

## DrJ Research Report

Report No: DRR 1205-05



Issue Date: July 9, 2012

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### Construction Details for the Use of Foam Plastic Insulating Sheathing in Light-Frame Construction

Trade Secret Report Holder:

Foam Sheathing Committee (FSC) Members

[americanchemistry.com/industry-groups/foam-sheathing-committee-fsc](http://americanchemistry.com/industry-groups/foam-sheathing-committee-fsc)

[continuousinsulation.org](http://continuousinsulation.org)

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#### CSI Designations:

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION    Section: 07 21 00 - Thermal Insulation    Section: 07 25 00 - Water-Resistive Barriers/Weather Barriers

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#### 1 Methods of Construction Evaluated<sup>1</sup>

- 1.1 Foam Plastic Insulating Sheathing (FPIS) products from the following manufacturers are recognized in this report.
  - 1.1.1 Atlas Roofing Corporation
  - 1.1.2 BASF Corporation
  - 1.1.3 DuPont de Nemours, Inc.
  - 1.1.4 Hunter Panels
  - 1.1.5 Insulfoam
  - 1.1.6 Kingspan Insulation, LLC
  - 1.1.7 Owens Corning
  - 1.1.8 Progressive Foam Technologies Inc.
  - 1.1.9 Rmax, a Business Unit of Sika Corporation
- 1.2 Products from the manufacturers in **Section 1.1** are listed in **Table 1**.

**Table 1. FPIS Manufacturers and Products**

Manufacturer	Report Number(s)	Product(s)
Atlas Roofing Corporation	<a href="#">ESR-1375</a> <a href="#">TER 1306-03</a> <a href="#">TER 2202-01</a> <a href="#">TER 2209-01</a> <a href="#">TER 2305-04</a> <a href="#">TER 2309-04</a>	EnergyShield® Pro EnergyShield® CGF Pro EnergyShield® XR EnergyShield® Ply Pro EnergyShield® EnergyShield® CGF EnergyShield® PanelCast
	<a href="#">ESR-1962</a> <a href="#">TER 1905-02</a> <a href="#">TER 2305-04</a> <a href="#">TER 2309-04</a> <a href="#">ULEX.R16529</a>	ThermalStar® ThermalStar® GPS ThermalStar® LWI ThermalStar® LWI GPS ThermalStar® SWI ThermalStar® SWI GPS ThermalStar® LCI ThermalStar® LCI GPS
BASF Corporation	<a href="#">ULEX.R5817</a>	Neopor® GPS Insulation Boards
	<a href="#">ESR-4431</a>	Neopor® ThermaPlus™ Products
DuPont de Nemours, Inc.	<a href="#">CCRR-0435</a>	Thermax™ Sheathing Thermax™ Light Duty Thermax™ Heavy Duty Thermax™ Metal Building Thermax™ White Finish Thermax™ ci Exterior Insulation Thermax XARMOR™ ci Exterior Insulation
	<a href="#">CCRR-0440</a>	Thermax™ Metal Building Board NH Insulation Thermax™ White Finish NH Insulation Thermax™ Light Duty NH Insulation (interior/exterior) Thermax™ Heavy Duty NH Insulation Thermax™ Basic NH Insulation
	<a href="#">ESR-4755</a>	Styrofoam™ Cavitymate™ Styrofoam™ Cavitymate™ Plus Styrofoam™ Cavitymate™ XR Styrofoam™ Cavitymate™ Ultra Styrofoam™ Ultra Styrofoam™ Duramate™ Plus Styrofoam™ Residential Sheathing Styrofoam™ Residing Board Styrofoam™ UtilityFit Styrofoam™ Scoreboard, Styrofoam™ Sheathing Material Styrofoam™ Square Edge Styrofoam™ Tongue and Groove Styrofoam™ Plazamate XR

**Table 1. FPIS Manufacturers and Products**

Manufacturer	Report Number(s)	Product(s)
DuPont de Nemours, Inc.	<u>ESR-3089</u>	Tuff-R™ Tuff-R™ C Super Tuff-R™ Super Tuff-R™ C ISOCAST™ R
Hunter Panels	<u>TER 1402-01</u> <u>TER 1402-02</u> <u>TER 1508-01</u> <u>TER 2102-05</u> <u>TER 2204-04</u>	Xci Foil (Class A) Xci Foil (Class A) PLUS Xci 286 Xci CG (Class A) Xci Ply (Class A, Xci Foil Xci CG Xci Ply Xci NB
Insulfoam	<u>TER 2309-01</u>	Blueskin VP Tech
Kingspan	<u>TER 1011-01</u> <u>TER 1407-03</u> <u>TER 1407-05</u> <u>TER 1410-09</u>	GreenGuard® Insulation Board GreenGuard® CM GreenGuard® LG CM GreenGuard® SL GreenGuard® LG SL GreenGuard® SLX GreenGuard® LG SLX GreenGuard® SB GreenGuard® LG SB GreenGuard® PGU GreenGuard® Fanfold
	<u>TER 1601-06</u> <u>TER 1601-07</u> <u>TER 1603-04</u>	Kingspan® Kooltherm® Insulation Boards
Owens Corning	<u>ULEX.R8811</u>	FOAMULAR® FOAMULAR® NGX™

**Table 1. FPIS Manufacturers and Products**

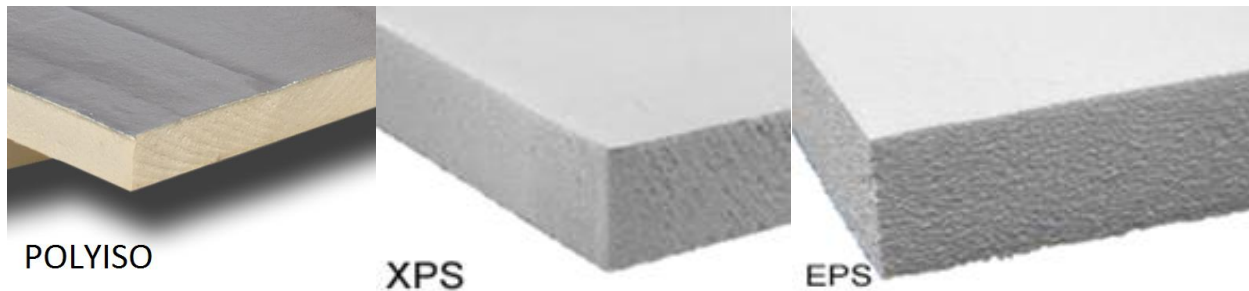
Manufacturer	Report Number(s)	Product(s)
Progressive Foam Technologies Inc.	<u>ULEX.R18532</u>	Chrome® GPS Contoured Expanded Polystyrene Insulation Contoured Graphite Polystyrene Insulation Proboard® Proboard® Core Proboard® Insulating Sheathing Proboard® FR Proboard® Original Proboard® Premium Proboard® Ultra™ Proboard® Versa™ Proboard® Versa™ VP ProFold® ProFold® Original ProFold® Premium Progressive Foam® Rigid Foam Plastic Insulating Sheathing Halo® Halo® Exterra® Halo® Interra® Plus Halo® Subterra®
Rmax, a Business Unit of Sika Corporation	<u>TER 1212-03</u>	ECOMAXci® ECOMAXci® FR Air Barrier
	<u>TER 2202-02</u>	Durasheath®
	<u>TER 1207-01</u> <u>TER 1309-03</u>	Thermasheath® Thermasheath®-SI TSX-8500 TSX-8510 ECOMAXci® FR ECOMAXci® FR White
	<u>TER 1504-04</u>	ECOMAXci® Ply
	<u>TER 1504-05</u>	ThermaBase-CI™
	<u>TER 1811-02</u>	ECOMAXci™ FR Ply
	<u>TER 2202-02</u>	Durasheath®
	<u>TER 2312-01</u>	Sika Rmax Pro Select R-Matte Plus-3

## 2 Product Description and Materials

2.1 FPIS products used in accordance with this research report shall comply with the following material standards:

- 2.1.1 Expanded polystyrene (EPS) manufactured in compliance with ASTM C578.
- 2.1.2 Graphite polystyrene (GPS) manufactured in compliance with ASTM C578.
- 2.1.3 Extruded polystyrene (XPS) manufactured in compliance with ASTM C578.
- 2.1.4 Polyisocyanurate (Polyiso) manufactured in compliance with ASTM C1289

- 2.2 FPIS products are produced under proprietary manufacturing processes and are formed into rigid insulation panels.
- 2.3 Where wind pressure resistance is required, FPIS products used in accordance with this research report shall comply with ANSI/ABTG FS 100.
- 2.4 GPS, EPS, and XPS foam plastic sheathing complying with ASTM C578 are used with:
  - 2.4.1 No facings
  - 2.4.2 Facings on one side
  - 2.4.3 Facings on both sides
- 2.5 Polyiso foam plastic sheathing complying with ASTM C1289 must have facings on both sides.
- 2.6 FPIS products are typically available in the following sizes:
  - 2.6.1 Thicknesses range from 1/2" to 6".
  - 2.6.2 The standard product width is 48".
  - 2.6.3 Standard lengths include 96", 108", and 120".
- 2.7 Consult the manufacturer for availability of specific widths or lengths.
- 2.8 Consult FPIS manufacturer and manufacturers of other wall components for material property data regarding vapor permeability, WRB qualification, air barrier qualification, fire performance properties, and other matters required to ensure an overall code-compliant wall assembly. See **Section 5** for additional information.



**Figure 1.** Examples of Polyiso, XPS, and EPS Foam Plastic Insulating Sheathing

- 2.9 Any code compliance issues not specifically addressed in this section are outside the scope of this DRR.
- 2.10 Any engineering evaluation conducted for this DRR was performed within DrJ's professional scope of work on the dates provided herein.

### 3 Definitions

- 3.1 Air Barrier: One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies.
- 3.2 Continuous Insulation (CI): Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.
- 3.3 Flashing: Materials used to aid in the integration of fenestration products and penetrations into a wall assembly to direct liquid water to the exterior side of the WRB. Flashing materials consist of many types based on application (e.g., head, jamb, cap, sill, etc.) and may be attached using various methods (e.g., mechanical, self-adhered, liquid or spray applied, etc.).
- 3.4 Vapor Retarder: Material placed within a wall assembly to control the flow of water vapor through the assembly.

- 3.5 Water-Resistive Barrier (WRB): A material behind an exterior wall covering assembly or cladding that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly. Function may be provided by taped joints and penetrations of FPIS if tested by the manufacturer and installed per the manufacturer installation instructions. A separate WRB membrane may also be placed to the inside or outside of the FPIS.
- 3.6 New Materials<sup>2</sup> are defined as building materials, equipment, appliances, systems, or methods of construction not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.<sup>3</sup> The design strengths and permissible stresses shall be established by tests<sup>4</sup> and/or engineering analysis.<sup>5</sup>
- 3.7 Duly Authenticated Reports<sup>6</sup> and Research Reports<sup>7</sup> are test reports and related engineering evaluations, which are written by an approved agency<sup>8</sup> and/or an approved source.<sup>9</sup>
  - 3.7.1 These reports contain intellectual property and/or trade secrets, which are protected by the Defend Trade Secrets Act (DTSA).<sup>10</sup>
- 3.8 An approved agency is “approved” when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory.
- 3.9 An approved source is “approved” when a professional engineer (i.e., Registered Design Professional) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.<sup>11</sup>
- 3.10 The regulatory authority shall enforce<sup>12</sup> the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing<sup>13</sup> stating the nonconformance and the path to its cure.
- 3.11 The regulatory authority shall accept Duly Authenticated Reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.<sup>14</sup>
- 3.12 Approval equity is a fundamental commercial and legal principle.<sup>15</sup>

#### **4 Applicable Standards for the Listing; Regulations for the Regulatory Evaluation<sup>16</sup>**

- 4.1 *Standards*
  - 4.1.1 *ASTM C578: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*
  - 4.1.2 *ASTM C1289: Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board*
  - 4.1.3 *ANSI/ABTG FS 100: Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies*
- 4.2 *Regulations*
  - 4.2.1 *IBC – 18, 21, 24: International Building Code®*
  - 4.2.2 *IRC – 18, 21, 24: International Residential Code®*
  - 4.2.3 *IECC – 18, 21, 24: International Energy Conservation Code®*

#### **5 Regulatory Compliance Assessment - Application of Constructon Details.**

- 5.1 This research report applies to the manufacturers listed in **Section 1.1** and the products listed in **Table 1**.
- 5.2 This research report addresses the general construction framing details for applying FPIS continuous insulation in wood or steel light-frame exterior wall assemblies and mass walls (CMU or concrete), and integrating with various code-required wall components such as cladding, water-resistive barriers (WRB), vapor retarders, and air barriers.

- 5.2.1 With a couple exceptions, details in this research report only illustrate solid wood structural framing members. However, the same principles apply for typical shapes used for cold-formed steel light-frame construction. The general concepts may also be used with CMU or concrete construction with slight modification.
- 5.3 Specific code compliance considerations are outside of the scope of this research report and must be verified for a given selection and arrangement of materials, and for a given building location and climate condition. These include but are not limited to continuous insulation amounts, wall cavity insulation amount and type, location and type of WRB, location and type of vapor retarder, location and type of air barrier, structural requirements, thermal resistance or fire endurance, and flame spread characteristics.
- 5.4 Consult the FPIS manufacturer and manufacturers of other wall components for material property data regarding vapor permeability, WRB qualification, air barrier qualification, fire performance properties, and other matters required to ensure an overall code-compliant wall assembly.
- 5.5 For guidance on specific matters of code compliance, refer to the locally applicable building code, manufacturer installation instructions for specified materials, and the research reports listed in **Section 7** that address specific code compliance topics for appropriate application of FPIS materials.
- 5.6 All wall assembly components shall be approved, installed, and inspected in accordance with the applicable building code, approved construction documents, manufacturer installation instructions, and good practice.
- 5.7 FPIS products shall be attached to and supported by the wall framing in accordance with the manufacturer installation instructions.

## 6 Installation

- 6.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report, and the applicable building code.
- 6.2 In the event of a conflict between the manufacturer installation instructions and this report, the more restrictive shall govern.
- 6.3 The details shown in this research report are conceptual in nature and are intended to provide the user with code compliance and best practices for detailing walls using FPIS. Suitability for a specific application is the responsibility of the building designer. See **Section 9** for specific conditions of use.



Detail	Topic	Figures
Basic Wall Assembly Variations	Light Frame Wall	<b>Figure 2.</b> Wood-Frame Wall with Structural Panel (as required) Bracing and Exterior Finish of FPIS, WRB, and Lap Siding
		<b>Figure 3.</b> Wood-Frame Wall with Structural Panel (as required) Bracing and Exterior Finish of FPIS (joints taped) as WRB, Furring, and Lap Siding
		<b>Figure 4.</b> Wood-Frame Wall with Structural Panel Bracing (as required) and Exterior Finish of FPIS, WRB, Furring, and Lap Siding
		<b>Figure 5.</b> Wood-Frame Wall with Let-in Bracing (LIB) and Exterior Finish of WRB, FPIS, Furring, and Lap Siding
		<b>Figure 6.</b> Wood-Frame Wall with LIB and Exterior Finish of FPIS, WRB, Drainage Space, and PC Stucco
		<b>Figure 7.</b> Wood-Frame Wall with LIB and Exterior Finish of FPIS as WRB and Brick Veneer
		<b>Figure 8.</b> Wood-Frame Wall with LIB Bracing, FPIS as WRB, Furring (or Drainage Mat), Lath, and Stucco Veneer
		<b>Figure 9.</b> Inside Corner: Wood Frame Wall with Continuous Insulation, FPIS, WRB, and Lap Siding without Furring (Provide sufficient framing to attach siding trim and siding as well as interior finish.)
		<b>Figure 10.</b> Inside Corner: Wood Frame Wall with Continuous Insulation, FPIS Taped (WRB), Furring, and Lap Siding (Provide sufficient framing to attach siding trim and siding as well as interior finish.)
		<b>Figure 11.</b> Outside Corner: Wood Frame Wall with Continuous Insulation, FPIS Taped (WRB), Furring, and Lap Siding (Provide sufficient framing to attach siding trim and siding as well as interior finish.)
	Bottom of Wall	<b>Figure 12.</b> Bottom of Wall Covered in FPIS with Flashing and Extending Down Foundation
		<b>Figure 13.</b> FPIS Extending Over Foundation with Protection Board Where Exposed Above Grade
		<b>Figure 14.</b> FPIS Extending Over Foundation with Termite Shield, Horizontal Mechanical Flashing, and Protection Board (or Coating) over FPIS Where Exposed Above Grade
		<b>Figure 15.</b> Concrete or CMU Wall, (11/2" or less) FPIS, 2 layers WRBs, Stucco (Alternate WRB options: [1] one separate WRB behind FPIS [2] FPIS taped joints + 1 layer WRB [building paper])
		<b>Figure 16.</b> Concrete or CMU Wall, (11/2" or greater) FPIS (taped as WRB), Wood Furring, Stucco (Alternate WRB options: [1] one separate WRB behind FPIS [2] on separate WRB in front of FPIS)
	Top of Wall – Gable with Unconditioned Attic Space	<b>Figure 17.</b> Top of Wall at Gable End with Gable End Frame Sheathed with WSP and Supported Over FPIS with 2x, Which Also Extends to Inside of Wall to Supply Attachment for Ceiling Finish (Note: Bracing is not shown.)
		<b>Figure 18.</b> Top of Wall at Gable End with Gable End Frame Sheathed with WSP and Cantilevered Over Wall (Note: Gable bracing is not shown. Contact component manufacturer for load-specific details.)
	Top of Wall – Gable with Conditioned Attic Space	<b>Figure 19.</b> Top of Wall at Gable End with Gable End Frame Sheathed with FPIS Continuous from Wall Below (Note: Bracing is not shown.)

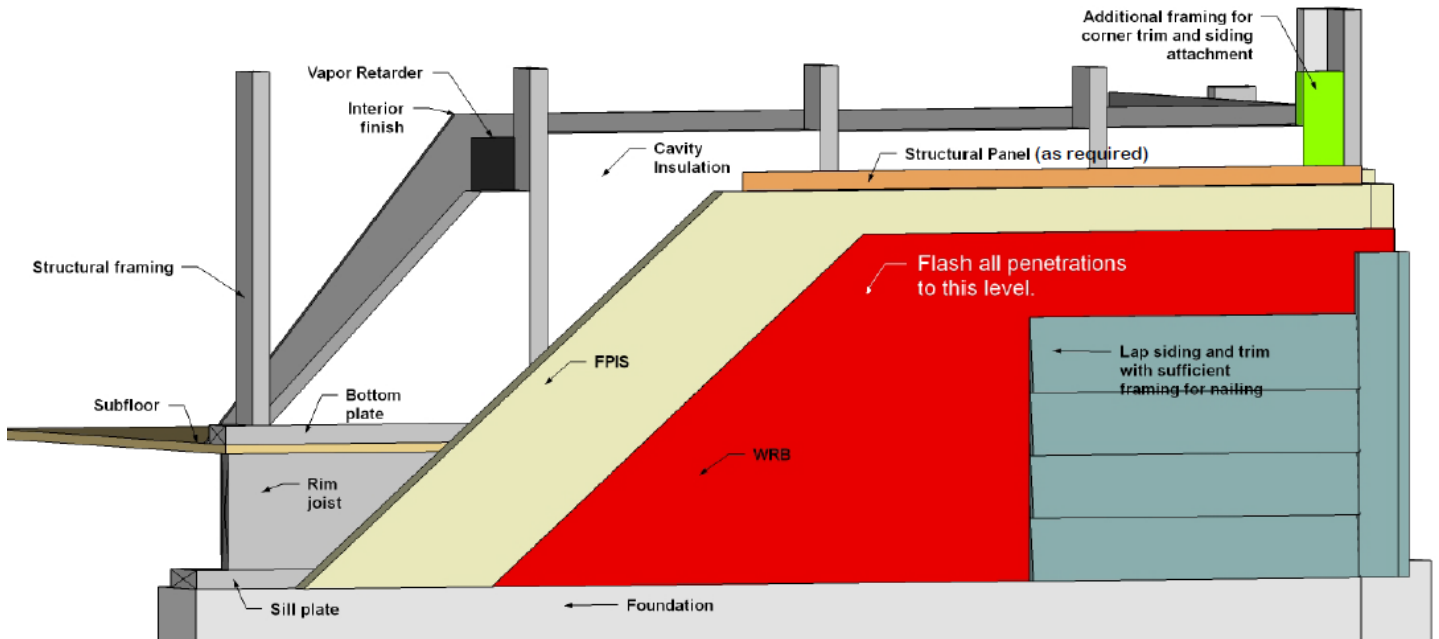


Detail	Topic	Figures
Basic Wall Assembly Variations	Top of Wall – Eave	<b>Figure 20.</b> Top of Wall at Eave with Rafter Construction
		<b>Figure 21.</b> Top of Wall at Eave with Standard Heel Truss
		<b>Figure 22.</b> Top of Wall at Eave with Cantilever Truss
		<b>Figure 23.</b> Top of Wall at Energy Heel Truss
		<b>Figure 24.</b> Top of Wall Standard Truss Eave Detail with Eave Ledger Attached to Structural Framing Through FPIS
	Roof Intersection with Wall	<b>Figure 25.</b> Roof Intersecting with Wall (view from outside)
		<b>Figure 26.</b> Roof Intersecting with Wall (view from inside showing blocking)
	Deck Ledger	<b>Figure 27.</b> Deck Ledger – 2" FPIS Wall Sheathing, 1" FPIS Behind Ledger at Patio Door Opening
		<b>Figure 28.</b> Deck Ledger – 2" FPIS Wall Sheathing, 1" FPIS behind Ledger at Rim
Window/Door Penetration Details	Standard Installation	<b>Figure 29.</b> Standard Installation – Sill
		<b>Figure 30.</b> Standard Installation – Jambs
		<b>Figure 31.</b> Standard Installation – Header
	Lumber Window Buck Installation	<b>Figure 32.</b> Wood Buck Installation – Sill
		<b>Figure 33.</b> Wood Buck Installation – Jamb
		<b>Figure 34.</b> Wood Buck Installation – Header
	Picture Frame Installation	<b>Figure 35.</b> Picture Frame Installation – Sill
		<b>Figure 36.</b> Picture Frame Installation – Jamb
		<b>Figure 37.</b> Picture Frame Installation – Header
	Rainscreen Installation	<b>Figure 38.</b> Rainscreen Installation – Sill
		<b>Figure 39.</b> Rainscreen Installation – Jamb
		<b>Figure 40.</b> Rainscreen Installation – Header
	Other Penetrations	<b>Figure 41.</b> Penetration – 2" FPIS Taped Joints, Furring, Lap Siding

