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ALTERNATE BRACE WALL PANELS
(ICC interpretation by John R. Henry, P.E)

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Section 2308: Conventional Light Frame Construction

Section 2308 of the 2006 International Building Code (IBC) permits prescriptive conventional wood frame construction without engineering provided the scope, limitations, and restrictions prescribed in the section are strictly followed. The provisions include prescriptive framing requirements for both vertical gravity loads, as well as bracing methods intended to resist lateral load effects from wind pressure and seismic ground motion. This column addresses several questions regarding the 2007 CBC prescriptive conventional wood frame wall bracing in Seismic Design Category D and E.

Answers to FAQ's:

Q: The wall bracing requirements in Seismic Design Category A, B, and C are relatively straightforward. For example, conventional wood frame buildings in Seismic Design Category C require braced wall panels spaced not more than 25 feet-on-center and must comprise at least 25 percent of the wall according to Table 2308.9.3(1). However, conventional wood frame buildings in Seismic Design Category D and E must use [Table 2308.12.4](#) to determine the amount of wall bracing required. [Table 2308.12.4](#) provides the minimum length of wall bracing per 25 feet of wall, but does not provide a minimum percentage. Since there is no percentage given, we are unsure of how to properly apply the requirements of the table. For example, for a building sited where $SDS > 1.00g$, the table requires 12 feet of wall bracing for every 25 feet of wall. It is clear that a 25-foot-long wall requires 12 feet of bracing and a 50-foot-long wall requires 24 feet of bracing, but what amount of bracing would be required for a 40-foot-long wall?

A: A rational way to apply the requirements of the table would be to convert the required bracing length to a minimum percentage of bracing. For example, for $SDS > 1.00g$, the table requires 12 feet of type S-W wall bracing (wood structural panel or diagonal wood sheathing) for every 25 feet of wall line, which is 48 percent of bracing ($100 \times 12/25 = 48$ percent). Therefore, a 40-footlong wall would require 19.2 feet of braced wall panels ($0.48 \times 40 = 19.2$). Note that Section 2308.12.4 requires braced wall panels to be distributed along the length of the braced wall line and start no more than 8 feet from each end of the braced wall line.

Q: The bracing required by [Table 2308.12.4](#) is not totally clear. For $SDS > 1.00g$, the table requires 12 feet of wall bracing for every 25 feet of wall line. Does this mean each braced wall panel must be a minimum of 12 feet in length, or can the 12 feet of required bracing consist of braced wall panels prescribed in Section 2308.9.3?

A: The bracing can be made up of braced wall panels prescribed in Section 2308.9.3. Section 2308.12.4 states that the sum of lengths of braced wall panels at each braced wall line shall conform to [Table 2308.12.4](#). It should also be noted that Section 2308.12 covers additional requirements for Seismic Design Category D or E, in addition to the requirements for Seismic Design Category B and C. Section 2308.12.11 covers additional requirements for Seismic Design Category B and C, in addition to the requirements covered in Section 2308.1 through 2308.10.

Q: Footnote "a" of [Table 2308.12.4](#) states that the height-to-width ratio for braced wall panels cannot exceed 2:1. For a typical 8-foot-high wall, this means the minimum length of the braced wall panel must be 4 feet. The alternate braced wall panel described in Section 2308.9.3.1 is 2 feet, 8 inches in length, and the alternate braced wall panels adjacent to an opening in Section 2308.9.3.2 are 16 inches in length for a one-story building. Does footnote "a" in effect mean that the alternate braced wall panels of Section 2308.9.3.1 and 2308.9.3.2 cannot be used in Seismic Design Category D and E because of the restriction on height-to-width ratio?

A: No. Footnote "a" restricts the height-to-width ratio of braced wall panels to 2:1, not alternate braced wall panels. The footnote was not intended to limit the use of alternate braced wall panels in SDC D and E. [Table 2308.12.4](#) of the IBC was derived from Section 12.4 and Table 12.4-2 of the 2003 edition of the National Earthquake Reduction Program (NEHRP) provisions, which are the basis for seismic requirements in the IBC. The conventional light-frame bracing requirements in the NEHRP provisions do not include alternate braced wall panels. In addition, the conventional light-frame bracing requirements in the NEHRP provisions do not require overturning restraint at braced wall panels. Thus, the purpose of limiting the aspect ratio of braced wall panels is to minimize overturning demand due to the lack of overturning restraint. In contrast, the alternate braced wall panels do address overturning directly by requiring overturning restraint devices, and thus are not subject to the 2:1 height-to-width limitation.

