Design Approval Number: PI011223-47
PRODUCT: Structural Insulated Panels (SIPs)
DIVISION: 06 00 00 Wood, Plastic, and Composites
SECTION: 06 12 00 Structural Panels

PREFLEX Inc.
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Manufacturing Location:
Preflex, Inc.
Avenida Juventino Rosas #20, Col. 20 de Nov
Tijuana, Baja California, Mexico 22100

1. SUBJECT
1.1 PREFLEX *Structural Insulated Panels*. Wall and Roof Panels 8-ft to 20-ft long, 4-1/2-in. to 12-1/4-in. thick.

2. SCOPE
Compliance with the following codes:
2.1 2022 California Building Code (CBC)
2.2 2022 California Residential Code (CRC)
2.3 Title 25 of the California Code of Regulations Division 1, Chapter 3, Subchapter 1, Section 3000 through 3074

Properties evaluated:
2.4 Structural
2.5 Thermal Barrier

3. USES
3.1 General. PREFLEX *Structural Insulated Panels* are used as structural insulated roof and wall panels capable of resisting transverse, axial and in-plane shear loads.

3.2 Construction Types. *Structural Insulated Panels* shall be considered combustible building elements when determining the Type of Construction in accordance with IBC Chapter 6.

3.3 Fire Resistive Assemblies. *Structural Insulated Panels* shall not be used as part of a fire-rated assembly unless suitable evidence and details are submitted and approved by the authority having jurisdiction.

4. DESCRIPTION
4.1 General. PREFLEX *Structural Insulated Panels* are factory-assembled, engineered-wood-faced, structural insulated panels (SIPs) with an expanded polystyrene (EPS) foam core. The product is intended for use as load-bearing or non-load- bearing wall roof and floor panels. *Structural Insulated Panels* are available in 4-1/2-in. through 12-1/4-in. overall thicknesses and are custom-made to the specifications for each use. The maximum product size is 8-ft wide and up to 20-ft in length.

4.2 Materials.
4.2.1 Facing. The facings consist of single-ply oriented strand board (OSB) facings a minimum of 7/16-in. thick conforming to DOC PS 2, Exposure 1, PRN-612 Rated Sheathing. Panels may be manufactured with the facing strength axis oriented in either direction with respect to the direction of product bending provided the appropriate design values are used.

4.2.2 Core. The core material is EPS foam plastic insulation conforming to ASTM C578, Type I. The foam core, up to 4-in. thickness, has a flame spread rating not exceeding 75 and a smoke-developed rating not exceeding 450 when tested in accordance with ASTM E84. Cores used in structural insulated panels up to 15-in thick, comply with IBC Section 2603.3 Exception 4.

4.2.3 Adhesive. Adhesives comply with Type II, Class 2 performance requirements set forth in the ICC-ES Acceptance Criteria for Sandwich Panel Adhesives (AC05).

4.2.4 Material Sources. The facing, core and adhesive used in the construction of *Structural Insulated Panels* must be materials from approved sources as identified in the in-plant quality system documentation.

4.2.5 Splines. *Structural Insulated Panels* are interconnected with block splines, or lumber splines (Figure 1). Splines fit into recesses in the core material along the edges of the SIPs.

4.2.5.1 Block Splines. Block splines (Figure 1) are manufactured in the same manner as the SIP except with an overall thickness that is 1-in. less than the overall thickness of the panels to be joined. Block splines are 3 inches wide.

4.2.5.2 Lumber Splines. Lumber splines (Figures 2 and 3) are nominal two by lumber with a minimum specific gravity of 0.42. The lumber members are attached to each other using 3 inch (76 mm) long x 0.131 inch (3 mm) nails, in two rows along the length spaced 16 inches (406 mm) on center.

4.2.5.3 Top and Bottom Plates. Preflex SIPs are constructed with a minimum of one top plate, one bottom plate located between the facings and a sill and a cap plate which span the full width of the SIP. Top, bottom, sill, and cap plates are #2 nominal 2 x lumber with a minimum specific gravity of 0.42. The sill and cap plates shall be cut to the same width as the panel so that the panel facings have full bearing on the sill plate. Top plates shall be attached to the sill plate using 3 inch (76 mm) long x 0.131 inch (3 mm) nails. Nails shall be placed in two rows along the length of the plate spaced at 16 inches (406 mm) on-center.