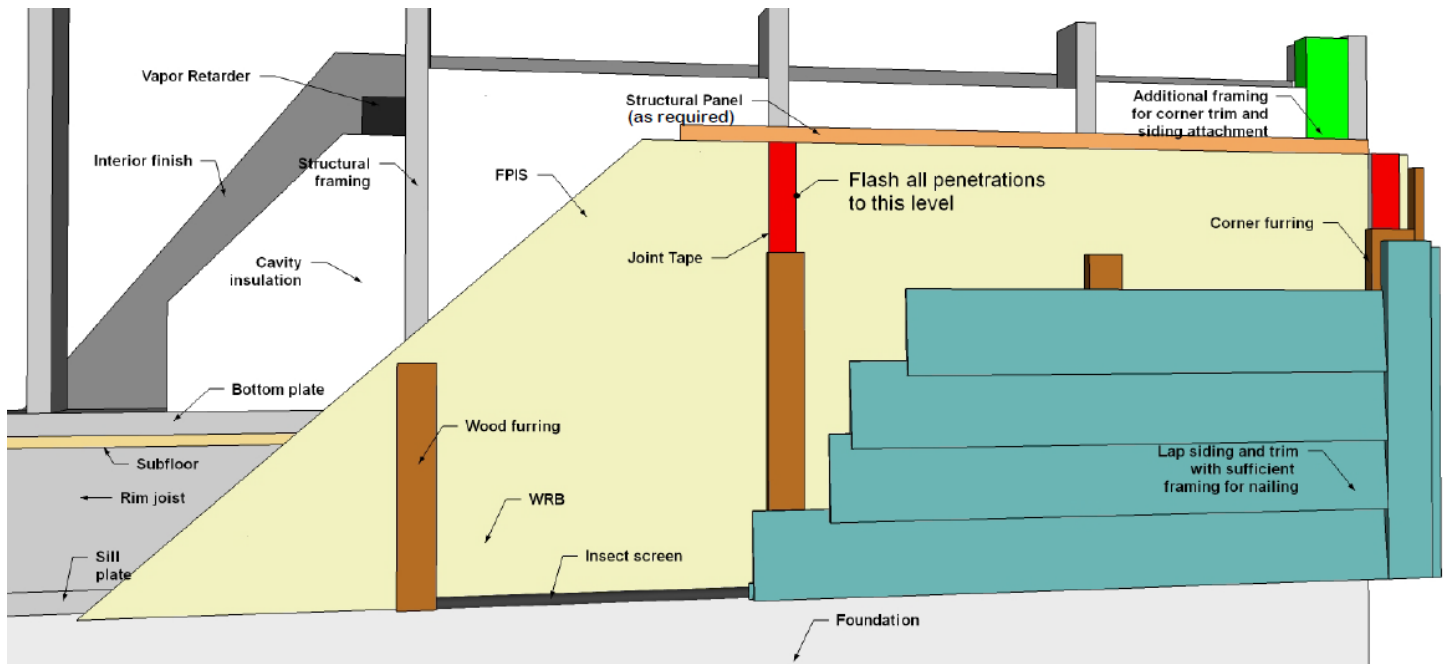
## 6.4 Basic Wall Assembly Variations

### 6.4.1 Light Frame Wall

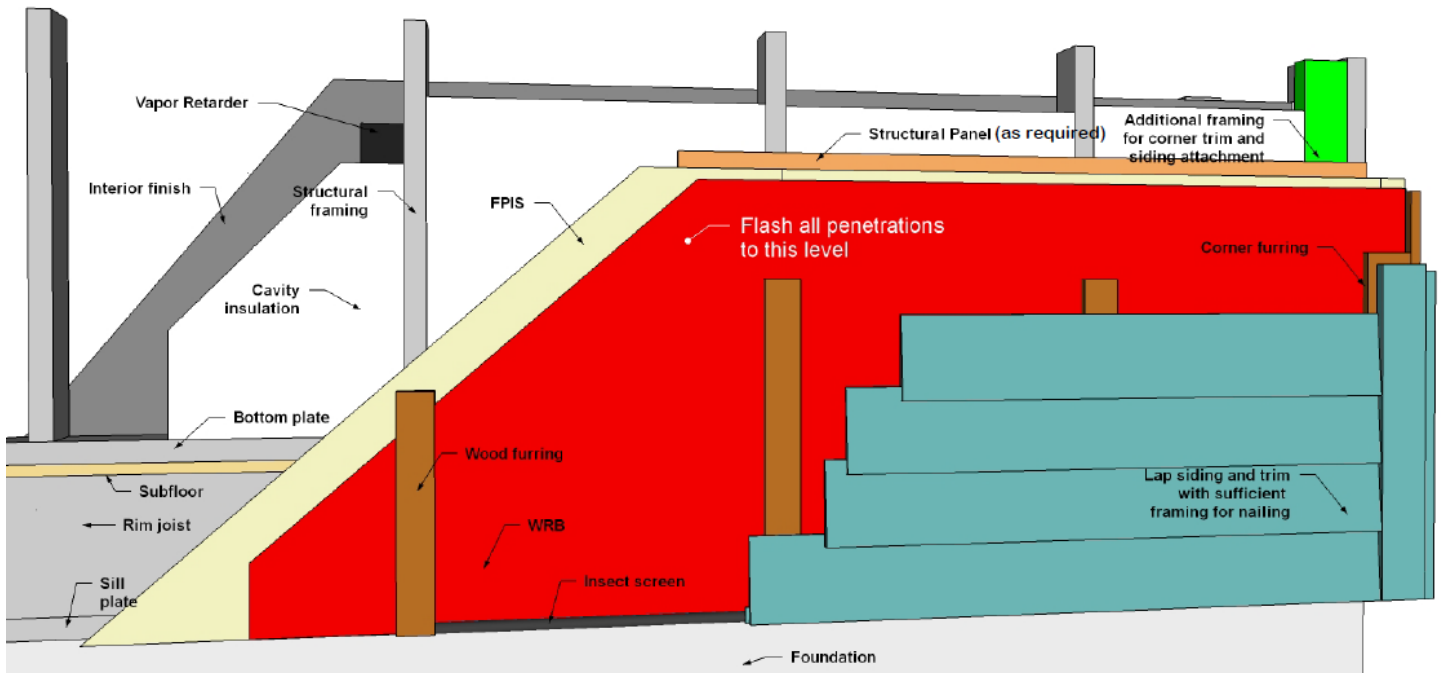
- 6.4.1.1 Wall assemblies showing structural framing (e.g., wood or cold-formed steel), interior finish, vapor retarder, cavity insulation, wall bracing (e.g., structural sheathing or wood let-in brace or metal strap brace), FPIS (continuous insulation), WRB, and exterior finish (siding and trim).



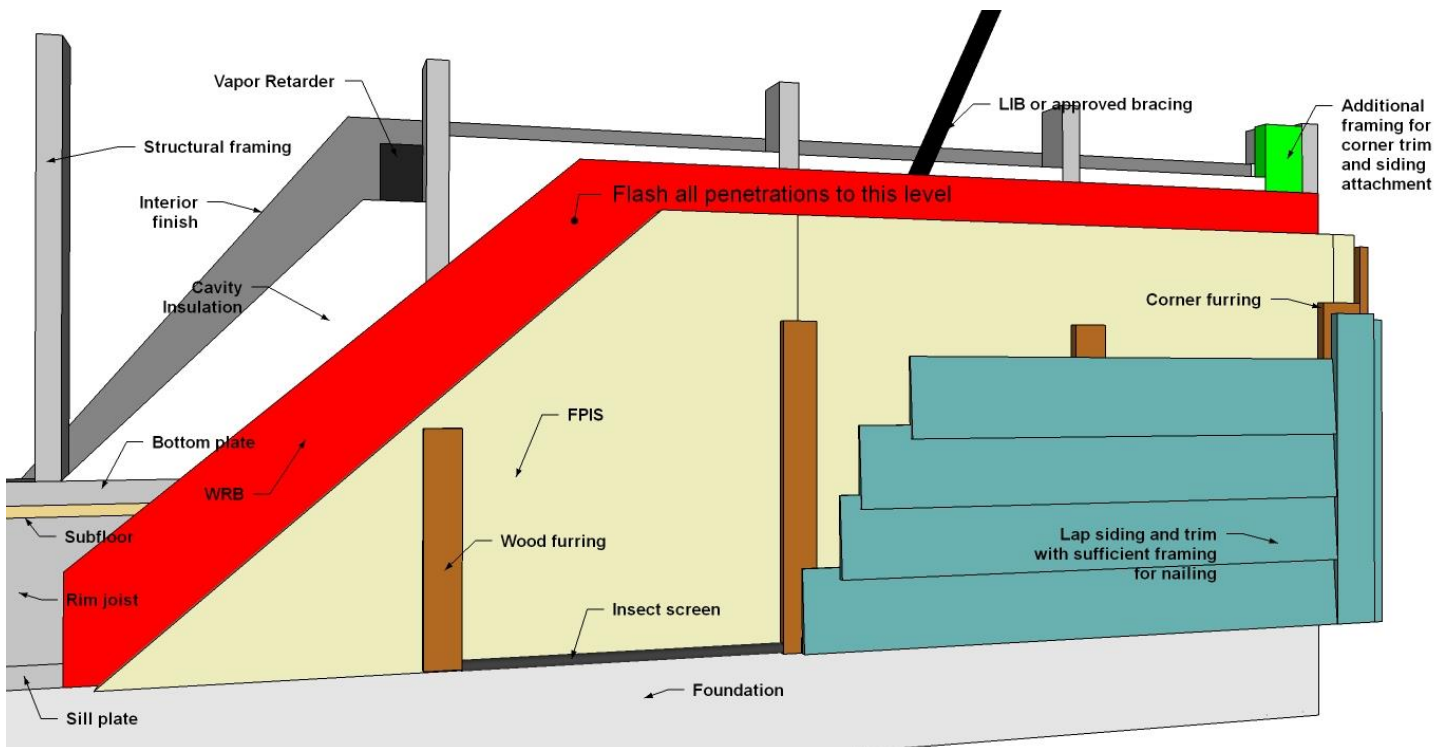
**Figure 2.** Wood-Frame Wall with Structural Panel (as required) Bracing and Exterior Finish of FPIS, WRB, and Lap Siding



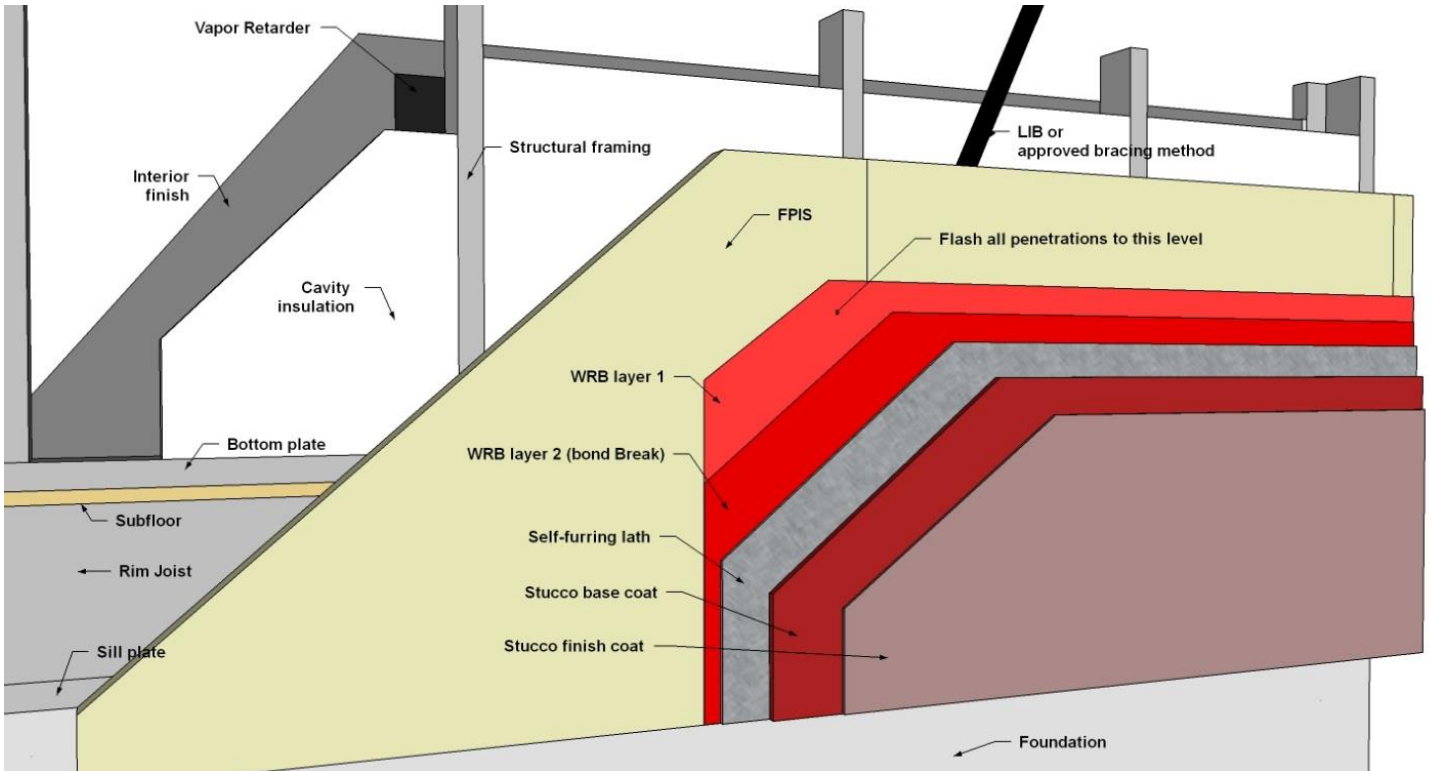
**Figure 3.** Wood-Frame Wall with Structural Panel (as required) Bracing and Exterior Finish of FPIS (joints taped) as WRB, Furring, and Lap Siding<sup>17</sup>



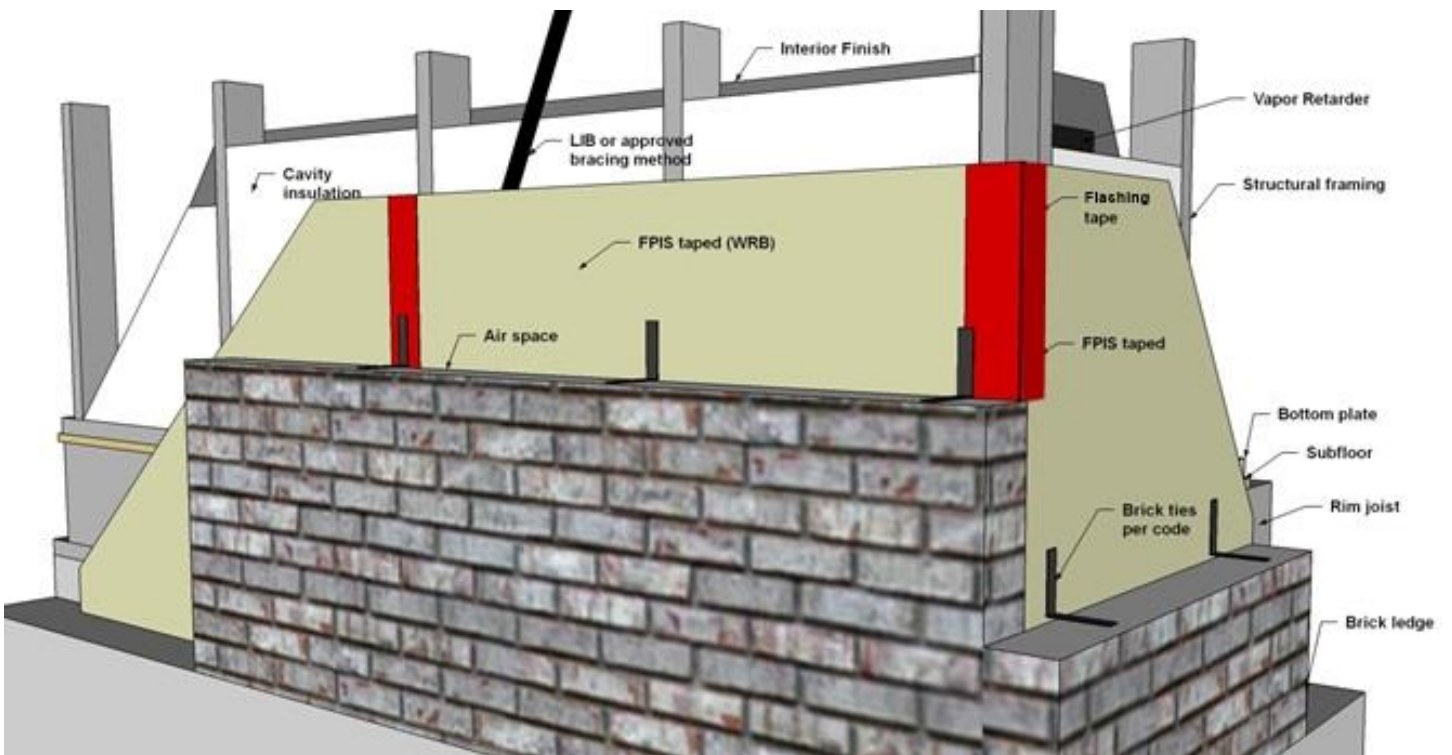
**Figure 4.** Wood-Frame Wall with Structural Panel Bracing (as required) and Exterior Finish of FPIS, WRB, Furring, and Lap Siding



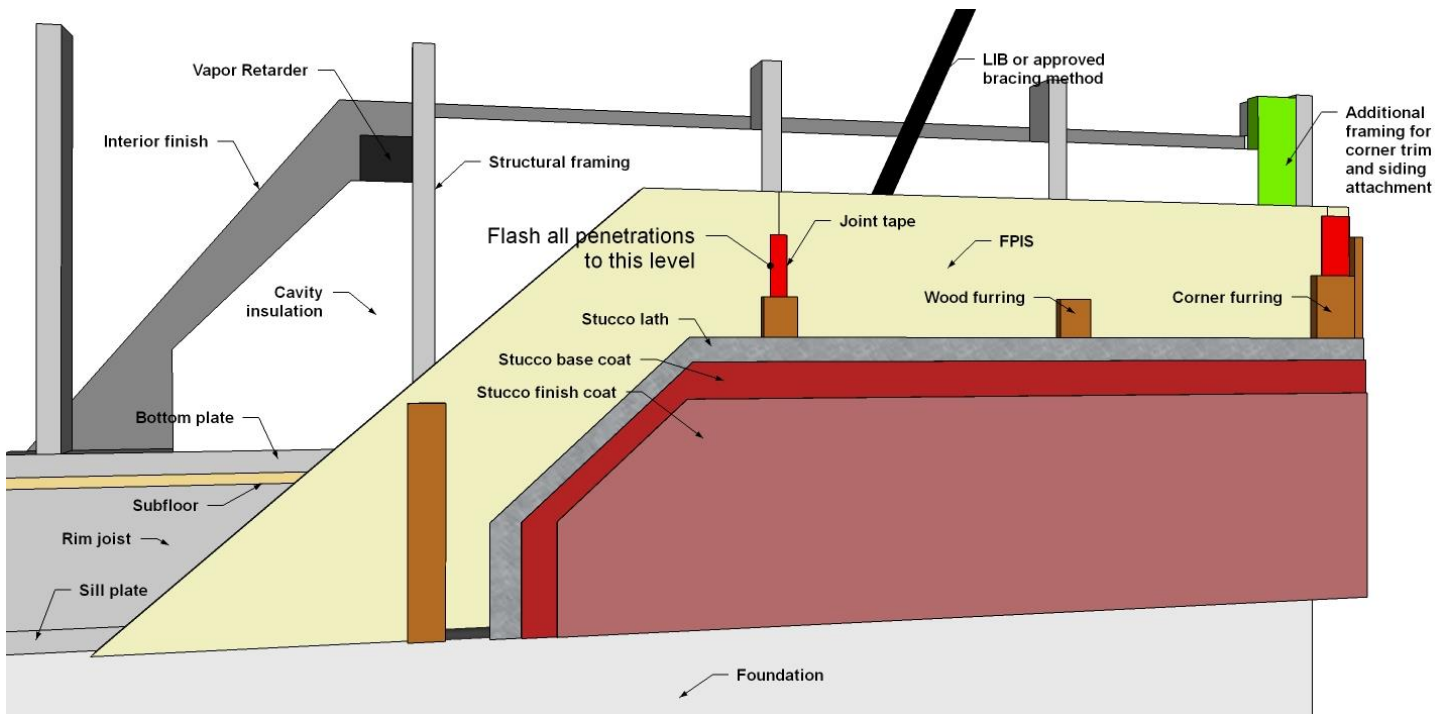
**Figure 5.** Wood-Frame Wall with Let-in Bracing (LIB) and Exterior Finish of WRB, FPIS, Furring, and Lap Siding



