



ICC-ES Evaluation Report

ESR-4455

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES,

Section: 06 12 19—Shear Wall Panels

REPORT HOLDER:

SIMPSON STRONG-TIE COMPANY, INC.

EVALUATION SUBJECT:

STRONG-WALL® SITE-BUILT PORTAL FRAME SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)

Property evaluated:

- Structural

2.0 USES

The Strong-Wall® Site-Built Portal Frame System (PFS) is to be used as a braced wall panel with narrow wall widths in wood-framed buildings constructed in accordance with the IRC. The PFS allows builders to use 10-inch (254 mm) or 12-inch (305 mm) nominal column sizes as narrow walls, maximizing wall openings in standard wall framing. The PFS has a contributing length of wall bracing as listed in [Table 4](#). This length is used to comply with the total length of bracing required by Section [R602.10](#) of the IRC, in accordance with Section [4.1.1](#) of this report.

3.0 DESCRIPTION

3.1 General:

The PFS is a site-assembled wall bracing assembly designed and constructed to support gravity loads and resist lateral in-plane and out-of-plane wind and seismic forces in wood-framed wall construction. The PFS can be designed and assembled in either a single-wall portal or double-wall portal configuration. The single-wall portal configuration consists of one 10-inch (254 mm) or 12-inch (305 mm) nominal column, a post, a header, and a Single-Wall Portal Frame Kit (PFS-HKS) described in Section 3.2 (See [Figure 5](#)). The double-wall portal configuration consists of two 10-inch (254 mm) or 12-inch (305 mm) nominal columns, a header, and a Double-Wall Portal Frame Kit

(PFS-HKD) described in Section 3.2 (See [Figure 6](#)). In both configurations, the portal frame hardware kit is combined with solid-sawn lumber or Laminated Veneer Lumber (LVL) supplied by others and assembled on-site to make a lateral-force-resisting portal frame wall assembly.

The PFS is intended to be used when the length of wall available for braced wall panels is less than that required for the narrow braced wall panels described in Section [R602.10.6](#) of the 2021, 2018, 2015, and 2012 IRC (Sections [R602.10.3.2](#) through [R602.10.3.4](#) of the 2009 IRC). The PFS is acceptable for use as a braced wall panel in accordance with applications accepted under the IRC for Method PFH, except for buildings located in Seismic Design Category D₀-D₂, in which the PFS is acceptable for use in single-story applications only. The PFS portal frame assemblies must be supported directly on a concrete foundation.

3.2 Material:

The Site-Built Portal Frame System is constructed by combining the lumber, concrete anchors and standard hex nuts, supplied by others, with the appropriate PFS Kit supplied by Simpson Strong-Tie. The components of each PFS kit are shown in [Table 1](#) and described in Section 3.2.1.

3.2.1 PFS Kit Components: The following components are provided by Simpson Strong-Tie. They are required in the assembly and installation of the Strong-Wall® Site-Built Portal Frame System.

3.2.1.1 PFS-HD U-shaped Holdown Straps: A proprietary bent strap combined with the PFS-BP Bearing Plate, described in 3.2.1.2, comprises the holdown assembly for the Portal Frame Columns. Two of the holdown assemblies are used on each column of the portal frame. The strap complies with the specifications listed in [Table 3](#). Each holdown is fastened to the Portal Frame column with ten SDW22300 screws and anchored to the foundation using two 5/8-inch (15.9 mm) diameter bolts. See [Table 6](#) for anchorage specifications.

3.2.1.2 PFS-BP Bearing Plate: A 3-inch x 3 1/2-inch (76.2 mm x 88.9 mm) plate washer that is combined with the PFS-HD, described in 3.2.1.1, to form the holdown assembly. The plate complies with the specifications listed in [Table 3](#).

3.2.1.3 PFS-SB Composite Standoff Bases: Bases are made from a composite material and provide a bearing surface with 1-inch (25.4 mm) standoff for the Portal Frame

Columns. The bases come in two sizes, one for the 10-inch (254 mm) nominal column (PFS-SB9), and one for the 12-inch (305 mm) nominal column (PFS-SB12). Each kit will contain one 10-inch (254 mm) and one 12-inch (305 mm) base for each column. The extra base need not be used.

3.2.1.4 PFS-MCS Portal Strap: A proprietary, galvanized steel strap that is used to reinforce the moment connection between the header and the column. The strap complies with the specifications listed in [Table 3](#). Each strap must be nailed with a minimum of twenty-five 10d nails with a minimum length of 2½ inches (63.5 mm). Alternately, the straps may be installed with a minimum of twenty-five Strong-Drive SD10212 Connector Screws (nails and SD screws not included in the portal kit). See [Figure 8](#) for installation locations.

3.2.1.5 ABW44Z Adjustable Post Base: A proprietary adjustable post base, evaluated under ICC-ES [ESR-1622](#), that is used as a base for the post in the single-wall portal frame configuration. The post base attaches to the post with eight Simpson Strong-Tie SD9112 Connector screws, included in the Single-Wall Portal Kit. The post base is anchored to the concrete foundation using one ½-inch-diameter (12.7 mm) anchor bolt. See [Table 7](#) for anchorage specifications.

3.2.1.6 SDW22300 Truss-ply Screws: The SDW22300 are 0.220-inch-diameter (5.59 mm) by 2¹⁵/₁₆-inch-long (74.6 mm) high-strength structural wood screws. The screws are used to fasten the wood members together at the header to column connection, and to fasten the PFS-HD holdowns to the wood columns. Thirty-three screws are provided in the Single-Wall Portal Kit, and sixty-six screws are provided in the Double-Wall Portal Kit.

3.2.1.7 SD9112 Connector Screws: The SD connector screws are #9 by 1½-inch (38.1 mm) long, and are evaluated under ICC-ES [ESR-1622](#). They have a mechanically galvanized coating that complies with ASTM B695, Class 55. The screws are included with the Single-Wall Portal Kit for use with the ABW44Z post base.

3.2.2 System Components Not Supplied in PFS Kit: The following components required to assemble and install the Strong-Wall® Site-Built Portal Frame System are not included in the PFS kit and must be provided separately.

3.2.2.1 Portal Frame Column: The Portal Frame column is made up of two plies of either Laminated Veneer Lumber (LVL) or solid sawn lumber. Portal frame columns must be sized as noted in [Figures 5](#) and [6](#) and constructed and shimmed as noted in Section 4.2.2 and [Figures 3, 4](#) and [5](#).