5. DESIGN
5.1 Overall Structural System. The scope of this report is limited to the evaluation of the SIP component. Panel connections and other details related to incorporation of the product into the overall structural system of a building are beyond the scope of this report.

5.2 Design Approval. Where required by the authority having jurisdiction, structures using *Structural Insulated Panels* shall be designed by a registered design professional. Construction documents, including engineering calculations and drawings providing floor plans, window details, door details and connector details, shall be submitted to the code official when application is made for a permit. The individual preparing such documents shall possess the necessary qualifications as required by the applicable code and the professional registration laws of the state where the construction is undertaken. Approved construction documents shall be available at all times on the jobsite during installation.

5.3 Design Loads. Design loads to be resisted by the product shall be as required under the applicable code. Loads on the panels shall not exceed the loads noted in this report. Where loading conditions result in superimposed stresses, the sum of the ratio of actual loads over allowable loads shall not exceed one. Calculations demonstrating that the loads applied are less than the allowable loads described in this report shall be submitted to the code official for approval.

5.4 Allowable Loads. Allowable axial, transverse and in-plane shear loads may be selected from Tables 1 through 5. For loading conditions not specifically addressed herein, structural members designed in accordance with accepted engineering practice shall be provided to meet applicable code requirements.

5.5 Concentrated Loads. Axial loads shall be applied to the product through continuous members such as structural insulated roof or floor panels or repetitive members such as joists, trusses or rafters spaced at regular intervals of 24-in. on center or less. Such members shall be fastened to the sill/cap plate or similar member to distribute the load to the product. For other loading conditions, reinforcement shall be provided. This reinforcement shall be designed in accordance with accepted engineering practice.

5.6 Eccentric and Side Loads. Axial loads shall be applied concentrically to the top of the product. Loads shall not be applied eccentrically or through framing attached to one side of the panel (such as balloon framing) except where additional engineering documentation is provided.

5.7 Openings. Openings in panels beyond the scope of this report shall be reinforced with wood or steel designed in accordance with accepted engineering practice to resist all loads applied to the opening as required by the adopted code. Details for door and window openings shall be provided to clarify the manner of supporting axial, transverse and/or in-plane shear loads at openings. Such details shall be subject to approval by the local authority having jurisdiction.

5.8 In-Plane Shear Design. Shear walls utilizing block or lumber splines shall be sized to resist all code required wind and seismic loads without exceeding the allowable loads provided herein. Shear wall chords, hold-downs and connections to transfer shear forces between the wall and surrounding structure shall be designed in accordance with accepted engineering practice.

5.8.1 Seismic Design Categories A, B, and C. Use of the shear wall configurations in Table 4 is limited to structures in Seismic Design Categories A, B and C. Where SIPs are used to resist seismic forces the following factors shall be used for design: Response Modification Coefficient, R = 2.0; System Overstrength Factor, Ω_0 = 2.5; Deflection Amplification Factor, C_d = 2.0. The maximum panel height-to-width ratio shall be 2:1.

5.8.2 Seismic Design Categories A through F. The shear wall configuration in Table 5 may be used in Seismic Design Categories A through F. Where SIPs are used to resist seismic forces the following factors shall be used for design: Response Modification Coefficient, R = 6.5; System Overstrength Factor, Ω_0 = 3; Deflection Amplification Factor, C_d = 4.0. The maximum panel height-to-width ratio shall be 1:1.

5.9 Combined Loads. Panels subjected to any combination of transverse, axial or in-plane shear loads shall be analyzed utilizing a straight-line interaction. (See Section 5.3)

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6. INSTALLATION

6.1 General. *Structural Insulated Panels* shall be fabricated, identified and erected in accordance with this report, the approved construction documents and the applicable codes. In the event of a conflict between the manufacturer's published installation instructions and this report, this report shall govern. Approved construction documents shall be available at all times on the jobsite during installation.

6.2 Splines. *Structural Insulated Panels* are interconnected at the panel edges through the use of a spline. The spline type may be of any configuration listed in Section 4.2.5 as required by the specific design. The spline shall be secured in place with not less than 2-1/2 inch (64 mm) long x 0.113 inch (2.9 mm) nails, spaced 6-in. on center with an edge distance of 5/8 inch (19 mm) on both sides of the panel, or an approved equivalent fastener. All joints shall be sealed in accordance with the SIP manufacturer's installation instructions (See Figures 1 through 5). Alternate spline connections may be required for panels subjected to in-plane shear forces. Such panels shall be interconnected exactly as required in Tables 4 and 5 or as directed by the designer.