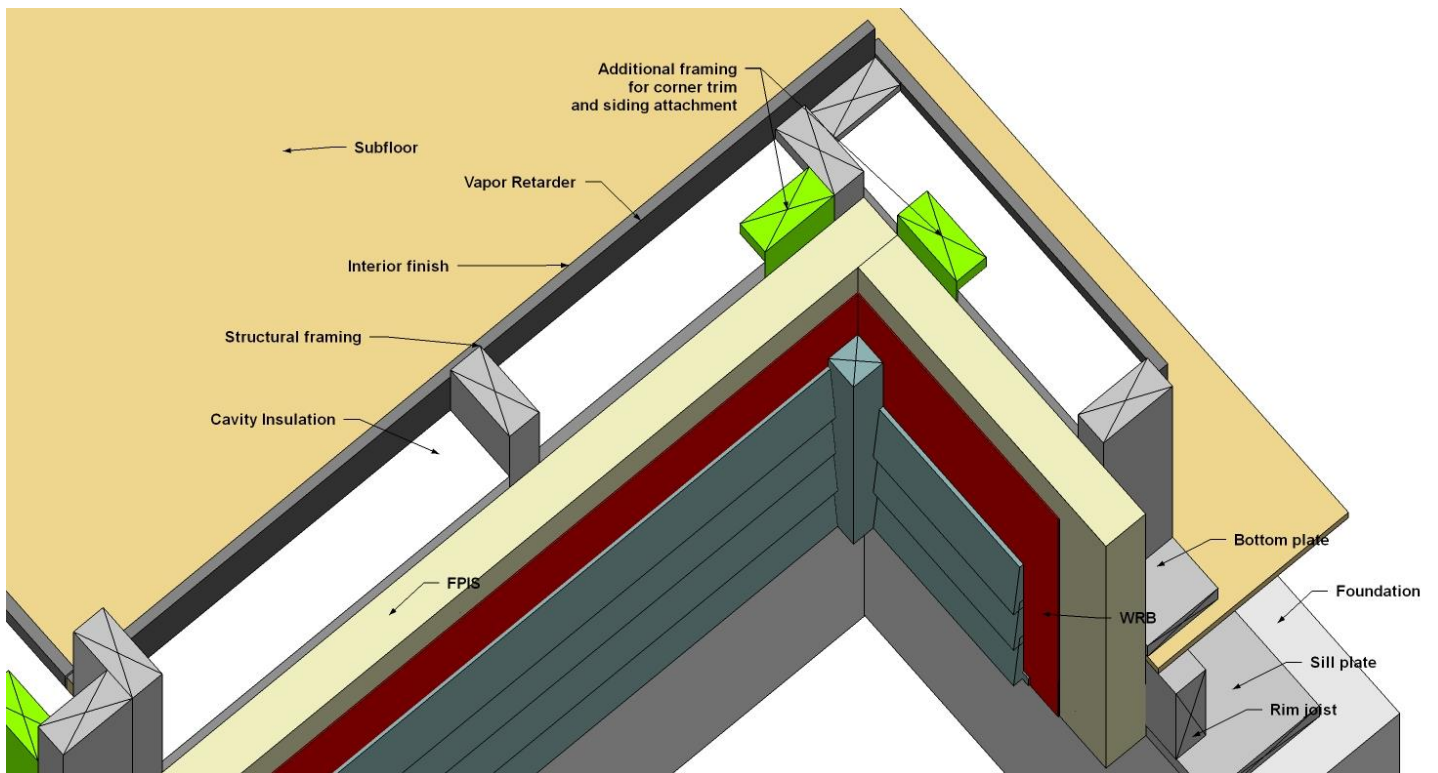
**Figure 6.** Wood-Frame Wall with LIB and Exterior Finish of FPIS, WRB, Drainage Space, and PC Stucco<sup>18</sup>



**Figure 7.** Wood-Frame Wall with LIB and Exterior Finish of FPIS as WRB and Brick Veneer (anchored and separately supported)

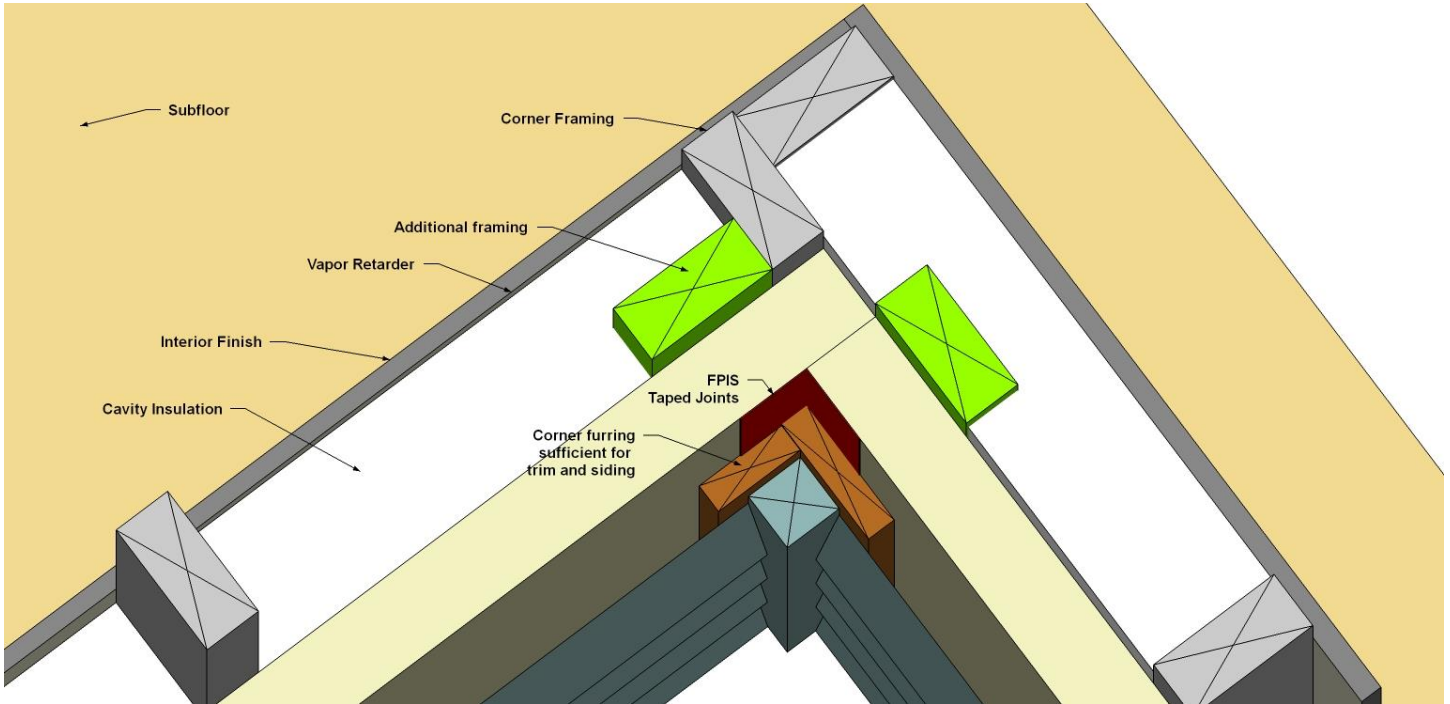


**Figure 8.** Wood-Frame Wall with LIB Bracing, FPIS as WRB, Furring (or Drainage Mat), Lath, and Stucco Veneer<sup>19</sup>

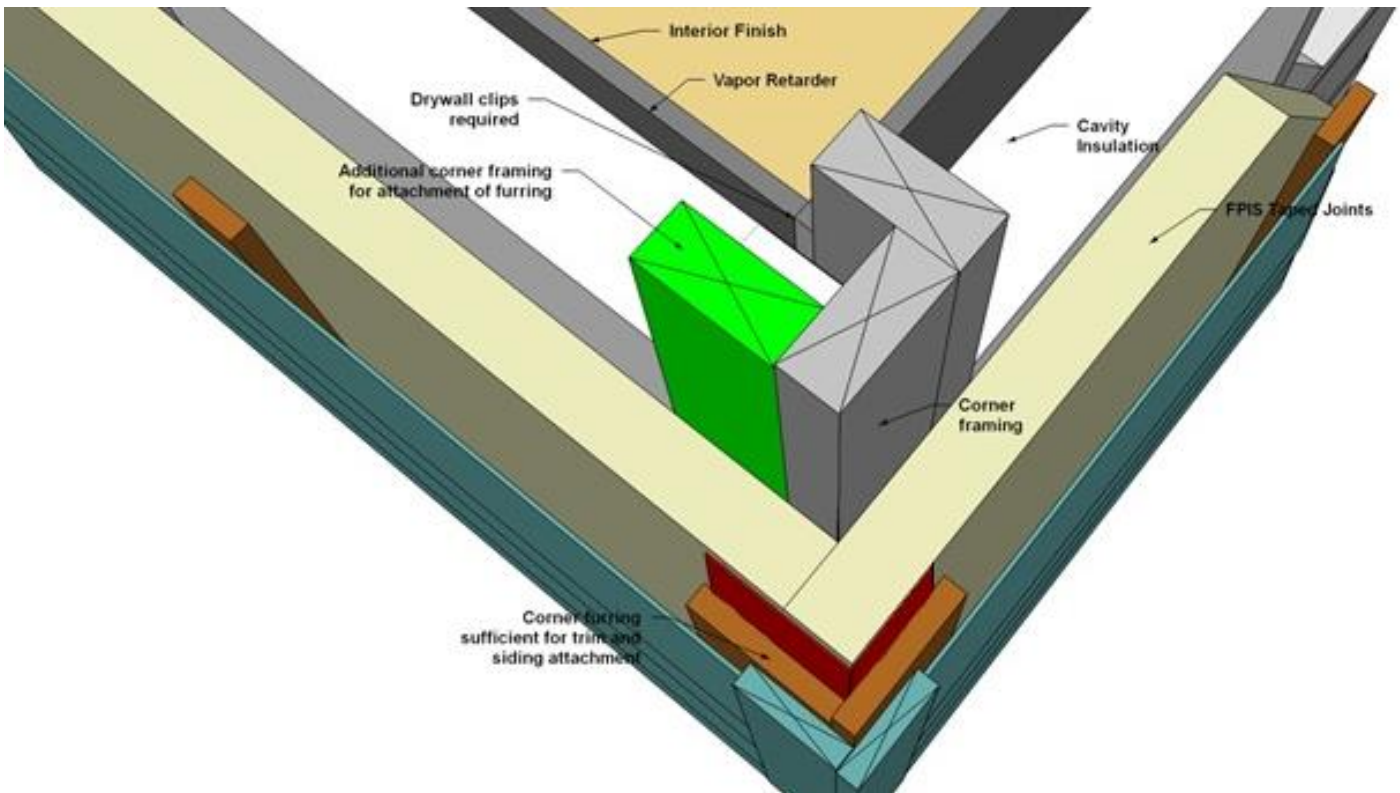


**Figure 9.** Inside Corner: Wood Frame Wall with Continuous Insulation, FPIS, WRB, and Lap Siding without Furring (Provide sufficient framing to attach siding trim and siding as well as interior finish.)





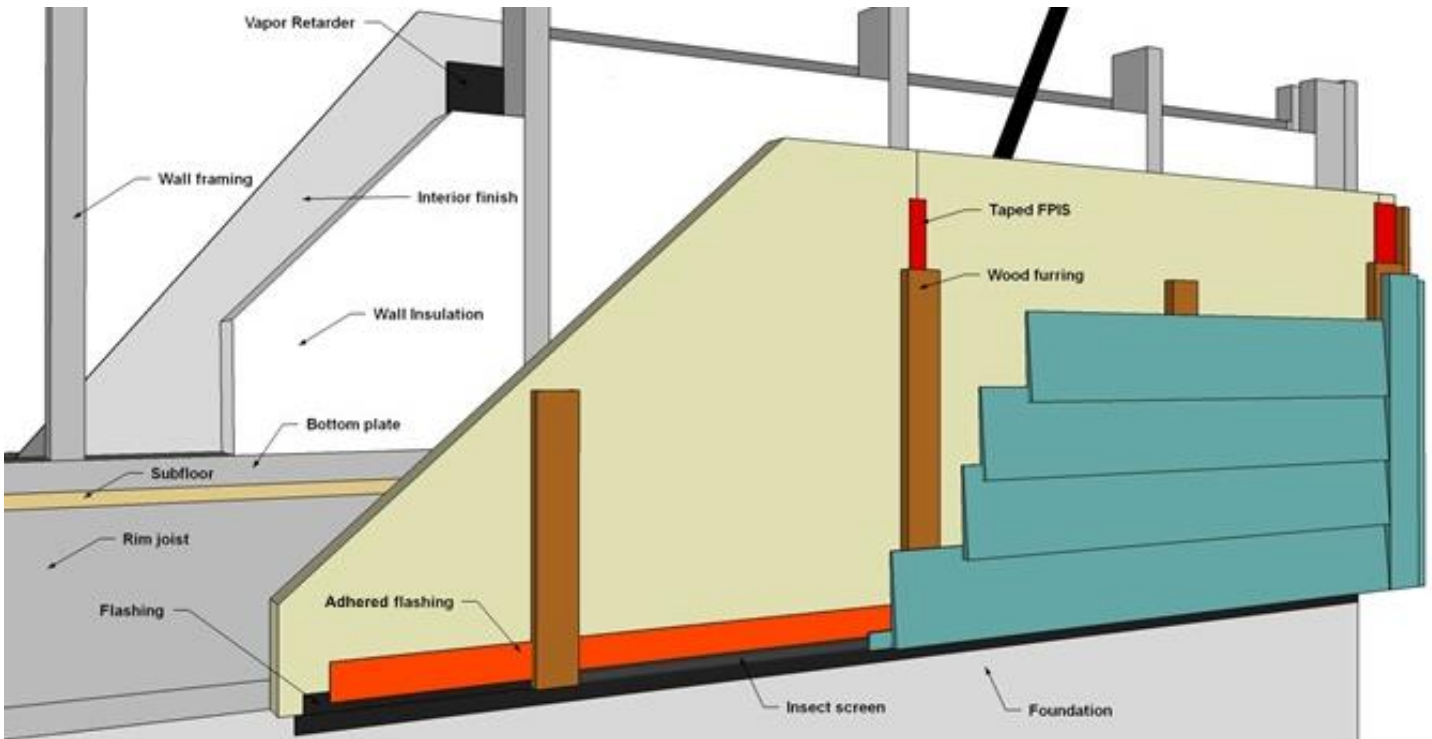
**Figure 10.** Inside Corner: Wood Frame Wall with Continuous Insulation, FPIS Taped (WRB), Furring, and Lap Siding (Provide sufficient framing to attach siding trim and siding as well as interior finish.)



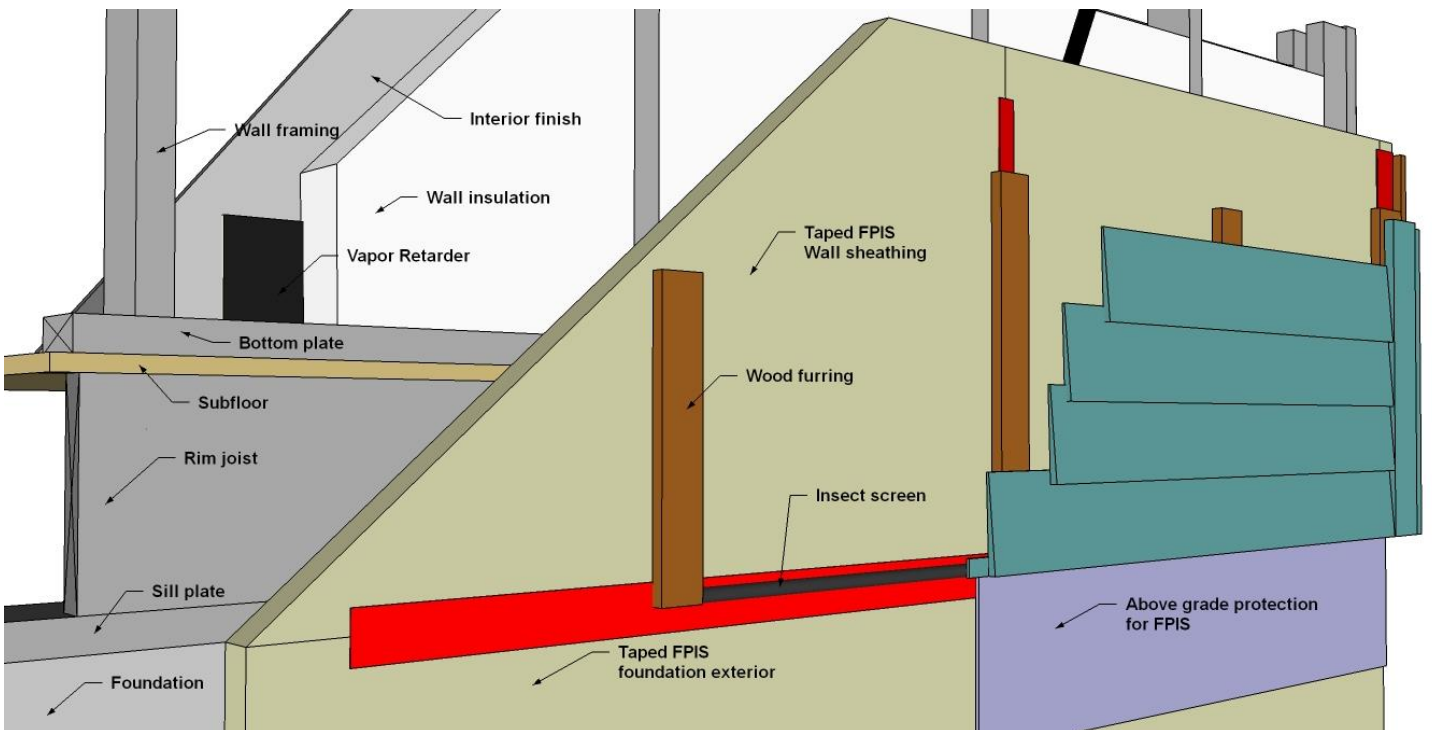
**Figure 11.** Outside Corner: Wood Frame Wall with Continuous Insulation, FPIS Taped (WRB), Furring, and Lap Siding (Provide sufficient framing to attach siding trim and siding as well as interior finish.)