The LVL must comply with the minimum reference design stresses listed below:

Design Property	Minimum Value (psi)
Modulus of Elasticity, E	2.0 × 10 ⁶
Flexural Stress, F _b	2,600
Horizontal Shear, F _v	285
Compression Perp to Grain, F _{c⊥}	750
Compression Parallel to Grain, F _c	2,510

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

The LVL must also have a minimum equivalent specific gravity (SG) of 0.50 and maximum in-service moisture content of 16%. Lumber dimensions for LVL column plies must be either 1¾-inch x 9¼-inch (44.5 mm x 235 mm) or 1¾-inch x 11⅞-inch (44.5 mm x 302 mm).

The solid sawn lumber must comply with the minimum assigned specific gravity listed below:

Species	Minimum Assigned Specific Gravity
Southern Pine (SP)	0.55
Douglas-Fir Larch (DF)	0.50
Hem-Fir (HF)	0.43
Spruce-Pine-Fir (SPF)	0.42

All sawn lumber must have a minimum #2 grade and a maximum in-service moisture content of 19%. Nominal lumber dimensions for solid sawn column plies must be either 2 x 10 or 2 x 12.

3.2.2.2 Portal Frame Header: The Portal Frame header is made up of two plies of either LVL or Solid Sawn Lumber. LVL headers may be used with solid sawn columns. Portal frame headers must be sized to support the gravity load applied from above in addition to the notes in [Figures 5](#) and [6](#), and must be constructed and shimmed as noted in Section [4.2.1](#) and [Figure 4](#).

The LVL must comply with the LVL material specifications noted in Section 3.2.2.1. Lumber dimensions for LVL header plies must be 1¾-inch (44.5 mm) x a minimum depth of 11⅞-inch (302 mm).

The solid sawn lumber header must comply with the solid sawn lumber material specifications noted in Section 3.2.2.1. Nominal lumber dimensions for solid sawn headers plies must be 2 x 12 or deeper.

3.2.2.3 Post for Single Portal Frame: The post for the single-wall portal frame must be a solid sawn 4 x 4, or double 2 x 4 with a full length 7/16-inch (11.1 mm) shim between them. The post must be SP, DF, HF, or SPF, with a minimum #2 grade and a maximum in-service moisture content of 19%.

3.2.2.4 Concrete Anchor Rod: Anchor rods are used to anchor the holdown assemblies and post base to the concrete foundation when SET-3G adhesive is used. Anchor rods for the PFS-HD hold-downs are 5/8-inch (15.9 mm) diameter and the anchor rod for the ABW44 post base is ½-inch (12.7 mm) diameter. Anchor rods are ASTM F1554 Grade 36, or ASTM A36 minimum threaded rods, having a length sufficient to provide the required embedment listed in [Table 6](#) or [Table 7](#), and as shown in [Figure 11](#), and have sufficient projection above the top of concrete to allow for holdown or post base installation.

3.2.2.5 Epoxy Concrete Anchorage Adhesive: Simpson Strong-Tie SET-3G is a two-part epoxy adhesive evaluated under ICC-ES [ESR-4057](#). The embedment must be as listed in [Table 6](#) or [Table 7](#), and as shown in [Figure 11](#).

3.2.2.6 Pre-Assembled Anchor Bolt: As an alternate cast-in-place option, the Simpson Strong-Tie PAB4 can be used to anchor the ABW44 post base, and the Simpson Strong-Tie PAB5 can be used to anchor the PFS-HD holdown. The embedment must be as listed in [Table 6](#) or [Table 7](#), and as shown in [Figure 11](#).

3.2.2.7 Mechanical Anchor: As an alternate to adhesive anchors or cast-in-place anchors, the Simpson Strong-Tie THD50400, evaluated under ICC-ES [ESR-2713](#), may be used to anchor the ABW44 post base as shown in [Table 7](#). The Titen HD is a post-installed concrete and masonry screw anchor.

3.2.2.8 Anchorage Nut: Nuts must comply with ASTM A563 Grade A (noted as "STANDARD").

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Contributing lengths of bracing for each PFS for wind and seismic loads are listed in [Table 4](#). Contributing lengths of bracing depend on the framing material used for the column and header, the vertical load on the column, and the size of the column. If solid sawn lumber is used for a component of the portal frame, the contributing bracing length must be the shortest length listed for any species wood that is used.

The minimum total length of braced wall panels based on wind speed for the wall line containing the PFS is to be taken as the same as required for Method Portal frame with hold-downs (PFH), specified in [Table R602.10.3\(1\)](#) and modified by the applicable adjustment factors in [Table R602.10.3\(2\)](#) of the 2021 and 2018 IRC (Method Wood Structural Panels (WSP) for 2015 and 2012 IRC, and [Table R602.10.1.2\(1\)](#) of the 2009 IRC).

The minimum total length of braced wall panels based on seismic design category for the wall line containing the PFS is to be taken as the same as required for Method PFH, specified in [Table R602.10.3\(3\)](#), and modified by the applicable adjustment factors in [Table R602.10.3\(4\)](#) of the 2021 and 2018 IRC (Method Wood Structural Panels (WSP) for 2015 and 2012 IRC, and [Table R602.10.1.2\(2\)](#) and [Table R602.10.1.2\(2\)](#) of the 2009 IRC).

The acceptable mixing of braced wall panel methods on a braced wall line is to be the same as required for Method PFH in accordance with [Section R602.10.4.1](#) of the 2021 and 2018 and 2015 IRC ([R602.10.4.1](#) of the 2012 IRC and [R602.10.1.1](#) of the 2009 IRC).

The header is to be selected to be in accordance with the prescriptive header span tables of the IRC for sawn lumber headers, or published prescriptive tables provided by the manufacturer for engineered lumber headers. In addition, the header end reaction must not exceed the maximum allowable header reaction provided in [Table 4](#).

The maximum height of the PFS portal frame is 10 feet. However, a pony wall up to 24 inches in height may be added to the top of the portal frame, when the pony wall is constructed in accordance with [Section R602.10](#) of the IRC and [Section 4.2.5](#) of this report.

The adjustment factors for omission of gypsum board provided in [Table R602.10.3\(2\)](#) or [R602.10.3\(4\)](#) of the 2021, 2018, 2015, and 2012 IRC ([R602.10.1.2\(1\)](#) and [R602.10.1.2\(3\)](#) of the 2009 IRC), are not applicable.

The Strong-Wall® Site-Built Portal Frame System must be installed on a concrete foundation. Anchorage solutions provided within this report are for anchorage of the Portal Frame System only. The foundation construction must be in accordance with the requirements of the IRC. The foundation must comply with the minimum requirements for Method PFH defined in [Figure R602.10.6.2](#) of the 2021, 2018, 2015 and 2012 IRC ([Section R602.10.3.3](#) for 2009 IRC). Method PFH requires a continuous 12-inch x 12-inch (305 mm x 305 mm) concrete foundation across the length of the braced-wall line that is reinforced with a minimum of one #4 rebar top and bottom.