6.3 Plates. The top and bottom plates of the panels shall be dimensional lumber sized to match the core thickness of the panel. The plates shall be secured using not less than 2-1/2 inch (64 mm) long x 0.113 inch (2.9 mm) nails, spaced 6-inch (213 mm) on center with an edge distance of 5/8 inch (19 mm) on both sides of the panel. A cap plate and a sill plate of 1-1/2-inch (152 mm) minimum thickness dimensional lumber with a specific gravity of 0.42 that is cut to the full thickness of the panel shall be secured to the first top plate using 3 inch (76 mm) long x 0.131 inch (3 mm) nails. Nails shall be placed in two rows along the length of the plate spaced at 16 inches (406 mm) on-center. SIPs Alternate plate connections may be required for panels subjected to in-plane shear forces. Such panels shall be interconnected exactly as required in Tables 4 and 5 or as directed by the designer.

6.4 Cutting and Notching. No field cutting or routing of the panels shall be permitted except as shown on approved construction documents.

6.5 Protection from Decay. SIPs that rest on exterior foundation walls shall not be located within 8-in. of exposed earth. SIPs supported by concrete or masonry that is in direct contact with earth shall be protected from the concrete or masonry by a moisture barrier.

6.6 Protection from Termites. In areas subject to damage from termites, SIPs shall be protected from termites using an approved method. Panels shall not be installed below grade or in contact with earth.

6.7 Heat-Producing Fixtures. Heat-producing fixtures shall not be installed in the panels unless protected by a method approved by the code official or documented in test reports. This limitation shall not be interpreted to prohibit heat-producing elements with suitable protection.

6.8 Plumbing Installation Restrictions. Plumbing and waste lines may extend at right angles through the wall panels but are not permitted vertically within the core. Lines shall not interrupt splines or panel plates unless approved by a registered design professional.

6.9 Voids and Holes

6.10 Voids in Core. In lieu of openings designed in accordance with section 5.7, the following voids are permitted. Voids may be provided in the panel core during fabrication at predetermined locations only. Voids parallel to the panel span shall be limited to a single 1-in. maximum diameter hole, centered in the thickness of the panel. Such voids shall be spaced a minimum of 4-ft on center measured perpendicular to the panel span.

6.10.1 Holes in Panels. Holes may be placed in panels during fabrication at predetermined locations only. Holes shall be limited to 4-in. by 4-in. square. The minimum distance between holes shall not be less than 4-ft on center measured perpendicular to the panel span and 24-in. on center measured parallel to the panel span. Not more than three holes shall be permitted in a single line parallel to the panel span. The holes may intersect voids permitted elsewhere in this report.

6.11 Panel Cladding

6.11.1 Roof Covering. Roof panels shall be covered by an approved roof covering. The roof covering, underlayment and flashing shall comply with the applicable codes. All roofing materials must be installed in accordance with the manufacturer's installation instructions. The use of roof coverings requiring the application of heat during installation shall be reviewed and approved by a registered design professional.

6.11.2 Exterior Wall Covering. Wall Panels shall be covered on the exterior by a water-resistive barrier as required by the applicable code. The water-resistive barrier shall be attached with flashing in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. The exterior facing of the SIP wall shall be covered with weather protection as required by the adopted building code or other approved materials.

6.12 Interior Finish. The SIP foam plastic core shall be separated from the interior of the building by an approved thermal barrier of 1/2-in. gypsum wallboard or equivalent thermal barrier where required by IBC Section 2603.4.

7. CONDITIONS OF USE

Structural Insulated Panels as described in this report comply with the codes listed in Section 2 above, subject to the following conditions:

This report is applicable to

7.1 This report is applicable to the Title 25 of the California Code of Regulations Division 1, Chapter 3, Subchapter 1, Section 3000 through 3074 factory build component program.

7.2 Installation complies with this report and the approved construction documents.

7.3 This report applies only to the panel thicknesses specifically listed herein.

7.4 In-use panel heights/spans shall not exceed the values listed herein. Extrapolation beyond the values listed herein is not permitted.