#### 6.4.2 Bottom of Wall

##### 6.4.2.1 Not code required and typically recommended with FPIS thickness over 1"

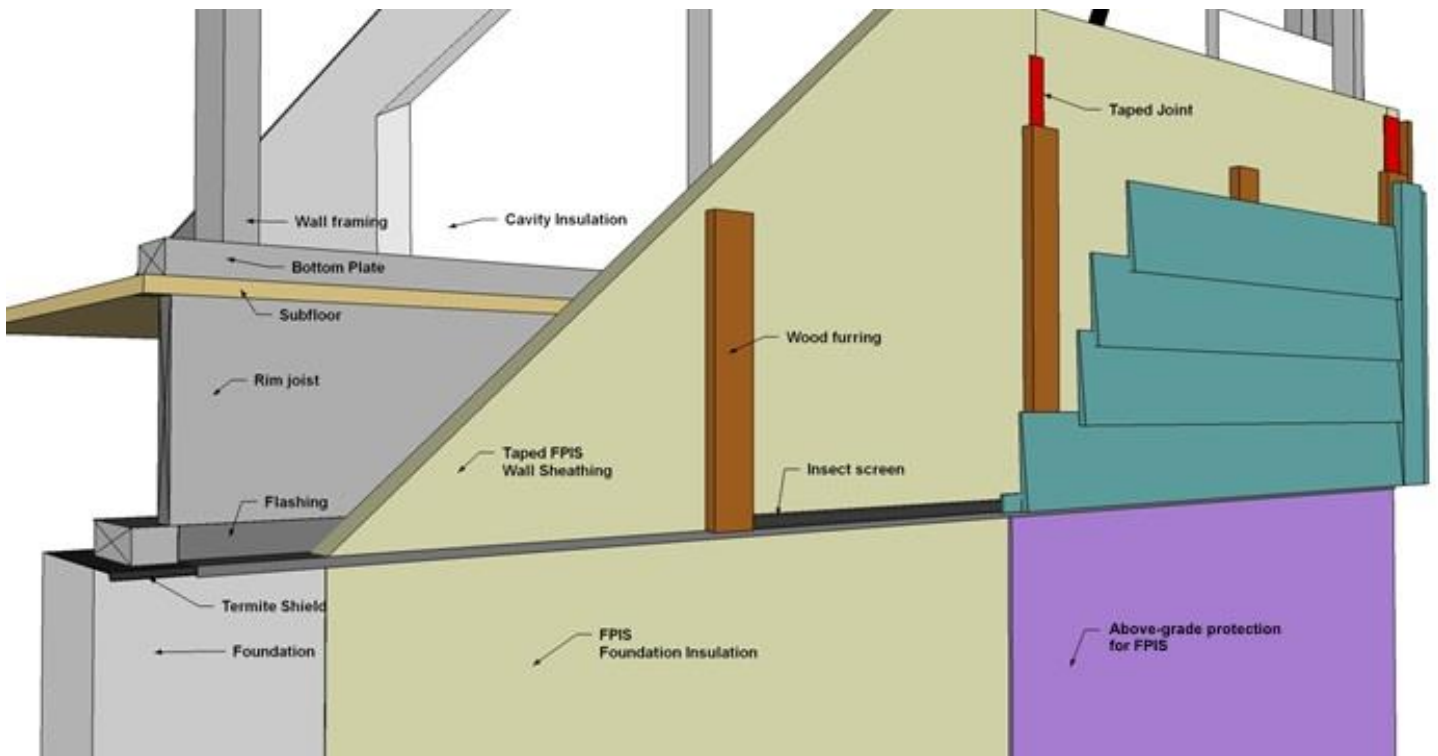


**Figure 12.** Bottom of Wall Covered in FPIS with Flashing and Extending Down Foundation

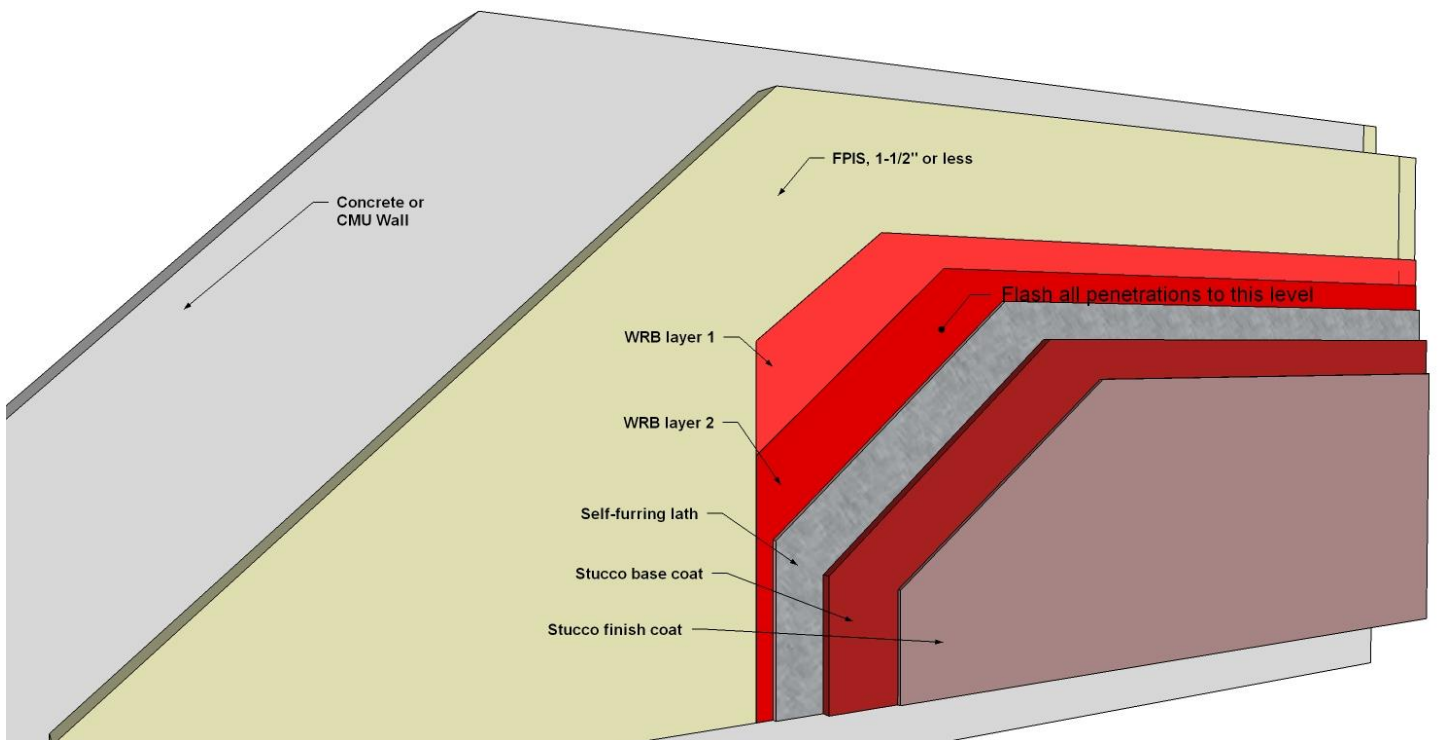


**Figure 13.** FPIS Extending Over Foundation with Protection Board Where Exposed Above Grade

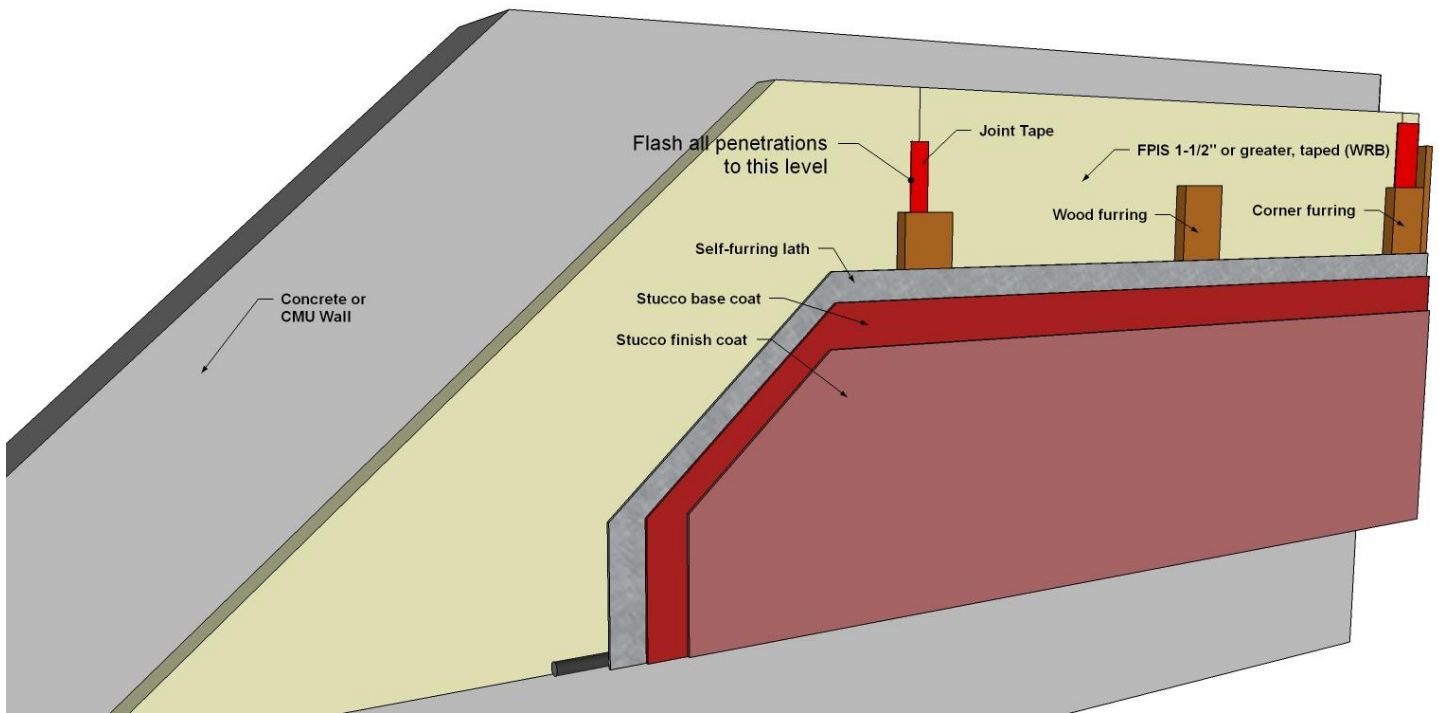




**Figure 14.** FPIS Extending Over Foundation with Termite Shield, Horizontal Mechanical Flashing, and Protection Board (or Coating) over FPIS Where Exposed Above Grade



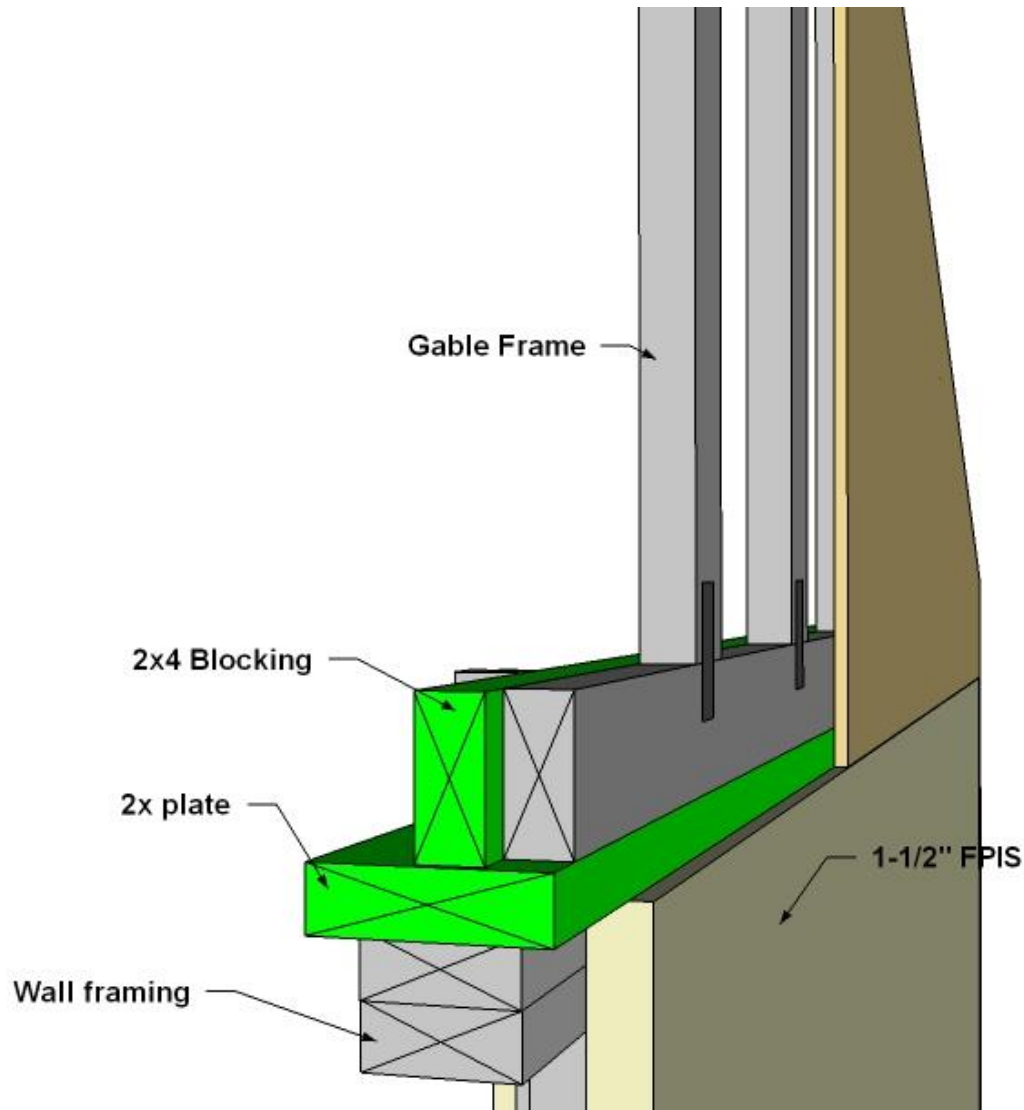
**Figure 15.** Concrete or CMU Wall, (1½" or less) FPIS, 2 layers WRBs, Stucco  
(Alternate WRB options: [1] one separate WRB behind FPIS [2] FPIS taped joints + 1 layer WRB [building paper])



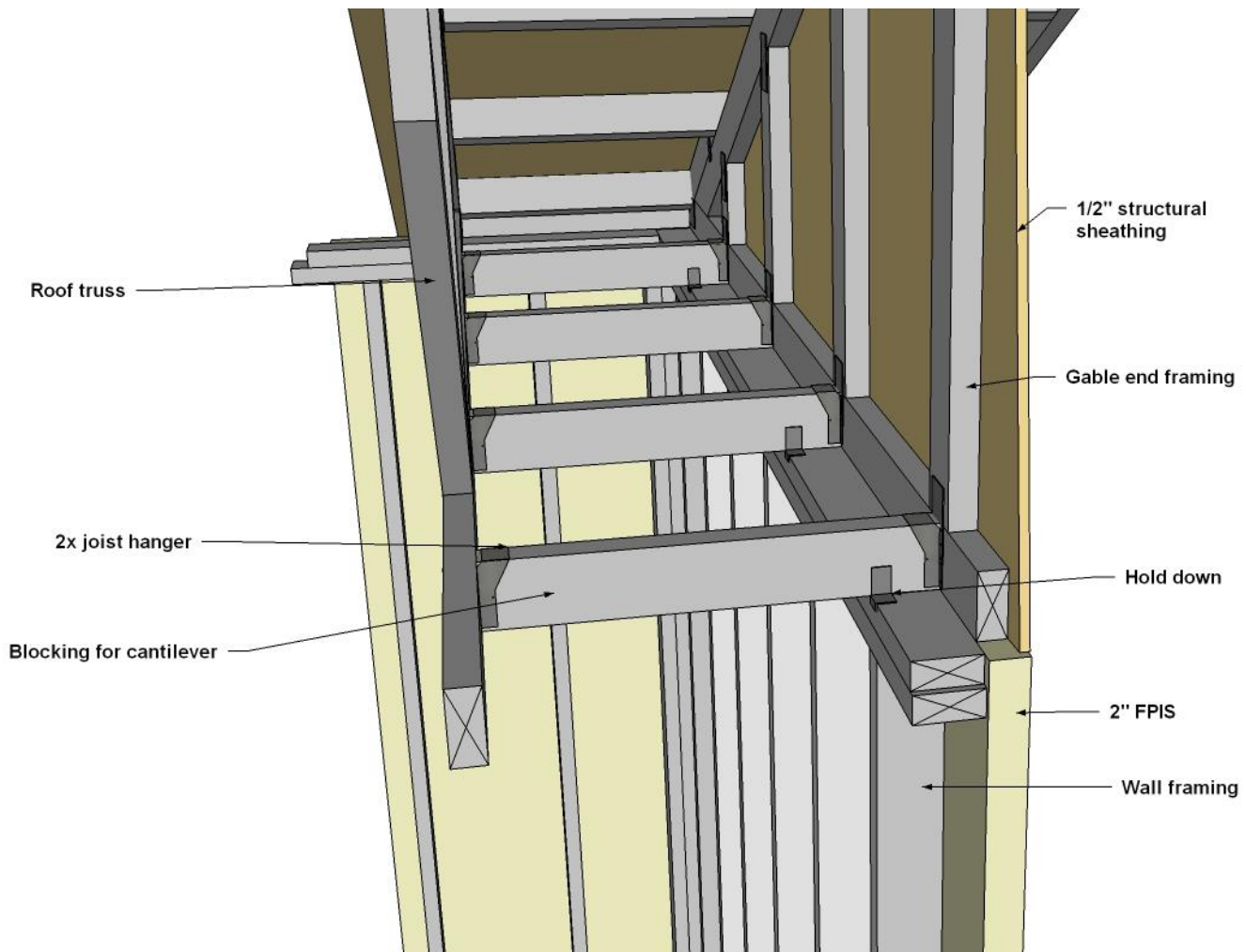
**Figure 16.** Concrete or CMU Wall, (1½" or greater) FPIS (taped as WRB), Wood Furring, Stucco  
(Alternate WRB options: [1] one separate WRB behind FPIS [2] on separate WRB in front of FPIS)

6.4.3 Top of Wall – Gable with Unconditioned Attic Space

6.4.3.1 Illustrates non-FPIS sheathing at gable



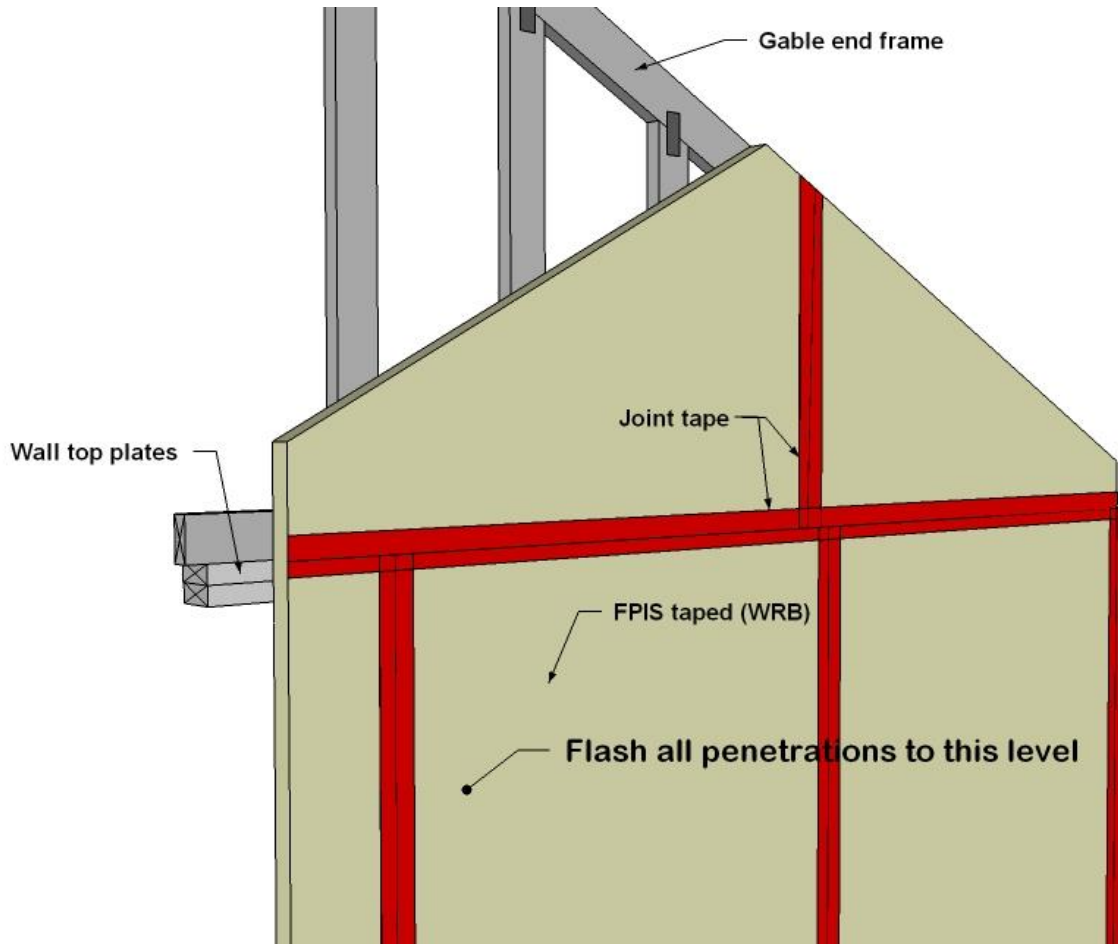
**Figure 17.** Top of Wall at Gable End with Gable End Frame Sheathed with WSP and Supported Over FPIS with 2x, Which Also Extends to Inside of Wall to Supply Attachment for Ceiling Finish  
(Note: Bracing is not shown.)



**Figure 18.** Top of Wall at Gable End with Gable End Frame Sheathed with WSP and Cantilevered Over Wall  
(Note: Gable bracing is not shown. Contact component manufacturer for load-specific details.)

