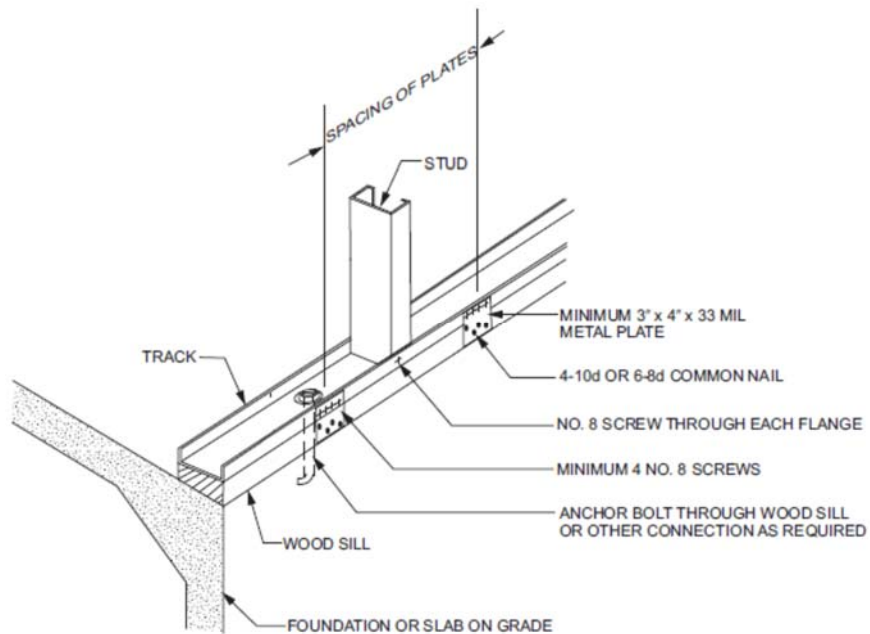
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE 603.3.1(3)

WALL TO WOOD SILL CONNECTION
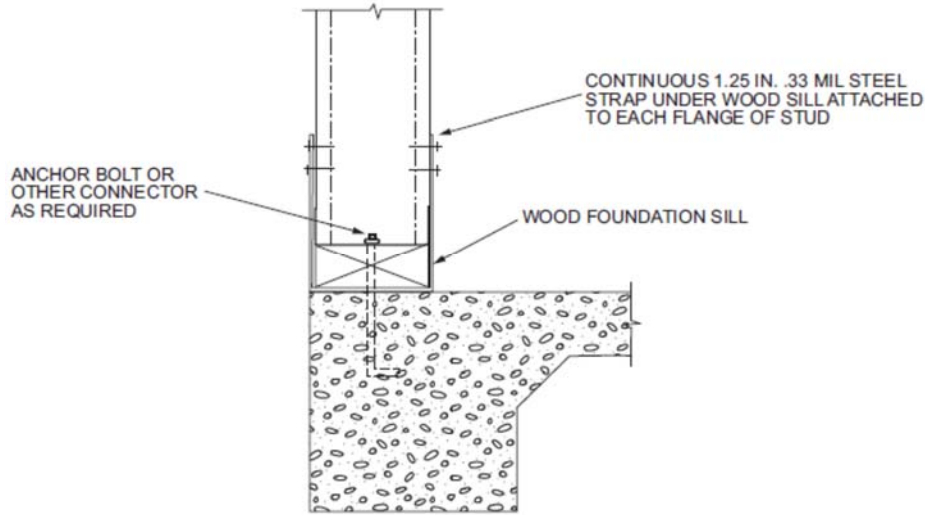
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE 603.3.1(4)
WIND UPLIFT CONNECTOR

603.3.1.1 Gable endwalls. Gable endwalls with heights greater than 10 feet (3048 mm) shall be anchored to foundations or floors in accordance with Table 603.3.1.1(1) or 603.3.1.1(2).

TABLE 603.3.1.1(1)
GABLE ENDWALL TO FLOOR CONNECTION REQUIREMENTS [a, b, c]

ULTIMATE WIND SPEED (mph)		WALL BOTTOM TRACK TO FLOOR JOIST OR TRACK CONNECTION		
Exposure Category		Stud height, *h* (feet)		
B	**C**	**$10 < h \leq 14$**	**$14 < h \leq 18$**	**$18 < h \leq 22$**
115	—	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.
120	—	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.
130	115	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	2-No. 8 screws @ 12″ o.c.
≤ 140	120	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	2-No. 8 screws @ 12″ o.c.
—	130	2-No. 8 screws @ 12″ o.c.	1-No. 8 screw @ 8″ o.c.	2-No. 8 screws @ 8″ o.c.
—	≤ 140	2-No. 8 screws @ 12″ o.c.	1-No. 8 screw @ 8″ o.c.	2-No. 8 screws @ 8″ o.c.

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

a. Refer to Table 603.3.1.1(2) for gable endwall bottom track to foundation connections.
b. Where attachment is not given, special design is required.
c. Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.

TABLE 603.3.1.1(2)

**GABLE ENDWALL BOTTOM TRACK TO FOUNDATION
CONNECTION REQUIREMENTS** [a, b, c]

ULTIMATE WIND SPEED (mph)		MINIMUM SPACING FOR $^1/_2$ -INCH-DIAMETER ANCHOR BOLTS [d]		
Exposure Category		**Stud height, _h_ (feet)**		
B	**C**	**10 < _h_ ≤ 14**	**14 < _h_ ≤ 18**	**18 < _h_ ≤ 22**
115	—	6′- 0″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
120	—	6′- 0″ o.c.	5′- 7″ o.c.	6′- 0″ o.c.
130	115	5′- 0″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
≤ 140	120	6′- 0″ o.c.	5′- 6″ o.c.	6′- 0″ o.c.
—	130	5′- 3″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
—	≤ 140	3′- 0″ o.c.	3′- 0″ o.c.	3′- 0″ o.c.

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

a. Refer to Table 603.3.1.1(1) for gable endwall bottom track to floor joist or track connection connections.
b. Where attachment is not given, special design is required.
c. Stud height, _h_, is measured from wall bottom track to wall top track or brace connection height.
d. Foundation anchor straps are permitted in place of anchor bolts if spaced as required to provide equivalent anchorage to the required anchor bolts and installed   in accordance with manufacturer's requirements.

603.3.2 Minimum stud sizes. Cold-formed steel walls shall be constructed in accordance with Figure 603.3.1(1), 603.3.1(2) or 603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables 603.3.2(2) through 603.3.2(16). Interior load-bearing wall stud size and thickness shall be determined in accordance with the limits set forth in Tables 603.3.2(2) through 603.3.2(16) based on an ultimate design wind speed of 115 miles per hour (51 m/s), Exposure Category B, and the building width, stud spacing and snow load, as appropriate. Fastening requirements shall be in accordance with Section 603.2.5 and Table 603.3.2(1). Top and bottom tracks shall have the same minimum thickness as the wall studs.

Exterior wall studs shall be permitted to be reduced to the next thinner size, as shown in Tables 603.3.2(2) through 603.3.2(16), but not less than 33 mils (0.84 mm), where both of the following conditions exist:

1. Minimum of $^1/_2$ -inch (12.7 mm) gypsum board is installed and fastened on the interior surface in accordance with Section 702.
2. Wood structural sheathing panels of minimum $^7/_{16}$ inch-thick (11.1 mm) oriented strand board or $^{15}/_{32}$ - inch-thick (12 mm) plywood are installed and fastened in accordance with Section 603.9.1 and Table 603.3.2(1) on the outside surface.

Interior load-bearing walls shall be permitted to be reduced to the next thinner size, as shown in Tables 603.3.2(2) through 603.3.2(16), but not less than 33 mils (0.84 mm), where not less than $^1/_2$ -inch (12.7 mm) gypsum board is installed and fastened in accordance with Section 702 on both sides of the wall.

The tabulated stud thickness for load-bearing walls shall be used where the attic load is 10 pounds per square foot (480 Pa) or less. A limited attic storage load of 20 pounds per square foot (960 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables 603.3.2(2) through 603.3.2(16).

For two-story buildings, the tabulated stud thickness for walls supporting one floor, roof and ceiling shall be used where the second-floor live load is 30 pounds per square foot (1440 Pa). Second-floor live loads of 40 psf (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables 603.3.2(2) through 603.3.2(11).

For three-story buildings, the tabulated stud thickness for walls supporting one or two floors, roof and ceiling shall be used where the third-floor live load is 30 pounds per square foot (1440 Pa). Third-floor live loads of 40 pounds per square foot (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables 603.3.2(12) through 603.3.2(16).

TABLE 603.3.2(1)
WALL FASTENING SCHEDULE [a]

DESCRIPTION OF BUILDING ELEMENT	NUMBER AND SIZE OF FASTENERS[a]	SPACING OF FASTENERS
Wall stud to top or bottom track	2-No. 8 screws	Each end of stud, one per flange
Structural sheathing to wall studs	No. 8 screws[b]	6″ o.c. on edges and 12″ o.c. at intermediate supports
$^{1}/_{2}$ ″ gypsum board to framing	No. 6 screws	12″ o.c.

For SI: 1 inch = 25.4 mm.

a. All screw sizes shown are minimum.
b. Screws for attachment of structural sheathing panels are to be bugle-head, flat-head, or similar head styles with a minimum head diameter of 0.29 inch.

TABLE 603.3.2(2)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43

		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
130	115	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
≤ 140	120	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	33	33	33	33	33	43	43	43	43
			24	43	43	43	43	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43
—	≤ 140	350S 162	16	33	33	33	33	43	43	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	54
		550S 162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Second-floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
   Building width is in the direction of horizontal framing members supported by the wall studs.
c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(3)
28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
130	115	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	43	54
			16	33	33	33	33	33	33	33	33	33	33	33	33

Wind Exp. B	Wind Exp. C	Member Size	Stud Spacing (in)	20	30	50	70	20	30	50	70	20	30	50	70
		550S162	24	33	33	33	43	33	33	33	43	33	33	33	43
≤ 140	120	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
		350S162	24	33	33	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	24	33	33	33	43	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	33	33	33	33	43	43	43	43	43
		350S162	24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	24	33	33	33	43	43	43	43	43	43	43	43	43
—	≤ 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
		350S162	24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
    Second-floor dead load is 10 psf.
    Second-floor live load is 30 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(4)
32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
		350S162	24	33	33	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	24	33	33	33	43	33	33	33	43	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
		350S162	24	33	33	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	24	33	33	33	43	33	33	33	43	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
		350S162	24	33	33	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	24	33	33	43	43	33	33	33	43	33	33	43	43
≤ 140	120	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
		350S162	24	33	33	43	54	43	43	43	54	54	54	54	54
			16	33	33	33	33	33	33	33	33	33	33	33	33

		550S162	24	33	33	43	43	33	33	33	43	43	43	43	43
=	130	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43
=	≤ 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a.   Deflection criterion: L/240.
b.   Design load assumptions:
     Second-floor dead load is 10 psf.
     Second-floor live load is 30 psf.
     Roof/ceiling dead load is 12 psf.
     Attic live load is 10 psf.
c.   Building width is in the direction of horizontal framing members supported by the wall studs.
d.   Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(5)
36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
≤ 140	120	350S162	16	33	33	33	43	33	33	33	33	33	33	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
—	130	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	43	43	43	43	54
—	≤ 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	54	43	43	43	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Second-floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(6)
40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	33	43	54	33	43	43	54	43	43	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	33	33	43	54	33	33	43	43	33	33	43	54
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	43	43	54	33	43	43	54	43	43	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	33	33	43	54
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	54	54	43	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	33	33	43	54
≤ 140	120	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	43	54
—	130	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	43	54
—	≤ 140	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Second-floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(7)
24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
130	115	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
≤ 140	120	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	43	54	43	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43
—	≤ 140	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Second-floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(8)
28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	43	54	43	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
≤ 140	120	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
—	130	350S162	16	33	33	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	43	43	43	43
—	≤ 140	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
    Second-floor dead load is 10 psf.
    Second-floor live load is 30 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(9)
32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	54
130	115	350S162	16	33	33	43	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	43	43	43	54
≤ 140	120	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	43	43	54	33	43	43	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
—	≤ 140	350S162	16	43	43	43	43	43	43	43	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Second-floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(10)
36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
120	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
130	115	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
≤ 140	120	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
—	≤ 140	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
    Second-floor dead load is 10 psf.
    Second-floor live load is 30 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(11)
40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	43	43	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
120	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
130	115	350S162	16	43	43	43	54	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
≤ 140	120	350S162	16	43	43	43	54	43	43	43	54	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
—	130	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54
			24	54	54	54	68	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
—	≤ 140	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54
			24	54	54	54	68	54	54	54	68	54	54	68	68
		550S162	16	33	33	43	43	33	33	43	43	33	43	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Second-floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(12)
24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
120	—	350S162	16	43	43	43	43	33	33	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
130	115	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
≤ 140	120	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
—	≤ 140	350S162	16	43	43	43	43	43	43	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	33	33	33	43	43
			24	43	43	54	54	43	43	43	43	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
    Top- and middle-floor dead load is 10 psf.
    Top-floor live load is 30 psf.
    Middle-floor live load is 40 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(13)
28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
≤ 140	120	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	43	43	43	43	43	43	43	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	≤ 140	350S162	16	43	43	43	54	54	54	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a.   Deflection criterion: $L/240$.
b.   Design load assumptions:
    Top- and middle-floor dead load is 10 psf.
    Top-floor live load is 30 psf.
    Middle-floor live load is 40 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c.   Building width is in the direction of horizontal framing members supported by the wall studs.
d.   Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(14)
32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	43	43	43	54	43	43	43	43	54	54	54	54
			24	54	54	54	68	54	54	54	54	54	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
≤ 140	120	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54
			24	54	54	54	68	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	43	43	43	54	43	54	54	54	54	54	54	54
			24	54	54	54	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	≤ 140	350S162	16	43	43	54	54	54	54	54	54	54	54	54	54
			24	54	54	54	68	54	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
   Top- and middle-floor dead load is 10 psf.
   Top-floor live load is 30 psf.
   Middle-floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(15)
36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
≤ 140	120	350S162	16	54	54	54	54	43	43	54	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	54	54	68	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	≤ 140	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.
b. Design load assumptions:
   Top- and middle-floor dead load is 10 psf.
   Top-floor live load is 30 psf.
   Middle-floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2(16)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
120	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
130	115	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
≤ 140	120	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
—	130	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
—	≤ 140	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s,
  1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a.   Deflection criterion: L/240.
b.   Design load assumptions:
      Top- and middle-floor dead load is 10 psf.
      Top-floor live load is 30 psf.
      Middle-floor live load is 40 psf.
      Roof/ceiling dead load is 12 psf.
      Attic live load is 10 psf.
c.   Building width is in the direction of horizontal framing members supported by the wall studs.
d.   Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

603.3.2.1 Gable endwalls. The size and thickness of gable endwall studs

with heights less than or equal to 10 feet (3048 mm) shall be permitted in accordance with the limits set forth in Table 603.3.2.1(1). The size and thickness of gable endwall studs with heights greater than 10 feet (3048 mm) shall be determined in accordance with the limits set forth in Table 603.3.2.1(2).

TABLE 603.3.2.1(1)
ALL BUILDING WIDTHS GABLE ENDWALLS
8, 9 OR 10 FEET IN HEIGHT [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)		
Exp. B	Exp. C			8-foot Studs	9-foot Studs	10-foot Studs
115	—	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
120	—	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
130	115	350S162	16	33	33	33
			24	33	43	43
		550S162	16	33	33	33
			24	33	33	33
< 140	120	350S162	16	33	33	43
			24	33	43	54
		550S162	16	33	33	33
			24	33	33	33
—	130	350S162	16	33	33	43
			24	43	43	54
		550S162	16	33	33	33
			24	33	43	43
—	< 140	350S162	16	33	43	43
			24	43	54	54
		550S162	16	33	33	33
			24	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a.   Deflection criterion L/240.
b.   Design load assumptions:
  Ground snow load is 70 psf.
  Roof/ceiling dead load is 12 psf.
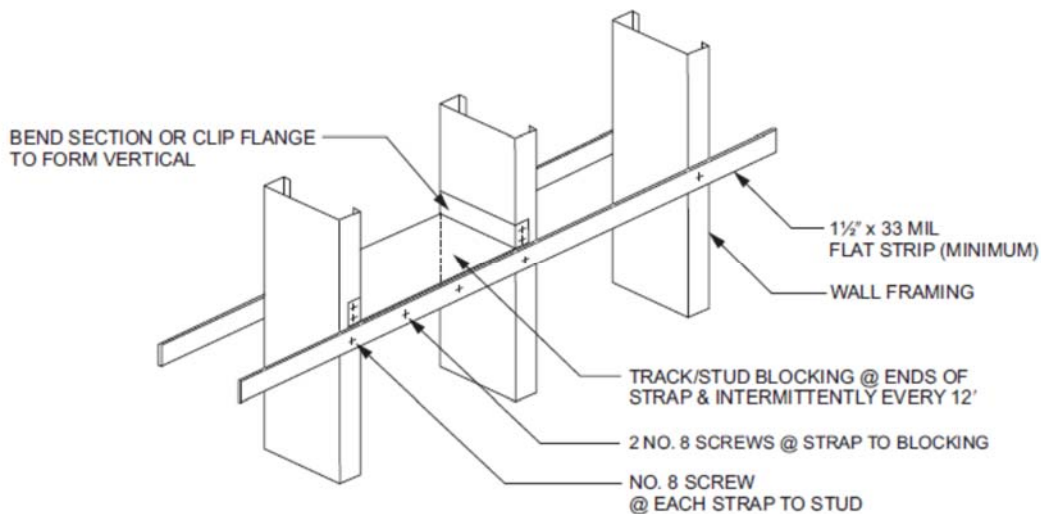 Floor dead load is 10 psf.
  Floor live load is 40 psf.
  Attic dead load is 10 psf.
c.   Building width is in the direction of horizontal framing members supported by the wall studs.
d.   Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel

shall be used for 54 and 68 mil thicknesses.

TABLE 603.3.2.1(2)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT [a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)					
				Stud Height, h (feet)					
Exp. B	Exp. C			$10 < h \le 12$	$12 < h \le 14$	$14 < h \le 16$	$16 < h \le 18$	$18 < h \le 20$	$20 < h \le 22$
115	—	350S162	16	33	43	68	97	—	—
			24	43	68	—	—	—	—
		550S162	16	33	33	33	43	43	54
			24	33	43	43	54	68	97
120	—	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	43	54	68
			24	33	43	54	54	68	97
130	115	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	54	54	97
			24	43	43	54	68	97	97
≤ 140	120	350S162	16	43	68	—	—	—	—
			24	68	—	—	—	—	—
		550S162	16	33	43	43	54	68	97
			24	43	54	54	68	97	—
—	130	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	33	43	54	68	97	—
			24	43	54	54	97	—	—
—	≤ 140	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	43	43	54	97	97	—
			24	54	54	68	—	—	—

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion L/240.
b. Design load assumptions:
 Ground snow load is 70 psf.
 Roof/ceiling dead load is 12 psf.
 Floor dead load is 10 psf.
 Floor live load is 40 psf.
 Attic dead load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

603.3.3 Stud bracing. The flanges of cold-formed steel studs shall be laterally braced in accordance with one of the following:

1. Gypsum board on both sides, structural sheathing on both sides, or gypsum board on one side and structural sheathing on the other side of load-bearing walls with gypsum board installed with minimum No. 6 screws in accordance with Section 702 and structural sheathing installed in accordance with Section 603.9 and Table 603.3.2(1).

2. Horizontal steel straps fastened in accordance with Figure 603.3.3(1) on both sides at mid-height for 8-foot (2438 mm) walls, and at one-third points for 9-foot and 10-foot (2743 mm and 3048 mm) walls. Horizontal steel straps shall be not less than $1^{1}/_{2}$ inches in width and 33 mils in thickness (38 mm by 0.84 mm). Straps shall be attached to the flanges of studs with one No. 8 screw. In-line blocking shall be installed between studs at the termination of straps and at 12-foot (3658 mm) intervals along the strap. Straps shall be fastened to the blocking with two No. 8 screws.

3. Sheathing on one side and strapping on the other side fastened in accordance with Figure 603.3.3(2). Sheathing shall be installed in accordance with Item 1. Steel straps shall be installed in accordance with Item 2.

BEND SECTION OR CLIP FLANGE
TO FORM VERTICAL

1½" x 33 MIL
FLAT STRIP (MINIMUM)

WALL FRAMING

TRACK/STUD BLOCKING @ ENDS OF
STRAP & INTERMITTENTLY EVERY 12'

2 NO. 8 SCREWS @ STRAP TO BLOCKING

NO. 8 SCREW
@ EACH STRAP TO STUD

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 603.3.3(1)
STUD BRACING WITH STRAPPING ONLY
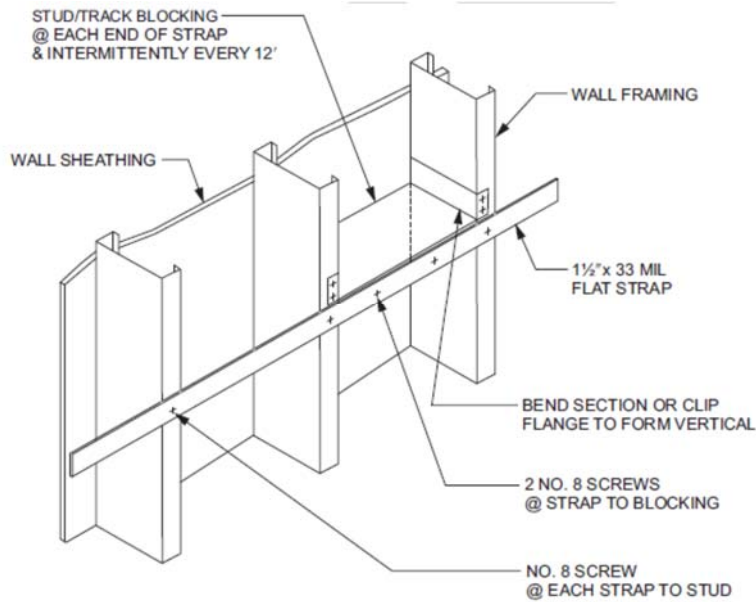
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 603.3.3(2)
STUD BRACING WITH STRAPPING AND SHEATHING MATERIAL

603.3.4 Cutting and notching. Flanges and lips of cold-formed steel studs and headers shall not be cut or notched.

603.3.5 Splicing. Steel studs and other structural members shall not be spliced without an approved design. Tracks shall be spliced in accordance with Figure 603.3.5.
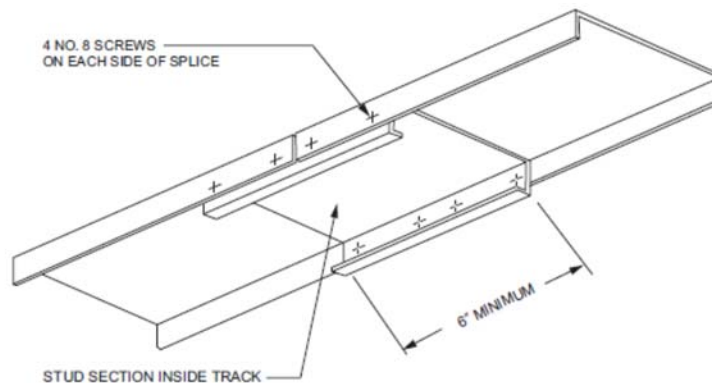
For SI: 1 inch = 25.4 mm.

FIGURE 603.3.5
TRACK SPLICE

603.4 Corner framing. In exterior walls, corner studs and the top tracks shall be installed in accordance with Figure 603.4.

4 NO. 8 SCREWS AT LAPPED TRACK

2 NO. 8 SCREWS @ 24" O.C. CONNECTING CORNER STUDS

CLIP TRACK FLANGE AT LAP JOINT

TRACK

EXTERIOR WALL STUD

INTERIOR GYPSUM WALL BOARD FINISH

TRACK

NO. 6 SCREWS

PLAN

ALTERNATE PLAN
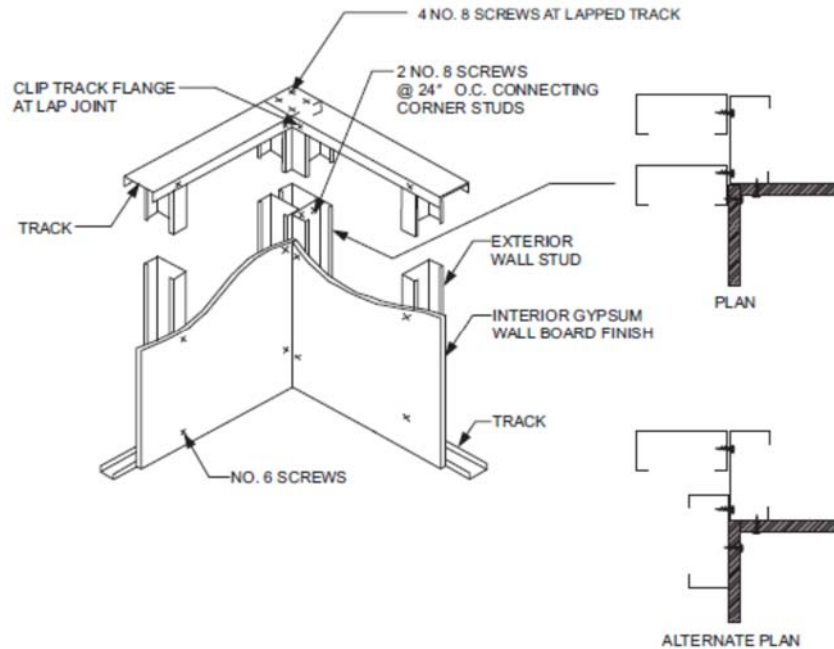
For SI: 1 inch = 25.4 mm.

FIGURE 603.4
CORNER FRAMING

603.5 Exterior wall covering. The method of attachment of exterior wall covering materials to cold-formed steel stud wall framing shall conform to the manufacturer's installation instructions.

603.6 Headers. Headers shall be installed above all wall openings in exterior walls and interior load-bearing walls. Box beam headers and back-to-back headers each shall be formed from two equal sized C-shaped members in accordance with Figures 603.6(1) and 603.6(2), respectively, and Tables 603.6(1) through 603.6(6). L-shaped headers shall be permitted to be constructed in accordance with AISI S230. Alternately, headers shall be permitted to be designed and constructed in accordance with AISI S240.

2 NO.8 SCREWS @ 24″ O.C.
ONE PER FLANGE

TRACK

C-SHAPES

TRACK OR C-SHAPE
ATTACH WITH NO. 8 SCREWS
(MINIMUM DEPTH = HEADER
DEPTH MINUS ½ INCH)

2 NO. 8 SCREWS AT
24″ ON CENTER,
ONE PER FLANGE

KING STUD(S)

TRACK

JACK STUD(S)

CRIPPLE STUD

TRACK

NO. 8 SCREWS THROUGH
SHEATHING TO EACH
JACK AND KING STUD
AT 12″ ON CENTER

STRUCTURAL SHEATHING

For SI: 1 inch = 25.4 mm.
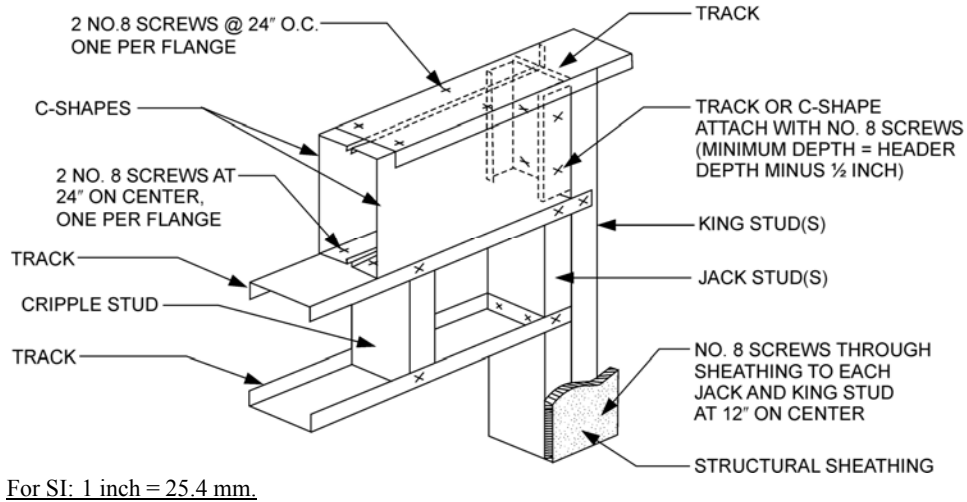
FIGURE 603.6(1)
BOX BEAM HEADER

2 NO. 8 SCREWS
AT 24″ ON CENTER
(2 SCREWS THROUGH
TOP FLANGES AND
2 SCREWS THROUGH
BOTTOM FLANGES)

TRACK

2″ x 2″ CLIP ANGLE ATTACHED
WITH NO. 8 SCREWS,
MINIMUM LENGTH = WEB DEPTH
MINUS ½ INCH

BACK-TO-BACK
C-SHAPES

2 NO. 8 SCREWS
AT 24″ ON CENTER

TRACK

CRIPPLE STUD

JACK STUDS (AS REQUIRED)

KING STUDS (AS REQUIRED)

TRACK

STRUCTURAL SHEATHING

NO. 8 SCREWS THROUGH
SHEATHING TO EACH JACK
& KING STUD AT 12″ ON CENTER

For SI: 1 inch = 25.4 mm.

FIGURE 603.6(2)
BACK-TO-BACK HEADER

TABLE 603.6(1)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only [a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf) Building width [c] (feet)					GROUND SNOW LOAD (30 psf) Building width [c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-33	3′-3″	2′-8″	2′-2″	—	—	2′-8″	2′-2″	—	—	—
2-350S162-43	4′-2″	3′-9″	3′-4″	2′-11″	2′-7″	3′-9″	3′-4″	2′-11″	2′-7″	2′-2″
2-350S162-54	6′-2″	5′-10″	5′-8″	5′-3″	4′-10″	5′-11″	5′-8″	5′-2″	4′-10″	4′-6″
2-350S162-68	6′-7″	6′-3″	6′-0″	5′-10″	5′-8″	6′-4″	6′-1″	5′-10″	5′-8″	5′-6″
2-550S162-33	4′-8″	4′-0″	3′-6″	3′-0″	2′-6″	4′-1″	3′-6″	3′-0″	2′-6″	—
2-550S162-43	6′-0″	5′-4″	4′-10″	4′-4″	3′-11″	5′-5″	4′-10″	4′-4″	3′-10″	3′-5″
2-550S162-54	8′-9″	8′-5″	8′-1″	7′-9″	7′-3″	8′-6″	8′-1″	7′-8″	7′-2″	6′-8″
2-550S162-68	9′-5″	9′-0″	8′-8″	8′-4″	8′-1″	9′-1″	8′-8″	8′-4″	8′-1″	7′-10″
2-800S162-33	4′-5″	3′-11″	3′-5″	3′-1″	2′-10″	3′-11″	3′-6″	3′-1″	2′-9″	2′-3″
2-800S162-43	7′-3″	6′-7″	5′-11″	5′-4″	4′-10″	6′-7″	5′-11″	5′-4″	4′-9″	4′-3″
2-800S162-54	10′-10″	10′-2″	9′-7″	9′-0″	8′-5″	10′-2″	9′-7″	8′-11″	8′-4″	7′-9″
2-800S162-68	12′-8″	11′-10″	11′-2″	10′-7″	10′-1″	11′-11″	11′-2″	10′-7″	10′-0″	9′-6″
2-1000S162-43	7′-10″	6′-10″	6′-1″	5′-6″	5′-0″	6′-11″	6′-1″	5′-5″	4′-11″	4′-6″
2-1000S162-54	12′-3″	11′-5″	10′-9″	10′-2″	9′-6″	11′-6″	10′-9″	10′-1″	9′-5″	8′-9″
2-1000S162-68	14′-5″	13′-5″	12′-8″	12′-0″	11′-6″	13′-6″	12′-8″	12′-0″	11′-5″	10′-10″
2-1200S162-54	12′-11″	11′-3″	10′-0″	9′-0″	8′-2″	11′-5″	10′-0″	9′-0″	8′-1″	7′-4″
2-1200S162-68	15′-11″	14′-10″	14′-0″	13′-4″	12′-8″	15′-0″	14′-0″	13′-3″	12′-7″	11′-11″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm,
   1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.
a.   Deflection criteria: L/360 for live loads, L/240 for total loads.
b.   Design load assumptions:
      Roof/ceiling dead load is 12 psf.
      Attic dead load is 10 psf.
c.   Building width is in the direction of horizontal framing members supported by the header.
d.   Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.6(2)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only [a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf) Building width [c] (feet)					GROUND SNOW LOAD (70 psf) Building width [c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	2′-4″	—	—	—	—	—	—	—	—	—
2-350S162-54	4′-8″	4′-2″	3′-9″	3′-5″	3′-1″	3′-7″	3′-2″	2′-9″	2′-5″	2′-0″

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width [c] (feet)					Building width [c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-68	5′-7″	5′-2″	4′-9″	4′-4″	3′-11″	4′-7″	4′-1″	3′-7″	3′-2″	2′-10″
2-550S162-33	2′-2″	—	—	—	—	—	—	—	—	—
2-550S162-43	3′-8″	3′-1″	2′-6″	—	—	2′-3″	—	—	—	—
2-550S162-54	6′-11″	6′-3″	5′-9″	5′-3″	4′-9″	5′-6″	4′-11″	4′-5″	3′-11″	3′-5″
2-550S162-68	8′-0″	7′-6″	6′-11″	6′-5″	5′-11″	6′-9″	6′-1″	5′-6″	5′-0″	4′-7″
2-800S162-33	2′-7″	—	—	—	—	—	—	—	—	—
2-800S162-43	4′-6″	3′-9″	3′-1″	2′-5″	—	2′-10″	—	—	—	—
2-800S162-54	8′-0″	7′-3″	6′-8″	6′-1″	5′-7″	6′-5″	5′-9″	5′-1″	4′-7″	4′-0″
2-800S162-68	9′-9″	9′-0″	8′-3″	7′-8″	7′-1″	8′-0″	7′-3″	6′-7″	6′-0″	5′-6″
2-1000S162-43	4′-8″	4′-1″	3′-6″	2′-9″	—	3′-3″	2′-2″	—	—	—
2-1000S162-54	9′-1″	8′-2″	7′-3″	6′-7″	6′-0″	7′-0″	6′-2″	5′-6″	5′-0″	4′-6″
2-1000S162-68	11′-1″	10′-2″	9′-5″	8′-8″	8′-1″	9′-1″	8′-3″	7′-6″	6′-10″	6′-3″
2-1200S162-54	7′-8″	6′-9″	6′-1″	5′-6″	5′-0″	5′-10″	5′-1″	4′-7″	4′-1″	3′-9″
2-1200S162-68	12′-3″	11′-3″	10′-4″	9′-7″	8′-11″	10′-1″	9′-1″	8′-3″	7′-6″	6′-10″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm,
　　1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.
a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.
b. Design load assumptions:
　　Roof/ceiling dead load is 12 psf.
　　Attic dead load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.6(3)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling [a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width [c] (feet)					Building width [c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	2′-2″	—	—	—	—	2′-1″	—	—	—	—
2-350S162-54	4′-4″	3′-10″	3′-5″	3′-1″	2′-9″	4′-3″	2′-9″	3′-4″	3′-0″	2′-8″
2-350S162-68	5′-0″	4′-9″	4′-7″	4′-2″	3′-9″	4′-11″	4′-8″	4′-6″	4′-1″	3′-9″
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3′-5″	2′-9″	2′-1″	—	—	3′-3″	2′-7″	—	—	—
2-550S162-54	6′-6″	5′-10″	5′-3″	4′-9″	4′-4″	6′-4″	5′-9″	5′-2″	4′-8″	4′-3″
2-550S162-68	7′-2″	6′-10″	6′-5″	5′-11″	5′-6″	7′-0″	6′-9″	6′-4″	5′-10″	5′-4″

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf) Building width[c] (feet)					GROUND SNOW LOAD (30 psf) Building width[c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-800S162-33	2′-1″	—	—	—	—	—	—	—	—	—
2-800S162-43	4′-2″	3′-4″	2′-7″	—	—	4′-0″	3′-3″	2′-5″	—	—
2-800S162-54	7′-6″	6′-9″	6′-2″	5′-7″	5′-0″	7′-5″	6′-8″	6′-0″	5′-5″	4′-11″
2-800S162-68	9′-3″	8′-5″	7′-8″	7′-1″	6′-6″	9′-1″	8′-3″	7′-7″	7′-0″	6′-5″
2-1000S162-43	4′-4″	3′-9″	2′-11″	—	—	4′-3″	3′-8″	2′-9″	—	—
2-1000S162-54	8′-6″	7′-6″	6′-8″	6′-0″	5′-5″	8′-4″	7′-4″	6′-6″	5′-10″	5′-4″
2-1000S162-68	10′-6″	9′-7″	8′-9″	8′-0″	7′-5″	10′-4″	9′-5″	8′-7″	7′-11″	7′-3″
2-1200S162-54	7′-1″	6′-2″	5′-6″	5′-0″	4′-6″	6′-11″	6′-1″	5′-5″	4′-10″	4′-5″
2-1200S162-68	11′-7″	10′-7″	9′-8″	8′-11″	8′-2″	11′-5″	10′-5″	9′-6″	8′-9″	8′-0″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa,
1 pound per square inch = 6.895 kPa.

a.   Deflection criteria: L/360 for live loads, L/240 for total loads.
b.   Design load assumptions:
Second-floor dead load is 10 psf.
Roof/ceiling dead load is 12 psf.
Second-floor live load is 30 psf.
Attic dead load is 10 psf.
c.   Building width is in the direction of horizontal framing members supported by the header.
d.   Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.6(4)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling [a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf) Building width[c] (feet)					GROUND SNOW LOAD (70 psf) Building width[c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	3′-5″	3′-0″	2′-7″	2′-2″	—	2′-8″	2′-2″	—	—	—
2-350S162-68	4′-6″	4′-1″	3′-8″	3′-3″	2′-11″	3′-9″	3′-3″	2′-10″	2′-5″	2′-1″
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2′-0″	—	—	—	—	—	—	—	—	—
2-550S162-54	5′-3″	3′-8″	4′-1″	3′-8″	3′-2″	4′-3″	3′-8″	3′-1″	2′-7″	2′-0″
2-550S162-68	6′-5″	5′-10″	5′-3″	4′-9″	4′-4″	5′-5″	4′-9″	4′-3″	3′-9″	3′-4″
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	2′-6″	—	—	—	—	—	—	—	—	—
2-800S162-54	6′-1″	5′-5″	4′-10″	4′-3″	3′-9″	4′-11″	4′-3″	3′-8″	3′-0″	2′-5″

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-800S162-68	7′-8″	6′-11″	6′-3″	5′-9″	5′-2″	6′-5″	5′-9″	5′-1″	4′-6″	4′-0″
2-1000S162-43	2′-10″	—	—	—	—	—	—	—	—	—
2-1000S162-54	6′-7″	5′-10″	5′-3″	4′-9″	4′-3″	5′-4″	4′-9″	4′-1″	3′-5″	2′-9″
2-1000S162-68	8′-8″	7′-10″	7′-2″	6′-6″	5′-11″	7′-4″	6′-6″	5′-9″	5′-1″	4′-6″
2-1200S162-54	5′-6″	4′-10″	4′-4″	3′-11″	3′-7″	4′-5″	3′-11″	3′-6″	3′-2″	2′-11″
2-1200S162-68	9′-7″	8′-8″	7′-11″	7′-2″	6′-6″	8′-1″	7′-2″	6′-4″	5′-8″	5′-0″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm,
   1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: L/360 for live loads, L/240 for total loads.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Roof/ceiling dead load is 12 psf.
   Second-floor live load is 30 psf.
   Attic dead load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE 603.6(5)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling [a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	2′-5″	—	—	—	—	2′-4″	—	—	—	—
2-350S162-68	3′-6″	3′-0″	2′-6″	2′-1″	—	3′-5″	2′-11″	2′-6″	2′-0″	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	3′-11″	3′-3″	2′-8″	2′-0″	—	3′-10″	3′-3″	2′-7″	—	—
2-550S162-68	5′-1″	4′-5″	3′-10″	3′-3″	2′-9″	5′-0″	4′-4″	3′-9″	3′-3″	2′-9″
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	4′-7″	3′-10″	3′-1″	2′-5″	—	4′-6″	3′-9″	3′-0″	2′-4″	—
2-800S162-68	6′-0″	5′-3″	4′-7″	3′-11″	3′-4″	6′-0″	5′-2″	4′-6″	3′-11″	3′-3″
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	5′-0″	4′-4″	3′-6″	2′-9″	—	4′-11″	4′-3″	3′-5″	2′-7″	—
2-1000S162-68	6′-10″	6′-0″	5′-3″	4′-6″	3′-10″	6′-9″	5′-11″	5′-2″	4′-5″	3′-9″

| MEMBER DESIGNATION | GROUND SNOW LOAD (20 psf) | | | | | GROUND SNOW LOAD (30 psf) | | | | |
| | Building width[c] (feet) | | | | | Building width[c] (feet) | | | | |
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-1200S162-54	4′-2″	3′-7″	3′-3″	2′-11″	—	4′-1″	3′-7″	3′-2″	2′-10″	—
2-1200S162-68	7′-7″	6′-7″	5′-9″	5′-0″	4′-2″	7′-6″	6′-6″	5′-8″	4′-10″	4′-1″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm,
 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.
b. Design load assumptions:
 Second-floor dead load is 10 psf.
 Roof/ceiling dead load is 12 psf.
 Second-floor live load is 40 psf
 Third-floor live load is 30 psf.
 Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel
 shall be used for 54 and 68 mil thicknesses.