7.5 The panels are manufactured in the production facilities listed in this report.

8. EVIDENCE SUBMITTED

The following evidence has be examined to evaluate this product:

8.1 Review of the plant's quality assurance manual.

8.2 Testing in accordance with ASTM E72 for Transverse, Axial and Shearwall Racking Loads.

8.3 Testing in accordance with ASTM E2126 for cyclic shearwall racking loads.

Evaluation evidence and data are on file with ICC NTA, LLC. Product evaluations are performed under the direct supervision of licensed Professional Engineers.

9. FINDINGS

All products referenced herein are manufactured under an in-plant Quality Assurance program to ensure that the production quality meets or exceeds the requirements of the codes noted herein. Furthermore, product must comply with the conditions of this report.

This report is subject to annual review.

10. IDENTIFICATION

Each eligible product shall be permanently marked to provide the following information:

10.1 The Design Approval Number

10.2 The name of the report holder

10.3 Identifier for production facility

10.4 Project or batch number, date and shift of manufacture or other means of tracing product to quality documentation

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Table 1: Allowable Roof Uniform Transverse Loads, Blocked Bearing, Short Duration (psf) [1]

Panel Length (ft)	6-1/2-in. SIP thickness			8-1/4-in. SIP thickness			10-1/4-in. SIP thickness			12-1/4-in. SIP thickness		
	Deflection Limit[2]			Deflection Limit[2]			Deflection Limit[2]			Deflection Limit[2]		
	L/180	L/240	L/360	L/180	L/240	L/360	L/180	L/240	L/360	L/180	L/240	L/360
8	73.6	73.6	51.3	86.3	84.3	53.4	89.2	89.2	62.4	83.8	83.8	66.2
10	63.1	59.6	40.5	72.7	70.5	44.9	77.0	77.0	54.1	74.3	74.3	58.5
12	52.7	44.2	29.7	59.1	56.7	36.4	64.9	64.9	45.9	65.0	65.0	50.8
14	41.3	28.79	18.9	45.5	42.9	27.8	52.8	52.8	37.6	55.4	55.4	43.1
16	22.1	13.4	8.1	31.9	29.2	19.3	40.6	40.6	29.4	46.0	46.0	35.5
18							28.5	28.5	21.2	36.5	36.5	27.8
20										27.1	27.1	20.1

[1] Table values assume a simply supported panel with 1-1/2-in. of continuous bearing on facing at supports with solid wood plates at bearing locations. Values do not include the dead weight of the panel.
[2] Deflection limit shall be selected by building designer based on the serviceability requirements of the structure and the requirements of adopted building code. Values are based on loads of short duration only and do not consider the effects of creep.
[3] Tabulated values are based on the strong-axis of the facing material oriented parallel to the direction of panel bending. WAB indicates weak-axis bending of the facing material; the strong-axis of the facing material is oriented perpendicular to the direction of panel bending.

Table 2: Allowable Wall Uniform Transverse Loads (psf) [1]

Panel Length (ft)	4-1/2-in. SIP thickness			6-1/2-in. SIP thickness		
	Deflection Limit[2]			Deflection Limit[2]		
	L/180	L/240	L/360	L/180	L/240	L/360
8 WAB[3]	53.8	41.1	27.1	60.4	60.4	43.7
8	43.9	41.3	27.7	61.0	61.0	43.3
10	38.9	33.5	22.4	52.1	52.1	35.7
12	34.0	25.7	17.2	43.2	42.7	28.1
14	23.9	17.9	11.9	34.3	31.0	20.5
16	13.5	10.1	6.7	25.4	19.3	12.9

[1] Table values represent wall panel capacities (4-5/8-in. and 6-1/2-in. thickness panels only) utilizing a zero bearing configuration.
[2] Deflection limit shall be selected by building designer based on the serviceability requirements of the structure and the requirements of adopted building code. Values are based on loads of short duration only and do not consider the effects of creep.
[3] Tabulated values are based on the strong-axis of the facing material oriented parallel to the direction of panel bending. WAB indicates weak-axis bending of the facing material; the strong-axis of the facing material is oriented perpendicular to the direction of panel bending.