Note that Sections 2308.9.3.1 and 2308.9.3.2 state that any bracing required by Section 2308.9.3 is permitted to be replaced by alternate braced wall panels constructed in accordance with the requirements prescribed in the two sections. The application of the provisions may be described by the following step-by-step procedure:

* **Step 1**—Select the type of wall bracing material to be used. G-P = gypsum board, fiberboard, particleboard, lath and plaster, or gypsum sheathing boards; S-W = wood structural panels and diagonal wood sheathing.

* **Step 2** — Determine the required amount of bracing from [Table 2308.12.4](#) based on the type of sheathing used and the seismic ground motion parameter, SDS.

* **Step 3** — Check maximum 2:1 height-to-width ratio in accordance with Footnote "a" of [Table 2308.12.4](#).

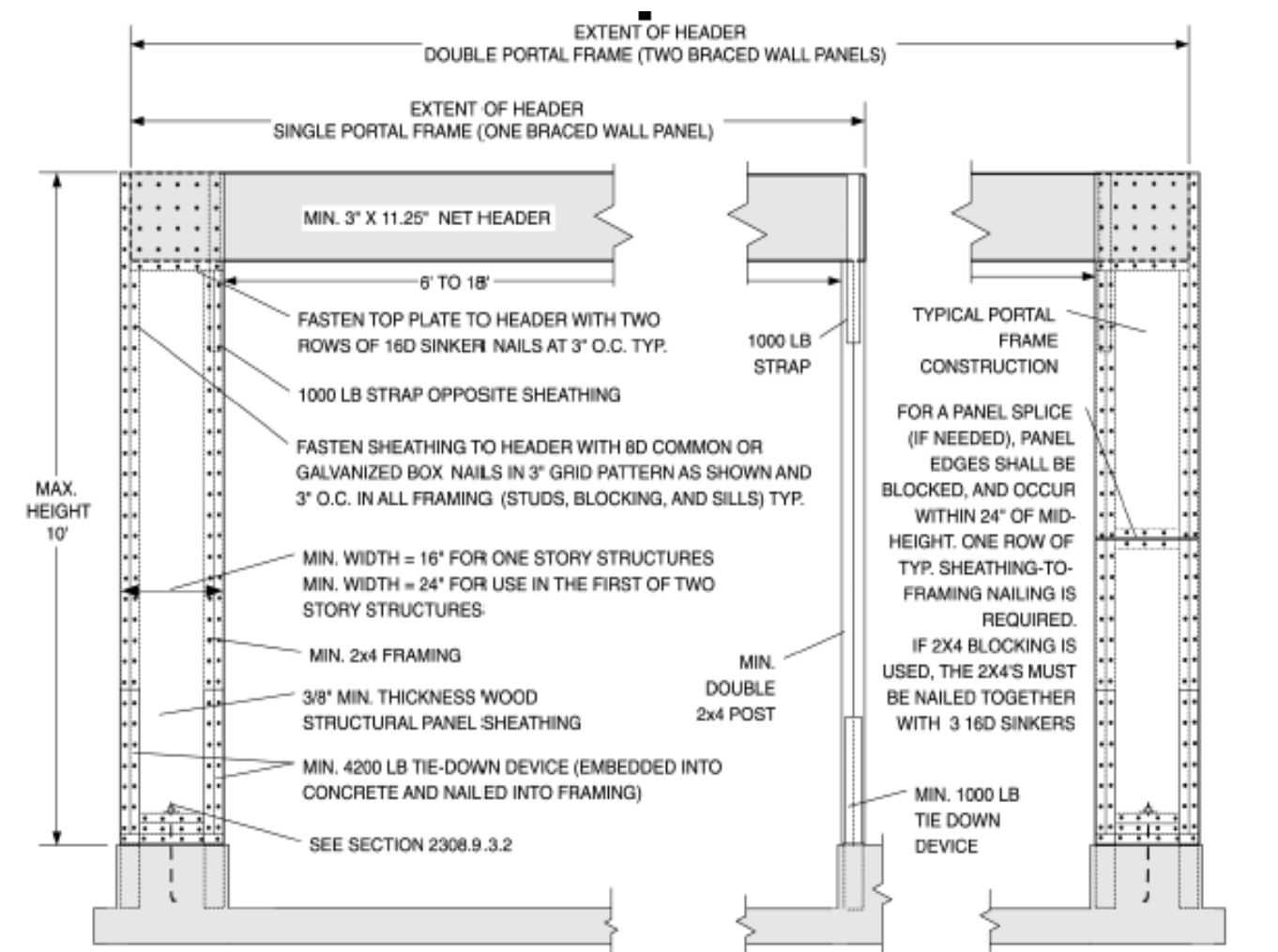
* **Step 4** — Determine the number of braced wall panels required to meet the minimum length of bracing prescribed in the table.