TABLE 603.6(6)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling [a, b, d]

| MEMBER DESIGNATION | GROUND SNOW LOAD (50 psf) | | | | | GROUND SNOW LOAD (70 psf) | | | | |
| | Building width[c] (feet) | | | | | Building width[c] (feet) | | | | |
	24	**28**	**32**	**36**	**40**	**24**	**28**	**32**	**36**	**40**
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	2′-2″	—	—	—	—	—	—	—	—	—
2-350S162-68	3′-3″	2′-9″	2′-3″	—	—	2′-11″	2′-5″	—	—	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	3′-7″	2′-11″	2′-3″	—	—	3′-3″	2′-7″	—	—	—
2-550S162-68	4′-9″	2′-1″	3′-6″	3′-0″	2′-5″	4′-4″	3′-9″	3′-2″	2′-8″	2′-1″
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	4′-3″	3′-5″	2′-8″	—	—	3′-9″	3′-0″	2′-3″	—	—
2-800S162-68	5′-8″	4′-11″	4′-2″	3′-7″	2′-11″	5′-3″	4′-6″	3′-10″	3′-3″	2′-7″
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	4′-8″	3′-11″	3′-1″	2′-2″	—	4′-3″	3′-5″	2′-7″	—	—
2-1000S162-68	6′-5″	5′-7″	4′-9″	4′-1″	3′-4″	5′-11″	5′-1″	4′-5″	3′-8″	2′-11″
2-1200S162-54	3′-11″	3′-5″	3′-0″	2′-4″	—	3′-7″	3′-2″	2′-10″	—	—
2-1200S162-68	7′-1″	6′-2″	5′-3″	4′-6″	3′-8″	6′-6″	5′-8″	4′-10″	4′-0″	3′-3″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm,
 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: L/360 for live loads, L/240 for total loads.
b. Design load assumptions:
   Second-floor dead load is 10 psf.
   Roof/ceiling dead load is 12 psf.
   Second-floor live load is 40 psf
   Third-floor live load is 30 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

603.6.1 Headers in gable endwalls. Box beam and back-to-back headers in gable endwalls shall be permitted to be constructed in accordance with Section 603.6 or with the header directly above the opening in accordance with Figures 603.6.1(1) and 603.6.1(2) and the following provisions:
   1. Two 362S162-33 for openings less than or equal to 4 feet (1219 mm).
   2. Two 600S162-43 for openings greater than 4 feet (1219 mm) but less than or equal to 6 feet (1829 mm).
   3. Two 800S162-54 for openings greater than 6 feet (1829 mm) but less than or equal to 9 feet (2743 mm).
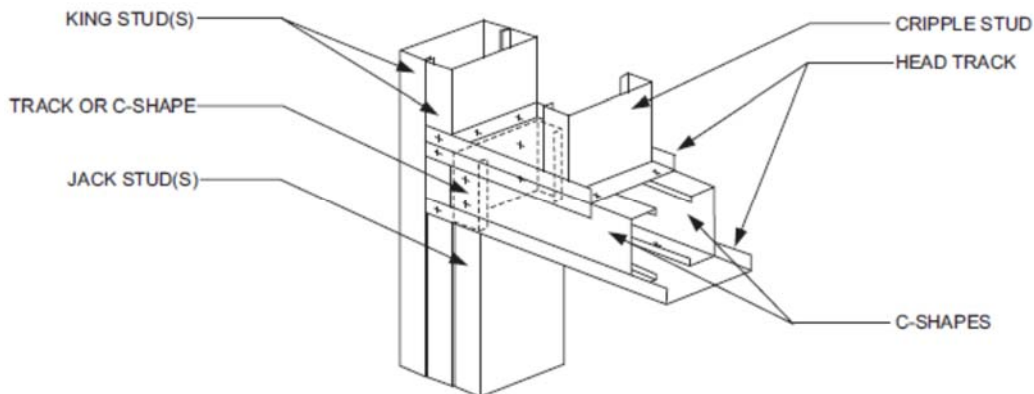
FIGURE 603.6.1(1)
BOX BEAM HEADER IN GABLE ENDWALL
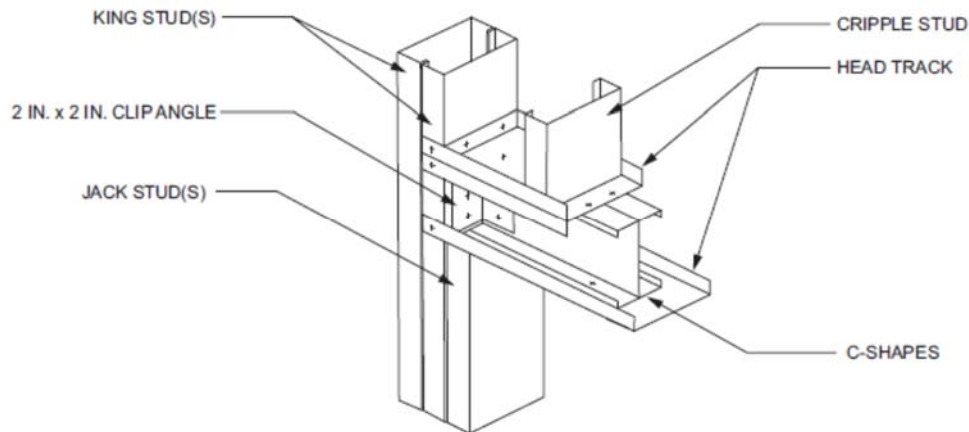
For SI: 1 inch = 25.4 mm.

FIGURE 603.6.1(2)
BACK-TO-BACK HEADER IN GABLE ENDWALL

603.7 Jack and king studs. The number of jack and king studs installed on each side of a header shall comply with Table 603.7(1). King, jack and cripple studs shall be of the same dimension and thickness as the adjacent wall studs. Headers shall be connected to king studs in accordance with Table 603.7(2) and the following provisions:

1. For box beam headers, one-half of the total number of required screws shall be applied to the header and one-half to the king stud by use of C-shaped or track member in accordance with Figure 603.6(1). The track or C-shaped sections shall extend the depth of the header minus $^1/_2$ -inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs.

2. For back-to-back headers, one-half the total number of screws shall be applied to the header and one-half to the king stud by use of a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle in accordance with Figure 603.6(2). The clip angle shall extend the depth of the header minus $^1/_2$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs. Jack and king studs shall be interconnected with structural sheathing in accordance with Figures 603.6(1) and 603.6(2).

TABLE 603.7(1)
TOTAL NUMBER OF JACK AND KING STUDS
REQUIRED AT EACH END OF AN OPENING

SIZE OF OPENING (feet-inches)	24-INCH O.C. STUD SPACING		16-INCH O.C. STUD SPACING	
	No. of jack studs	No. of king studs	No. of jack studs	No. of king studs
Up to 3′-6″	1	1	1	1
> 3′-6″ to 5′-0″	1	2	1	2
> 5′-0″ to 5′-6″	1	2	2	2
> 5′-6″ to 8′-0″	1	2	2	2
> 8′-0″ to 10′-6″	2	2	2	3
> 10′-6″ to 12′-0″	2	2	3	3
> 12′-0″ to 13′-0″	2	3	3	3
> 13′-0″ to 14′-0″	2	3	3	4
> 14′-0″ to 16′-0″	2	3	3	4
> 16′-0″ to 18′-0″	3	3	4	4

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

TABLE 603.7(2)
HEADER TO KING STUD CONNECTION REQUIREMENTS [a, b, c, d]

HEADER SPAN (feet)	ULTIMATE WIND SPEED (mph), EXPOSURE CATEGORY					
	115 B	120 B	130 B / 115 C	≤140 B / 120 C	130 C	≤140 C
≤ 4	4-No. 8 screws	4-No. 8 screws	4-No. 8 screws	4-No. 8 screws	6-No. 8 screws	6-No. 8 screws
> 4 to 8	4-No. 8 screws	4-No. 8 screws	4-No. 8 screws	6-No. 8 screws	8-No. 8 screws	8-No. 8 screws
> 8 to 12	4-No. 8 screws	6-No. 8 screws	6-No. 8 screws	8-No. 8 screws	10-No. 8 screws	12-No. 8 screws
> 12 to 16	4-No. 8 screws	6-No. 8 screws	8-No. 8 screws	10-No. 8 screws	12-No. 8 screws	14-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 4.448 N.

a. All screw sizes shown are minimum.
b. For headers located on the first floor of a two-story building or the first or second floor of a three-story building, the total number of screws is permitted to be reduced by 2 screws, but the total number of screws shall be not less than four.
c. For roof slopes of 6:12 or greater, the required number of screws shall be permitted to be reduced by half, but the total number of screws shall be not less than four.
d. Screws can be replaced by an uplift connector that has a capacity of the number of screws multiplied by 164 pounds.

603.8 Head and sill track. Head track spans above door and window openings and sill track spans beneath window openings shall comply with Table 603.8. For openings less than 4 feet (1219 mm) in height that have both a head track and a sill track, multiplying the spans by 1.75 shall be permitted in Table 603.8. For openings less than or equal to 6 feet (1829 mm) in height that have both a head track and a sill track, multiplying the spans in Table 603.8 by 1.50 shall be permitted.
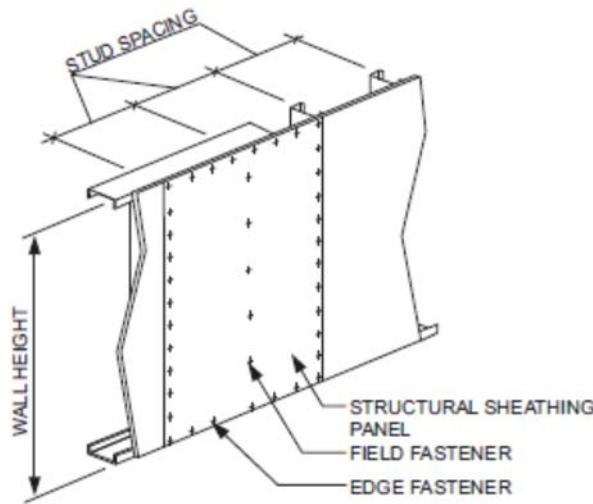
603.9 Structural sheathing. Structural sheathing shall be installed in accordance with Figure 603.9 and this section on all sheathable exterior wall surfaces, including areas above and below openings.

TABLE 603.8
HEAD AND SILL TRACK SPAN

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		ALLOWABLE HEAD AND SILL TRACK SPAN [a, b, c] (feet-inches)					
		TRACK DESIGNATION [d]					
B	**C**	**350T125-33**	**350T125-43**	**350T125-54**	**550T125-33**	**550T125-43**	**550T125-54**
115	—	5′-9″	6′-9″	9′-3″	7′-3″	9′-1″	12′-5″
120	—	5′-6″	6′-6″	8′-11″	7′-0″	8′-9″	11′-11″
130	115	4′-10″	5′-9″	7′-10″	6′-2″	7′-8″	10′-6″
≤ 140	120	4′-8″	5′-6″	7′-6″	5′-11″	7′-4″	10′-1″
—	130	4′-3″	5′-1″	6′-11″	5′-6″	6′-9″	9′-4″
—	≤ 140	4′-0″	4′-9″	6′-5″	5′-1″	6′-4″	8′-8″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection limit: L/240.

b. Head and sill track spans are based on components and cladding wind pressures and 48-inch tributary span.

c. For openings less than 4 feet in height that have both a head track and sill track, the spans are permitted to be multiplied by 1.75. For openings less than or   equal to 6 feet in height that have both a head track and a sill track, the spans are permitted to be multiplied by a factor of 1.5.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

FIGURE 603.9
STRUCTURAL SHEATHING FASTENING PATTERN

603.9.1 Sheathing materials. Structural sheathing panels shall consist of minimum $^7/_{16}$-inch-thick (11 mm) oriented strand board or $^{15}/_{32}$-inch-thick (12 mm) plywood.

603.9.2 Determination of minimum length of full-height sheathing. The minimum length of full-height sheathing on each braced wall line shall be determined by multiplying the length of the braced wall line by the percentage obtained from Table 603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table 603.9.2(2). The minimum length of full-height sheathing shall be not less than 20 percent of the braced wall line length.

To be considered full-height sheathing, structural sheathing shall extend from the bottom to the top of the wall without interruption by openings. Only sheathed, full- height wall sections, uninterrupted by openings, which are not less than 48 inches (1219 mm) wide, shall be counted toward meeting the minimum percentages in Table 603.9.2(1). In addition, structural sheathing shall comply with all of the following requirements:

1. Be installed with the long dimension parallel to the stud framing and shall cover the full vertical height of wall from the bottom of the bottom track to the top of the top track of each story. Installing the long dimension perpendicular to the stud framing or using shorter segments shall be permitted provided that the horizontal joint is blocked as described in Item 2.

2. Be blocked where the long dimension is installed perpendicular to the stud framing. Blocking shall be not less than 33 mil (0.84 mm) thickness. Each horizontal structural sheathing panel shall be fastened with No. 8 screws spaced at 6 inches (152 mm) on center to the blocking at the joint.

3. Be applied to each end (corners) of each of the exterior walls with a minimum 48-inch-wide (1219 mm) panel.

Exception: Where stone or masonry veneer is installed, the required length of full-height sheathing and over-turning anchorage required shall be determined in accordance with Section 603.9.5.

TABLE 603.9.2(1)
MINIMUM PERCENTAGE OF FULL-HEIGHT
STRUCTURAL SHEATHING ON EXTERIOR WALLS [a, b]

WALL SUPPORTING	ROOF SLOPE	ULTIMATE WIND SPEED AND EXPOSURE (mph)					
		115 B	120 B	130 B 115 C	≤ 140 120 C	≤ 130 C	≤ 140 C
Roof and ceiling only (one story or top floor of two- or three-story building)	3:12	9	11	11	13	17	20
	6:12	13	15	17	22	28	35
	9:12	23	27	29	33	53	59
	12:12	32	39	40	44	70	76

WALL SUPPORTING	ROOF SLOPE	ULTIMATE WIND SPEED AND EXPOSURE (mph)					
		115 B	120 B	130 B 115 C	≤ 140 120 C	≤ 130 C	≤ 140 C
One story, roof and ceiling (first floor of a two-story building or second floor of a three-story building)	3:12	26	32	34	39	53	67
	6:12	27	33	34	44	61	75
	9:12	38	45	46	61	78	92
	12:12	43	53	57	72	106	116
Two stories, roof and ceiling (first floor of a three-story building)	3:12	43	53	57	64	89	113
	6:12	41	51	51	67	95	114
	9:12	53	63	63	89	104	126
	12:12	54	67	74	100	142	157

For SI: 1 mph = 0.447 m/s.

a. Linear interpolation is permitted.

b. For hip-roofed homes the minimum percentage of full-height sheathing, based on wind, is permitted to be multiplied by a factor of 0.95 for roof slopes not   exceeding 7:12 and a factor of 0.9 for roof slopes greater than 7:12.

TABLE 603.9.2(2)
FULL-HEIGHT SHEATHING LENGTH ADJUSTMENT FACTORS

PLAN ASPECT RATIO	LENGTH ADJUSTMENT FACTORS	
	Short wall	Long wall
1:1	1.0	1.0
1.5:1	1.5	0.67
2:1	2.0	0.50
3:1	3.0	0.33
4:1	4.0	0.25

603.9.2.1 Full height sheathing. The minimum percentage of full-height structural sheathing shall be multiplied by 1.10 for 9-foot-high (2743 mm) walls and multiplied by 1.20 for 10-foot-high (3048 mm) walls.

603.9.2.2 Full-height sheathing in lowest story. In the lowest story of a dwelling, multiplying the percentage of full-height sheathing required in Table 603.9.2(1) by 0.6 shall be permitted where hold-down anchors are provided in accordance with Section 603.9.4.2.

603.9.3 Structural sheathing fastening. Edges and interior areas of structural sheathing panels shall be fastened to framing members and tracks in accordance with Figure 603.9 and Table 603.3.2(1). Screws for attachment of structural sheathing panels shall be bugle-head, flat-head, or similar head style with a minimum head diameter of 0.29 inch (8 mm).

For continuously sheathed braced wall lines using wood structural panels

installed with No. 8 screws spaced 4 inches (102 mm) on center at all panel edges and 12inches (304.8 mm) on center on intermediate framing members, the following shall apply:

1. Multiplying the percentages of full-height sheathing in Table 603.9.2(1) by 0.72 shall be permitted.
2. For bottom track attached to foundations or framing below, the bottom track anchor or screw connection spacing in Tables 505.3.1(1) and 603.3.1 shall be multiplied by two-thirds

603.9.4 Uplift connection requirements. Uplift connections shall be provided in accordance with this section.

603.9.4.1 Ultimate design wind speeds greater than 130 mph. Where ultimate design wind speeds exceed 130 miles per hour (58 m/s), Exposure Category C walls shall be provided with direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F8.2, as required for 140 miles per hour (63 m/s), Exposure Category C.

603.9.4.2 Hold-down anchor. Where the percentage of full-height sheathing is adjusted in accordance with Section 603.9.2.2, a hold-down anchor, with a strength of 4,300 pounds (19 kN), shall be provided at each end of each full-height sheathed wall section used to meet the minimum percent sheathing requirements of Section 603.9.2. Hold-down anchors shall be attached to back-to-back studs; structural sheathing panels shall have edge fastening to the studs, in accordance with Section 603.9.3 and AISI S230, Table E11-1.

A single hold-down anchor, installed in accordance with Figure 603.9.4.2, shall be permitted at the corners of buildings.
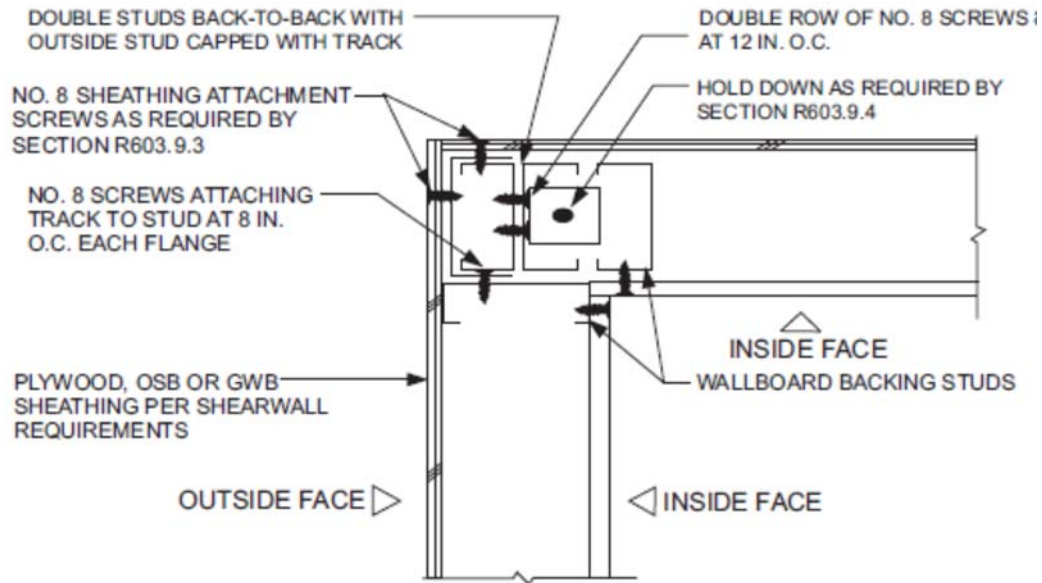
For SI: 1 inch = 25.4 mm.

FIGURE 603.9.4.2
CORNER STUD HOLD-DOWN DETAIL

603.9.5 Structural sheathing for stone and masonry veneer. Where stone and masonry veneer are installed in accordance with Section 703.8, the length of full-height sheathing for exterior and interior wall lines backing or perpendicular to and laterally supporting walls with veneer shall comply with this section.

603.9.5.1 Seismic Design Category C. In Seismic Design Category C, the length of structural sheathing for walls supporting one story, roof and ceiling shall be the greater of the amounts required by Section 603.9.2, except Section 603.9.2.2 shall be permitted.

603.9.5.2 Seismic Design Categories D$_0$, D$_1$ and D$_2$. *Deleted*

TABLE 603.9.5(1)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING
Delete Table

TABLE 603.9.5(2)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING
Delete Table

TABLE 603.9.5(3)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING
Delete Table

TABLE 603.9.5(4)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING
Delete Table

SECTION 604
WOOD STRUCTURAL PANELS

604.1 Identification and grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2 or ANSI/APA PRP 210, CSA O325 or CSA O437. Panels shall be identified by a grade mark or certificate of inspection issued by an approved agency.

604.2 Allowable spans. The maximum allowable spans for wood structural panel wall sheathing shall not exceed the values set forth in Table 602.3(3).

604.3 Installation. Wood structural panel wall sheathing shall be attached to framing in accordance with Table 602.3(1) or 602.3(3).

SECTION 605
PARTICLEBOARD

605.1 Identification and grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency. Particleboard shall comply with the grades specified in Table 602.3(4).

SECTION 606
GENERAL MASONRY CONSTRUCTION

606.1 General.   Masonry construction shall be designed and constructed in accordance with the provisions of this section, TMS 402, TMS 403, or TMS 404.

606.1.1 Professional registration not required. Where the empirical design provisions of Appendix A of TMS 402, the provisions of TMS 403, or the provisions of this section are used to design masonry, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

606.2 Masonry construction materials.

606.2.1 Concrete masonry units. Concrete masonry units shall conform to the following standards: ASTM C55 for concrete brick; ASTM C73 for calcium silicate face brick; ASTM C90 for load-bearing concrete masonry units; ASTM C744 for prefaced concrete and calcium silicate masonry units; or ASTM C1634 for concrete facing brick.

606.2.2 Clay or shale masonry units. Clay or shale masonry units shall conform to the following standards: ASTM C34 for structural clay load-bearing wall tile; ASTM C56 for structural clay nonload-bearing wall tile; ASTM C62 for building brick (solid masonry units made from clay or shale); ASTM C126 for ceramic-glazed structural clay facing tile, facing brick and solid masonry units; ASTM C212 for structural clay facing tile; ASTM C216 for facing brick (solid masonry units made from clay or shale); ASTM C652 for hollow brick (hollow masonry units made from clay or shale); ASTM C1088 for solid units of thin veneer brick; or ASTM C1405 for glazed brick (single-fired solid brick units).
> **Exception:** Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Section 302.

606.2.3 AAC masonry. AAC masonry units shall conform to ASTM C1691 and ASTM C1693 for the strength class specified.

606.2.4 Stone masonry units. Stone masonry units shall conform to the following standards: ASTM C503 for marble building stone (exterior); ASTM C568 for limestone building stone; ASTM C615 for granite building stone; ASTM C616 for sandstone building stone; or ASTM C629 for slate building

stone.

606.2.5 Architectural cast stone. Architectural cast stone shall conform to ASTM C1364.

606.2.6 Adhered manufactured stone masonry veneer units. Adhered manufactured stone masonry veneer units shall conform to ASTM C1670.

606.2.7 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

606.2.8 Mortar. Except for mortars listed in Sections 606.2.9, 606.2.10 and 606.2.11, mortar for use in masonry construction shall meet the proportion specifications of Table 606.2.8 or the property specifications of ASTM C270. The type of mortar shall be in accordance with Sections 606.2.8.1, 606.2.8.2 and 606.2.8.3.

606.2.8.1 Foundation walls. Mortar for masonry foundation walls constructed as set forth in Tables 404.1.1(1) through 404.1.1(4) shall be Type M or S mortar.

606.2.8.2 Masonry in Seismic Design Categories A, B and C. Mortar for masonry serving as the lateral force-resisting system in Seismic Design Categories A, B and C shall be Type M, S or N mortar.

TABLE 606.2.8
MORTAR PROPORTIONS [a, b]

MORTAR	TYPE	PROPORTIONS BY VOLUME (cementitious materials)								Aggregate ratio (measured in damp, loose conditions)
		Portland cement or blended cement	Mortar cement			Masonry cement			Hydrated lime [c] or lime putty	
			M	S	N	M	S	N		
Cement-lime	M	1	—	—	—	—	—	—	$1/4$	Not less than $2^{1}/_4$ and not more than 3 times the sum of separate volumes of lime, if used, and cement
	S	1	—	—	—	—	—	—	over $^1/_4$ to $^1/_2$	
	N	1	—	—	—	—	—	—	over $^1/_2$ to $1^1/_4$	
	O	1	—	—	—	—	—	—	over $1^1/_4$ to	
Mortar cement	M	1	—	—	1	—	—	—	—	
	M	—	1	—	—	—	—	—		
	S	$^1/_2$	—	—	1	—	—	—		
	S	—	—	1	—	—	—	—		
	N	—	—	—	1	—	—	—		
	O	—	—	—	1	—	—	—		

Masonry cement	M	$\frac{1}{}$	=	=	=	$\frac{}{1}$	=	$\frac{1}{1}$	=
	M	$\frac{}{1/2}$	=	=	=		=	$\frac{}{1}$	
	S	—	=	=	=		$\frac{}{1}$	$\frac{}{1}$	
	S	—	=	=	=		$\frac{}{1}$	$\frac{}{1}$	
	N	—	=	=	=			$\frac{}{1}$	
	O	—	=	=	=			$\frac{}{1}$	

For SI: 1 cubic foot = 0.0283 m^3, 1 pound = 0.454 kg.

a. For the purpose of these specifications, the weight of 1 cubic foot of the respective materials shall be considered to be as follows:

Portland cement	94 pounds	**Masonry cement**	Weight printed on bag
Mortar cement	Weight printed on bag	**Hydrated lime**	40 pounds
Lime putty (Quicklime)	80 pounds	**Sand, damp and loose**	80 pounds of dry sand

b. Two air-entraining materials shall not be combined in mortar.

c. Hydrated lime conforming to the requirements of ASTM C207.

606.2.8.3 Masonry in Seismic Design Categories D$_0$, D$_1$ and D$_2$. *Deleted*

606.2.9 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

606.2.10 Mortar for AAC masonry. Thin-bed mortar for AAC masonry shall comply with Article 2.1 C.1 of TMS 602. Mortar used for the leveling courses of AAC masonry shall comply with Article 2.1 C.2 of TMS 602.

606.2.11 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to ASTM C270 Type S or Type N or shall comply with ANSI A118.4 for latex-modified Portland cement mortar.

606.2.12 Grout. Grout shall consist of cementitious material and aggregate in accordance with ASTM C476 or the proportion specifications of Table 606.2.12. Type M or Type S mortar to which sufficient water has been added to produce pouring consistency shall be permitted to be used as grout.

TABLE 606.2.12
GROUT PROPORTIONS BY
VOLUME FOR MASONRY CONSTRUCTION

TYPE	PORTLAND CEMENT OR BLENDED CEMENT SLAG	HYDRATED LIME OR LIME PUTTY	AGGREGATE MEASURED IN A DAMP, LOOSE CONDITION	
			Fine	**Coarse**
Fine	1	0 to 1/10	2$^1/_4$ to 3 times the sum of the volume of the cementitious materials	—

Coarse	1	0 to 1/10	$2^{1}/_{4}$ to 3 times the sum of the volume of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

606.2.13 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602.

606.3 Construction requirements.

606.3.1 Bed and head joints. Unless otherwise required or indicated on the project drawings, head and bed joints shall be $^{3}/_{8}$ -inch (9.5 mm) thick, except that the thickness of the bed joint of the starting course placed over foundations shall be not less than $^{1}/_{4}$ -inch (6.4 mm) and not more than $^{3}/_{4}$ -inch (19.1 mm). Mortar joint thickness for load- bearing masonry shall be within the following tolerances from the specified dimensions:
1. Bed joint: + $^{1}/_{8}$ -inch (3.2 mm).
2. Head joint: - $^{1}/_{4}$ -inch (6.4 mm), + $^{3}/_{8}$ -inch (9.5 mm).
3. Collar joints: - $^{1}/_{4}$ -inch (6.4 mm), + $^{3}/_{8}$ -inch (9.5 mm).

606.3.2 Masonry unit placement. The mortar shall be sufficiently plastic and units shall be placed with sufficient pressure to extrude mortar from the joint and produce a tight joint. Deep furrowing of bed joints that produces voids shall not be permitted. Any units disturbed to the extent that initial bond is broken after initial placement shall be removed and re-laid in fresh mortar. Surfaces to be in contact with mortar shall be clean and free of deleterious materials.

606.3.2.1 Solid masonry. Solid masonry units shall be laid with full head and bed joints and all interior vertical joints that are designed to receive mortar shall be filled.

606.3.2.2 Hollow masonry. For hollow masonry units, head and bed joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell.

606.3.3 Installation of wall ties. The installation of wall ties shall be as follows:
1. The ends of wall ties shall be embedded in mortar joints. Wall ties shall have not less than $^{5}/_{8}$ -inch (15.9 mm) mortar coverage from the exposed face.
2. Wall ties shall not be bent after being embedded in grout or mortar.
3. For solid masonry units, solid grouted hollow units, or hollow units in anchored masonry veneer, wall ties shall be embedded in mortar bed not

less than 1 $^1/_2$ -inches (38 mm).

4. For hollow masonry units in other than anchored masonry veneer, wall ties shall engage outer face shells by not less than $^1/_2$ -inch (13 mm).

606.3.4 Protection for reinforcement. Bars shall be completely embedded in mortar or grout. Joint reinforcement embedded in horizontal mortar joints shall not have less than $^5/_8$ -inch (15.9 mm) mortar coverage from the exposed face. Other reinforcement shall have a minimum coverage of one bar diameter over all bars, but not less than $^3/_4$ -inch (19 mm), except where exposed to weather or soil, in which case the minimum coverage shall be 2 inches (51 mm).

606.3.4.1 Corrosion protection. Minimum corrosion protection of joint reinforcement, anchor ties and wire fabric for use in masonry wall construction shall con- form to Table 606.3.4.1.

TABLE 606.3.4.1
MINIMUM CORROSION PROTECTION

MASONRY METAL ACCESSORY	STANDARD
Joint reinforcement, interior walls	ASTM A641, Class 1
Wire ties or anchors in exterior walls completely embedded in mortar or grout	ASTM A641, Class 3
Wire ties or anchors in exterior walls not completely embedded in mortar or grout	ASTM A153, Class B-2
Joint reinforcement in exterior walls or interior walls exposed to moist environment	ASTM A153, Class B-2
Sheet metal ties or anchors exposed to weather	ASTM A153, Class B-2
Sheet metal ties or anchors completely embedded in mortar or grout	ASTM A653, Coating Designation G60
Stainless steel hardware for any exposure	ASTM A167, Type 304

606.3.5 Grouting requirements.

606.3.5.1 Grout placement. Grout shall be a plastic mix suitable for pumping without segregation of the constituents and shall be mixed thoroughly. Grout shall be placed by pumping or by an approved alternate method and shall be placed before any initial set occurs and not more than $1^1/_2$ hours after water has been added. Grout shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Grout shall not be pumped through aluminum pipes.

Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to Table 606.3.5.1. Grout shall

be poured in lifts with a maximum height of 8 feet (2438 mm). Where a total grout pour exceeds 8 feet (2438 mm) in height, the grout shall be placed in lifts not exceeding 64 inches (1626 mm) and special inspection during grouting shall be required. If the work is stopped for 1 hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation and with the grout 1 inch (25 mm) below the top.

TABLE 606.3.5.1
GROUT SPACE DIMENSIONS AND POUR HEIGHTS

GROUT TYPE	GROUT POUR MAXIMUM HEIGHT (feet)	MINIMUM WIDTH OF GROUT SPACES [a, b] (inches)	MINIMUM GROUT [b, c] SPACE DIMENSIONS FOR GROUTING CELLS OF HOLLOW UNITS (inches x inches)
Fine	1	0.75	1.5×2
	5	2	2×3
	12	2.5	2.5×3
	24	3	3×3
Coarse	1	1.5	1.5×3
	5	2	2.5×3
	12	2.5	3×3
	24	3	3×4

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

a. For grouting between masonry wythes.

b. Grout space dimension is the clear dimension between any masonry protrusion and shall be increased by the horizontal projection of the diameters of the horizontal bars within the cross section of the grout space.

c. Area of vertical reinforcement shall not exceed 6 percent of the area of the grout space.

606.3.5.2 Cleanouts. Provisions shall be made for cleaning the space to be grouted. Mortar that projects more than $1/2$-inch (12.7 mm) into the grout space and any other foreign matter shall be removed from the grout space prior to inspection and grouting. Where required by the building official, cleanouts shall be provided in the bottom course of masonry for each grout pour where the grout pour height exceeds 64 inches (1626 mm). In solid grouted masonry, cleanouts shall be spaced horizontally not more than 32 inches (813 mm) on center. The cleanouts shall be sealed before grouting and after inspection.

606.3.5.3 Construction. Requirements for grouted masonry construction shall be as follows:
1. Masonry shall be built to preserve the unobstructed vertical continuity of the cells or spaces to be filled. In partially grouted construction, cross webs forming cells to be filled shall be full-bedded in mortar to prevent leakage of grout. Head and end

joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

2. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement.

3. Cells containing reinforcement shall be filled solidly with grout.

4. The thickness of grout or mortar between masonry units and reinforcement shall be not less than $^1/_4$ -inch (6.4 mm), except that $^1/_4$ -inch (6.4 mm) bars shall be permitted to be laid in horizontal mortar joints not less than $^1/_2$ -inch (12.7 mm) thick, and steel wire reinforcement shall be permitted to be laid in horizontal mortar joints not less than twice the thickness of the wire diameter.

606.3.6 Grouted multiple-wythe masonry. Grouted multiple-wythe masonry shall conform to all the requirements specified in Section 606.3.5 and the requirements of this section.

606.3.6.1 Bonding of backup wythe. Where all interior vertical spaces are filled with grout in multiple-wythe construction, masonry headers shall not be permitted. Metal wall ties shall be used in accordance with Section 606.13.2 to prevent spreading of the wythes and to maintain the vertical alignment of the wall. Wall ties shall be installed in accordance with Section 606.13.2 where the backup wythe in multiple-wythe construction is fully grouted.

606.3.6.2 Grout barriers. Vertical grout barriers or dams shall be built of solid masonry across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall be not more than 25 feet (7620 mm) apart. The grouting of any section of a wall between control barriers shall be completed in one day without interruptions greater than 1 hour.

606.3.7 Masonry bonding pattern. Masonry laid in running and stack bond shall conform to Sections 606.3.7.1 and 606.3.7.2.

606.3.7.1 Masonry laid in running bond. In each wythe of masonry laid in running bond, head joints in successive courses shall be offset by not less than one-fourth the unit length, or the masonry walls shall be reinforced longitudinally as required in Section 606.3.7.2.

606.3.7.2 Masonry laid in stack bond. Where unit masonry is laid with

less head joint offset than in Section 606.3.7.1, the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 inches (1219 mm) apart shall be 0.0007 times the vertical cross-sectional area of the wall.

606.4 Thickness of masonry. The nominal thickness of masonry walls shall conform to the requirements of Sections 606.4.1 through 606.4.4.

606.4.1 Minimum thickness. The minimum thickness of masonry bearing walls more than one story high shall be 8 inches (203 mm). Solid masonry walls of one-story dwellings and garages shall be not less than 6 inches (152 mm) in thickness where not greater than 9 feet (2743 mm) in height, provided that where gable construction is used, an additional 6 feet (1829 mm) is permitted to the peak of the gable. Masonry walls shall be laterally supported in either the horizontal or vertical direction at intervals as required by Section 606.6.4.

606.4.2 Rubble stone masonry wall. The minimum thickness of rough, random or coursed rubble stone masonry walls shall be 16 inches (406 mm).

606.4.3 Change in thickness. Where walls of masonry of hollow units or masonry-bonded hollow walls are decreased in thickness, a course of solid masonry or masonry units filled with mortar or grout shall be constructed between the wall below and the thinner wall above, or special units or construction shall be used to transmit the loads from face shells or wythes above to those below.

606.4.4 Parapet walls. Unreinforced solid masonry parapet walls shall be not less than 8 inches (203 mm) thick and their height shall not exceed four times their thickness. Unreinforced hollow unit masonry parapet walls shall be not less than 8 inches (203 mm) thick, and their height shall not exceed three times their thickness.

606.5 Corbeled masonry. Corbeled masonry shall be in accordance with Sections 606.5.1 through 606.5.3.

606.5.1 Units. Solid masonry units or masonry units filled with mortar or grout shall be used for corbeling.

606.5.2 Corbel projection. The maximum projection of one unit shall not exceed one-half the height of the unit or one-third the thickness at right angles

to the wall. The maximum corbeled projection beyond the face of the wall shall not exceed:
1. One-half of the wall thickness for multiple-wythe walls bonded by mortar or grout and wall ties or masonry headers.
2. One-half the wythe thickness for single wythe walls, masonry-bonded hollow walls, multiple-wythe walls with open collar joints and veneer walls.

606.5.3 Corbeled masonry supporting floor or roof framing members. Where corbeled masonry is used to support floor or roof-framing members, the top course of the corbel shall be a header course or the top course bed joint shall have ties to the vertical wall.

606.6 Support conditions. Bearing and support conditions shall be in accordance with Sections 606.6.1 through 606.6.4.

606.6.1 Bearing on support. Each masonry wythe shall be supported by not less than two-thirds of the wythe thickness.

606.6.2 Support at foundation. Cavity wall or masonry veneer construction shall be permitted to be supported on an 8-inch (203 mm) foundation wall, provided the 8-inch (203 mm) wall is corbeled to the width of the wall system above with masonry constructed of solid masonry units or masonry units filled with mortar or grout. The total horizontal projection of the corbel shall not exceed 2-inches (51 mm) with individual corbels projecting not more than one-third the thickness of the unit or one-half the height of the unit. The hollow space behind the corbeled masonry shall be filled with mortar or grout.

606.6.3 Beam supports. Beams, girders or other concentrated loads supported by a wall or column shall have a bearing of not less than 3 inches (76 mm) in length measured parallel to the beam on solid masonry not less than 4 inches (102 mm) in thickness, or on a metal bearing plate of adequate design and dimensions to distribute the load safely, or on a continuous reinforced masonry member projecting not less than 4 inches (102 mm) from the face of the wall.

606.6.3.1 Joist bearing. Joists shall have a bearing of not less than $1^{1}/_{2}$ - inches (38 mm), except as provided in Section 606.6.3, and shall be supported in accordance with Figure 606.11(1).

606.6.4 Lateral support. Masonry walls shall be laterally supported in either

the horizontal or the vertical direction. The maximum spacing between lateral supports shall not exceed the distances in Table 606.6.4. Lateral support shall be provided by cross walls, pilasters, buttresses or structural frame members where the limiting distance is taken horizontally, or by floors or roofs where the limiting distance is taken vertically.

TABLE 606.6.4
SPACING OF LATERAL SUPPORT FOR MASONRY WALLS

CONSTRUCTION	MAXIMUM WALL LENGTH TO THICKNESS OR WALL HEIGHT TO THICKNESS [a, b]
Bearing walls:	
Solid or solid grouted	20
All other	18
Nonbearing walls:	
Exterior	18
Interior	36

For SI: 1 foot = 304.8 mm.

a. Except for cavity walls and cantilevered walls, the thickness of a wall shall be its nominal thickness measured perpendicular to the face of the wall. For cavity walls, the thickness shall be determined as the sum of the nominal thicknesses of the individual wythes. For cantilever walls, except for parapets, the ratio of height to nominal thickness shall not exceed 6 for solid masonry, or 4 for hollow masonry. For parapets, see Section 606.4.4.

b. An additional unsupported height of 6 feet is permitted for gable end walls.

606.6.4.1 Horizontal lateral support. Lateral support in the horizontal direction provided by intersecting masonry walls shall be provided by one of the methods in Section 606.6.4.1.1 or 606.6.4.1.2.

606.6.4.1.1 Bonding pattern. Fifty percent of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than 3 inches (76 mm) on the unit below.

606.6.4.1.2 Metal reinforcement. Interior non-load-bearing walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement of not less than 9 gage [0.148 inch (4 mm)], or $1/4$ -inch (6 mm) galvanized mesh hardware cloth. Intersecting masonry walls, other than interior nonload-bearing walls, shall be anchored at vertical intervals of not more than 8 inches (203 mm) with joint reinforcement of not less than 9 gage (4 mm) and shall extend not less than 30 inches (762 mm) in each direction at the intersection. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent area of anchorage to that required by this section.

606.6.4.2 Vertical lateral support. Vertical lateral support of masonry walls in Seismic Design Category A, B and C shall be provided in accordance with one of the methods in Section 606.6.4.2.1 or 606.6.4.2.2.

606.6.4.2.1 Roof structures. Masonry walls shall be anchored to roof structures with metal strap anchors spaced in accordance with the manufacturer's instructions, $^1/_2$ -inch (13 mm) bolts spaced not more than 6 feet (1829 mm) on center, or other approved anchors. Anchors shall be embedded not less than 16 inches (406 mm) into the masonry, or be hooked or welded to bond beam reinforcement placed not less than 6 inches (152 mm) from the top of the wall.

606.6.4.2.2 Floor diaphragms. Masonry walls shall be anchored to floor diaphragm framing by metal strap anchors spaced in accordance with the manufacturer's instructions, $^1/_2$ -inch-diameter (13 mm) bolts spaced at intervals not to exceed 6 feet (1829 mm) and installed as shown in Figure 606.11(1), or by other approved methods.

606.7 Piers. The unsupported height of masonry piers shall not exceed 10 times their least dimension. Where structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with grout or Type M or S mortar, except that unfilled hollow piers shall be permitted to be used if their unsupported height is not more than four times their least dimension. Where hollow masonry units are solidly filled with grout or Type M, S or N mortar, the allowable compressive stress shall be permitted to be increased as provided in Table 606.9.

606.7.1 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.

606.8 Chases. Chases and recesses in masonry walls shall not be deeper than one-third the wall thickness. The maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm) and shall have not less than 8 inches (203 mm) of masonry in back of the chases and recesses and between adjacent chases or recesses and the jambs of openings. Chases and recesses in masonry walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and shall not be permitted within the required area of a pier. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on noncombustible lintels.

606.9 Allowable stresses. Allowable compressive stresses in masonry shall not exceed the values prescribed in Table 606.9. In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.

606.9.1 Combined units. In walls or other structural members composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the member is composed. The net thickness of any facing unit that is used to resist stress shall be not less than $1^1/_2$ inches (38 mm).

TABLE 606.9
ALLOWABLE COMPRESSIVE STRESSES FOR
EMPIRICAL DESIGN OF MASONRY

CONSTRUCTION; COMPRESSIVE STRENGTH OF UNIT, GROSS AREA	ALLOWABLE COMPRESSIVE STRESSES [a] GROSS CROSS-SECTIONAL AREA [b]	
	Type M or S mortar	Type N mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:		
8,000 + psi	350	300
4,500 psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Grouted[c] masonry, of clay or shale; sand-lime or concrete-		
4,500 + psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Solid masonry of solid concrete masonry units:		
3,000 + psi	225	200
2,000 psi	160	140
1,200 psi	115	100
Masonry of hollow load- bearing units:		
2,000 + psi	140	120
1,500 psi	115	100
1,000 psi	75	70
700 psi	60	55
Hollow walls (cavity or masonry bonded[d]) solid units:		
2,500 + psi	160	140
1,500 psi	115	100
Hollow units	75	70
Stone ashlar masonry:		
Granite	720	640
Limestone or marble	450	400
Sandstone or cast stone	360	320

Rubble stone masonry: Coarse, rough or random	120	100

For SI: 1 pound per square inch = 6.895 kPa.

a. Linear interpolation shall be used for determining allowable stresses for masonry units having compressive strengths that are intermediate between those given in the table.
b. Gross cross-sectional area shall be calculated on the actual rather than nominal dimensions.
c. See Section 606.13.
d. Where floor and roof loads are carried on one wythe, the gross cross-sectional area is that of the wythe under load; if both wythes are loaded, the gross cross-sectional area is that of the wall minus the area of the cavity between the wythes. Walls bonded with metal ties shall be considered as cavity walls unless the collar joints are filled with mortar or grout.

606.10 Lintels. Masonry over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or masonry arches, designed to support load imposed.

606.11 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in Figure 606.11(1). Footings shall be permitted to be considered as points of lateral support.

SHEATHING NAILED IN ACCORDANCE WITH TABLE R602.3(1)

RAFTER

CEILING JOIST

3-16d

½ IN. BOLT AT 8 FT. O.C. EMBEDDED 4 IN. MIN.

BLOCKING

2 IN. NOMINAL PLATE

SHEATHING NAILED IN ACCORDANCE WITH TABLE R602.3(1)

16d AT 16 IN. O.C.

3-16d

½ IN. BOLT AT 8 FT. O.C. EMBEDDED 4 IN. MIN.

2-8d PER SHEATHING

BOLT EMBEDDED 4 IN.

JOIST

APPROVED METAL CONNECTOR

SEE TABLE FOR BOLT SIZE AND SPACING

3 IN. NOMINAL LEDGER

LEDGER BOLT SIZE AND SPACING

JOIST SPAN	BOLT SIZE AND SPACING	
	ROOF	FLOOR
10 FT.	½ AT 2 FT. 6 IN.	½ AT 2 FT. 0 IN.
	⅞ AT 3 FT. 6 IN.	⅞ AT 2 FT. 9 IN.
10—15 FT.	½ AT 1 FT. 9 IN.	½ AT 1 FT. 4 IN.
	⅞ AT 2 FT. 6 IN.	⅞ AT 2 FT. 0 IN.
15—20 FT.	½ AT 1 FT. 3 IN.	½ AT 1 FT. 0 IN.
	⅞ AT 2 FT. 0 IN.	⅞ AT 1 FT. 6 IN.

SHEATHING NAILED IN ACCORANCE WITH TABLE R602.3(1)

3 IN. NOMINAL BLOCKING JOIST

3-16d PER JOIST SPACING

3 IN. NOMINAL END JOIST

JOISTS PERPENDICULAR TO WALL

3-16d PER JOIST SPACING

3 IN. NOMINAL LEDGER

½ IN. BOLT AT 8 FT. O.C. EMBEDDED AT 4 IN. MIN.

JOISTS PARALLEL TO WALL

SEE TABLE ABOVE FOR BOLT AND SIZE SPACING

EMBEDDED 4 IN. MIN.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Where bolts are located in hollow masonry, the cells in the courses receiving the bolt shall be grouted solid.

FIGURE 606.11(1)
ANCHORAGE REQUIREMENTS FOR MASONRY WALLS
LOCATED IN SEISMIC DESIGN CATEGORY A, B OR C AND
WHERE WIND LOADS ARE LESS THAN 30 PSF

ROOF CONNECTORS AT 48 IN. MAX. O.C.

ROOF

#4 BARS AROUND OPENINGS

DETAIL B

#4 BARS WITHIN 8 IN. OF ENDS OF WALLS AND AT CORNERS

#4 BARS (MIN.) AT DIAPHRAGMS CONT. THRU C.J.

#4 BARS (MIN.) WITHIN 8 IN. OF ALL C.J.'S

CONTROL JOINT (C.J.)

#4 BARS AT 10 FT O.C.

