

UDC Wall Bracing Provisions

Permanent Rule effective September 1, 2014

A 'How To' guide for use of the new provisions

Summary: Forget what you knew about the previous wall bracing provisions – this method is a different concept. The provisions are generally based on the 2012 IRC Simplified Wall Bracing Provisions. The new prescriptive Tables provide the number of braced wall panels required on a rectangle side (intermittent sheathing method) OR the total length of braced wall panels required on a rectangle side (continuously sheathed method) in wood frame walls parallel to the wind direction being considered.

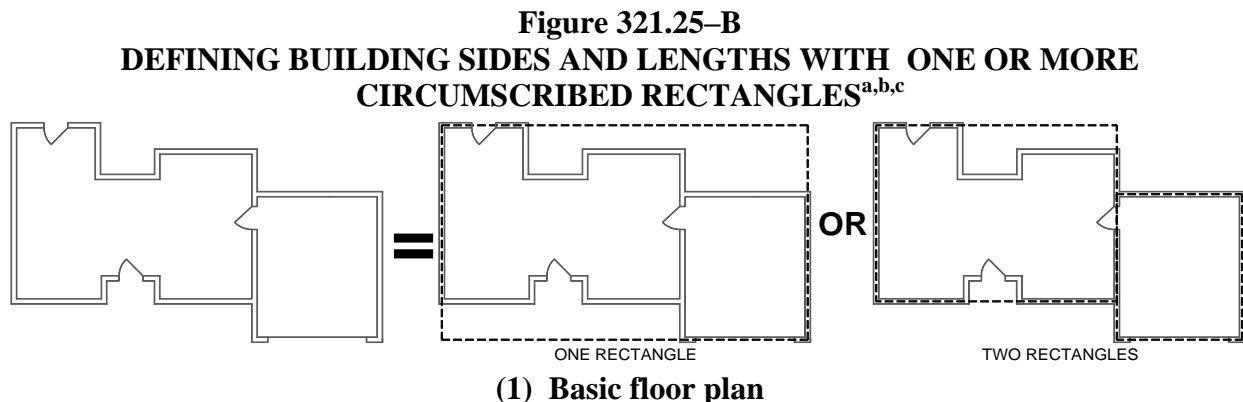
What hasn't changed? Generally the bracing materials and fastening in Table 321.25-G remain unchanged.

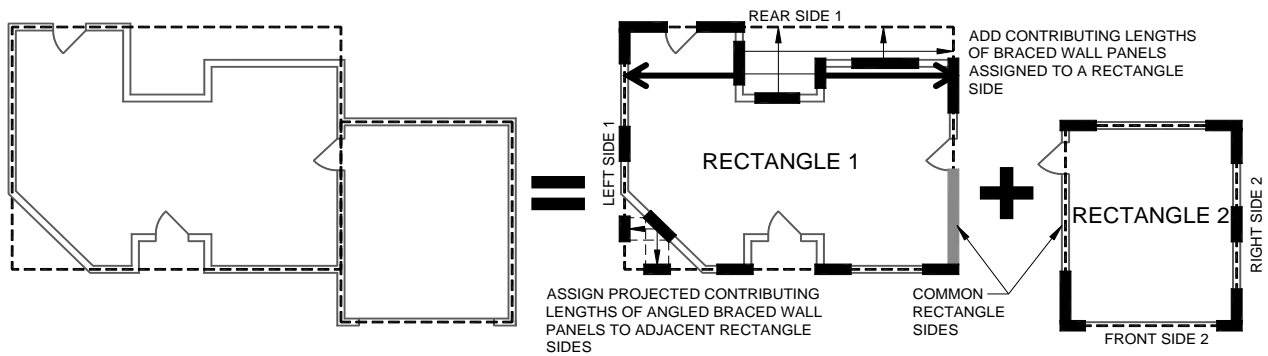
Major Assumptions/Defaults:

- Interior side of exterior walls are sheathed with ½" gypsum board
- 10' wall heights
- Wind Exposure category B
- For the intermittent bracing method roof eave (top of wall) to ridge height is 10'

