ICC-ES Evaluation Report

ESR-1267

Reissued October 2017

This report is subject to renewal October 2018.

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 12 19—Shear Wall Panels

REPORT HOLDER:

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EVALUATION SUBJECT:

STRONG-WALL SHEAR PANELS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015 *International Building Code*® (2015 IBC)
- 2015 *International Residential Code*® (2015 IRC)
- 2012 *International Building Code*® (2012 IBC)
- 2012 *International Residential Code*® (2012 IRC)
- 2009 *International Building Code*® (2009 IBC)
- 2009 *International Residential Code*® (2009 IRC)
- 2006 *International Building Code*® (2006 IBC)
- * ~~2006 *International Residential Code*® (2006 IRC)~~

Property evaluated:

Structural

2.0 USES

The Strong-Wall Shear Panels are recognized for use as shear walls in wood-framed buildings classified as Type V construction or in buildings constructed in accordance with the IRC. Strong-Wall Shear panels are permitted to replace each 4 feet (1219 mm) of braced wall panel length specified in Section 2308.6 of the 2015 IBC (Section 2308.9.3 of the 2012, 2009 and 2006 IBC), and Section R602.10 of the IRC, in accordance with Section 4.1.3 of this report.

3.0 DESCRIPTION

3.1 General:

The Strong-Wall Shear Panels are prefabricated, wood-based panels designed and constructed to support gravity loads and resist lateral in-plane and out-of-plane wind and earthquake loads in wood-framed wall construction.

Three Strong-Wall panel types are recognized in this evaluation report: Standard Strong-Wall Panels, Garage Portal-frame Strong-Wall Panels, and Raised Floor Strong-Wall Panels. Refer to Figure 1 for details. Standard Strong-Wall (SW) Panels and Garage Portal-frame Strong-Wall (SW) Panels must be supported directly on concrete or masonry foundations. Raised Floor (RF) Strong-Wall Panels must be supported on wood-floor framing members.

The Strong-Wall panels described in this report are permitted to have shear wall aspect ratios greater than those specified in Table 2305.3.4 of the 2006 IBC, Table 4.3.4 of AWC SDPWS-2008 as referenced in the 2009 and 2012 IBC, and Table 4.3.4 of AWC SDPWS-2015 as referenced in the 2015 IBC, since the allowable shear loads recognized in this evaluation report are based on cyclic-load tests in accordance with the ICC-ES Acceptance Criteria for Prefabricated Wood Shear Panels (AC130), approved January 2013 (editorially revised February 2015).

3.2 Materials:

3.2.1 Framing Members: All Strong-Wall panels have a top and bottom plate and perimeter framing members and may have solid blocking. Panels more than 24 inches (610 mm) wide have one or more interior studs. Perimeter framing members are E-rated southern pine, two-ply, glued-laminated lumber, Grade 2.1E6, combination symbol 57. The top and bottom plates are E-rated southern pine, two-ply, glued-laminated lumber, Grade 1.9E6, combination symbol 56. The bottom (sill) plate of Strong-Wall panels recognized for installation directly on concrete is preservative-treated by pressure process in accordance with AWPA standards with an approved wood preservative. The bottom (sill) plate of Raised Floor Strong-Wall panels is non-treated. When panels have interior studs, the studs are visually graded Douglas fir-larch lumber, No. 2 or better. When panels have blocking members, the blocking is E-rated southern pine, two-ply, glued-laminated lumber, Grade 1.9E6, combination symbol 56.

3.2.2 Sheathing and Sheathing Edge Reinforcement: The sheathing of the Strong-Wall panels is $^{15}/_{32}$-inch-thick (11.9 mm), Structural I, Exposure 1, oriented strand board (OSB) complying with DOC PS-2. The edges of the sheathing at the perimeter of the Strong-Wall panels are reinforced with factory-installed, No. 20 gage [0.0359 inch (0.91 mm) base-metal thickness], galvanized steel U-channel complying with ASTM A653, designation SS, with a minimum yield strength of 33 ksi (193 MPa).

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3.2.3 Sheathing Fasteners: The Strong-Wall panel sheathing is attached to perimeter framing members, top and bottom plates, interior stud(s) and blocking, with factory-installed, $2^1/_4$-inch-long (57 mm), 10d common nails.

3.2.4 Hold-down Device: The hold-down device is the HDQ8, as described in evaluation report ESR-2330. The HDQ8 hold-downs are factory-attached to the Shear-Wall panel perimeter vertical framing members with SDS $^1/_4$ by $2^1/_2$-inch-long (6.4 mm by 63.5 mm) wood screws described in evaluation report ESR-2236.

3.2.5 Hold-down Bolts and Rods: The chemical composition or the minimum physical properties, or both, of hold-down anchor bolts must comply with ASTM A307 or ASTM F1554, Grade 36. PAB7 anchor bolts are manufactured by Simpson Strong-Tie and comply with ASTM F1554, Grade 36 material. SSTB® anchor bolts are manufactured by Simpson Strong-Tie and comply with ASTM F1554, Grade 36, material as described in evaluation report ESR-2611.

For two-story stacked conditions with ASD design uplifts due to overturning exceeding 13 kips (57.8 kN), the hold-down anchor bolts and rods must use $^7/_8$-inch-diameter (22.2 mm) high-strength steel (F_u = 120 ksi) as shown in Figure 4, unless ASTM A307 or ASTM F1554, Grade 36, material can be justified by a registered design professional.

For Strong-Wall panels supported on a second story, $^7/_8$-inch-diameter (22 mm) all-threaded rod (ATR), complying with ASTM A36, must be used to connect the Strong-Wall panel to the anchor bolt with a coupler nut complying with Section 3.2.8.

3.2.6 Take-up Device: The optional Simpson take-up device (model TUD) used with the Strong-Wall panels is described in evaluation report ESR-2320.

3.2.7 Bottom Plate Anchor Bolts: The bottom (mudsill) plate anchor bolts used with Simpson Strong-Wall panels supported directly on foundations must be minimum $^5/_8$-inch-diameter (15.9 mm) anchor bolts complying with ASTM F1554, Grade 36, or ASTM A307.

3.2.8 Nuts: Nuts must comply with the minimum grades and styles specified for the connected bolt or rod. Coupler nuts must comply with the same specification as the nuts for proof stresses, and IFI 128.

3.2.9 Anchor Bolt Bearing Plate: The Simpson anchor bolt bearing plate, which is supplied as a component of the Standard and Garage Portal-frame Strong-Wall panels, is No. 3 gage [0.2391 inch (6.1 mm) base-metal thickness] ASTM A1011, Grade 33 steel, and has holes for field installed SDS wood screws and anchor bolts.

3.2.10 End Post Bearing Plate: The Simpson end post bearing plate, which is supplied as a component of the Raised Floor Strong-Wall panels, is $^3/_8$-inch-thick-by-$3^1/_2$-inch-wide-by $6^1/_2$-inch-long (9.5 mm by 71 mm by 165 mm) steel plate complying with ASTM A36.

3.2.11 Simpson SDS-Series Wood Screws: Simpson SDS-Series Wood Screws are described in evaluation report ESR-2236.

3.2.12 Top-of-Wall Shims: Optional $^3/_8$-inch- or $^1/_2$-inch-thick (9.5 or 12.7 mm) OSB shims supplied by the Simpson Strong-Tie Company may be used to fill gaps between Strong-Wall panels and the top plates or header of the building construction. Maximum shim height between Wood Strong-Wall and top plates or header is $^7/_8$ inch (22.2 mm). Thicker shims may be used provided shear transfer, overturning, out-of-plane stability and drift are considered by the designer.

3.2.13 Portal-frame Beam: The portal-frame beam must be minimum nominal 4-by-12, No. 1 Douglas fir-larch (DFL), sawn lumber for 4-inch-deep (102 mm) Strong-Walls, and minimum nominal 6-by-12, No. 1 DFL sawn lumber for 6-inch-deep (152 mm) Strong-Walls. The length of the beam used in a single- or double-portal condition may vary, but the maximum clear distance between supports must be limited to 16 feet 4 inches (4979 mm). The beam must have sufficient length to be continuous over the adjacent Strong-Wall panel(s).

An alternate portal-frame beam may be used, provided all of the following conditions are met:

1. The beam has a minimum height of 11.25 inches (286 mm).
2. The stiffness of the beam (the product of the beam modulus of elasticity, E, and moment of inertia, I) is greater than the stiffness of a nominally 4-by-12 or 6-by-12, DFL, grade No. 1 beam, as applicable.
3. The beam has a minimum compression perpendicular-to-grain value ($F_{c\perp}$) of 625 psi (4306 kPa).
4. The design of the beam complies with Section 4.1.2 of this report.

3.2.14 Stud Shoe: All Strong-Wall panels have factory-installed stud shoes fastened to the bottom plate and perimeter framing members which act as a barrier between the framing member and concrete. The stud shoes are formed from No. 20 gage [0.0359 inch (0.91 mm) base-metal thickness], galvanized steel sheet complying with ASTM A653, designation SS, with minimum yield strength of 33 ksi (193 MPa) and a minimum coating designation of G90.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Allowable stress design (ASD) in-plane shear loads are indicated in Table 1 for Standard Strong-Wall Panels and Garage Portal-frame Strong-Wall Panels supported directly on concrete or masonry foundations or steel beams; and in Table 2 for Raised Floor Strong-Wall Panels installed on wood-floor framing members or wood beams. The top-of-panel drifts noted in Tables 1 and 2 correspond to the tabulated ASD in-plane shear loads. Where Standard (SW) and Raised-floor (-RF) Strong-Wall panels are supported directly onto beams, the additional top-of-panel drift contributed by beam deflection must be added to the overall top-of-panel drift. The connections to the supporting beam and the beam including its support must be designed by a registered design professional. Panels installed on beams may be located at any level of the structure.

Allowable out-of-plane loads for Strong-Wall panels are shown in Tables 3A and 3B, and allowable vertical loads are shown in Table 4.

The Strong-Wall prefabricated wood shear panels may be used as components within a seismic-force-resisting system consisting of light-framed load-bearing wood walls sheathed with wood-based structural-use panels rated for shear resistance, provided the following seismic design coefficients and factors are used in design:

PARAMETER	IBC
Response Modification Coefficient	$R = 6^1/_2$
System Overstrength Factor	$\Omega_0 = 3$
Deflection Amplification Factor	$C_d = 4$

Where Strong-Wall shear panels of the same height but different widths are placed in a wall and combined with other shear-resisting systems, applied loads must be proportioned based on relative stiffness as illustrated in Example 1, following the tables of this report. Combination with other lateral-resisting structural systems for which the stiffness is unknown is prohibited.

Strong-Wall panels may be stacked up to two stories provided the allowable shear values in Tables 1 and 2 of this report are not exceeded and the anchorage force includes an evaluation of cumulative overturning effect. Refer to Figure 4 of this report for additional stud requirements at the bottom panel in a stacked application. A sample calculation is provided in Example 2, following the tables of this report.

The foundation must be designed to resist all loads transferred, including the overturning moment of the Strong-Wall panel.

4.1.2 Garage Portal Strong-Wall Frames: Beams for Garage Portal Strong-Wall frames must be designed for the load combinations specified in Section 1605.3 of the IBC. For all load combinations, gravity loads must be considered to induce only simple span beam moments in the beam. For load combinations that include lateral load, a concentrated end moment equal to the top of wall moment must be placed at the end of the beam that is connected to the Strong-Wall panel according to the following: For 22-inch-wide (559 mm) walls, the moment induced into the header/beam of the Simpson Strong-Wall garage portal frame must be taken as 33 percent of the total lateral moment; and for 16-inch-wide (406 mm) panels, the moment induced into the header/beam of the Simpson Strong-Wall garage portal frame must be taken as 20 percent of the total lateral moment. The total lateral moment is calculated as the shear times the height as defined in Section 4.1.4 of this report.

4.1.3 Braced Wall Panels: The Strong-Wall panels may replace each 4 feet (1219 mm) of braced wall panel length specified in Section 2308.6 of the 2015 IBC (Section 2308.9.3 of the 2012, 2009 and 2006 IBC), or Section R602.10 of the IRC. The required length of bracing shall be based on wood structural panel sheathing (Method WSP in IRC and IBC).

4.1.4 Anchorage: The PAB7 anchorage details shown in Figure 2 of this report conform to Chapter 17 of the ACI 318-14 under the 2015 IBC (ACI 318-11 Appendix D under the 2012 IBC) and may be used to anchor Strong-Wall panels provided the design uplift force does not exceed the allowable uplift due to overturning listed in Figure 2. Similarly, the Simpson Strong-Tie SSTB® shown in Figure 2 may be used to anchor Strong-Wall panels provided the design uplift force due to overturning does not exceed the allowable uplift listed in ESR-2611. The $^5/_8$-inch-diameter (15.9 mm) mudsill anchor bolts described in Section 3.2.7 are used to transfer design in-plane shear forces for standard and portal applications. See Table 1 for quantity based on Strong-Wall panel width. Allowable in-plane shear capacities shown in Table 1 must be reduced as limited by anchor bolt and hold-down anchorage capacities for installations on masonry foundations. Alternatively, embedment length and anchorage details may be determined by a registered design professional in accordance with Chapters 19 and 21 of the IBC, as applicable, for the mudsill anchor bolts and the hold-down anchors for the Strong-Wall prefabricated wood shear panels.

Where load combinations include earthquake loads or effects, the design strength of anchorage to concrete must be determined in accordance with Sections 1901.3 and 1905 of the 2015 IBC or Section 1909 of the 2012 IBC or Section 1912 of the 2009 and 2006 IBC, as applicable, except for detached one- and two-family dwellings, assigned to Seismic Design Category A, B or C, or located where the mapped short-period spectral response acceleration, S_s, is less than 0.4g in accordance with IBC Section 1613.1, exception 1, anchorage may be designed based on wind load combinations.

The design uplift force due to overturning, F_{uplift}, for hold-down anchorage must be determined using the following formula:

$$F_{uplift} = \frac{Shear \times Height}{Width - 5.25"}$$

Where:

Shear = Applied design in-plane shear load for Strong-Wall panels and Strong-Wall portal frames, as applicable (lbs.)

Height = Strong-Wall panel height, *H*, from Table 1 or 2, as applicable (in.)

Width = Strong-Wall panel width, *W*, from Table 1 or 2, as applicable (in.)

The uplift force due to overturning for the 22-inch-wide (559 mm) and 16-inch-wide (406 mm) Garage Portal Strong-Wall panels may be taken as 67 percent and 80 percent, respectively, of the calculated design uplift force due to overturning.

The anchorage uplift force due to overturning for stacked applications must take into account cumulative overturning effect and may exceed the Uplift at Allowable ASD Shear values shown in Tables 1 and 2 of this report. A sample calculation is provided in Example 2, following the tables of this report.

4.2 Installation:

4.2.1 General: The manufacturer's installation instructions must be provided with each Strong-Wall panel assembly. Strong-Wall panels may be installed on foundations or wood framing as shown in Figures 1 through 7 of this report. Installation details for Strong-Wall panels prepared by a registered design professional to accommodate specific building conditions may be approved by the code official.

4.2.2 Standard and Raised Floor Strong-Wall Panels: Strong-Wall panels supported directly on an approved foundation must be connected to the foundation with $^5/_8$-inch-diameter (15.9 mm) mudsill anchor bolts described in Section 3.2.7. A bearing plate described in Section 3.2.9 is installed over the mudsill anchor bolts and attached to the Strong-Wall bottom plate with four Simpson SDS $^1/_4$-inch-diameter-by-$2^1/_2$-inch-long (6.4 mm by 63.5 mm) screws. The preinstalled HDQ8 hold-down (see Section 3.2.4) must be connected to the $^7/_8$-inch-diameter (22.2 mm) hold-down anchor bolts with a $^7/_8$-inch-diameter (22.2 mm) all-thread rod and coupler complying with Sections 3.2.5 and 3.2.8, respectively. Refer to Section 4.1.4 and Figure 2 for anchorage details.

The top plate of all Strong-Wall panels must be attached to wood framing members, having a minimum specific gravity of 0.42, with Simpson SDS-Series wood screws that are partially preinstalled by the manufacturer.

Raised-floor Strong-Wall panels must be located within a wall between wood floor framing members and double top plates of the site-built construction. Simpson SDS wood screws, which are preinstalled in the bottom (sill) plate of the Strong Wall panel, must be used to attach the panel to the required double rim joist or blocking beneath, which must have a minimum specific gravity of 0.42. See Figures 3 and 4 for typical raised-floor applications. For second-story installation of Raised Floor Strong-Wall panels, the first story in-plane lateral force—resisting element may be an aligned or offset Strong Wall panel or a site-built wood-framed wall with a post, as shown in Figure 4 (Details 14-SW2 and 13-SW2). When a vertical structural irregularity occurs, the registered design professional must design the supporting elements in accordance with the applicable provisions of the code. For stacked installations, the Strong-Wall panels must have the same width at each story.