24 IN. OR 40 db

#4 BARS AT 10 FT O.C. OR W1.7 JOINT REINFORCED AT 16 IN. O.C.

MINIMUM REINFORCEMENT FOR MASONRY WALLS

ANCHOR BOLTS

5 IN. MAX

2 IN. PLATE WITH ½ IN. Φ BOLTS NOT MORE THAN 4 FT O.C. EMBEDDED 4 IN. MIN.

TWO #4 LATERAL TIES WITHIN TOP 5 IN. OF COLUMN THAT ENCLOSE ANCHOR BOLTS AND VERTICAL REINFORCEMENT

COLUMN TIES

3 IN. x 3 IN. x ¼ IN. CLIP ANGLE 4 FT O.C. ONE ½ IN. BOLT

BOND BEAM STEEL TWO ½ IN. BARS

VERTICAL COLUMN REINFORCEMENT

LINTEL STEEL SEE SECTION R606.10

REINFORCEMENT SHALL HAVE MIN. ¼ IN. CLEARANCE

REINFORCEMENT— SEE SECTIONS R606.12.2.2.3 AND R606.12.2.3.3

NOT HEADER COURSE

12 IN. MAX. BEFORE GROUTING

DOWEL

METAL TIES SEE SECTION R608.1.2

WHERE INTERIOR STUD PARTITION MEETS WALL BOLT END STUD WITH ½ IN. Φ BOLTS 3 FT O.C.

LAP 40 DIA.

HEADER COURSES NOT PERMITTED

MIN. ¾ IN. GROUT

LAP 40 DIA.

SECTION 1

FIGURE 606.11(2)
REQUIREMENTS FOR REINFORCED GROUTED MASONRY
CONSTRUCTION IN SEISMIC DESIGN CATEGORY C

Figure deleted

FIGURE 606.11(3)
REQUIREMENTS FOR REINFORCED MASONRY CONSTRUCTION IN

SEISMIC DESIGN CATEGORY D$_0$, D$_1$ OR D$_2$

606.12 Seismic requirements. The seismic requirements of this section shall apply to the design of masonry and the construction of masonry building elements located in Seismic Design Category C. *Buildings with four or more dwelling units* shall comply with the requirements of Section 606.12.2. These requirements shall not apply to glass unit masonry conforming to Section 610, anchored masonry veneer conforming to Section 703.8 or adhered masonry veneer conforming to Section 703.12.

606.12.1 General. Masonry structures and masonry elements shall comply with the requirements of Sections 606.12.2 through 606.12.4 based on the seismic design category established in Table 301.2(2). Masonry structures and masonry elements shall comply with the requirements of Section 606.12 and Figures 606.11(1), 606.11(2) and 606.11(3) or shall be designed in accordance with TMS 402 or TMS 403

606.12.1.1 Floor and roof diaphragm construction. Floor and roof diaphragms shall be constructed of wood structural panels attached to wood framing in accordance with Table 602.3(1) or to cold-formed steel floor framing in accordance with Table 505.3.1(2) or to cold-formed steel roof framing in accordance with Table 804.3. Additionally, sheathing panel edges perpendicular to framing members shall be backed by blocking, and sheathing shall be connected to the blocking with fasteners at the edge spacing. For Seismic Design Categories C, where the width-to-thickness dimension of the diaphragm exceeds 2-to-1, edge spacing of fasteners shall be 4 inches (102 mm) on center.

606.12.2 Seismic Design Category C. *Buildings with four or more dwelling units* located in Seismic Design Category C shall comply with the requirements of this section.

606.12.2.1 Minimum length of wall without openings. Table 606.12.2.1 shall be used to determine the minimum required solid wall length without openings at each masonry exterior wall. The provided percentage of solid wall length shall include only those wall segments that are 3 feet (914 mm) or longer. The maximum clear distance between wall segments included in determining the solid wall length shall not exceed 18 feet (5486 mm). Shear wall segments required to meet the minimum wall length shall be in accordance with Section 606.12.2.2.3.

TABLE 606.12.2.1
MINIMUM SOLID WALL LENGTH ALONG EXTERIOR WALL LINES

SESIMIC DESIGN CATEGORY	MINIMUM SOLID WALL LENGTH (percent)[a]		
	One story or top story of two story	Wall supporting light-framed second story and roof	Wall supporting masonry second story and roof
Buildings with four or more dwelling units in C	20	25	35
D₀ or D₁	*Deleted*		
D₂	*Deleted*		

a. For all walls, the minimum required length of solid walls shall be based on the table percent multiplied by the dimension, parallel to the wall direction under consideration, of a rectangle inscribing the overall building plan.

606.12.2.2 Design of elements not part of the lateral force-resisting system.

606.12.2.2.1 Load-bearing frames or columns. Elements not part of the lateral force-resisting system shall be analyzed to determine their effect on the response of the system. The frames or columns shall be adequate for vertical load-carrying capacity and induced moment caused by the design story drift.

606.12.2.2.2 Masonry partition walls. Masonry partition walls, masonry screen walls and other masonry elements that are not designed to resist vertical or lateral loads, other than those induced by their own weight, shall be isolated from the structure so that vertical and lateral forces are not imparted to these elements. Isolation joints and connectors between these elements and the structure shall be designed to accommodate the design story drift.

606.12.2.2.3 Reinforcement requirements for masonry elements. Masonry elements listed in Section 606.12.2.2.2 shall be reinforced in either the horizontal or vertical direction as shown in Figure 606.11(2) and in accordance with the following:

1. Horizontal reinforcement. Horizontal joint reinforcement shall consist of not less than two longitudinal W1.7 wires spaced not more than 16 inches (406 mm) for walls greater than 4 inches (102 mm) in width and not less than one longitudinal W1.7 wire

spaced not more than 16 inches (406 mm) for walls not exceeding 4 inches (102 mm) in width; or not less than one No. 4 bar spaced not more than 48 inches (1219 mm). Where two longitudinal wires of joint reinforcement are used, the space between these wires shall be the widest that the mortar joint will accommodate. Horizontal reinforcement shall be provided within 16 inches (406 mm) of the top and bottom of these masonry elements.

2. Vertical reinforcement. Vertical reinforcement shall consist of not less than one No. 4 bar spaced not more than 48 inches (1219 mm). Vertical reinforcement shall be located within 16 inches (406 mm) of the ends of masonry walls.

606.12.2.3 Design of elements part of the lateral force-resisting system.

606.12.2.3.1 Connections to masonry shear walls. Connectors shall be provided to transfer forces between masonry walls and horizontal elements in accordance with the requirements of Section 4.1.4 of TMS 402. Connectors shall be designed to transfer horizontal design forces acting either perpendicular or parallel to the wall, but not less than 200 pounds per linear foot (2919 N/m) of wall. The maximum spacing between connectors shall be 4 feet (1219 mm). Such anchorage mechanisms shall not induce tension stresses perpendicular to grain in ledgers or nailers.

606.12.2.3.2 Connections to masonry columns. Connectors shall be provided to transfer forces between masonry columns and horizontal elements in accordance with the requirements of Section 4.1.4 of TMS 402. Where anchor bolts are used to connect horizontal elements to the tops of columns, the bolts shall be placed within lateral ties. Lateral ties shall enclose both the vertical bars in the column and the anchor bolts. There shall be not less than two No. 4 lateral ties provided in the top 5 inches (127 mm) of the column.

606.12.2.3.3 Minimum reinforcement requirements for masonry shear walls. Vertical reinforcement of not less than one No. 4 bar shall be provided at corners, within 16 inches (406 mm) of each side of openings, within 8 inches (203 mm) of each side of movement joints, within 8 inches (203 mm) of the ends of walls, and at a maximum spacing of 10 feet (3048 mm).

Horizontal joint reinforcement shall consist of not less than two wires

of W1.7 spaced not more than 16 inches (406 mm); or bond beam reinforcement of not less than one No. 4 bar spaced not more than 10 feet (3048 mm) shall be provided. Horizontal reinforcement shall be provided at the bottom and top of wall openings and shall extend not less than 24 inches (610 mm) nor less than 40 bar diameters past the opening; continuously at structurally connected roof and floor levels; and within 16 inches (406 mm) of the top of walls.

606.12.3 Seismic Design Category D$_0$ or D$_1$. *Deleted*

606.12.3.1 Design requirements. *Deleted*

606.12.3.2 Minimum reinforcement requirements for masonry walls. *Deleted*

TABLE.12.3.2
MINIMUM DISTRIBUTED WALL REINFORCEMENT FOR BUILDINGS ASSIGNED TO SEISMIC DESIGN CATEGORY D$_0$ or D$_1$
Table deleted

606.12.3.2.1 Shear wall reinforcement requirements. *Deleted*

606.12.3.3 Minimum reinforcement for masonry columns. *Deleted*

606.12.3.4 Material restrictions. *Deleted*

606.12.3.5 Lateral tie anchorage. *Deleted*

606.12.4 Seismic Design Category D$_2$. *Deleted*

606.12.4.1 Design of elements not part of the lateral force-resisting system. *Deleted*

TABLE 606.12.4.1
MINIMUM REINFORCING FOR STACKED BONDED MASONRY WALLS IN SEISMIC DESIGN CATEGORY D$_2$
Table deleted

606.12.4.2 Design of elements part of the lateral force-resisting system. *Deleted*

TABLE 606.12.4.2
MINIMUM RE INFORCING FOR STACKED BONDED
MASONRY WALLS IN SEISMIC DESIGN CATEGORY D2
Table deleted

606.13 Multiple-wythe masonry. The facing and backing of multiple-wythe masonry walls shall be bonded in accordance with Section 606.13.1, 606.13.2 or 606.13.3. In cavity walls, neither the facing nor the backing shall be less than 3 inches (76 mm) nominal in thickness and the cavity shall be not more than 4 inches (102 mm) nominal in width. The backing shall not be less than the thickness of the facing.

> **Exception:** Cavities shall be permitted to exceed the 4- inch (102 mm) nominal dimension provided that tie size and tie spacing have been established by calculation.

606.13.1 Bonding with masonry headers. Bonding with solid or hollow masonry headers shall comply with Sections 606.13.1.1 and 606.13.1.2.

606.13.1.1 Solid units. Where the facing and backing (adjacent wythes) of solid masonry construction are bonded by means of masonry headers, not less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches (76 mm) into the backing. The distance between adjacent full-length headers shall not exceed 24 inches (610 mm) either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap not less than 3 inches (76 mm), or headers from opposite sides shall be covered with another header course overlapping the header below not less than 3 inches (76 mm).

606.13.1.2 Hollow units. Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 34 inches (864 mm) by lapping not less than 3 inches (76 mm) over the unit below, or by lapping at vertical intervals not exceeding 17 inches (432 mm) with units that are not less than 50 percent thicker than the units below.

606.13.2 Bonding with wall ties or joint reinforcement. Bonding with wall ties or joint reinforcement shall comply with Section 606.13.2.3.

606.13.2.1 Bonding with wall ties. Bonding with wall ties, except as required by Section 607, where the facing and backing (adjacent wythes) of

masonry walls are bonded with $^3/_{16}$-inch-diameter (5 mm) wall ties embedded in the horizontal mortar joints, there shall be not less than one metal tie for each $4^1/_2$ square feet (0.418 m^2) of wall area. Ties in alternate courses shall be staggered. The maximum vertical distance between ties shall not exceed 24 inches (610 mm), and the maximum horizontal distance shall not exceed 36 inches (914 mm). Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls, the ends of ties shall be bent to 90-degree (0.79 rad) angles to provide hooks not less than 2 inches (51 mm) long. Additional bonding ties shall be provided at all openings, spaced not more than 3 feet (914 mm) apart around the perimeter and within 12 inches (305 mm) of the opening.

606.13.2.2 Bonding with adjustable wall ties. Where the facing and backing (adjacent wythes) of masonry are bonded with adjustable wall ties, there shall be not less than one tie for each 2.67 square feet (0.248 m^2) of wall area. Neither the vertical nor the horizontal spacing of the adjustable wall ties shall exceed 24 inches (610 mm). The maximum vertical offset of bed joints from one wythe to the other shall be 1.25 inches (32 mm). The maximum clearance between connecting parts of the ties shall be $^1/_{16}$ -inch (2 mm). Where pintle legs are used, ties shall have not less than two $^3/_{16}$ -inch-diameter (5 mm) legs.

606.13.2.3 Bonding with prefabricated joint reinforcement. Where the facing and backing (adjacent wythes) of masonry are bonded with prefabricated joint reinforcement, there shall be not less than one cross wire serving as a tie for each 2.67 square feet (0.248 m^2) of wall area. The vertical spacing of the joint reinforcement shall not exceed 16 inches (406 mm). Cross wires on prefabricated joint reinforcement shall not be smaller than No. 9 gage. The longitudinal wires shall be embedded in the mortar.

606.13.3 Bonding with natural or cast stone. Bonding with natural and cast stone shall conform to Sections 606.13.3.1 and 606.13.3.2.

606.13.3.1 Ashlar masonry. In ashlar masonry, bonder units, uniformly distributed, shall be provided to the extent of not less than 10 percent of the wall area. Such bonder units shall extend not less than 4 inches (102 mm) into the backing wall.

606.13.3.2 Rubble stone masonry. Rubble stone masonry 24 inches (610 mm) or less in thickness shall have bonder units with a maximum spacing of 3 feet (914 mm) vertically and 3 feet (914 mm) horizontally, and if the

masonry is of greater thickness than 24 inches (610 mm), shall have one bonder unit for each 6 square feet (0.557 m^2) of wall surface on both sides.

606.14 Anchored and adhered masonry veneer.

606.14.1 Anchored veneer. Anchored masonry veneer installed over a backing of wood or cold-formed steel shall meet the requirements of Section 703.8.

606.14.2 Adhered veneer. Adhered masonry veneer shall be installed in accordance with the requirements of Section 703.12.

**SECTION 607
GLASS UNIT MASONRY**

607.1 General. Panels of glass unit masonry located in load-bearing and nonload-bearing exterior and interior walls shall be constructed in accordance with this section.

607.2 Materials. Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of $^3/_{16}$ inch (5 mm). The surface of units in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. The use of reclaimed units is prohibited.

607.3 Units. Hollow or solid glass block units shall be standard or thin units.

607.3.1 Standard units. The specified thickness of standard units shall be not less than $3^7/_8$ -inches (98 mm).

607.3.2 Thin units. The specified thickness of thin units shall be not less than $3^1/_8$ inches (79 mm) for hollow units and not less than 3 inches (76 mm) for solid units.

607.4 Isolated panels. Isolated panels of glass unit masonry shall conform to the requirements of this section.

607.4.1 Exterior standard-unit panels. The maximum area of each individual standard-unit panel shall be 144 square feet (13.4 m^2) where the design wind pressure is 20 pounds per square foot (958 Pa). The maximum area of such panels subjected to design wind pressures other than20 pounds per square foot (958 Pa) shall be in accordance with Figure 607.4.1. The maximum panel

dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.
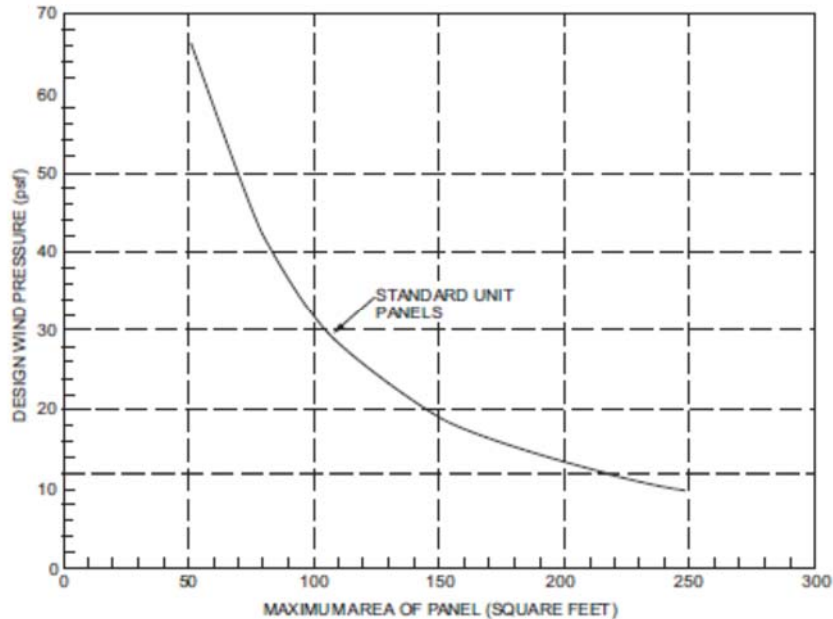
For SI: 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

FIGURE 607.4.1
GLASS UNIT MASONRY DESIGN WIND LOAD RESISTANCE

607.4.3 Interior panels. The maximum area of each individual standard-unit panel shall be 250 square feet (23.2 m²). The maximum area of each thin-unit panel shall be 150 square feet (13.9 m²). The maximum dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

607.4.4 Curved panels. The width of curved panels shall conform to the requirements of Sections 607.4.1, 607.4.2 and 607.4.3, except additional structural supports shall be provided at locations where a curved section joins a straight section, and at inflection points in multiple-curve walls.

607.5 Panel support. Glass unit masonry panels shall conform to the support requirements of this section.

607.5.1 Deflection. The maximum total deflection of structural members that support glass unit masonry shall not exceed l/600.

607.5.2 Lateral support.   Glass unit masonry panels shall be laterally supported along the top and sides of the panel. Lateral supports for glass unit masonry panels shall be designed to resist not less than 200 pounds per lineal feet (2918 N/m) of panel, or the actual applied loads, whichever is greater. Except for single-unit panels, lateral support shall be provided by panel anchors along the top and sides spaced not greater than 16 inches (406 mm) on center or by channel-type restraints. Single-unit panels shall be supported by channel-type restraints.

> **Exceptions:**
> 1. Lateral support is not required at the top of panels that are one unit wide.
> 2. Lateral support is not required at the sides of panels that are one unit high.

> **607.5.2.1 Panel anchor restraints.**   Panel anchors shall be spaced not greater than 16 inches (406 mm) on center in both jambs and across the head. Panel anchors shall be embedded not less than 12 inches (305 mm) and shall be provided with two fasteners so as to resist the loads specified in Section 607.5.2.

> **607.5.2.2 Channel-type restraints.**   Glass unit masonry panels shall be recessed not less than 1 inch (25 mm) within channels and chases. Channel-type restraints shall be oversized to accommodate expansion material in the opening, packing and sealant between the framing restraints, and the glass unit masonry perimeter units.

607.6 Sills.   Before the bedding of glass units, the sill area shall be covered with a water-base asphaltic emulsion coating. The coating shall be not less than $^1/_8$ -inch (3 mm) thick.

607.7 Expansion joints.   Glass unit masonry panels shall be provided with expansion joints along the top and sides at all structural supports. Expansion joints shall be not less than $^3/_8$ -inch (10 mm) in thickness and shall have sufficient thickness to accommodate displacements of the supporting structure. Expansion joints shall be entirely free of mortar and other debris and shall be filled with resilient material.

607.8 Mortar.   Glass unit masonry shall be laid with Type S or N mortar. Mortar shall not be retempered after initial set. Mortar unused within $1^1/_2$ hours after initial mixing shall be discarded.

607.9 Reinforcement.   Glass unit masonry panels shall have horizontal joint

reinforcement spaced not greater than 16 inches (406 mm) on center located in the mortar bed joint. Horizontal joint reinforcement shall extend the entire length of the panel but shall not extend across expansion joints. Longitudinal wires shall be lapped not less than 6 inches (152 mm) at splices. Joint reinforcement shall be placed in the bed joint immediately below and above openings in the panel. The reinforcement shall have not less than two parallel longitudinal wires of size W1.7 or greater, and have welded cross wires of size W1.7 or greater.

607.10 Placement. Glass units shall be placed so head and bed joints are filled solidly. Mortar shall not be furrowed. Head and bed joints of glass unit masonry shall be $^1/_4$ -inch (6.4 mm) thick, except that vertical joint thickness of radial panels shall be not less than $^1/_8$ -inch (3 mm) or greater than $^5/_8$ -inch (16 mm). The bed joint thickness tolerance shall be minus $^1/_{16}$ -inch (1.6 mm) and plus $^1/_8$ -inch (3 mm). The head joint thickness tolerance shall be plus or minus $^1/_8$ -inch (3 mm).

<div align="center">

SECTION 608
EXTERIOR CONCRETE WALL CONSTRUCTION

</div>

608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100 or ACI 318. Where PCA 100, ACI 318 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

608.1.1 Interior construction. These provisions are based on the assumption that interior walls and partitions, both load-bearing and nonload-bearing, floors and roof/ceiling assemblies are constructed of light-framed construction complying with the limitations of this code and the additional limitations of Section 608.2. Design and construction of light-framed assemblies shall be in accordance with the applicable provisions of this code. Where second- story exterior walls are of light-framed construction, they shall be designed and constructed as required by this code.

Aspects of concrete construction not specifically addressed by this code, including interior concrete walls, shall comply with ACI 318.

608.1.2 Other concrete walls. Exterior concrete walls constructed in accordance with this code shall comply with the shapes and minimum concrete cross-sectional dimensions of Table 608.3. Other types of forming systems resulting in concrete walls not in compliance with this section shall be designed

in accordance with ACI 318.

608.2 Applicability limits. The provisions of this section shall apply to the construction of exterior concrete walls for buildings not greater than 60 feet (18 288 mm) in plan dimensions, floors with clear spans not greater than 32 feet (9754 mm) and roofs with clear spans not greater than 40 feet (12 192 mm). Buildings shall not exceed 35 feet (10 668 mm) in mean roof height or two stories in height above grade. Floor/ceiling dead loads shall not exceed 10 pounds per square foot (479 Pa), roof/ceiling dead loads shall not exceed 15 pounds per square foot (718 Pa) and attic live loads shall not exceed 20 pounds per square foot (958 Pa). Roof overhangs shall not exceed 2 feet (610 mm) of horizontal projection beyond the exterior wall and the dead load of the overhangs shall not exceed 8 pounds per square foot (383 Pa).

   Walls constructed in accordance with the provisions of this section shall be limited to buildings subjected to a maximum design wind speed of 160 mph (72 m/s) Exposure B, 136 mph (61 m/s) Exposure C and 125 mph (56 m/s) Exposure D. Walls constructed in accordance with the provisions of this section shall be limited to detached one-, *two- and three-*family dwellings and *dwelling units* assigned to Seismic Design Category A or B.

   Buildings that are not within the scope of this section shall be designed in accordance with PCA 100 or ACI 318.

608.3 Concrete wall systems. Concrete walls constructed in accordance with these provisions shall comply with the shapes and minimum concrete cross-sectional dimensions of Table 608.3.

TABLE 608.3
DIMENSIONAL REQUIREMENTS FOR WALLS [a]

WALL TYPE AND NOMINAL THICKNESS	MAXIMUM WALL WEIGHT[b] (psf)	MINIMUM WIDTH, *W*, OF VERTICAL CORES (inches)	MINIMUM THICKNESS, *T*, OF VERTICAL CORES (inches)	MAXIMUM SPACING OF VERTICAL CORES (inches)	MAXIMUM SPACING OF HORIZONTAL CORES (inches)	MINIMUM WEB THICKNESS (inches)
4″ Flat [c]	50	NA	NA	NA	NA	NA
6″ Flat [c]	75	NA	NA	NA	NA	NA
8″ Flat [c]	100	NA	NA	NA	NA	NA
10″ Flat [c]	125	NA	NA	NA	NA	NA
6″ Waffle-grid	56	8 [d]	5.5 [d]	12	16	2
8″ Waffle-grid	76	8 [e]	8 [e]	12	16	2
6″ Screen-grid	53	6.25 [f]	6.25 [f]	12	12	NA

For SI: 1 inch = 25.4 mm; 1 pound per square foot = 0.0479 kPa, 1 pound per cubic foot = 2402.77 kg/m³, 1 square inch = 645.16 mm²,
         1 inch⁴ = 42 cm⁴.   NA = Not Applicable.
a.   Width "*W*," thickness "*T*," spacing and web thickness, refer to Figures 608.3(2) and 608.3(3).
b.   Wall weight is based on a unit weight of concrete of 150 pcf. For flat walls the weight is based on the nominal thickness. The tabulated

values do not include any allowance for interior and exterior finishes.

c.   Nominal wall thickness. The actual as-built thickness of a flat wall shall not be more than ½ inch less or more than ¼ inch more than the nominal dimension indicated.

d.   Vertical core is assumed to be elliptical-shaped. Another shape of core is permitted provided the minimum thickness is 5 inches, the moment of inertia, I, about the centerline of the wall (ignoring the web) is not less than 65 inch^4, and the area, A, is not less than 31.25 square inches. The width used to calculate A and I shall not exceed 8 inches.

e.   Vertical core is assumed to be circular. Another shape of core is permitted provided the minimum thickness is 7 inches, the moment of inertia, I, about the centerline of the wall (ignoring the web) is not less than 200 inch^4, and the area, A, is not less than 49 square inches. The width used to calculate A and I shall not exceed 8 inches.

f.   Vertical core is assumed to be circular. Another shape of core is permitted provided the minimum thickness is 5.5 inches, the moment of inertia, I, about the centerline of the wall is not less than 76 inch^4, and the area, A, is not less than 30.25 square inches. The width used to calculate A and I shall not exceed 6.25 inches.
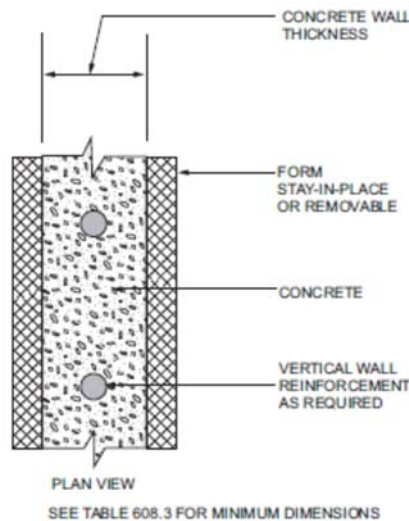
For SI: 1 inch = 25.4 mm.

FIGURE 608.3(1)
FLAT WALL SYSTEM

FIGURE 608.3(2)

2 IN. MINIMUM CONCRETE WEB THICKNESS

FORM –
STAY-IN-PLACE
OR REMOVABLE

HORIZONTAL CONCRETE CORE
(HIDDEN) AT MAXIMUM,
16 IN. ON CENTER

VERTICAL CONCRETE CORE

12 IN. MAXIMUM

W WIDTH MINIMUM

VERTICAL WALL
REINFORCEMENT
AS REQUIRED

T

THICKNESS
MINIMUM

PLAN VIEW

SEE TABLE R608.3 FOR MINIMUM DIMENSIONS
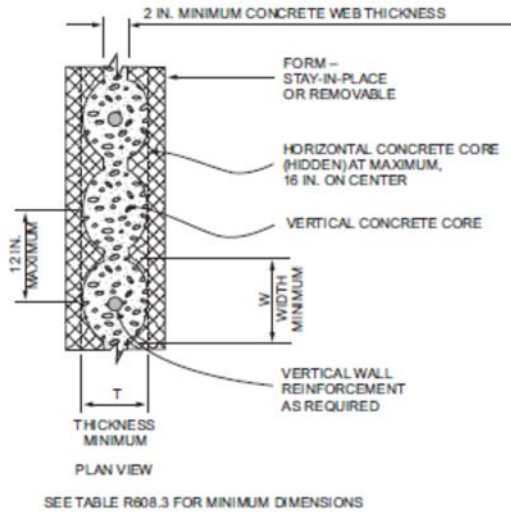
For SI: 1 inch = 25.4 mm.

FIGURE 608.3(2)
WAFFLE-GRID WALL SYSTEM

FORM –
STAY-IN-PLACE
OR REMOVABLE

VERTICAL WALL
REINFORCEMENT
AS REQUIRED

HORIZONTAL CONCRETE
CORE (HIDDEN) AT
MAXIMUM, 12 IN.
ON CENTER

VERTICAL
CONCRETE CORE

12 IN. MAXIMUM

W WIDTH MINIMUM

T

THICKNESS
MINIMUM

PLAN VIEW

SEE TABLE R608.3 FOR MINIMUM DIMENSIONS
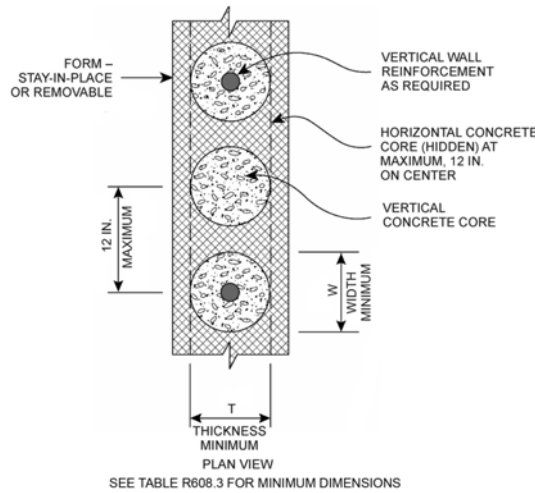
For SI: 1 inch = 25.4 mm.

FIGURE 608.3(3)
SCREEN-GRID WALL SYSTEM

608.3.1 Flat wall systems. Flat concrete wall systems shall comply with Table 608.3 and Figure 608.3(1) and have a minimum nominal thickness of 4 inches (102 mm).

608.3.2 Waffle-grid wall systems. Waffle-grid wall systems shall comply

with Table 608.3 and Figure 608.3(2) and shall have a minimum nominal thickness of 6 inches (152 mm) for the horizontal and vertical concrete members (cores). The core and web dimensions shall comply with Table 608. 3. The maximum weight of waffle-grid walls shall comply with Table 608.3.

608.3.3 Screen-grid wall systems. Screen-grid wall systems shall comply with Table 608.3 and Figure 608.3(3) and shall have a minimum nominal thickness of 6 inches (152 mm) for the horizontal and vertical concrete members (cores). The core dimensions shall comply with Table 608.3. The maximum weight of screen-grid walls shall comply with Table 608.3.

608.4 Stay-in-place forms. Stay-in-place concrete forms shall comply with this section.

608.4.1 Surface burning characteristics. The flame spread index and smoke-developed index of forming material, other than foam plastic, left exposed on the interior shall comply with Section 302.9. The surface burning characteristics of foam plastic used in insulating concrete forms shall comply with Section 316.3.

608.4.2 Interior covering. Stay-in-place forms con- structed of rigid foam plastic shall be protected on the interior of the building as required by Sections 316.4 and 702.3.4. Where gypsum board is used to protect the foam plastic, it shall be installed with a mechanical fastening system. Use of adhesives is permitted in addition to mechanical fasteners.

608.4.3 Exterior wall covering. Stay-in-place forms constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an approved exterior wall covering complying with this code. Exterior surfaces of other stay-in-place forming systems shall be protected in accordance with this code.

Requirements for installation of masonry veneer, stucco and other finishes on the exterior of concrete walls and other construction details not covered in this section shall comply with the requirements of this code.

608.4.4 Flat ICF wall systems. Flat ICF wall system forms shall conform to ASTM E2634.

608.5 Materials. Materials used in the construction of concrete walls shall comply with this section.

608.5.1 Concrete and materials for concrete. Materials used in concrete, and the concrete itself, shall conform to requirements of this section, PCA 100 or ACI 318.

608.5.1.1 Cements. The following standards as referenced in Chapter 44 shall be permitted to be used.
1. ASTM C150
2. ASTM C595
3. ASTM C1157

608.5.1.2 Concrete mixing and delivery. Mixing and delivery of concrete shall comply with ASTM C94 or ASTM C685.

608.5.1.3 Maximum aggregate size. The nominal maximum size of coarse aggregate shall not exceed one-fifth the narrowest distance between sides of forms, or three-fourths the clear spacing between reinforcing bars or between a bar and the side of the form.
   Exception: When approved, these limitations shall not apply where removable forms are used and workability and methods of consolidation permit concrete to be placed without honeycombs or voids.

608.5.1.4 Proportioning and slump of concrete. Proportions of materials for concrete shall be established to provide workability and consistency to permit concrete to be worked readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding. Slump of concrete placed in removable forms shall not exceed 6 inches (152 mm).
   Exception: When approved, the slump is permitted to exceed 6 inches (152 mm) for concrete mixtures that are resistant to segregation, and are in accordance with the form manufacturer's recommendations.

Slump of concrete placed in stay-in-place forms shall exceed 6 inches (152 mm). Slump of concrete shall be determined in accordance with ASTM C143.

608.5.1.5 Compressive strength. The minimum specified compressive strength of concrete, f'_c, shall comply with Section 402.2 and shall be not less than 2,500 pounds per square inch (17.2 MPa) at 28 days.

608.5.1.6 Consolidation of concrete. Concrete shall be consolidated by

suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration.

Exception: When approved, self-consolidating concrete mixtures with slumps equal to or greater than 8 inches (203 mm) that are specifically designed for placement without internal vibration need not be internally vibrated.

608.5.2 Steel reinforcement and anchor bolts.

608.5.2.1 Steel reinforcement. Steel reinforcement shall comply with ASTM A615, ASTM A706, or ASTM A996. ASTM A996 bars produced from rail steel shall be Type R.

608.5.2.2 Anchor bolts. Anchor bolts for use with connection details in accordance with Figures 608.9(1) through 608.9(12) shall be bolts with heads complying with ASTM A307 or ASTM F1554. ASTM A307 bolts shall be Grade A with heads. ASTM F1554 bolts shall be Grade 36 minimum. Instead of bolts with heads, it is permissible to use rods with threads on both ends fabricated from steel complying with ASTM A36. The threaded end of the rod to be embedded in the concrete shall be provided with a hex or square nut.

608.5.2.3 Sheet steel angles and tension tie straps. Angles and tension tie straps for use with connection details in accordance with Figures 608.9(1) through 608.9(12) shall be fabricated from sheet steel complying with ASTM A653 SS, ASTM A792 SS, or ASTM A875 SS. The steel shall be minimum Grade 33 unless a higher grade is required by the applicable figure.

608.5.3 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other approved material suitable for supporting and containing concrete. Forms shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

608.5.4 Reinforcement installation details.

608.5.4.1 Support and cover. Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system such that displacement will not occur during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (76 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be $1^{1}/_{2}$ -inches (38 mm) for No. 5 bars and smaller, and 2 inches (50 mm) for No. 6 bars and larger. For concrete cast in removable forms that will not be exposed to the earth or weather, and for concrete cast in stay-in-place forms, minimum cover shall be $^{3}/_{4}$ -inch (19 mm). The minus tolerance for cover shall not exceed the smaller of one-third the required cover and $^{3}/_{8}$ -inch (10 mm). See Section 608.5.4.4 for cover requirements for hooks of bars developed in tension.

TABLE 608.5.4(1)
LAP SPLICE AND TENSION DEVELOPMENT LENGTHS

	BAR SIZE NO.	YIELD STRENGTH OF STEEL, f_y psi (MPa)	
		40,000 (280)	60,000 (420)
		Splice length or tension development length (inches)	
Lap splice length-tension	4	20	30
	5	25	38
	6	30	45
Tension development length for straight bar	4	15	23
	5	19	28
	6	23	34
Tension development length for: a. 90-degree and 180-degree standard hooks with not less than $2^{1}/_{2}$ -inches of side cover perpendicular to plane of hook, and b. 90-degree standard hooks with not less than 2 inches of cover on the bar extension beyond the hook.	4	6	9
	5	7	11
	6	8	13
Tension development length for bar with 90-degree or 180-degree standard hook having less cover than required in Items a and b.	4	8	12
	5	10	15
	6	12	18

For SI: 1 inch = 25.4 mm, 1 degree = 0.0175 rad, 1 pound per square inch = 6.895 kPa.
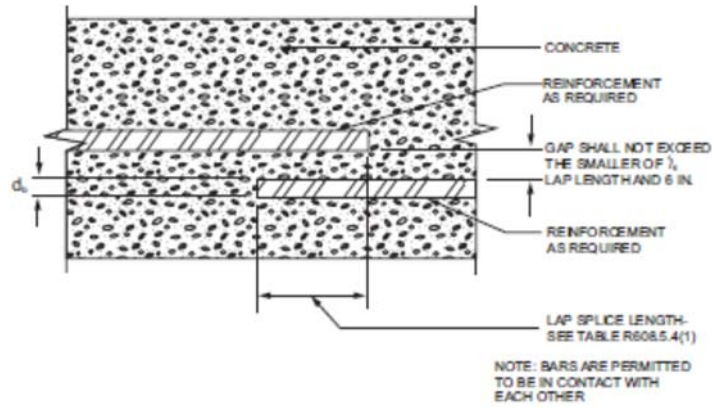
For SI: 1 inch = 25.4 mm.

FIGURE 608.5.4(1)
LAP SPLICES
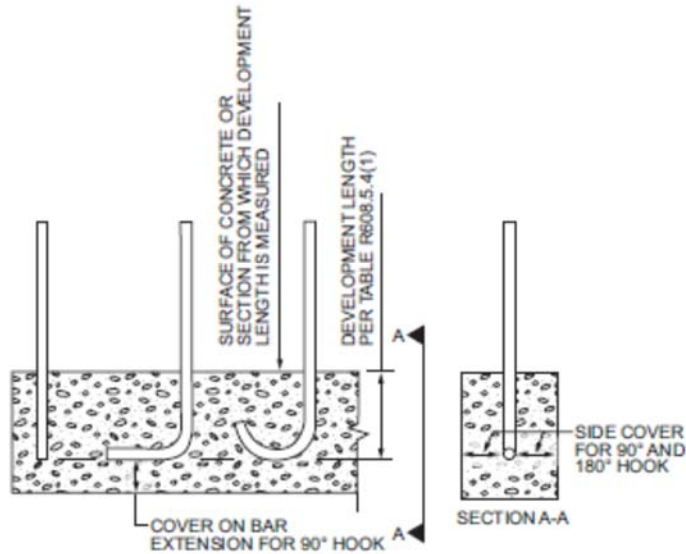
For SI: 1 degree = 0.0175 rad.

FIGURE 608.5.4(2)
DEVELOPMENT LENGTH AND COVER FOR
HOOKS AND BAR EXTENSION
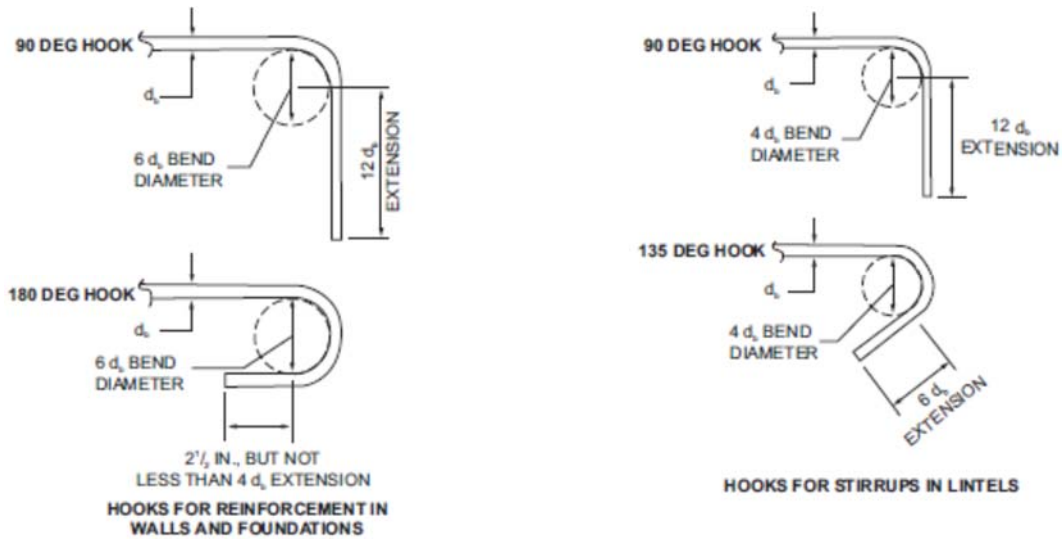
For SI: 1 inch = 25.4 mm, 1 degree = 0.0175 rad.

FIGURE 608.5.4(3)
STANDARD HOOKS

TABLE 608.5.4(2)
MAXIMUM SPACING FOR ALTERNATIVE BAR SIZE AND
ALTERNATIVE GRADE OF STEEL [a, b, c]

BAR SPACING FROM APPLICABLE TABLE IN SECTION 608.6 (inches)	BAR SIZE FROM APPLICABLE TABLE IN SECTION 608.6													
	#4					#5					#6			
	Alternate bar size and alternate grade of steel desired													
	Grade 60		Grade 40			Grade 60		Grade 40			Grade 60		Grade 40		
	#5	#6	#4	#5	#6	#4	#6	#4	#5	#6	#4	#5	#4	#5	#6
	Maximum spacing for alternate bar size and alternate grade of steel (inches)														
8	12	18	5	8	12	5	11	3	5	8	4	6	2	4	5
9	14	20	6	9	13	6	13	4	6	9	4	6	3	4	6
10	16	22	7	10	15	6	14	4	7	9	5	7	3	5	7
11	17	24	7	11	16	7	16	5	7	10	5	8	3	5	7
12	19	26	8	12	18	8	17	5	8	11	5	8	4	6	8
13	20	29	9	13	19	8	18	6	9	12	6	9	4	6	9
14	22	31	9	14	21	9	20	6	9	13	6	10	4	7	9
15	23	33	10	16	22	10	21	6	10	14	7	11	5	7	10
16	25	35	11	17	23	10	23	7	11	15	7	11	5	8	11
17	26	37	11	18	25	11	24	7	11	16	8	12	5	8	11
18	28	40	12	19	26	12	26	8	12	17	8	13	5	8	12
19	29	42	13	20	28	12	27	8	13	18	9	13	6	9	13
20	31	44	13	21	29	13	28	9	13	19	9	14	6	9	13

BAR SPACING FROM APPLICABLE TABLE IN SECTION 608.6 (inches)	BAR SIZE FROM APPLICABLE TABLE IN SECTION 608.6														
	#4					#5					#6				
	Alternate bar size and alternate grade of steel desired														
	Grade 60		Grade 40			Grade 60		Grade 40			Grade 60		Grade 40		
	#5	#6	#4	#5	#6	#4	#6	#4	#5	#6	#4	#5	#4	#5	#6
	Maximum spacing for alternate bar size and alternate grade of steel (inches)														
21	33	46	14	22	31	14	30	9	14	20	10	15	6	10	14
22	34	48	15	23	32	14	31	9	15	21	10	16	7	10	15
23	36	48	15	24	34	15	33	10	15	22	10	16	7	11	15
24	37	48	16	25	35	15	34	10	16	23	11	17	7	11	16
25	39	48	17	26	37	16	35	11	17	24	11	18	8	12	17
26	40	48	17	27	38	17	37	11	17	25	12	18	8	12	17
27	42	48	18	28	40	17	38	12	18	26	12	19	8	13	18
28	43	48	19	29	41	18	40	12	19	26	13	20	8	13	19
29	45	48	19	30	43	19	41	12	19	27	13	20	9	14	19
30	47	48	20	31	44	19	43	13	20	28	14	21	9	14	20
31	48	48	21	32	45	20	44	13	21	29	14	22	9	15	21
32	48	48	21	33	47	21	45	14	21	30	15	23	10	15	21
33	48	48	22	34	48	21	47	14	22	31	15	23	10	16	22
34	48	48	23	35	48	22	48	15	23	32	15	24	10	16	23
35	48	48	23	36	48	23	48	15	23	33	16	25	11	16	23
36	48	48	24	37	48	23	48	15	24	34	16	25	11	17	24
37	48	48	25	38	48	24	48	16	25	35	17	26	11	17	25
38	48	48	25	39	48	25	48	16	25	36	17	27	12	18	25
39	48	48	26	40	48	25	48	17	26	37	18	27	12	18	26
40	48	48	27	41	48	26	48	17	27	38	18	28	12	19	27
41	48	48	27	42	48	26	48	18	27	39	19	29	12	19	27
42	48	48	28	43	48	27	48	18	28	40	19	30	13	20	28
43	48	48	29	44	48	28	48	18	29	41	20	30	13	20	29
44	48	48	29	45	48	28	48	19	29	42	20	31	13	21	29
45	48	48	30	47	48	29	48	19	30	43	20	32	14	21	30
46	48	48	31	48	48	30	48	20	31	44	21	32	14	22	31
47	48	48	31	48	48	30	48	20	31	44	21	33	14	22	31
48	48	48	32	48	48	31	48	21	32	45	22	34	15	23	32

For SI: 1 inch = 25.4 mm.

a. This table is for use with tables in Section 608.6 that specify the minimum bar size and maximum spacing of vertical wall reinforcement for foundation walls and above-grade walls. Reinforcement specified in tables in Section 608.6 is based on Grade 60 (420 MPa) steel reinforcement.

b. Bar spacing shall not exceed 48 inches on center and shall be not less than one-half the nominal wall thickness.

c. For Grade 50 (350 MPa) steel bars (ASTM A996, Type R), use spacing for Grade 40 (280 MPa) bars or interpolate between Grade 40 (280 MPa) and Grade 60 (420 MPa).