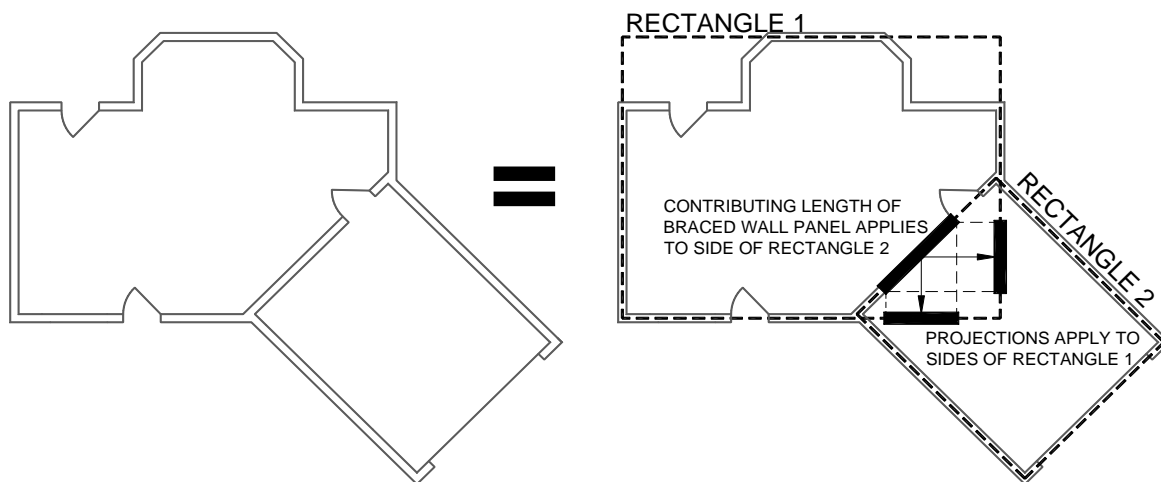
Starting with the topmost floor level ...

STEP 1: Define the rectangle sides by circumscribing the outermost extents of the building at each floor level with a rectangle. The maximum length of any side of the rectangle is 75' for intermittent bracing and 80' for continuously sheathed bracing. For either method the maximum length to width ratio of the rectangle is 3:1. If the length of the rectangle side exceeds the prescriptive limit of the respective table or the length to width ratio exceeds 3:1 the building must be circumscribed or divided with more than one rectangle or designed by engineering analysis. See examples below from the rules - Figure 321.25-B.





(2) Angled-building-side plan^d



(3) Angled floor plan^e

^aEach floor plan level shall be circumscribed with one or more rectangles around the entire floor plan at the floor level under consideration as shown. When multiple rectangles are used, each side shall be braced as though it were a separate building and the bracing amount added together along the common wall where adjacent rectangles overlap or abut.

^bRectangles shall surround all enclosed plan offsets and projections. Chimneys, partial height projections, and open structures, such as carports and decks, shall be excluded from the rectangle.

^cEach rectangle shall have a maximum rectangle length-to-width ratio of 3:1.

^dProjected contributing lengths of angled braced wall panels shall be assigned to the closest rectangle sides, as shown for the angled corner in the angled-building-side-plan shown above.

^eBraced wall panels located on a common wall where angled rectangles intersect, as shown in Figure 321.25-B(3), shall have their contributing length applied towards the required length of bracing for the parallel rectangle side and its projected contributing lengths towards the adjacent angled rectangle sides. Where the common side of rectangle 2 as shown in Figure 321.25-B(3) has no physical wall, the portion shall be designed in accordance with s. SPS 321.25 (8) (a).

STEP 2: Select the wall bracing method (intermittent or continuous), materials, and panel width (intermittent method) from Table 321.25-G. If using intermittent braced wall panels, in general most of the bracing methods are considered equivalent and the method simply tells you the NUMBER of panels required on a rectangle side. For continuously sheathed bracing the method yields the total LENGTH of braced wall required on a rectangle side.

