

STATE OF WISCONSIN
Department of Safety and Professional Services

IN THE MATTER OF RULEMAKING	:	ORDER OF THE
PROCEEDINGS BEFORE THE	:	DEPARTMENT OF SAFETY
DEPARTMENT OF SAFETY AND	:	AND PROFESSIONAL SERVICES,
PROFESSIONAL SERVICES	:	ADOPTING RULES
	:	CLEARINGHOUSE RULE 14-015

ORDER

An order of the Department of Safety and Professional Services to repeal SPS 321.25 (8) (d) to (f), (g) 4., (h), and (9); Tables 321.25–K and 321.25–L; and Figures 321.25–D to 321.25–K;

to renumber SPS 321.25 (8) (g) (title), (intro.), and 1. to 3.;

to amend SPS 320.09 (5) (b) 2. d., 321.02 (1) (c), Table 321.25–A, 321.25 (7) (d) and (8) (a) (Note), and 320 to 325 Appendix – Minimum Fastener Schedule Table;

to repeal and recreate SPS 321.25 (8) (b) and (c), Tables 321.25–G to 321.25–J, and Figures 321.25–A to 321.25–C;

and to create SPS 321.02 (1) (c) (Note), relating to wall bracing for one- and two-family dwellings.

ANALYSIS

Statutes interpreted:

Sections 101.63 (intro.) and (1) (intro.) and (5).

Statutory authority:

Sections 101.63 (intro.) and (1) (intro.) and 227.11 (2) (a).

Explanation of agency authority:

Sections 101.63 (intro.) and (1) (intro.) require the Department to adopt rules that establish standards for the construction and inspection of one- and two-family dwellings and components thereof. No set of rules may be adopted that has not taken into account the costs of specific code provisions to home buyers in relationship to the benefits derived from the provisions.

Section 227.11 (2) (a) of the Statutes authorizes the Department to promulgate rules interpreting any statute that is enforced or administered by the Department, if the rule is considered necessary to effectuate the purpose of the statute.

Related statute or rule:

Various other statutes and rules promulgated by the Department address construction and inspection of public buildings and places of employment, and some of those rules likewise address designing those structures to withstand wind loads.

Plain language analysis:

These rule revisions clarify and simplify the prescriptive methods in chapter SPS 321 for designing wall bracing for one- and two-family homes, to adequately withstand wind loads.

Summary of, and comparison with, existing or proposed federal regulation:

An Internet-based search of the *Code of Federal Regulations* (CFR) and the *Federal Register* did not reveal any federal regulations relating to the rule revisions herein for one- and two-family dwellings – other than the preemptive construction, installation, and safety standards for manufactured homes in 24 CFR Parts 3280 and 3285.

Comparison with rules in adjacent states:

Illinois: An Internet-based search did not reveal the existence of a statewide one- and two-family dwelling code. Dwelling regulation appears to be left up to the individual local units of government.

Iowa: An Internet-based search did not reveal the existence of a statewide one- and two-family dwelling code. Dwelling regulation appears to be left up to the individual local units of government.

Michigan: An Internet-based search revealed a mandatory, statewide one- and two-family dwelling code. The Residential Construction Code under the Construction Code Commission's General Rules, in section 408.305, contains the state amendments to the 2009 International Residential Code® (IRC®) developed by the International Code Council, Inc., and includes wall-bracing requirements that are similar to the requirements which are being replaced by the rule revisions contained herein.

Minnesota: An Internet-based search revealed a mandatory, statewide one- and two-family dwelling code. The Minnesota Department of Labor and Industry, in Chapter 1309, adopts the 2006 IRC, chapters 2-10 and 43. Chapters 2-10 contain the general construction provisions of the IRC, which include wall-bracing requirements that are similar to the requirements which would be replaced by the rule revisions contained herein.

Summary of factual data and analytical methodologies:

The Department received input during several meetings with the Dwelling Code Council. The makeup of this Council is established under section 15.407 (10) of the Statutes and consists of members who are appointed by the Governor. The Council includes representatives of several types

of small businesses. Through this Council, the Department was able to gather information on the potential impacts of the rule revisions contained herein.