608.5.4.2 Location of reinforcement in walls. For location of reinforcement in foundation walls and above-grade walls, see Sections 404.1.3.3.7.2 and 608.6.5, respectively.

608.5.4.3 Lap splices. Vertical and horizontal wall reinforcement required by Sections 608.6 and 608.7 shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splices shall be in accordance with Table 608.5.4(1) and Figure 608.5.4(1). The maximum gap between noncontact parallel bars at a lap splice shall not exceed the smaller of one-fifth the required lap length and 6 inches (152 mm). See Figure 608.5.4(1).

608.5.4.4 Development of bars in tension. Where bars are required to be developed in tension by other provisions of this code, development lengths and cover for hooks and bar extensions shall comply with Table 608.5.4(1) and Figure 608.5.4(2). The development lengths shown in Table 608.5.4(1) shall apply to bundled bars in lintels installed in accordance with Section 608.8.2.2.

608.5.4.5 Standard hooks. Where reinforcement is required by this code to terminate with a standard hook, the hook shall comply with Figure 608.5.4(3).

608.5.4.6 Webs of waffle-grid walls. Reinforcement, including stirrups, shall not be placed in webs of waffle-grid walls, including lintels. Webs are permitted to have form ties.

608.5.4.7 Alternate grade of reinforcement and spacing. Where tables in Sections 404.1.3 and 608.6 specify vertical wall reinforcement based on minimum bar size and maximum spacing, which are based on Grade 60 (420 MPa) steel reinforcement, different size bars or bars made from a different grade of steel are permitted provided an equivalent area of steel per linear foot of wall is provided. Use of Table 608.5.4(2) is permitted to determine the maximum bar spacing for different bar sizes than specified in the tables and bars made from a different grade of steel. Bars shall not be spaced less than one-half the wall thickness, or more than 48 inches (1219 mm) on center.

608.5.5 Construction joints in walls. Construction joints shall be made and located to not impair the strength of the wall. Construction joints in plain concrete walls, including walls required to have not less than No. 4 bars at 48 inches (1219 mm) on center by Section 608.6, shall be located at points of lateral support, and not less than one No. 4 bar shall extend across the construction joint at a spacing not to exceed 24 inches (610 mm) on center. Construction joint reinforcement shall have not less than 12 inches (305 mm)

of embedment on both sides of the joint. Construction joints in reinforced concrete walls shall be located in the middle third of the span between lateral supports, or located and constructed as required for joints in plain concrete walls.

Exception: Vertical wall reinforcement required by this code is permitted to be used in lieu of construction joint reinforcement, provided the spacing does not exceed 24 inches (610 mm), or the combination of wall reinforcement and No. 4 bars described in Section 608.5.5 does not exceed 24 inches (610 mm).

608.6 Above-grade wall requirements.

608.6.1 General. The minimum thickness of load-bearing and nonload-bearing above-grade walls and reinforcement shall be as set forth in the appropriate table in this section based on the type of wall form to be used. The wall shall be designed in accordance with ACI 318 where the wall or building is not within the limitations of Section 608.2, where design is required by the tables in this section or where the wall is not within the scope of the tables in this section.

Above-grade concrete walls shall be constructed in accordance with this section and Figure 608.6(1), 608.6(2), 608.6(3) or 608.6(4). Above-grade concrete walls that are continuous with stem walls and not laterally supported by the slab-on-ground shall be designed and constructed in accordance with this section. Concrete walls shall be supported on continuous foundation walls or slabs-on-ground that are monolithic with the footing in accordance with Section 403. The minimum length of solid wall without openings shall be in accordance with Section 608.7. Reinforcement around openings, including lintels, shall be in accordance with Section 608.8. Lateral support for above-grade walls in the out-of-plane direction shall be provided by connections to the floor framing system, if applicable, and to ceiling and roof framing systems in accordance with Section 608.9. The wall thickness shall be equal to or greater than the thickness of the wall in the story above.

608.6.2 Wall reinforcement for wind. Vertical wall reinforcement for resistance to out-of-plane wind forces shall be determined from Table 608.6(1), 608.6(2), 608.6(3) or 608.6(4). For the design of nonload-bearing walls, in Tables 608.6(1), 608.6(2) and 608.6(3) use the appropriate column labeled "Top." (see Sections 608.7.2.2.2 and 608.7.2.2.3). There shall be a vertical bar at corners of exterior walls. Unless more horizontal reinforcement is required by Section 608.7.2.2.1, the minimum horizontal reinforcement shall be four No. 4 bars [Grade 40 (280 MPa)] placed as follows: top bar within 12 inches (305 mm) of the top of the wall, bottom bar within 12 inches (305 mm) of the finish

floor and one bar each at approximately one-third and two-thirds of the wall
height.
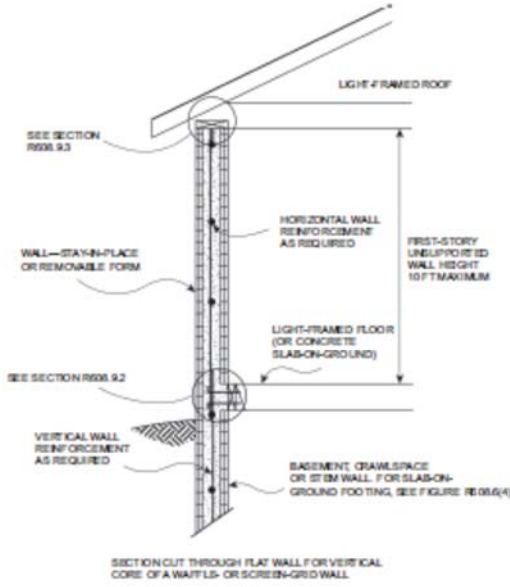
For SI: 1 foot = 304.8 mm.

FIGURE R608.6(1)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION ONE STORY
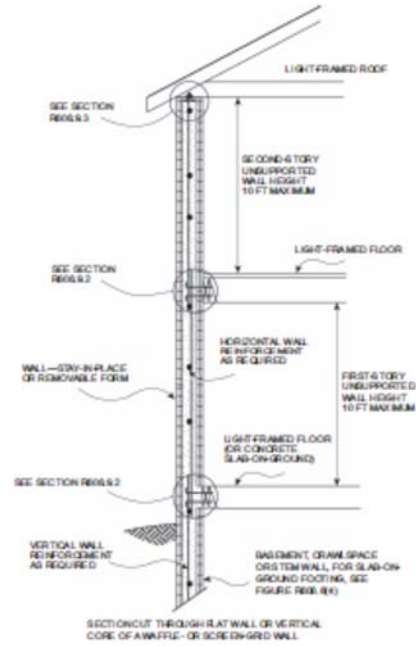
For SI: 1 foot = 304.8 mm.

FIGURE R608.6(3)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION TWO-STORY
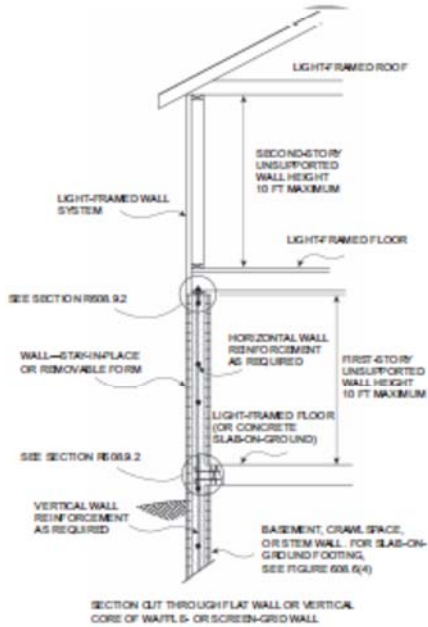
For SI: 1 foot = 304.8 mm.

FIGURE R608.6(2)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION CONCRETE FIRST STORY AND LIGHT-FRAMED SECOND STORY
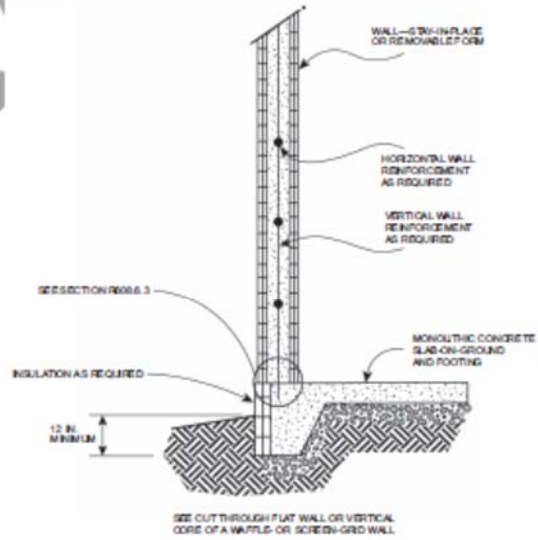
For SI: 1 inch = 25.4 mm.

FIGURE R608.6(4)
ABOVE-GRADE CONCRETE WALL SUPPORTED ON MONOLITHIC SLAB-ON-GROUND FOOTING

TABLE 608.6(1)
MINIMUM VERTICAL REINFORCEMENT FOR
FLAT ABOVE-GRADE WALLS [a, b, c, d, e]

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT- BAR SIZE AND SPACING (inches) [f, g]							
				Nominal [h] wall thickness (inches)							
Exposure Category				4		6		8		10	
B	C	D		Top [i]	Side [i]	Top [i]	Side [i]	Top [i]	Side [i]	Top [i]	Side [i]
115			8	4@48	4@48	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@39	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@41	4@34	4@48	4@48	4@48	4@48	4@48	4@48
120			8	4@48	4@43	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@36	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@37	4@34	4@48	4@48	4@48	4@48	4@48	4@48
130	110		8	4@48	4@38	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@39	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
140	119	110	8	4@43	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@31	4@48	4@48	4@48	4@48	4@48	4@48
150	127	117	8	4@37	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@33	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@31	4@27	4@48	4@48	4@48	4@48	4@48	4@48
160	136	125	8	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@29	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@27	4@24	4@48	4@48	4@48	4@48	4@48	4@48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 1.895 kPa, 1 square foot = 0.0929 m².

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, Kzt, equal to 1.0, and Risk Category II.
b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
c. See Section 608.6.5 for location of reinforcement in wall.
d. Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
e. Interpolation is not permitted.
f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Vertical reinforcement with a yield strength of less than 60,000 psi or bars of a different size than specified in the table are permitted in accordance with Section 608.5.4.7 and Table 608.5.4(2).
h. See Table 608.3 for tolerances on nominal thicknesses.
i. "Top" means gravity load from roof or floor construction bears on top of wall. "Side" means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonload-bearing walls where floor framing members span parallel to the wall, use of the "Top" bearing condition is permitted.

TABLE 608.6(2)
MINIMUM VERTICAL REINFORCEMENT FOR
WAFFLE-GRID ABOVE-GRADE WALLS [a, b, c, d, e]

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT- BAR SIZE AND SPACING (inches) [f, g]			
				Nominal [h] wall thickness (inches)			
Exposure Category				6		8	
B	C	D		Top [i]	Side [i]	Top [i]	Side [i]
115			8	4@48	4@48	4@48	4@48
			9	4@48	5@43	4@48	4@48
			10	5@47	5@37	4@48	4@48
120			8	4@48	5@48	4@48	4@48
			9	4@48	5@40	4@48	4@48
			10	5@43	5@37	4@48	4@48
130	110		8	4@48	5@42	4@48	4@48
			9	5@45	5@37	4@48	4@48
			10	5@37	5@37	4@48	4@48
140	119	110	8	4@48	5@38	4@48	4@48
			9	5@39	5@37	4@48	4@48
			10	5@37	5@35	4@48	4@48
150	127	117	8	5@43	5@37	4@48	4@48
			9	5@37	5@37	4@48	4@48
			10	5@36	6@44	4@48	4@48
160	136	125	8	5@38	5@37	4@48	4@48
			9	5@37	6@47	4@48	4@48
			10	6@45	6@39	4@48	6@46

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m².

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II.

b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.

c. See Section 608.6.5 for location of reinforcement in wall.

d. Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.

e. Interpolation is not permitted.

f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches such as, 12, 24, 36 and 48, that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi or bars of a different size than specified in the table are permitted in accordance with Section 608.5.4.7 and Table 608.5.4(2).

h. See Table 608.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.

i. "Top" means gravity load from roof or floor construction bears on top of wall. "Side" means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonload-bearing walls and where floor framing members span parallel to the wall, the "top" bearing condition is permitted to be used.

TABLE 608.6(3)
MINIMUM VERTICAL REINFORCEMENT FOR
6-INCH SCREEN-GRID ABOVE-GRADE WALLS [a, b, c, d, e]

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches) [f, g]	
Exposure Category				Nominal [h] wall thickness (inches)	
				6	
B	**C**	**D**		**Top** [i]	**Side** [i]
115			8	4@48	4@48
			9	4@48	5@41
			10	4@48	6@48
120			8	4@48	4@48
			9	4@48	5@38
			10	5@42	6@48
130	110		8	4@48	5@41
			9	5@44	6@48
			10	5@35	6@48
140	119	110	8	4@48	5@36
			9	5@38	6@48
			10	6@48	6@48
150	127	117	8	5@42	6@48
			9	6@48	6@48
			10	6@48	6@42
160	136	125	8	5@37	6@48
			9	6@48	6@45
			10	6@44	6@38

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m^2.

a.   Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II.

b.   Table is based on concrete with a minimum specified compressive strength of 2,500 psi.

c.   See Section 608.6.5 for location of reinforcement in wall.

d.   Deflection criterion is L/240, where L is the unsupported height of the wall in inches.

e.   Interpolation is not permitted.

f.   Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g.   Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches such as, 12, 24, 36 and 48, that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi or bars of a different size than specified in the table are permitted in accordance with Section 608.5.4.7 and Table 608.5.4(2).

h.   See Table 608.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.

i.   "Top" means gravity load from roof or floor construction bears on top of wall. "Side" means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonload-bearing wall and where floor framing members span parallel to the wall, use of the "Top" bearing condition is permitted.

TABLE 608.6(4)
MINIMUM VERTICAL REINFORCEMENT FOR
FLAT, WAFFLE- AND SCREEN-GRID ABOVE-GRADE WALLS DESIGNED
CONTINUOUS WITH FOUNDATION STEM WALLS [a, b, c, d, e, k]

MAXIMUM WIND SPEED (mph)			HEIGHT OF STEM WALL [h, i] (feet)	MAXIMUM DESIGN LATERAL SOIL LOAD (psf/ft)	MAXIMUM UNSUPPORTED HEIGHT OF ABOVE-GRADE WALL (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches) [f, g]						
Exposure Category						Wall type and nominal thickness [j] (inches)						
						Flat				Waffle		Screen
B	C	D				4	6	8	10	6	8	6
115			3	30	8	4@30	4@48	4@48	4@48	4@22	4@26	4@21
				30	10	4@23	5@43	4@48	4@48	4@17	4@20	4@16
				60	10	4@19	5@37	4@48	4@48	4@14	4@17	4@14
			6	30	10	DR	5@21	6@35	4@48	DR	4@10	DR
				60	10	DR	5@12	6@25	6@28	DR	DR	DR
120			3	30	8	4@28	4@48	4@48	4@48	4@21	4@48	4@20
				30	10	4@22	5@41	4@48	4@48	4@16	4@19	4@15
				60	10	4@18	5@35	4@48	4@48	4@14	4@17	4@13
			6	30	10	DR	5@21	6@35	4@48	DR	4@10	DR
				60	10	DR	5@12	6@25	6@28	DR	DR	DR
130	110		3	30	8	4@25	4@48	4@48	4@48	4@18	4@22	4@18
				30	10	4@19	5@36	4@48	4@48	4@14	4@17	4@13
				60	10	4@16	5@34	4@48	4@48	4@12	4@17	4@12
			6	30	10	DR	5@19	6@35	4@48	DR	4@9	DR
				60	10	DR	5@12	6@24	6@28	DR	DR	DR
140	119	110	3	30	8	4@22	5@42	4@48	4@48	4@16	4@20	4@16
				30	10	4@17	5@34	4@48	4@48	4@21	4@17	4@12
				60	10	4@15	5@34	4@48	4@48	4@11	4@17	4@10
			6	30	10	DR	5@18	6@35	6@35	DR	4@48	DR
				60	10	DR	5@11	6@23	6@28	DR	DR	DR
150	127	117	3	30	8	4@20	5@37	4@48	4@48	4@15	4@18	4@14
				30	10	4@15	5@34	4@48	4@48	4@11	4@17	4@11
				60	10	4@13	5@34	4@48	4@48	4@10	4@16	4@9
			6	30	10	DR	5@17	6@33	6@32	DR	4@8	DR
				60	10	DR	DR	6@22	6@28	DR	DR	DR
160	136	125	3	30	8	4@18	5@34	4@48	4@48	4@13	4@17	4@13
				30	10	4@13	5@34	4@48	4@48	4@10	4@16	4@9
				60	10	4@11	5@31	6@45	4@48	4@9	4@14	4@8
			6	30	10	DR	5@15	6@31	6@30	DR	4@7	DR
				60	10	DR	DR	6@21	6@27	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m². DR = Design Required.

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, Kzt, equal to 1.0, and Risk Category II.
b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
c. See Section 608.6.5 for location of reinforcement in wall.
d. Deflection criterion is L/240, where L is the height of the wall in inches from the exterior finish ground level to the top of the above-

grade wall.

e. Interpolation is not permitted. For intermediate values of basic wind speed, heights of stem wall and above-grade wall, and design lateral soil load, use next higher value.

f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. In waffle and screen-grid walls where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches such as, 12, 24, 36 and 48, that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section 608.5.4.7 and Table 608.5.4(2).

h. Height of stem wall is the distance from the exterior finish ground level to the top of the slab-on-ground.

i. Where the distance from the exterior finish ground level to the top of the slab-on-ground is equal to or greater than 4 feet, the stem wall shall be laterally supported at the top and bottom before backfilling. Where the wall is designed and constructed to be continuous with the above-grade wall, temporary supports bracing the top of the stem wall shall remain in place until the above-grade wall is laterally supported at the top by floor or roof construction.

j. See Table 608.3 for tolerances on nominal thicknesses, and minimum core dimensions and maximum spacing of horizontal and vertical cores for waffle- and screen-grid walls.

k. Tabulated values are applicable to construction where gravity loads bear on top of wall, and conditions where gravity loads from floor construction are transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. See Tables 608.6(1), 608.6(2) and 608.6(3).

608.6.3 Continuity of wall reinforcement between stories. Vertical reinforcement required by this section shall be continuous between elements providing lateral support for the wall. Reinforcement in the wall of the story above shall be continuous with the reinforcement in the wall of the story below, or the foundation wall, if applicable. Lap splices, where required, shall comply with Section 608.5.4.3 and Figure 608.5.4(1). Where the above-grade wall is supported by a monolithic slab-on-ground and footing, dowel bars with a size and spacing to match the vertical above-grade concrete wall reinforcement shall be embedded in the monolithic slab-on-ground and footing the distance required to develop the dowel bar in tension in accordance with Section 608.5.4.4 and Figure 608.5.4(2) and lap-spliced with the above-grade wall reinforcement in accordance with Section 608.5.4.3 and Figure 608.5.4(1).

Where a construction joint in the wall is located below the level of the floor and less than the distance required to develop the bar in tension, the distance required to develop the bar in tension shall be measured from the top of the concrete below the joint. See Section 608.5.5.

Exception: Where reinforcement in the wall above cannot be made continuous with the reinforcement in the wall below, the bottom of the reinforcement in the wall above shall be terminated in accordance with one of the following:

1. Extend below the top of the floor the distance required to develop the bar in tension in accordance with Section 608.5.4.4 and Figure 608.5.4(2).

2. Lap-spliced in accordance with Section 608.5.4.3 and Figure

608.5.4(1) with a dowel bar that extends into the wall below the distance required to develop the bar in tension in accordance with Section 608.5.4.4 and Figure 608.5.4(2).

608.6.4 Termination of reinforcement. Where indicated in Items 1 through 3, vertical wall reinforcement in the top-most story with concrete walls shall be terminated with a 90-degree (1.57 rad) standard hook complying with Section 608.5.4.5 and Figure 608.5.4(3).

1. Vertical bars adjacent to door and window openings required by Section 608.8.1.2.
2. Vertical bars at the ends of required solid wall segments (see Section 608.7.2.2.2).
3. Vertical bars (other than end bars, see Item 2) used as shear reinforcement in required solid wall segments where the reduction factor for design strength, R_3, used is based on the wall having horizontal and vertical shear reinforcement (see Section 608.7.2.2.3).

The bar extension of the hook shall be oriented parallel to the horizontal wall reinforcement and be within 4 inches (102 mm) of the top of the wall.

Horizontal reinforcement shall be continuous around the building corners by bending one of the bars and lap-splicing it with the bar in the other wall in accordance with Section 608.5.4.3 and Figure 608.5.4(1).

In required solid wall segments where the reduction factor for design strength, R_3, is based on the wall having horizontal and vertical shear reinforcement in accordance with Section 608.7.2.2.1, horizontal wall reinforcement shall be terminated with a standard hook complying with Section 608.5.4.5 and Figure 608.5.4(3) or in a lap-splice, except at corners where the reinforcement shall be continuous as required.

Exception: In lieu of bending horizontal reinforcement at corners, separate bent reinforcing bars shall be permitted provided that the bent bar is lap-spliced with the horizontal reinforcement in both walls in accordance with Section 608.5.4.3 and Figure 608.5.4(1).

608.6.5 Location of reinforcement in wall. Except for vertical reinforcement at the ends of required solid wall segments, which shall be located as required by Section 608.7.2.2.2, the location of the vertical reinforcement shall not vary from the center of the wall by more than the greater of 10 percent of the wall thickness and $^3/_8$ -inch (10 mm). Horizontal and vertical reinforcement shall be located to provide not less than the minimum cover required by Section 608.5.4.1.

608.7 Solid walls for resistance to lateral forces.

608.7.1 Length of solid wall. Each exterior wall line in each story shall have a total length of solid wall required by Section 608.7.1.1. A solid wall is a section of flat, waffle-grid or screen-grid wall, extending the full story height without openings or penetrations, except those permitted by Section 608.7.2. Solid wall segments that contribute to the total length of solid wall shall comply with Section 608.7.2.

608.7.1.1 Length of solid wall for wind. Buildings shall have solid walls in each exterior endwall line (the side of a building that is parallel to the span of the roof or floor framing) and sidewall line (the side of a building that is perpendicular to the span of the roof or floor framing) to resist lateral in-plane wind forces. The site-appropriate basic wind speed and exposure category shall be used in Tables 608.7(1A) through (1C) to determine the unreduced total length, *UR*, of solid wall required in each exterior endwall line and sidewall line. For buildings with a mean roof height of less than 35 feet (10 668 mm), the unreduced values determined from Tables 608.7(1A) though (1C) are permitted to be reduced by multiplying by the applicable factor, R_1, from Table 608.7(2); however, reduced values shall be not less than the minimum values in Tables 608.7(1A) through (1C). Where the floor-to-ceiling height of a story is less than 10 feet (3048 mm), the unreduced values determined from Tables 608.7(1A) through (1C), including minimum values, are permitted to be reduced by multiplying by the applicable factor, R_2, from Table 608.7(3). To account for different design strengths than assumed in determining the values in Tables 608.7(1A) through (1C), the unreduced lengths determined from Tables 608.7(1A) through (1C), including minimum values, are permitted to be reduced by multiplying by the applicable factor, R_3, from Table 608.7(4). The reductions permitted by Tables 608.7(2), 608.7(3) and 608.7(4) are cumulative.

  The total length of solid wall segments, *TL*, in a wall line that comply with the minimum length requirements of Section 608.7.2.1 [see Figure 608.7(1)] shall be equal to or greater than the product of the unreduced length of solid wall from Tables 608.7(1A) through (1C), *UR* and the applicable reduction factors, if any, from Tables 608.7(2), 608.7(3) and 608.7(4) as indicated by Equation 6-1.

$TL = R_1 \times R_2 \times R_3 \times UR$ **(Equation 6-1)**

where:
  TL = Total length of solid wall segments in a wall line that comply with

Section 608.7.2.1 [see Figure 608.7(1)].

R_1 = 1.0 or reduction factor for mean roof height from Table 608.7(2).

R_2 = 1.0 or reduction factor for floor-to-ceiling wall height from Table 608.7(3).

R_3 = 1.0 or reduction factor for design strength from Table 608.7(4).

UR = Unreduced length of solid wall from Tables 608.7(1A) through (1C).

The total length of solid wall in a wall line, *TL*, shall be not less than that provided by two solid wall segments complying with the minimum length requirements of Section 608.7.2.1.

To facilitate determining the required wall thickness, wall type, number and grade of vertical bars at each end of each solid wall segment, and whether shear reinforcement is required, use of Equation 6-2 is permitted.

$$R \leq \frac{TL}{R_1 \times R_2 \times UR}$$

(Equation 6-2)

After determining the maximum permitted value of the reduction factor for design strength, *R₃*, in accordance with Equation 6-2, select a wall type from Table 608.7(4) with R_3 less than or equal to the value calculated.

608.7.2 Solid wall segments. Solid wall segments that contribute to the required length of solid wall shall comply with this section. Reinforcement shall be provided in accordance with Section 608.7.2.2 and Table 608.7(4). Solid wall segments shall extend the full story-height without openings, other than openings for the utilities and other building services passing through the wall. In flat walls and waffle-grid walls, such openings shall have an area of less than 30 square inches (19 355 mm^2) without any dimension exceeding $6^1/_4$ - inches (159 mm), and shall not be located within 6 inches (152 mm) of the side edges of the solid wall segment. In screen-grid walls, such openings shall be located in the portion of the solid wall segment between horizontal and vertical cores of concrete and opening size and location are not restricted provided there is not any concrete removed.

608.7.2.1 Minimum length of solid wall segment and maximum spacing. Only solid wall segments equal to or greater than 24 inches (610 mm) in length shall be included in the total length of solid wall required by Section 608.7.1. In addition, not more than two solid wall segments equal to or greater than 24 inches (610 mm) in length and less than 48 inches (1219

mm) in length shall be included in the required total length of solid wall. The maximum clear opening width shall be 18 feet (5486 mm). See Figure 608.7(1).

608.7.2.2 Reinforcement in solid wall segments.

608.7.2.2.1 Horizontal shear reinforcement. Where reduction factors for design strength, R_3, from Table 608.7(4) based on horizontal and vertical shear reinforcement being provided are used, solid wall segments shall have horizontal reinforcement consisting of minimum No. 4 bars. Horizontal shear reinforcement shall be the same grade of steel required for the vertical reinforcement at the ends of solid wall segments by Section 608.7.2.2.2.
The spacing of horizontal reinforcement shall not exceed the smaller of one-half the length of the solid wall segment, minus 2 inches (51 mm), and 18 inches (457 mm). Horizontal shear reinforcement shall terminate in accordance with Section 608.6.4.

608.7.2.2.2 Vertical reinforcement. Vertical reinforcement applicable to the reduction factor(s) for design strength, R_3, from Table 608.7(4) that is used, shall be located at each end of each solid wall segment in accordance with the applicable detail in Figure 608.7(2). The No. 4 vertical bar required on each side of an opening by Section 608.8.1.2 is permitted to be used as reinforcement at the ends of solid wall segments where installed in accordance with the applicable detail in Figure 608.7(2). There shall be not less than two No. 4 bars at each end of solid wall segments located as required by the applicable detail in Figure 608.7(2). One of the bars at each end of solid wall segments shall be deemed to meet the requirements for vertical wall reinforcement required by Section 608.6.
The vertical wall reinforcement at each end of each solid wall segment shall be developed below the bottom of the adjacent wall opening [see Figure 608.7(3)] by one of the following methods:
1. Where the wall height below the bottom of the adjacent opening is equal to or greater than 22 inches (559 mm) for No. 4 or 28 inches (711 mm) for No. 5 vertical wall reinforcement, reinforcement around openings in accordance with Section 608.8.1 shall be sufficient.
2. Where the wall height below the bottom of the adjacent opening is less than required by Item 1, the vertical wall reinforcement adjacent to the opening shall extend into the footing far enough

to develop the bar in tension in accordance with Section 608.5.4.4 and Figure 608.5.4(2), or shall be lap-spliced with a dowel that is embedded in the footing far enough to develop the dowel-bar in tension.

TABLE 608.7(1A)
UNREDUCED LENGTH, _UR_, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL FOR WIND PERPENDICULAR TO RIDGE ONE STORY OR TOP STORY OF TWO STORY [a, c, d, e, f, g]

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, _UR_, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet) Basic Wind Speed (mph) Exposure						
			115B — —	120B — —	130B 110C —	140B 119C 110D	150B 127C 117D	160B 136C 125D	Minimum [b]
15	15	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	0.92
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.15
		7:12	2.00	2.18	2.56	2.97	3.41	3.88	1.25
		12:12	3.20	3.48	4.09	4.74	5.44	6.19	1.54
	30	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	0.98
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.43
		7:12	2.78	3.03	3.56	4.13	4.74	5.39	1.64
		12:12	5.17	5.63	6.61	7.67	8.80	10.01	2.21
	45	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	1.04
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.72
		7:12	3.57	3.88	4.56	5.28	6.07	6.90	2.03
		12:12	7.15	7.78	9.13	10.59	12.16	13.84	2.89
	60	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	1.09
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	2.01
		7:12	4.35	4.73	5.55	6.44	7.39	8.41	2.42
		12:12	9.12	9.93	11.66	13.52	15.52	17.66	3.57
30	15	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	1.82
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	2.23
		7:12	3.61	3.93	4.61	5.34	6.13	6.98	2.42
		12:12	5.61	6.10	7.16	8.31	9.54	10.85	2.93
	30	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	1.93
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	2.75
		7:12	4.92	5.35	6.28	7.29	8.37	9.52	3.12
		12:12	8.92	9.71	11.39	13.22	15.17	17.26	4.14
	45	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	2.03
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	3.26
		7:12	6.23	6.78	7.96	9.23	10.60	12.06	3.82
		12:12	12.23	13.31	15.63	18.12	20.80	23.67	5.36

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B = =	120B = =	130B 110C =	140B 119C 110D	150B 127C 117D	160B 136C 125D	Minimum [b]
	60	≤ 1:12	1.84	2.01	2.35	2.73	3.13	3.57	2.14
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	3.78
		7:12	7.54	8.21	9.64	11.17	12.83	14.60	4.52
		12:12	15.54	16.92	19.86	23.03	26.44	30.08	6.57
60	15	≤ 1:12	3.42	3.72	4.36	5.06	5.81	6.61	3.63
		5:12	4.75	5.17	6.06	7.03	8.07	9.19	4.40
		7:12	6.76	7.36	8.64	10.02	11.51	13.09	4.75
		12:12	10.35	11.27	13.23	15.34	17.61	20.04	5.71
	30	≤ 1:12	3.42	3.72	4.36	5.06	5.81	6.61	3.83
		5:12	4.75	5.17	6.06	7.03	8.07	9.19	5.37
		7:12	9.12	9.93	11.66	13.52	15.52	17.66	6.07
		12:12	16.30	17.75	20.83	24.16	27.73	31.55	8.00
	45	≤ 1:12	3.55	3.87	4.54	5.27	6.05	6.88	4.03
		5:12	4.94	5.37	6.31	7.31	8.40	9.55	6.34
		7:12	11.71	12.75	14.97	17.36	19.93	22.67	7.39
		12:12	22.70	24.71	29.00	33.64	38.62	43.94	10.29
	60	≤ 1:12	3.68	4.01	4.71	5.46	6.27	7.13	4.23
		5:12	5.11	5.57	6.54	7.58	8.70	9.90	7.31
		7:12	14.38	15.66	18.37	21.31	24.46	27.83	8.71
		12:12	29.30	31.90	37.44	43.42	49.85	56.72	12.57

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound-force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, *Kzt*, equal to 1.0, and Risk Category II. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, *UR*, of solid wall length required in each endwall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.

b. Tabulated lengths in the "minimum" column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section 608.7.1.1.

c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1, from Table 608.7(2). The reduced length shall be not less than the "minimum" value shown in the table.

d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in this table or Table 608.7 (1B) or (1C), or multiply the value in the table by the reduction factor, R_2, from Table 608.7(3).

e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3, from Table 608.7(4).

f. The reduction factors, R_1, R_2 and R_3, in Tables 608.7(2), 608.7(3), and 608.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid wall segments in each wall line shall comply with Sections 608.7.1 and 608.7.2.1, respectively.

g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

TABLE 608.7(1B)
UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN
EACH EXTERIOR ENDWALL FOR WIND PERPENDICULAR TO
RIDGE FIRST STORY OF TWO STORY [a, c, d, e, f, g]

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B 110C	140B 119C 110D	150B 127C 117D	160B 136C 125D	Minimum [b]
15	15	≤ 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.54
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	2.76
		7:12	4.31	4.70	5.51	6.39	7.34	8.35	2.87
		12:12	5.51	6.00	7.04	8.16	9.37	10.66	3.15
	30	≤ 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.59
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.05
		7:12	5.09	5.55	6.51	7.55	8.67	9.86	3.26
		12:12	7.48	8.15	9.56	11.09	12.73	14.49	3.83
	45	≤ 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.65
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.34
		7:12	5.88	6.40	7.51	8.71	10.00	11.37	3.65
		12:12	9.46	10.30	12.09	14.02	16.09	18.31	4.51
	60	≤ 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.71
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.63
		7:12	6.66	7.25	8.51	9.87	11.32	12.89	4.04
		12:12	11.43	12.45	14.61	16.94	19.45	22.13	5.19
30	15	≤ 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.06
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	5.47
		7:12	7.94	8.65	10.15	11.77	13.51	15.37	5.65
		12:12	9.94	10.82	12.70	14.73	16.91	19.24	6.17
	30	≤ 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.16
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	5.98
		7:12	9.25	10.07	11.82	13.71	15.74	17.91	6.35
		12:12	13.25	14.43	16.93	19.64	22.54	25.65	7.38
	45	≤ 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.27
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	6.50
		7:12	10.56	11.50	13.50	15.65	17.97	20.45	7.06
		12:12	16.56	18.03	21.16	24.55	28.18	32.06	8.60
	60	≤ 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.38
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	7.01

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	
			—	—	110C	119C	127C	136C	Minimum [b]
			—	—	—	110D	117D	125D	
		7:12	11.87	12.93	15.17	17.60	20.20	22.98	7.76
		12:12	19.87	21.64	25.40	29.45	33.81	38.47	9.81
60	15	≤ 1:12	9.87	10.74	12.61	14.62	16.79	19.10	10.10
		5:12	13.71	14.93	17.52	20.32	23.33	26.54	10.87
		7:12	15.08	16.42	19.27	22.35	25.66	29.20	11.22
		12:12	18.67	20.33	23.86	27.67	31.77	36.14	12.19
	30	≤ 1:12	9.87	10.74	12.61	14.62	16.79	19.10	10.30
		5:12	13.71	14.93	17.52	20.32	23.33	26.54	11.85
		7:12	17.44	18.99	22.29	25.85	29.67	33.76	12.54
		12:12	24.62	26.81	31.46	36.49	41.89	47.66	14.48
	45	≤ 1:12	10.27	11.18	13.12	15.21	17.47	19.87	10.50
		5:12	14.26	15.52	18.22	21.13	24.26	27.60	12.82
		7:12	20.21	22.01	25.83	29.95	34.39	39.12	13.86
		12:12	31.20	33.97	39.87	46.23	53.07	60.39	16.76
	60	≤ 1:12	10.64	11.59	13.60	15.77	18.11	20.60	10.70
		5:12	14.77	16.09	18.88	21.90	25.14	28.60	13.79
		7:12	23.05	25.09	29.45	34.15	39.21	44.61	15.18
		12:12	37.97	41.34	48.52	56.27	64.60	73.49	19.05

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, *Kzt*, equal to 1.0, and Risk Category II. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, *UR*, of solid wall length required in each endwall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.

b. Tabulated lengths in the "minimum" column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 1016 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section 608.7.1.1.

c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, *R*1, from Table 608.7(2). The reduced length shall be not less than the "minimum" value shown in the table.

d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in this table or Table 608.7(1A) or (1C), or multiply the value in the table by the reduction factor, *R*2, from Table 608.7(3).

e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, *R*3, from Table 608.7(4).

f. The reduction factors, *R*1, *R*2 and *R*3, in Tables 608.7(2), 608.7(3), and 608.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid wall segments in each wall line shall comply with Sections 608.7.1 and 608.7.2.1, respectively.

g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

TABLE 608.7(1C)
UNREDUCED LENGTH, _UR_, OF SOLID WALL REQUIRED IN
EACH EXTERIOR SIDEWALL FOR WIND PARALLEL TO RIDGE [a, c, d, e, f, g]

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, _UR_, OF SOLID WALL REQUIRED IN SIDEWALLS FOR WIND PARALLEL TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	
			=	=	110C	119C	127C	136C	Minimum[b]
			=	=	=	110D	117D	125D	
			One story or top story of two story						
< 30	15	≤ 1:12	1.08	1.18	1.39	161	1.84	2.10	0.90
		5:12	1.29	1.40	1.65	1.91	2.19	2.49	1.08
		7:12	1.38	1.50	1.76	2.04	2.35	2.67	1.17
		12:12	1.63	1.78	2.09	2.42	2.78	3.16	1.39
	30	≤ 1:12	2.02	2.20	2.59	3.00	3.44	3.92	1.90
		5:12	2.73	2.97	3.48	4.04	4.64	5.28	2.62
		7:12	3.05	3.32	3.89	4.51	5.18	5.89	2.95
		12:12	3.93	4.27	5.02	5.82	6.68	7.60	3.86
	45	≤ 1:12	3.03	3.30	3.87	4.49	5.15	5.86	2.99
		5:12	4.55	4.96	5.82	6.75	7.74	8.81	4.62
		7:12	5.24	5.71	6.70	7.77	8.92	10.15	5.36
		12:12	7.16	7.79	9.14	10.61	12.17	13.85	7.39
	60	≤ 1:12	4.11	4.47	5.25	6.09	6.99	7.96	4.18
		5:12	6.78	7.39	8.67	10.05	11.54	13.13	7.07
		7:12	8.00	8.71	10.22	11.85	13.61	15.48	8.38
		12:12	11.35	12.36	14.51	16.82	19.31	21.97	12.00
60	45	≤ 1:12	3.17	3.46	4.06	4.70	5.40	6.14	2.99
		5:12	4.75	5.18	6.07	7.04	8.09	9.20	4.62
		7:12	5.47	5.96	6.99	8.11	9.31	10.59	5.36
		12:12	7.45	8.11	9.52	11.04	12.68	14.43	7.39
	60	≤ 1:12	4.41	4.81	5.64	6.54	7.51	8.54	4.18
		5:12	7.22	7.86	9.23	10.70	12.29	13.98	7.07
		7:12	8.50	9.25	10.86	12.59	14.46	16.45	8.38
		12:12	12.02	13.09	15.36	17.81	20.45	23.27	12.00
< 30	15	≤ 1:12	3.03	3.30	3.88	4.49	5.16	5.87	2.52
		5:12	3.24	3.52	4.14	4.80	5.51	6.26	2.70
		7:12	3.33	3.62	4.25	4.93	5.66	6.44	2.79
		12:12	3.58	3.90	4.58	5.31	6.10	6.94	3.01
	30	≤ 1:12	5.50	5.99	7.03	8.16	9.36	10.65	5.14
		5:12	6.21	6.76	7.93	9.20	10.56	12.01	5.86
		7:12	6.52	7.10	8.34	9.67	11.10	12.63	6.19
		12:12	7.41	8.06	9.46	10.97	12.60	14.33	7.10

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN SIDEWALLS FOR WIND PARALLEL TO RIDGE (feet)						Minimum[b]
			Basic Wind Speed (mph) Exposure						
			__115B__	__120B__	__130B__	__140B__	__150B__	__160B__	
			__=__	__=__	__110C__	__119C__	__127C__	__136C__	__Minimum__[b]
			__=__	__=__	__=__	__110D__	__117D__	__125D__	
			__One story or top story of two story__						
	__45__	≤ 1:12	8.00	8.71	10.22	11.85	13.61	15.48	7.85
		5:12	9.52	10.37	12.17	14.11	16.20	18.43	9.48
		7:12	10.21	11.12	13.05	15.14	17.38	19.77	10.21
		12:12	12.13	13.20	15.50	17.97	20.63	23.47	12.25
	__60__	≤ 1:12	10.56	11.50	13.50	15.65	17.97	20.44	10.65
		5:12	13.24	14.41	16.91	19.62	22.52	25.62	13.54
		7:12	14.45	15.73	18.46	21.41	24.58	27.97	14.85
		12:12	17.80	19.38	22.75	26.38	30.29	34.46	18.48
__60__	__45__	≤ 1:12	8.39	9.14	10.72	12.44	14.28	16.25	7.85
		5:12	9.97	10.86	12.74	14.78	16.97	19.30	9.48
		7:12	10.69	11.64	13.66	15.84	18.19	20.69	10.21
		12:12	12.67	13.80	16.19	18.78	21.56	24.53	12.25
	__60__	≤ 1:12	11.37	12.38	14.53	16.85	19.35	22.01	10.65
		5:12	14.18	15.44	18.12	21.02	24.13	27.45	13.54
		7:12	15.46	16.83	19.75	22.91	26.29	29.92	14.85
		12:12	18.98	20.66	24.25	28.13	32.29	36.74	18.48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s,
   1 pound-force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II. The design pressures were used to calculate forces to be resisted by solid wall segments in each sidewall. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, *UR*, of solid wall length required in each sidewall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.

b. Tabulated lengths in the "minimum" column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section 608.7.1.1.

c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, *R*1, from Table 608.7(2). The reduced length shall be not less than the "minimum" value shown in the table.

d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in this table or Table 608.7(1A) or (1B), or multiply the value in the table by the reduction factor, *R*2, from Table 608.7(3).

e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, *R*3, from Table 608.7(4).

f. The reduction factors, *R*1, *R*2 and *R*3, in Tables 608.7(2), 608.7(3), and 608.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections 608.7.1 and 608.7.2.1, respectively.

g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

TABLE 608.7(2)
REDUCTION FACTOR, R_1, FOR BUILDINGS WITH
MEAN ROOF HEIGHT LESS THAN 35 FEET

MEAN ROOF HEIGHT [b, c] (feet)	REDUCTION FACTOR R_1, FOR MEAN ROOF HEIGHT		
	Exposure category		
	B	**C**	**D**
≤ 15	0.96	0.84	0.87
20	0.96	0.89	0.91
25	0.96	0.93	0.94
30	0.96	0.97	0.98
35	1.00	1.00	1.00

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

a. See Section 608.7.1.1 and Note c to Table 608.7(1A) for application of reduction factors in this table. This reduction is not permitted for "minimum" values.

b. For intermediate values of mean roof height, use the factor for the next greater height, or determine by interpolation.

c. Mean roof height is the average of the roof eave height and height of the highest point on the roof surface, except that for roof slopes of less than or equal to $2^1/_2$: 12 (10 degrees), the mean roof height is permitted to be taken as the roof eave height.