**Table 321.25–G
BRACING METHODS^{a, f}**

Material	Minimum Brace Material Thickness or Size	Maximum Nominal Wall Height ^b	Minimum Braced Wall Panel Width or Brace Angle	Connection Criteria	
				Minimum Fasteners	Maximum Spacing
Intermittent Bracing Methods					
LIB ^c Let-in bracing	1x4 wood brace (or approved metal brace installed per manufacturer instructions)	10'	45° angle and maximum 16" o.c. stud spacing ^b	2-8d common nails or 3-8d box nails (2 3/8" long x 0.113" diameter)	Per stud and top and bottom plates ^e
DWB Diagonal wood boards	3/4" (1" nominal) for maximum 24" o.c. stud spacing	10'	48"	2-8d box nails (2 3/8" long x 0.113" diameter) or 2 - 1 3/4" long 16-gage staples	Per stud and top and bottom plates ^e
WSP Wood structural panel	3/8" for maximum 16" o.c. stud spacing; 7/16" for maximum 24" o.c. stud spacing	10'	48"	6d common nail or 8d box nail (2 3/8" long x 0.113" diameter); or 7/16"- or 1/2"- crown 16-gage staples, 1 1/4" long	6" edges, 12" field (nails) 3" edges, 6" field (staples)
SFB Structural fiberboard sheathing	1/2" for maximum 16" o.c. stud spacing	10'	48"	1 1/2" long x 0.120" diameter galvanized roofing nails or 1"-crown 16-gage staples, 1 1/4" long	3" edges, 6" field
GB Gypsum board (installed on both sides of wall)	1/2" for maximum 24" o.c. stud spacing	10'	96"	5d cooler nails, or #6 screws	7" edges, 7" field (including top and bottom plates)
Continuous Sheathed Bracing Methods					
CS-WSP ^d Continuous sheathed WSP	3/8" for maximum 16" o.c. stud spacing;	12'	Refer to Table 321.25-H	Same as WSP	Same as WSP

	7/16" for maximum 24" o.c. stud spacing				
CS-SFB ^d Continuous sheathed SFB	1/2" for maximum 16" o.c. stud spacing			Same as SFB	Same as SFB
Narrow Panel Bracing					
PF Portal frame	7/16"	12'	Refer to Figure 321.25-A	Refer to Figure 321.25-A	Refer to Figure 321.25-A

^aThe interior side of all exterior walls shall be sheathed with minimum 1/2-inch gypsum wallboard unless otherwise permitted to be excluded by this subsection. All edges of panel-type wall bracing, except horizontal joints in GB bracing, shall be attached to framing or blocking.

^bThe actual measured wall height shall include stud height and thickness of top and bottom plates. The actual wall height shall be permitted to exceed the listed nominal values by not more than 4 1/2 inches. Tabulated bracing amounts in s. SPS 321.25 (8) (c) are based on a 10-foot nominal wall height for all bracing methods and shall be permitted to be adjusted to other nominal wall heights not exceeding 12 feet in accordance with footnotes to Table 321.25-I or Table 321.25-J.

^cLIB is not permitted for walls supporting a roof and two floors. Two LIB braces installed at a 60° angle from horizontal shall be permitted to be substituted for each 45° angle LIB brace.

^dBracing with CS-WSP and CS-SFB shall have sheathing installed on all sheathable surfaces above, below, and between wall openings.



^eShall be attached to the top and bottom plates and any intermediate studs, in one continuous length.

^fEach braced panel may contain no more than one hole, having a maximum dimension of no more than ten percent of the least dimension of the panel, and confined to the middle three-fourths of the panel.

STEP 3: DETERMINE NUMBER OF PANELS OR REQUIRED TOTAL LENGTH OF BRACING REQUIRED USING ONE OF THE FOLLOWING METHODS

- A) Intermittent braced wall panels. Determine the NUMBER of braced panels required on each rectangle side using Table 321.25-I based on the length of the perpendicular side. NOTE a minimum of 2 braced wall panels is required on each rectangle side.

**Table 321.25-I
REQUIRED NUMBER OF INTERMITTENT BRACED WALL PANELS
ON WALLS PARALLEL TO EACH RECTANGLE SIDE
AT EACH FLOOR LEVEL^{a,b,c,d,e,f,h}**

		Required Number of Brace Panels on a Building Side		
		Length of Perpendicular Side (feet) ^g		
Wall Supporting:		≤25	≤50	≤75
Roof and ceiling only		1 ⁱ	2	3
One floor, roof and ceiling		2	4	6

Two floors, roof and ceiling		3	6	9
------------------------------	---	---	---	---

^aInterpolation is permitted. Extrapolation to buildings larger than addressed in this table is prohibited.

^bThis table applies to wind exposure category B. For wind exposure category C or D, multiply the number of braced wall panels required by 1.3 or 1.6, respectively.

Wind exposure category B is comprised of urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.

Wind exposure category C is comprised of flat, open country and grasslands with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet extending more than 1,500 feet from the building site in any quadrant. This exposure also applies to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet.

Wind exposure category D is comprised of flat, unobstructed areas exposed to wind flowing over open water for a distance of at least 1 mile. This exposure applies only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1,500 feet or 10 times the height of the building or structure, whichever is greater.