Analysis and supporting documents used to determine effect on small business or in preparation of economic impact analysis:

The rule revisions are not expected to significantly impact small business because they clarify and simplify current requirements rather than impose new restrictions.

Fiscal Estimate and Economic Impact Analysis:

The Fiscal Estimate and Economic Impact Analysis is attached.

Effect on small business:

These rule revisions are not expected to have an economic impact on small businesses, as defined in section 227.114 (1) of the Statutes. The Department’s Regulatory Review Coordinator may be contacted by e-mail at Tom.Engels@wisconsin.gov, or by calling (608) 266-8608.

Agency contact person:

Sam Rockweiler, Rules Coordinator, at the Department of Safety and Professional Services, Division of Policy Development, 1400 East Washington Avenue, Room 151, P.O. Box 8366, Madison, WI, 53708-8366; or at telephone (608) 266-0797; or by e-mail at sam.rockweiler@wi.gov.

TEXT OF RULE

SECTION 1. SPS 320.09 (5) (b) 2. d. is amended to read:

SPS 320.09 (5) (b) 2. d. The location and construction details of ~~the braced wall lines~~ wall bracing on each building side and floor level.

SECTION 2. SPS 321.02 (1) (c) is amended to read:





SPS 321.02 (1) (c) *Wind loads.* Dwellings shall be designed and constructed to withstand either a horizontal and uplift pressure of 20 pounds per square foot acting over the surface area or the wind loads determined in accordance with ASCE 7-05, *Minimum Design Loads for Buildings and Other Structures.*

SECTION 3. SPS 321.02 (1) (c) (Note) is created to read:

SPS 321.02 (1) (c) Note: ASCE 7-05 allows for substantial reduction from 20 psf as applied to the surface area.

SECTION 4. SPS Table 321.25–A is amended to read:

**Table 321.25–A
SIZE, HEIGHT AND SPACING OF WOOD STUDS^{a,c}**
(Partial Table)

<u>Nominal Stud Size (inches)</u>	<u>Maximum Laterally Unsupported Stud Height^a (feet)</u>	<u>Bearing and Exterior Nonbearing Walls</u>				<u>Interior Nonbearing Walls</u>	
		<u>Maximum Spacing When Supporting Roof and Ceiling Only (inches)</u>	<u>Maximum Spacing When Supporting One Floor, Roof and Ceiling (inches)</u>	<u>Maximum Spacing When Supporting Two Floors, Roof and Ceiling (inches)</u>	<u>Maximum Spacing When Supporting One Floor Only (inches)</u>	<u>Maximum Laterally Unsupported Stud Height^a (feet)</u>	<u>Maximum Spacing (inches)</u>
2x6	10,12 ^d					20	24

^cAll spacing dimensions are to the center of the studs.

^dUnless supported by structural analysis, use of stud heights that range from over 10 feet to 12 feet is limited to where all of the following conditions are met: snow loads do not exceed 25 psf; tributary dimensions for floors and roofs do not exceed 6 feet; spans for floors and roofs do not exceed 12 feet; eave projections do not exceed 2 feet; the bending modulus of elasticity is at least 1,600,000 lb_f per square inch; the allowable fiber stress in bending for the wood is not less than 1310 psi as determined by multiplying the AF&PA NDS tabular base design value by the repetitive use factor, and by the size factor for all species except southern pine; utility, standard, stud, and No. 3 grade lumber of any species is not used; and the allowable deflection does not exceed whichever of the following are applicable:

- Interior walls and partitions – span height/180.
 - Exterior walls with plaster or stucco finish – span height/360.
 - Exterior walls with other brittle finishes – span height/240.
 - Exterior walls with flexible finishes – span height/120.
 - Exterior walls with interior gypsum wallboard finish – span height/180.
- Any manufacturer-specified limits for any included windows or doors.

SECTION 5. SPS 321.25 (7) (d) and (8) (a) (Note) are amended to read:

SPS 321.25 (7) (d) Cripple walls with a stud height of 14 inches or greater shall be braced in accordance with sub. (8) ~~or (9)~~.