Strong-Wall panels may be installed with a solid lumber member (shim) or a site-built cripple shear wall located between the top of the panel and the double top plate of the building construction, provided the installation has been designed by a registered design professional. Refer to Figure 7 for typical shim and cripple wall installations.

4.2.3 Garage Portal-frame Strong-Wall Panels: Single or double portal-frame conditions are recognized for the Garage Portal Strong-Wall panels supported directly on a concrete foundation that has been designed by a registered design professional. A single portal-frame consists of one Strong-Wall panel attached to a portal-frame header beam, with the other end of the header beam supported by an approved post. A double portal-frame consists of a Strong-Wall panel at each end of the header beam. Refer to Figure 5 for Garage Portal-frame Strong-Wall installation details.

The Garage Portal header beam must comply with Section 3.2.13 of this evaluation report. When the header is sawn lumber (not an engineered-wood product, such as LVL), documentation must be provided to the code official verifying that the moisture content of the sawn-lumber header beam is less than 19 percent at the time of installation.

4.2.4 Holes in Framing Members and Panel Sheathing: Field-cutting of framing members or of OSB sheathing of all Strong-Wall panels is not permitted except for locations shown in Figure 6.

4.3 Special Inspection:

4.3.1 2015 IBC: Periodic special inspection must be provided in accordance with Section 1705.1.1, 1705.11.1 or 1705.12.2, as applicable, with the exception of those structures that qualify under Section 1704.2, 1704.3, or 1705.3 and subject to approval of the code official.

4.3.2 2012 IBC: Periodic special inspection must be provided in accordance with Section 1705.1.1, 1705.10.1 or 1705.11.2, as applicable, with the exception of those structures that qualify under Section 1704.2, 1704.3, or 1705.3 and subject to approval of the code official.

4.3.3 2009 IBC: Periodic special inspection must be provided in accordance with Section 1704.15, 1706.2 or 1707.3 as applicable, with the exception of those structures that qualify under Section 1704.1, 1704.4, or 1705.3 and subject to approval of the code official.

4.3.4 2006 IBC: Periodic special inspection must be provided in accordance with Section 1704.13 or 1707.3, with the exception of those structures that qualify under Section 1704.1, 1704.4, or 1705.3 and subject to approval of the code official.

4.3.5 IRC: In jurisdictions governed by the IRC, special inspections are not required, except where an engineered design according to Section R301.1.3 of the IRC is used. Where an engineered design is used, special inspections in accordance with Section 4.3 of this report must be provided.

5.0 CONDITIONS OF USE

The Simpson Strong-Wall panels described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The panels 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 The panel sizes are limited to the maximum widths and heights set forth in this report.

5.3 Design loads and drifts must not exceed the allowable loads and drifts set forth in this report.

5.4 Calculations and details justifying that the design loads do not exceed allowable loads specified in this report must be submitted to the code official for approval, except for the braced and alternate braced wall substitutions noted in Section 4.1.3 of this report. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.5 Design of the structural members (concrete or masonry foundations or steel or wood beams) supporting the Strong-Wall panels is outside the scope of this report.

5.6 Use of OSB sheathing to resist combined shear and uplift from wind in accordance with Section 4.4 of ANSI/AWC SDPWS-2015 and -2008, is beyond the scope of this report.

5.7 The Strong-Walls are fabricated by Simpson Strong-Tie Company in Stockton, California, with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with ICC ES Acceptance Criteria for Prefabricated Wood Shear Panels (AC130), approved January 2013 (editorially revised February 2015). Additional data was submitted for the anchorage to concrete in accordance with ACI 318-11, Appendix D.

7.0 IDENTIFICATION

The Strong-Wall panels are identified with a label bearing the manufacturer's name (Simpson Strong-Tie Company Inc.), the model number, and the evaluation report number (ESR-1267).

TABLE 1—SIMPSON STRONG-WALL PANELS SUPPORTED ON FOUNDATIONS[1]

MODEL NO	PANEL DIMENSIONS (in.)			FASTENERS			SEISMIC			WIND		
	Width	Height	Thickness	SDS Screws at Top of Wall[2] (Qty.)	Mudsill Anchor Bolts[3] (Qty–Dia) (in.)	Holdown Anchor Bolts[4] (Qty–Dia.) (in.)	Allow. ASD Shear Load, V (lbs)	Drift at Allow. ASD Shear (in)	Uplift at Allow. ASD Shear (lbs)	Allow. ASD Shear Load, V (lbs)	Drift at Allow. ASD Shear (in)	Uplift at Allow. ASD Shear (lbs)
STANDARD STRONG-WALL PANEL												
SW18x8	18	93 1/4	3 1/2	9	2 – 5/8	2 – 7/8	1,100	0.33	8,045	1,455	0.53	10,640
SW24x8	24	93 1/4	3 1/2	12	2 – 5/8	2 – 7/8	1,530	0.37	7,610	2,010	0.53	9,995
SW32x8	32	93 1/4	3 1/2	16	2 – 5/8	2 – 7/8	2,550	0.33	8,890	3,500	0.52	12,200
SW48x8	48	93 1/4	3 1/2	24	3 – 5/8	2 – 7/8	3,390	0.27	7,395	5,595	0.50	12,205
SW18x9	18	105 1/4	3 1/2	9	2 – 5/8	2 – 7/8	1,040	0.37	8,585	1,375	0.60	11,350
SW24x9	24	105 1/4	3 1/2	12	2 – 5/8	2 – 7/8	1,530	0.39	8,590	2,010	0.59	11,285
SW32x9	32	105 1/4	3 1/2	16	2 – 5/8	2 – 7/8	2,055	0.31	8,085	3,100	0.56	12,195
SW48x9	48	105 1/4	3 1/2	24	3 – 5/8	2 – 7/8	3,015	0.28	7,425	4,955	0.53	12,200
SW24x10	24	117 1/4	3 1/2	12	2 – 5/8	2 – 7/8	1,525	0.42	9,535	1,950	0.63	12,195
SW32x10	32	117 1/4	3 1/2	16	2 – 5/8	2 – 7/8	2,055	0.33	9,010	2,785	0.55	12,205
SW48x10	48	117 1/4	3 1/2	24	3 – 5/8	2 – 7/8	3,015	0.30	8,270	4,450	0.50	12,205
SW24x12x6	24	141 1/4	5 1/2	12	2 – 5/8	2 – 7/8	1,195	0.51	9,000	1,585	0.80	11,940
SW32x12x6	32	141 1/4	5 1/2	16	2 – 5/8	2 – 7/8	1,755	0.43	9,265	2,310	0.65	12,200
SW48x12x6	48	141 1/4	5 1/2	24	3 – 5/8	2 – 7/8	2,770	0.36	9,150	3,690	0.53	12,190
DOUBLE GARAGE PORTAL STRONG-WALL PANEL												
SW16x7x4	16	78	4	8	2 – 5/8	2 – 7/8	2,670	0.36	7,750	3,500	0.53	10,160
SW16x7x6	16	78	5 3/4	8	2 – 5/8	2 – 7/8	2,670	0.36	7,750	3,500	0.53	10,160
SW16x8x4	16	90	4	8	2 – 5/8	2 – 7/8	2,350	0.40	7,870	3,105	0.60	10,400
SW16x8x6	16	90	5 3/4	8	2 – 5/8	2 – 7/8	2,350	0.40	7,870	3,105	0.60	10,400
SW22x7x4	22	78	4	10	2 – 5/8	2 – 7/8	4,160	0.37	6,490	5,420	0.53	8,455
SW22x7x6	22	78	5 3/4	10	2 – 5/8	2 – 7/8	4,160	0.37	6,490	5,420	0.53	8,455
SW22x8x4	22	90	4	10	2 – 5/8	2 – 7/8	3,730	0.42	6,715	4,880	0.60	8,785
SW22x8x6	22	90	5¾	10	2 – 5/8	2 – 7/8	3,730	0.42	6,715	4,880	0.60	8,785
SINGLE GARAGE PORTAL STRONG-WALL PANEL												
SW16x7x4	16	78	4	8	2 – 5/8	2 – 7/8	1,335	0.36	7,750	1,750	0.53	10,160
SW16x7x6	16	78	5 3/4	8	2 – 5/8	2 – 7/8	1,335	0.36	7,750	1,750	0.53	10,160
SW16x8x4	16	90	4	8	2 – 5/8	2 – 7/8	1,175	0.40	7,870	1,555	0.60	10,415
SW16x8x6	16	90	5 3/4	8	2 – 5/8	2 – 7/8	1,175	0.40	7,870	1,555	0.60	10,415
SW22x7x4	22	78	4	10	2 – 5/8	2 – 7/8	2,080	0.37	6,490	2,710	0.53	8,455
SW22x7x6	22	78	5 3/4	10	2 – 5/8	2 – 7/8	2,080	0.37	6,490	2,710	0.53	8,455
SW22x8x4	22	90	4	10	2 – 5/8	2 – 7/8	1,865	0.42	6,715	2,440	0.60	8,785
SW22x8x6	22	90	5 3/4	10	2 – 5/8	2 – 7/8	1,865	0.42	6,715	2,440	0.60	8,785

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.45 N, 1 lbs/ft = 14.6 N/m.

[1]Allowable shear and uplift loads shown in the table are for Strong-Wall panels installed on concrete foundations. For installations on masonry foundations see Section 4.1.4.
[2]SDS-Series Simpson Wood Screws (refer to ESR-2236).
[3]Mudsill anchor bolts must comply with ASTM A307 or ASTM F1554, Grade 36, and Section 3.2.7 of this report.
[4]Hold-down anchor bolts must comply with Section 3.2.5 of this report and be installed for each Strong-Wall panel according to Section 4.1.4 of this report.

TABLE 2—SIMPSON STRONG-WALL PANELS SUPPORTED ON WOOD FLOOR CONSTRUCTION[1]

MODEL NO.	PANEL DIMENSIONS (in.)			FASTENERS			SEISMIC			WIND		
	Width	Height	Thickness	SDS[2] Screws at Top of Wall (Qty.)	SDS[2] Screws at Bottom of Wall (Qty.)	Holdown Anchor Bolts or Rods[3] (Qty.–Dia.) (in.)	Allow. ASD Shear Load, V (lbs)	Drift at Allow. ASD Shear (in)	Uplift at Allow. ASD Shear (lbs)	Allow. ASD Shear Load, V (lbs)	Drift at Allow. ASD Shear (in)	Uplift at Allow. ASD Shear (lbs)
RAISED FLOOR STRONG-WALL PANEL ON A FIRST FLOOR												
SW18x8-RF	18	93 1/4	3 1/2	9	13	2 – 7/8	835	0.41	6,105	1,080	0.53	7,900
SW24x8-RF	24	93 1/4	3 1/2	12	16	2 – 7/8	1,210	0.39	6,020	1,640	0.53	8,155
SW32x8-RF	32	93 1/4	3 1/2	16	20	2 – 7/8	1,790	0.39	6,240	2,330	0.53	8,120
SW48x8-RF	48	93 1/4	3 1/2	24	28	2 – 7/8	2,715	0.31	5,920	4,320	0.53	9,425
SW18x9-RF	18	105 1/4	3 1/2	9	13	2 – 7/8	680	0.37	5,615	910	0.60	7,510
SW24x9-RF	24	105 1/4	3 1/2	12	16	2 – 7/8	965	0.40	5,415	1,270	0.60	7,130
SW32x9-RF	32	105 1/4	3 1/2	16	20	2 – 7/8	1,505	0.38	5,920	2,090	0.60	8,225
SW48x9-RF	48	105 1/4	3 1/2	24	28	2 – 7/8	2,550	0.35	6,280	3,770	0.60	9,280
SW24x10-RF	24	117 1/4	3 1/2	12	16	2 – 7/8	900	0.40	5,630	1,175	0.67	7,350
SW32x10-RF	32	117 1/4	3 1/2	16	20	2 – 7/8	1,500	0.45	6,575	2,015	0.67	8,830
SW48x10-RF	48	117 1/4	3 1/2	24	28	2 – 7/8	2,215	0.36	6,075	3,220	0.67	8,830
RAISED FLOOR STRONG-WALL PANEL SUPPORTED ON A SECOND FLOOR[4]												
SW18x8-RF	18	93 1/4	3 1/2	9	13	2 – 7/8	750	0.37	5,485	1,000	0.53	7,315
SW24x8-RF	24	93 1/4	3 1/2	12	16	2 – 7/8	1,095	0.39	5,445	1,455	0.53	7,235
SW32x8-RF	32	93 1/4	3 1/2	16	20	2 – 7/8	1,595	0.40	5,560	2,115	0.53	7,375
SW48x8-RF	48	93 1/4	3 1/2	24	28	2 – 7/8	2,510	0.39	5,475	3,340	0.53	7,285
SW18x9-RF	18	105 1/4	3 1/2	9	13	2 – 7/8	600	0.33	4,955	810	0.60	6,685
SW24x9-RF	24	105 1/4	3 1/2	12	16	2 – 7/8	935	0.38	5,250	1,245	0.60	6,990
SW32x9-RF	32	105 1/4	3 1/2	16	20	2 – 7/8	1,360	0.39	5,350	1,805	0.60	7,100
SW48x9-RF	48	105 1/4	3 1/2	24	28	2 – 7/8	2,310	0.41	5,685	3,055	0.60	7,520
SW24x10-RF	24	117 1/4	3 1/2	12	16	2 – 7/8	810	0.37	5,065	1,080	0.67	6,755
SW32x10-RF	32	117 1/4	3 1/2	16	20	2 – 7/8	1,320	0.46	5,785	1,730	0.67	7,585
SW48x10-RF	48	117 1/4	3 1/2	24	28	2 – 7/8	2,005	0.41	5,500	2,660	0.67	7,295

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.45 N, 1 lbs/ft = 14.6 N/m.

[1]Allowable shear and uplift loads shown in the table are for Strong-Wall panels installed on raised wood floor systems.
[2]SDS-Series Simpson Wood Screws (refer to ESR-2236).
[3]Hold-down anchor bolt/rods must comply with Section 3.2.5 and be installed for each Strong-Wall panel according to Section 4.1.4 of this report.
[4]Second Floor Uplifts are at base of second floor Strong-Wall panel. For stacked conditions, cumulative overturning at base of first floor wall must be evaluated.

TABLE 3A—ALLOWABLE OUT-OF-PLANE LOADS FOR STANDARD AND RAISED FLOOR STRONG-WALL PANELS[1,2,3,4]

MODEL WIDTH	ALLOWABLE LOAD (lbs per linear foot)		ALLOWABLE LOAD (lbs per square foot)	
	End Post	Interior Stud	End Post	Interior Stud
SW18x8	64	—	45	—
SW24x8	64	—	38	—
SW32x8	64	31	48	23
SW48x8	64	31	48	23
SW18x9	44	—	31	—
SW24x9	44	—	26	—
SW32x9	44	21	33	16
SW48x9	44	21	33	16
SW24x10	31	—	19	—
SW32x10	31	15	23	11
SW48x10	31	15	23	11
SW24x12x6	68	—	41	—
SW32x12x6	68	36	51	27
SW48x12x6	68	36	51	27

For **SI:** 1 foot = 304.8 mm, 1 plf = 14.6 N/m, 1 psf = 47.9 N/m^2.

[1]Allowable loads are governed by deflection at L/240
[2]For deflection limit of L/180, the tabulated loads must be multiplied by (240/180) = 1.33.
[3]Combined axial and bending loads on the Strong-Wall panels' studs and end posts must be determined by the following formula:

$$P_{actual} / P_{allow} + W_{actual} / W_{allow} \leq 1.0$$

Where: P_{actual} = Actual axial ASD design load (lbs).
P_{allow} = 14,100 lbs (end post) or 4,620 lbs (stud) for the 8-, 9-, and 10-foot tall panels.
P_{allow} = 16,800 lbs (end post) or 5520 lbs (stud) for the 12-foot tall panels.
W_{actual} = Actual ASD out of plane load (plf).
W_{allow} = Allowable load (plf) from table.
[4]Allowable post loads in psf are based on the panel tributary width plus 8 inches.

TABLE 3B—ALLOWABLE OUT-OF-PLANE LOADS FOR GARAGE PORTAL-FRAME STRONG-WALL PANELS[1,2,3,4]

MODEL WIDTH	ALLOWABLE LOAD	
	End Post (plf)	Sheathing (psf)
SW16x7x4	155	217
SW22x7x4	155	103
SW16x8x4	101	217
SW22x8x4	101	103
SW16x7x6	470	217
SW22x7x6	470	103
SW16x8x6	306	217
SW22x8x6	306	103

For **SI:** 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 psf = 47.9 N/m^2.