^cTabulated values are based on a nominal wall height of 10 feet. For nominal wall heights other than 10 feet and not more than 12 feet, multiply the required number of brace panels by the following factors: 0.9 for 8 feet, 0.95 for 9 feet, 1.15 for 11 feet, or 1.3 for 12 feet.

^dTabulated values are based on a roof with a top-of-wall-to-ridge height of 10 feet. For top-of-wall-to-ridge heights other than 10 feet, multiply the required number of brace panels by the following factors for each floor level support condition:

- Roof only – 0.7 for 5 feet, 1.3 for 15 feet, or 1.6 for 20 feet
- Roof + 1 Floor – 0.85 for 5 feet, 1.15 for 15 feet, or 1.3 for 20 feet
- Roof + 2 Floors – 0.9 for 5 feet or 1.1 for 15 feet.

^eWhere minimum ½-inch gypsum wallboard is not included on the interior side of the wall, multiply the number of braced wall panels by 1.7 for LIB bracing or 1.4 for all other bracing methods, except this increase is not required for the portal frame method.

^fAdjustments in footnotes b to e apply cumulatively. Fractions of panels shall be rounded to the nearest one-half braced wall panel.

^gPerpendicular sides to the front and rear sides are the left and right sides. Perpendicular sides to the left and right sides are the front and rear sides. See Figure 321.25–B.

^hThe following braced wall panel conditions shall be permitted to be counted as one-half a braced wall panel toward meeting the required number of panels: (1) one 60 degree LIB; (2) one 48” GB or one 96” GB with gypsum wallboard on one side; (3) one 36” WSP or SFB braced wall panel for wall heights not more than 9 feet; (4) a 48” WSP or SFB braced wall panel where there is no more than one unblocked horizontal joint; or (5) one PF brace panel complying with Figure 321.25–A.










ⁱThis value of less than 2 serves only as the beginning value for calculation purposes. The resulting value shall be 2 or greater, to be consistent with subd. 2.

OR

- B) Continuously Sheathed braced walls. Determine the TOTAL LENGTH of braced wall panels on each rectangle side using Table 321.25-J based on the length of the perpendicular side.

Table 321.25–J
REQUIRED LENGTH OF CONTINUOUS BRACING ON WALLS PARALLEL TO
EACH RECTANGLE SIDE AT EACH FLOOR LEVEL^{a,b,c,d,e,g,h}

Top-of-Wall-to-Ridge	Wall Supporting:	Total Required Length (feet) of Full-Height Bracing on Any Side of Rectangle
-----------------------------	-------------------------	---

Height (feet)			Length of Perpendicular Side (feet) ^f							
			10	20	30	40	50	60	70	80
10	Roof and ceiling only		2.0 ⁱ	3.5 ⁱ	5.0	6.0	7.5	9.0	10.5	12.0
	One floor, roof and ceiling		3.5 ⁱ	6.5	9.0	12.0	14.5	17.0	19.8	22.6
	Two floors, roof and ceiling		5.0	9.5	13.5	17.5	21.5	25.5	29.2	33.4
15	Roof and ceiling only		2.6 ⁱ	4.6	6.5	7.8	9.8	11.7	13.7	15.7
	One floor, roof and ceiling		4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
	Two floors, roof and ceiling		5.5	10.5	14.9	19.3	23.7	27.5	32.1	36.7
20	Roof and ceiling only		2.9 ⁱ	5.2	7.3	8.8	11.1	13.2	15.4	17.6
	One floor, roof and ceiling		4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
	Two floors, roof and ceiling		6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5

^aInterpolation is permitted. Extrapolation to buildings larger than addressed in this table is prohibited.

^bThis table applies to wind exposure category B. For wind exposure category C or D, multiply the required length of wall bracing by 1.3 or 1.6, respectively. Wind exposure categories are as defined in Table 321.25–I footnote b.

^cTabulated values are based on a nominal wall height of 10 feet. For nominal wall heights other than 10 feet, multiply the required length of bracing by the following factors: 0.90 for 8 feet, 0.95 for 9 feet, 1.05 for 11 feet, or 1.10 for 12 feet.

^dWhere minimum ½-inch gypsum wallboard interior finish is not provided, the required bracing amount for the affected rectangle side shall be multiplied by 1.4, except this increase is not required for the portal frame method.

^eAdjustments in footnotes b to d apply cumulatively.