(8) (a) Note: Acceptable engineering wall bracing practices include any of the following:

1. The provisions under section R602.10 or R602.12 of the International Residential Code (IRC) – 2009 2012.
2. Design in accordance with the engineering basis of the 2012 IRC bracing provisions, such as described in Crandell, J. and Martin, Z., “The Story Behind the 2009 IRC Wall Bracing Provisions (Part 2: New Wind Bracing Requirements),” Wood Design Focus, Forest Products Society, Peachtree Corners, GA, Spring 2009.
3. Installation instructions from the manufacturer of the bracing product that are compliant with section SPS 321.02.

SECTION 6. SPS 321.25 (8) (b) and (c), Tables 321.25–G to 321.25–J, and Figures 321.25–A to 321.25–C are repealed and recreated to read:

SPS 321.25 (8) (b) Bracing materials and methods. Wall bracing shall consist of the materials and methods listed in Table 321.25–G or approved alternatives capable of providing the required wind load resistance as determined in accordance with s. SPS 321.02 (1) (c).

**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; 7/16" for maximum 24" o.c. stud spacing	12'	Refer to Table 321.25-H	Same as WSP	Same as WSP
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 4½ 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.

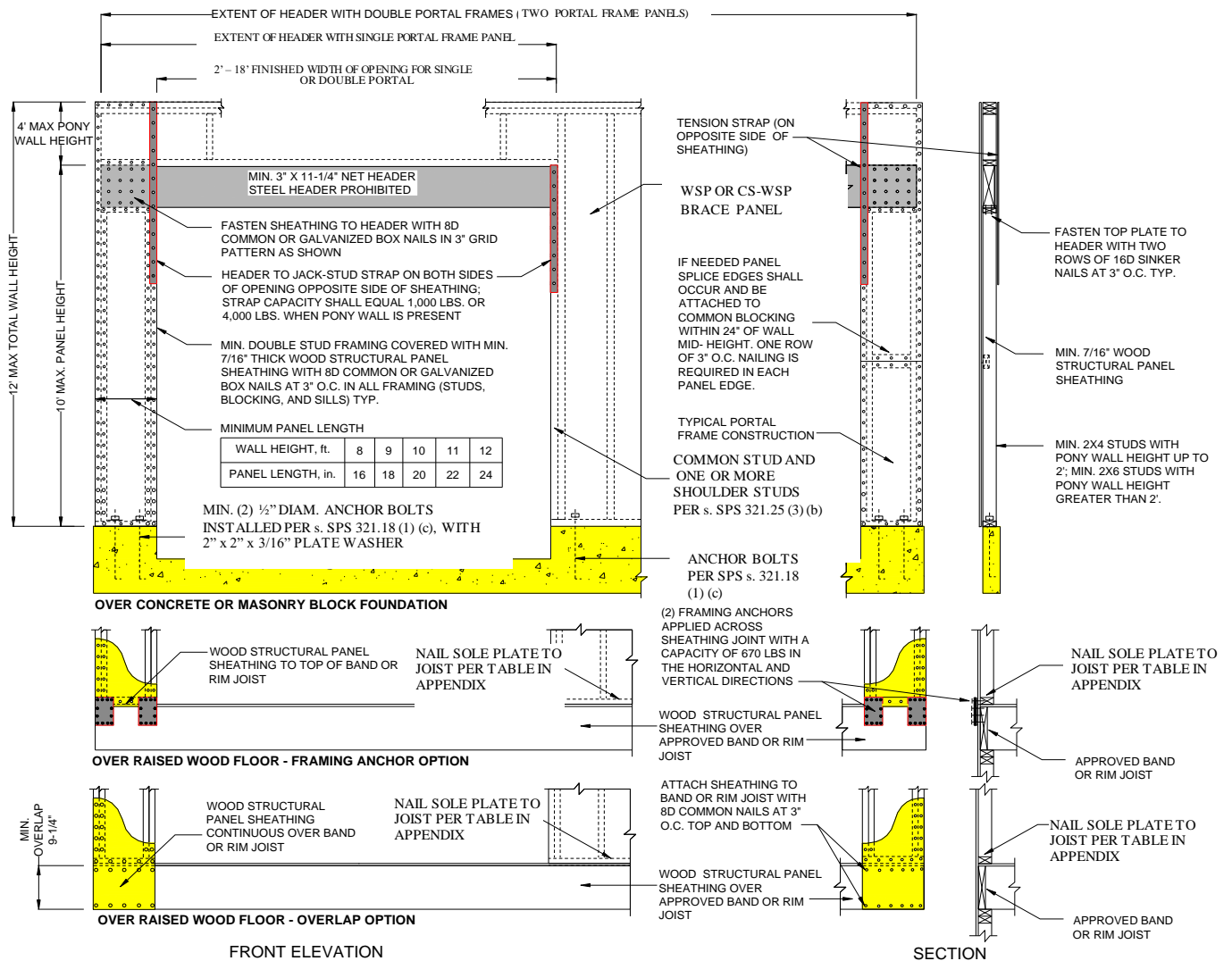
Table 321.25–H^{a, b}
MINIMUM WIDTHS OF CS-WSP AND CS-SFB BRACED WALL PANELS