TABLE 608.7(3) [a, b]
REDUCTION FACTOR, R_2, FOR
FLOOR-TO-CEILING WALL HEIGHTS LESS THAN 10 FEET

STORY UNDER CONSIDERATION	FLOOR-TO-CEILING HEIGHT [c] (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	REDUCTION FACTOR, R_2
Endwalls—for wind perpendicular to ridge				
One story or top story of two story	8	15	≤ 5:12	0.83
			7:12	0.90
			12:12	0.94
		60	≤ 5:12	0.83
			7:12	0.95
			12:12	0.98
First story of two story	16 combined first and second story	15	≤ 5:12	0.83
			7:12	0.86
			12:12	0.89
		60	≤ 5:12	0.83
			7:12	0.91
			12:12	0.95
Sidewalls—for wind parallel to ridge				
One story or top story of two story	8	15	≤ 1:12	0.84
			5:12	0.87
			7:12	0.88
			12:12	0.89
		60	≤ 1:12	0.86
			5:12	0.92
			7:12	0.93
			12:12	0.95

STORY UNDER CONSIDERATION	FLOOR-TO-CEILING HEIGHT ^c (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	REDUCTION FACTOR, R_2
First story of two story	16 combined first and second story	15	$\leq$ 1:12	0.83
			5:12	0.84
			7:12	0.85
			12:12	0.86
		60	$\leq$ 1:12	0.84
			5:12	0.87
			7:12	0.88
			12:12	0.90

For SI: 1 foot = 304.8 mm.

a. See Section 608.7.1.1 and Note d to Table 608.7(1A) for application of reduction factors in this table.
b. For intermediate values of endwall length and roof slope, use the next higher value or determine by interpolation.
c. Tabulated values in Table 608.7(1A) and (1C) for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated values in Table 608.7(1B) and (1C) for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights between those shown in this table and those assumed in Table 608.7(1A), (1B) or (1C), use the solid wall lengths in Table 608.7(1A), (1B) or (1C), or determine the reduction factor by interpolating between 1.0 and the factor shown in this table.

TABLE 608.7(4) ^{a, c}
REDUCTION FACTOR FOR DESIGN STRENGTH, R_3, FOR FLAT, WAFFLE- AND SCREEN-GRID WALLS

NOMINAL THICKNESS OF WALL (inches)	VERTICAL BARS AT EACH END OF SOLID WALL SEGMENT		VERTICAL REINFORCEMENT LAYOUT DETAIL [see Figure 608.7(2)]	REDUCTION FACTOR, R_3, FOR LENGTH OF SOLID WALL			
				Horizontal and vertical shear reinforcement provided			
				No		Yes^d	
	Number of bars	Bar size		40,000^b	60,000^b	40,000^b	60,000^b
Flat walls							
4	2	4	1	0.74	0.61	0.74	0.50
	3	4	2	0.61	0.61	0.52	0.27
	2	5	1	0.61	0.61	0.48	0.25
	3	5	2	0.61	0.61	0.26	0.18
6	2	4	3	0.70	0.48	0.70	0.48
	3	4	4	0.49	0.38	0.49	0.33
	2	5	3	0.46	0.38	0.46	0.31
	3	5	4	0.38	0.38	0.32	0.16
8	2	4	3	0.70	0.47	0.70	0.47
	3	4	5	0.47	0.32	0.47	0.32
	2	5	3	0.45	0.31	0.45	0.31
	4	4	6	0.36	0.28	0.36	0.25
	3	5	5	0.31	0.28	0.31	0.16
	4	5	6	0.28	0.28	0.24	0.12
10	2	4	3	0.70	0.47	0.70	0.47
	2	5	3	0.45	0.30	0.45	0.30
	4	4	7	0.36	0.25	0.36	0.25
	6	4	8	0.25	0.22	0.25	0.13
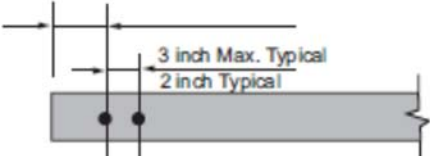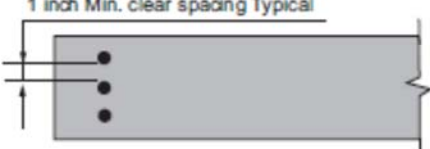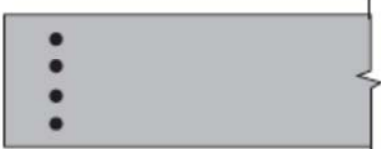
NOMINAL THICKNESS OF WALL (inches)	VERTICAL BARS AT EACH END OF SOLID WALL SEGMENT		VERTICAL REINFORCEMENT LAYOUT DETAIL [see Figure 608.7(2)]	REDUCTION FACTOR, R_3, FOR LENGTH OF SOLID WALL			
				Horizontal and vertical shear reinforcement provided			
	Number of bars	Bar size		No		Yes[d]	
				40,000[b]	60,000[b]	40,000[b]	60,000[b]
	4	5	7	0.24	0.22	0.24	0.12
	6	5	8	0.22	0.22	0.12	0.08
Waffle-grid walls[e]							
6	2	4	3	0.78	0.78	0.70	0.48
	3	4	4	0.78	0.78	0.49	0.25
	2	5	3	0.78	0.78	0.46	0.23
	3	5	4	0.78	0.78	0.24	0.16
8	2	4	3	0.78	0.78	0.70	0.47
	3	4	5	0.78	0.78	0.47	0.24
	2	5	3	0.78	0.78	0.45	0.23
	4	4	6	0.78	0.78	0.36	0.18
	3	5	5	0.78	0.78	0.23	0.16
	4	5	6	0.78	0.78	0.18	0.13
Screen-grid walls[e]							
6	2	4	3	0.93	0.93	0.70	0.48
	3	4	4	0.93	0.93	0.49	0.25
	2	5	3	0.93	0.93	0.46	0.23
	3	5	4	0.93	0.93	0.24	0.16

For SI: 1 inch = 25.4 mm, 1,000 pounds per square inch = 6.895 MPa.

a. See Note e to Table 608.7(1A) for application of adjustment factors in this table.

b. Yield strength in pounds per square inch of vertical wall reinforcement at ends of solid wall segments.

c. Values are based on concrete with a specified compressive strength, $f'c$, of 2,500 psi. Where concrete with $f'c$ of not less than 3,000 psi is used, values in shaded cells are permitted to be decreased by multiplying by 0.91.

d. Horizontal and vertical shear reinforcement shall be provided in accordance with Section 608.7.2.2.

e. Each end of each solid wall segment shall have rectangular flanges. In the through-the-wall dimension, the flange shall be not less than $5^1/_2$ inches for 6-inch- nominal waffle- and screen-grid walls, and not less than $7^1/_2$ inches for 8-inch-nominal waffle-grid walls. In the in-plane dimension, flanges shall be long enough to accommodate the vertical reinforcement required by the layout detail selected from Figure 608.7(2) and provide the cover required by Section 608.5.4.1. If necessary to achieve the required dimensions, form material shall be removed or use of flat wall forms is permitted.

WIND PERPENDICULAR TO RIDGE

A B C ← ONE STORY OR TOP STORY OF TWO STORY [TABLE R608.7(1B)] SEE SECTION R608.7.1.1

D E ← FIRST STORY OF TWO STORY [(TABLE R608.7(1A)] SEE SECTION R608.7.1.1

L SIDEWALL

W ENDWALL

WIND PARALLEL TO RIDGE

A B C ← ONE STORY OR TOP STORY OF TWO STORY [TABLE R608.7(1C)] SEE SECTION R608.7.1.1

D E F ← FIRST STORY OF TWO STORY [TABLE R608.7(1C)] SEE SECTION R608.7.1.1

L SIDEWALL

W ENDWALL

NOTE: EACH SOLID WALL SEGMENT (A, B, C, D, E, AND F) SHALL COMPLY WITH THE MINIMUM SOLID WALL SEGMENT LENGTH IN ORDER TO BE APPLICABLE TO THE MINIMUM SOLID WALL LENGTH EQUATIONS IN SECTION R608.7.1.1. SEE SECTION R608.7.2

FIGURE 608.7(1)
MINIMUM SOLID WALL LENGTH

DETAIL NO.	NOM. WALL THICKNESS, IN.	REINFORCEMENT LAYOUT AT ENDS OF SOLID WALL SEGMENTS	NOTES
1	4	3 inch Max. Typical 2 inch Typical	For SI: 1 inch = 25.4 mm. 1. See Table R608.7(4) for use of details.
2	4		2. Minimum length of solid wall segment and size and grade of reinforcement in each end of each solid wall segment shall be determined from Table R608.7(4).
3	6 8 10		3.. For minimum cover requirements, see Section R608.5.4.1.
4	6		4.. For details 3 - 8 where two or more bars are in the same row parallel to the end of the segment, place bars so that corner bars are as close to the sides of the wall segments as minimum cover requirements of Section R608.5.4.1 will permit.
5	8	1 inch Min. clear spacing Typical	
6	8		5.. For waffle- and screen-grid walls, each end of each solid wall segment shall have rectangular flanges. In the through-the-wall dimension, the flange shall be not less than 5½ inches for 6-inch nominal waffle- and screen-grid forms, and not less than 7½ inches for 8-inch nominal waffle-grid forms. In the in-plane dimension, flanges shall be long enough to accommodate the vertical reinforcement required by the layout detail selected and provide the cover required by Section R608.5.4.1. If necessary to achieve the required dimensions, form material shall be removed or flat wall forms are permitted. See Table R608.7(4), Note e.
7	10		
8	10	* For minimum cover see Section R608.5.4.1	

FIGURE 608.7(2)
VERTICAL REINFORCEMENT LAYOUT DETAIL

VERTICAL WALL REINFORCEMENT
AT END OF SOLID WALL SEGMENT.
SEE SECTION R608.7.2.2.2

WALL

WALL HEIGHT
BELOW LOWEST
ADJACENT
OPENING MORE
THAN REQUIRED
BY SECTION
R608.7.2.2.2

FOOTING

VERTICAL REINFORCEMENT EXTENDED
OR DOWELED TO FOUNDATION WHERE
WALL HEIGHT BELOW OPENING IS LESS
THAN REQUIRED BY SECTION R608.7.2.2.2

ALSO, SEE FIGURE R608.8(1)
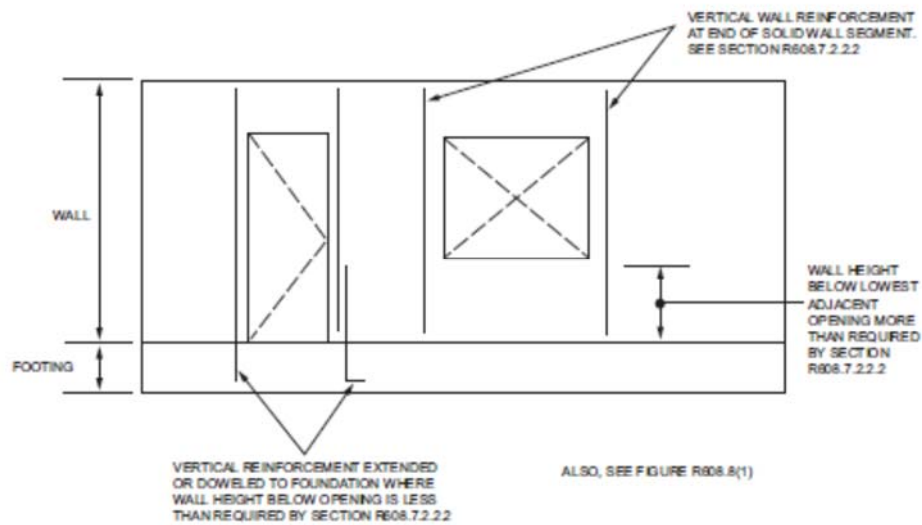
FIGURE 608.7(3)
VERTICAL WALL REINFORCEMENT
ADJACENT TO WALL OPENINGS

608.7.2.2.3 Vertical shear reinforcement. Where reduction factors for design strength, R_3, from Table 608.7(4) based on horizontal and vertical shear reinforcement being provided are used, solid wall segments shall have vertical reinforcement consisting of minimum No. 4 bars. Vertical shear reinforcement shall be the same grade of steel required by Section 608.7.2.2.2 for the vertical reinforcement at the ends of solid wall segments. The spacing of vertical reinforcement throughout the length of the segment shall not exceed the smaller of one third the length of the segment, and 18 inches (457 mm). Vertical shear reinforcement shall be continuous between stories in accordance with Section 608.6.3, and shall terminate in accordance with Section 608.6.4. Vertical shear reinforcement required by this section is permitted to be used for vertical reinforcement required by Table 608.6(1), 608.6(2), 608.6(3) or 608.6(4), whichever is applicable.

608.7.2.3 Solid wall segments at corners. At all interior and exterior corners of exterior walls, a solid wall segment shall extend the full height of each wall story. The segment shall have the length required to develop the horizontal reinforcement above and below the adjacent opening in tension in accordance with Section 608.5.4.4. For an exterior corner, the limiting dimension is measured on the outside of the wall, and for an interior corner the limiting dimension is measured on the inside of the wall. See

Section 608.8.1. The length of a segment contributing to the required length of solid wall shall comply with Section 608.7.2.1.

The end of a solid wall segment complying with the minimum length requirements of Section 608.7.2.1 shall be located not more than 6 feet (1829 mm) from each corner.

608.8 Requirements for lintels and reinforcement around openings.

608.8.1 Reinforcement around openings.

Reinforcement shall be provided around openings in walls equal to or greater than 2 feet (610 mm) in width in accordance with this section and Figure 608.8(1), in addition to the minimum wall reinforcement required by Sections 404.1.3, 608.6 and 608.7. Vertical wall reinforcement required by this section is permitted to be used as reinforcement at the ends of solid wall segments required by Section 608.7.2.2.2 provided it is located in accordance with Section 608.8.1.2. Wall openings shall have a mini- mum depth of concrete over the width of the opening of 8 inches (203 mm) in flat walls and waffle-grid walls, and 12 inches (305 mm) in screen-grid walls. Wall openings in waffle-grid and screen-grid walls shall be located such that not less than one-half of a vertical core occurs along each side of the opening.

608.8.1.1 Horizontal reinforcement.

Lintels complying with Section 608.8.2 shall be provided above wall openings equal to or greater than 2 feet (610 mm) in width.

Openings equal to or greater than 2 feet (610 mm) in width shall have not less than one No. 4 bar placed within 12 inches (305 mm) of the bottom of the opening. See Figure 608.8(1).

Horizontal reinforcement placed above and below an opening shall extend beyond the edges of the opening the dimension required to develop the bar in tension in accordance with Section 608.5.4.4.

Exception: Continuous horizontal wall reinforcement placed within 12 inches (305 mm) of the top of the wall story as required in Sections 404.1.3.2 and 608.6.2 is permitted in lieu of top or bottom lintel reinforcement required by Section 608.8.2 provided that the continuous horizontal wall reinforcement meets the location requirements specified in Figures 608.8(2), 608.8(3), and 608.8(4) and the size requirements specified in Tables 608.8(2) through 608.8(10).

608.8.1.2 Vertical reinforcement.

Not less than one No. 4 bar [Grade 40 (280 MPa)] shall be provided on each side of openings equal to or greater than 2 feet (610 mm) in width. The vertical reinforcement required by this

section shall extend the full height of the wall story and shall be located within 12 inches (305 mm) of each side of the opening. The vertical reinforcement required on each side of an opening by this section is permitted to serve as reinforcement at the ends of solid wall segments in accordance with Section 608.7.2.2.2, provided it is located as required by the applicable detail in Figure 608.7(2). Where the vertical reinforcement required by this section is used to satisfy the requirements of Section 608.7.2.2.2 in waffle- and screen-grid walls, a concrete flange shall be created at the ends of the solid wall segments in accordance with Table 608.7(4), Note e. In the top-most story, the reinforcement shall terminate in accordance with Section 608.6.4.

608.8.2 Lintels. Lintels shall be provided over all openings equal to or greater than 2 feet (610 mm) in width. Lintels with uniform loading shall conform to Sections 608.8.2.1 and 608.8.2.2, or Section 608.8.2.3. Lintels supporting concentrated loads, such as from roof or floor beams or girders, shall be designed in accordance with ACI 318.

608.8.2.1 Lintels designed for gravity load-bearing conditions. Where a lintel will be subjected to gravity load conditions 1 through 5 of Table 608.8(1), the clear span of the lintel shall not exceed that permitted by Tables 608.8(2) through 608.8(8). The maximum clear span of lintels with and without stirrups in flat walls shall be determined in accordance with Tables 608.8(2) through 608.8(5), and constructed in accordance with Figure 608.8(2). The maximum clear span of lintels with and without stirrups in waffle-grid walls shall be determined in accordance with Tables 608.8(6) and 608.8(7), and constructed in accordance with Figure 608.8(3). The maximum clear span of lintels with and without stirrups in screen-grid walls shall be determined in accordance with Table 608.8(8), and constructed in accordance with Figure 608.8(4).

Where required by the applicable table, No. 3 stirrups shall be installed in lintels at a maximum spacing of $d/2$ where d equals the depth of the lintel, D, less the cover of the concrete as shown in Figures 608.8(2) through 608.8(4). The smaller value of d computed for the top and bottom bar shall be used to determine the maximum stirrup spacing. Where stirrups are required in a lintel with a single bar or two bundled bars in the top and bottom, they shall be fabricated like the letter "c" or "s" with 135-degree (2.36 rad) standard hooks at each end that comply with Section 608.5.4.5 and Figure 608.5.4(3) and installed as shown in Figures 608.8(2) through 608.8(4). Where two bars are required in the top and bottom of the lintel and the bars are not bundled, the bars shall be separated by not less than 1

inch (25 mm). The free end of the stirrups shall be fabricated with 90- or 135-degree (1.57 or 2.36 rad) standard hooks that comply with Section 608.5.4.5 and Figure 608.5.4(3) and installed as shown in Figures 608.8(2) and 608.8(3). For flat, waffle-grid and screen-grid lintels, stirrups are not required in the center distance, A, portion of spans in accordance with Figure 608.8(1) and Tables 608.8(2) through 608.8(8). See Section 608.8.2.2, Item 5, for requirement for stirrups throughout lintels with bundled bars.
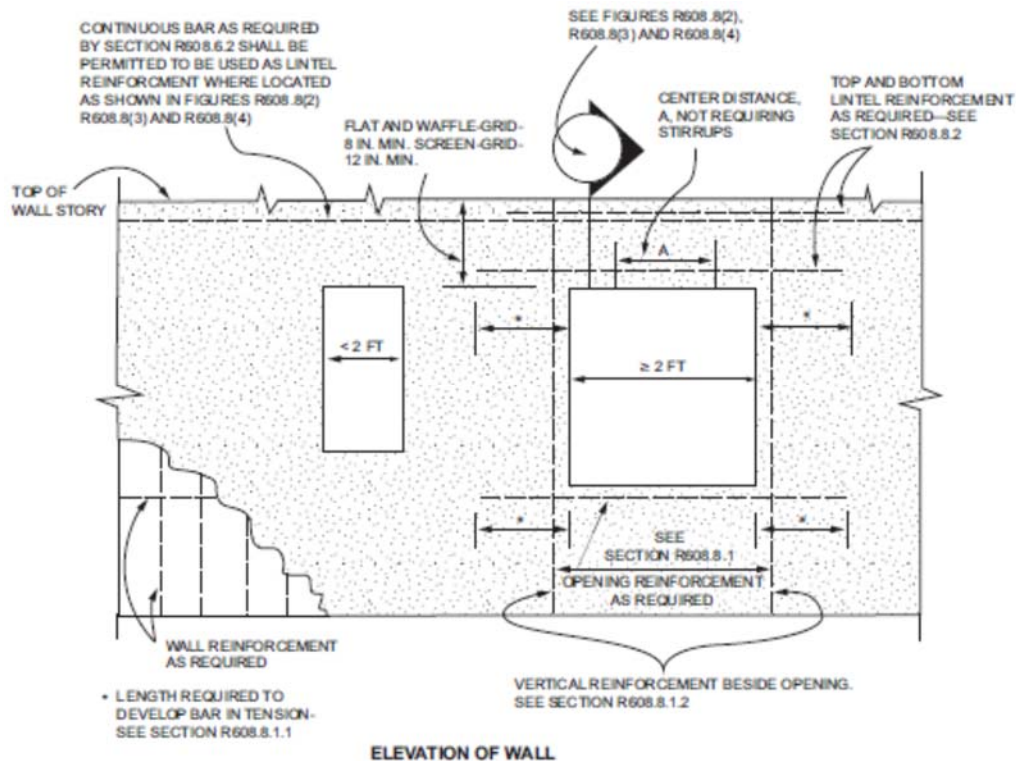
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 608.8(1)
REINFORCEMENT OF OPENINGS

608.8.2.2 Bundled bars in lintels. It is permitted to bundle two bars in contact with each other in lintels if all of the following are observed:
1. Bars equal to or less than No. 6 are bundled.
2. Where the wall thickness is not sufficient to provide not less than 3 inches (76 mm) of clear space beside bars (total on both sides) oriented horizontally in a bundle, the bundled bars shall be oriented

in a vertical plane.

3. Where vertically oriented bundled bars terminate with standard hooks to develop the bars in tension beyond the support (see Section 608.5.4.4), the hook extensions shall be staggered to provide not less than 1 inch (25 mm) clear spacing between the extensions.

4. Bundled bars shall not be lap spliced within the lintel span and the length on each end of the lintel that is required to develop the bars in tension.

5. Bundled bars shall be enclosed within stirrups throughout the length of the lintel. Stirrups and the installation thereof shall comply with Section 608.8.2.1.

608.8.2.3 Lintels without stirrups designed for nonload-bearing conditions. The maximum clear span of lintels without stirrups designed for nonload-bearing conditions of Table 608.8(1).1 shall be determined in accordance with this section. The maximum clear span of lintels without stirrups in flat walls shall be determined in accordance with Table 608.8(9), and the maximum clear span of lintels without stirrups in walls of waffle-grid or screen-grid construction shall be determined in accordance with Table 608.8(10).
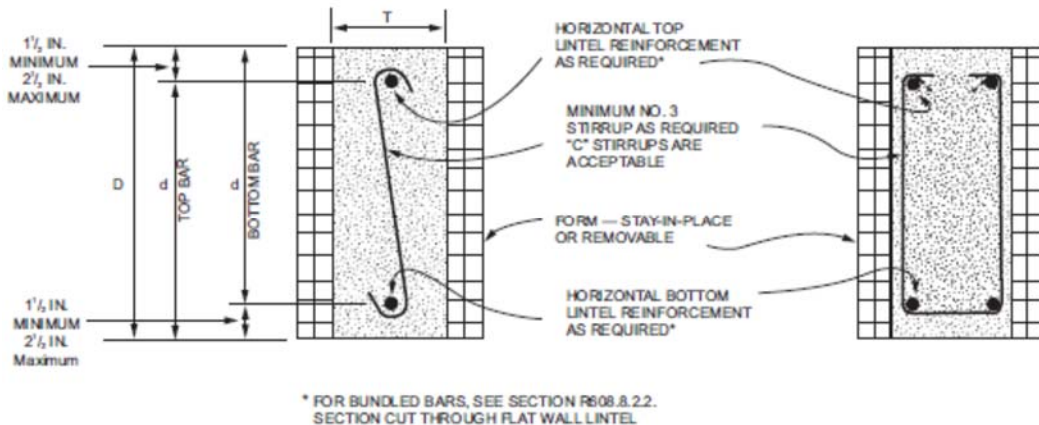
For SI: 1 inch = 25.4 mm.

FIGURE 608.8(2)
LINTEL FOR FLAT WALLS

1½ IN. MINIMUM
2½ IN. MAXIMUM

D

d TOP BAR

d BOTTOM BAR

1½ IN. MINIMUM
2½ IN. MAXIMUM

T

HORIZONTAL TOP LINTEL REINFORCEMENT AS REQUIRED

MINIMUM NO. 3 STIRRUP AS REQUIRED "C" STIRRUPS ARE ACCEPTABLE

CONCRETE WEB (HIDDEN)

VERTICAL CONCRETE CORE

FORM — STAY-IN-PLACE OR REMOVABLE

HORIZONTAL BOTTOM LINTEL REINFORCEMENT AS REQUIRED*

(a) SINGLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A WAFFLE-GRID LINTEL

1½ IN. MINIMUM
2½ IN. MAXIMUM

D

d TOP BAR

d BOTTOM BAR

1½ IN. MINIMUM
2½ IN. MAXIMUM

T

HORIZONTAL TOP LINTEL REINFORCEMENT AS REQUIRED*

MINIMUM NO. 3 STIRRUP AS REQUIRED "C" STIRRUPS ARE ACCEPTABLE

CONCRETE WEB (HIDDEN)

FORM — STAY-IN-PLACE OR REMOVABLE

VERTICAL CONCRETE CORE

HORIZONTAL BOTTOM LINTEL REINFORCEMENT AS REQUIRED*

(b) DOUBLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A WAFFLE-GRID LINTEL

*FOR BUNDLED BARS, SEE SECTION R608.8.2.2.

NOTE: CROSS HATCHING REPRESENTS THE AREA IN WHICH FORM MATERIAL SHALL BE REMOVED, IF NECESSARY, TO CREATE FLANGES CONTINUOUS THE LENGTH OF THE LINTEL. FLANGES SHALL HAVE A MINIMUM THICKNESS OF 3 IN., AND A MINIMUM WIDTH OF 5 IN. AND 7 IN. IN 6 IN. NOMINAL AND 8 IN. NOMINAL WAFFLE-GRID WALLS, RESPECTIVELY. SEE NOTE a TO TABLES R608.8(6) AND R608.8(10).

For SI: 1 inch = 25.4 mm.

FIGURE 608.8(3)
LINTELS FOR WAFFLE-GRID WALLS
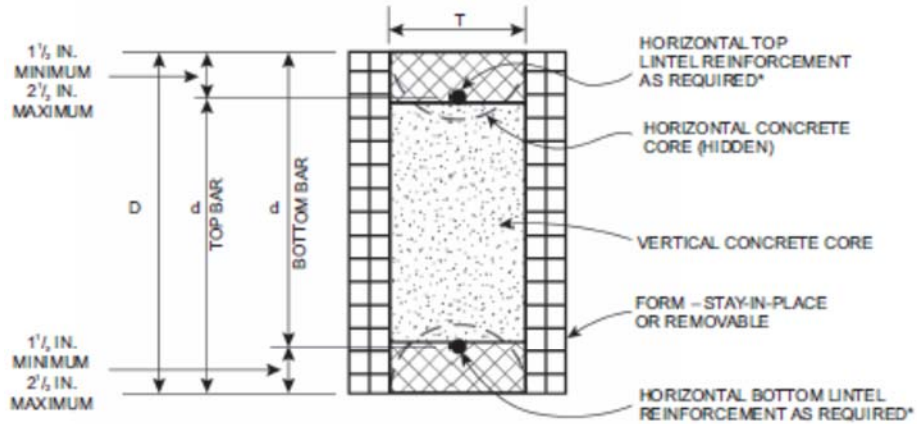
(a) SINGLE FORM HEIGHT SECTION CUT THROUGH
VERTICAL CORE OF A SCREEN-GRID LINTEL
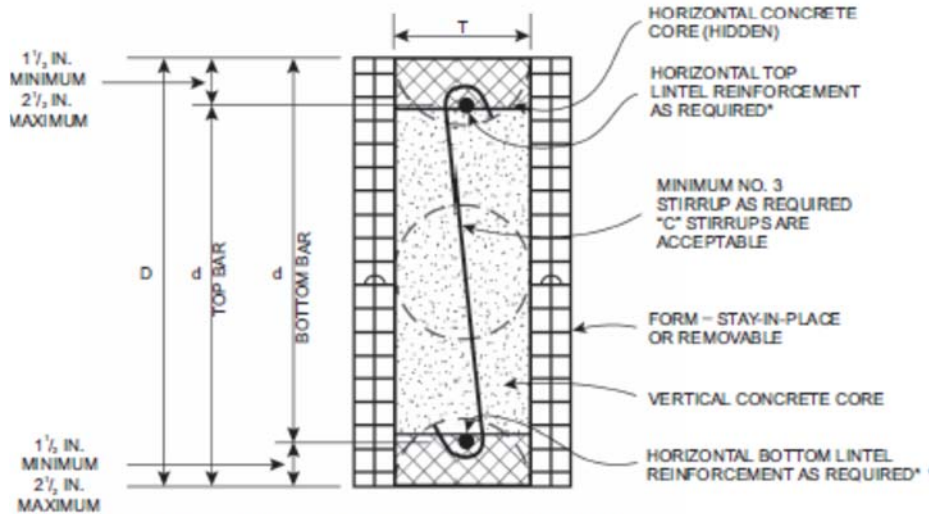
(b) DOUBLE FORM HEIGHT SECTION CUT THROUGH VERTICAL
CORE OF A SCREEN-GRID LINTEL

*FOR BUNDLED BARS, SEE SECTION R608.8.2.2

NOTE: CROSS HATCHING REPRESENTS THE AREA IN WHICH FORM MATERIAL SHALL BE REMOVED,
IF NECESSARY, TO CREATE FLANGES CONTINUOUS THE LENGTH OF THE LINTEL. FLANGES
SHALL HAVE A MINIMUM THICKNESS OF 2.5 IN. AND A MINIMUM WIDTH OF 5 IN. SEE NOTE a
TO TABLES R608.8(8) AND R608.8(10).

For SI: 1 inch = 25.4 mm.

FIGURE 608.8(4)
LINTELS FOR SCREEN-GRID WALLS

TABLE 608.8(1)
LINTEL DESIGN LOADING CONDITIONS [a, b, d]

DESCRIPTION OF LOADS AND OPENINGS ABOVE INFLUENCING DESIGN OF LINTEL			DESIGN LOAD CONDITION [c]
Opening in wall of top story of two-story building, or first story of one-story building			
Wall supporting loads from roof, including attic floor, if applicable, and	Top of lintel equal to or less than W/2 below top of wall		2
	Top of lintel greater than W/2 below top of wall		NLB
Wall not supporting loads from roof or attic floor			NLB
Opening in wall of first story of two-story building where wall immediately above is of concrete construction, or opening in basement wall of one-story building where wall immediately above is of concrete construction			
LB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, and	Top of lintel greater than W/2 below bottom of opening in story above		1
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	1
		Opening is partially within the footprint of the opening in the story above	4
LB ledger board mounted to side of wall with bottom of ledger more than W/2 above top of lintel			NLB
NLB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, or no ledger board, and	Top of lintel greater than W/2 below bottom of opening in story above		NLB
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	NLB
		Opening is partially within the footprint of the opening in the story above	1
Opening in basement wall of two-story building where walls of two stories above are of concrete construction			
LB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, and	Top of lintel greater than W/2 below bottom of opening in story above		1
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	1
		Opening is partially within the footprint of the opening in the story above	5
LB ledger board mounted to side of wall with bottom of ledger more than W/2 above top of lintel			NLB
NLB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, or no ledger board, and	Top of lintel greater than W/2 below bottom of opening in story above		NLB
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	NLB
		Opening is partially within the footprint of the opening in the story above	1
Opening in wall of first story of two-story building where wall immediately above is of light-framed construction, or opening in basement wall of one-story building where wall immediately above is of light-framed construction			
Wall supporting loads from roof, second floor and top-story wall of light-framed construction, and	Top of lintel equal to or less than W/2 below top of wall		3
	Top of lintel greater than W/2 below top of wall		NLB
Wall not supporting loads from roof or second floor			NLB

a.   LB means load bearing, NLB means nonload bearing, and W means width of opening.
b.   Footprint is the area of the wall below an opening in the story above, bounded by the bottom of the opening and vertical lines extending downward from the edges of the opening.
c.   For design loading condition "NLB" see Tables 608.8(9) and 608.8(10). For all other design loading conditions, see Tables 608.8(2) through 608.8(8).
d.   An NLB ledger board is a ledger attached to a wall that is parallel to the span of the floor, roof or ceiling framing that supports the edge of the floor, ceiling or roof.

TABLE 608.8(2)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
4-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, m]
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
8	Span without stirrups [i, j]		3-2	3-4	2-4	2-6	2-2	2-1	2-0	2-0	2-0
	1-#4	40,000	5-2	5-5	4-1	4-3	3-10	3-7	3-4	2-9	2-9
		60,000	6-2	6-5	4-11	5-1	4-6	4-2	3-8	2-11	2-10
	1-#5	40,000	6-3	6-7	5-0	5-2	4-6	4-2	3-8	2-11	2-10
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		1-1	1-2	0-8	0-9	0-7	0-6	0-5	0-4	0-4
12	Span without stirrups [i, j]		3-4	3-7	2-9	2-11	2-8	2-6	2-5	2-2	2-2
	1-#4	40,000	6-7	7-0	5-4	5-7	5-0	4-9	4-4	3-8	3-7
		60,000	7-11	8-6	6-6	6-9	6-0	5-9	5-3	4-5	4-4
	1-#5	40,000	8-1	8-8	6-7	6-10	6-2	5-10	5-4	4-6	4-5
		60,000	9-8	10-4	7-11	8-2	7-4	6-11	6-2	4-10	4-8
	2-#4 1-#6	40,000	9-1	9-8	7-4	7-8	6-10	6-6	6-0	4-10	4-8
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		1-8	1-11	1-1	1-3	1-0	0-11	0-9	0-6	0-6
16	Span without stirrups [i, j]		4-7	5-0	3-11	4-0	3-8	3-7	3-4	3-1	3-0
	1-#4	40,000	6-8	7-3	5-6	5-9	5-2	4-11	4-6	3-10	3-8
		60,000	9-3	10-1	7-9	8-0	7-2	6-10	6-3	5-4	5-2
	1-#4	40,000	9-6	10-4	7-10	8-2	7-4	6-11	6-5	5-5	5-3
		60,000	11-5	12-5	9-6	9-10	8-10	8-4	7-9	6-6	6-4
	2-#4 1-#6	40,000	10-7	11-7	8-10	9-2	8-3	7-9	7-2	6-1	5-11
		60,000	12-9	13-10	10-7	11-0	9-10	9-4	8-7	6-9	6-6
	2-#5	40,000	13-0	14-1	10-9	11-2	9-11	9-2	8-2	6-6	6-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		2-3	2-8	1-7	1-8	1-4	1-3	1-0	0-9	0-8
20	Span without stirrups A [i, j]		5-9	6-5	5-0	5-2	4-9	4-7	4-4	3-11	3-11
	1-#4	40,000	7-5	8-2	6-3	6-6	5-10	5-7	5-1	4-4	4-2
		60,000	9-0	10-0	7-8	7-11	7-1	6-9	6-3	5-3	5-1
	1-#5	40,000	9-2	10-2	7-9	8-1	7-3	6-11	6-4	5-4	5-2
		60,000	12-9	14-2	10-10	11-3	10-1	9-7	8-10	7-5	7-3
	2-#4 1-#6	40,000	11-10	13-2	10-1	10-5	9-4	8-11	8-2	6-11	6-9
		60,000	14-4	15-10	12-1	12-7	11-3	10-9	9-11	8-4	8-1
	2-#5	40,000	14-7	16-2	12-4	12-9	11-4	10-6	9-5	7-7	7-3

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
		60,000	17-5	19-2	14-9	15-3	13-5	12-4	11-0	8-8	8-4
	2-#6	40,000	16-4	18-11	12-7	13-3	11-4	10-6	9-5	7-7	7-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		2-9	3-5	2-0	2-2	1-9	1-7	1-4	0-11	0-11
24	Span without stirrups [i, j]		6-11	7-9	6-1	6-3	5-9	5-7	5-3	4-9	4-8
	1-#4	40,000	8-0	9-0	6-11	7-2	6-5	6-2	5-8	4-9	4-8
		60,000	9-9	11-0	8-5	8-9	7-10	7-6	6-11	5-10	5-8
	1-#5	40,000	10-0	11-3	8-7	8-11	8-0	7-7	7-0	5-11	5-9
		60,000	13-11	15-8	12-0	12-5	11-2	10-7	9-10	8-3	8-0
	2-#4 1-#6	40,000	12-11	14-6	11-2	11-6	10-5	9-10	9-1	7-8	7-5
		60,000	15-7	17-7	13-6	13-11	12-7	11-11	11-0	9-3	9-0
	2-#5	40,000	15-11	17-11	13-7	14-3	12-8	11-9	10-8	8-7	8-4
		60,000	19-1	21-6	16-5	17-1	15-1	14-0	12-6	9-11	9-7
	2-#6	40,000	17-7	21-1	14-1	14-10	12-8	11-9	10-8	8-7	8-4
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		3-3	4-1	2-5	2-7	2-1	1-11	1-7	1-2	1-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

a.   See Table 608.3 for tolerances permitted from nominal thickness.
b.   Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
c.   Table values are based on uniform loading. See Section 608.8.2 for lintels supporting concentrated loads.
d.   Deflection criterion is L/240, where L is the clear span of the lintel in inches, or $^1/_2$ -inch, whichever is less.
e.   Linear interpolation is permitted between ground snow loads and between lintel depths.
f.   DR indicates design required.
g.   Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
h.   Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
i.   Allowable clear span without stirrups applicable to all lintels of the same depth, D. Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
j.   Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
k.   Center distance, A, is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
l.   Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A, shall be permitted to be multiplied by 1.10.
m.   The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(3)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
6-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, m]
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	**2**		**3**		**4**		**5**	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
8	Span without stirrups [i, j]		4-2	4-8	3-1	3-3	2-10	2-6	2-3	2-0	2-0
	1-#4	40,000	5-1	5-5	4-2	4-3	3-10	3-6	3-3	2-8	2-7
		60,000	6-2	6-7	5-0	5-2	4-8	4-2	3-11	3-3	3-2
	1-#5	40,000	6-3	6-8	5-1	5-3	4-9	4-3	4-0	3-3	3-2
		60,000	7-6	8-0	6-1	6-4	5-8	5-1	4-9	3-8	3-6
	2-#4 1-#6	40,000	7-0	7-6	5-8	5-11	5-3	4-9	4-5	3-8	3-6
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		1-7	1-10	1-1	1-2	0-11	0-9	0-8	0-5	0-5
12	Span without stirrups [i, j]		4-2	4-8	3-5	3-6	3-2	2-11	2-9	2-5	2-4
	1-#4	40,000	5-7	6-1	4-8	4-10	4-4	3-11	3-8	3-0	2-11
		60,000	7-9	8-6	6-6	6-9	6-1	5-6	5-1	4-3	4-1
	1-#5	40,000	7-11	8-8	6-8	6-11	6-2	5-7	5-2	4-4	4-2
		60,000	9-7	10-6	8-0	8-4	7-6	6-9	6-3	5-2	5-1
	2-#4 1-#6	40,000	8-11	9-9	7-6	7-9	6-11	6-3	5-10	4-10	4-8
		60,000	10-8	11-9	8-12	9-4	8-4	7-6	7-0	5-10	5-8
	2-#5	40,000	10-11	12-0	9-2	9-6	8-6	7-8	7-2	5-6	5-3
		60,000	12-11	14-3	10-10	11-3	10-1	9-0	8-1	6-1	5-10
	2-#6	40,000	12-9	14-0	10-8	11-1	9-7	8-1	7-3	5-6	5-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		2-6	3-0	1-9	1-10	1-6	1-3	1-1	0-9	0-8
16	Span without stirrups [i, j]		5-7	6-5	4-9	4-11	4-5	4-0	3-10	3-4	3-4
	1-#4	40,000	6-5	7-2	5-6	5-9	5-2	4-8	4-4	3-7	3-6
		60,000	7-10	8-9	6-9	7-0	6-3	5-8	5-3	4-4	4-3
	1-#5	40,000	7-11	8-11	6-10	7-1	6-5	5-9	5-4	4-5	4-4
		60,000	11-1	12-6	9-7	9-11	8-11	8-0	7-6	6-2	6-0
	2-#4 1-#6	40,000	10-3	11-7	8-10	9-2	8-3	7-6	6-11	5-9	5-7
		60,000	12-5	14-0	10-9	11-1	10-0	9-0	8-5	7-0	6-9
	2-#5	40,000	12-8	14-3	10-11	11-4	10-2	9-2	8-7	6-9	6-6
		60,000	15-2	17-1	13-1	13-7	12-3	11-0	10-3	7-11	7-7
	2-#6	40,000	14-11	16-9	12-8	13-4	11-4	9-8	8-8	6-9	6-6
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	**2**		**3**		**4**		**5**	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
	Center distance A [k, l]		3-3	4-1	2-5	2-7	2-1	1-9	1-6	1-0	1-0
20	Span without stirrups [i, j]		6-11	8-2	6-1	6-3	5-8	5-2	4-11	4-4	4-3
	1-#5	40,000	8-9	10-1	7-9	8-0	7-3	6-6	6-1	5-1	4-11
		60,000	10-8	12-3	9-5	9-9	8-10	8-0	7-5	6-2	6-0
	2-#4 1-#6	40,000	9-11	11-4	8-9	9-1	8-2	7-4	6-10	5-8	5-7
		60,000	13-9	15-10	12-2	12-8	11-5	10-3	9-7	7-11	7-9
	2-#5	40,000	14-0	16-2	12-5	12-11	11-7	10-6	9-9	7-11	7-8
		60,000	16-11	19-6	15-0	15-6	14-0	12-7	11-9	9-1	8-9
	2-#6	40,000	16-7	19-1	14-7	15-3	13-1	11-3	10-2	7-11	7-8
		60,000	19-11	22-10	17-4	18-3	15-6	13-2	11-10	9-1	8-9
	Center distance A [k, l]		3-11	5-2	3-1	3-3	2-8	2-2	1-11	1-4	1-3
24	Span without stirrups [i, j]		8-2	9-10	7-4	7-8	6-11	6-4	5-11	5-3	5-2
	1-#5	40,000	9-5	11-1	8-7	8-10	8-0	7-3	6-9	5-7	5-5
		60,000	11-6	13-6	10-5	10-9	9-9	8-9	8-2	6-10	6-8
	2-#4 1-#6	40,000	10-8	12-6	9-8	10-0	9-0	8-2	7-7	6-4	6-2
		60,000	12-11	15-2	11-9	12-2	11-0	9-11	9-3	7-8	7-6
	2-#5	40,000	15-2	17-9	13-9	14-3	12-10	11-7	10-10	9-0	8-9
		60,000	18-4	21-6	16-7	17-3	15-6	14-0	13-1	10-4	10-0
	2-#6	40,000	18-0	21-1	16-4	16-11	14-10	12-9	11-8	9-2	8-11
		60,000	21-7	25-4	19-2	20-4	17-2	14-9	13-4	10-4	10-0
	Center distance A [k, l]		4-6	6-2	3-8	4-0	3-3	2-8	2-3	1-7	1-6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

a. See Table 608.3 for tolerances permitted from nominal thickness.
b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
c. Table values are based on uniform loading. See Section 608.8.2 for lintels supporting concentrated loads.
d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ -inch, whichever is less.
e. Linear interpolation is permitted between ground snow loads and between lintel depths.
f. DR indicates design required.
g. Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
i. Allowable clear span without stirrups applicable to all lintels of the same depth, D. Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
k. Center distance, A, is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A, shall be permitted to be

multiplied by 1.10.

m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(4)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
8-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, m]
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
8	Span without stirrups [i, j]		4-4	4-9	3-7	3-9	3-4	2-10	2-7	2-1	2-0
	1-#4	40,000	4-4	4-9	3-7	3-9	3-4	2-11	2-9	2-3	2-2
		60,000	6-1	6-7	5-0	5-3	4-8	4-0	3-9	3-1	3-0
	1-#5	40,000	6-2	6-9	5-2	5-4	4-9	4-1	3-10	3-2	3-1
		60,000	7-5	8-1	6-2	6-5	5-9	4-11	4-7	3-9	3-8
	2-#4 1-#6	40,000	6-11	7-6	5-9	6-0	5-4	4-7	4-4	3-6	3-5
		60,000	8-3	9-0	6-11	7-2	6-5	5-6	5-2	4-2	4-1
	2-#5	40,000	8-5	9-2	7-0	7-3	6-6	5-7	5-3	4-2	4-0
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		2-1	2-6	1-5	1-6	1-3	0-11	0-10	0-6	0-6
12	Span without stirrups [i, j]		4-10	5-8	4-0	4-2	3-9	3-2	3-0	2-7	2-6
	1-#4	40,000	5-5	6-1	4-8	4-10	4-4	3-9	3-6	2-10	2-10
		60,000	6-7	7-5	5-8	5-11	5-4	4-7	4-3	3-6	3-5
	1-#5	40,000	6-9	7-7	5-9	6-0	5-5	4-8	4-4	3-7	3-6
		60,000	9-4	10-6	8-1	8-4	7-6	6-6	6-1	5-0	4-10
	2-#4 1-#6	40,000	8-8	9-9	7-6	7-9	7-0	6-0	5-8	4-7	4-6
		60,000	10-6	11-9	9-1	9-5	8-5	7-3	6-10	5-7	5-5
	2-#5	40,000	10-8	12-0	9-3	9-7	8-7	7-5	6-11	5-6	5-4
		60,000	12-10	14-5	11-1	11-6	10-4	8-11	8-4	6-7	6-4
	2-#6	40,000	12-7	14-2	10-10	11-3	10-2	8-3	7-6	5-6	5-4
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [k, l]		3-2	4-0	2-4	2-6	2-0	1-6	1-4	0-11	0-10
16	Span without stirrups [i, j]		6-5	7-9	5-7	5-10	5-2	4-5	4-2	3-7	3-6
	1-#4	40,000	6-2	7-1	5-6	5-8	5-1	4-5	4-2	3-5	3-4
		60,000	7-6	8-8	6-8	6-11	6-3	5-5	5-1	4-2	4-0
	1-#5	40,000	7-8	8-10	6-10	7-1	6-4	5-6	5-2	4-3	4-1
		60,000	9-4	10-9	8-4	8-7	7-9	6-8	6-3	5-2	5-0
	2-#4 1-#6	40,000	8-8	10-0	7-8	8-0	7-2	6-2	5-10	4-9	4-8
		60,000	12-0	13-11	10-9	11-2	10-0	8-8	8-1	6-8	6-6

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_v (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	**2**		**3**		**4**		**5**	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
	2-#5	40,000	12-3	14-2	11-0	11-4	10-3	8-10	8-3	6-9	6-7
		60,000	14-10	17-2	13-3	13-8	12-4	10-8	10-0	7-11	7-8
	2-#6	40,000	14-6	16-10	13-0	13-5	12-1	10-1	9-2	6-11	6-8
		60,000	17-5	20-2	15-7	16-1	14-6	11-10	10-8	7-11	7-8
	Center distance A [k, l]		4-1	5-5	3-3	3-6	2-10	2-1	1-10	1-3	1-2
20	Span without stirrups [i, j]		7-10	9-10	7-1	7-5	6-7	5-8	5-4	4-7	4-6
	1-#5	40,000	8-4	9-11	7-8	8-0	7-2	6-3	5-10	4-9	4-8
		60,000	10-2	12-1	9-5	9-9	8-9	7-7	7-1	5-10	5-8
	2-#4 1-#6	40,000	9-5	11-3	8-8	9-0	8-1	7-0	6-7	5-5	5-3
		60,000	11-6	13-8	10-7	11-0	9-11	8-7	8-0	6-7	6-5
	2-#5	40,000	11-9	13-11	10-10	11-2	10-1	8-9	8-2	6-8	6-7
		60,000	16-4	19-5	15-0	15-7	14-0	12-2	11-4	9-3	9-0
	2-#6	40,000	16-0	19-0	14-9	15-3	13-9	11-10	10-10	8-3	8-0
		60,000	19-3	22-11	17-9	18-5	16-7	13-7	12-4	9-3	9-0
	Center distance A [k, l]		4-10	6-10	4-1	4-5	3-7	2-8	2-4	1-7	1-6
24	Span without stirrups [i, j]		9-2	11-9	8-7	8-11	8-0	6-11	6-6	5-7	5-6
	1-#5	40,000	8-11	10-10	8-6	8-9	7-11	6-10	6-5	5-3	5-2
		60,000	10-11	13-3	10-4	10-8	9-8	8-4	7-10	6-5	6-3
	2-#4 1-#6	40,000	10-1	12-3	9-7	9-11	8-11	7-9	7-3	6-0	5-10
		60,000	12-3	15-0	11-8	12-1	10-11	9-5	8-10	7-3	7-1
	2-#5	40,000	12-6	15-3	11-11	12-4	11-1	9-7	9-0	7-5	7-3
		60,000	17-6	21-3	16-7	17-2	15-6	13-5	12-7	10-4	10-1
	2-#6	40,000	17-2	20-11	16-3	16-10	15-3	13-2	12-4	9-7	9-4
		60,000	20-9	25-3	19-8	20-4	18-5	15-4	14-0	10-7	10-3
	Center distance A [k, l]		5-6	8-1	4-11	5-3	4-4	3-3	2-10	1-11	1-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa; Grade 60 = 420 MPa.