4.1.2 Anchorage: The cast-in-place anchorage-to-concrete details defined in this report conform to [ACI 318 \(-19 and -14\) Chapter 17](#) and [ACI 318-11 Appendix D](#). The PFS-HD holdowns must be anchored to the concrete in accordance with [Table 6](#) and the details shown in [Figure 11](#) of this report. The ABW post base must be anchored to the

concrete foundation in accordance with [Table 7](#) and the details shown in [Figure 11](#) of this report.

4.2 Installation:

4.2.1 General: The Site-Built Portal Frame System must be installed within the wall envelope in accordance with the manufacturer's installation instructions, the applicable code, and this report. Installation details shown in [Figures 1](#) through [11](#) represent typical surrounding framing conditions and connection requirements for normal applications as referenced in this report.

The following three lumber combinations are allowable for the single-wall and double-wall installation:

1. LVL column(s) and header (See [Figure 1](#))
2. Solid sawn column(s) and header (See [Figures 2](#) and [3](#))
3. Solid sawn column(s) with an LVL header (See [Figure 4](#)).

The cut dimensions of the header and column components are shown in [Figure 5](#) for a single-wall portal frame and in [Figure 6](#) for a double-wall portal frame. The sawn lumber or LVL components must be field cut to length with square ends for assembly on-site. The plies of the lumber components must be fastened together as specified in [Table 5](#) and [Figure 7](#).

4.2.2 Column Assembly: When columns are constructed of solid sawn lumber, a shim must be installed for proper fitment within the holdown. The shim can be either a short shim block at the bottom of the column (See [Figure 2](#)) or a full-length shim block (See [Figure 3](#)). The shim must be a minimum of $\frac{7}{16}$ -inch (11.1 mm) thick to a maximum of $\frac{1}{2}$ -inch (12.7 mm) thick. Where columns are constructed of solid sawn lumber and headers are of LVL lumber a $\frac{1}{4}$ -inch-thick (6.4 mm) shim block must be installed at the tops of the columns between the header and the column in order for the outside face to be flush for installation of the straps as shown in [Figure 4](#).

4.2.3 Single-Wall Header-to-Post Connection: For Single-Wall Portal Frames, the end of the header not supported by a column must be supported on a 4 x 4 post or two 2 x 4s with a $\frac{7}{16}$ -inch (11.1 mm) shim in between them. Where the post consists of two 2 x 4s, the assembly must be nailed together with 10d common nails at 18 inches (457.2 mm) on center on each side, staggered from side to side. A PFS-MCS Portal Strap is fastened to the header and the post.

4.2.4 Header-to-Column Connection: The columns and headers are each formed from two pieces of lumber that are cut to different lengths, so that a single ply of the headers and columns overlaps at the header-to-column connection. The header-to-column connection must be made by first installing the SDW22300 Screws as shown in [Figure 8](#), then installing the PFS-MCS straps as shown in [Figure 8](#).

4.2.5 Pony Wall Assembly: Pony walls are to be constructed with full height studs on each end of the PFS as shown in [Figure 9](#). All framing attached to and around the PFS must comply with the fastening requirements of the IRC [table R602.3](#). Sheath all framing with a minimum $\frac{3}{8}$ -inch (9.5 mm) wood structural panel sheathing and fasten with 8d x $2\frac{1}{2}$ -inch (3.3 mm x 63.5 mm) nails at 6:12 per [Table R602.3\(3\)](#) of the IRC. Provide header to jack-stud straps at the PFS column per [Table R602.10.6.4](#) of the 2021, 2018, 2015 and 2012 IRC ([Table R602.10.6.4](#) of the 2009 IRC) on both sides of the opening on opposite sides of sheathing.

4.3 Special Inspection:

4.3.1 General: Special Inspection does not apply to prescriptive construction under the IRC. Refer to IRC Section [R109](#) for inspection requirements.

5.0 CONDITIONS OF USE

The Strong-Wall® Site-Built Portal Frame System (PFS) described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section [1.0](#) of this report, subject to the following conditions:

- 5.1** The PFS must be installed in accordance with this report, the manufacturer’s instructions and the building plans approved by the code official. In the event of a conflict between this report and the manufacturer’s installation instructions, this report governs.
- 5.2** Contributing lengths of bracing must not exceed the bracing lengths set forth in this report.
- 5.3** No end checks or splits are allowed in the connection zone of sawn lumber or LVL.
- 5.4** No holes or notches are allowed in the wood used in the PFS except as shown in [Figure 10](#).
- 5.5** Components for site-assembled PFS must be protected from weather exposure prior to and during installation. PFS used in exterior walls must be provided with a weather-resistant exterior wall envelope complying with Section [R703.1](#) of the IRC.
- 5.6** The foundation must meet the requirements defined in Section [4.1.1](#) of this report.

5.7 The Strong-Wall® Site-Built Portal Frame Kits described in Section [3.2.1](#) and [Table 1](#) are produced at the Simpson Strong-Tie facilities located in McKinney, Texas, under a quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Site-assembled Wood Portal Frames Used as Wall Bracing under the IRC (AC514), dated December 2019, editorially revised December 2020.

Data for the anchorage to concrete in accordance with [ACI 318-14](#).

7.0 IDENTIFICATION

7.1 The Strong-Wall® Site-Built Portal Frame Kits (PFS-HKS and PFS-HKD) are identified with a label on the box bearing the manufacturer’s name (Simpson Strong-Tie Company Inc.), the product name or designation, the production date, and the evaluation report number (ESR-4455).

7.2 The report holder’s contact information is the following:
SIMPSON STRONG-TIE COMPANY, INC
5956 WEST LAS POSITAS BOULEVARD
PLEASANTON, CALIFORNIA 94588
(800) 999-5099
www.strongtie.com

Table 1—PFS Kit Components			
PFS-HKS Single-Wall Portal Kit		PFS-HKD Double-Wall Portal Kit	
(2)	PFS-HD Holdown	(4)	PFS-HD Holdown
(2)	PFS-BP Bearing Plates	(4)	PFS-BP Bearing Plates
(1)	PFS-SB9 Composite Standoff Base	(2)	PFS-SB9 Composite Standoff Bases
(1)	PFS-SB12 Composite Standoff Base	(2)	PFS-SB12 Composite Standoff Bases
(5)	PFS-MCS Moment Connection Straps	(8)	PFS-MCS Moment Connection Straps
(1)	ABW44Z Adjustable Post Base	(66)	SDW22300 Truss-Ply Screws
(33)	SDW22300 Truss-Ply Screws	(1)	6-lobe T40 Driver Bit
(8)	SD9112 Connector Screws	(1)	Installation Instructions (T-L-PFSWIN19)
(1)	6-lobe T40 Driver Bit		
(1)	Installation Instructions (T-L-PFSWIN19)		