6.4.4 Top of Wall – Gable with Conditioned Attic Space

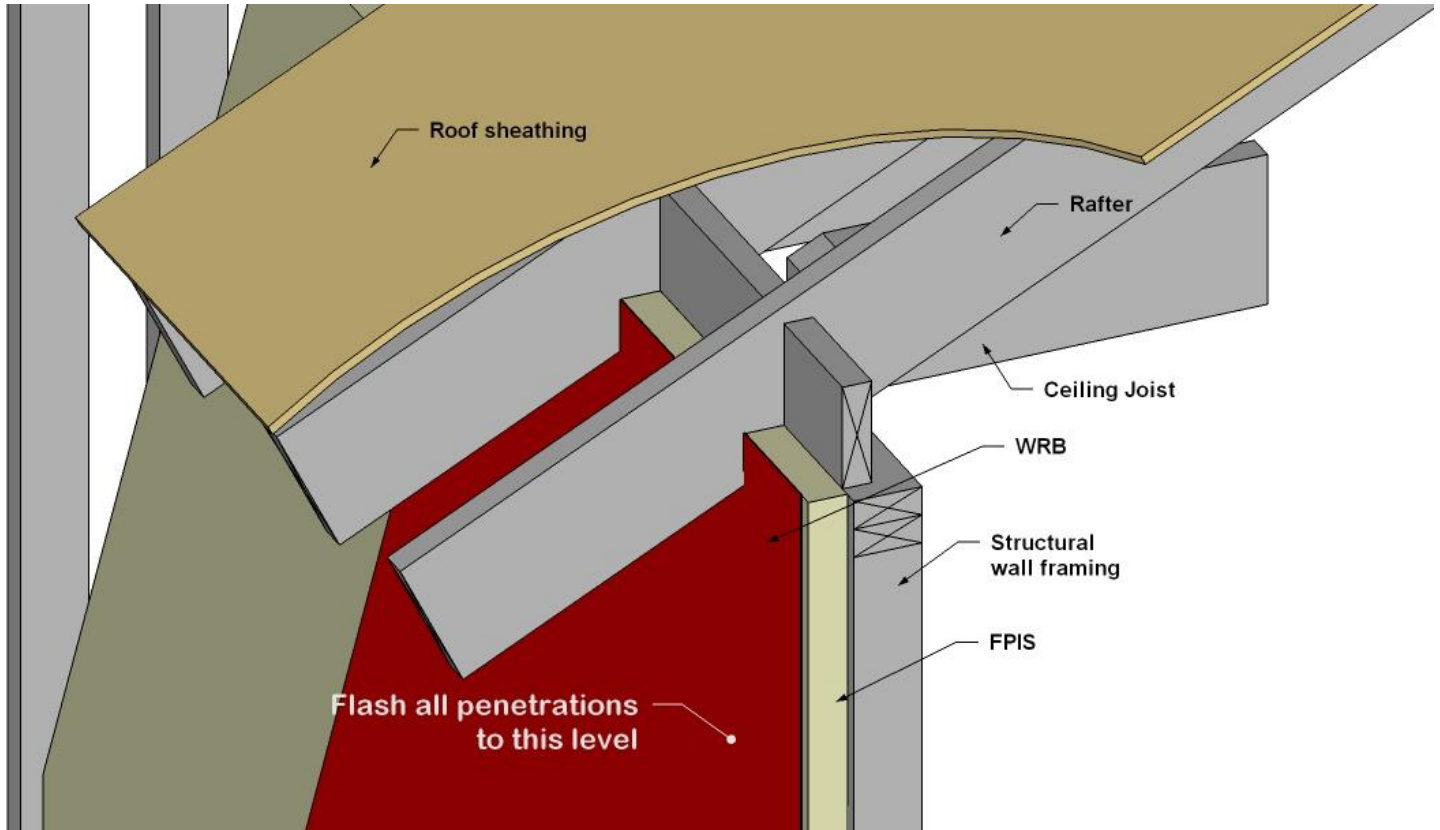
6.4.4.1 Illustrates FPIS sheathing at gable



**Figure 19.** Top of Wall at Gable End with Gable End Frame Sheathed with FPIS Continuous from Wall Below  
(Note: Bracing is not shown.)