* **Step 5** —The braced wall panels must not be spaced more than 25 feet on center in accordance with Figure 2308.9.3, and must begin no more than 8 feet from each end of each braced line in Seismic Design Category D and E.

* **Step 6** — Once the above requirements are met, each braced wall panel may be replaced by an alternate braced wall panel constructed in accordance with Section 2308.9.3.1 or Section 2308.9.3.2. It should be noted that both of these sections impose a 10-foot height limit on alternate braced wall panels.

DISCLAIMER: *The building official has the final authority in rendering interpretations of the code as prescribed in IBC Section 104.1. Opinions by ICC staff are based solely on the published model code and do not consider federal, state, or local amendments, ordinances, or policies.*

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**TABLE 2308.12.4
WALL BRACING IN SEISMIC DESIGN CATEGORIES D AND E
(Minimum Length of Wall Bracing per each 25 Linear Feet of Braced Wall Line)**

CONDITION	SHEATHING TYPE	SDS < 0.50	0.50<SDS<0.75	0.75<SDS<1.00	SDS > 1.00 Fortuna!
One story	G-P	10 feet 8 inches	14 feet 8 inches	18 feet 8 inches	25 feet
	S-W	5 feet 4 inches	8 feet 0 inches	9 feet 4 inches	12 feet
Story below top story	G-P	18 feet 8 inches	NP	NP	NP
	S-W	10 feet 8 inches	13 feet 4 inches	17 feet 4 inches	21 feet 4 inches
Bottom story of three stories	G-P	Conventional construction not permitted, design by engineer or architect is required			
	S-W				

NOTES:

a. Minimum length of panel bracing of one face of the wall for S-W sheathing or both faces of the wall for G-P sheathing; h/w ratio shall not exceed 2:1. For S-W panel bracing of the same material on two faces of the wall, the minimum length is permitted to be one-half the tabulated value but the h/w ratio shall not exceed 2:1 and design for uplift is required.

b. NP - Not Permitted; G-P = gypsum board, fiberboard, particleboard, lath and plaster or gypsum sheathing boards; S-W= wood structural panels 3/8" thick minimum.

c. Nailing as specified below shall occur at all panel edges at studs, at top and bottom plates and, where occurring, at blocking:

**** S-W Nailing - 6" edge 12" field, if there are not design requirements/recommendations, made by engineer or architect;***

**** Gypsum board – 7" o.c.***

For 1/2-inch gypsum board, 5d (0.113 inch diameter) cooler nails;

For 5/8-inch gypsum board, No. 11 gage (0.120 inch diameter);

For gypsum sheathing board, 13/4 inches long by 7/16 -inch head, diamond point galvanized nails at 4 inches on center;

**** For gypsum lath, No. 13 gage (0.092 inch) by 11/8 inches long, 19/64-inch head, plasterboard at 5 inches on center;***

**** For Portland cement plaster, No. 11 gage (0.120 inch) by 11/2 inches long, 7/16 - inch head at 6 inches on center;***

**** For fiberboard and particleboard, No. 11 gage (0.120 inch) by 11/2 inches long, 7/16 - inch head, galvanized nails at 3 inches on center.***

FIGURE 2308.9.3