Table 2—Portal Frame System Dimensions								
Framing Materials ¹	Column Sizes (in.)		Minimum Header Depths (in.)	Rough Opening Dimensions		Max. Total Height (in.)	Anchor Dia. (in.)	
	10 in. Nominal	12 in. Nominal		Max. Height (in.)	Allowable Width (ft.)		Each Column	Post
LVL	(2) 1¼×9¼	(2) 1¼×11⅝	11⅝	108⅝	2 min. 18 max.	120 ³	(2) ⅝	(1) ½
Solid Sawn ²	(2) 1½×9¼	(2) 1½×11¼	11¼	108¾				

For **SI**: 1 inch = 25.4 mm

- 1. LVL is 2.0E min.; Solid sawn lumber is #2 or better, SP, DF, HF or SPF.
- 2. Solid sawn columns require either a full-length wood shim or a wood shim at the holdown assemblies.
- 3. Maximum total height is 144 in. when a pony wall constructed in accordance with Section [4.2.5](#) is added to the top of the Portal Frame.

Component	Material	Min. Base Metal Thickness (in.)	Coating	Min F _y , (ksi)	Min F _u , (ksi)
PFS-MCS ¹	16 ga.	0.057	G90	33	45
PFS-HD ¹	12 ga.	0.099	G90	33	45
PFS-BP ²	3/8-in.	0.365	None	36	58

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

1. Component complies with [ASTM A653 SS GR. 33](#).
2. Bearing plate complies with [ASTM A36](#).

Framing Material	Concurrent Vertical Load on Column (lb.) ^{4,7}	Contributing Length (ft.) ¹				Maximum Allowable Header End Reaction (lb.) ⁵
		10-in. Nominal Column Size		12-in. Nominal Column Size		
		Single-Wall Portal	Double-Wall Portal	Single-Wall Portal	Double-Wall Portal	
LVL	1,000	4.00	8.00	4.00	8.00	5,200
	4,000	4.00	8.00	4.00	8.00	
	7,500	4.00	8.00	4.00	8.00	
DF/SP	1,000	3.00	6.00	4.00	8.00	3,600
	4,000	3.00	6.00	4.00	8.00	
SPF/HF	1,000	2.75	5.50	3.50	7.00	3,100
	4,000	2.75	5.50	3.50	7.00	

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

1. The contributing length must be chosen based on the species and type of lumber used. If solid sawn lumber is used for any component, the contributing length must be the shortest length listed for any species of wood that is used.
2. The PFS is acceptable for use as a braced wall panel in accordance with applications accepted under the IRC for Method PFH, except for buildings located in Seismic Design Category D₀-D₂, in which the PFS is acceptable for use in single-story applications only.
3. The PFS is applicable for use up to a 10 ft. story height. The wall height may be increased up to a max. height of 12 ft. when used in combination with a 2 ft. max. height pony wall.
4. Concurrent vertical load denotes the total maximum concentric vertical load allowed on the panel acting in combination with lateral loading.
5. The header must be sized in accordance with Section 4.1.1 of this report.
6. Minimum header depths for LVL and solid sawn lumber are 11⁷/₈-in. and 11¹/₄-in. respectively.
7. For 10-in. nominal DF/SP and SPF/HF columns constructed with shim at holdown only, the vertical load is limited to 2,500 lb.

Nominal Portal Frame Column Width	Material	Column/Header Thickness (in.)	Fastener (in.) ²	Column		Header	
				Fasteners/Row	Spacing, S1, (in.)	Rows of Fasteners	Spacing, S2 (in.)
12-in.	LVL	3½	0.162×3½	4	10.5	2	16
	DF/SP/SPF/HF ¹	3½	0.162×3½	4	9	2	16
	DF/SP/SPF/HF	3	0.148×3	4	9	2	12
10-in.	LVL	3½	0.162×3½	3	10.5	2	16
	DF/SP/SPF/HF ¹	3½	0.162×3½	3	9	2	16
	DF/SP/SPF/HF	3	0.148×3	3	9	2	12

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

1. ⁷/₁₆-in. min. OSB shim between plies.
2. SDW22300 screws may be substituted for nails at a 1:1 replacement.

Design Criteria	SET-3G™ ¹		PAB5	
	W (in.) ⁵	d _e (in.) ⁵	W (in.) ⁵	d _e (in.) ⁵
Seismic ²	22	7	18	6
Wind ³	14	5	12	4

For SI: 1 inch = 25.4 mm

1. Adhesive anchorage solutions assume standard strength anchor rod (ASTM F1554 Grade 36 or A36).
2. Seismic indicates Seismic Design Category C through D₂. Detached 1 and 2 family dwellings in SDC C may use wind anchorage solutions.
3. Wind includes Seismic Design Category A and B and detached one- and two-family dwellings in SDC C.
4. Foundation dimensions are for anchorage only. Foundation design (size and reinforcement) by others. A registered design professional may specify alternate embedment, footing size, or anchor bolt.
5. Refer to [Figure 11](#) of this report for W and d_e dimensions.

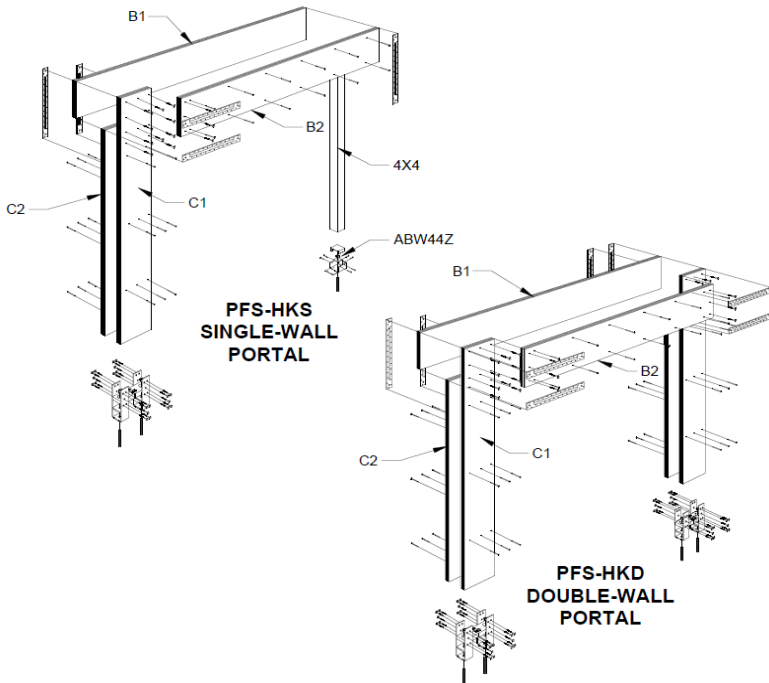


FIGURE 1—LVL PORTAL FRAME ASSEMBLY
(See [Figures 5](#) and [6](#) for definitions of C1, C2, B1, and B2)