Table 3: Allowable Axial Loads (plf) [1,2,3,4]

Lateral Brace Spacing (ft)	Panel Thickness
	4 ½, 6 ½
8	3166
10	2968
12	2771

[1] All values are for normal duration and may not be increased for other durations.
[2] Axial loads shall be applied concentrically to the top of the panel through repetitive members spaced not more than 24-in. on center. Such members shall be fastened to a rim board or similar member to distribute along the top of the SIP.
[3] The ends of both facings must bear on the attached sill or cap plate to achieve the tabulated axial loads.
[4] Tabulated values are based on the strong-axis of the facing material oriented parallel to the direction of panel bending.

Table 4: Allowable In-Plane Shear Strength (Pounds per Foot) for SIP Shear Walls (Wind and Seismic Loads in Seismic Design Categories A, B and C) [1, 2, 5]

Spline Type[3]	Minimum Nominal SIP Thickness (in.)	Minimum Facing Connections[2,4]			Shear Strength (plf)
		Chord[2]	Plate[2, 5]	Spline[3]	
Block or Lumber Spline	4-1/2	0.113-in. x 2-1/2-in. nails, 6-in. on center	0.113-in. x 2-1/2-in. nails, 6-in. on center	0.113-in. x 2-1/2-in. nails, 6-in. on center	867

[1] Maximum shear wall dimensions ratio shall not exceed 2:1 (height: width) for resisting wind or seismic loads.
[2] Chords, hold downs and connections to other structural elements must be designed by a registered design professional in accordance with accepted engineering practice.
[3] Spline type at interior panel-to-panel joints only. Solid chord members are required at each end of each shear wall segment.
[4] Required connections must be made on each side of the panel. Dimensional or engineered lumber shall have an equivalent specific gravity of 0.42 or greater.
[5] Shearwall configuration in Table 4 require a single top plate and a single bottom plate. Additionally, walls require sill and cap plates as described in Section 4.2.5.3.
[6] See Sections 5.8.1 and 6 for additional design and construction details.

Table 5: Allowable In-Plane Shear Strength (Pounds per Foot) for SIP Shear Walls (Wind and Seismic Loads in Seismic Design Categories A, B, C, D, E and F) [1, 2, 6]

Spline Type[3]	Minimum Nominal SIP Thickness (in.)	Minimum Facing Connections[2,4]			Shear Strength (plf)
		Chord[2]	Plate[2, 5]	Spline[3]	
Lumber Spline	4-5/8	0.131-in. x 2-1/2-in. nails, 3-in. on center	0.131-in. x 2-1/2-in. nails, 3-in. on center (in all plates)	0.131-in. x 2-1/2-in. nails, 3-in. on center	377

[1] Maximum shear wall dimensions ratio shall not exceed 1:1 (height: width) for resisting wind or seismic loads.
[2] Chords, hold downs and connections to other structural elements must be designed by a registered design professional in accordance with accepted engineering practice.
[3] Spline type at interior panel-to-panel joints only. Solid chord members are required at each end of each shear wall segment.
[4] Required connections must be made on each side of the panel. Dimensional or engineered lumber shall have an equivalent specific gravity of 0.42 or greater.
[5] Shearwall configuration in Table 5 require a single top plate and a double bottom plate. Additionally, walls require sill and cap plates as described in Section 4.2.5.3
[6] See Sections 5.8.2 and 6 for additional design and construction details.