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.

Figure 321.25–A
PF – PORTAL FRAME BRACE CONSTRUCTION



Note: Steel headers are permitted if designed by structural analysis.

Note: As shown in the above cross-section, 1/2-inch gypsum wallboard is not required on the interior side of the wall.

(c) *Bracing amount.* Bracing methods and materials complying with Table 321.25–G shall be applied to walls in accordance with all of the following requirements:

1. For the purpose of determining bracing amounts, the outermost extents of the building plan at each floor level shall be circumscribed with a rectangle to define the overall length of each building side as shown in Figure 321.25–B.
2. In no case may the amount of bracing be less than two braced wall panels on walls parallel to each rectangle side for each floor level of the building.
3. Where used, the number of intermittent brace panels applied to walls parallel to each rectangle side shall comply with Table 321.25–I.

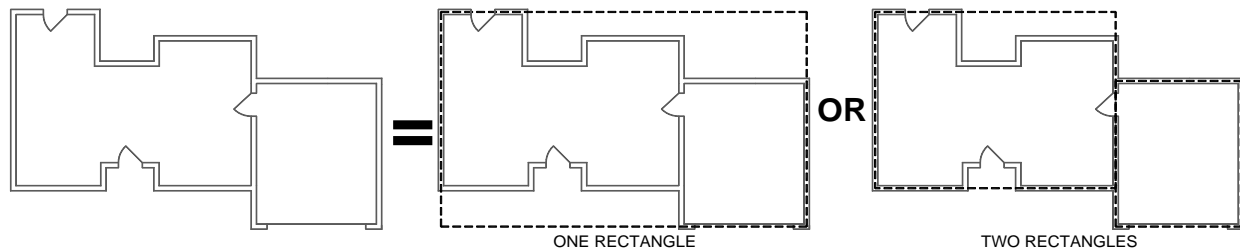
4. Where used, the total length of continuous sheathed brace panels applied to walls parallel to each building side shall comply with Table 321.25–J.