Design Criteria	SET-3G™ ¹		PAB4		Titen HD® ²	
	W (in.) ⁶	d _e (in.) ⁶	W (in.) ⁶	d _e (in.) ⁶	W (in.) ⁶	d _e (in.) ⁶
Seismic ³	13	6	10	4	—	—
Wind ⁴	8	4	6	4	6	4

For SI: 1 inch = 25.4 mm

1. Adhesive anchorage solutions assume standard strength anchor rod (ASTM F1554 Grade 36 or A36).
2. Titen HD® anchorage solutions require Simpson Strong-Tie zinc-plated Heavy-Duty Screw Anchor model THD50400, evaluated under ICC-ES [ESR-2713](#).
3. Seismic indicates Seismic Design Category C through D₂. Detached one- and two-family dwellings in SDC C may use wind anchorage solutions.
4. Wind includes Seismic Design Category A and B and detached one- and two-family dwellings in SDC C.
5. Foundation dimensions are for portal frame anchorage only. Foundation design (size and reinforcement) by others. A registered design professional may specify alternate embedment, footing size, or anchor bolt.
Refer to [Figure 11](#) of this report for W and d_e dimensions.

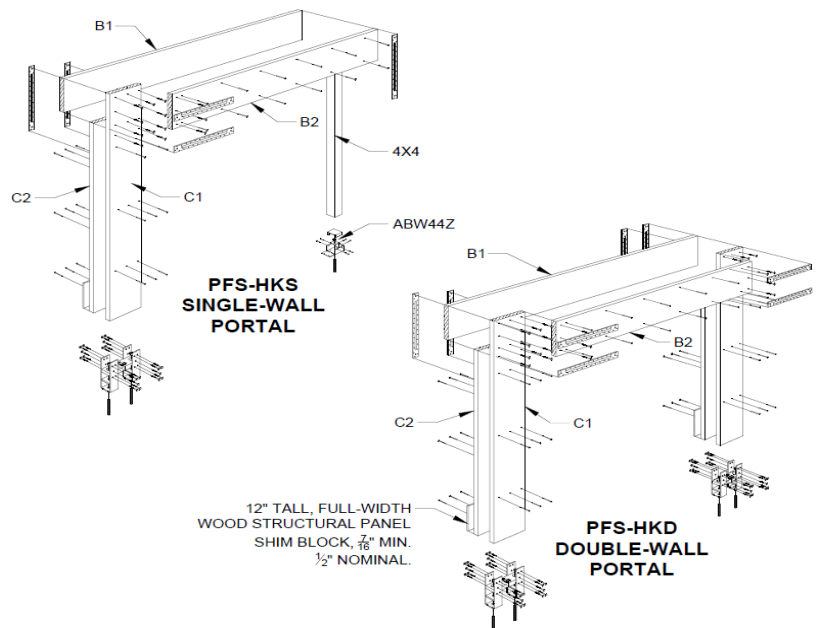


FIGURE 2—SOLID SAWN PORTAL FRAME ASSEMBLY WITH SHIM BLOCK AT HOLDDOWN
(See [Figures 5](#) and [6](#) for definitions of C1, C2, B1, and B2)

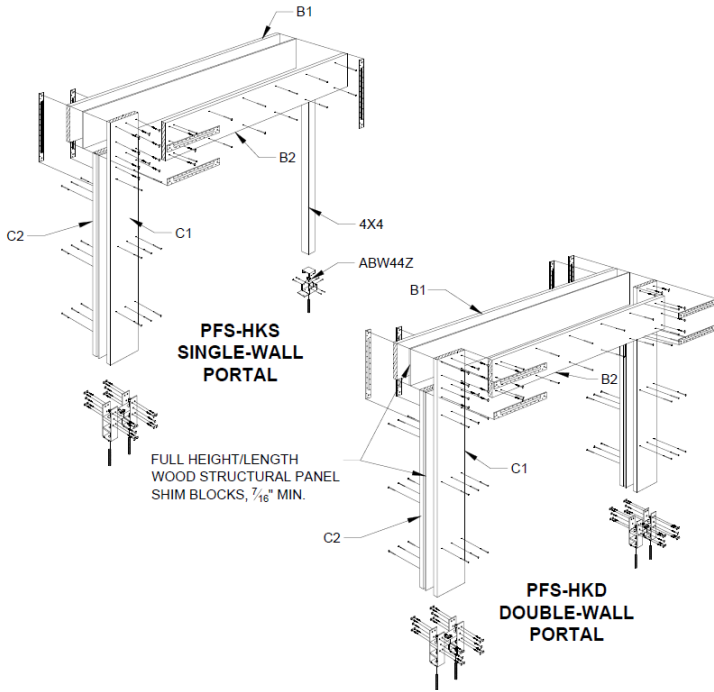


FIGURE 3—SOLID SAWM PORTAL FRAME ASSEMBLY WITH FULL LENGTH SHIM BLOCKS
 (See [Figures 5](#) and [6](#) for definitions of C1, C2, B1, and B2)