[1]Allowable post loads are governed by deflection at L/240.
[2]Allowable sheathing loads are governed by material strength properties, where duration of load, C_D, is equal to 1.6.
[3]For deflection limit of L/180, the tabulated loads must be multiplied by (240/180) = 1.33.
[4]Combined axial and bending loads on the Strong-Wall panels' end posts must be determined by the following formula:

$$P_{actual} / P_{allow} + W_{actual} / W_{allow} \leq 1.0$$

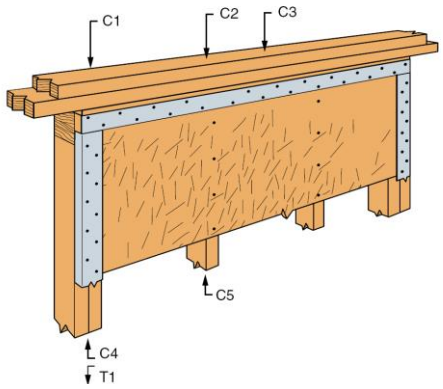
Where: P_{actual} = Actual axial ASD design load (lbs).
P_{allow} = 21,100 lbs for the 4-inch-thick panels.
P_{allow} = 35,200 lbs for the 6-inch-thick panels.
W_{actual} = Actual ASD out of plane load (plf).
W_{allow} = Allowable load (plf) from the table.

TABLE 4—ALLOWABLE VERTICAL LOADS FOR STRONG-WALL PANELS (lbs)[1,2]

Strong-Wall Model No.	C1	C2	C3		C4	C5		T1
	C_D = 1.0	C_D = 1.0	C_D = 1.0	C_D = 1.25	C_D = 1.6	C_D = 1.0	C_D = 1.25	C_D = 1.6
SW16x7x4, 8x4 SW22x7x4, 8x4	7,100	N/A	N/A	N/A	21,100	N/A	N/A	12,200
SW16x7x6, 8x6 SW22x7x6, 8x6	10,700	N/A	N/A	N/A	35,200	N/A	N/A	12,200
SW18x8, 9 SW24x8, 9, 10	6,100	N/A	1,685	2,105	14,100	N/A	N/A	12,200
SW32x8, 9, 10 SW48x8, 9, 10	6,100	3,330	2,955	3,690	14,100	4,270	4,620	12,200
SW24x12x6	9,920	N/A	2,820	3,525	16,800	N/A	N/A	12,200
SW32x12x6 SW48x12x6	9,920	5,410	4,945	6,185	16,800	5,280	5,520	12,200

For **SI:** 1 lb = 4.45 N.

[1]C1 = Allowable compressive (perpendicular to grain) force on end post.
C2 = Allowable compressive (perpendicular to grain) force on interior stud.
C3 = Allowable compressive force (due to bending) on top plates between posts/studs.
C4 = Allowable compressive force (due to buckling) on end post.
C5 = Allowable compressive force (due to buckling) on interior stud.
T1 = Allowable tension force (as limited by the holdown).
[2]For RF Raised Floor Walls, use the corresponding Standard Strong-Wall Model Values.



EXAMPLE 1 – WOOD STRONG-WALL STIFFNESS DISTRIBUTION ALONG THE SAME WALL LINE

Given:
Seismic loading
Design Shear (ASD) V = 3,500 lbs
8 foot foundation to plate height
Combine SW panels, of the same height but different width, along the same wall line using stiffness distribution:

Try (1) SW24x8 and (1) SW32x8 along the same wall line

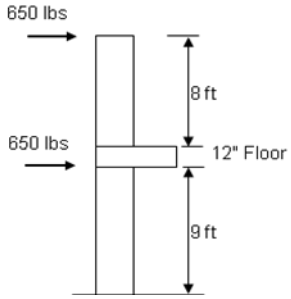
Wall Model	Allow. Shear V_a (Table 1) (lbs)	Drift at Allow. V_a (in)	Stiffness $K=V_a$/Drift (lbs/in)	Relative Stiffness (RR) RR=K/ΣK
SW24x8	1,530	0.37	4,135	0.35
SW32x8	2,550	0.33	7,727	0.65
		Total:	11,862	1.00

Wall Model	Distributed Shear = VxRR (lbs)		Allow. Shear V_a (Table 1) (lbs)		Drift at Design Shear =Distributed Shear/K (in)
SW24x8	1,225	<	1,530	**OK**	0.30
SW32x8	2,275	<	2,550	**OK**	0.30

>>> Use (1) SW24x8 and (1) SW32x8 along the same wall line

EXAMPLE 2 – WOOD STRONG-WALL TWO-STORY STACKED DESIGN

Given:
Wind loading
$V_{2nd\ story}$ = 650 lbs
$V_{1st\ story}$ = 650 lbs
V_{Total} = 650 + 650 = 1,300 lbs
First story wall installed on foundation



Try SW18x8-RF over SW18x9

$V_{2nd\ story}$ = 650 lbs < V_{Allow} = 1,000 lbs (Table 2 – Second Floor) **OK**

V_{Total} = 1,300 lbs < V_{Allow} = 1,375 lbs (Table 1 – Standard Panel) **OK**

Use Table 2 – First Floor when First story wall installed on wood floor

Calculate cumulative overturning anchorage force:

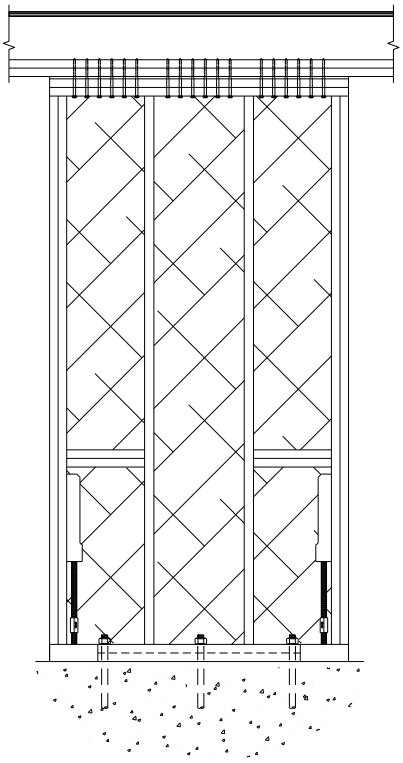
F_{uplift} = (Shear x Height) / (Width – 5.25 inches) (Section 4.1.4)

F_{uplift} = [(650 lbs x 18 ft + 650 lbs x 9 ft) x 12 in/ft] / (18 in – 5.25 in)

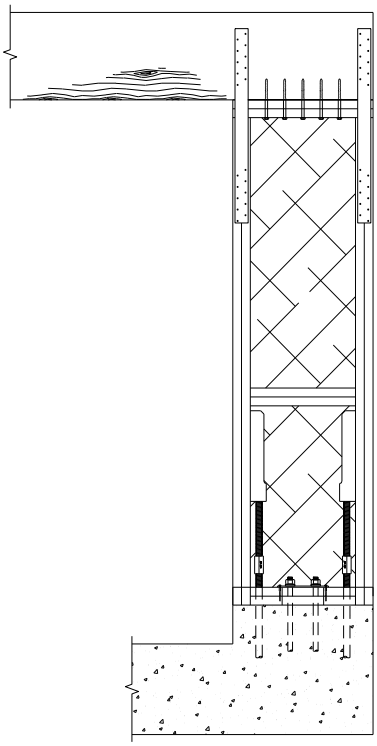
F_{uplift} = 16,520 lbs

>>> Use SW18x8-RF over SW18x9 for stacked application

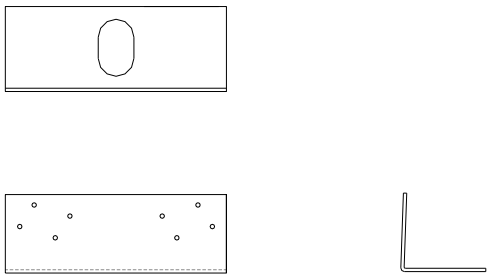
For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb = 4.45 N, 1 lb/in = 0.175 N/mm



STANDARD STRONG-WALL

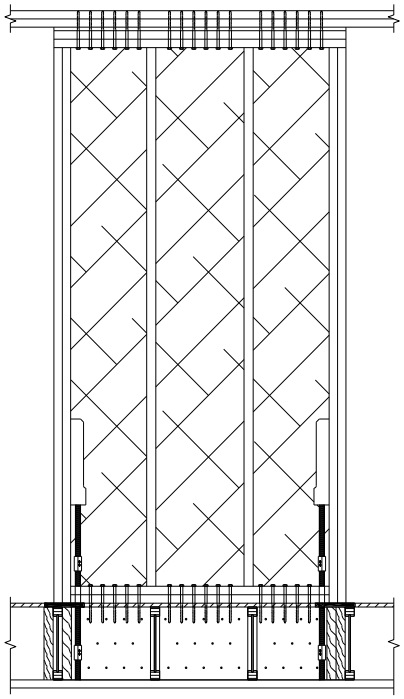


GARAGE PORTAL STRONG-WALL



SW24 STUD SHOE SHOWN,
OTHERS SIMILAR

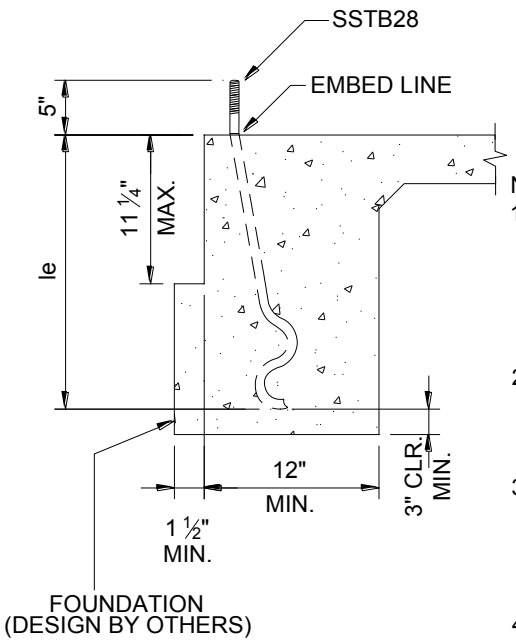
STRONG-WALL STUD SHOE



RAISED FLOOR STRONG-WALL

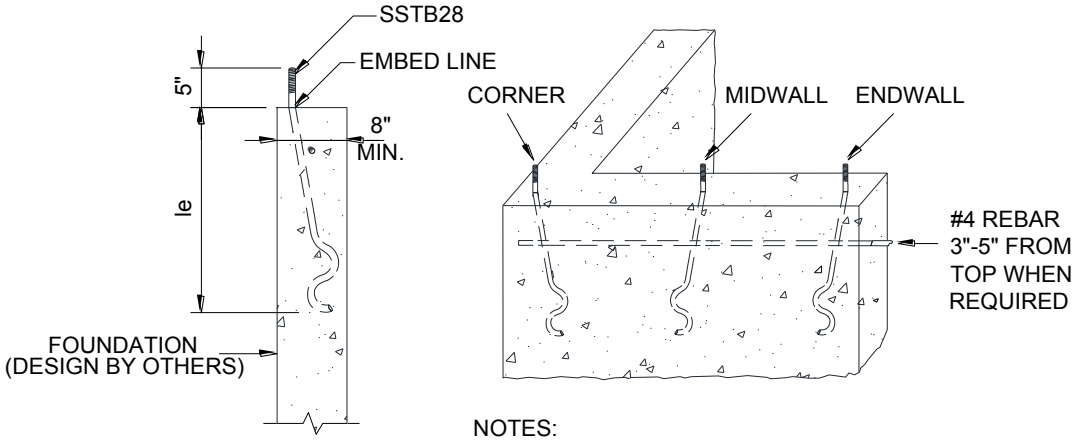
FIGURE 1—STRONG-WALL PANELS

MINIMUM SSTB ANCHOR REQUIREMENTS [1, 2, 3, 4]	
WOOD STRONG-WALL MODEL	**SLAB ON GRADE - SLAB EDGE (CORNER AND MIDWALL)**
SW16	SSTB28
SW22	
SW18	
SW24	
SW32	
SW48	



NOTES:
1. TABLE APPLIES TO SINGLE STORY WOOD STRONG-WALL APPLICATIONS (STANDARD AND RAISED FLOOR) ON CONCRETE FOUNDATIONS. TWO-STORY STACKED APPLICATIONS MAY REQUIRE HIGH-STRENGTH ANCHORS (DESIGNED BY OTHERS).
2. ADDITIONAL APPLICATIONS MAY USE THE SSTB WHERE THE DEMAND UPLIFT FORCE IS LESS THAN THE ALLOWABLE SSTB LOAD SHOWN IN ICC-ES ESR-2611.
3. FOUNDATION DIMENSIONS ARE FOR ANCHORAGE ONLY. FOUNDATION DESIGN (SIZE AND REINFORCEMENT) BY OTHERS. THE REGISTERED DESIGN PROFESSINAL MAY SPECIFY ALTERNATE EMBEDMENT, FOOTING SIZE OR ANCHOR BOLT.
4. SEE ICC-ES ESR-2611 FOR ADDITIONAL SSTB INFORMATION.

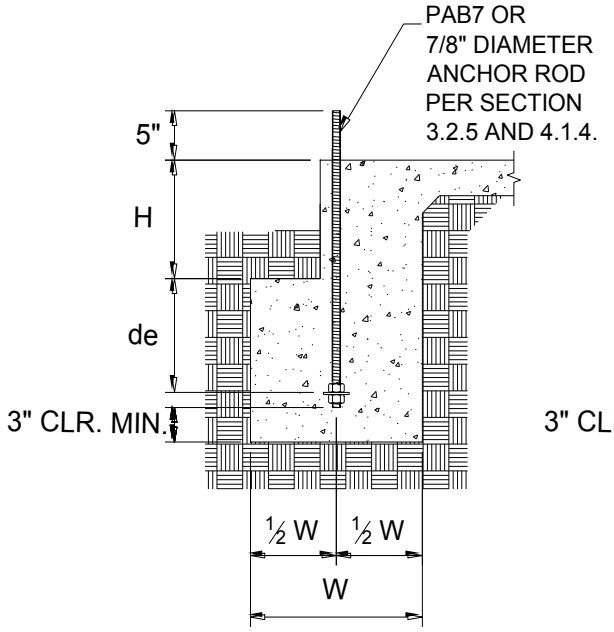
SSTB ANCHORAGE (SLAB ON GRADE) 9-SW1

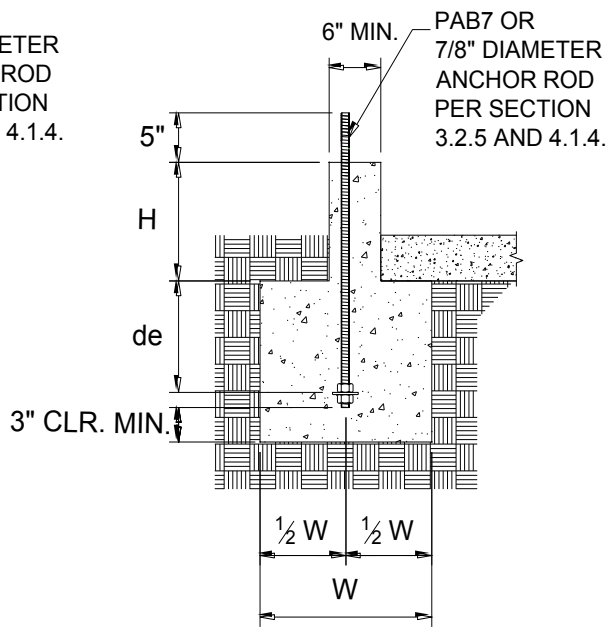


NOTES:
1. SSTB MAY BE USED WHERE THE DEMAND UPLIFT FORCE IS LESS THAN THE ALLOWABLE SSTB LOAD SHOWN IN ICC-ES ESR-2611.
2. FOUNDATION DIMENSIONS ARE FOR ANCHORAGE ONLY. FOUNDATION DESIGN (SIZE AND REINFORCEMENT) BY OTHERS. THE REGISTERED DESIGN PROFESSINAL MAY SPECIFY ALTERNATE EMBEDMENT, FOOTING SIZE OR ANCHOR BOLT.
3. SEE ICC-ES ESR-2611 FOR ADDITIONAL SSTB INFORMATION.