5. The location of brace panels applied to walls parallel to each building side shall comply with Figure 321.25–C.

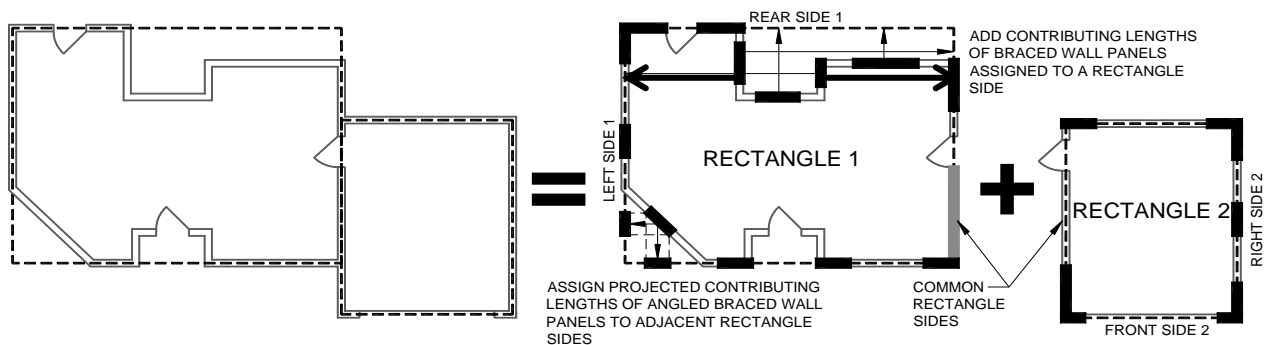
6. Balloon-frame walls may be no longer than 21 feet and shall have a maximum height of two floors unless constructed in accordance with an approved design. Wall framing shall be continuous from the lowest floor to the wall top plate at the roof. All edges of sheathing shall be supported on and fastened to blocking or framing. Braced wall panels may not be required on the balloon-frame wall portion provided the bracing amount and brace spacing requirement are satisfied for the building side. Where brace panels are located on the balloon-frame wall portion, they shall have a height-to-width ratio of not more than 2.5:1.

7. For a gable end wall, if the brace-panel height does not exceed 12 feet at the highest portion and if the 12½-foot and 21-foot spacing requirements in Figure 321.25–C are met, the wall is adequately braced. Where a brace panel exceeds 12 feet in height, it shall have a height-to-width ratio of not more than 2.5:1, and comply with Figure 21.25–C.

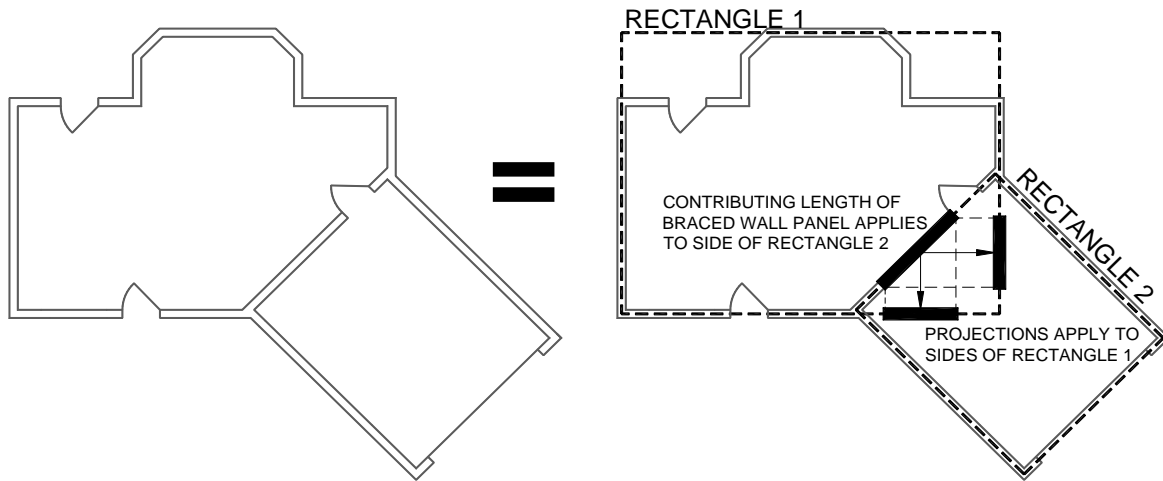
Figure 321.25–B
DEFINING BUILDING SIDES AND LENGTHS WITH ONE OR MORE CIRCUMSCRIBED RECTANGLES^{a,b,c}



(1) Basic floor plan



(2) Angled-building-side plan^d



(3) Angled floor plan^c

^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).

**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}**

Wall Supporting:		Required Number of Brace Panels on a Building Side		
		Length of Perpendicular Side (feet) ^g		
		≤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

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

^hThis 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.





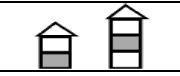

^fAdjustments in footnotes b to e apply cumulatively. Fractions of panels shall be rounded to the nearest one-half braced wall panel.




^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.

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 Height (feet)	Wall Supporting:		Total Required Length (feet) of Full-Height Bracing on Any Side of Rectangle							
			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 1/2-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.