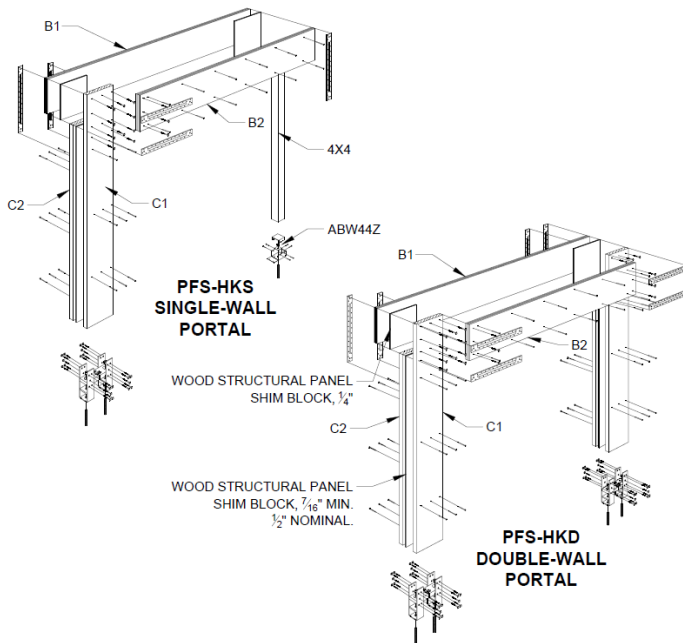
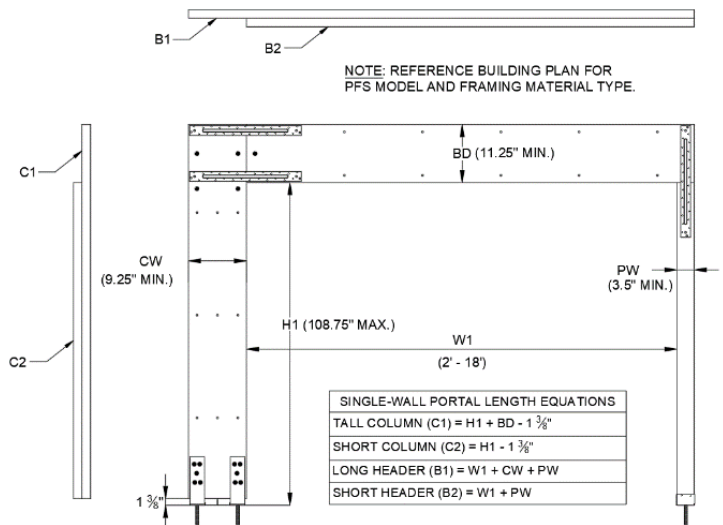


FIGURE 4—PORTAL FRAME ASSEMBLY WITH SOLID SAWM COLUMN AND LVL HEADER
 (See [Figures 5](#) and [6](#) for definitions of C1, C2, B1, and B2)



LEGEND	
BD = HEADER DEPTH	H1 = OPENING HEIGHT
CW = COLUMN WIDTH	W1 = OPENING WIDTH
PW = POST WIDTH	

* H1 FOR THE PFS FRAMING IS THE OPENING HEIGHT MEASURED FROM THE TOP OF CONCRETE AT THE HOLDOWN LOCATION TO THE BOTTOM OF HEADER. ACTUAL OPENING HEIGHTS WILL VARY DEPENDING FOOTING TYPE. TAKE CURB HEIGHTS INTO CONSIDERATION WHEN CALCULATING COLUMN LENGTHS.