SSTB ANCHORAGE (CONCRETE STEMWALL) 10-SW1

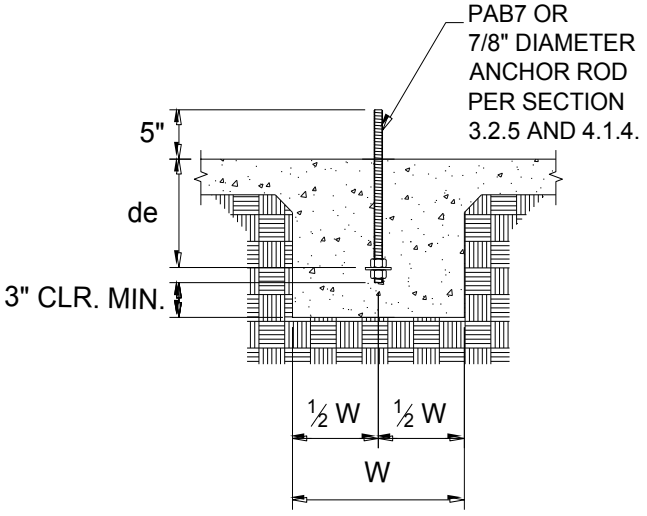
FIGURE 2—ANCHORAGE DETAILS

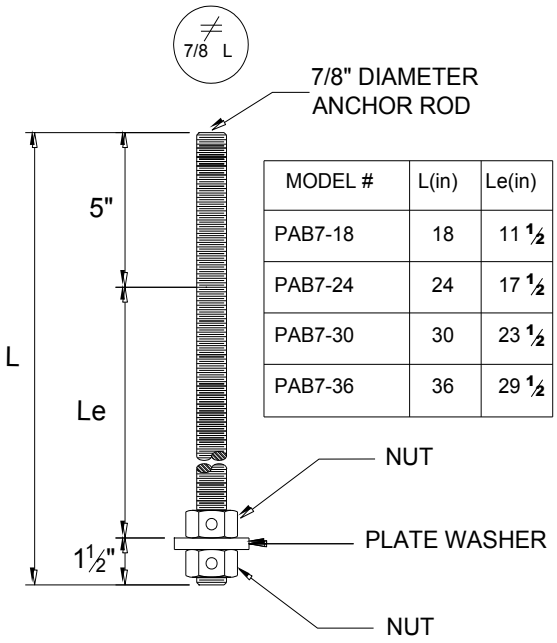




H = 13 ½" MAXIMUM WITH PAB7-30 ANCHOR BOLT WHEN de = 10"
H = 19 ½" MAXIMUM WITH PAB7-36 ANCHOR BOLT WHEN de = 10"

SLAB ON GRADE FOUNDATION **CURB OR STEMWALL FOUNDATION**





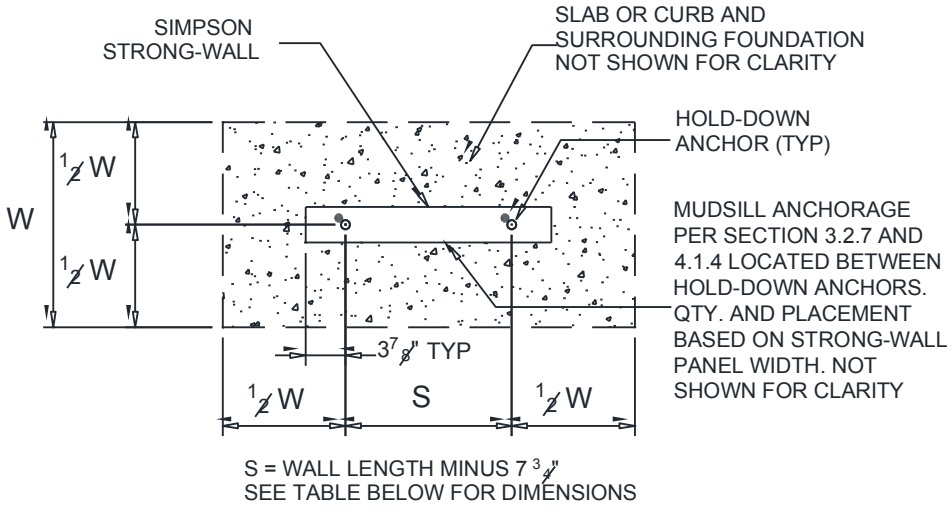
MODEL #	L(in)	Le(in)
PAB7-18	18	11 ½
PAB7-24	24	17 ½
PAB7-30	30	23 ½
PAB7-36	36	29 ½

INTERIOR FOUNDATION **PAB7 ANCHOR BOLT**

NOTES:
1. SEE 2-SW1 FOR DIMENSIONS AND ADDITIONAL NOTES.

ANCHORAGE – TYPICAL SECTIONS 1-SW1

FIGURE 2—ANCHORAGE DETAILS (CONTINUED)



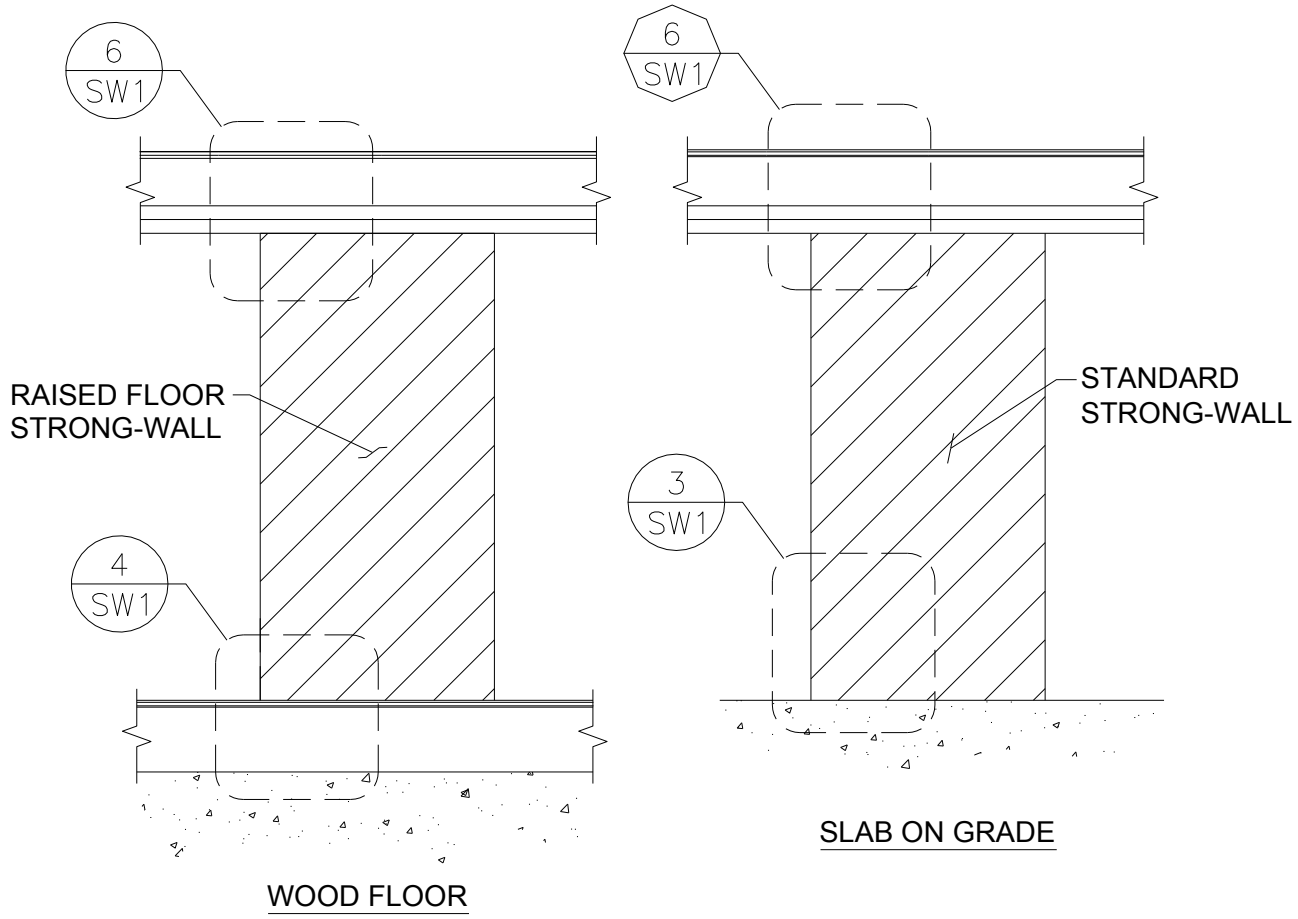
FOUNDATION PLAN VIEW

FOUNDATION DIMENSIONS FOR STRONG-WALL ANCHORAGE				
	CONDITION	ASD ALLOWABLE UPLIFT (lbs)	w (in)	de (in)
SEISMIC	CRACKED	11,900	27	9
		13,100	29	10
	UNCRACKED	12,500	24	8
		13,100	25	9
WIND	CRACKED	6,200	16	6
		10,000	22	8
		12,900	26	9
		13,100	27	9
	UNCRACKED	6,400	14	6
		9,300	18	6
		12,500	22	8
		13,100	23	8

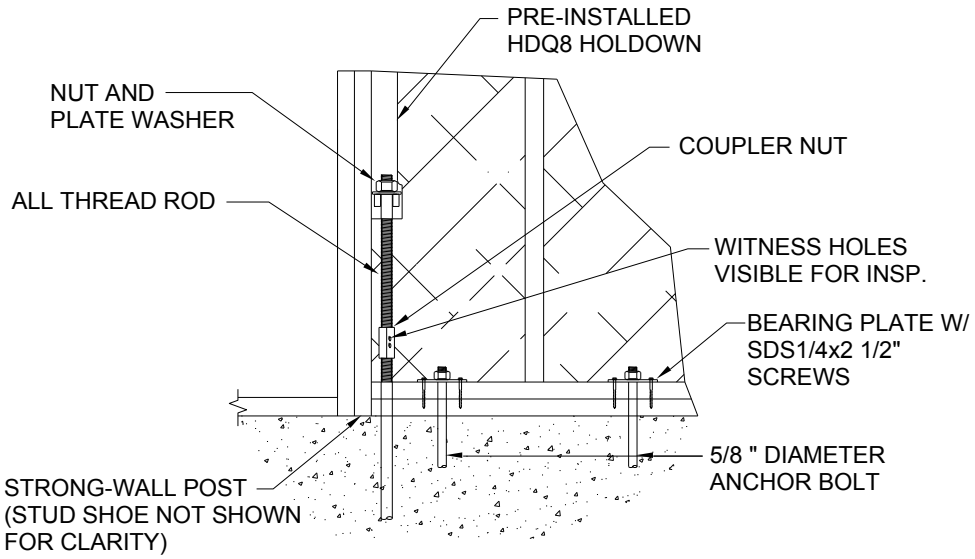
NOTES:
1. ANCHORAGE DESIGNS CONFORM TO ACI 318-11 APPENDIX D AND ACI 318-14 AND ASSUME MINIMUM f'c=2,500 PSI CONCRETE, ASTM A307 OR ASTM F1554, GRADE 36 ANCHOR RODS AND NO SUPPLEMENTARY REINFORCEMENT. HIGH STRENGTH ANCHORAGE DESIGN BY OTHERS WHEN REQUIRED.
2. SEISMIC INDICATES SEISMIC DESIGN CATEGORY C THROUGH F. DETACHED 1 AND 2 FAMILY DWELLINGS IN SDC C MAY USE WIND ANCHORAGE SOLUTIONS. SEISMIC ANCHORAGE DESIGNS CONFORM TO ACI 318-11 SECTION D.3.3.4.3 AND ACI 318-14 SECTION 17.2.3.4.3.
3. WIND INCLUDES SEISMIC DESIGN CATEGORY A AND B.
4. FOUNDATION DIMENSIONS ARE FOR ANCHORAGE ONLY. FOUNDATION DESIGN (SIZE AND REINFORCEMENT) BY OTHERS. THE REGISTERED DESIGN PROFESSIONAL MAY SPECIFY ALTERNATE EMBEDMENT, FOOTING SIZE OR ANCHOR BOLT.

ANCHORAGE SCHEDULE 2-SW1

FIGURE 2—ANCHORAGE DETAILS (CONTINUED)