Note: Top and bottom reinforcement for lintels without stirrups, as shown in shaded cells, shall be equal to or greater than that required for lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups.

a. See Table 608.3 for tolerances permitted from nominal thickness.
b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
c. Table values are based on uniform loading. See Section 608.8.2 for lintels supporting concentrated loads.
d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$-inch, whichever is less.
e. Linear interpolation is permitted between ground snow loads and between lintel depths.
f. DR indicates design required.
g. Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
i. Allowable clear span without stirrups applicable to all lintels of the same depth, D. Top and bottom reinforcement for lintels without

stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than *d/2*.

j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.

k. Center distance, *A*, is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.

l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, *A*, shall be permitted to be multiplied by 1.10.

m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(5)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
10-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, m]
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, *D* [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
8	Span without stirrups [i, j]		6-0	7-2	4-7	4-10	4-1	3-1	2-11	2-3	2-2
	1-#4	40,000	4-3	4-9	3-7	3-9	3-4	2-9	2-7	2-1	2-1
		60,000	5-11	6-7	5-0	5-3	4-8	3-10	3-8	2-11	2-11
	1-#5	40,000	6-1	6-9	5-2	5-4	4-9	3-11	3-9	3-0	2-11
		60,000	7-4	8-1	6-3	6-5	5-9	4-9	4-6	3-7	3-7
	2-#4 1-#6	40,000	6-10	7-6	5-9	6-0	5-5	4-5	4-2	3-4	3-4
		60,000	8-2	9-1	6-11	7-2	6-6	5-4	5-0	4-1	4-0
	2-#5	40,000	8-4	9-3	7-1	7-4	6-7	5-5	5-1	4-1	4-0
		60,000	9-11	11-0	8-5	8-9	7-10	6-6	6-1	4-8	4-6
	2-#6	40,000	9-9	10-10	8-3	8-7	7-9	6-4	5-10	4-1	4-0
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance *A* [k, l]		2-6	3-1	1-10	1-11	1-7	1-1	0-11	0-7	0-7
12	Span without stirrups [i, j]		5-5	6-7	4-7	4-10	4-3	3-5	3-3	2-8	2-8
	1-#4	40,000	5-3	6-0	4-8	4-10	4-4	3-7	3-4	2-9	2-8
		60,000	6-5	7-4	5-8	5-10	5-3	4-4	4-1	3-4	3-3
	1-#5	40,000	6-6	7-6	5-9	6-0	5-5	4-5	4-2	3-5	3-4
		60,000	7-11	9-1	7-0	7-3	6-7	5-5	5-1	4-2	4-0
	2-#4 1-#6	40,000	7-4	8-5	6-6	6-9	6-1	5-0	4-9	3-10	3-9
		60,000	10-3	11-9	9-1	9-5	8-6	7-0	6-7	5-4	5-3
	2-#5	40,000	10-5	12-0	9-3	9-7	8-8	7-2	6-9	5-5	5-4
		60,000	12-7	14-5	11-2	11-6	10-5	8-7	8-1	6-6	6-4
	2-#6	40,000	12-4	14-2	10-11	11-4	10-2	8-5	7-8	5-7	5-5
		60,000	14-9	17-0	13-1	13-6	12-2	10-0	9-1	6-6	6-4

	Center distance $A^{k,l}$		3-9	4-11	2-11	3-2	2-7	1-9	1-7	1-0	1-0
16	Span without stirrups[i,j]		7-1	9-0	6-4	6-8	5-10	4-9	4-6	3-9	3-8
	1-#4	40,000	5-11	7-0	5-5	5-8	5-1	4-3	4-0	3-3	3-2
		60,000	7-3	8-7	6-8	6-11	6-3	5-2	4-10	3-11	3-10
	1-#5	40,000	7-4	8-9	6-9	7-0	6-4	5-3	4-11	4-0	3-11
		60,000	9-0	10-8	8-3	8-7	7-9	6-5	6-0	4-11	4-9
	2-#4 1-#6	40,000	8-4	9-11	7-8	7-11	7-2	5-11	5-7	4-6	4-5
		60,000	10-2	12-0	9-4	9-8	8-9	7-3	6-10	5-6	5-5
	2-#5	40,000	10-4	12-3	9-6	9-10	8-11	7-4	6-11	5-8	5-6
		60,000	14-4	17-1	13-3	13-8	12-4	10-3	9-8	7-10	7-8
	2-#6	40,000	14-1	16-9	13-0	13-5	12-2	10-1	9-6	7-0	6-10
		60,000	17-0	20-2	15-8	16-2	14-7	12-0	10-11	8-0	7-9
	Center distance $A^{k,l}$		4-9	6-8	4-0	4-4	3-6	2-5	2-2	1-5	1-4
20	Span without stirrups[i,j]		8-7	11-4	8-1	8-5	7-5	6-1	5-9	4-10	4-9
	1-#4	40,000	6-5	7-10	6-2	6-4	5-9	4-9	4-6	3-8	3-7
		60,000	7-10	9-7	7-6	7-9	7-0	5-10	5-6	4-5	4-4
	1-#5	40,000	8-0	9-9	7-8	7-11	7-2	5-11	5-7	4-6	4-5
		60,000	9-9	11-11	9-4	9-8	8-9	7-3	6-10	5-6	5-5
	2-#4 1-#6	40,000	9-0	11-1	8-8	8-11	8-1	6-9	6-4	5-2	5-0
		60,000	11-0	13-6	10-6	10-11	9-10	8-2	7-9	6-3	6-2
	2-#5	40,000	11-3	13-9	10-9	11-1	10-0	8-4	7-10	6-5	6-3
		60,000	15-8	19-2	15-0	15-6	14-0	11-8	11-0	8-11	8-9
	2-#6	40,000	15-5	18-10	14-8	15-2	13-9	11-5	10-9	8-6	8-3
		60,000	18-7	22-9	17-9	18-5	16-7	13-10	12-9	9-5	9-2
	Center distance $A^{k,l}$		5-7	8-4	5-1	5-5	4-5	3-1	2-9	1-10	1-9
24	Span without stirrups[i,j]		9-11	13-7	9-9	10-2	9-0	7-5	7-0	5-10	5-9
	1-#5	40,000	8-6	10-8	8-5	8-8	7-10	6-6	6-2	5-0	4-11
		60,000	10-5	13-0	10-3	10-7	9-7	8-0	7-6	6-1	6-0
	2-#4 1-#6	40,000	9-7	12-1	9-6	9-9	8-10	7-5	7-0	5-8	5-6
		60,000	11-9	14-9	11-7	11-11	10-10	9-0	8-6	6-11	6-9
	2-#5	40,000	12-0	15-0	11-9	12-2	11-0	9-2	8-8	7-1	6-11
		60,000	14-7	18-3	14-4	14-10	13-5	11-2	10-7	8-7	8-5
	2-#6	40,000	14-3	17-11	14-1	14-7	13-2	11-0	10-4	8-5	8-3
		60,000	19-11	25-0	19-7	20-3	18-4	15-3	14-5	10-10	10-7
	Center distance $A^{k,l}$		6-3	9-11	6-1	6-6	5-4	3-9	3-4	2-2	2-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

Note: Top and bottom reinforcement for lintels without stirrups, as shown in shaded cells, shall be equal to or greater than that required for lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups.

a. See Table 608.3 for tolerances permitted from nominal thickness.

b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.

c. Table values are based on uniform loading. See Section 608.8.2 for lintels supporting concentrated loads.

d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $^1/_2$ inch, whichever is less.

e. Linear interpolation is permitted between ground snow loads and between lintel depths.

f. DR indicates design required.

g. Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.

i. Allowable clear span without stirrups applicable to all lintels of the same depth, D. Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.

j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.

k. Center distance, A, is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.

l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A, shall be permitted to be multiplied by 1.10.

m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(6)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
6-INCH-THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, o]
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR SPAN 32 FEET

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
8 [i]	Span without stirrups [k, l]		2-7	2-9	2-0	2-1	2-0	2-0	2-0	2-0	2-0
	1-#4	40,000	5-2	5-5	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	1-#5	40,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	2-#4 1-#6	40,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A [m, n]		0-9	0-10	0-6	0-6	0-5	0-5	0-4	STL	STL
12 [i]	Span without stirrups [k, l]		2-11	3-1	2-6	2-7	2-5	2-4	2-3	2-1	2-0
	1-#4	40,000	5-9	6-2	4-8	4-10	4-4	4-1	3-9	3-2	3-1
		60,000	8-0	8-7	6-6	6-9	6-0	5-5	4-11	3-11	3-10
	1-#5	40,000	8-1	8-9	6-8	6-11	6-0	5-5	4-11	3-11	3-10
		60,000	9-1	10-3	6-8	7-0	6-0	5-5	4-11	3-11	3-10
	2-#4 1-#6	40,000	9-1	9-9	6-8	7-0	6-0	5-5	4-11	3-11	3-10
	Center distance A [m, n]		1-3	1-5	0-10	0-11	0-9	0-8	0-6	STL	STL
	Span without stirrups [k, l]		4-0	4-4	3-6	3-7	3-4	3-3	3-1	2-10	2-10

LINTEL DEPTH, D[g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH[h], f_v (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	**2**		**3**		**4**		**5**	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
16[i]	1-#4	40,000	6-7	7-3	5-6	5-9	5-2	4-10	4-6	3-9	3-8
		60,000	8-0	8-10	6-9	7-0	6-3	5-11	5-5	4-7	4-5
	1-#5	40,000	8-2	9-0	6-11	7-2	6-5	6-0	5-7	4-8	4-6
		60,000	11-5	12-6	9-3	9-9	8-4	7-7	6-10	5-6	5-4
	2-#4 1-#6	40,000	10-7	11-7	8-11	9-3	8-3	7-7	6-10	5-6	5-4
		60,000	12-2	14-0	9-3	9-9	8-4	7-7	6-10	5-6	5-4
	2-#5	40,000	12-2	14-2	9-3	9-9	8-4	7-7	6-10	5-6	5-4
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A[m, n]		1-8	2-0	1-2	1-3	1-0	0-11	0-9	STL	STL
20[i]	Span without stirrups[k, l]		5-0	5-6	4-6	4-7	4-3	4-1	4-0	3-8	3-8
	1-#4	40,000	7-2	8-2	6-3	6-6	5-10	5-6	5-1	4-3	4-2
		60,000	8-11	9-11	7-8	7-11	7-1	6-8	6-2	5-2	5-0
	1-#5	40,000	9-1	10-2	7-9	8-1	7-3	6-10	6-4	5-4	5-2
		60,000	12-8	14-2	10-11	11-3	10-2	9-6	8-9	7-1	6-10
	2-#4 1-#6	40,000	10-3	11-5	8-9	9-1	8-2	7-8	7-1	6-0	5-10
		60,000	14-3	15-11	11-9	12-5	10-8	9-9	8-9	7-1	6-10
	2-#5	40,000	14-6	16-3	11-6	12-1	10-4	9-6	8-6	6-11	6-8
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A[m, n]		2-0	2-6	1-6	1-7	1-3	1-1	1-0	STL	STL
24w[j]	Span without stirrups[k, l]		6-0	6-8	5-5	5-7	5-3	5-0	4-10	4-6	4-5
	1-#4	40,000	7-11	9-0	6-11	7-2	6-5	6-0	5-7	4-8	4-7
		60,000	9-8	10-11	8-5	8-9	7-10	7-4	6-10	5-9	5-7
	1-#5	40,000	9-10	11-2	8-7	8-11	8-0	7-6	7-0	5-10	5-8
		60,000	12-0	13-7	10-6	10-10	9-9	9-2	8-6	7-2	6-11
	2-#4 1-#6	40,000	11-1	12-7	9-8	10-1	9-1	8-6	7-10	6-7	6-5
		60,000	15-6	17-7	13-6	14-0	12-8	11-10	10-8	8-7	8-4
	2-#5	40,000	15-6	17-11	12-8	13-4	11-6	10-7	9-7	7-10	7-7
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A[m, n]		2-4	3-0	1-9	1-11	1-6	1-4	1-2	STL	STL

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch-nominal waffle-grid forms and not less than 7 inches in width for 8-inch-nominal waffle-grid forms. See Figure 608.8(3). Flat form lintels shall be permitted in place of waffle-grid lintels. See Tables 608.8(2) through 608.8(5).

b. See Table 608.3 for tolerances permitted from nominal thicknesses and minimum dimensions and spacing of cores.

c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes l and n. Table values are based on uniform loading. See Section 608.8.2 for lintels supporting concentrated loads.

d. Deflection criterion is L/240, where L is the clear span of the lintel in inches, or $^1/_2$ -inch, whichever is less.
e. Linear interpolation is permitted between ground snow loads.
f. DR indicates design required. STL indicates stirrups required throughout lintel.
g. Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
i. Lintels less than 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables 608.8(2) through 608.8(5)], or, if necessary, form material shall be removed from waffle-grid forms so as to provide the required cover for stirrups. Allowable spans for lintels formed with flat-wall forms shall be determined from Tables 608.8(2) through 608.8(5).
j. Where stirrups are required for 24-inch-deep lintels, the spacing shall not exceed 12 inches on center.
k. Allowable clear span without stirrups applicable to all lintels of the same depth, D. Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
m. Center distance, A, is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
n. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A, shall be permitted to be multiplied by 1.10.
o. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(7)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
8-INCH-THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, o]
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH[h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
8[i]	Span without stirrups[k, l]		2-6	2-9	2-0	2-1	2-0	2-0	2-0	2-0	2-0
	1-#4	40,000	4-5	4-9	3-7	3-9	3-4	3-0	2-10	2-3	2-2
		60,000	5-6	6-2	4-0	4-3	3-7	3-1	2-10	2-3	2-2
	1-#5	40,000	5-6	6-2	4-0	4-3	3-7	3-1	2-10	2-3	2-2
	Center distance A[m, n]		0-9	0-10	0-6	0-6	0-5	0-4	0-4	STL	STL
12[i]	Span without stirrups[k, l]		2-10	3-1	2-6	2-7	2-5	2-3	2-2	2-0	2-0
	1-#4	40,000	5-7	6-1	4-8	4-10	4-4	3-11	3-8	3-0	2-11
		60,000	6-9	7-5	5-8	5-11	5-4	4-9	4-5	3-8	3-7
	1-#5	40,000	6-11	7-7	5-10	6-0	5-5	4-10	4-6	3-9	3-7
		60,000	8-8	10-1	6-7	7-0	5-11	5-2	4-8	3-9	3-7
	2-#4 1-#6	40,000	8-8	9-10	6-7	7-0	5-11	5-2	4-8	3-9	3-7
		60,000	8-8	10-1	6-7	7-0	5-11	5-2	4-8	3-9	3-7
	Center distance A[m, n]		1-2	1-5	0-10	0-11	0-9	0-7	0-6	STL	STL
	Span without stirrups[k, l]		3-10	4-3	3-6	3-7	3-4	3-2	3-0	2-10	2-9

LINTEL DEPTH, D [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH[h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
16[i]	1-#4	40,000	6-5	7-2	5-6	5-9	5-2	4-8	4-4	3-7	3-6
		60,000	7-9	8-9	6-9	7-0	6-3	5-8	5-3	4-4	4-3
	1-#5	40,000	7-11	8-11	6-10	7-1	6-5	5-9	5-4	4-5	4-4
		60,000	9-8	10-11	8-4	8-8	7-10	7-0	6-6	5-2	5-1
	2-#4 1-#6	40,000	9-0	10-1	7-9	8-0	7-3	6-6	6-1	5-0	4-11
		60,000	11-5	13-10	9-2	9-8	8-3	7-2	6-6	5-2	5-1
	Center distance A[m, n]		1-6	1-11	1-2	1-3	1-0	0-10	0-8	STL	STL
20[i]	Span without stirrups[k, l]		4-10	5-5	4-5	4-7	4-3	4-0	3-11	3-7	3-7
	1-#4	40,000	7-0	8-1	6-3	6-5	5-10	5-3	4-11	4-1	3-11
		60,000	8-7	9-10	7-7	7-10	7-1	6-5	6-0	4-11	4-10
	1-#5	40,000	8-9	10-1	7-9	8-0	7-3	6-6	6-1	5-1	4-11
		60,000	10-8	12-3	9-6	9-10	8-10	8-0	7-5	6-2	6-0
	2-#4 1-#6	40,000	9-10	11-4	8-9	9-1	8-2	7-4	6-10	5-8	5-7
		60,000	12-0	13-10	10-8	11-0	9-11	9-0	8-4	6-8	6-6
	2-#5	40,000	12-3	14-1	10-10	11-3	10-2	8-11	8-1	6-6	6-4
		60,000	14-0	17-6	11-8	12-3	10-6	9-1	8-4	6-8	6-6
	Center distance A[m, n]		1-10	2-5	1-5	1-7	1-3	1-0	0-11	STL	STL
24[j]	Span without stirrups[k, l]		5-9	6-7	5-5	5-6	5-2	4-11	4-9	4-5	4-4
	1-#4	40,000	7-6	8-10	6-10	7-1	6-5	5-9	5-5	4-6	4-4
		60,000	9-2	10-9	8-4	8-8	7-10	7-1	6-7	5-6	5-4
	1-#5	40,000	9-5	11-0	8-6	8-10	8-0	7-2	6-8	5-7	5-5
		60,000	11-5	13-5	10-5	10-9	9-9	8-9	8-2	6-10	6-8
	2-#4 1-#6	40,000	10-7	12-5	9-8	10-0	9-0	8-1	7-7	6-3	6-2
		60,000	12-11	15-2	11-9	12-2	11-0	9-11	9-3	7-8	7-6
	2-#5	40,000	13-2	15-6	12-0	12-5	11-2	9-11	9-2	7-5	7-3
		60,000	16-3	21-0	14-1	14-10	12-9	11-1	10-1	8-1	7-11
	2-#6	40,000	14-4	18-5	12-6	13-2	11-5	9-11	9-2	7-5	7-3
	Center distance A[m, n]		2-1	2-11	1-9	1-10	1-6	1-3	1-1	STL	STL

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch-nominal waffle-grid forms and not less than 7 inches in width for 8-inch-nominal waffle-grid forms. See Figure 608.8(3). Flat-form lintels shall be permitted in lieu of waffle-grid lintels. See Tables 608.8(2) through 608.8(5).

b. See Table 608.3 for tolerances permitted from nominal thicknesses and minimum dimensions and spacing of cores.

c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes l and n. Table values are based on uniform loading. See Section 608.8.2 for lintels supporting concentrated loads.

d. Deflection criterion is L/240, where L is the clear span of the lintel in inches, or $^1/_2$-inch, whichever is less.

e. Linear interpolation is permitted between ground snow loads.

f. STL indicates stirrups required throughout lintel.

g. Lintel depth, *D*, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.

i. Lintels less than 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables 608.8(2) through 608.8(5)], or, if necessary, form material shall be removed from waffle-grid forms so as to provide the required cover for stirrups. Allowable spans for lintels formed with flat-wall forms shall be determined from Tables 608.8(2) through 608.8(5).

j. Where stirrups are required for 24-inch-deep lintels, the spacing shall not exceed 12 inches on center.

k. Allowable clear span without stirrups applicable to all lintels of the same depth, *D*. Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than *d/2*.

l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.

m. Center distance, *A*, is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.

n. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, *A*, shall be permitted to be multiplied by 1.10.

o. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(8)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
6-INCH-THICK SCREEN-GRID LINTELS IN LOAD-BEARING WALLS [a, b, c, d, e, f, p]
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, *D* [g] (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH [h], f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet - inches)								
12 [i,j]	Span without stirrups		2-9	2-11	2-4	2-5	2-3	2-3	2-2	2-0	2-0
16 [i,j]	Span without stirrups		3-9	4-0	3-4	3-5	3-2	3-1	3-0	2-9	2-9
20 [i,j]	Span without stirrups		4-9	5-1	4-3	4-4	4-1	4-0	3-10	3-7	3-7
24 [k]	Span without stirrups [l, m]		5-8	6-3	5-2	5-3	5-0	4-10	4-8	4-4	4-4
	1-#4	40,000	7-11	9-0	6-11	7-2	6-5	6-1	5-8	4-9	4-7
		60,000	9-9	11-0	8-5	8-9	7-10	7-5	6-10	5-9	5-7
	1-#5	40,000	9-11	11-2	8-7	8-11	8-0	7-7	7-0	5-11	5-9
		60,000	12-1	13-8	10-6	10-10	9-9	9-3	8-6	7-2	7-0
	2-#4 1-#6	40,000	11-2	12-8	9-9	10-1	9-1	8-7	7-11	6-8	6-6
		60,000	15-7	17-7	12-8	13-4	11-6	10-8	9-8	7-11	7-8
	2-#5	40,000	14-11	18-0	12-2	12-10	11-1	10-3	9-4	7-8	7-5
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance *A* [n, o]		2-0	2-6	1-6	1-7	1-4	1-2	1-0	STL	STL

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

a. Where lintels are formed with screen-grid forms, form material shall be removed if necessary to create top and bottom flanges of the lintel that are not less than 5 inches in width and not less than 2.5 inches in depth (in the vertical direction). See Figure 608.8(4). Flat-

form lintels shall be permitted in lieu of screen-grid lintels. See Tables 608.8(2) through 608.8(5).

b. See Table 608.3 for tolerances permitted from nominal thickness and minimum dimensions and spacings of cores.

c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes m and o. Table values are based on uniform loading. See Section 608.7.2.1 for lintels supporting concentrated loads.

d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $^1/_2$ inch, whichever is less.

e. Linear interpolation is permitted between ground snow loads.

f. DR indicates design required. STL indicates stirrups required throughout lintel.

g. Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.

i. Stirrups are not required for lintels less than 24 inches in depth fabricated from screen-grid forms. Top and bottom reinforcement shall consist of a No. 4 bar having a yield strength of 40,000 psi or 60,000 psi.

j. Lintels between 12 and 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables 608.8(2) through 608.8(5)], or form material shall be removed from screen-grid forms to provide a concrete section comparable to that required for a flat wall. Allowable spans for flat lintels with stirrups shall be determined from Tables 608.8(2) through 608.8(5).

k. Where stirrups are required for 24-inch-deep lintels, the spacing shall not exceed 12 inches on center.

l. Allowable clear span without stirrups applicable to all lintels of the same depth, D. Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than 12 inches.

m. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.

n. Center distance, A, is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.

o. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A, shall be permitted to be multiplied by 1.10.

p. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 608.8(9)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
FLAT LINTELS WITHOUT STIRRUPS IN NONLOAD-BEARING WALLS [a, b, c, d, e, g]

LINTEL DEPTH, D [f] (inches)	NUMBER OF BARS AND BAR SIZE	STEEL YIELD STRENGTH, f_y (psi)	NOMINAL WALL THICKNESS (inches)							
			4		6		8		10	
			Lintel Supporting							
			Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable
			Maximum Clear Span of Lintel (feet - inches)							
8	1-#4	40,000	10-11	11-5	9-7	11-2	7-10	9-5	7-3	9-2
		60,000	12-5	11-7	10-11	13-5	9-11	13-2	9-3	12-10
	1-#5	40,000	12-7	11-7	11-1	13-8	10-1	13-5	9-4	13-1
		60,000	DR	DR	12-7	16-4	11-6	14-7	10-9	14-6
	2-#4 1-#6	40,000	DR	DR	12-0	15-3	10-11	15-0	10-2	14-8
		60,000	DR	DR	DR	DR	12-2	15-3	11-7	15-3
	2-#5	40,000	DR	DR	DR	DR	12-7	16-7	11-9	16-7
		60,000	DR	DR	DR	DR	DR	DR	13-3	16-7
	2-#6	40,000	DR	DR	DR	DR	DR	DR	13-2	17-8
		60,000	DR	DR	DR	DR	DR	DR	DR	DR

LINTEL DEPTH, D [f] (inches)	NUMBER OF BARS AND BAR SIZE	STEEL YIELD STRENGTH, f_y (psi)	NOMINAL WALL THICKNESS (inches)							
			4		6		8		10	
			Lintel Supporting							
			Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable
			Maximum Clear Span of Lintel (feet - inches)							
12	1-#4	40,000	11-5	9-10	10-6	12-0	9-6	11-6	8-9	11-1
		60,000	11-5	9-10	11-8	13-3	10-11	14-0	10-1	13-6
	1-#5	40,000	11-5	9-10	11-8	13-3	11-1	14-4	10-3	13-9
		60,000	11-5	9-10	11-8	13-3	11-10	16-0	11-9	16-9
	2-#4 1-#6	40,000	DR	DR	11-8	13-3	11-10	16-0	11-2	15-6
		60,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4
	2-#5	40,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4
		60,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4
16	1-#4	40,000	13-6	13-0	11-10	13-8	10-7	12-11	9-11	12-4
		60,000	13-6	13-0	13-8	16-7	12-4	15-9	11-5	15-0
	1-#5	40,000	13-6	13-0	13-10	17-0	12-6	16-1	11-7	15-4
		60,000	13-6	13-0	13-10	17-1	14-0	19-7	13-4	18-8
	2-#4 1-#6	40,000	13-6	13-0	13-10	17-1	13-8	18-2	12-8	17-4
		60,000	13-6	13-0	13-10	17-1	14-0	20-3	14-1	—
	2-#5	40,000	13-6	13-0	13-10	17-1	14-0	20-3	14-1	—
		60,000	DR	DR	13-10	17-1	14-0	20-3	14-1	—
20	1-#4	40,000	14-11	15-10	13-0	14-10	11-9	13-11	10-10	13-2
		60,000	15-3	15-10	14-11	18-1	13-6	17-0	12-6	16-2
	1-#5	40,000	15-3	15-10	15-2	18-6	13-9	17-5	12-8	16-6
		60,000	15-3	15-10	15-8	20-5	15-9	—	14-7	20-1
	2-#4 1-#6	40,000	15-3	15-10	15-8	20-5	14-11	—	13-10	—
		60,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—
	2-#5	40,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—
		60,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—
24	1-#4	40,000	16-1	17-1	13-11	15-10	12-7	14-9	11-8	13-10
		60,000	16-11	18-5	16-1	19-3	14-6	18-0	13-5	17-0
	1-#5	40,000	16-11	18-5	16-3	19-8	14-9	18-5	13-8	17-4
		60,000	16-11	18-5	17-4	—	17-0	—	15-8	—
	2-#4 1-#6	40,000	16-11	18-5	17-4	—	16-1	—	14-10	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-1	—
	2-#5	40,000	16-11	18-5	17-4	—	17-6	—	17-4	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-8	—

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa. DR = Design Required.

a. See Table 608.3 for tolerances permitted from nominal thickness.

b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note e.

c.   Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $^{1}/_{2}$ -inch, whichever is less.
d.   Linear interpolation between lintels depths, D, is permitted provided the two cells being used to interpolate are shaded.
e.   Where concrete with a minimum specified compressive strength of 3,000 psi is used, spans in cells that are shaded shall be permitted to be multiplied by 1.05.
f.   Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
g.   The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information purposes only.

TABLE 608.8(10)
MAXIMUM ALLOWABLE CLEAR SPANS FOR
WAFFLE-GRID AND SCREEN-GRID LINTELS
WITHOUT STIRRUPS IN NONLOAD- BEARING WALLS [c, d, e, f, g]

LINTEL DEPTH [h], D (inches)	FORM TYPE AND NOMINAL WALL THICKNESS (inches)					
	6-inch Waffle-grid [a]		8-inch Waffle-grid [a]		6-inch Screen-grid [b]	
	Lintel supporting					
	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable
	Maximum Clear Span of Lintel (feet - inches)					
8	10-3	8-8	8-8	8-3	—	—
12	9-2	7-6	7-10	7-1	8-8	6-9
16	10-11	10-0	9-4	9-3	—	—
20	12-5	12-2	10-7	11-2	—	—
24	13-9	14-2	11-10	12-11	13-0	12-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

a.   Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch waffle-grid forms and not less than 7 inches in width for 8-inch waffle-grid forms. See Figure 608.8(3). Flat-form lintels shall be permitted in lieu of waffle-grid lintels. See Tables 608.8(2) through 608.8(5).
b.   Where lintels are formed with screen-grid forms, form material shall be removed if necessary to create top and bottom flanges of the lintel that are not less than 5 inches in width and not less than 2.5 inches in depth (in the vertical direction). See Figure 608.8(4). Flat-form lintels shall be permitted in lieu of screen-grid lintels. See Tables 608.8(2) through 608.8(5).
c.   See Table 608.3 for tolerances permitted from nominal thickness and minimum dimensions and spacing of cores.
d.   Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note g.
e.   Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $^{1}/_{2}$ -inch, whichever is less.
f.   Top and bottom reinforcement shall consist of a No. 4 bar having a minimum yield strength of 40,000 psi.
g.   Where concrete with a minimum specified compressive strength of 3,000 psi is used, spans in shaded cells shall be permitted to be multiplied by 1.05.
h.   Lintel depth, D, is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

608.9 Requirements for connections–general. Concrete walls shall be connected to footings, floors, ceilings and roofs in accordance with this section.

608.9.1 Connections between concrete walls and light-framed floor, ceiling and roof systems. Connections between concrete walls and light-framed floor, ceiling and roof systems using the prescriptive details of Figures 608.9(1) through 608.9(12) shall comply with this section and Sections 608.9.2 and 608.9.3.

608.9.1.1 Anchor bolts. Anchor bolts used to connect light-framed floor, ceiling and roof systems to concrete walls in accordance with Figures 608.9(1) through 608.9(12) shall have heads, or shall be rods with threads on both ends with a hex or square nut on the end embedded in the concrete. Bolts and threaded rods shall comply with Section 608.5.2.2. Anchor bolts with J- or L-hooks shall not be used where the connection details in these figures are used.

608.9.1.2 Removal of stay-in-place form material at bolts. Holes in stay-in-place forms for installing bolts for attaching face-mounted wood ledger boards to the wall shall be not less than 4 inches (102 mm) in diameter for forms not greater than $1^1/_2$ -inches (38 mm) in thickness, and increased 1 inch (25 mm) in diameter for each $^1/_2$ -inch (12.7 mm) increase in form thickness. Holes in stay-in-place forms for installing bolts for attaching face-mounted cold-formed steel tracks to the wall shall be not less than 4 inches (102 mm) square. The wood ledger board or steel track shall be in direct contact with the concrete at each bolt location.

> **Exception:** A vapor retarder or other material less than or equal to $^1/_{16}$ inch (1.6 mm) in thickness is permitted to be installed between the wood ledger or cold-formed track and the concrete.

608.9.2 Connections between concrete walls and light-framed floor systems. Connections between concrete walls and light-framed floor systems shall be in accordance with one of the following:

1. For floor systems of wood-framed construction, the provisions of Section 608.9.1 and the prescriptive details of Figures 608.9(1) through 608.9(4), where permitted by the tables accompanying those figures. Portions of connections of wood-framed floor systems not noted in the figures shall be in accordance with Section 502, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

2. For floor systems of cold-formed steel construction, the provisions of Section 608.9.1 and the prescriptive details of Figures 608.9(5) through 608.9(8), where permitted by the tables accompanying those figures. Portions of connections of cold-formed steel-framed floor systems not noted in the figures shall be in accordance with Section 505, or AISI S230, if applicable.

3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.

4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.

5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction or AISI S100 for cold-formed steel frame construction.

608.9.3 Connections between concrete walls and light-framed ceiling and roof systems. Connections between concrete walls and light-framed ceiling and roof systems shall be in accordance with one of the following:

1. For ceiling and roof systems of wood-framed construction, the provisions of Section 608.9.1 and the prescriptive details of Figures 608.9(9) and 608.9(10), where permitted by the tables accompanying those figures. Portions of connections of wood-framed ceiling and roof systems not noted in the figures shall be in accordance with Section 802, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

2. For ceiling and roof systems of cold-formed steel construction, the provisions of Section 608.9.1 and the prescriptive details of Figures 608.9(11) and 608.9(12), where permitted by the tables accompanying those figures. Portions of connections of cold-formed-steel framed ceiling and roof systems not noted in the figures shall be in accordance with Section 804, or AISI S230, if applicable.

3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.

4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.

5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction or AISI S100 for cold-formed steel-framed construction

SHEATHING
BOUNDARY NAILING
SEE TABLE R602.3(1)

10d COMMON NAILS AT 6 IN.
ON CENTER FROM SHEATHING
TO JOIST WITH TENSION
TIES ATTACHED

10 IN. MINIMUM HEIGHT WITH
WEB MATERIAL REMOVED

5 IN.

5 IN.

3 IN.

3 IN.

A

$\frac{3}{4}$ IN. MINIMUM
CLEAR

MINIMUM
EMBEDMENT "E"
SEE TABLE BELOW

PROVIDE WEB STIFFENER BOTH SIDES
OF WEB AT I-JOIST, WHERE OCCURS

$\frac{1}{2}$ IN. DIAMETER ANCHOR BOLT. SEE
TABLE R608.9(1) FOR SPACING. CENTER
BOLT NOT MORE THAN 2 IN. FROM
JOIST FACE AT TENSION TIES.

TENSION TIE. SEE TABLE R608.9(1) FOR
SPACING. PROVIDE STEEL PLATE WASHER
4 × 4 × $\frac{1}{2}$ IN. TO FACE OF JOIST WEB.
PROVIDE 4 IN. × 6 IN. × 4 IN. × 43 MIL MINIMUM
BENT STEEL PLATE ANGLE UNDER PLATE
WASHER WITH 6-10 × 1$\frac{1}{2}$ IN. COMMON NAILS
TO JOIST. TENSION TIE LRFD CAPACITY 1280LB.

WOOD 2 × 8 MINIMUM LEDGER TYPICAL,
3 × 8 WHERE REQUIRED BY TABLE R608.9(1)

SECTION

CUT WASHER

ANCHOR BOLT SPACING

6 IN.

E (in)	wall type
2$\frac{7}{4}$ in.	4 in. flat
4$\frac{7}{4}$ in.	6 in. flat 6 in. waffle-grid 6 in. screen-grid
6$\frac{3}{4}$ in.	8 in. flat 10 in. flat 8 in. waffle-grid

JOIST

TENSION TIE

4 IN. DIAMETER SOLID CONCRETE BEHIND
AND ALIGNED WITH ANGLE

DETAIL A – PLAN VIEW

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PERPENDICULAR

TABLE 608.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PERPENDICULAR [a, b]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph)					
		115B	120B	130B	140B	150B	160B
		=	=	110C	119C	127C	136C
		=	=	=	110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						

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

a.   This table is for use with the detail in Figure 608.9(1). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.

b.   Wall design per other provisions of Section 608 is required. For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.
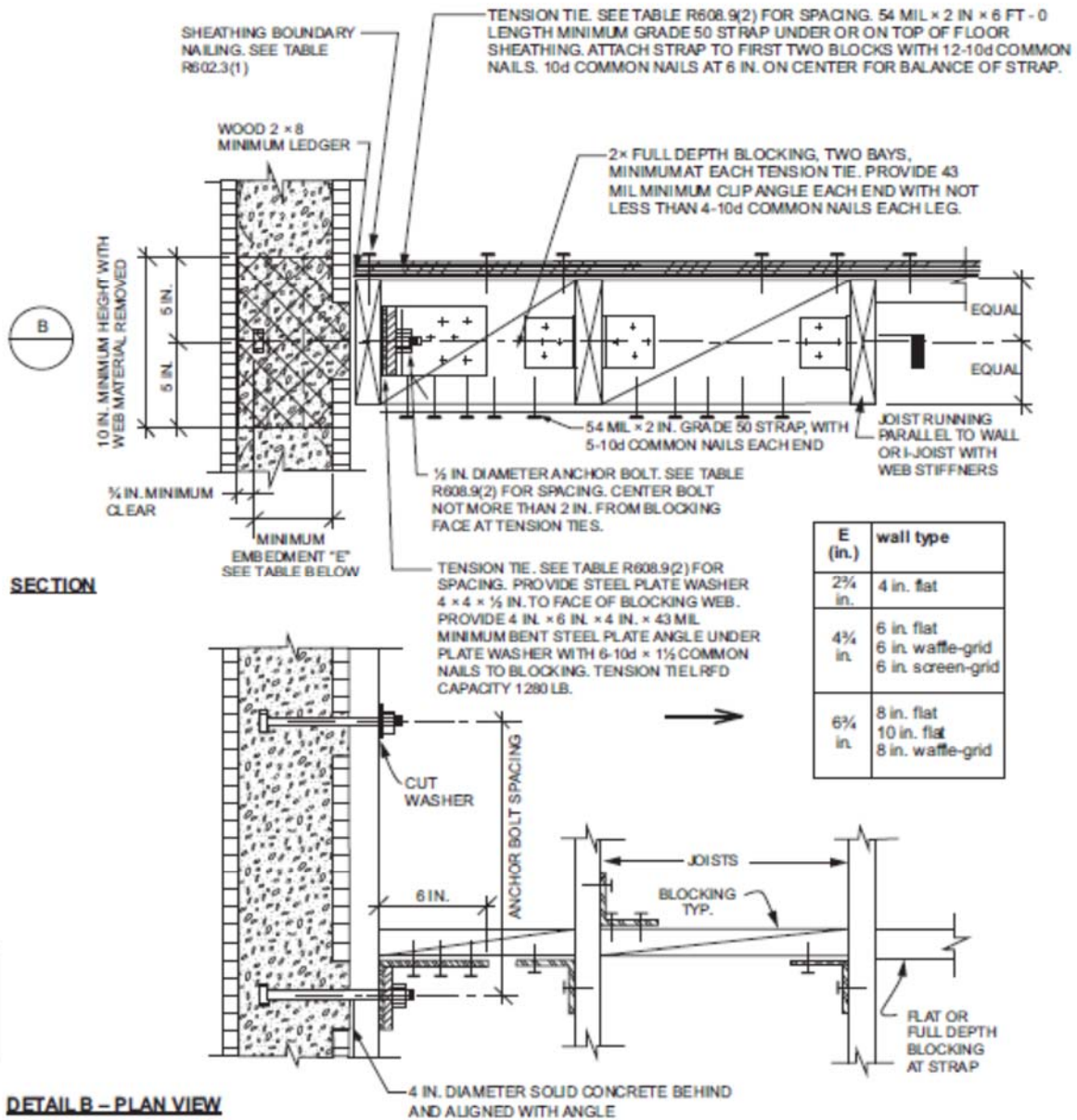
FIGURE 608.9(2)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PARALLEL

TABLE 608.9(2)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PARALLEL[a, b]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B = =	**120B** = =	**130B** **110C** =	**140B** **119C** **110D**	**150B** **127C** **117D**	**160B** **136C** **125D**
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

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

a.   This table is for use with the detail in Figure 608.9(2). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.

b.   Wall design per other provisions of Section 608 is required.

SHEATHING BOUNDARY NAILING
SEE TABLE R602.3(1)

10d COMMON NAILS AT 6 IN. CENTER
FROM SHEATHING TO JOISTS WITH
TENSION TIES ATTACHED.

A

43 MIL CONTINUOUS PLATE WITH
NAILING TO MATCH BOUNDARY
NAILING. SEE TABLE R602.3(1)

3 IN.

TENSION TIE – SEE
TABLE R608.9(3)
FOR SPACING

7 IN.
MIN.

8 IN. MINIMUM
WITH WEB
MATERIAL
REMOVED

JOIST (I-JOIST NOT PERMITTED)

WOOD 2 × 6 MINIMUM SILL PLATE
TYPICAL, 3 × 6 WHERE REQUIRED
BY TABLE R608.9(3)

$\frac{1}{2}$ IN. ANCHOR BOLT TYPICAL, $\frac{5}{8}$ IN.
WHERE REQUIRED. SEE TABLE
R608.9(3) FOR SIZE AND SPACING.

SECTION

JOIST TYP.

3 IN.

4 IN.

TENSION TIE 4 IN. × 3 IN. × 3 IN. × 43 MIL.
MINIMUM CLIP ANGLE EACH FACE
JOIST WITH 6-10d × 1½ IN. COMMON
NAILS ON VERTICAL AND HORIZONTAL LEGS

ANCHOR BOLT WITH
¼ × 3 × 3 STEEL
PLATE WASHER

TENSION TIE LRFD CAPACITY 1280 LB.
FOR BOTH ANGLES (640 LB PER ANGLE)

EQUAL

DETAIL A – PLAN VIEW

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(3)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR

TABLE 608.9(3)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B = =	120B = =	130B 110C =	140B 119C 110D	150B 127C 117D	160B 136C 125D
12	12						6
12	24					6	6
12	36					6	6
12	48				6	6	6
16	16					6	6A
16	32				6	6	6A
16	48			6	6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B
24	48		6	6A	6B	6B	8B

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

a. This table is for use with the detail in Figure 608.9(3). Use of this detail is permitted where cell is not shaded.

b. Wall design per other provisions in Section 608 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(3). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

SHEATHING BOUNDARY NAILING. SEE TABLE R602.3(1)

TENSION TIE. 54 MIL × 2 IN. × 6 FT - 0 LENGTH MINIMUM GRADE 50 STRAP CONTINUOUS UNDER OR ON TOP OF FLOOR SHEATHING. ATTACH STRAP TO FIRST TWO BLOCKS WITH 12-10d COMMON NAILS. 10d COMMON NAILS AT 6 IN. ON CENTER FOR BALANCE OF STRAP.