FIGURE 5—SINGLE WALL PORTAL FRAME INSTALLATION AND CUT LENGTHS

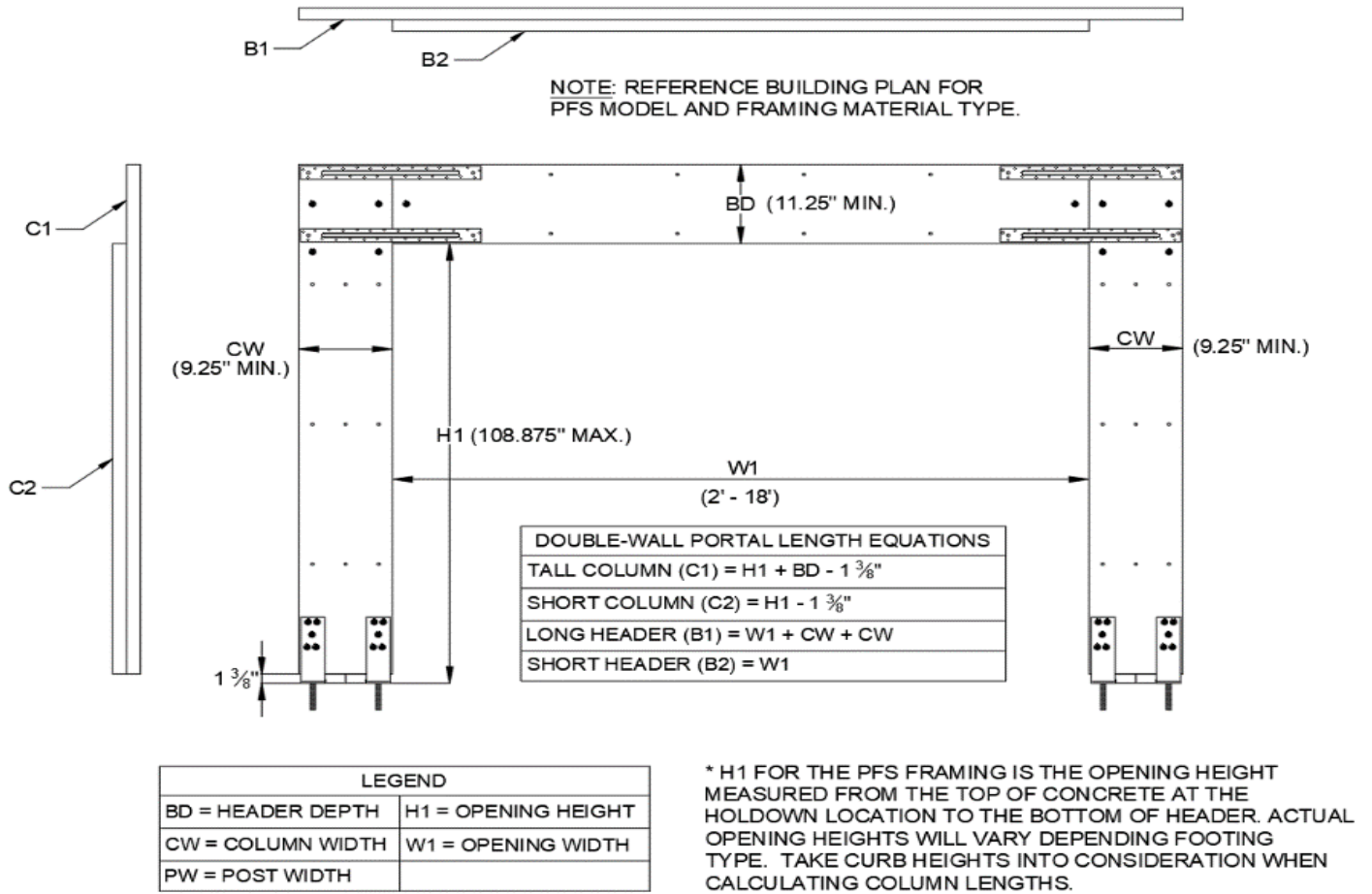


FIGURE 6—DOUBLE WALL PORTAL FRAME INSTALLATION AND CUT LENGTHS

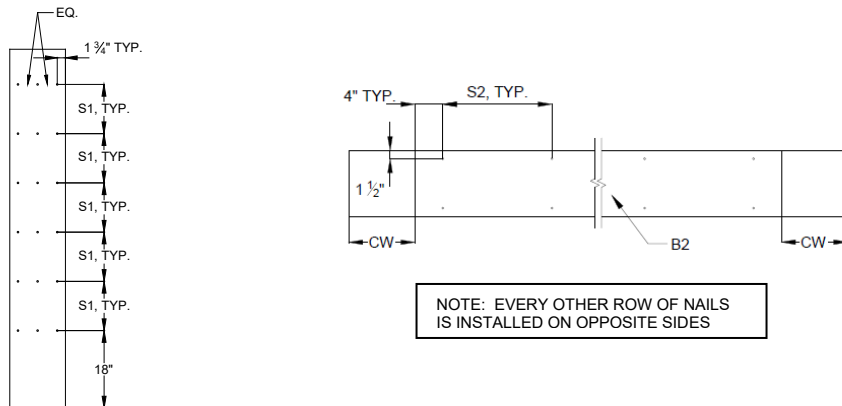
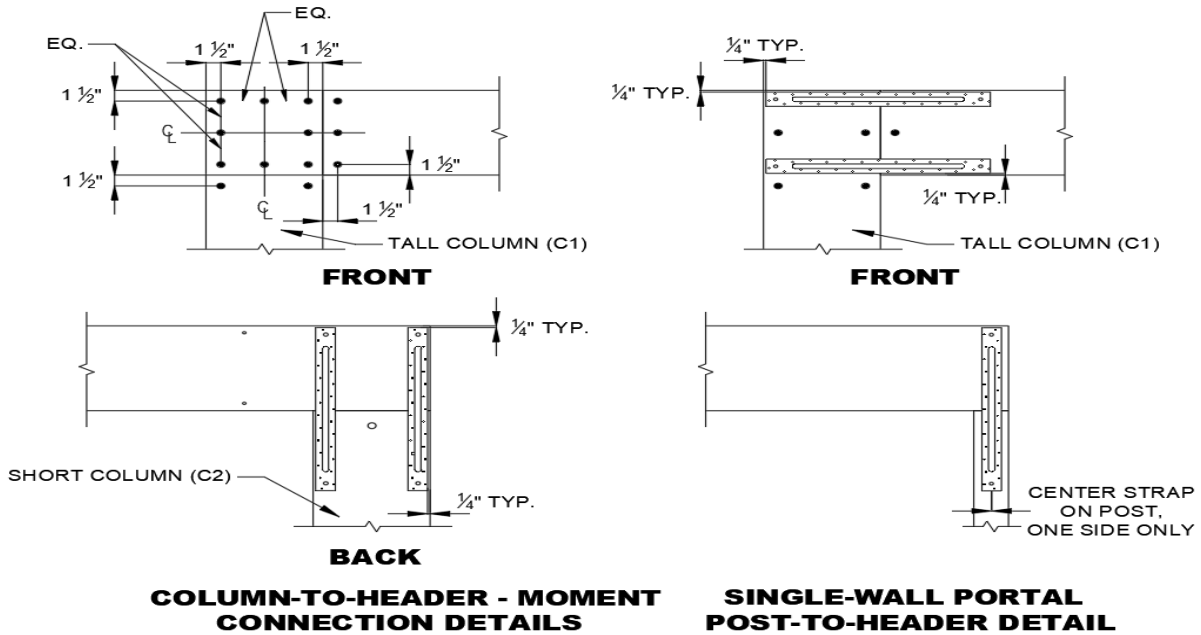


FIGURE 7—PORTAL FRAME BUILT-UP COLUMN AND HEADER NAILING



- COLUMN-TO-HEADER MOMENT CONNECTION INSTALLATION**
1. CONNECT THE HEADER SUB-ASSEMBLY TO THE COLUMN SUB-ASSEMBLY STARTING WITH THE SDW SCREWS (PROVIDED), AS SHOWN.
 2. INSTALL THE PFS-MCS STRAPS USING 0.148"-DIAMETER NAILS (2 1/2" MINIMUM LENGTH). THE STRAPS MUST BE INSTALLED HORIZONTALLY ON THE TALL COLUMN (C1) SIDE AND VERTICALLY ON THE SHORT COLUMN (C2) SIDE, AS SHOWN.
- NOTE: STRONG-DRIVE #10x2 1/2" (SD10212) CONNECTOR SCREWS (NOT PROVIDED) MAY BE SUBSTITUTED FOR THE NAILS.