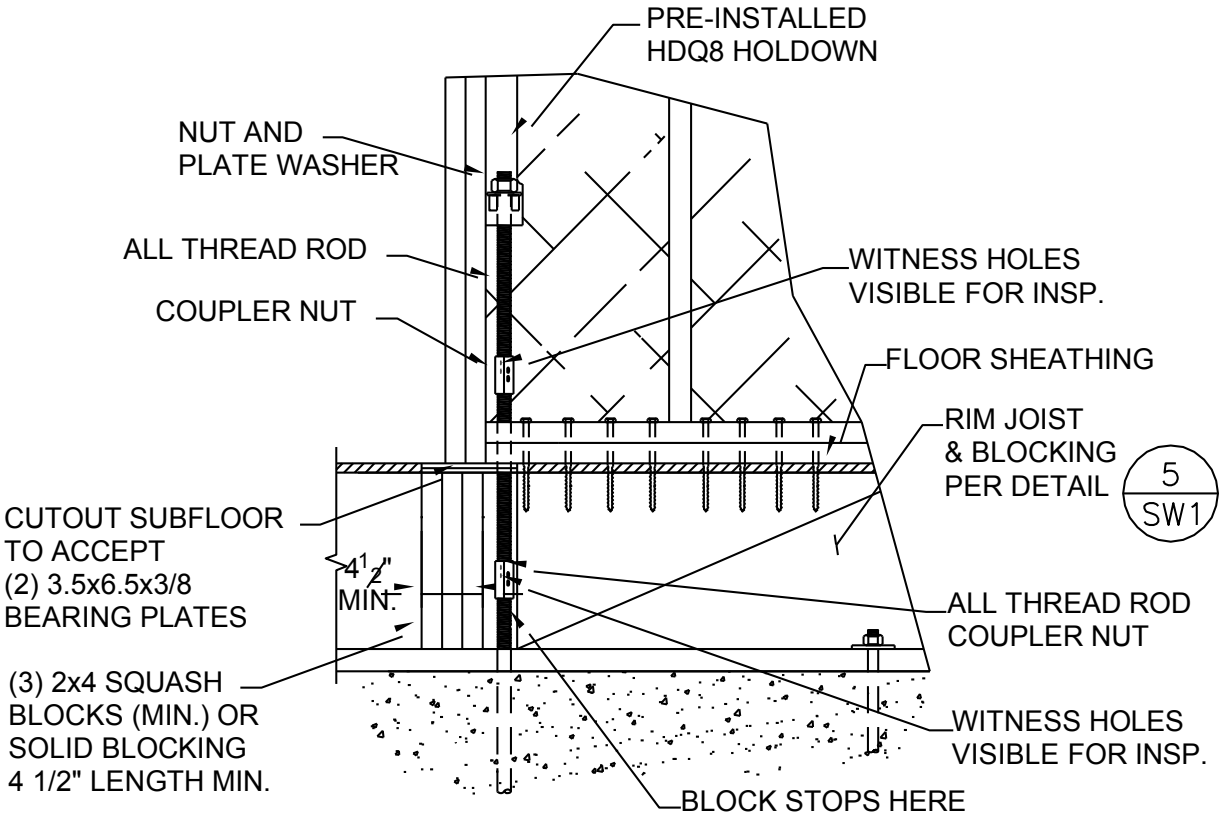


SINGLE STORY STRONG-WALL 11-SW1



STANDARD WALL SILL 3-SW1

FIGURE 3—SINGLE-STORY STRONG-WALL DETAILS



RAISED FLOOR WALL SILL 4-SW1

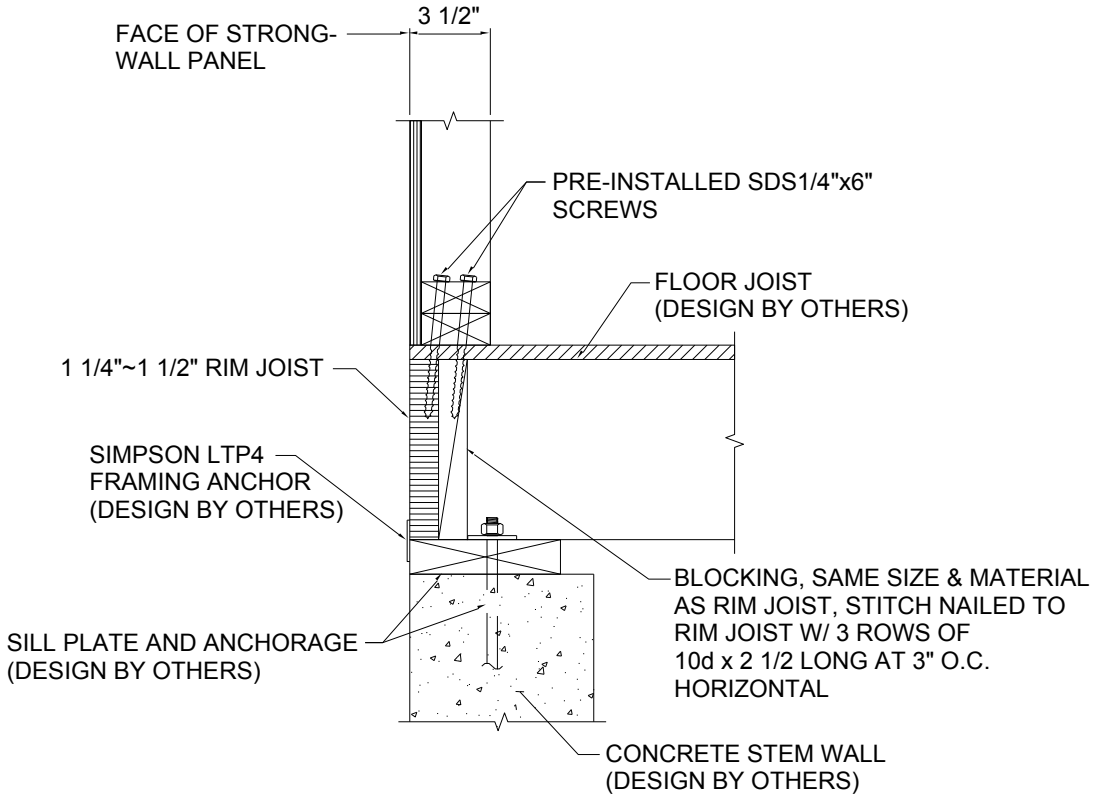
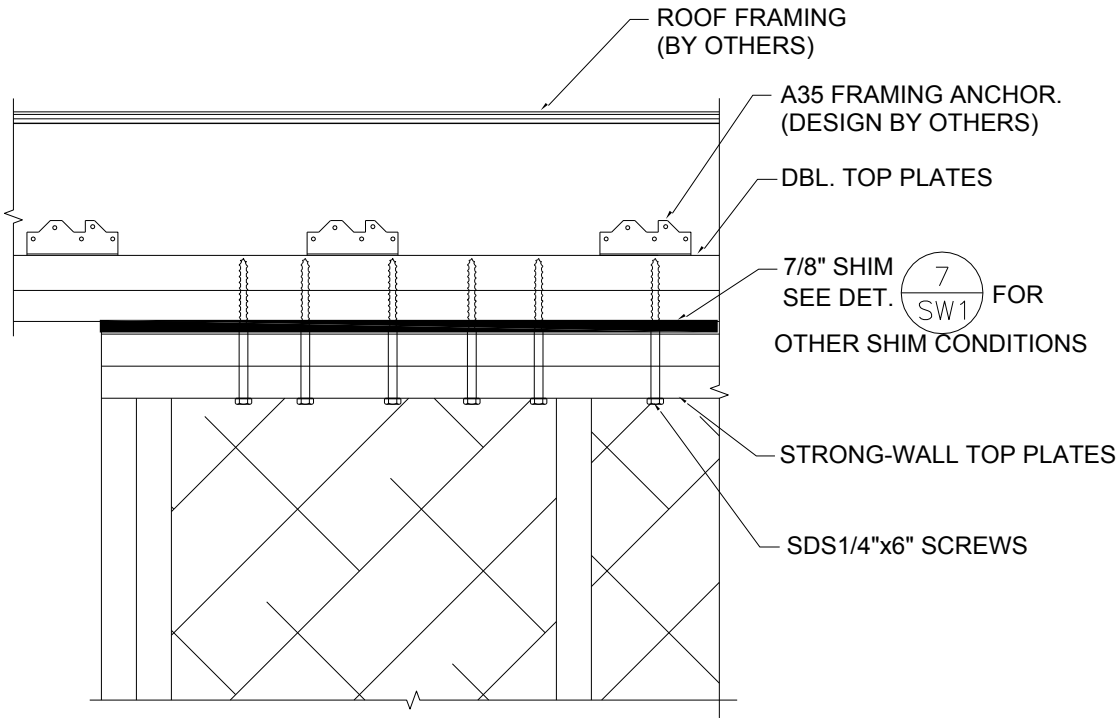


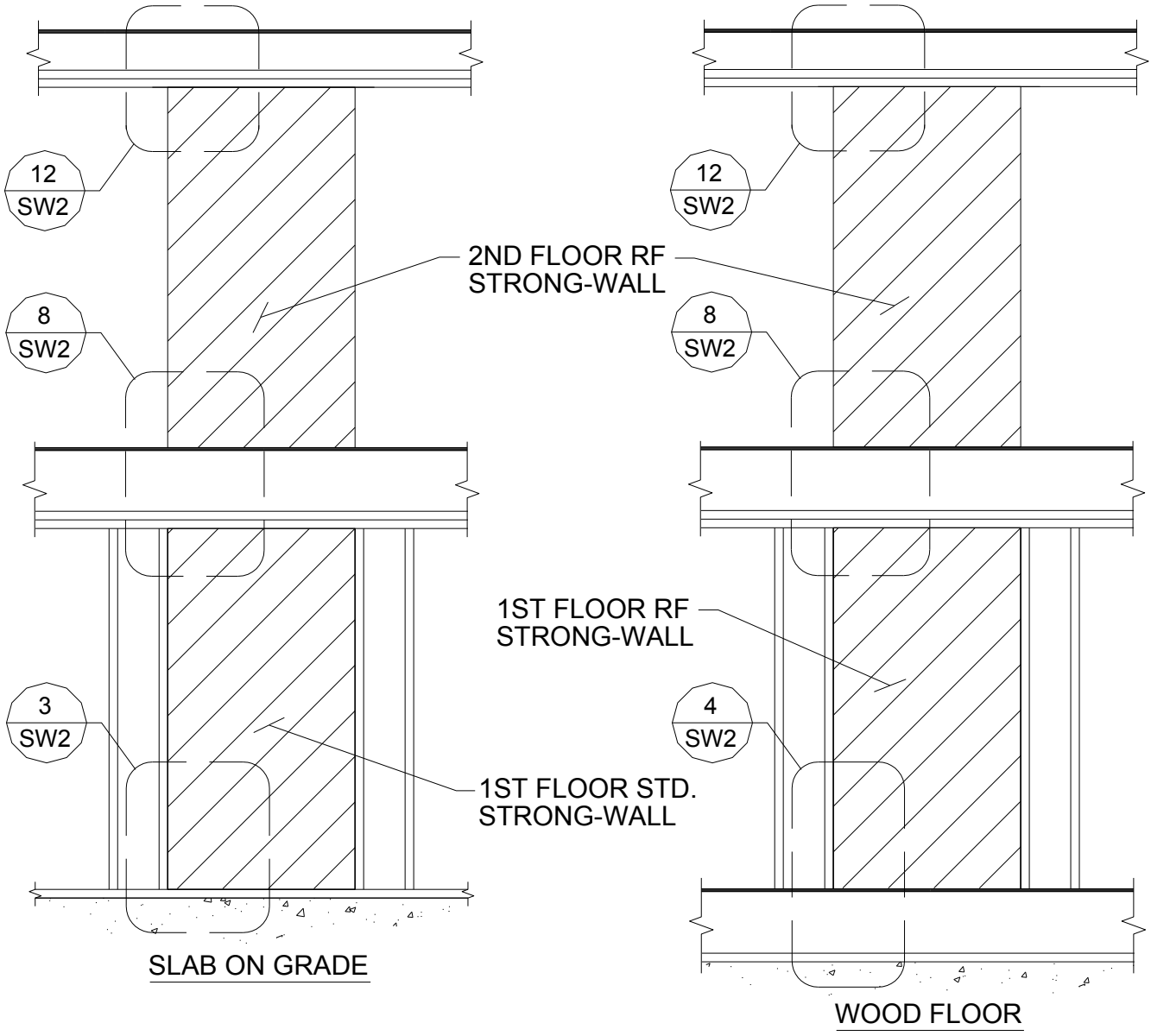
FIGURE 3—SINGLE-STORY STRONG-WALL DETAILS (Continued)

RAISED FLOOR WALL SECTION 5-SW1



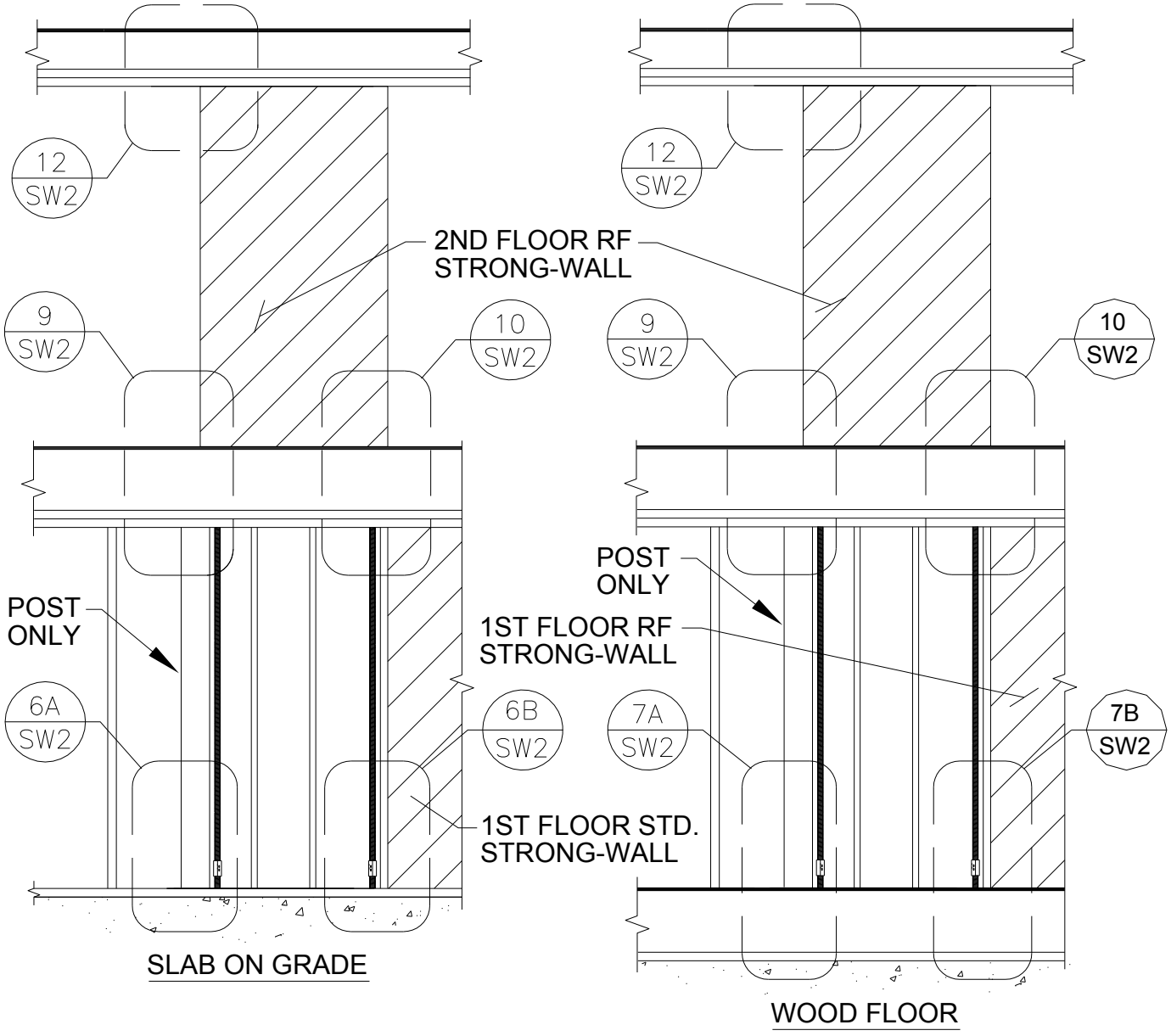
TOP PLATE CONNECTION 6-SW1, 12-SW2

FIGURE 3—SINGLE-STORY STRONG-WALL DETAILS (Continued)



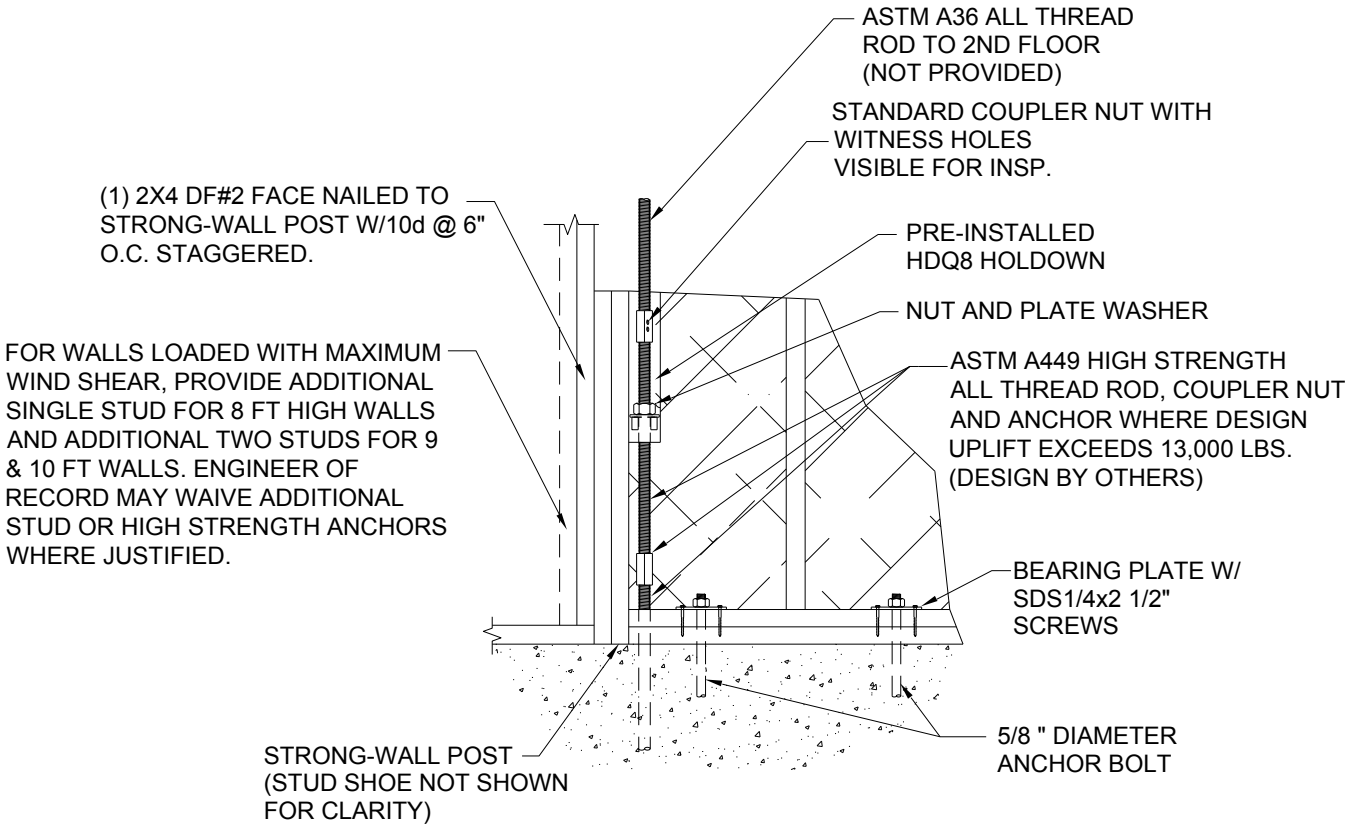
STACKED STRONG-WALL 14-SW2

FIGURE 4—TWO-STORY STRONG-WALL INSTALLATION DETAILS

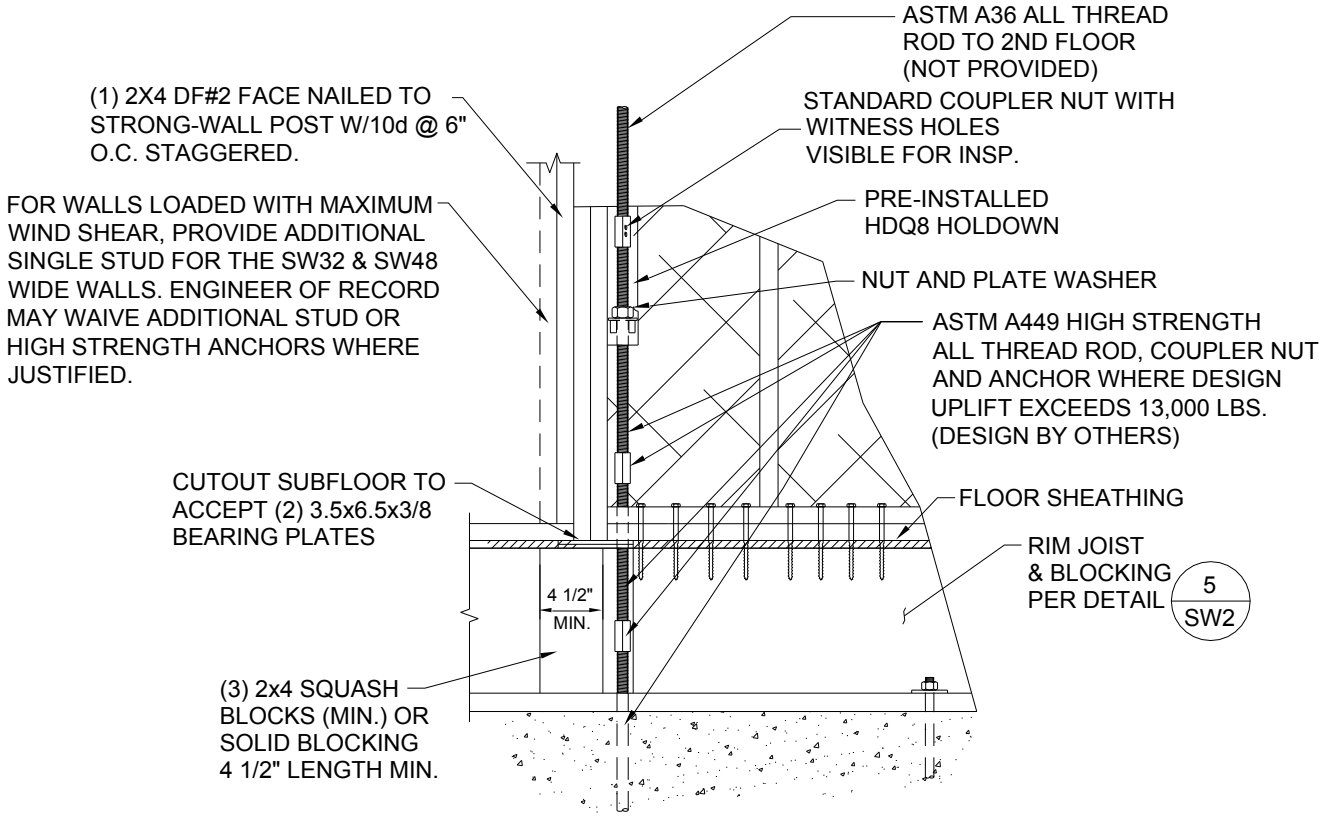


NON-STACKED STRONG-WALL 13-SW2

FIGURE 4—TWO-STORY STRONG-WALL INSTALLATION DETAILS (Continued)