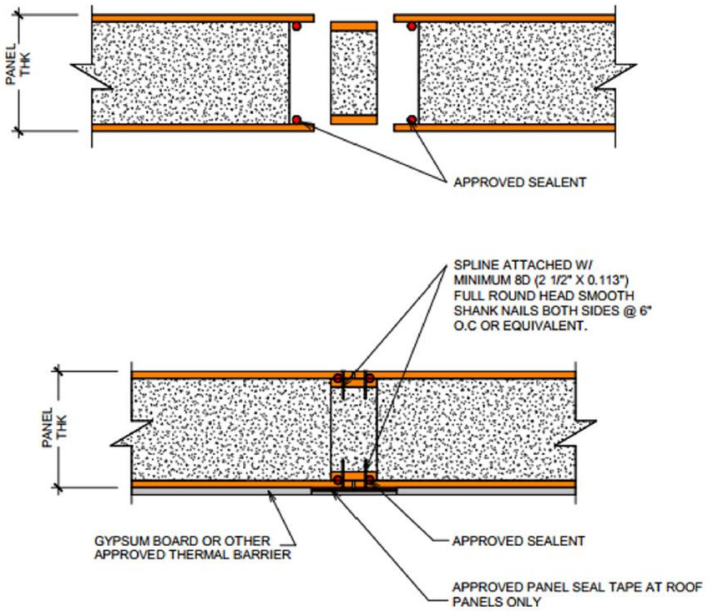

Figure 1: Block Spline Panel to Panel Connection

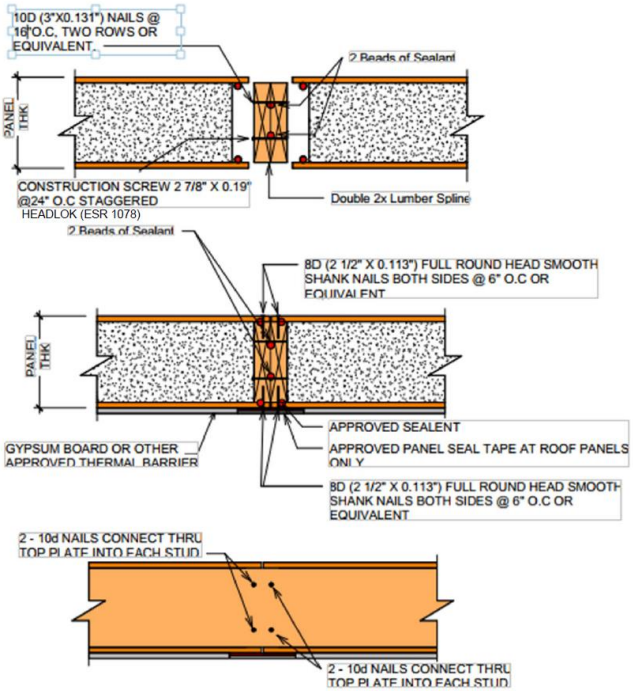

Figure 2: Double Lumber Spline Panel to Panel Connection for Shearwalls in Seismic Design Categories A, B, and C

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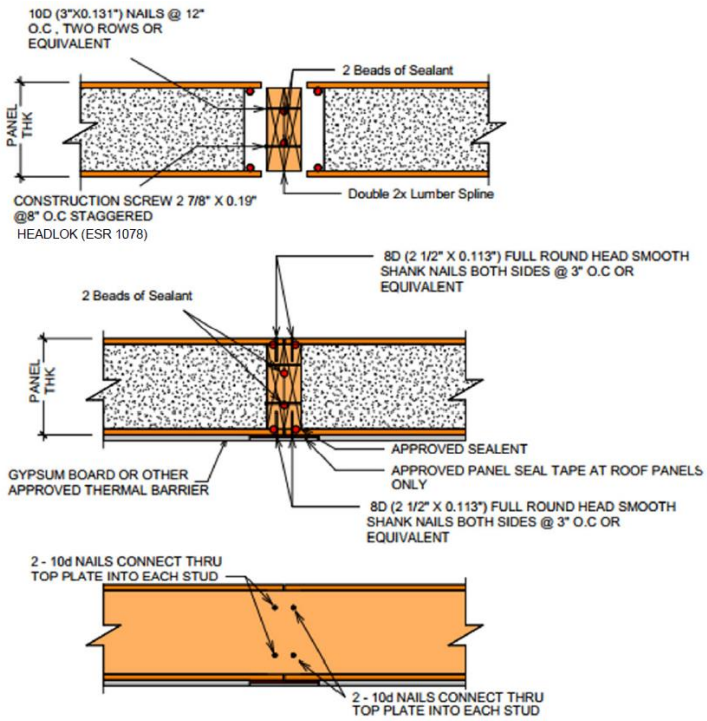

Figure 3: Double Lumber Spline Panel to Panel Connection for Shearwalls in Seismic Design Categories A through F