FIGURE 8—PORTAL FRAME COLUMN-TO-HEADER CONNECTION

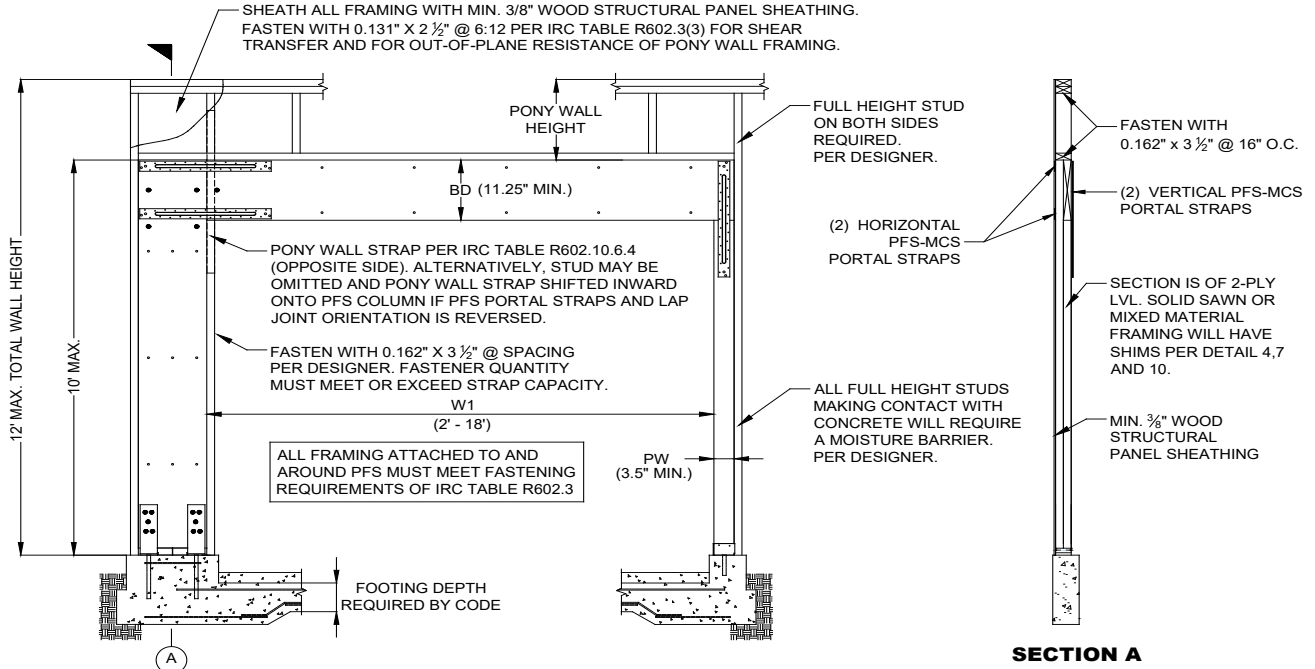


FIGURE 9—PONY WALL ASSEMBLY REQUIREMENTS

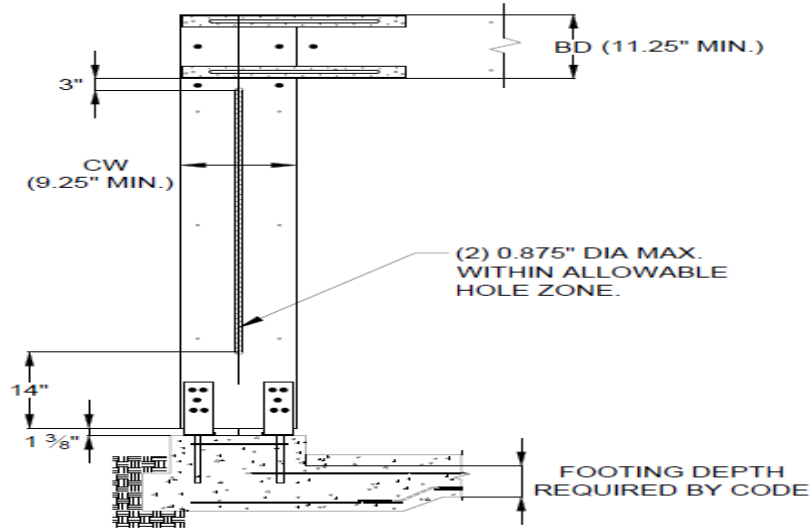
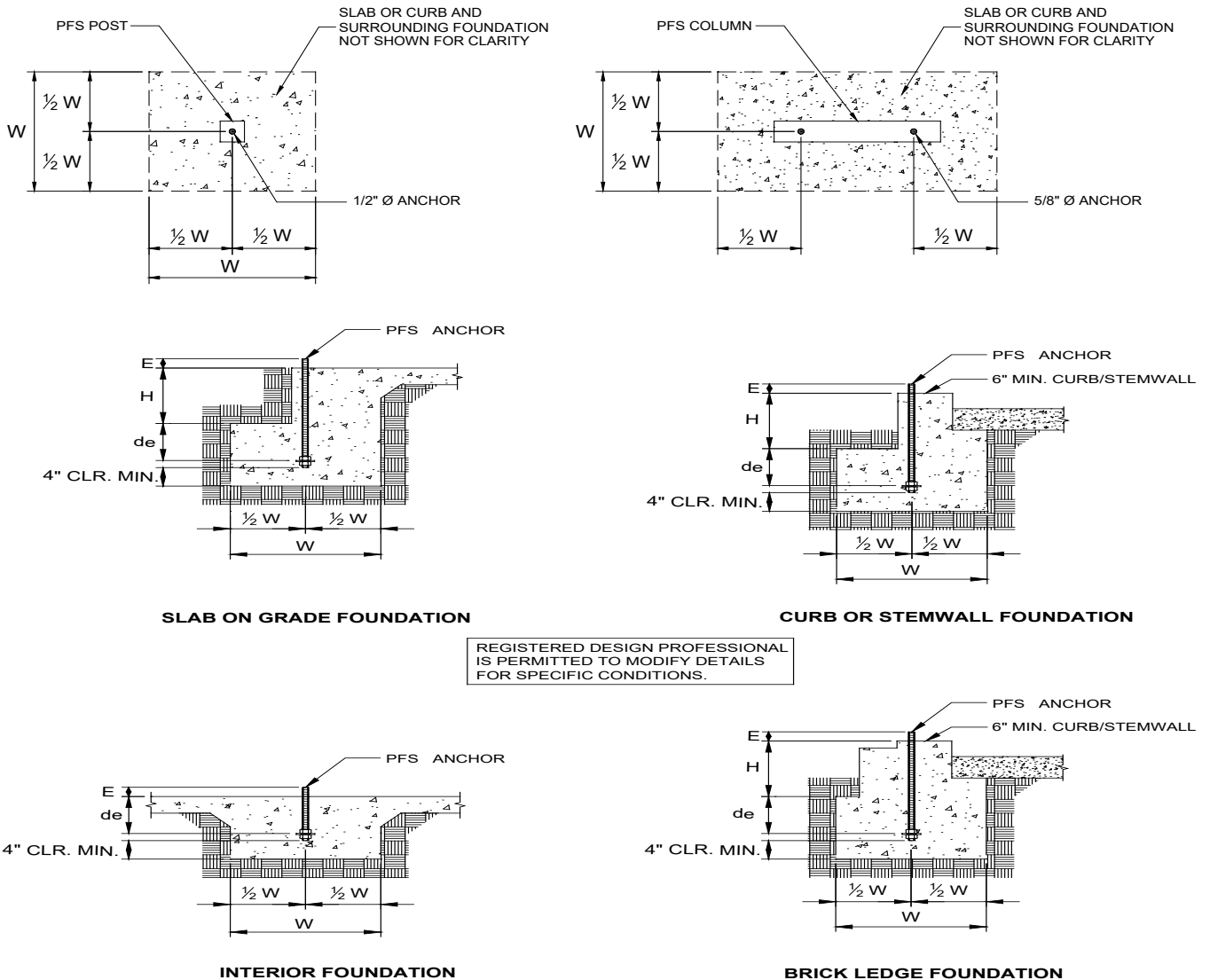


FIGURE 10—PORTAL FRAME COLUMN ALLOWABLE HOLE ZONE



REGISTERED DESIGN PROFESSIONAL IS PERMITTED TO MODIFY DETAILS FOR SPECIFIC CONDITIONS.

NOTES:

1. SEE TABLES 6 AND 7 FOR DIMENSIONS AND ADDITIONAL NOTES.
2. CAST-IN-PLACE ANCHOR SHOWN. POST-INSTALLED ADHESIVE AND MECHANICAL ANCHOR SIMILAR.
3. $E = 1\frac{1}{4}$ " FOR 5/8" \varnothing ANCHORS AND 1" FOR 1/2" DIAMETER ANCHORS.
4. MAXIMUM $H = 10" = l_e - d_e$, WHERE l_e = EFFECTIVE ANCHOR LENGTH.

FIGURE 11—PORTAL FRAME ANCHORAGE SOLUTIONS (PLAN AND TYPICAL SECTIONS)