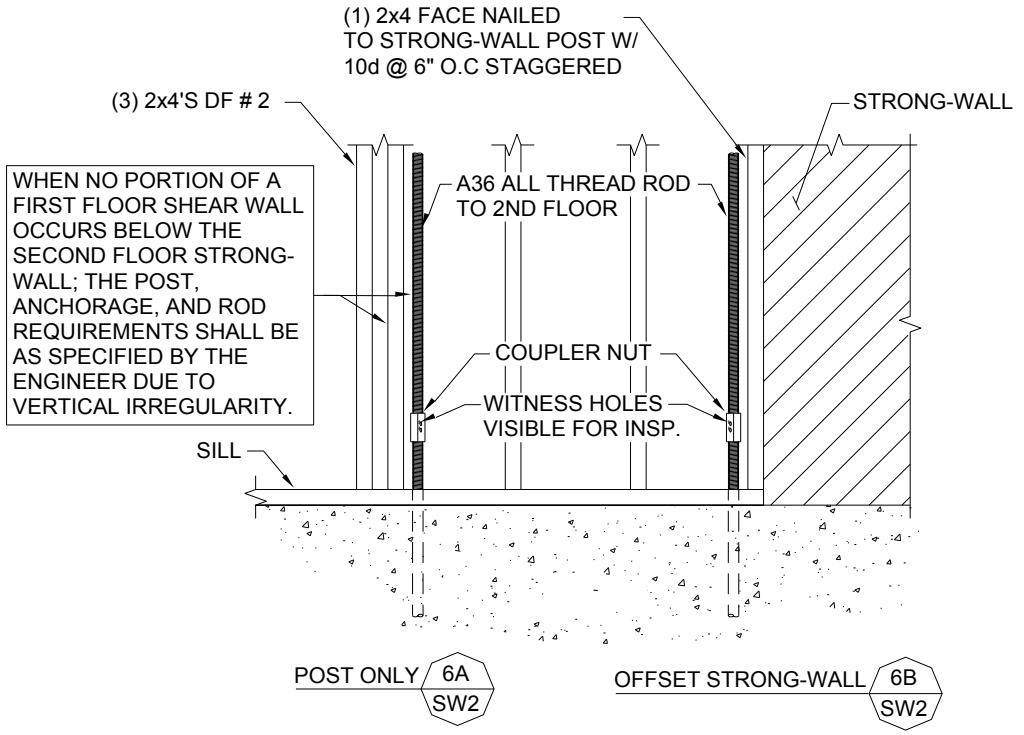


STANDARD WALL SILL (STACKED) 3-SW2

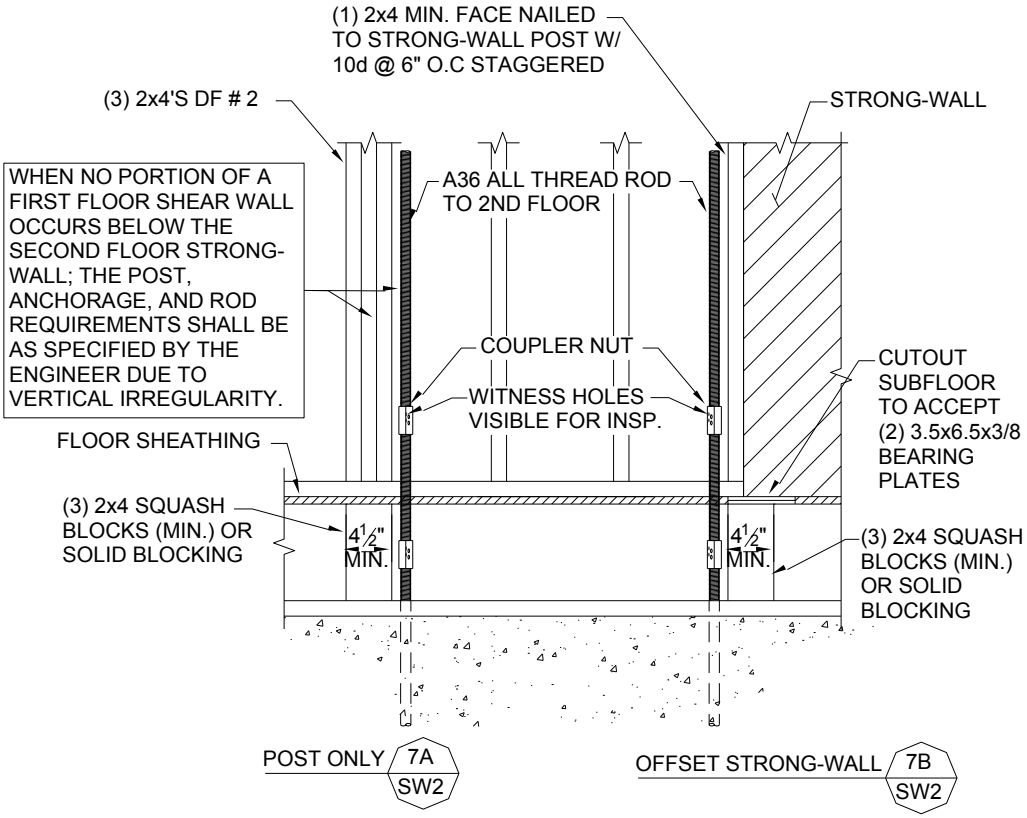


RAISED FLOOR WALL SILL (STACKED) 4-SW2

FIGURE 4—TWO-STORY STRONG-WALL INSTALLATION DETAILS (Continued)

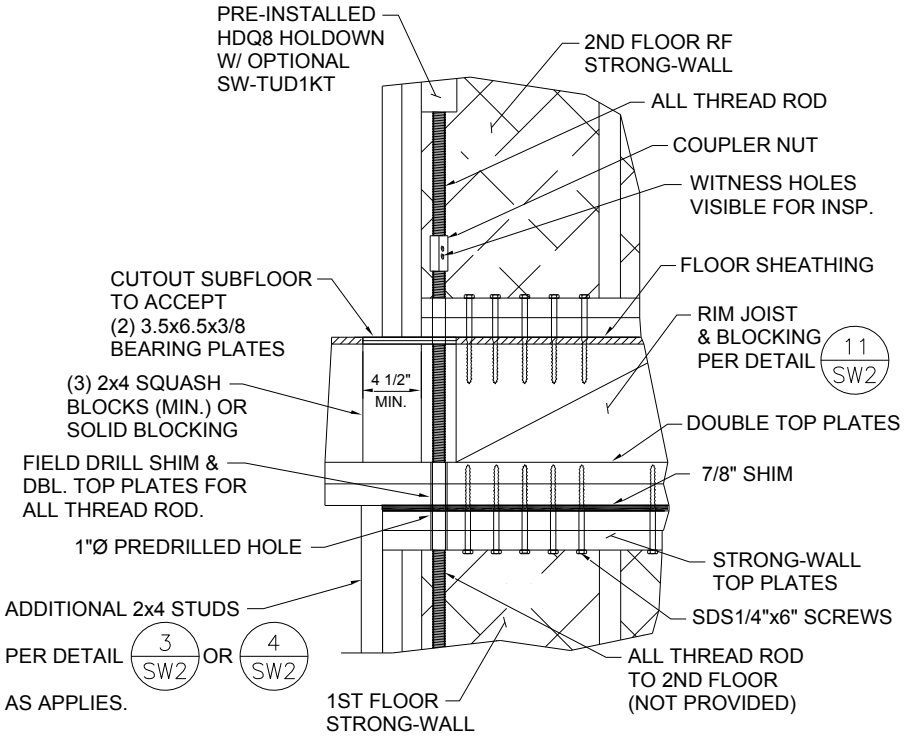


NON-STACKED STRONG-WALLS (SLAB-ON-GRADE) 6-SW2

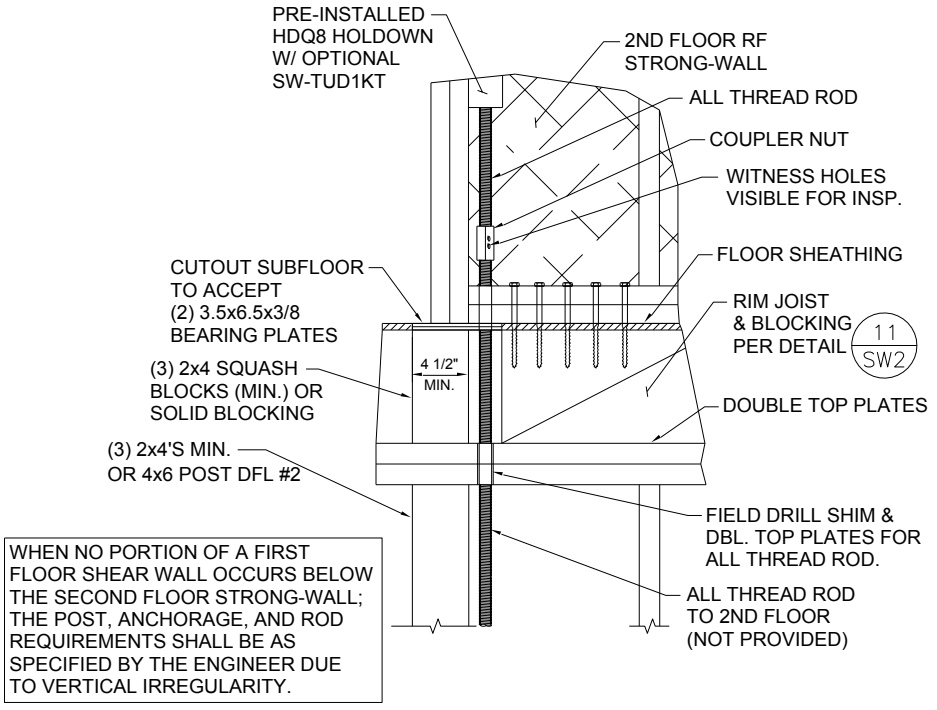


NON-STACKED STRONG-WALLS (WOOD FLOOR) 7-SW2

FIGURE 4—TWO-STORY STRONG-WALL INSTALLATION DETAILS (Continued)

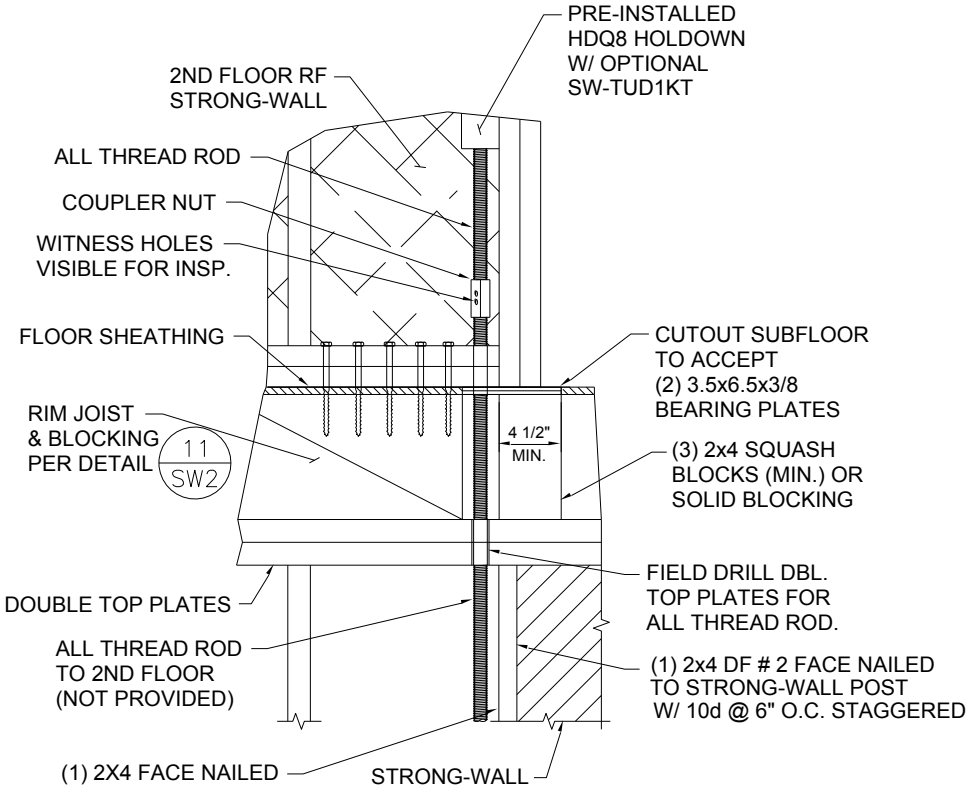


SECOND FLOOR (STACKED) 8-SW2

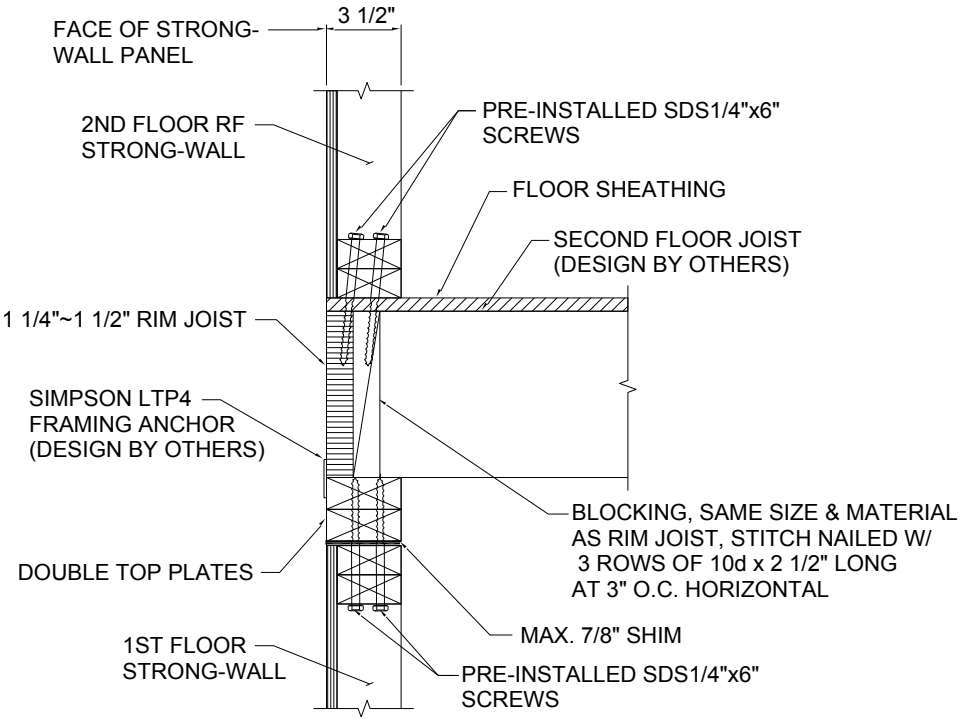


SECOND FLOOR (POST ONLY BELOW) 9-SW2

FIGURE 4—TWO-STORY STRONG-WALL INSTALLATION DETAILS (Continued)