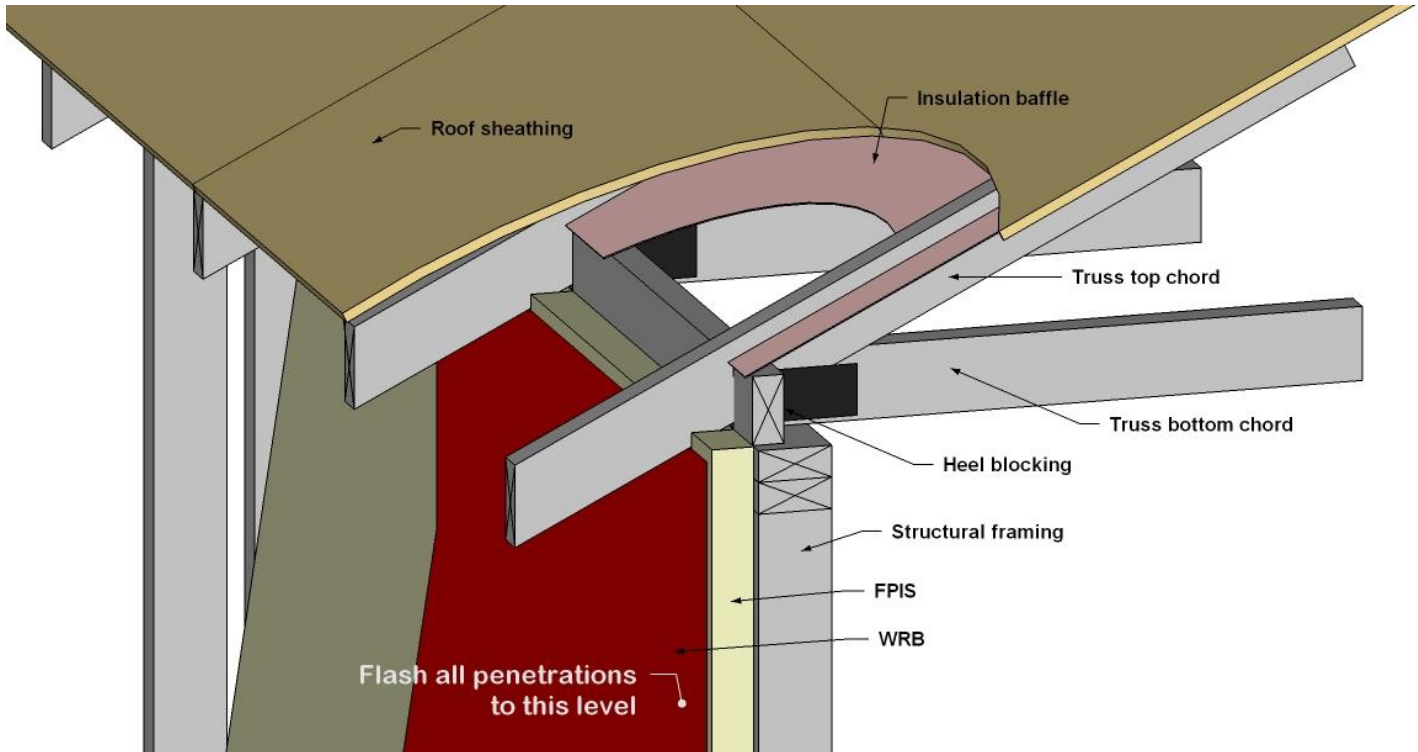
6.4.5 *Top of Wall – Eave*

6.4.5.1 Rafter, standard truss heel, high truss heel, and cantilevered truss

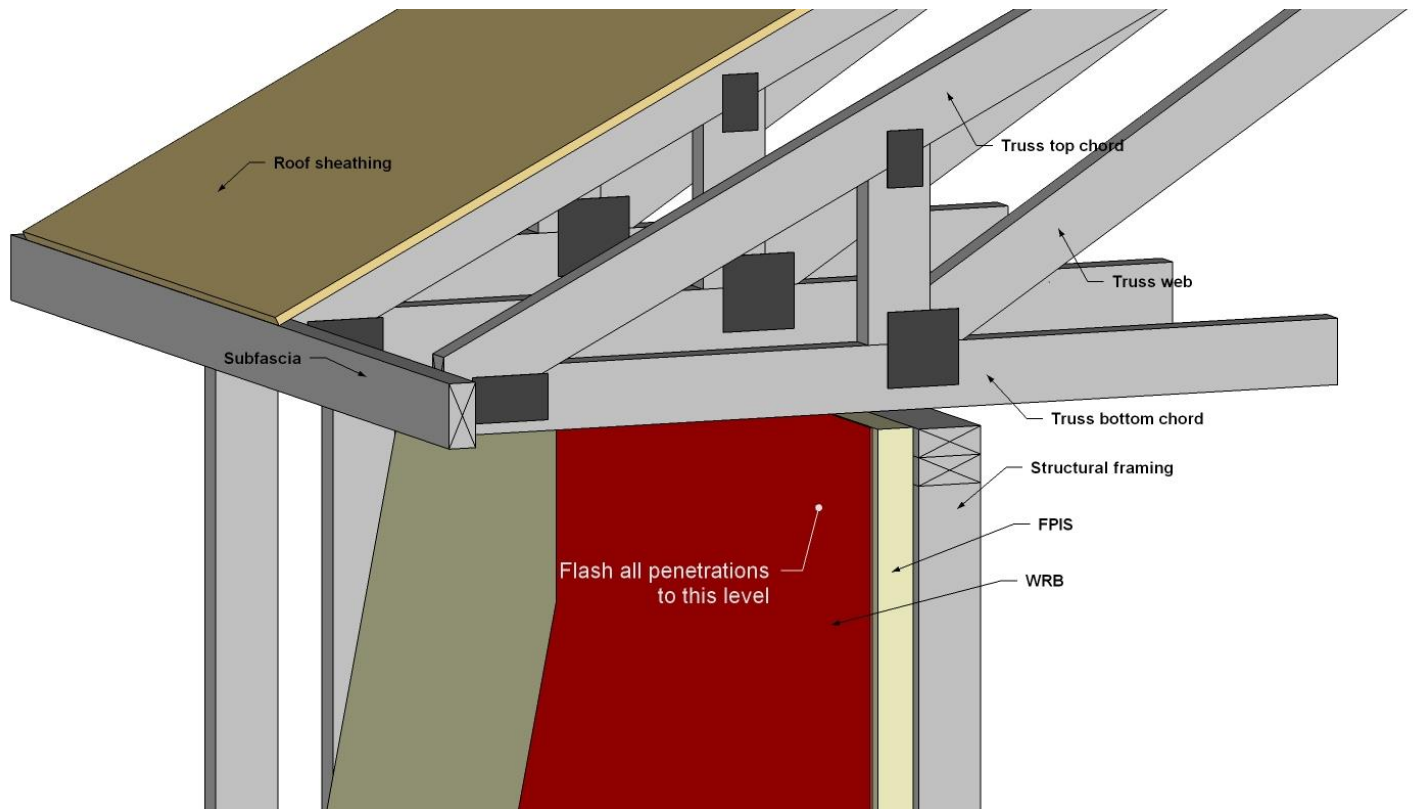


**Figure 20.** Top of Wall at Eave with Rafter Construction



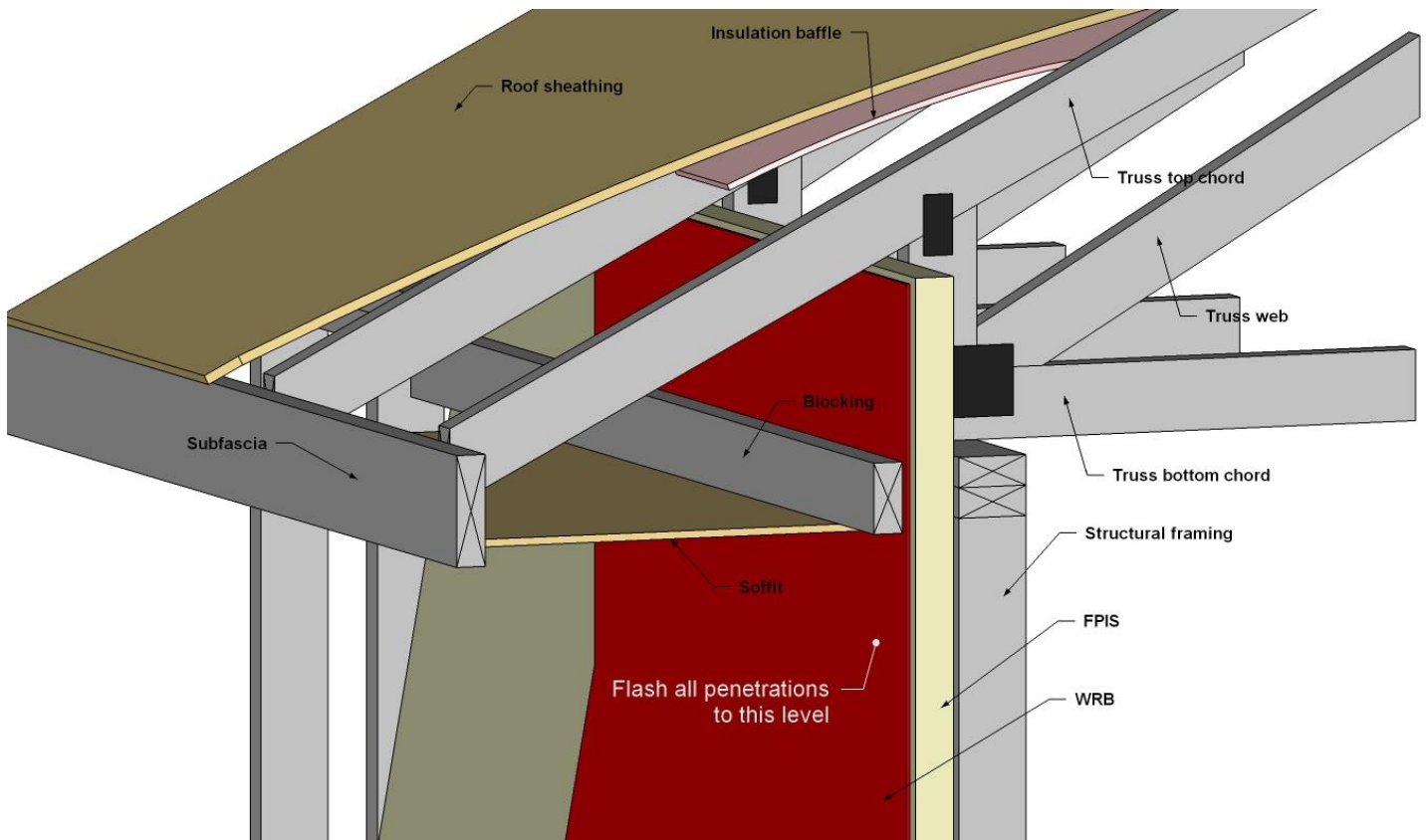


**Figure 21.** Top of Wall at Eave with Standard Heel Truss

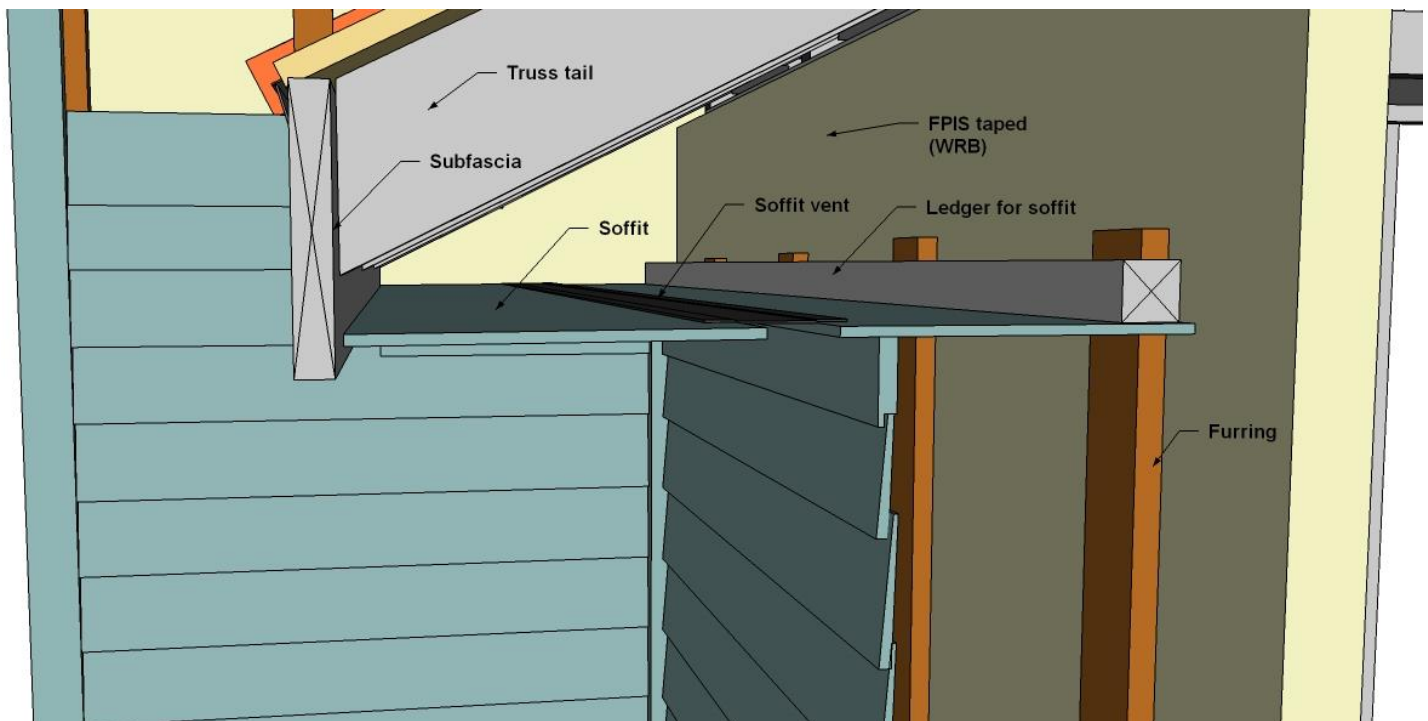


**Figure 22.** Top of Wall at Eave with Cantilever Truss



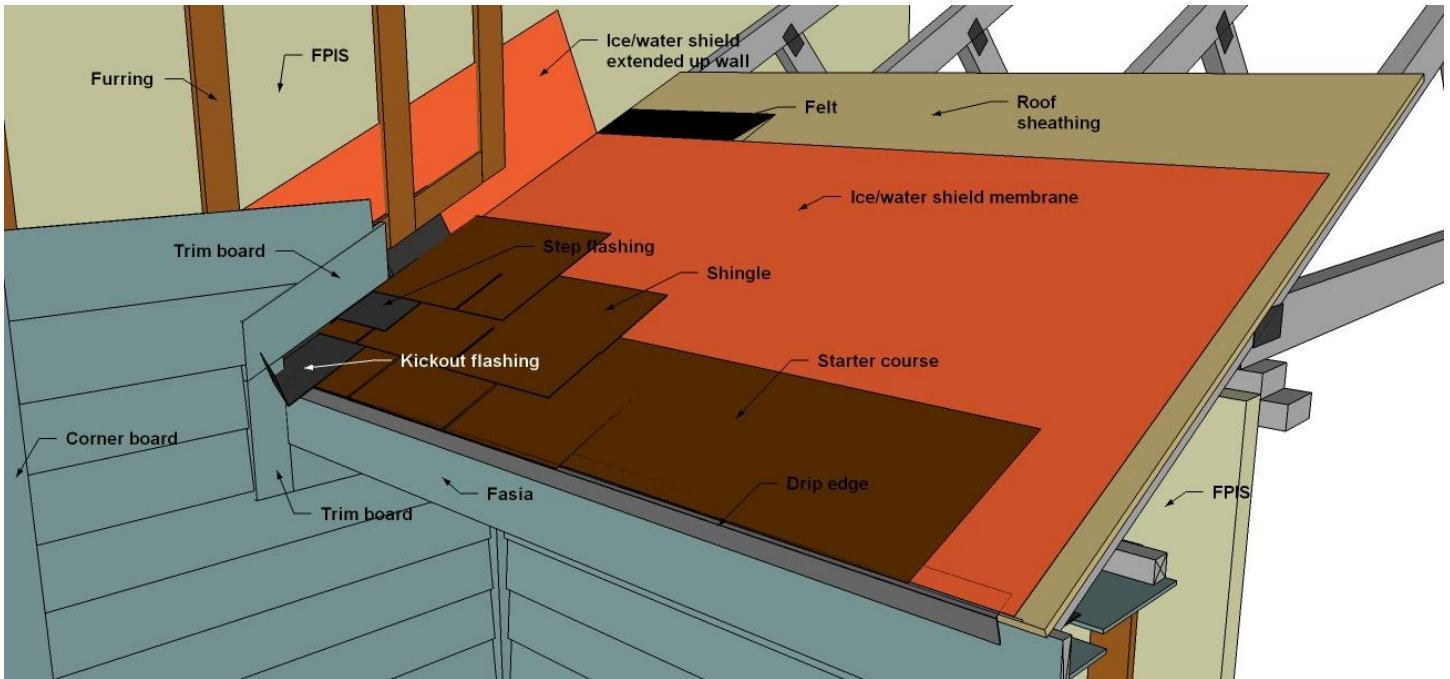


**Figure 23.** Top of Wall at Energy Heel Truss

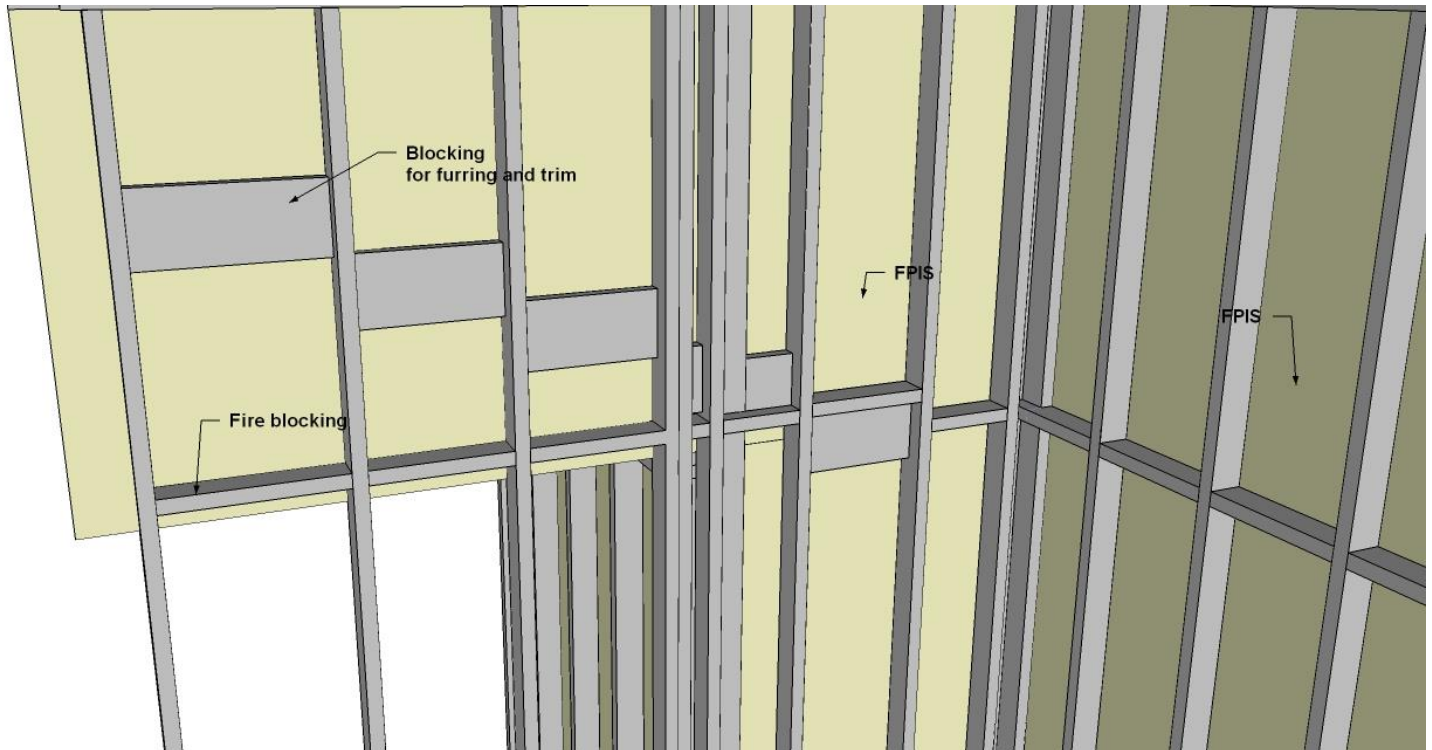


**Figure 24.** Top of Wall Standard Truss Eave Detail with Eave Ledger Attached to Structural Framing Through FPIS

#### 6.4.6 Roof Intersection with Wall



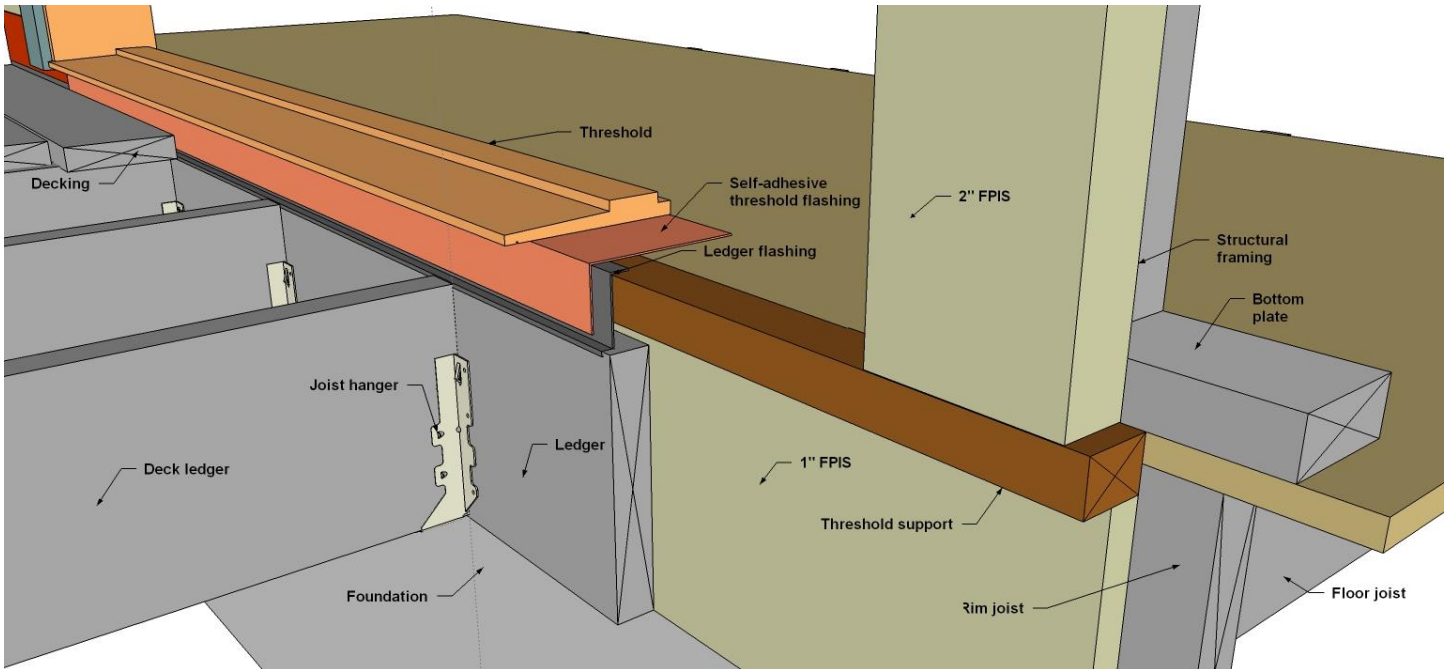
**Figure 25.** Roof Intersecting with Wall (view from outside)



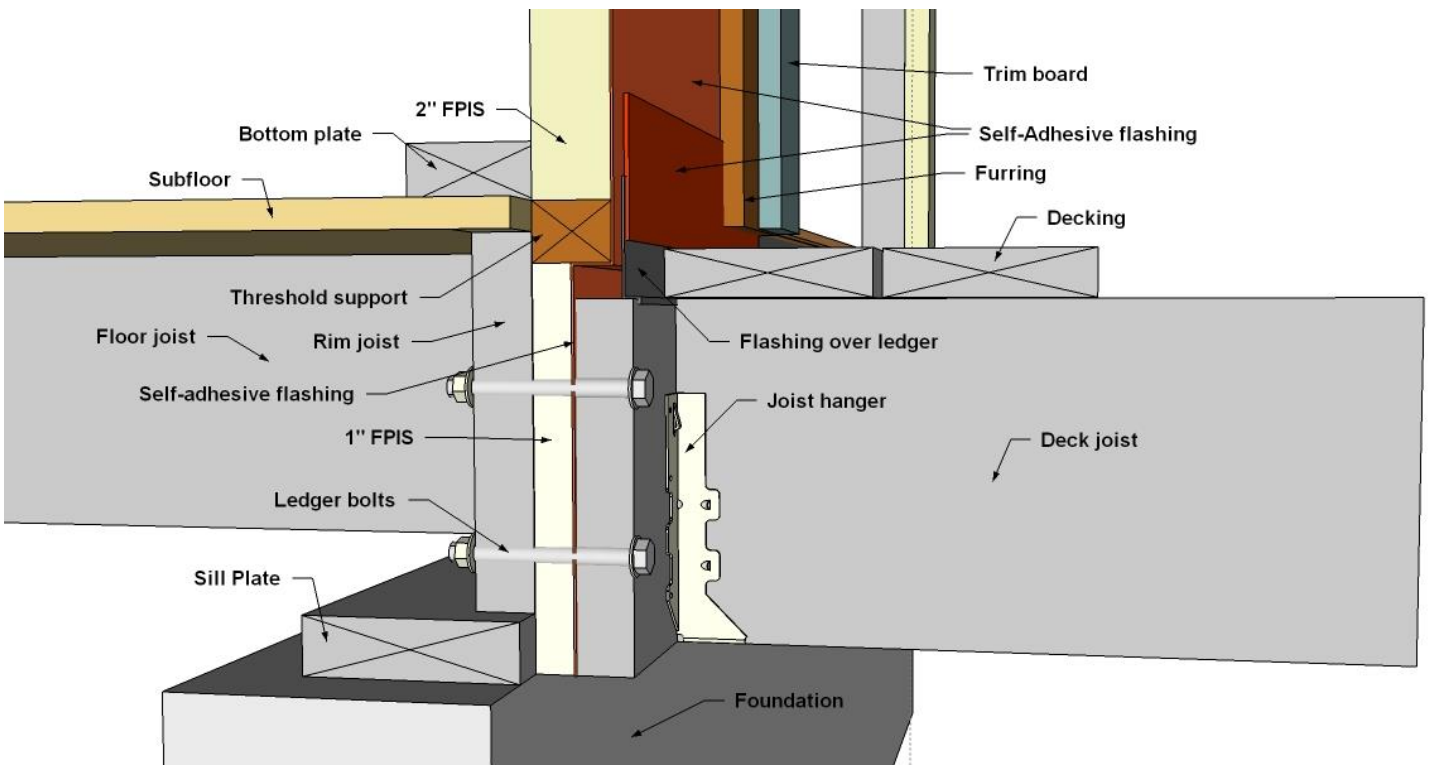
**Figure 26.** Roof Intersecting with Wall (view from inside showing blocking)

#### 6.4.7 Deck Ledger

##### 6.4.7.1 2" FPIS CI at patio door opening (two views of same application) with 1" FPIS behind ledger<sup>20</sup>



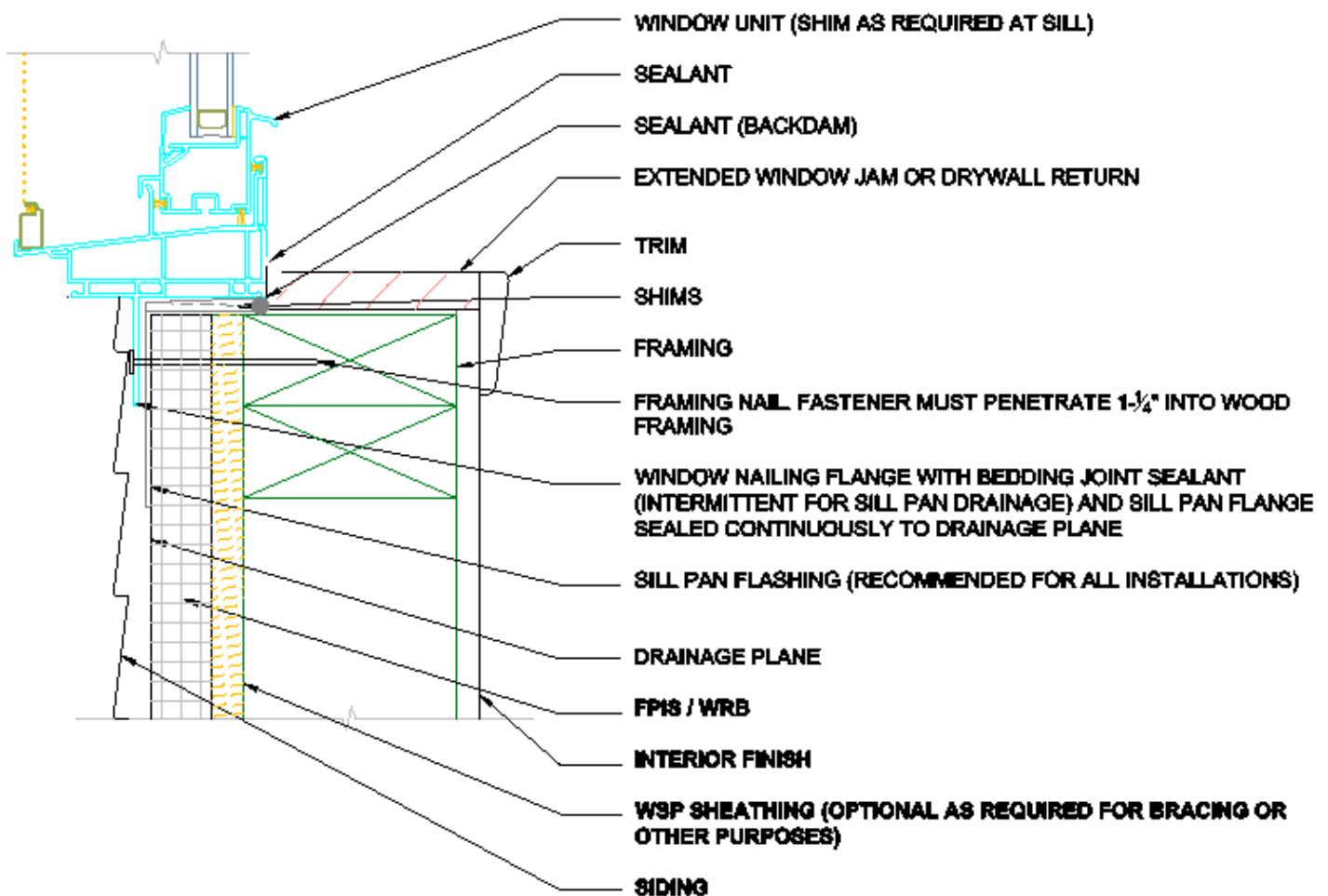
**Figure 27.** Deck Ledger – 2" FPIS Wall Sheathing, 1" FPIS Behind Ledger at Patio Door Opening



**Figure 28.** Deck Ledger – 2" FPIS Wall Sheathing, 1" FPIS behind Ledger at Rim<sup>21</sup>

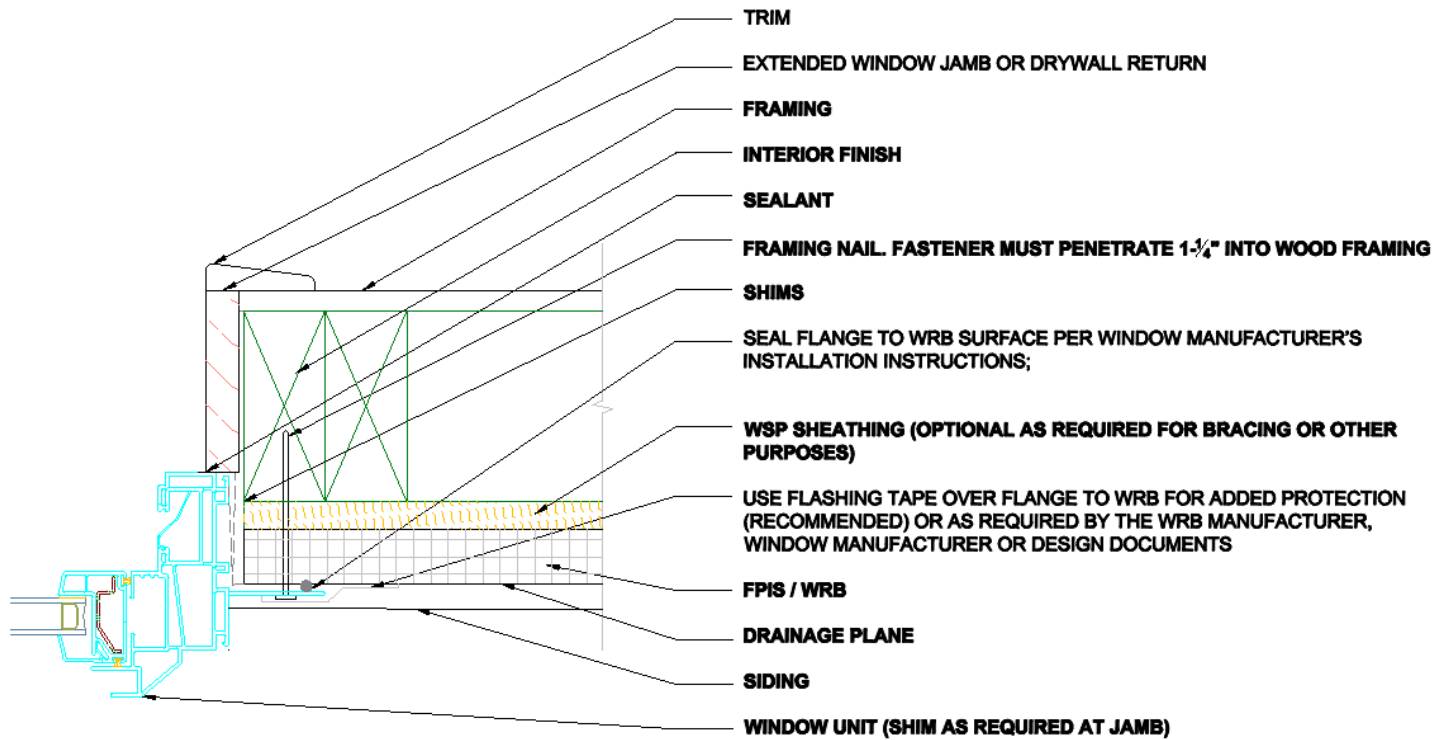
#### 6.4.8 Window/Door Penetration Details

- 6.4.8.1 The following details are for support and weather resistance.
- 6.4.8.2 The following details include windows with integral mounting flanges.
- 6.4.8.3 Frame walls as required by the applicable code.
- 6.4.8.4 Ensure rough opening is square and true.
- 6.4.8.5 Ensure appropriate framing in accordance with window installation method selected and support for FPIS edges is provided.
- 6.4.8.6 *Standard Installation*
  - 6.4.8.6.1 Standard installation concept with window flanges mounted directly over a limited thickness of FPIS.
  - 6.4.8.6.2 The most common method for installing windows in walls with up to approximately 2" thick FPIS and using FPIS as the WRB.
  - 6.4.8.6.3 Use of a separate WRB material is also common and acceptable with appropriate installation and detailing.

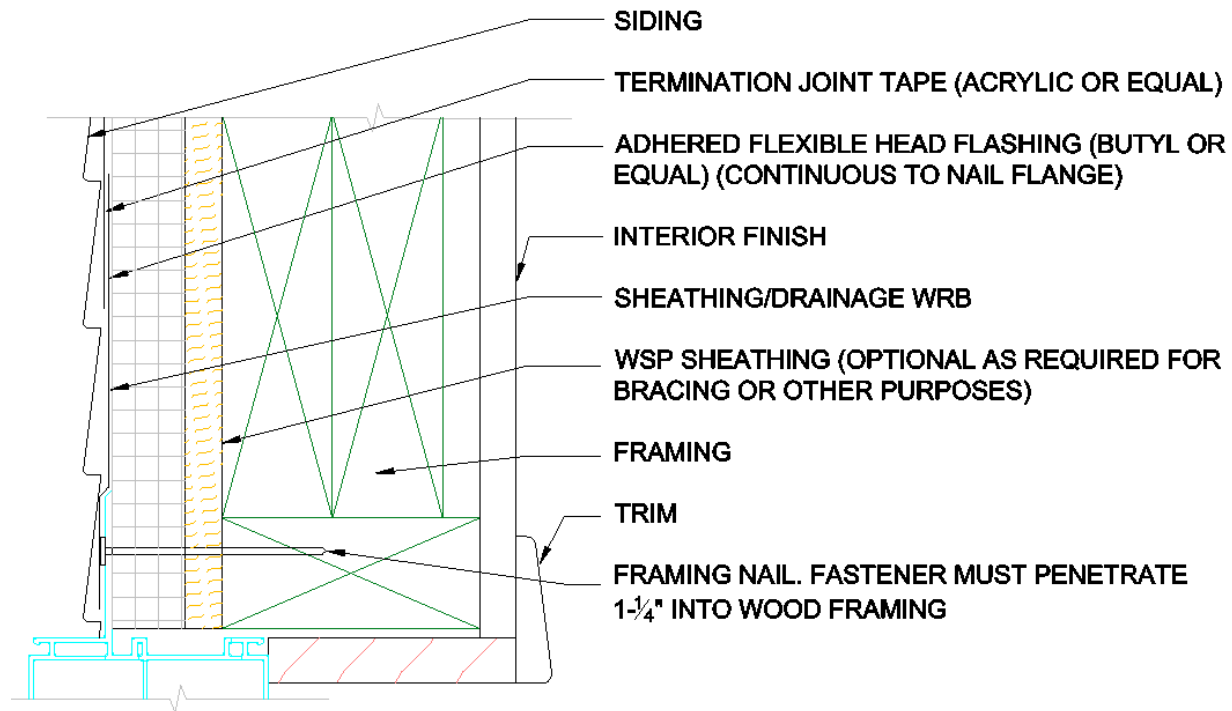


**Figure 29. Standard Installation – Sill**





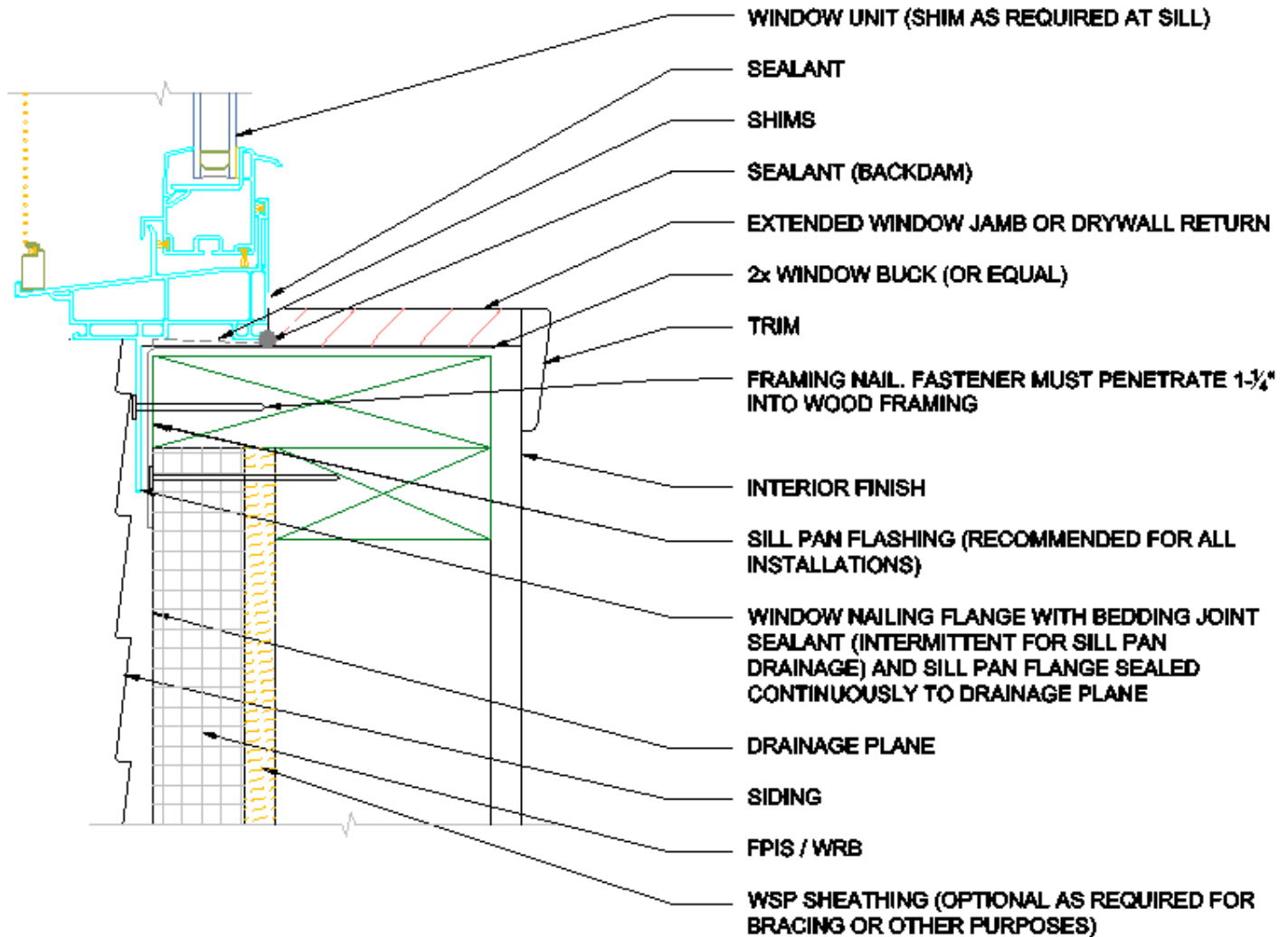
**Figure 30.** Standard Installation – Jamb