^fPerpendicular sides to the front and rear sides are the left and right sides. Perpendicular sides to the left and right sides are the front and rear sides. See Figure 321.25–B.

^gContinuous sheathing shall be applied to all surfaces of the wall, including areas between brace panels and above and below wall openings.

^hWhen used on a wall line with continuous sheathing, each portal frame panel is counted for its actual length in contributing toward the length of continuous sheathing used on other portions of the same wall line, such as the building side at a given story level.

ⁱAny value of less than 4.0 in this table serves only as the beginning value for calculation purposes. The resulting value shall be 4.0 or greater, to be consistent with Table 321.25–H and subd. 2.

STEP 4: If required, apply any adjustment factors (adjustments may decrease or increase the required bracing amount) per the footnotes to the respective Table for the method used (intermittent or continuous). For example wall heights taller than 10' and wind exposure category C or D would both increase the bracing amount. Absence of interior ½" gypsum board sheathing increases the required bracing amount.

STEP 5: Repeat steps 2 through 4 considering wind in the perpendicular direction.

STEP 6: Determine the minimum required width of braced wall panels. For intermittent bracing method the minimum length of braced wall panel is given in Table 321.25-G (see step 2 above). For continuously sheathed bracing method the minimum width is determined using Table 321.25-H dependent on the maximum opening height adjacent to the panel and the wall height.

Table 321.25-H^{a, b}
MINIMUM WIDTHS OF CS-WSP AND CS-SFB BRACED WALL PANELS

Maximum Opening Height Adjacent to Braced Wall Panel	Minimum Width of Full-Height Braced Wall Panel (inches)			
	8' Tall Wall	9' Tall Wall	10' Tall Wall	12' Tall Wall
5'- 4"	24	27	30	36
6'- 8"	32	30	30	36
8'	48	41	38	36
9'	-	54	46	41
10'	-	-	60	48
12'	-	-	-	72

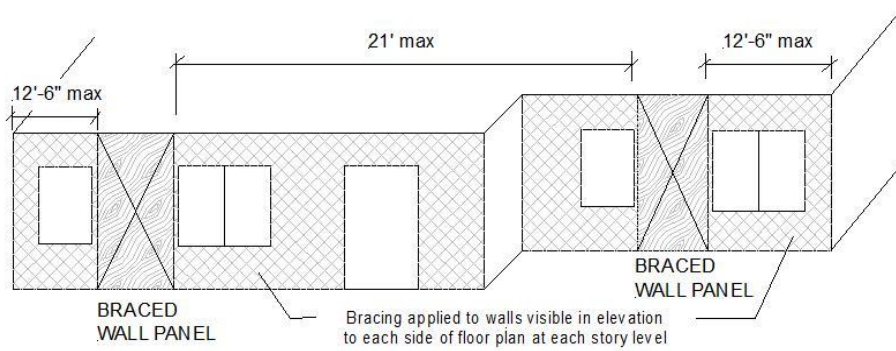
^aSheathing shall extend from the top of the top plate to the bottom of the bottom plate and may be multiple sheets. All joints shall be blocked.

^bInterpolation is permitted.

PF (Portal Frame) Method: Portal Frame narrow panel bracing may be used with either the intermittent or continuously sheathed bracing methods. For Intermittent bracing, per Table 321.25-I footnote 'h', each PF panel (16-24" wide per Figure 321.25-A) counts as ½ of a braced wall panel when determining compliance with Table 321.25-I. For Continuously Sheathed bracing, the actual length of each PF panel (16-24" wide per Figure 321.15-A) in feet, counts toward the required total length of bracing required.

STEP 7: Check that the location of braced wall panels meets Figure 321.25-C. A braced wall panel must start within 12 ½' from the end of the rectangle side and braced panels must be spaced a maximum of 21' edge to edge along the rectangle side. For intermittent or continuous methods, each PF panel meeting the minimum required width of Fig. 321.25-A counts as a braced wall panel when evaluating compliance with Fig. 321.25-C.

FIGURE 321.25-C
LOCATION OF BRACED WALL PANELS ALONG A BUILDING SIDE^a



^aA braced wall panel can be anything from one-half to one brace panel.

STEP 8: Repeat steps 1 through 7 for additional floor levels.

See also the One- and Two-Family Dwellings (Uniform Dwelling Code) Program web page for a Frequently Asked Questions document that provides further guidance and explanation on the use of the wall bracing permanent rule provisions.