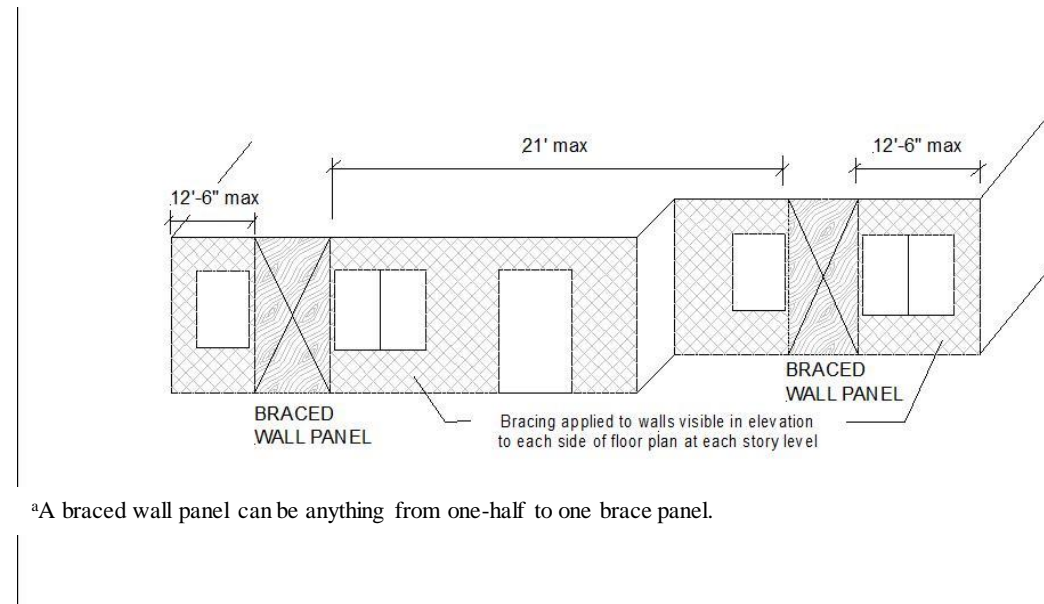
^fPerpendicular sides to the front and rear sides are the left and right sides. Perpendicular sides to the left and right sides are the front and rear sides. See Figure 321.25–B.

^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.

**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.

SECTION 7. SPS 321.25 (8) (d) to (f) are repealed.

SECTION 8. SPS 321.25 (8) (g) (title), (intro.), and 1. to 3. are renumbered SPS 321.25 (8) (d) (title), (intro.), and 1. to 3.

SECTION 9. SPS 321.25 (8) (g) 4. and (h) and (9), Tables 321.25–K and 321.25–L, and Figures 321.25–D to 321.25–K are repealed.

SECTION 10. SPS 320 to 325 Appendix, Minimum Fastener Schedule Table is amended to read:

**CHAPTERS SPS 320–325 Appendix
MINIMUM FASTENER SCHEDULE TABLE
(Partial Table)**

Other interior and exterior panel products and finishes installed per manufacturer requirements.
For engineered connectors, use manufacturer’s specified fasteners.

Description of Building Materials/Connection		Number and Type of Fastener ¹²³	
Wall Framing			
Sole plate to joist or blocking, face nail		2-16d at 16”o.c.	
Panel Sheathing			
Material	Fastener	Spacing of Fastener	
		Edges	Intermediate Supports
Wood panel siding to framing			
5/8” gypsum sheathing ⁵	1 3/4” galvanized roofing nail; 8d common nail; staple galvanized 1 5/8” long; 1 5/8” screws, Type W or S	4 7”	8 7”

SECTION 11. EFFECTIVE DATE. The rules adopted in this order shall take effect on the first day of the month following publication in the Wisconsin administrative register, pursuant to s. 227.22 (2) (intro.), Stats.

(END OF TEXT OF RULE)

Dated _____

Agency _____

Dave Ross, Secretary of the
Department of Safety and
Professional Services

File reference: SPS 320-325/P order and rules WB.Adopt