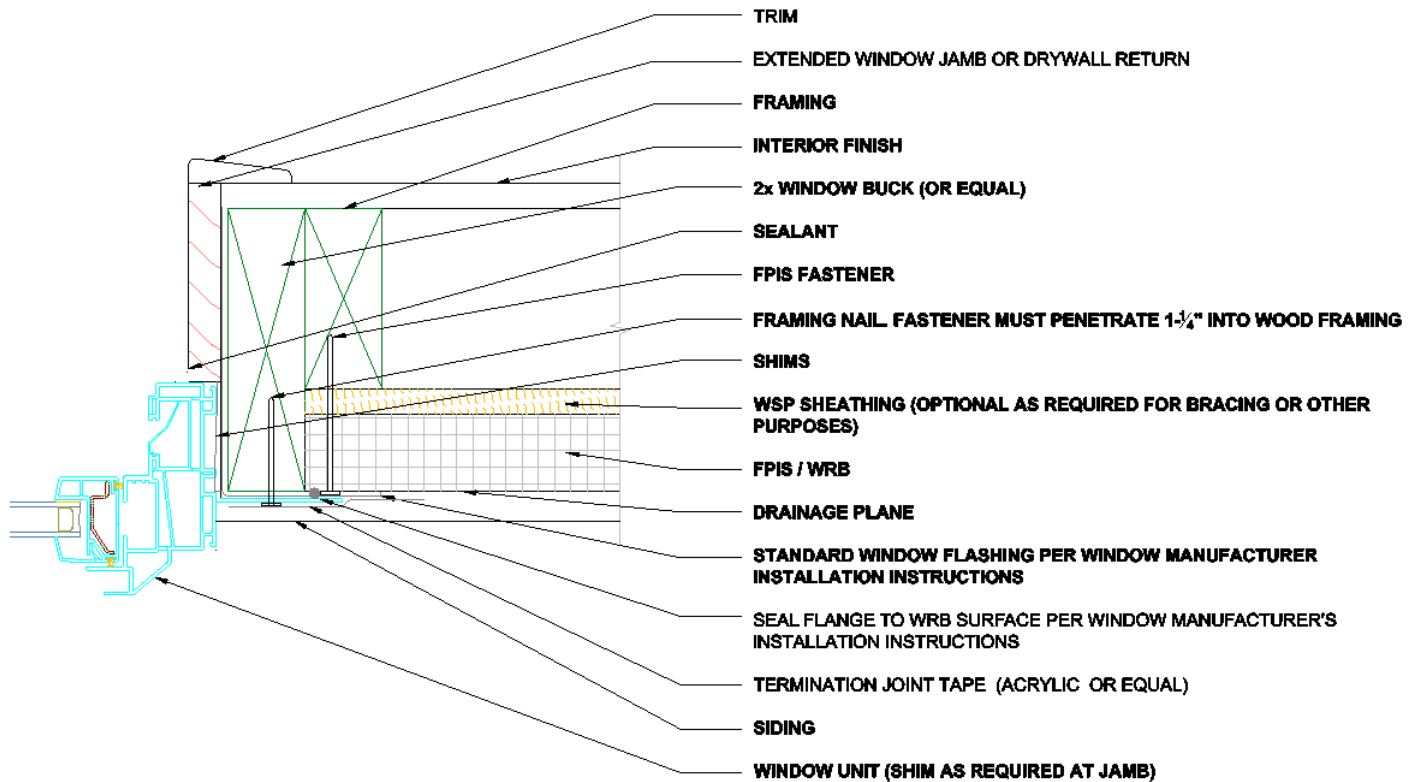
**Figure 31.** Standard Installation – Header

#### 6.4.9 Lumber Window Buck Installation

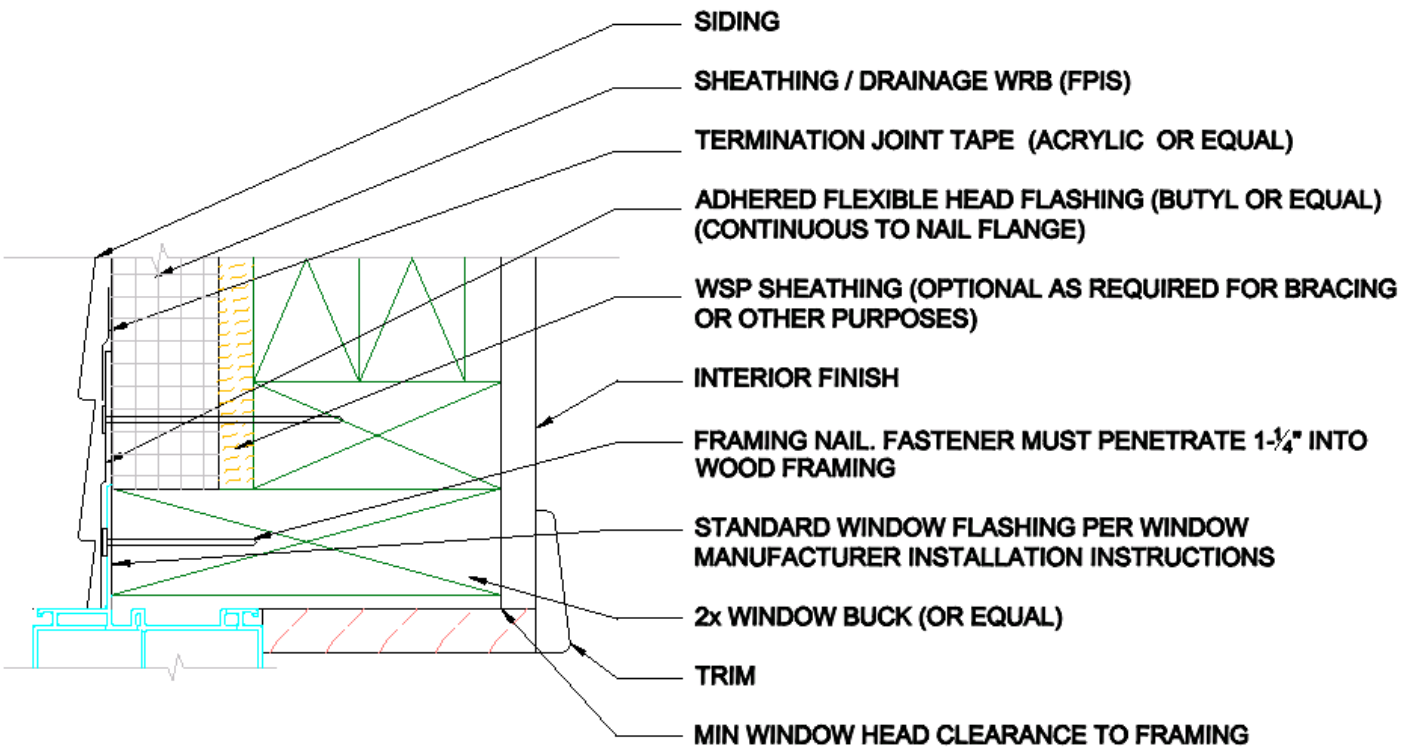
- 6.4.9.1 This concept is a common method for installing windows in walls with generally more than 1½" to 2" thick FPIS and using FPIS as the WRB.
- 6.4.9.2 Use of a separate WRB material is also common and acceptable with appropriate installation and detailing.



**Figure 32.** Wood Buck Installation – Sill



**Figure 33. Wood Buck Installation – Jamb**



**Figure 34. Wood Buck Installation – Header**



#### 6.4.10 Picture Frame Installation

- 6.4.10.1 This concept is with window flanges mounted directly to the picture frame and represents a common method for installing windows typically used for foam thicknesses of  $\frac{3}{4}$ " to  $1\frac{1}{2}$ " to match common lumber dimensions and using FPIS as the WRB.
- 6.4.10.2 Use of a separate WRB material is also common and acceptable with appropriate installation and detailing.

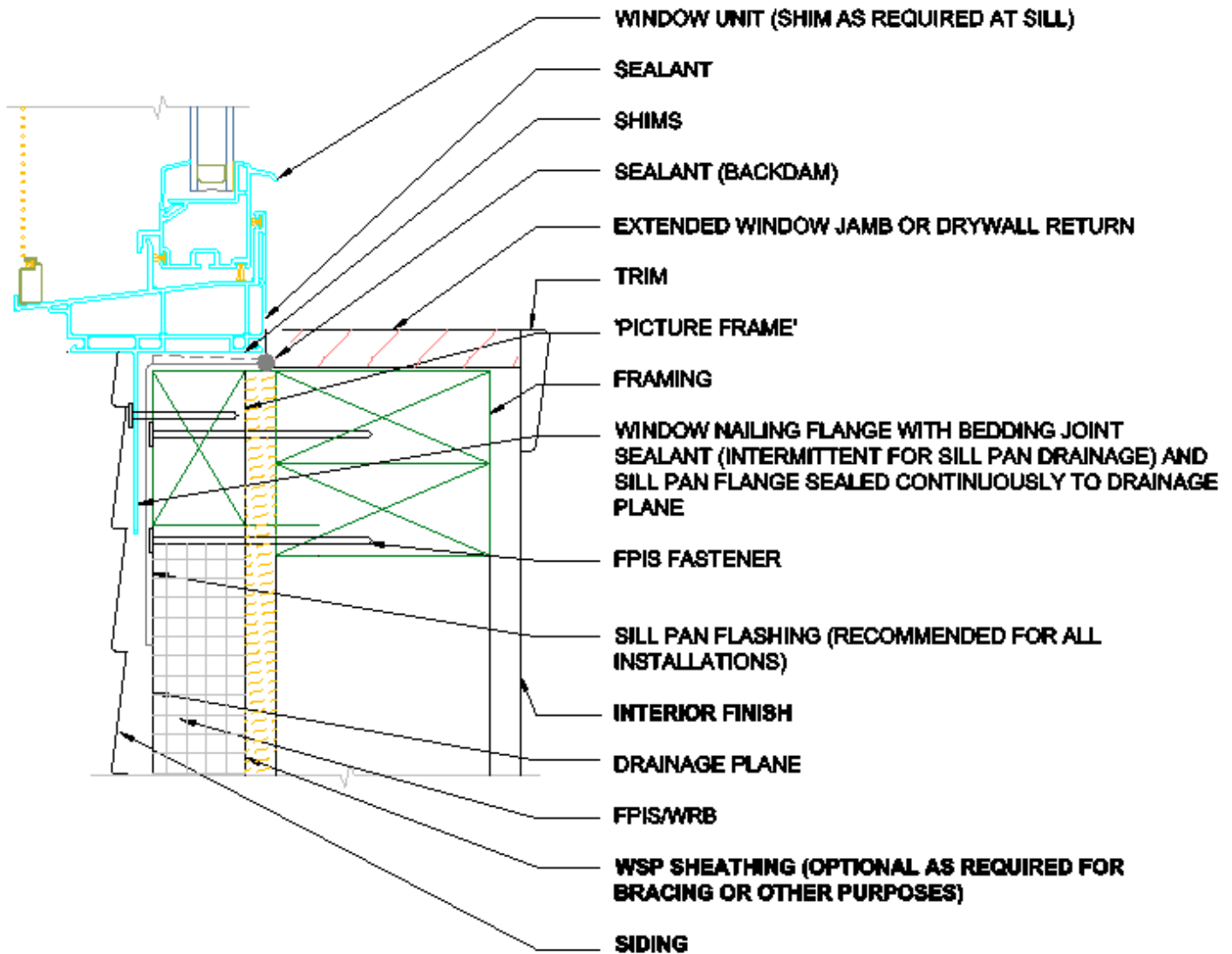
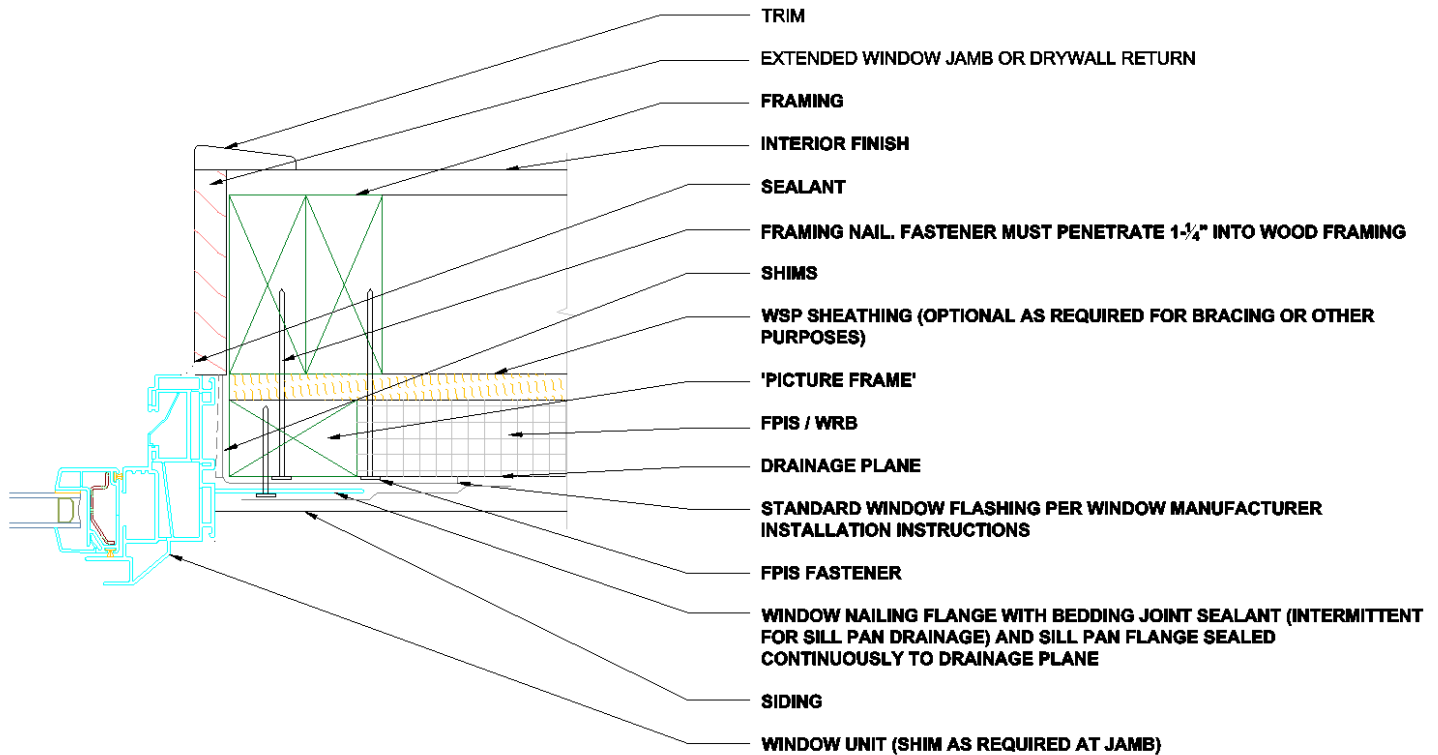
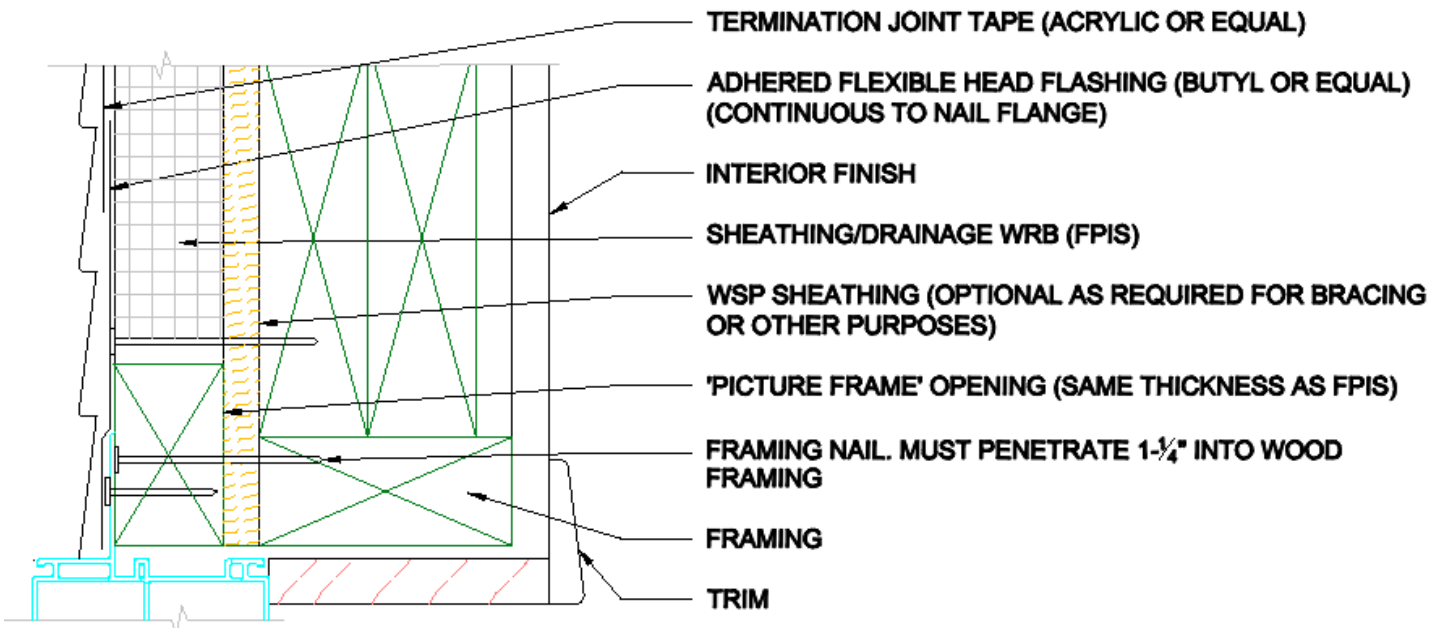


Figure 35. Picture Frame Installation – Sill



**Figure 36.** Picture Frame Installation – Jamb



**Figure 37.** Picture Frame Installation – Header

#### 6.4.11 Rainscreen Installation

- 6.4.11.1 This concept is with window flanges and furring mounted directly over any thickness of FPIS. Uses FPIS as the WRB.
- 6.4.11.2 Use of a separate WRB material is also common and acceptable with appropriate installation and detailing.