2× FULL DEPTH BLOCKING, TWO BAYS MINIMUM AT EACH TENSION TIE. PROVIDE 43 MIL MINIMUM CLIP ANGLE EACH END WITH NOT LESS THAN 4-10d COMMON NAILS EACH LEG.

JOIST RUNNING PARALLEL TO WALL

43 MIL CONTINUOUS PLATE WITH NAILING TO MATCH BOUNDARY NAILING. SEE TABLE R602.3(1)

3 IN.

54 MIL × 2 IN. GRADE 50 STRAP, WITH 5-10d COMMON NAILS EACH END

TENSION TIE – SEE TABLE R608.9(4) FOR SPACING

8 IN. MINIMUM WITH WEB MATERIAL REMOVED

7 IN. MIN.

WOOD 2 × 6 MINIMUM SILL PLATE TYPICAL. 3 × 6 WHERE REQUIRED BY TABLE R608.9(4)

½ IN. ANCHOR BOLT TYPICAL, ⅝ IN. WHERE REQUIRED. SEE TABLE R608.9(4) FOR SIZE AND SPACING.

SECTION

JOIST

JOIST

BLOCKING TYP.

3 IN.

FLAT OR FULL DEPTH BLOCKING AT STRAP

4 IN.

DETAIL B – PLAN VIEW

TENSION TIE. 4 IN. × 3 IN. × 3 IN. × 43 MIL MINIMUM CLIP ANGLE BOTH SIDES OF BLOCKING WITH 6-10d × 1½ IN. COMMON NAILS ON HORIZONTAL AND VERTICAL LEG. TENSION TIE LRFD CAPACITY 1280 LB FOR BOTH ANGLES, 640 LB PER ANGLE

EQUAL

ANCHOR BOLT WITH ¼ × 3 × 3 STEEL PLATE WASHER

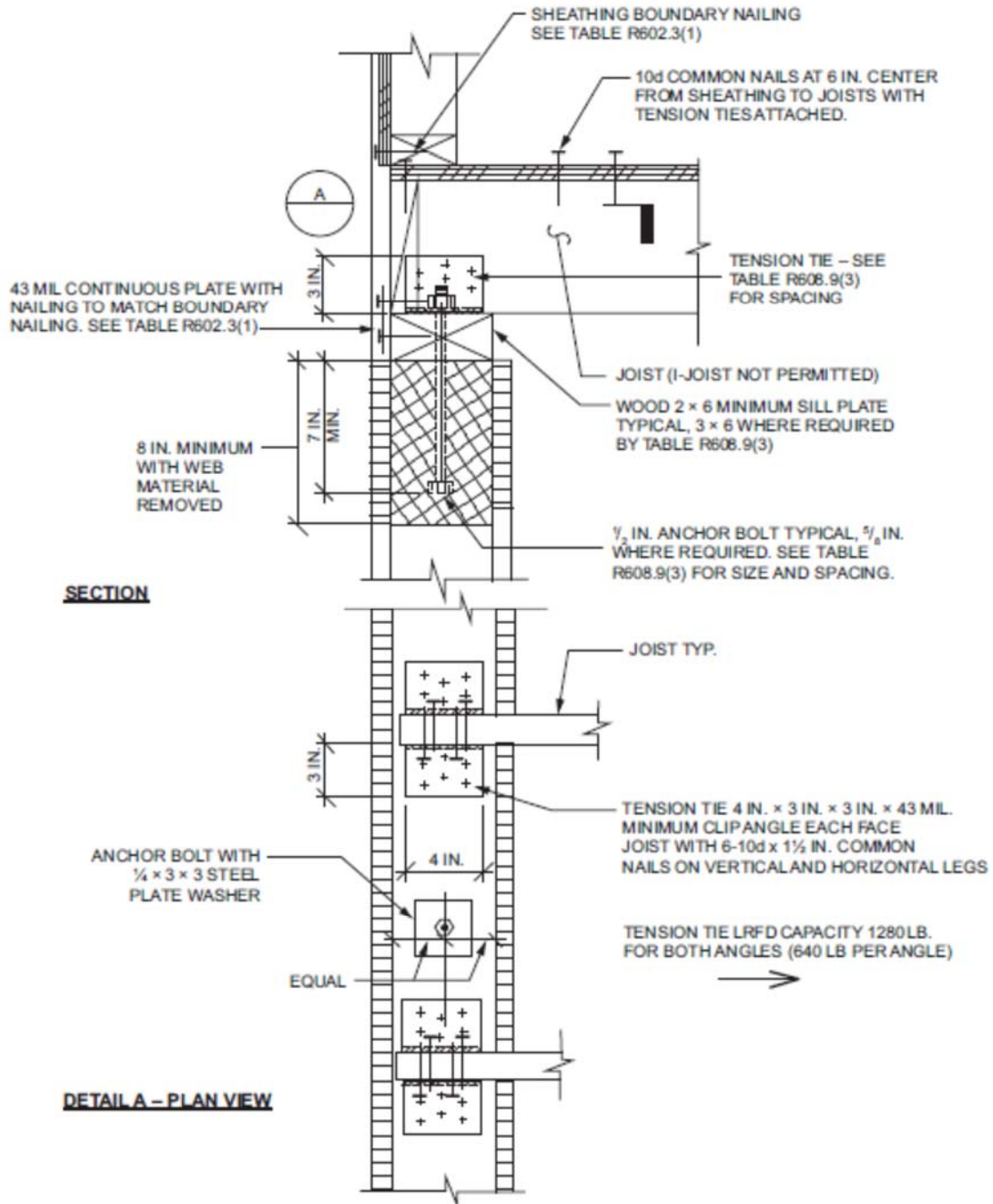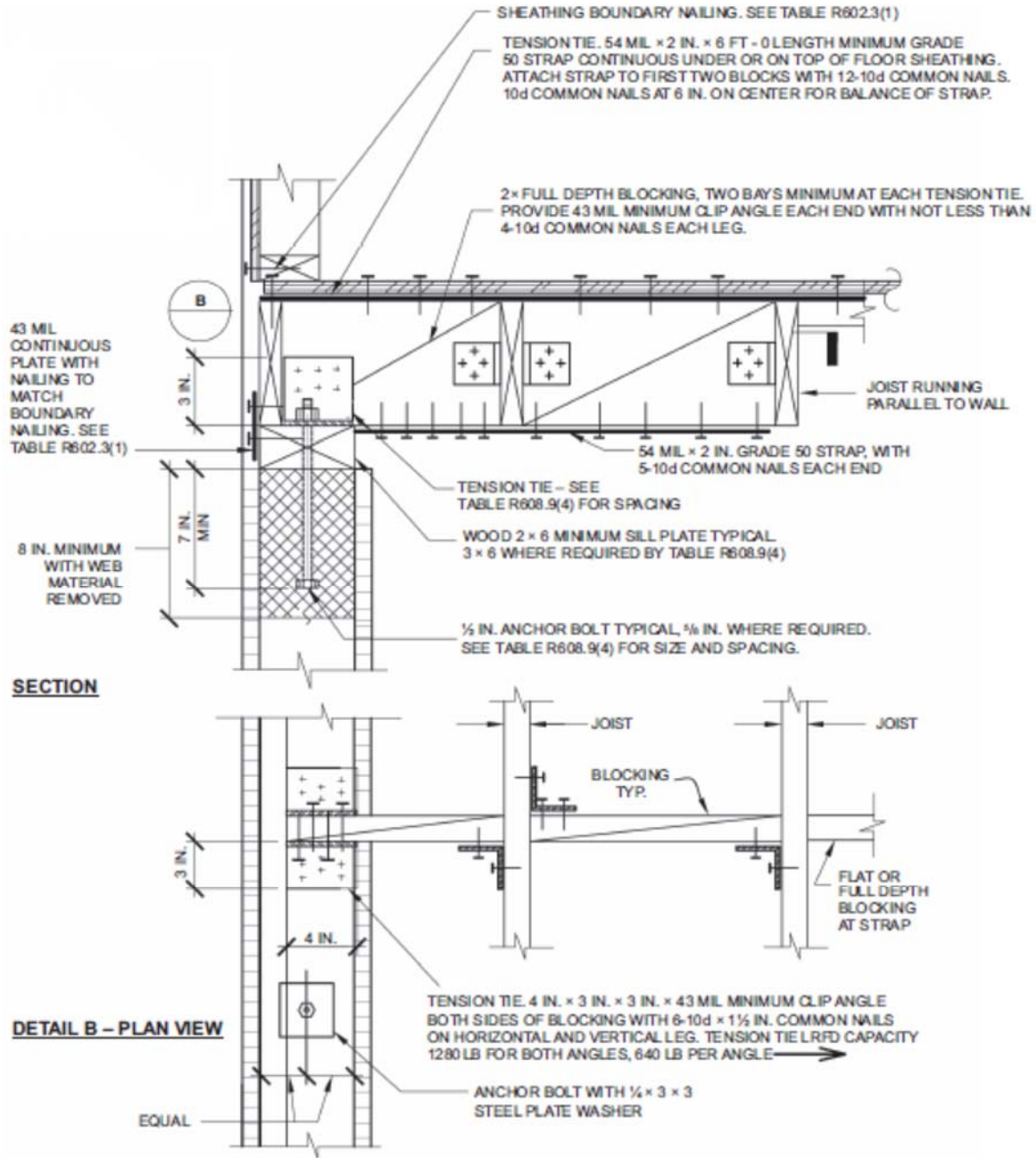For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(4)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL,
FRAMING PARALLEL

TABLE 608.9(4)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL,
FRAMING PARALLEL [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B — —	120B — —	130B 110C —	140B 119C 110D	150B 127C 117D	160B 136C 125D
12	12						6
12	24					6	6
12	36					6	6
12	48				6	6	6
16	16					6	6A
16	32				6	6	6A
16	48			6	6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B
24	48		6	6A	6B	6B	8B

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

a. This table is for use with the detail in Figure 608.9(4). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section 608 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(4). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$ -inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

SHEATHING BOUNDARY FASTENING.
SEE TABLE R505.3.1(2)

54 MIL GRADE 50 TRACK FOR ANCHOR BOLTS AT
19.2 IN. AND 24 IN. O.C. 43 MIL GRADE 50 OR 54
GRADE 33 FOR ANCHOR BOLTS AT 12 IN., OR 16 IN. O.C.

1 NO. 8 SCREW
TOP AND BOTTOM
FLANGE

NO. 8 SCREWS AT 6 IN. ON CENTER
FROM SHEATHING TO JOIST WITH
TENSION TIES ATTACHED.

10 INCH MINIMUM HEIGHT WITH
WEB MATERIAL REMOVED

5 IN.

5 IN.

¾ IN. MINIMUM
CLEAR

SECTION

MINIMUM
EMBEDMENT "E"
SEE TABLE BELOW

½ IN. DIAMETER ANCHOR BOLT TYPICAL.
SEE TABLE R608.9(5) FOR SPACING. CENTER
BOLT NOT MORE THAN 2 IN. FORM JOIST WEB
AT TENSION TIES.

TENSION TIE. SEE TABLE R608.9(5) FOR SPACING.
PROVIDE STEEL PLATE WASHER 4 × 4 × ½ IN. TO
FACE OF JOIST WEB. PROVIDE 4 IN. × 4 IN. × 43 MIL
MINIMUM BENT STEEL PLATE ANGLE UNDER PLATE
WASHER WITH 8 NO. 8 SCREWS TO JOIST WEB
TENSION TIE LRFD CAPACITY 3200 LB →

CUT
WASHER

ANCHOR BOLT SPACING

E (in.)	wall type
2¾ in.	4 in. flat
4¾ in.	6 in. flat 6 in. waffle-grid 6 in. screen-grid
6¾ in.	8 in. flat 10 in. flat 8 in. waffle-grid

JOIST

TENSION TIE

DETAIL A – PLAN VIEW

4 IN. × 4 IN. SOLID CONCRETE
BEHIND AND ALIGNED WITH ANGLE

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

**FIGURE 608.9(5)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PERPENDICULAR**

TABLE 608.9(5)
COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PERPENDICULAR [a, b, c]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE					
		115B	120B	130B	140B	150B	160B
		=	=	110C	119C	127C	136C
		=	=	=	110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.4470 m/s.

a.   This table is for use with the detail in Figure 608.9(5). Use of this detail is permitted where a cell is not shaded.

b.   Wall design per other provisions of Section 608 is required.

c.   For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

TENSION TIE. 64 MIL × 2 IN. × 6 FT. 0 LENGTH MINIMUM GRADE
50 STRAP UNDER OR ON TOP OF FLOOR SHEATHING. ATTACH
STRAP TO FIRST TWO BLOCKS WITH 12 NO. 8 SCREWS.
NO. 8 SCREWS AT 6 IN. ON CENTER FOR BALANCE OF STRAP

43 MIL MINIMUM TRACK. ONE NO.
8 SCREW FROM TRACK TO BLOCKING,
TOP AND BOTTOM FLANGE

SHEATHING BOUNDARY FASTENING.
SEE TABLE R505.3.1(2)

43 MIL MINIMUM FULL DEPTH BLOCKING, TWO
BAYS MINIMUM AT EACH TENSION TIE. PROVIDE
43 MIL MINIMUM CLIP ANGLE EACH END WITH
NOT LESS THAN 4 NO. 8 SCREWS EACH LEG

10 IN. MINIMUM HEIGHT WITH
WEB MATERIAL REMOVED

5 IN.

5 IN.

5 IN.

B

54 MIL × 2 IN. GRADE 50 STRAP,
WITH 4 NO. 8 SREWS EACH END

JOIST RUNNING
PARALLEL TO WALL

¾ IN. MINIMUM
CLEAR

SECTION

MINIMUM
EMBEDMENT "E"
SEE TABLE BELOW

½ IN. DIAMETER ANCHOR BOLT TYPICAL.
SEE TABLE R608.9(6) FOR SPACING.
CENTER BOLT NOT MORE THAN 2 IN.
FROM BLOCKING WEB.

TENSION TIE. SEE TABLE R608.9(6)
FOR SPACING. PROVIDE STEEL PLATE
WASHER 4 × 4 × ½ IN. TO FACE OF
BLOCKING WEB. PROVIDE 4 IN. ×
4 IN. × 4 IN. × 43 MIL MINIMUM BENT
STEEL PLATE ANGLE UNDER PLATE
WASHER WITH 8 NO. 8 SCREWS TO
BLOCKING WEB. TENSION TIE
LRFD CAPACITY 3200 LB →

E (in.)	wall type
2¾ in.	4 in. flat
4¾ in.	6 in. flat 6 in. waffle-grid 6 in. screen-grid
6¾ in.	8 in. flat 10 in. flat 8 in. waffle-grid

CUT
WASHER

ANCHOR BOLT SPACING

JOISTS
BLOCKING
TYP.

BLOCKING
TYP.

ALTERNATE END
CONNECTION WITH
BENT BLOCKING
WEB WITH 4 NO. 8
SCREWS EACH END

FLAT OR FULL
DEPTH
BLOCKING
AT STRAP

4 IN. × 4 IN. SOLID CONCRETE BEHIND
AND ALIGNED WITH ANGLE

DETAIL B – PLAN VIEW

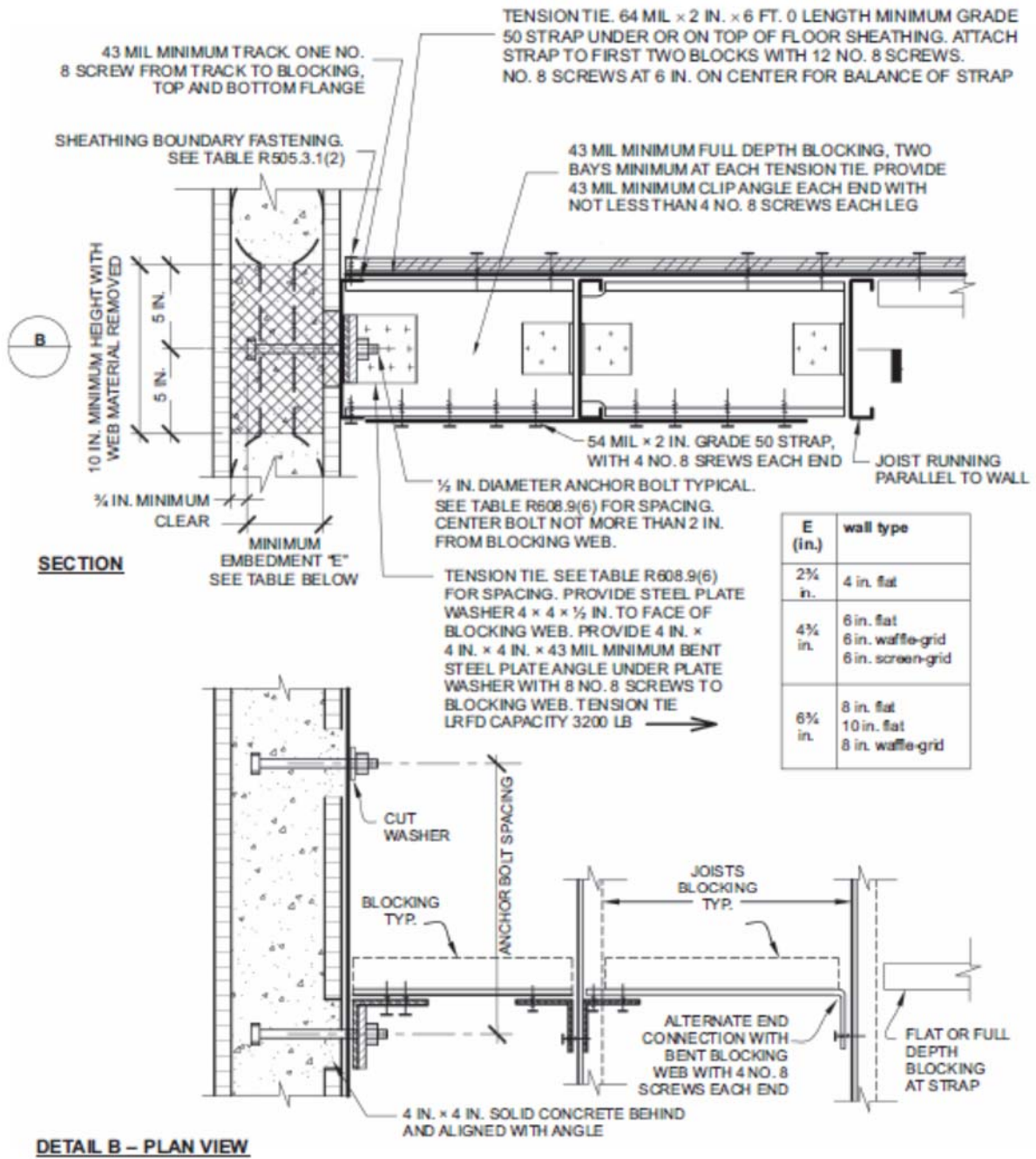For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(6)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PARALLEL

TABLE 608.9(6)
COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL,
FRAMING PARALLEL [a, b, c]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	**120B**	**130B**	**140B**	**150B**	**160B**
		—	—	**110C**	**119C**	**127C**	**136C**
		—	—	—	**110D**	**117D**	**125D**
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

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

a.   This table is for use with the detail in Figure 608.9(6). Use of this detail is permitted where a cell is not shaded.

b.   Wall design per other provisions of Section 608 is required.

c.   For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

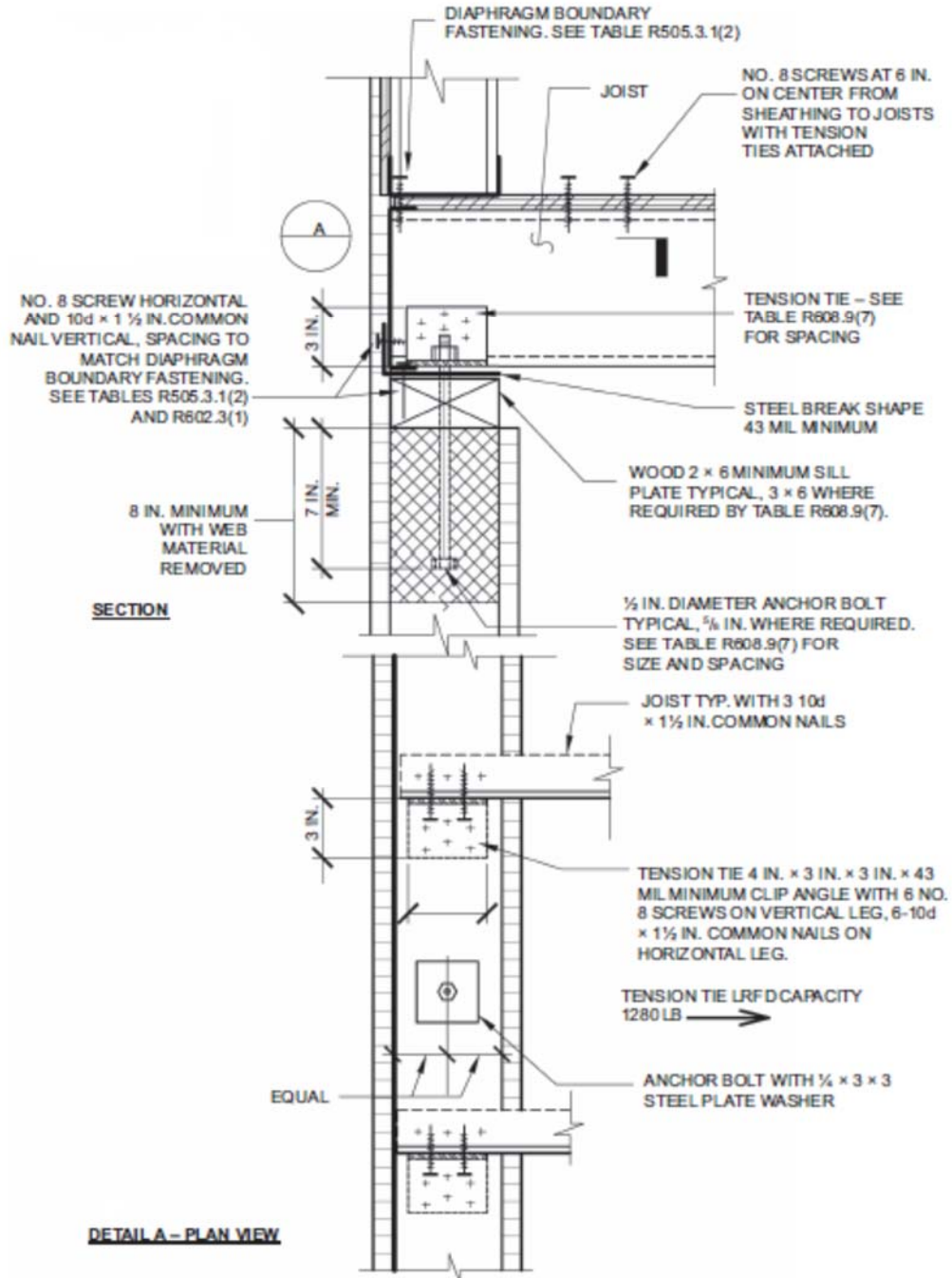For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(7)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR

TABLE 608.9(7)
COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B __ __	**120B** __ __	**130B** **110C** __	**140B** **119C** **110D**	**150B** **127C** **117D**	**160B** **136C** **125D**
12	12						6
12	24					6	6
16	16					6	6A
16	32				6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B

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

a.   This table is for use with the detail in Figure 608.9(7). Use of this detail is permitted where a cell is not shaded.

b.   Wall design per other provisions of Section 608 is required.

c.   For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

d.   Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(7). For the remainder of the wall, see Note b.

e.   Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $5/8$ -inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

DIAPHRAGM BOUNDARY FASTENING. SEE TABLE R505.3.1(2)

TENSION TIE: 54 MIL × 2 × 6 FT LENGTH MINIMUM GRADE 50 STRAP UNDER OR ON TOP OF FLOOR SHEATHING. ATTACH STRAP TO FIRST TWO BLOCKS WITH 12 NO. 8 SCREWS. NO. 8 SCREWS AT 6 IN. ON CENTER FOR BALANCE OF STRAP

43 MIL MINIMUM FULL DEPTH BLOCKING, TWO BAYS MINIMUM AT EACH TENSION TIE. PROVIDE 43 MIL MINIMUM CLIP ANGLE EACH END WITH NOT LESS THAN 4 NO. 8 SCREWS EACH LEG

NO. 8 SCREW HORIZONTAL AND 10d × 1½ IN. COMMON NAILS VERTICAL, SPACING TO MATCH DIAPHRAGM BOUNDRY FASTENING. SEE TABLES R505.3.1(2) AND R602.3(1)

TRACK

3 IN.

JOIST RUNNING PARALLEL TO WALL

TENSION TIE – SEE TABLE R608.9(8) FOR SPACING

54 MIL GRADE 50 × 2 IN. STRAP, WITH 4 NO. 8 SCREWS EACH END

WOOD 2 × 6 MINIMUM SILL PLATE TYPICAL, 3 × 6 WHERE REQUIRED BY TABLE R608.9(8)

7 IN. MIN.

8 IN. MINIMUM WITH WEB MATERIAL REMOVED

½ IN. DIAMETER ANCHOR BOLT TYPICAL, ⅝ IN. WHERE REQUIRED. SEE TABLE R608.9(8) FOR SIZE AND SPACING

SECTION

BLOCKING TYP. WITH 3 NO. 8 × 2½ WOOD SCREWS TO SILL

JOIST

JOIST

BLOCKING TYP.

3 IN.

ALTERNATE END CONNECTION WITH BENT BLOCKING WEB AND 4 NO. 8 SCREWS EACH END

FLAT OR FULL DEPTH BLOCKING AT STRAP

4 IN.

TENSION TIE 4 IN. × 3 IN. × 3 IN. × 43 MIL MINIMUM CLIP ANGLE WITH 6 NO. 8 SCREWS ON VERTICAL LEG, 4 10d × 1½ IN. COMMON NAILS ON HORIZONTAL LEG. TENSION TIE LRFD CAPACITY 1280 LB

EQUAL

ANCHOR BOLT WITH ¼ × 3 × 3 STEEL PLATE WASHER

DETAIL B – PLAN VIEW

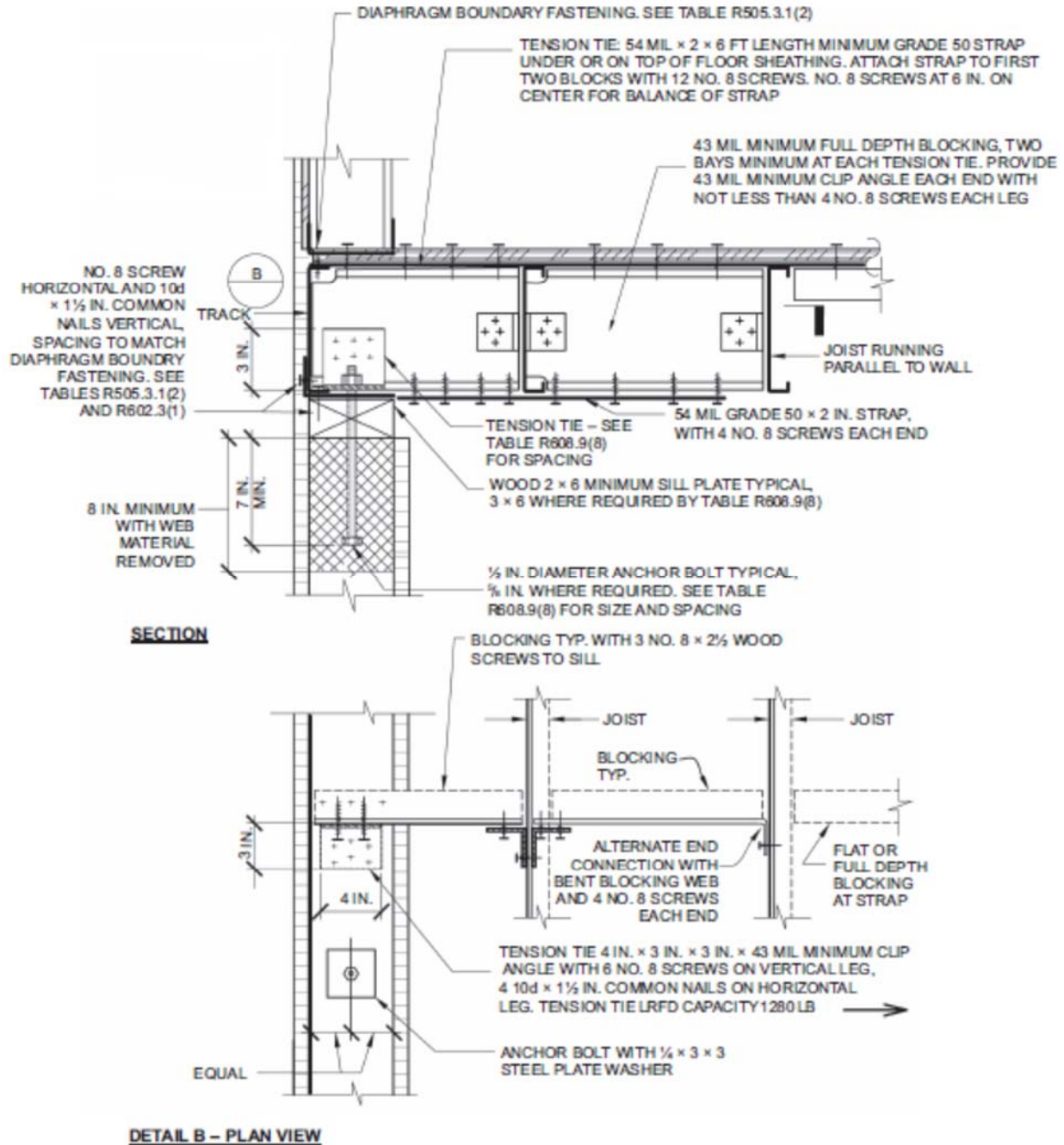For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(8)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL,
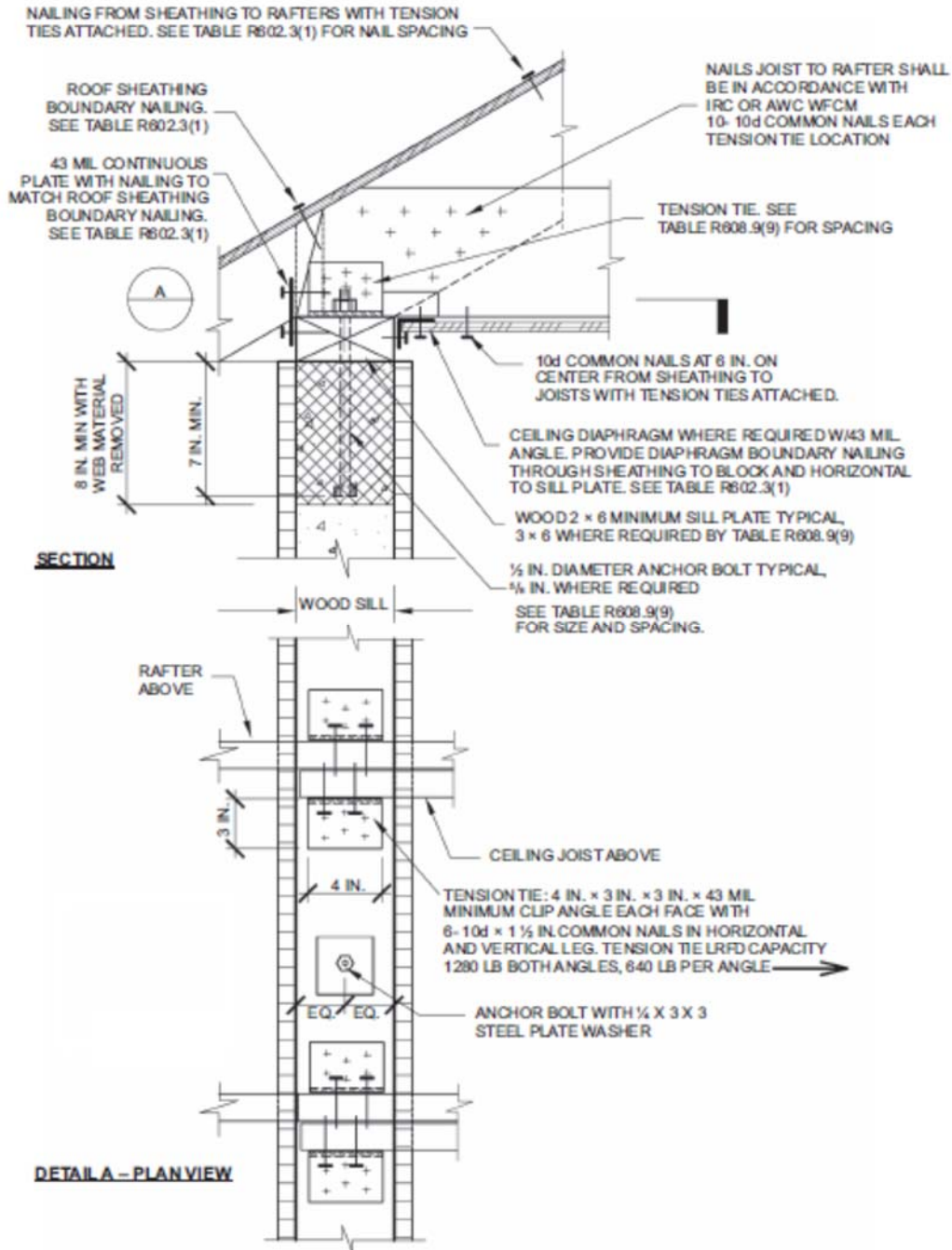**FRAMING PARALLEL**

TABLE 608.9(8)
COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL,
FRAMING PARALLEL [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B — —	**120B** — —	**130B** **110C** —	**140B** **119C** **110D**	**150B** **127C** **117D**	**160B** **136C** **125D**
12	12						6
12	24					6	6
16	16					6	6A
16	32				6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B

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

a. This table is for use with the detail in Figure 608.9(8). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section 608 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(8). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

NAILING FROM SHEATHING TO RAFTERS WITH TENSION TIES ATTACHED. SEE TABLE R602.3(1) FOR NAIL SPACING

NAILS JOIST TO RAFTER SHALL BE IN ACCORDANCE WITH IRC OR AWC WFCM 10- 10d COMMON NAILS EACH TENSION TIE LOCATION

ROOF SHEATHING BOUNDARY NAILING. SEE TABLE R602.3(1)

43 MIL CONTINUOUS PLATE WITH NAILING TO MATCH ROOF SHEATHING BOUNDARY NAILING. SEE TABLE R602.3(1)

TENSION TIE. SEE TABLE R608.9(9) FOR SPACING

A

10d COMMON NAILS AT 6 IN. ON CENTER FROM SHEATHING TO JOISTS WITH TENSION TIES ATTACHED.

CEILING DIAPHRAGM WHERE REQUIRED W/43 MIL ANGLE. PROVIDE DIAPHRAGM BOUNDARY NAILING THROUGH SHEATHING TO BLOCK AND HORIZONTAL TO SILL PLATE. SEE TABLE R602.3(1)

8 IN. MIN WITH WEB MATERIAL REMOVED

7 IN. MIN.

WOOD 2 × 6 MINIMUM SILL PLATE TYPICAL, 3 × 6 WHERE REQUIRED BY TABLE R608.9(9)

½ IN. DIAMETER ANCHOR BOLT TYPICAL, ⅝ IN. WHERE REQUIRED SEE TABLE R608.9(9) FOR SIZE AND SPACING.

SECTION

WOOD SILL

RAFTER ABOVE

3 IN.

4 IN.

EQ. EQ.

CEILING JOIST ABOVE

TENSION TIE: 4 IN. × 3 IN. × 3 IN. × 43 MIL MINIMUM CLIP ANGLE EACH FACE WITH 6- 10d × 1 ½ IN. COMMON NAILS IN HORIZONTAL AND VERTICAL LEG. TENSION TIE LRFD CAPACITY 1280 LB BOTH ANGLES, 640 LB PER ANGLE

ANCHOR BOLT WITH ¼ X 3 X 3 STEEL PLATE WASHER

DETAIL A – PLAN VIEW

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.
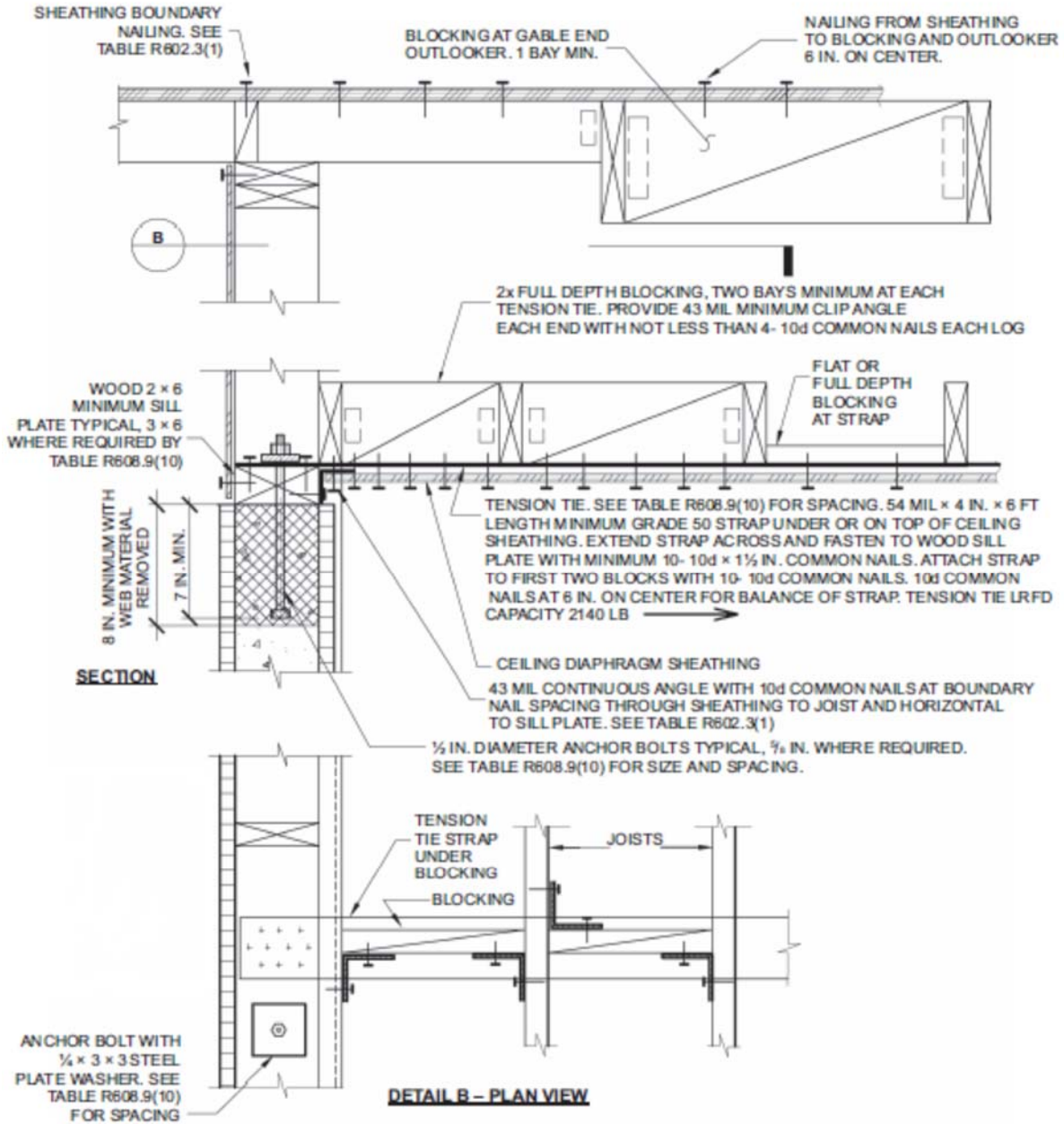
FIGURE 608.9(9)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR

TABLE 608.9(9)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24						6
12	36					6	6
12	48				6	6	6
16	16					6	6
16	32					6	6
16	48				6	6	6
19.2	19.2					6	6
19.2	38.4				6	6	
24	24				6		
24	48			6	8B		

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

a. This table is for use with the detail in Figure 608.9(9). Use of this detail is permitted where a cell is not shaded, and prohibited where shaded.

b. Wall design per other provisions of Section 608 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(9). For the remainder of the wall, see Note b.

e. Letter "B" indicates that a $^5/_8$ -inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

SHEATHING BOUNDARY
NAILING. SEE
TABLE R602.3(1)

BLOCKING AT GABLE END
OUTLOOKER. 1 BAY MIN.

NAILING FROM SHEATHING
TO BLOCKING AND OUTLOOKER
6 IN. ON CENTER.

B

2x FULL DEPTH BLOCKING, TWO BAYS MINIMUM AT EACH
TENSION TIE. PROVIDE 43 MIL MINIMUM CLIP ANGLE
EACH END WITH NOT LESS THAN 4- 10d COMMON NAILS EACH LOG

FLAT OR
FULL DEPTH
BLOCKING
AT STRAP

WOOD 2 × 6
MINIMUM SILL
PLATE TYPICAL, 3 × 6
WHERE REQUIRED BY
TABLE R608.9(10)

8 IN. MINIMUM WITH
WEB MATERIAL
REMOVED

7 IN. MIN.

TENSION TIE. SEE TABLE R608.9(10) FOR SPACING. 54 MIL × 4 IN. × 6 FT
LENGTH MINIMUM GRADE 50 STRAP UNDER OR ON TOP OF CEILING
SHEATHING. EXTEND STRAP ACROSS AND FASTEN TO WOOD SILL
PLATE WITH MINIMUM 10- 10d × 1½ IN. COMMON NAILS. ATTACH STRAP
TO FIRST TWO BLOCKS WITH 10- 10d COMMON NAILS. 10d COMMON
NAILS AT 6 IN. ON CENTER FOR BALANCE OF STRAP. TENSION TIE LRFD
CAPACITY 2140 LB

SECTION

CEILING DIAPHRAGM SHEATHING

43 MIL CONTINUOUS ANGLE WITH 10d COMMON NAILS AT BOUNDARY
NAIL SPACING THROUGH SHEATHING TO JOIST AND HORIZONTAL
TO SILL PLATE. SEE TABLE R602.3(1)

½ IN. DIAMETER ANCHOR BOLTS TYPICAL, ⅞ IN. WHERE REQUIRED.
SEE TABLE R608.9(10) FOR SIZE AND SPACING.