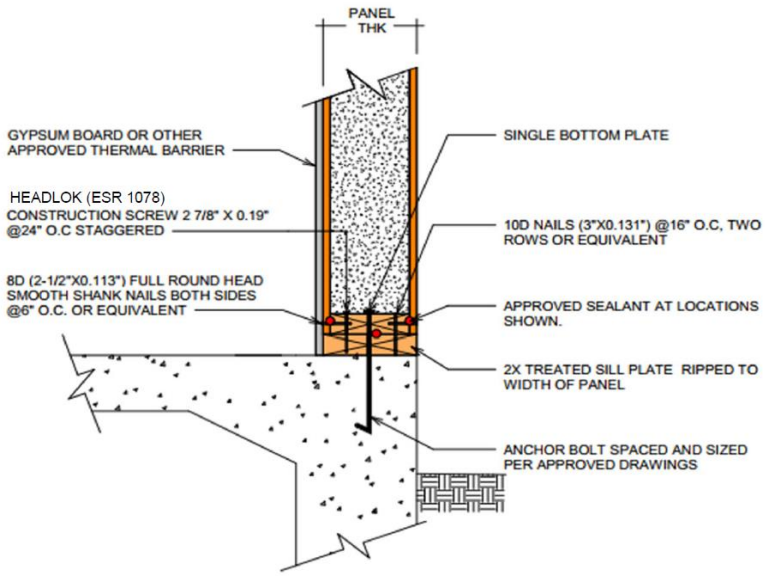

Figure 4: Base Plate and Sill Connection for Seismic Categories A through C

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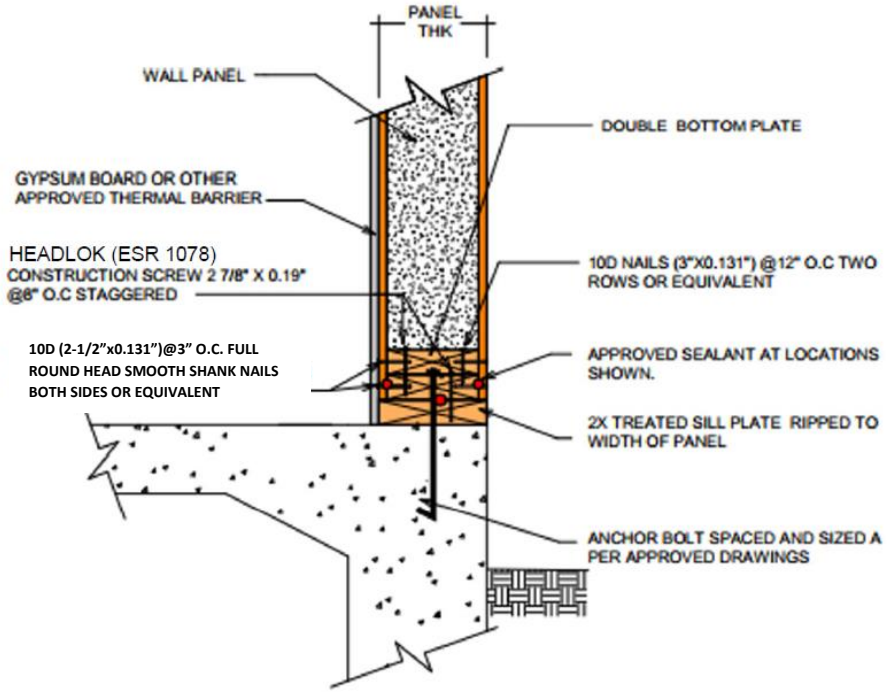

Figure 5: Base Plate and Sill Connection for Seismic Categories A through F

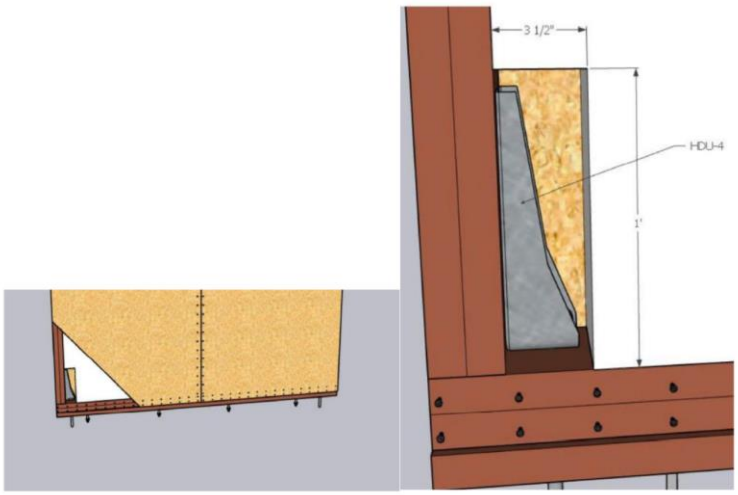

Figure 6: Hold-down locations and detail for Seismic Categories A through F

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