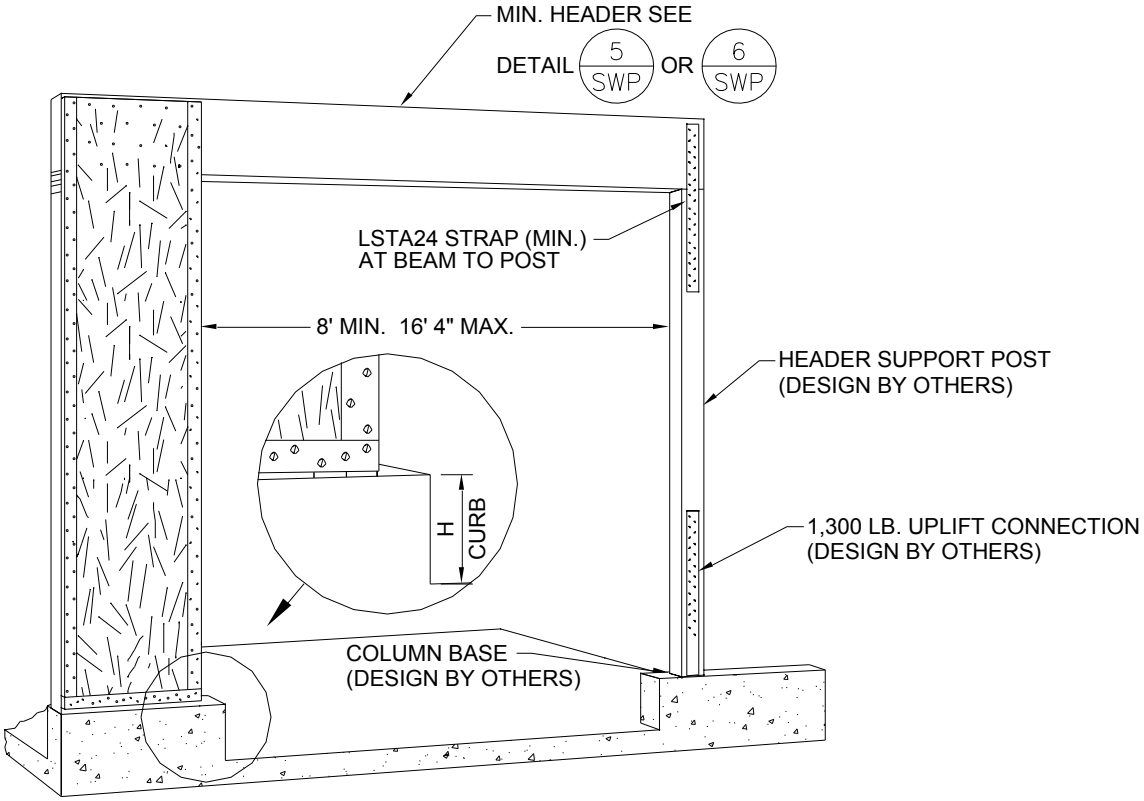


SECOND FLOOR (OFFSET STRONG-WALL) 10-SW2

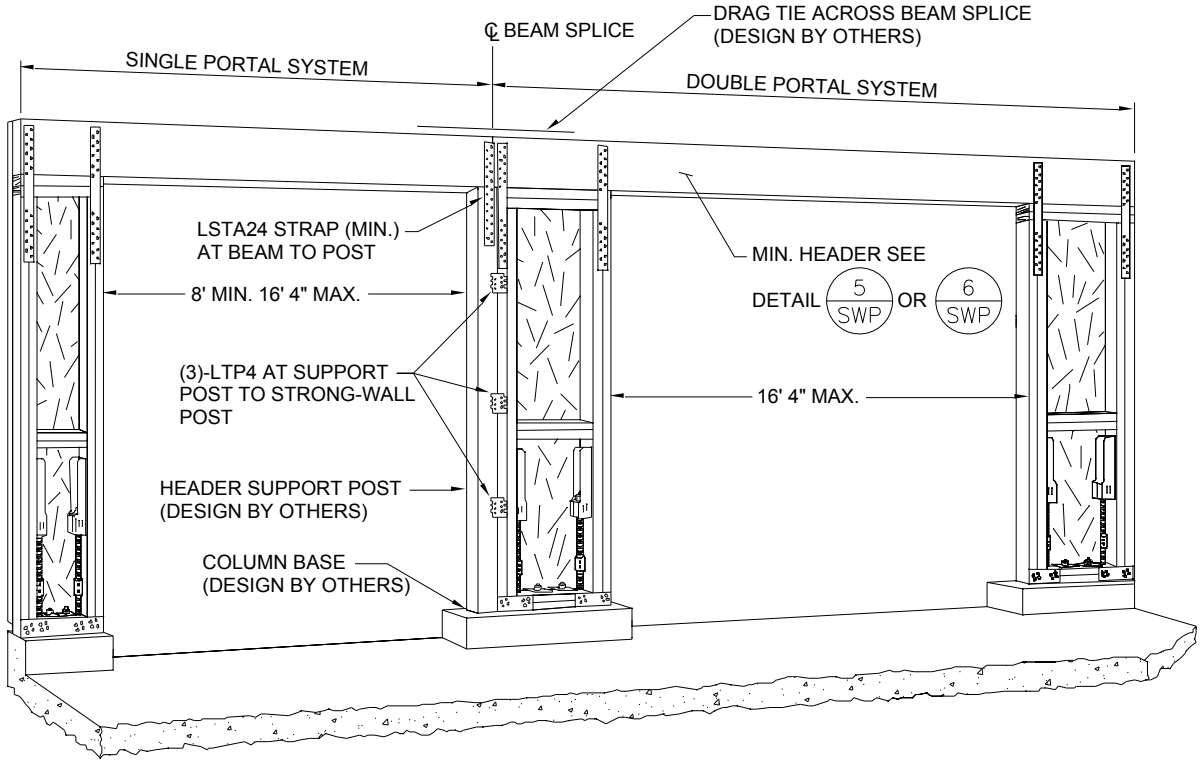


SECOND FLOOR SECTION 11-SW2

FIGURE 4—TWO-STORY STRONG-WALL INSTALLATION DETAILS (Continued)

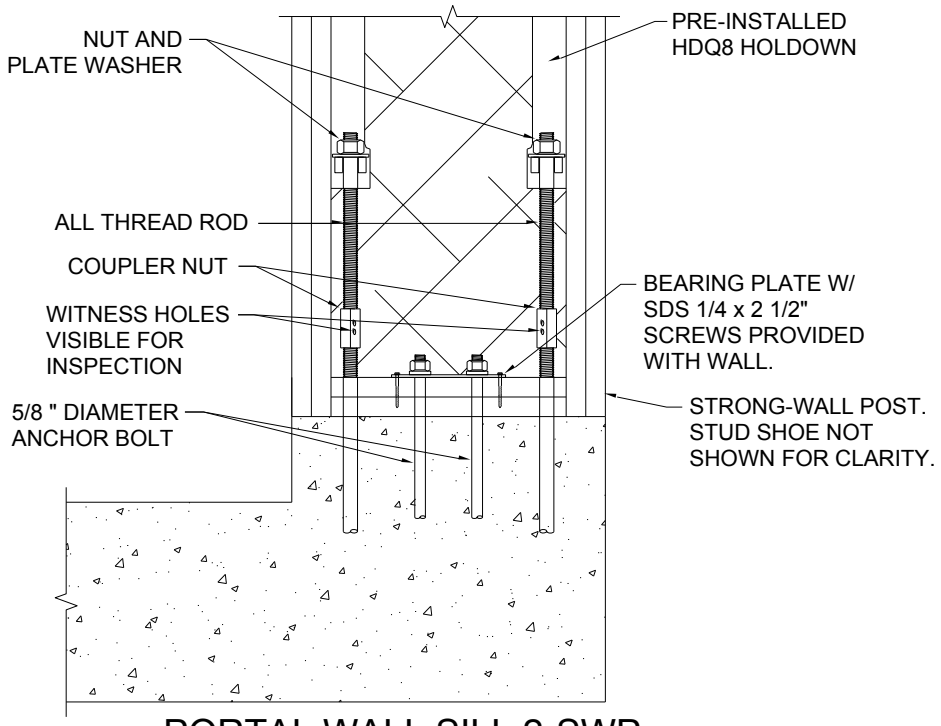


SINGLE PORTAL ASSEMBLY 8-SWP

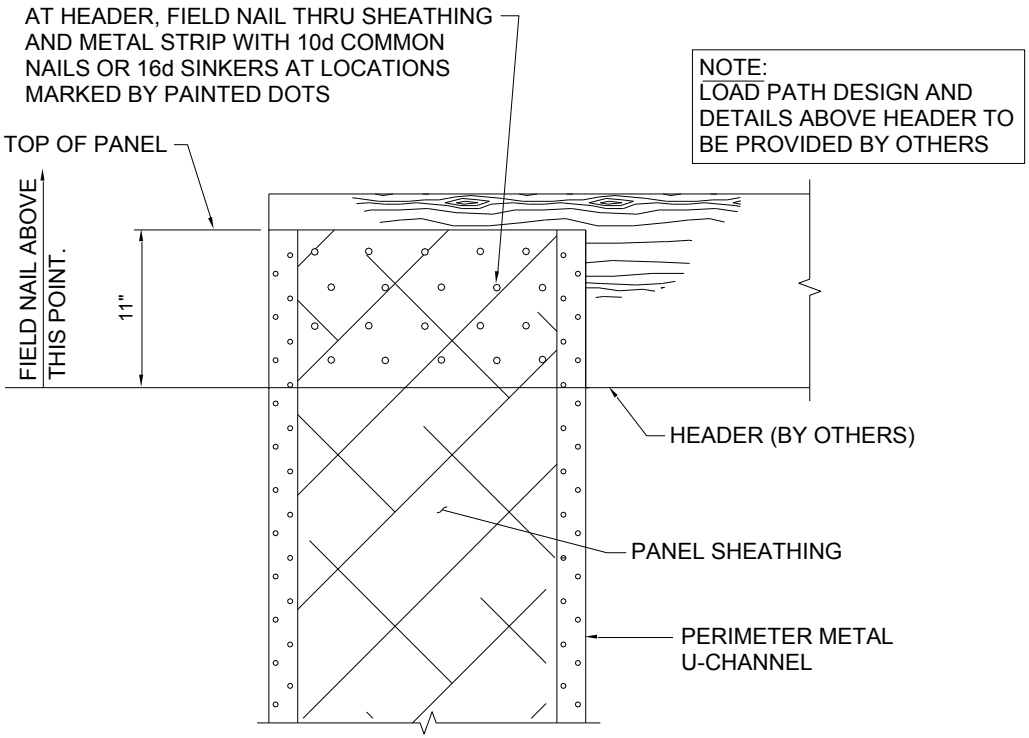


SINGLE & DOUBLE PORTAL ASSEMBLY 7-SWP

FIGURE 5—GARAGE PORTAL INSTALLATION DETAILS

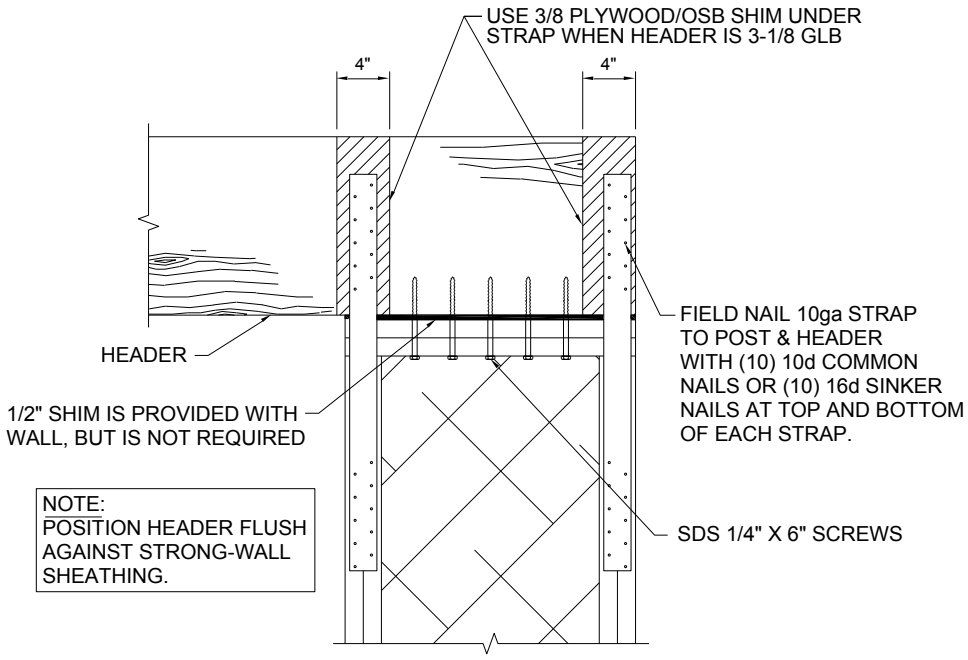


PORTAL WALL SILL 2-SWP

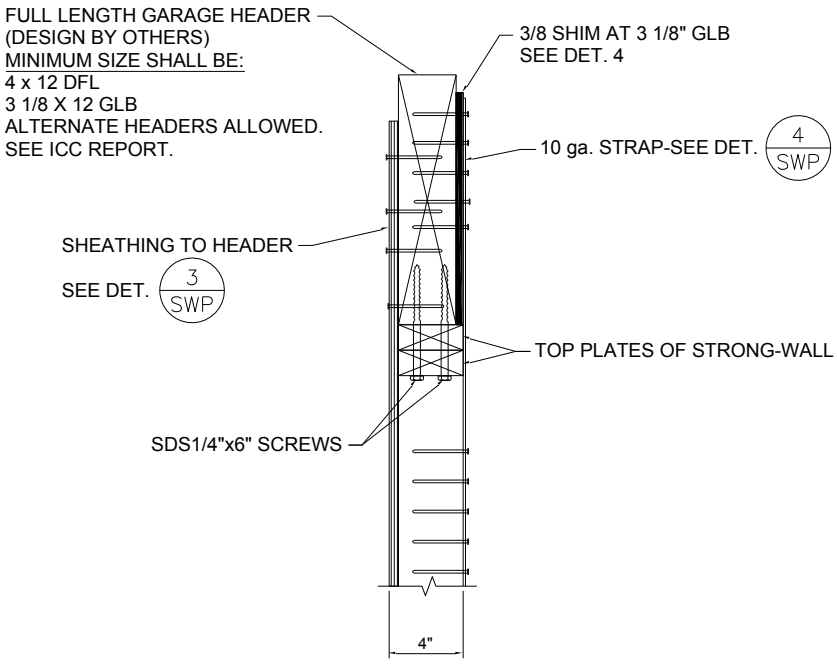


TOP OF WALL CONNECTION 3-SWP

FIGURE 5—GARAGE PORTAL INSTALLATION DETAILS (Continued)