TENSION
TIE STRAP
UNDER
BLOCKING

BLOCKING

JOISTS

ANCHOR BOLT WITH
¼ × 3 × 3 STEEL
PLATE WASHER. SEE
TABLE R608.9(10)
FOR SPACING

DETAIL B – PLAN VIEW

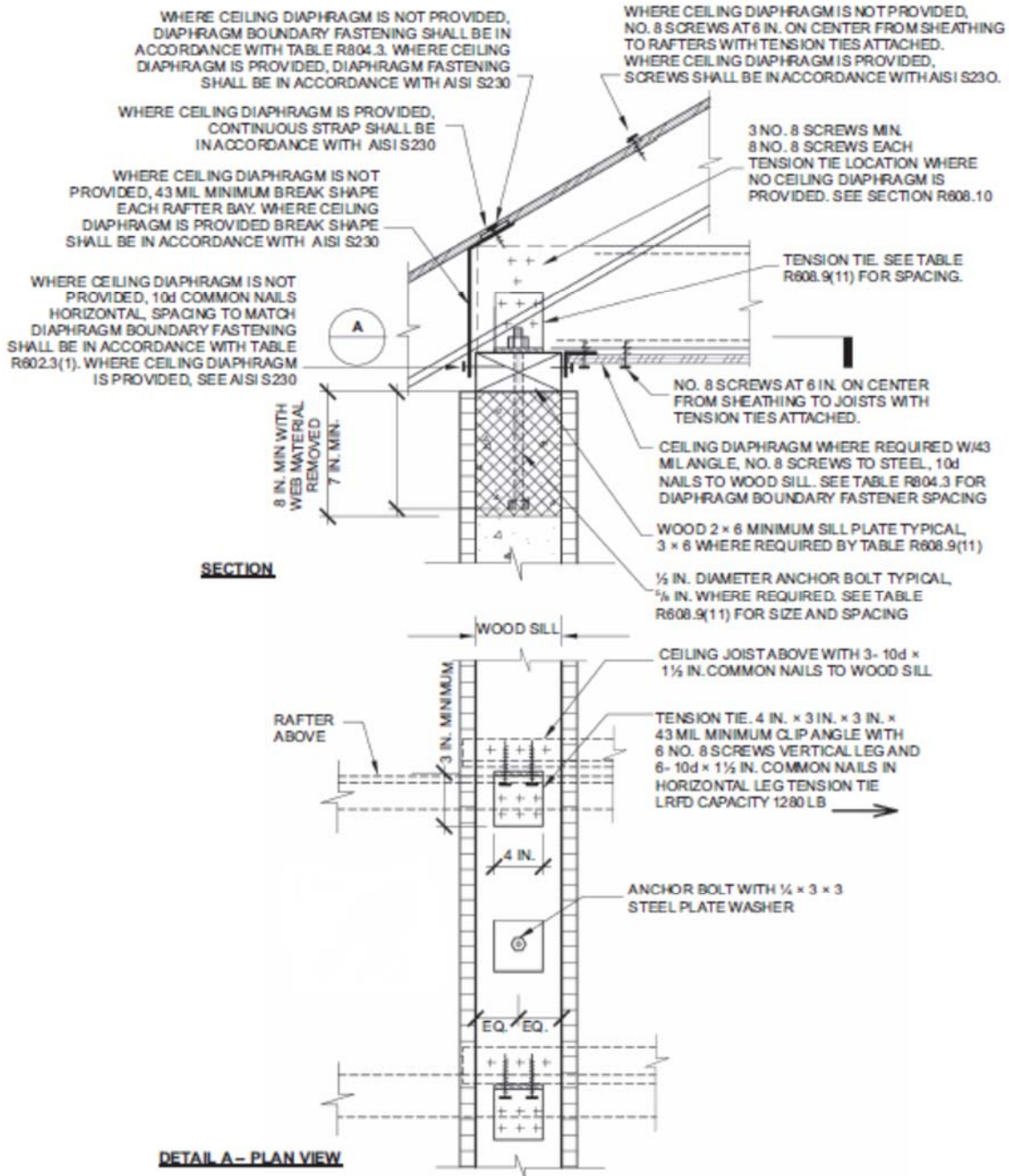For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(10)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL,
FRAMING PARALLEL

TABLE 608.9(10)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL,
FRAMING PARALLEL [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B — —	120B — —	130B 110C —	140B 119C 110D	150B 127C 117D	160B 136C 125D
12	12						6
12	24						6
12	36					6	6
12	48				6	6	6
16	16					6	6
16	32					6	6
16	48				6	6	6
19.2	19.2					6	6
19.2	38.4				6	6	
24	24				6		
24	48			6	8B		

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

a. This table is for use with the detail in Figure 608.9(10). Use of this detail is permitted where a cell is not shaded, and prohibited where shaded.
b. Wall design per other provisions of Section 608 is required.
c. For wind design, minimum 4-inch-nominal wall is permitted in cells that do not contain a number.
d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(10). For the remainder of the wall, see Note b.
e. Letter "B" indicates that a $^5/_8$ -inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

WHERE CEILING DIAPHRAGM IS NOT PROVIDED, DIAPHRAGM BOUNDARY FASTENING SHALL BE IN ACCORDANCE WITH TABLE R804.3. WHERE CEILING DIAPHRAGM IS PROVIDED, DIAPHRAGM FASTENING SHALL BE IN ACCORDANCE WITH AISI S230

WHERE CEILING DIAPHRAGM IS PROVIDED, CONTINUOUS STRAP SHALL BE IN ACCORDANCE WITH AISI S230

WHERE CEILING DIAPHRAGM IS NOT PROVIDED, 43 MIL MINIMUM BREAK SHAPE EACH RAFTER BAY. WHERE CEILING DIAPHRAGM IS PROVIDED BREAK SHAPE SHALL BE IN ACCORDANCE WITH AISI S230

WHERE CEILING DIAPHRAGM IS NOT PROVIDED, 10d COMMON NAILS HORIZONTAL, SPACING TO MATCH DIAPHRAGM BOUNDARY FASTENING SHALL BE IN ACCORDANCE WITH TABLE R602.3(1). WHERE CEILING DIAPHRAGM IS PROVIDED, SEE AISI S230

WHERE CEILING DIAPHRAGM IS NOT PROVIDED, NO. 8 SCREWS AT 6 IN. ON CENTER FROM SHEATHING TO RAFTERS WITH TENSION TIES ATTACHED. WHERE CEILING DIAPHRAGM IS PROVIDED, SCREWS SHALL BE IN ACCORDANCE WITH AISI S230.

3 NO. 8 SCREWS MIN. 8 NO. 8 SCREWS EACH TENSION TIE LOCATION WHERE NO CEILING DIAPHRAGM IS PROVIDED. SEE SECTION R608.10

TENSION TIE. SEE TABLE R608.9(11) FOR SPACING.

NO. 8 SCREWS AT 6 IN. ON CENTER FROM SHEATHING TO JOISTS WITH TENSION TIES ATTACHED.

CEILING DIAPHRAGM WHERE REQUIRED W/43 MIL ANGLE, NO. 8 SCREWS TO STEEL, 10d NAILS TO WOOD SILL. SEE TABLE R804.3 FOR DIAPHRAGM BOUNDARY FASTENER SPACING

WOOD 2 × 6 MINIMUM SILL PLATE TYPICAL, 3 × 6 WHERE REQUIRED BY TABLE R608.9(11)

½ IN. DIAMETER ANCHOR BOLT TYPICAL, ⅝ IN. WHERE REQUIRED. SEE TABLE R608.9(11) FOR SIZE AND SPACING

A

8 IN. MIN WITH WEB MATERIAL REMOVED

7 IN. MIN.

SECTION

WOOD SILL

3 IN. MINIMUM

RAFTER ABOVE

4 IN.

EQ. EQ.

CEILING JOIST ABOVE WITH 3- 10d × 1½ IN. COMMON NAILS TO WOOD SILL

TENSION TIE. 4 IN. × 3 IN. × 3 IN. × 43 MIL MINIMUM CLIP ANGLE WITH 6 NO. 8 SCREWS VERTICAL LEG AND 6- 10d × 1½ IN. COMMON NAILS IN HORIZONTAL LEG TENSION TIE LRFD CAPACITY 1280 LB

ANCHOR BOLT WITH ¼ × 3 × 3 STEEL PLATE WASHER

DETAIL A – PLAN VIEW

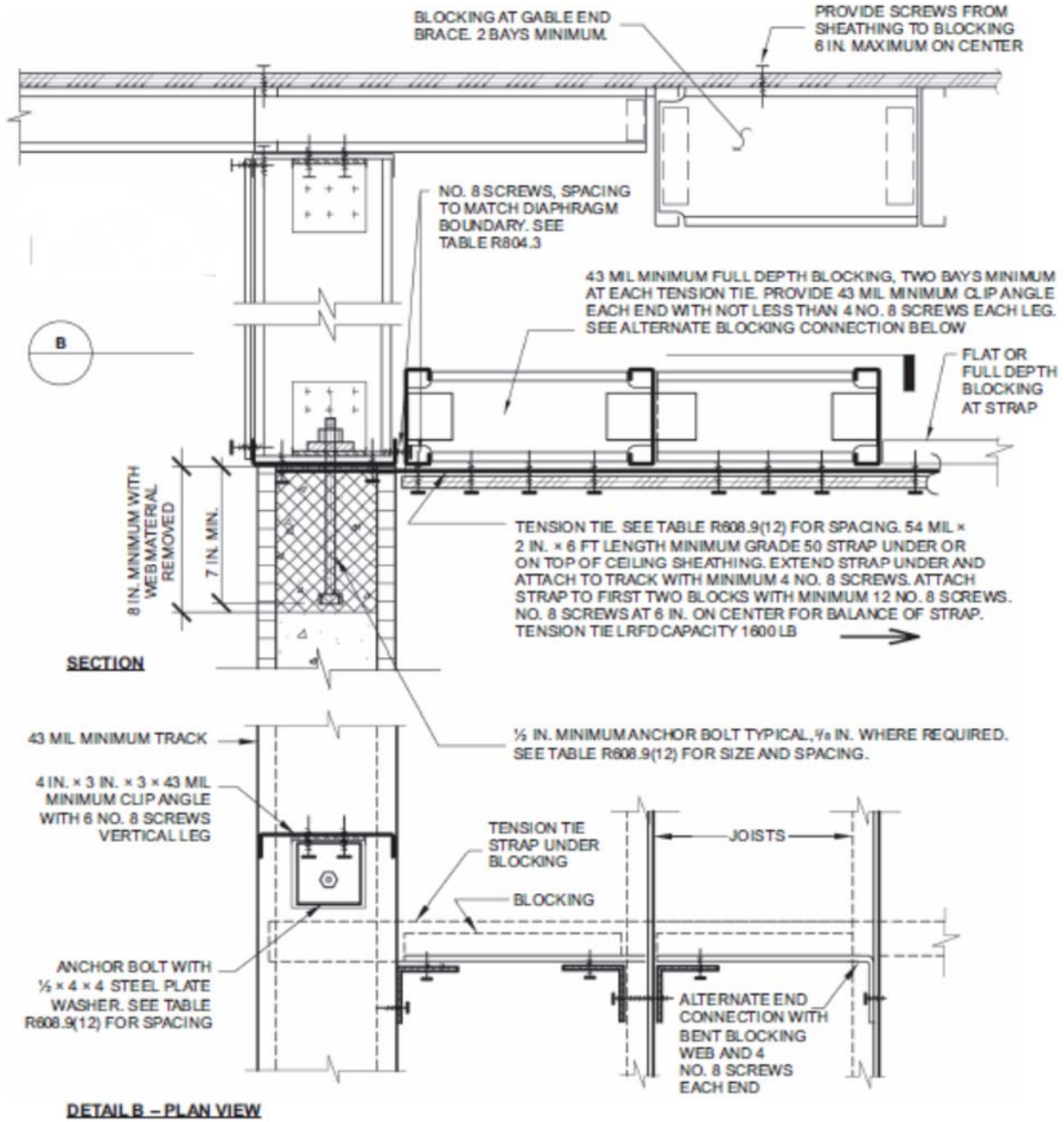For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(11)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR

TABLE 608.9(11)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL,
FRAMING PERPENDICULAR [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B = =	120B = =	130B 110C =	140B 119C 110D	150B 127C 117D	160B 136C 125D
12	12						6
12	24						6
16	16					6	6
16	32					6	6
19.2	19.2					6	6
19.2	38.4				6	6	6
24	24				6	6A	6B

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

a.   This table is for use with the detail in Figure 608.9(11). Use of this detail is permitted where a cell is not shaded.

b.   Wall design per other provisions of Section 608 is required.

c.   For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.

d.   Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(11). For the remainder of the wall, see Note b.

e.   Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$ - inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

BLOCKING AT GABLE END BRACE. 2 BAYS MINIMUM.

PROVIDE SCREWS FROM SHEATHING TO BLOCKING 6 IN. MAXIMUM ON CENTER

NO. 8 SCREWS, SPACING TO MATCH DIAPHRAGM BOUNDARY. SEE TABLE R804.3

43 MIL MINIMUM FULL DEPTH BLOCKING, TWO BAYS MINIMUM AT EACH TENSION TIE. PROVIDE 43 MIL MINIMUM CLIP ANGLE EACH END WITH NOT LESS THAN 4 NO. 8 SCREWS EACH LEG. SEE ALTERNATE BLOCKING CONNECTION BELOW

FLAT OR FULL DEPTH BLOCKING AT STRAP

B

8 IN. MINIMUM WITH WEB MATERIAL REMOVED

7 IN. MIN.

SECTION

TENSION TIE. SEE TABLE R608.9(12) FOR SPACING. 54 MIL × 2 IN. × 6 FT LENGTH MINIMUM GRADE 50 STRAP UNDER OR ON TOP OF CEILING SHEATHING. EXTEND STRAP UNDER AND ATTACH TO TRACK WITH MINIMUM 4 NO. 8 SCREWS. ATTACH STRAP TO FIRST TWO BLOCKS WITH MINIMUM 12 NO. 8 SCREWS. NO. 8 SCREWS AT 6 IN. ON CENTER FOR BALANCE OF STRAP. TENSION TIE LRFD CAPACITY 1600 LB

43 MIL MINIMUM TRACK

½ IN. MINIMUM ANCHOR BOLT TYPICAL, ⅝ IN. WHERE REQUIRED. SEE TABLE R608.9(12) FOR SIZE AND SPACING.

4 IN. × 3 IN. × 3 × 43 MIL MINIMUM CLIP ANGLE WITH 6 NO. 8 SCREWS VERTICAL LEG

TENSION TIE STRAP UNDER BLOCKING

JOISTS

BLOCKING

ANCHOR BOLT WITH ½ × 4 × 4 STEEL PLATE WASHER. SEE TABLE R608.9(12) FOR SPACING

ALTERNATE END CONNECTION WITH BENT BLOCKING WEB AND 4 NO. 8 SCREWS EACH END

DETAIL B – PLAN VIEW

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 608.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL,
FRAMING PARALLEL

TABLE 608.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL,
FRAMING PARALLEL [a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24						6
16	16					6	6
16	32					6	6
19.2	19.2					6	6
19.2	38.4				6	6	6
24	24				6	6	6B

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

a. This table is for use with the detail in Figure 608.9(12). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section 608 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in cells that do not contain a number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure 608.9(12). For the remainder of the wall, see Note b.

e. Letter "B" indicates that a $^5/_8$ -inch-diameter anchor bolt is required.

608.10 Floor, roof and ceiling diaphragms. Floors and roofs in buildings with exterior walls of concrete shall be designed and constructed as diaphragms. Where gable-end walls occur, ceilings shall be designed and constructed as diaphragms. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as diaphragms shall comply with the applicable requirements of this code, or AWC WFCM or AISI S230, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

SECTION 609
EXTERIOR WINDOWS AND DOORS

609.1 General. This section prescribes performance and construction requirements for exterior windows and doors installed in walls. Windows and doors shall be installed and flashed in accordance with the fenestration manufacturer's written instructions. Window and door openings shall be flashed in accordance with Section 703.4. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

609.2 Performance. Exterior windows and doors shall be capable of resisting the design wind loads specified in Table 301.2(2) adjusted for height and exposure in accordance with Table 301.2(3) or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. For exterior windows and doors tested in accordance with Sections 609.3 and 609.5, required design wind pressures determined from ASCE 7 using the ultimate strength design (USD) are permitted to be multiplied by 0.6. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *Ohio building code*.

609.3 Testing and labeling. Exterior windows and sliding doors shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance characteristics and approved inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or AMD 100, or comply with Section 609.5.
  Exception: Decorative glazed openings.

  609.3.1 Comparative analysis. Structural wind load design pressures for window and door units different than the size tested in accordance with Section 609.3 shall be permitted to be different than the design value of the tested unit where determined in accordance with one of the following comparative analysis methods:
  1. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section 609.3 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. Components of the smaller unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.
  2. In accordance with WDMA I.S.11.

609.4 Garage doors. Garage doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108.

609.5 Other exterior window and door assemblies. Exterior windows and door assemblies not included within the scope of Section 609.3 or 609.4 shall be tested in accordance with ASTM E330. Glass in assemblies covered by this section shall comply with Section 308.5.

609.6 Windborne debris protection. *Deleted*

609.6.1 Fenestration testing and labeling. *Deleted*

**609.6.2 Impact protective systems-testing and labeling.** *Deleted*

609.7 Anchorage methods. The methods cited in this section apply only to anchorage of window and glass door assemblies to the main force-resisting system.

609.7.1 Anchoring requirements. Window and glass door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

609.7.2 Anchorage details. Products shall be anchored in accordance with the minimum requirements illustrated in Figures 609.7.2(1), 609.7.2(2), 609.7.2(3), 609.7.2(4), 609.7.2(5), 609.7.2(6), 609.7.2(7) and 609.7.2(8).
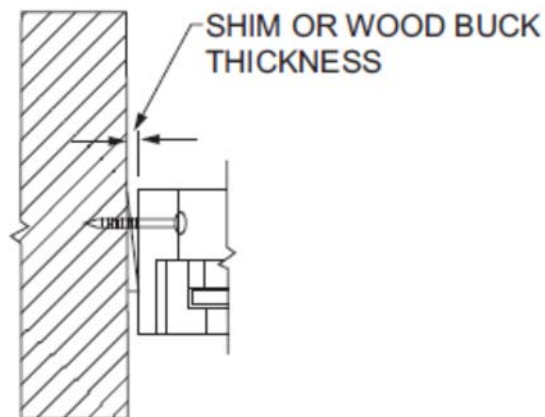
FIGURE 609.7.2(1)
THROUGH THE FRAME
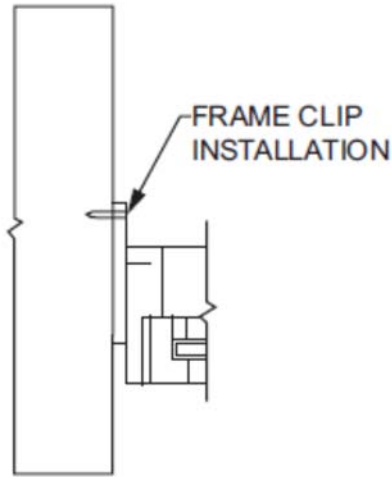
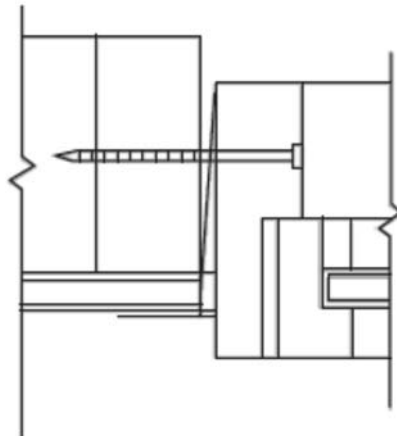**FIGURE 609.7.2(2)**
FRAME CLIP
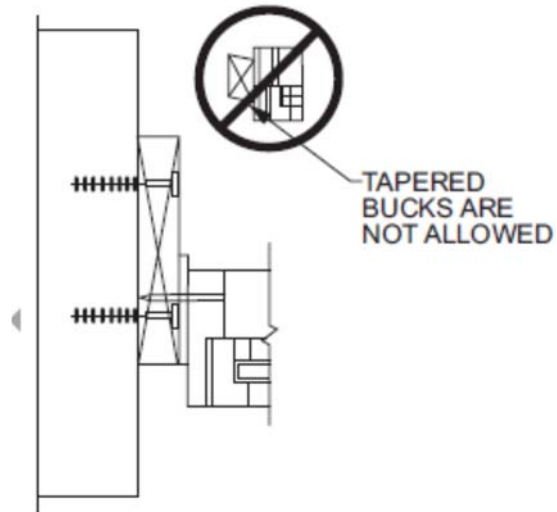
FIGURE 609.7.2(3)
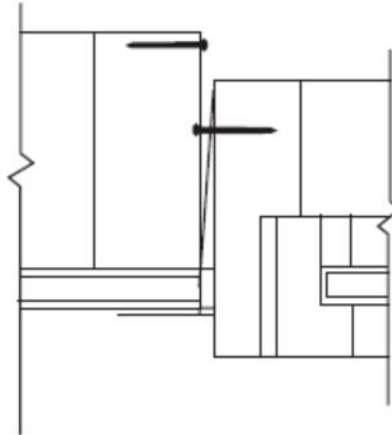**THROUGH THE FRAME**
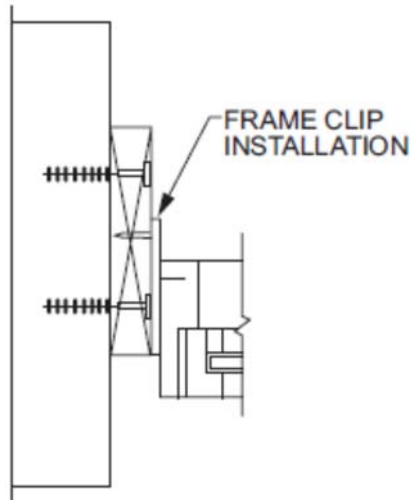
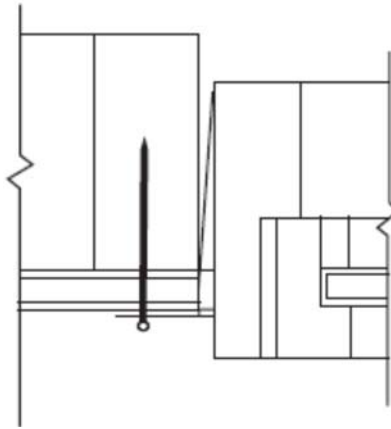**FIGURE 609.7.2(4)**
FRAME CLIP
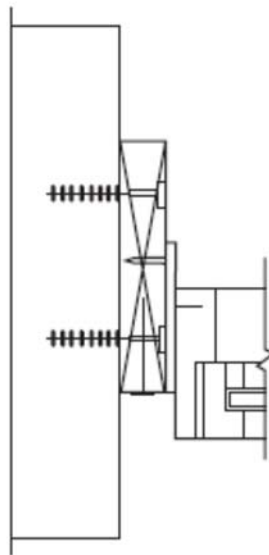
FIGURE 609.7.2(5)
THROUGH THE FLANGE

FIGURE 609.7.2(6)
THROUGH THE FLANGE

FIGURE 609.7.2(7)
FRAME CLIP

FIGURE 609.7.2(8)
THROUGH THE FLANGE

609.7.2.1 Masonry, concrete or other structural substrate. Where the wood shim or buck thickness is less than $1^1/_2$ inches (38 mm), window and glass door assemblies shall be anchored through the jamb, or by jamb clip and anchors shall be embedded directly into the masonry, concrete or other substantial substrate material. Anchors shall adequately transfer load from the window or door frame into the rough opening substrate [see Figures 609.7.2(1) and 609.7.2(2)].

   Where the wood shim or buck thickness is $1^1/_2$ inches (38 mm) or more, the buck is securely fastened to the masonry, concrete or other substantial substrate, and the buck extends beyond the interior face of the window or door frame, window and glass door assemblies shall be anchored through the jamb, or by jamb clip, or through the flange to the secured wood buck. Anchors shall be embedded into the secured wood buck to adequately transfer load from the window or door frame assembly [see Figures 609.7.2(3), 609.7.2(4) and 609.7.2(5)].

609.7.2.2 Wood or other approved framing material. Where the framing material is wood or other approved framing material, window and glass door assemblies shall be anchored through the frame, or by frame clip, or through the flange. Anchors shall be embedded into the frame construction to adequately transfer load [see Figures 609.7.2(6), 609.7.2(7) and 609.7.2(8)].

609.8 Mullions. Mullions shall be tested by an approved testing laboratory in accordance with AAMA 450, or be engineered in accordance with accepted engineering practice. Mullions tested as stand-alone units or qualified by engineering shall use performance criteria cited in Sections 609.8.1, 609.8.2 and

609.8.3. Mullions qualified by an actual test of an entire assembly shall comply with Sections 609.8.1 and 609.8.3.

609.8.1 Load transfer. Mullions shall be designed to transfer the design pressure loads applied by the window and door assemblies to the rough opening substrate.

609.8.2 Deflection. Mullions shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without deflecting more than L/175, where L is the span of the mullion in inches.

609.8.3 Structural safety factor. Mullions shall be capable of resisting a load of 1.5 times the design pressure loads applied by the window and door assemblies to be supported without exceeding the appropriate material stress levels. If tested by an approved laboratory, the 1.5 times the design pressure load shall be sustained for 10 seconds, and the permanent deformation shall not exceed 0.4 percent of the mullion span after the 1.5 times design pressure load is removed.

SECTION 610 STRUCTURAL INSULATED
PANEL WALL CONSTRUCTION

610.1 General. Structural insulated panel (SIP) walls shall be designed in accordance with the provisions of this section. Where the provisions of this section are used to design structural insulated panel walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

610.2 Applicability limits. The provisions of this section shall control the construction of exterior structural insulated panel walls and interior load-bearing structural insulated panel walls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist or truss span and not greater than two stories in height with each wall not greater than 10 feet (3048 mm) high. Exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed (V_{ult}) is not greater than 155 miles per hour (69 m/s) in Exposure B or 140 miles per hour (63 m/s) in Exposure C, the ground snow load is not greater than 70 pounds per square foot (3.35 kPa), and the seismic design category is A, B or C.

610.3 Materials. SIPs shall comply with the requirements of ANSI/APA PRS 610.1.

610.3.1 Lumber. The minimum lumber framing material used for SIPs prescribed in this document is NLGA graded No. 2 Spruce-pine-fir. Substitution of other wood species/grades that meet or exceed the mechanical properties and specific gravity of No. 2 Spruce-pine-fir shall be permitted.

610.3.2 SIP screws. Screws used for the erection of SIPs as specified in Section 610.5 shall be fabricated from steel, shall be provided by the SIP manufacturer and shall be sized to penetrate the wood member to which the assembly is being attached by not less than 1 inch (25 mm). The screws shall be corrosion resistant and have a minimum shank diameter of 0.188 inch (4.7 mm) and a minimum head diameter of 0.620 inch (15.5 mm).

610.3.3 Nails. Nails specified in Section 610 shall be common or galvanized box unless otherwise stated.

610.4 SIP wall panels. SIPs shall comply with Figure 610.4 and shall have minimum panel thickness in accordance with Tables 610.5(1) and 610.5(2) for above-grade walls. SIPs shall be identified by grade mark or certificate of inspection issued by an approved agency in accordance with ANSI/APA PRS 610.1.

FIGURE 610.4
SIP WALL PANEL

610.5 Wall construction. Exterior walls of SIP construction shall be designed and constructed in accordance with the provisions of this section and Tables 610.5(1) and 610.5(2) and Figures 610.5(1) through 610.5(5). SIP walls shall be fastened to other wood building components in accordance with Tables 602.3(1) through 602.3(4).

Framing shall be attached in accordance with Table 602.3(1) unless otherwise provided for in Section 610.

TABLE 610.5(1)
MINIMUM THICKNESS FOR SIP WALL
SUPPORTING SIP OR LIGHT-FRAME ROOF ONLY (inches) [a]

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)														
			24			28			32			36			40		
			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)		
Exp. B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
110	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)															
			24			28			32			36			40		
Exp. B	Exp. C		Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)		
			8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5
115	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
130	110	20	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
		30	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR
		50	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR
		70	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR
140	120	20	4.5	6.5	DR	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR
		30	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR
		50	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		70	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s. DR = Design Required.

a. Design assumptions:
   Maximum deflection criteria: L/240.
   Maximum roof dead load: 10 psf.
   Maximum roof live load: 70 psf.
   Maximum ceiling dead load: 5 psf.
   Maximum ceiling live load: 20 psf.
   Wind loads based on Table R301.2 (2).
   Strength axis of facing material applied vertically.

TABLE 610.5(2)
MINIMUM THICKNESS FOR SIP WALL
SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF ONLY (inches) [a]

| ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)															
			24			28			32			36			40		
Exp. B	Exp. C		Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)		
			8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
110	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	6.5	DR
		50	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR
		70	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR
115	—	20	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	DR	DR

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)														
			24			28			32			36			40		
			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)		
Exp. B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
		30	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR
		50	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR
		70	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
120	—	20	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR
		30	4.5	4.5	DR	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR	DR	DR	DR
		50	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR
		70	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
130	110	20	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR
		30	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		50	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		70	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR

For SI: 1 Inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

DR = Design Required.

a. Design assumptions:

Maximum deflection criteria: $L/240$.

Maximum roof dead load: 10 psf.

Maximum roof live load: 70 psf.

Maximum ceiling dead load: 5 psf.

Maximum ceiling live load: 20 psf.

Maximum second-floor dead load: 10 psf.

Maximum second-floor live load: 30 psf.

Maximum second-floor dead load from walls: 10 psf.

Maximum first-floor dead load: 10 psf.

Maximum first-floor live load: 40 psf.

Wind loads based on Table 301.2 (2).
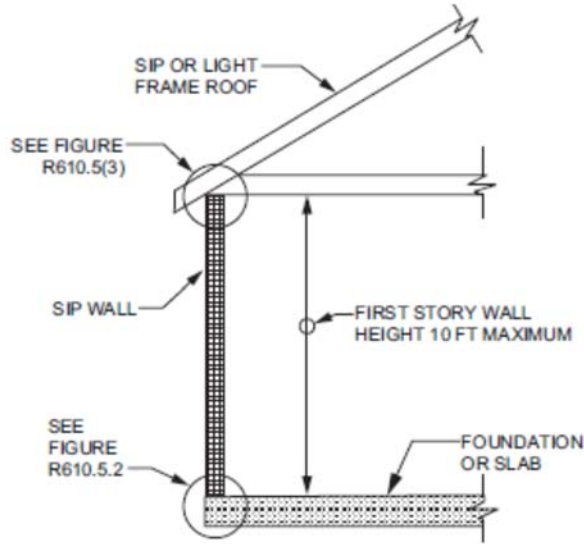
Strength axis of facing material applied vertically.

For SI: 1 foot = 304.8 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables 602.3(1) and (2), as appropriate.
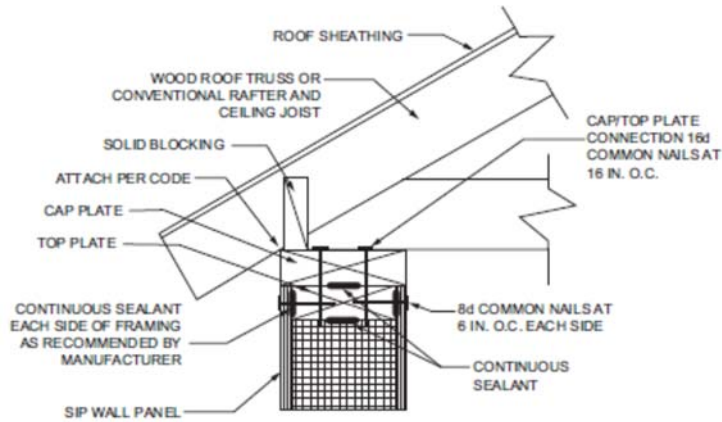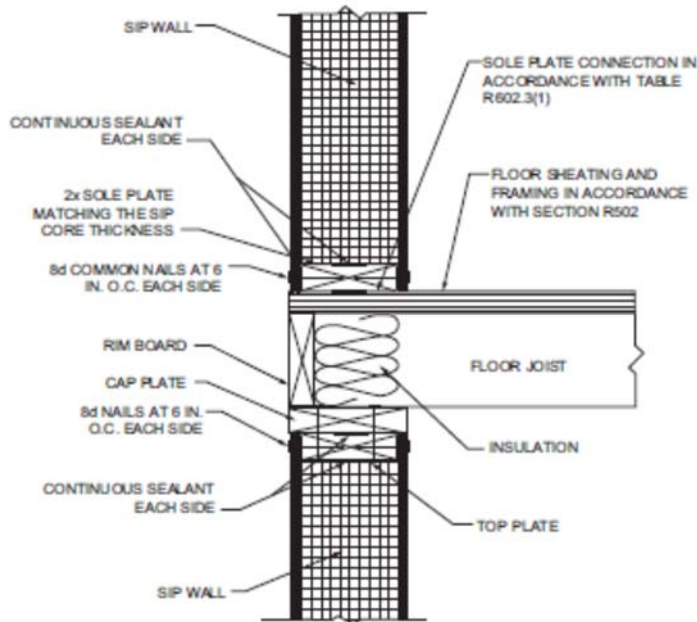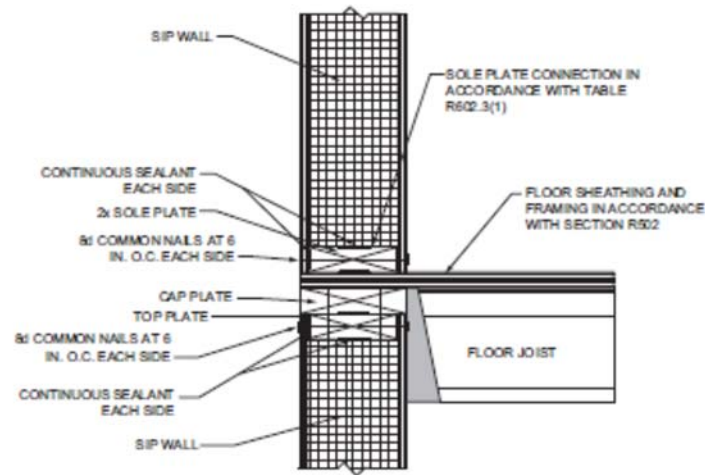
FIGURE 610.5(1)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS
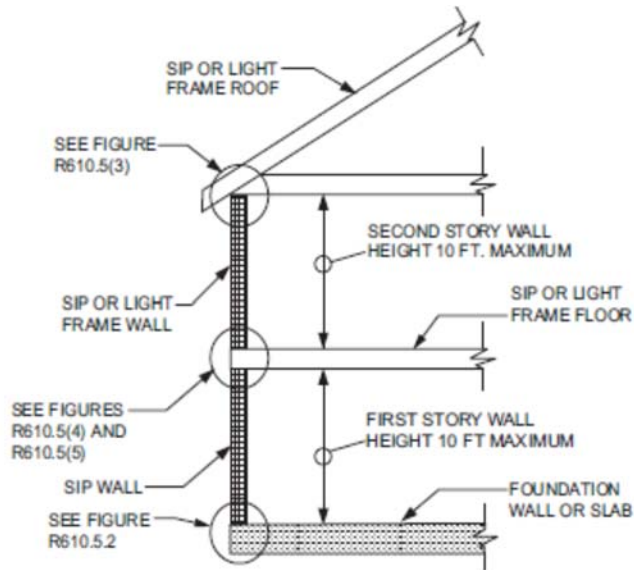
For SI: 1 foot = 304.8 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables 602.3(1) and (2), as appropriate.

FIGURE 610.5(2)
**MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS**

230

For SI: 1 inch = 25.4 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables 602.3(1) and (2), as appropriate.

FIGURE 610.5(3)
TRUSSED ROOF TO TOP PLATE CONNECTION

For SI: 1 inch = 25.4 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables 602.3(1) and (2), as appropriate.

FIGURE 610.5(4)
SIP WALL-TO-WALL PLATFORM FRAME CONNECTION

For SI: 1 inch = 25.4 mm.
Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables 602.3(1) and (2), as appropriate.

FIGURE 610.5(5)
SIP WALL-TO-WALL HANGING FLOOR FRAME CONNECTION
(I-Joist floor shown for Illustration only)

610.5.1 Top plate connection. SIP walls shall be capped with a double top plate installed to provide over-lapping at corner, intersections and splines in accordance with Figure 610.5.1. The double top plates shall be made up of a single 2-by (nominal 2-inch) top plate having a width equal to the width of the panel core, and shall be recessed into the SIP below. Over this top plate a cap plate shall be placed. The cap plate width shall match the SIP thickness and overlap the facers on both sides of the panel. End joints in top plates shall be offset not less than 24 inches (610 mm).
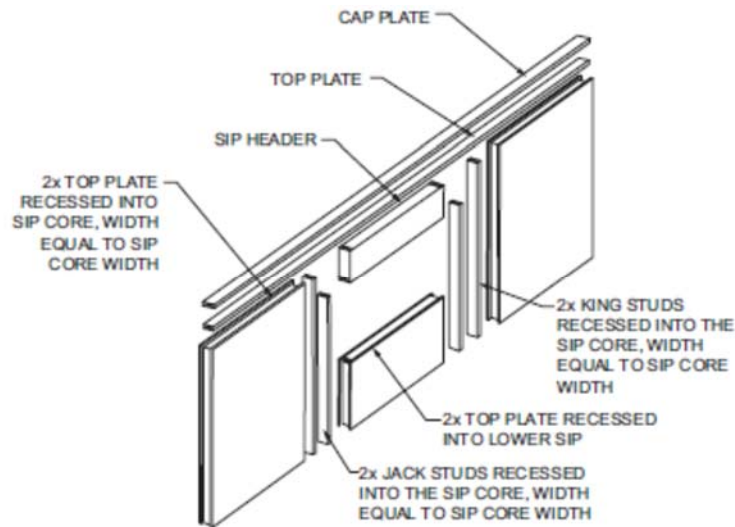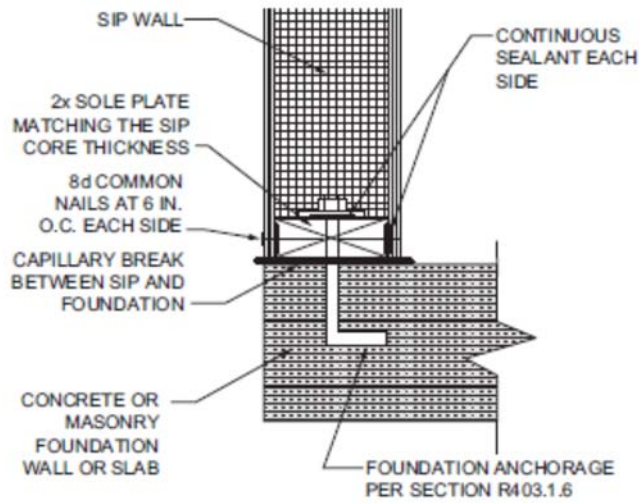
For SI: 1 inch = 25.4 mm.

Notes:

1. Top plates shall be continuous over header.
2. Lower 2x top plate shall have a width equal to the SIP core width and shall be recessed into the top edge of the panel. Cap plate shall be placed over the recessed top plate and shall have a width equal to the SIPs width.
3. SIP facing surfaces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 6 inches on center.

FIGURE 610.5.1
SIP WALL FRAMING CONFIGURATION

610.5.2 Bottom (sole) plate connection. SIP walls shall have full bearing on a sole plate having a width equal to the nominal width of the foam core. Where SIP walls are supported directly on continuous foundations, the wall wood sill plate shall be anchored to the foundation in accordance with Figure 610.5.2 and Section 403.1.
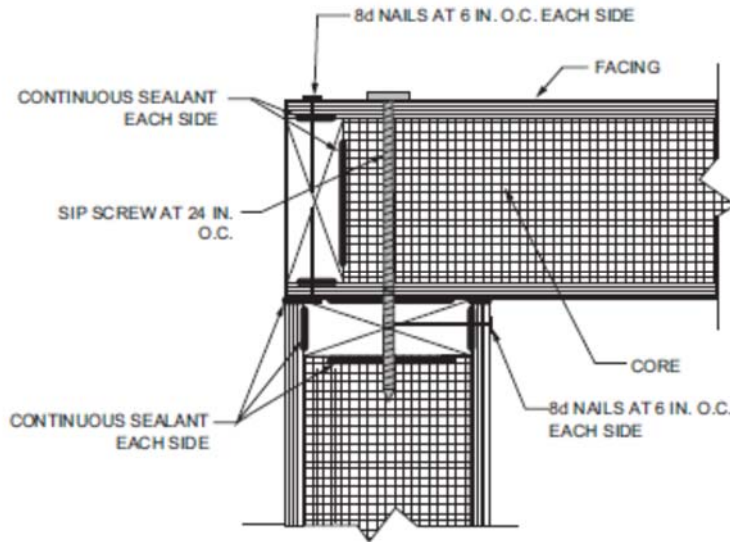
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 610.5.2
SIP WALL TO CONCRETE SLAB FOR
FOUNDATION WALL ATTACHMENT

610.5.3 Panel-to-panel connection. SIPs shall be connected at vertical in-plane joints in accordance with Figure 610.8 or by other approved methods.

610.5.4 Corner framing. Corner framing of SIP walls shall be constructed in accordance with Figure 610.5.4.

For SI: 1 inch = 25.4 mm.

FIGURE 610.5.4
## SIP CORNER FRAMING DETAIL

610.5.5 Wall bracing. SIP walls shall be braced in accordance with Section 602.10. SIP walls shall be considered continuous wood structural panel sheathing (bracing Method CS-WSP) for purposes of computing required bracing. SIP walls shall meet the requirements of Section 602.10.4.2 except that SIP corners shall be fabricated as shown in Figure 610.9. Where SIP walls are used for wall bracing, the SIP bottom plate shall be attached to wood framing below in accordance with Table 602.3(1).

610.5.6 Thermal barrier. SIP walls shall be separated from the interior of a building by an approved thermal barrier in accordance with Section 316.4.

610.6 Interior load-bearing walls. Interior load-bearing walls shall be constructed as specified for exterior walls.

610.7 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. Vertical chases shall have a minimum spacing of 24 inches (610 mm) on center. Not more than two horizontal chases shall be permitted in each wall panel, one at 14 inches (360 mm) plus or minus 2 inches (51 mm) from the bottom of the panel and one at 48 inches (1220 mm) plus or minus 2 inches (51 mm) from the bottom edge of the SIP's panel. Additional penetrations are permitted where justified by analysis.

610.8 Headers. SIP headers shall be designed and constructed in accordance with Table 610.8 and Figure 610.5.1. SIP headers shall be continuous sections without splines. Headers shall be not less than $11^7/_8$ inches (302 mm) deep. Headers longer than 4 feet (1219 mm) shall be constructed in accordance with Section 602.7. The strength axis of the factors on the header shall be oriented horizontally.
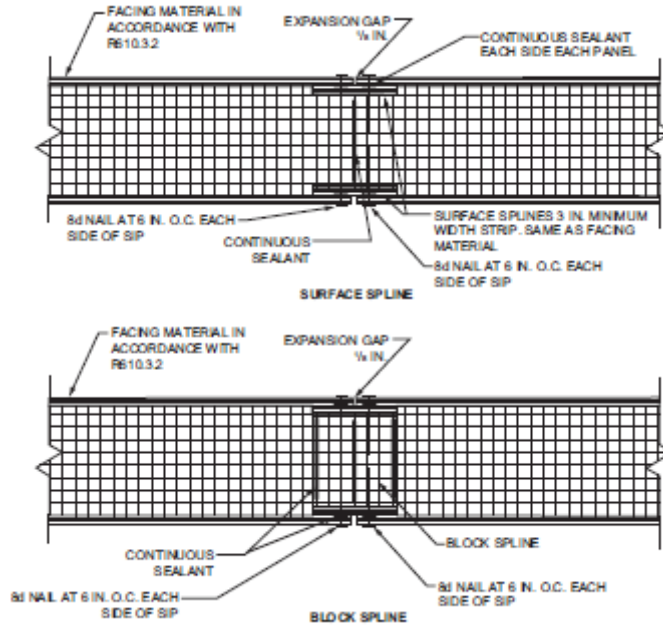
For SI: 1 inch = 25.4 mm.

FIGURE 610.8
TYPICAL SIP WALL PANEL-TO-PANEL CONNECTION DETAILS

TABLE 610.8
MAXIMUM SPANS FOR 11⁷/₈-INCH OR DEEPER SIP HEADERS (feet) [a, c, d]

LOAD CONDITION	SNOW LOAD (psf)	BUILDING [b] Width (feet)				
		24	28	32	36	40
Supporting roof only	20	4	4	4	4	2
	30	4	4	4	2	2
	50	2	2	2	2	2
	70	2	2	2	DR	DR
Supporting roof and one-story	20	2	2	DR	DR	DR
	30	2	2	DR	DR	DR
	50	2	DR	DR	DR	DR
	70	DR	DR	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa. DR = Design Required.

a. Design assumptions:
Maximum deflection criterion: L/240.
Maximum roof dead load: 10 psf.
Maximum ceiling load: 5 psf.
Maximum ceiling live load: 20 psf
Maximum second-floor live load: 30 psf.
Maximum second-floor dead load: 10 psf.
Maximum second-floor dead load from walls: 10 psf.
Maximum first floor dead load: 10 psf.
Wind loads based on Table 301.2(2).

Strength axis of facing material applied horizontally.
b. Building width is in the direction of horizontal framing members supported by the header.
c. The table provides for roof slopes between 3:12 and 12:12.
d. The maximum roof overhang is 24 inches (610 mm).

610.8.1 Wood structural panel box headers. Wood structural panel box headers shall be allowed where SIP headers are not applicable. Wood structural panel box headers shall be constructed in accordance with Figure 602.7.3 and Table 602.7.3.

Replaces: 4101:8-6-01

Effective: 7/1/2019

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Certification

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