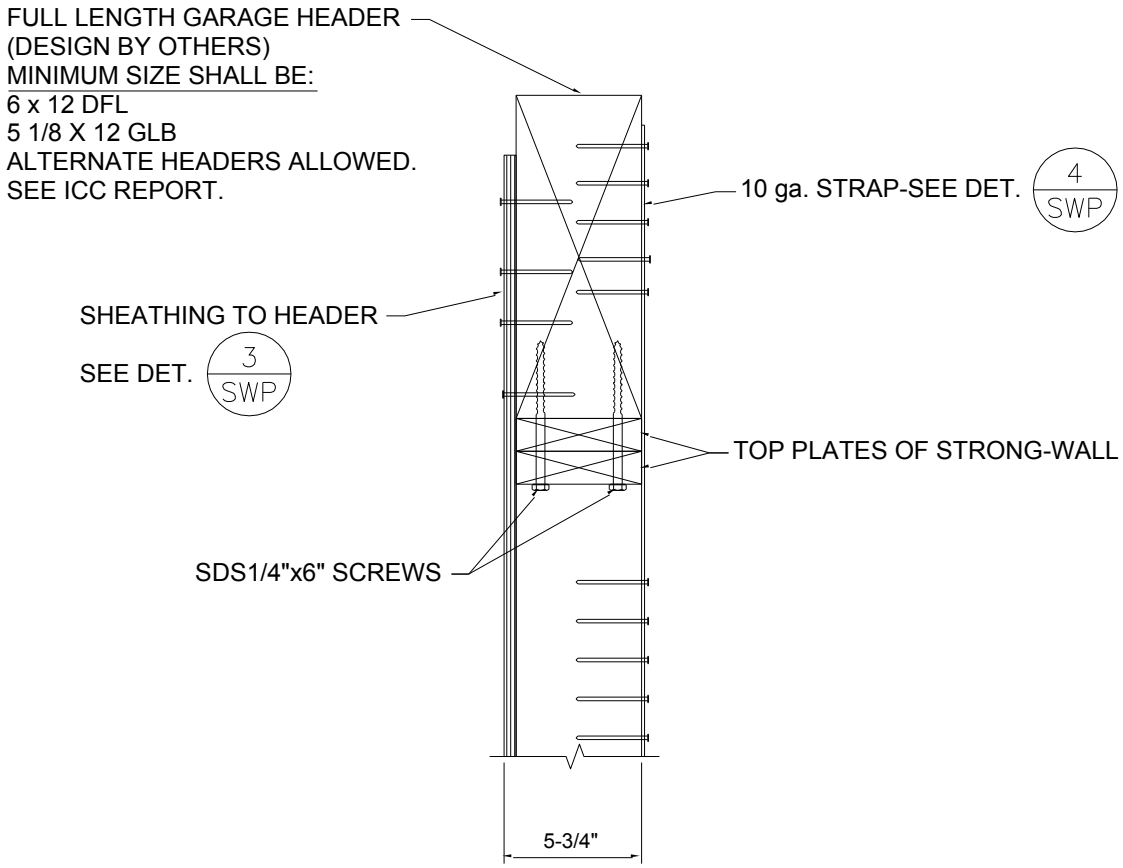


TOP OF WALL CONNECTION 4-SWP



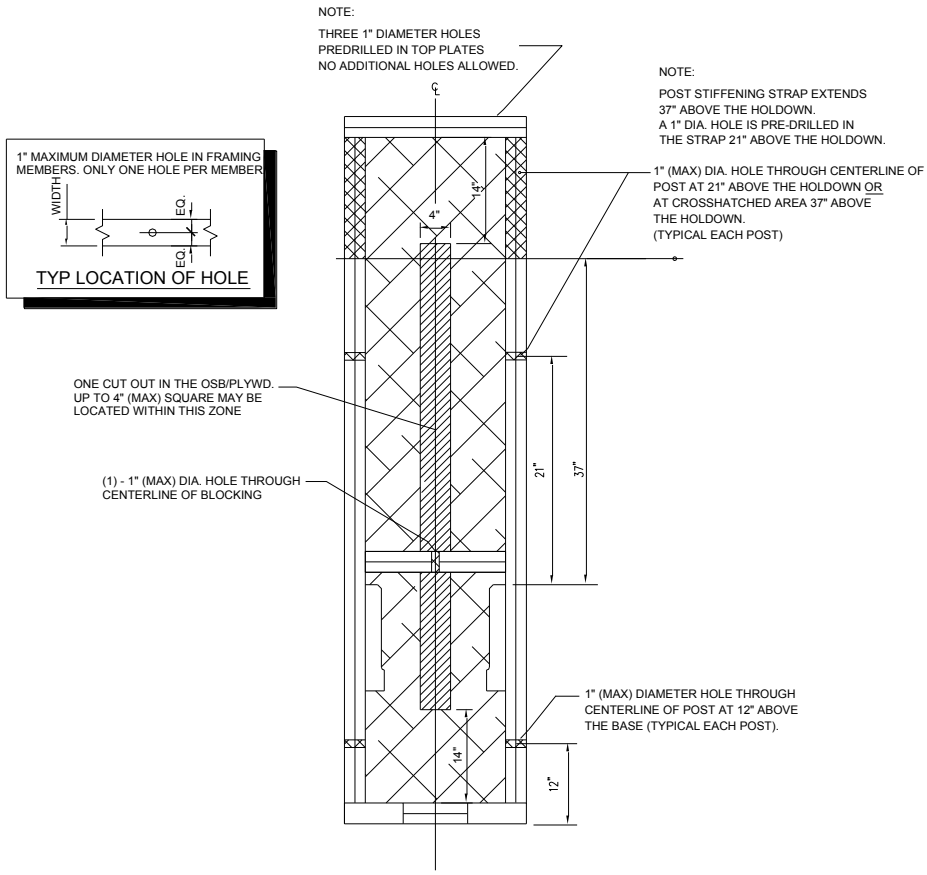
4" PORTAL WALL SECTION 5-SWP

FIGURE 5—GARAGE PORTAL INSTALLATION DETAILS (Continued)

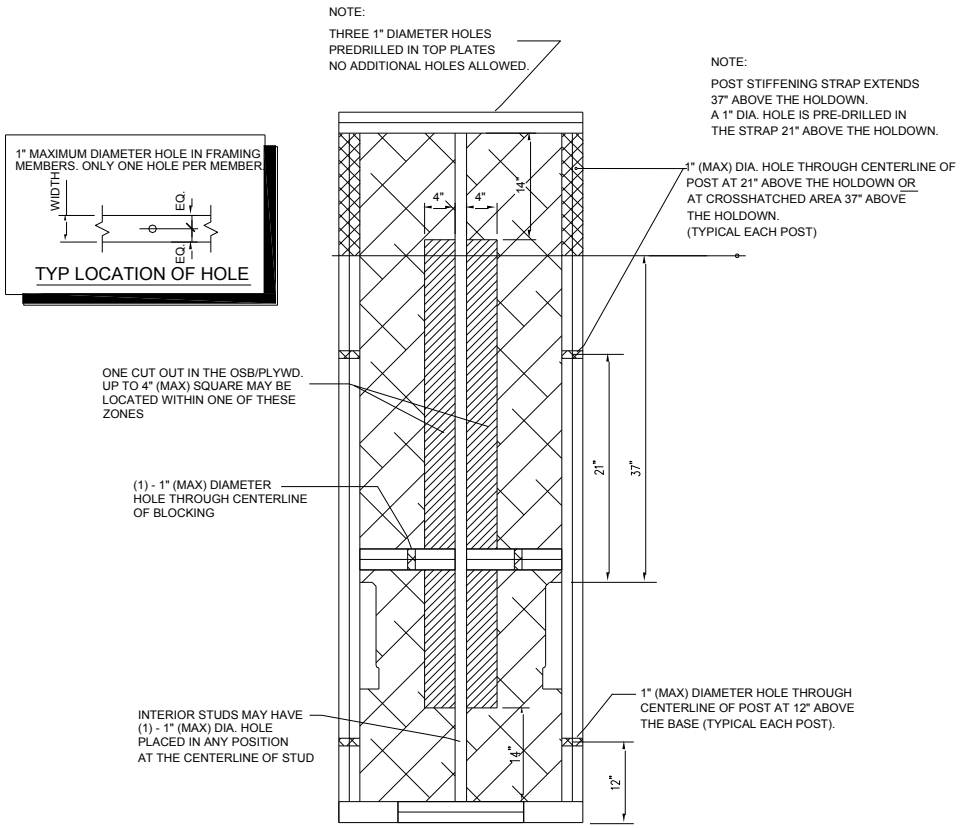


5.75" PORTAL WALL SECTION 6-SWP

FIGURE 5—GARAGE PORTAL INSTALLATION DETAILS (Continued)

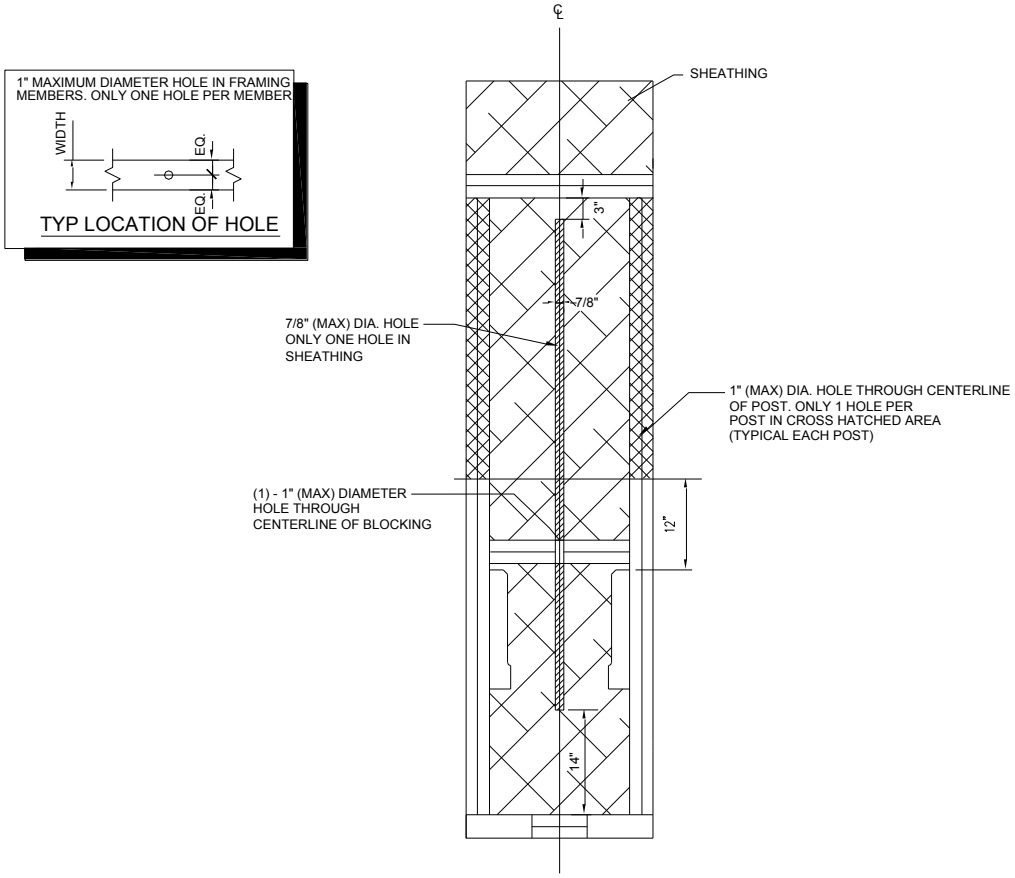


18" & 24" STANDARD OR RF WALL 2-SWO

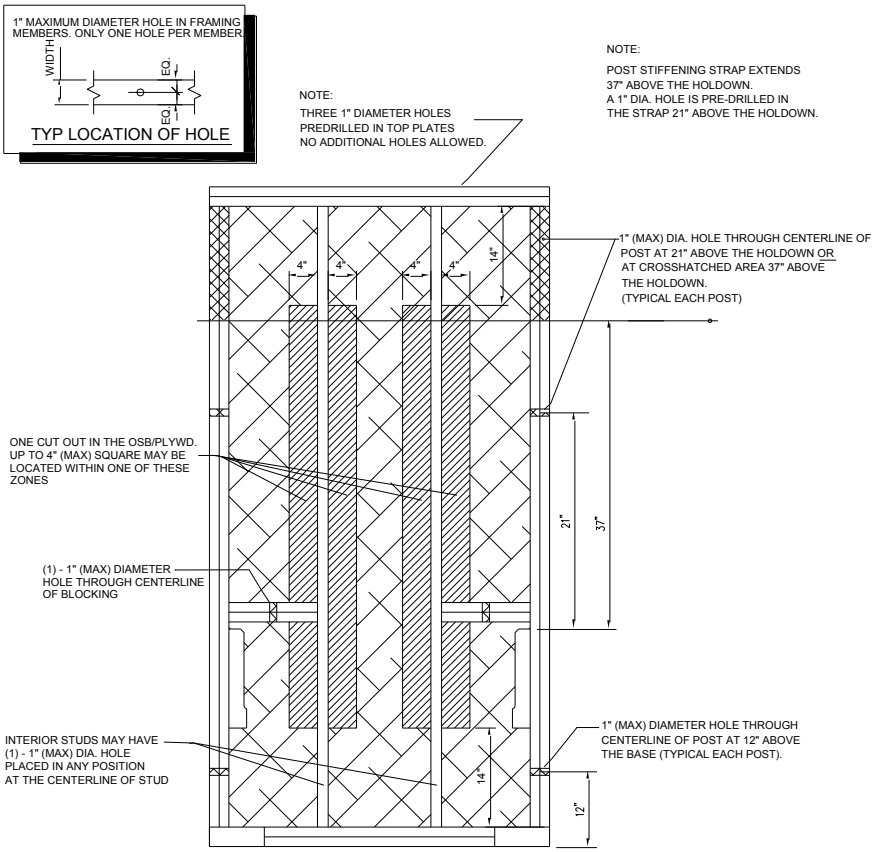


32" STANDARD OR RF WALL 4-SWO

FIGURE 6—ALLOWABLE OPENINGS

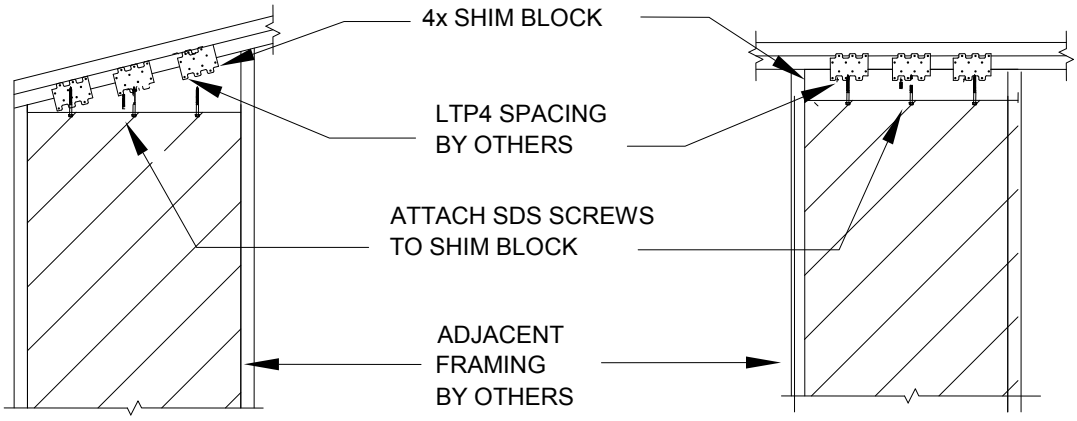


16" & 22" PORTAL WALL 1-SWO



48" STANDARD OR RF WALL 5-SWO

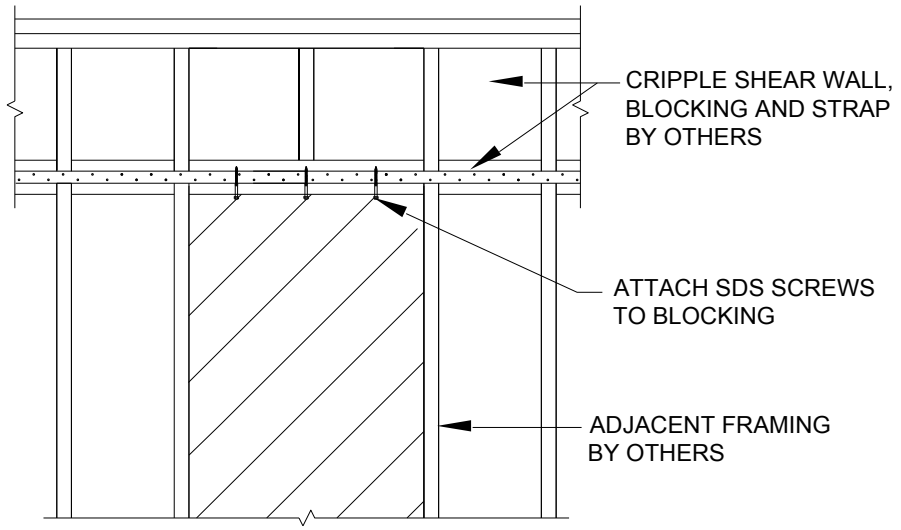
FIGURE 6—ALLOWABLE OPENINGS (Continued)



RAKE WALL **4x SHIM BLOCK**

ENGINEER OF RECORD SHALL DESIGN FOR:
1. SHEAR TRANSFER
2. OUT OF PLANE LOADING EFFECT
3. INCREASED OVERTURNING AND DRIFT DUE TO ADDITIONAL HEIGHT

SHIM BLOCK ON STD & RF WALLS 7-SW1



CRIPPLE WALL

ENGINEER OF RECORD SHALL DESIGN FOR:
1. SHEAR TRANSFER
2. OUT OF PLANE LOADING EFFECT
3. INCREASED OVERTURNING AND DRIFT DUE TO ADDITIONAL HEIGHT.

CRIPPLE WALL ON STD & RF WALLS 8-SW1

FIGURE 7—SHIM/CRIPPLE WALL DETAIL