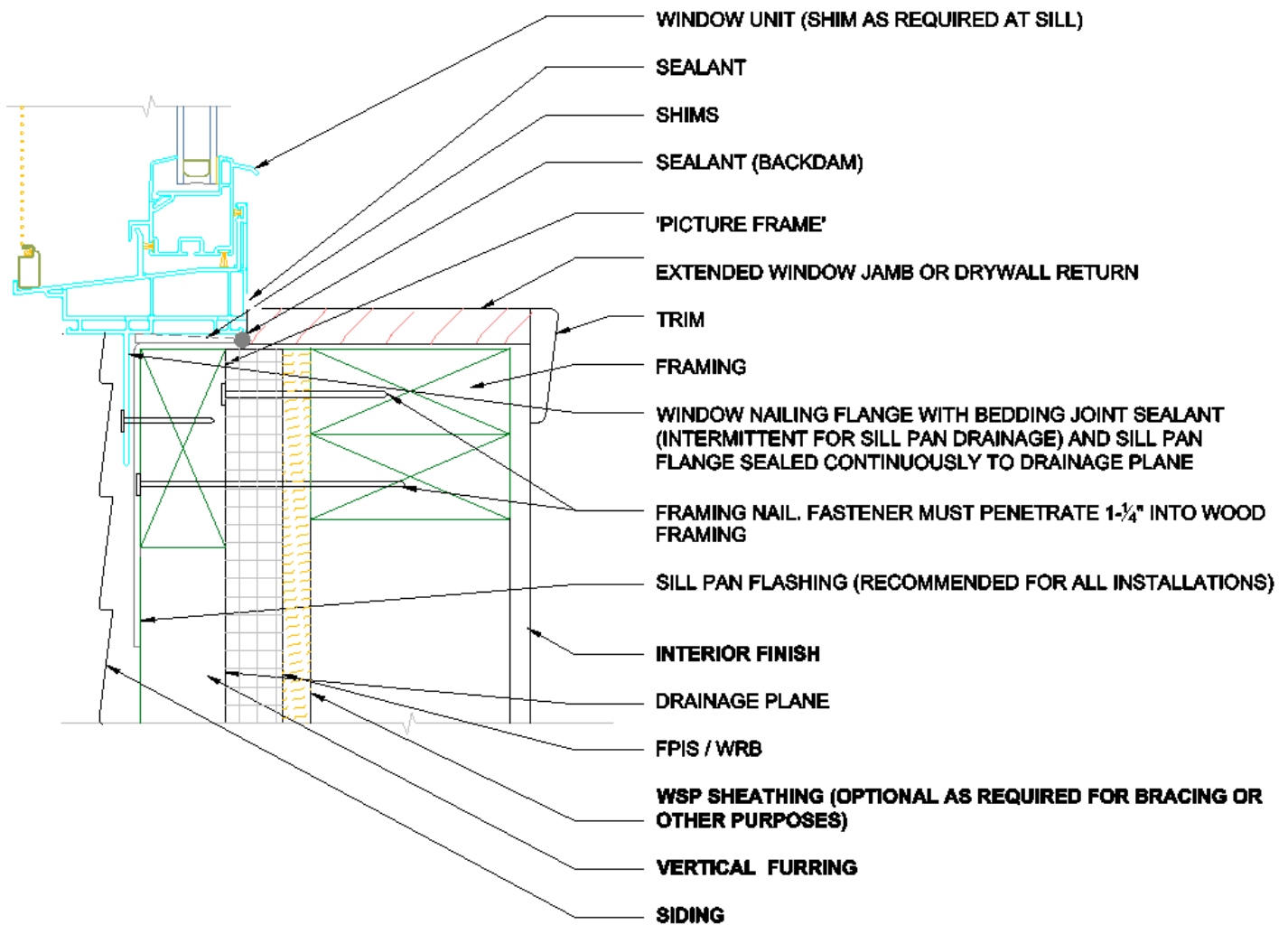
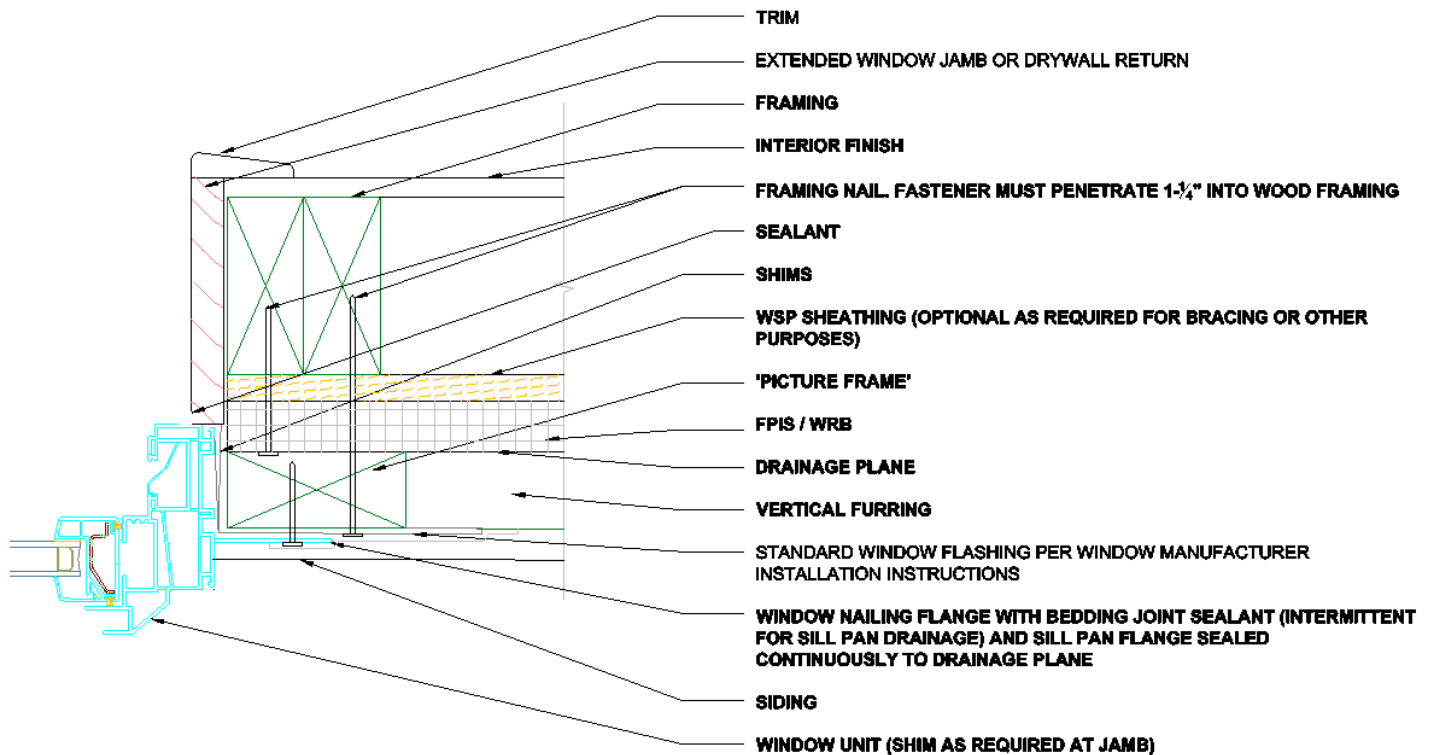
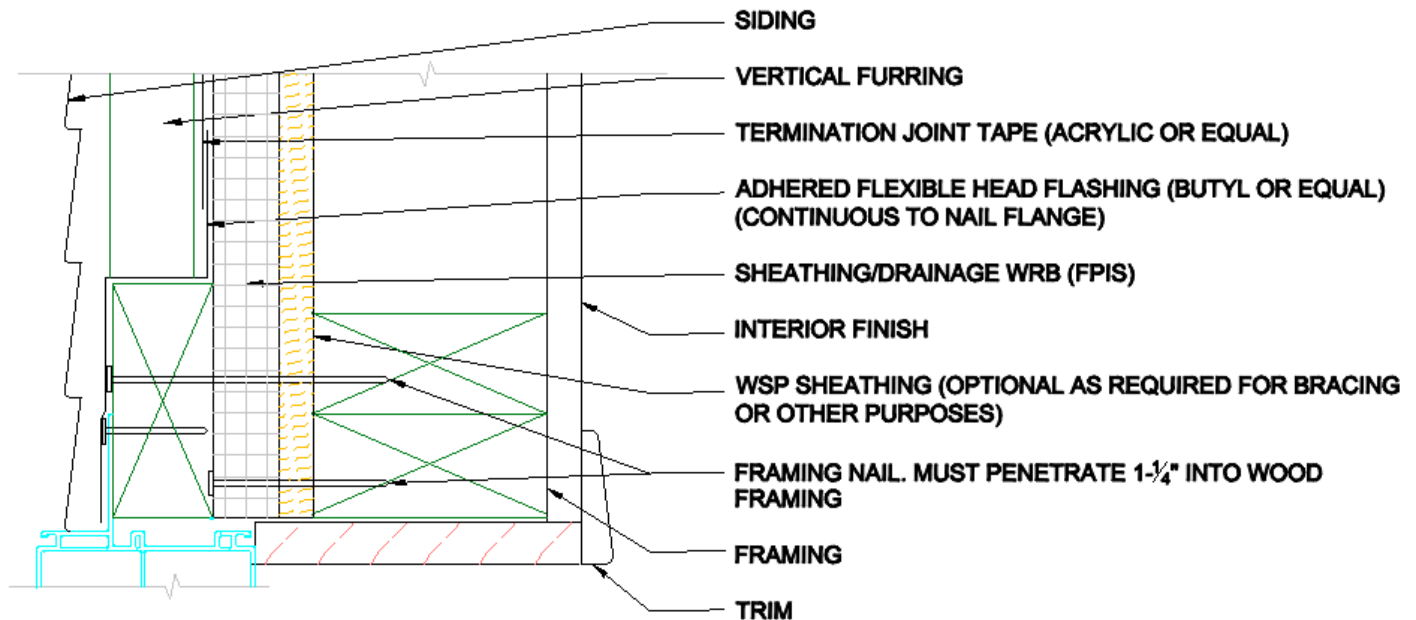


Figure 38. Rainscreen Installation – Sill

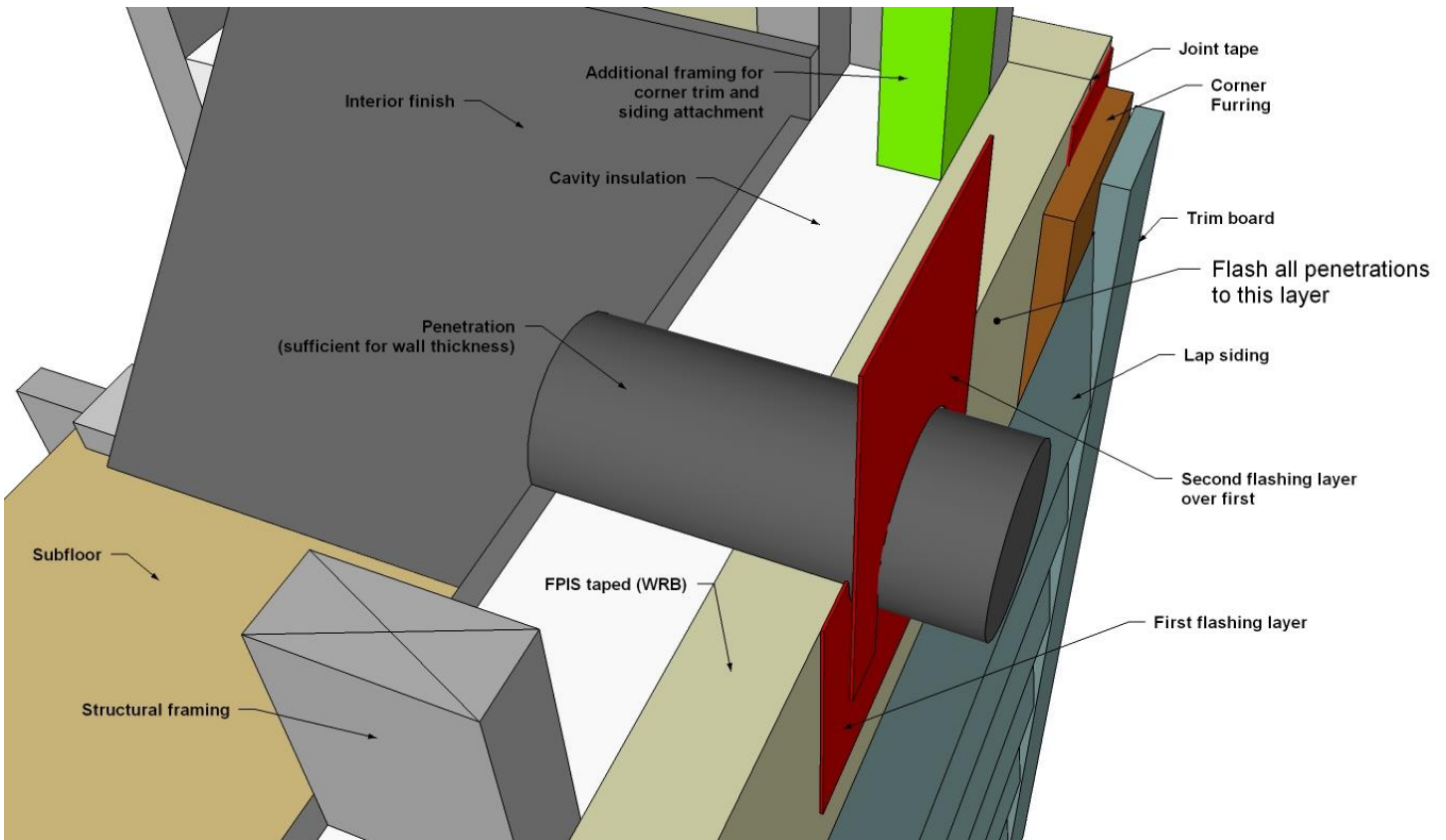


**Figure 39. Rainscreen Installation – Jamb**



**Figure 40. Rainscreen Installation – Header**

## 6.5 Other Penetrations



**Figure 41.** Penetration – 2" FPIS Taped Joints, Furring, Lap Siding

## 7 Substantiating Data

7.1 The following documents summarize the assessment for code compliance for the evaluated products listed in **Section 1.1:**

- 7.1.1 [DRR 1202-01: NFPA 285 Tested Assemblies Using Foam Plastic Insulating Sheathing Products](#)
- 7.1.2 [DRR 1202-03: Foam Plastic Insulating Sheathing Products in Exterior Walls of Type V Construction](#)
- 7.1.3 [DRR 1202-04: Foam Plastic Insulating Sheathing Products in Exterior Walls of Type I, II, III, or IV Construction](#)
- 7.1.4 [DRR 1410-05: Foam Plastic Insulating Sheathing Products & Accessories Used as a Code Compliant Water-Resistive Barrier \(WRB\) System](#)
- 7.1.5 [DRR 1410-06: Foam Plastic Insulating Sheathing Used as an Air Barrier Material in an Air Barrier Assembly](#)
- 7.1.6 Quick Guide: [Cladding Connections to Wood Frame Walls with Foam Plastic Insulating Sheathing \(FPIS\) Continuous Insulation \(ci\)](#)
- 7.1.7 Quick Guide: [Window Installation Instructions for Walls with Continuous Insulation](#)
- 7.2 [ABTGRR 1410-03: Assessment of Water Vapor Control Methods for Modern Insulated Light-Frame Wall Assemblies](#)
- 7.3 [ABTGRR 1501-02: Assessment of Moisture Control & Insulation Requirements in Vermont's Final Draft 2015 Residential Building Energy Standard \(RBES\) and Handbook](#)

- 7.4 [ABTGRR 1504-03: Water-Resistive Barriers: Assuring Consistent Assembly Water-Penetration Resistance](#)
- 7.5 [Attachment of Exterior Wall Coverings Through Foam Sheathing](#)
- 7.6 [Foam Sheathing Used as a Water-Resistive Barrier System](#)
- 7.7 [Window Installation with Foam Sheathing and Wood Framing](#)
- 7.8 Information contained herein may include the result of testing and/or data analysis by sources that are [approved agencies](#), [approved sources](#), and/or [RDPs](#). Accuracy of external test data and resulting analysis is relied upon.
- 7.9 Where pertinent, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as [being equivalent](#)<sup>22</sup> to the regulatory provision in terms of quality, [strength](#), effectiveness, [fire resistance](#), durability, and safety.
- 7.10 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or [Duly Authenticated Reports](#) from [approved agencies](#) and/or [approved sources](#) provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in [Duly Authenticated Reports](#), may be dependent upon published design properties by others.
- 7.11 Testing and engineering analysis: The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.<sup>23</sup>
- 7.12 Where additional condition of use and/or regulatory compliance information is required, please search for Foam Plastic Insulating Sheathing (FPIS) products on the [DrJ Certification website](#).

## 8 Findings

- 8.1 As outlined in **Section 5**, Foam Plastic Insulating Sheathing (FPIS) products have performance characteristics that were tested and/or meet applicable regulations and are suitable for use pursuant to its specified purpose.
- 8.2 The products listed in **Section 1.1** have been evaluated in the context of the reference standards and codes listed in **Section 4**, and are found to be compliant with all known state and local building codes.
  - 8.2.1 Refer to the evaluation reports for the products from each of the manufacturers and products listed in **Section 1.1** for more details.
- 8.3 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, Foam Plastic Insulating Sheathing (FPIS) products shall be approved for the following applications:
  - 8.3.1 Use in light-frame construction. The details shown herein are details for the installation of FPIS in accordance with the applicable codes referenced herein.
- 8.4 Any application specific issues not addressed herein can be engineered by an RDP.
- 8.5 [IBC Section 104.2.3](#)<sup>24</sup> ([IRC Section R104.2.2](#)<sup>25</sup> and [IFC Section 104.2.3](#)<sup>26</sup> are similar) in pertinent part states:

**104.2.3 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved.
- 8.6 **Approved:**<sup>27</sup> Building regulations require that the [building official](#) shall accept [Duly Authenticated Reports](#).<sup>28</sup>
  - 8.6.1 An [approved agency](#) is "approved" when it is [ANAB ISO/IEC 17065 accredited](#).
  - 8.6.2 An [approved source](#) is "approved" when an [RDP](#) is properly licensed to transact engineering commerce.



- 8.6.3 Federal law, [Title 18 US Code Section 242](#), requires that where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

## 9 Conditions of Use

- 9.1 Where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.
- 9.2 Interior finish shall comply with the locally applicable building code and approved construction documents (typically 1/2" gypsum wall board is used on the interior to comply with thermal barrier requirements for walls with FPIS on the exterior side).
- 9.3 Interior vapor retarder class (Class I, I, or III) shall be in accordance with the locally applicable building code and approved construction documents.
- 9.4 Wood or cold-formed steel framing shall comply with the locally applicable building code and approved construction documents. Where required, framing or blocking shall be provided for attachment of interior and exterior finish materials.
- 9.5 Wall bracing method and amount shall comply with the locally applicable building code and approved construction documents. Applicable bracing methods include continuous or intermittent structural panel bracing, wood let-in bracing, and metal strap bracing. Where intermittent panel bracing is used, FPIS continuous insulation thickness shall be reduced to maintain a uniform wall thickness as permitted by the locally applicable energy code.
- 9.6 Cavity insulation type and amount shall comply with the locally applicable energy code.
- 9.7 Continuous insulation type shall comply with this research report (**Section 2**) and shall be installed in accordance with the manufacturer installation instructions and the locally applicable building code. The amount of continuous insulation shall comply with the locally applicable building code (depending on class of interior vapor retarder used, climate zone, and amount of cavity insulation) and the locally applicable energy code (depending on climate zone).
- 9.8 The water-resistive barrier installation and flashing or sealing method at wall penetrations and transitions or discontinuities shall comply with the locally applicable building code, approved construction documents, WRB and flashing manufacturer installation instructions, and window and door component manufacturer installation instructions. The WRB layer may be a separate membrane, FPIS sheathing, or other method approved for use as a water-resistive barrier.
- 9.8.1 When FPIS is designated as the WRB, all board joints, seams, terminations, and penetrations (such as windows, doors, and service entries) shall be flashed and sealed to create a continuous barrier to liquid water intrusion. The materials and methods used for flashing and sealing, including joint tapes, self-adhered membranes, liquid-applied flashing, and sealants, must be explicitly specified as compatible and approved for use with the specific FPIS product by the FPIS manufacturer. Compatibility shall be verified through the FPIS manufacturer's current evaluation report and published installation instructions. The use of any flashing or sealing product not explicitly approved by the FPIS manufacturer is outside the scope of this report.
- 9.8.2 Refer to additional information in [DRR 1410-05](#).
- 9.9 A continuous air-barrier layer shall be provided in accordance with the locally applicable energy code. The air-barrier layer may be designated as the FPIS layer, the interior finish layer, the WRB layer, the structural sheathing layer, or other continuous material layer meeting the requirements for an air barrier.
- 9.9.1 Joints, penetrations, and transitions shall be sealed to maintain continuity of the air barrier.



- 9.9.2 Refer to the manufacturer data and installation instructions for approved air-barrier materials, components, and assemblies. Refer to additional information in [DRR 1410-06](#).
- 9.10 Window and door installations shall comply with the manufacturer installation instructions. Where application over FPIS is not addressed, refer to one or more of the following for guidance:
- 9.10.1 [Continuous Insulation and Residential Windows](#)
  - 9.10.2 [Window Installation in Walls with Foam Sheathing](#)
  - 9.10.3 [Installation and Performance of Flanged Fenestration Units Mounted on Walls with Foam Plastic Insulation Sheathing](#)
- 9.11 Cladding installation over foam sheathing shall comply with the locally applicable building code or an approved design, or an approved attachment method complying with the cladding connections resources at [continuousinsulation.org](#). Cladding fasteners shall penetrate into framing members for the required minimum embedment depth. Attachment to an approved sheathing material on when approved by design or specifically permitted by the locally applicable building code.
- 9.12 Furring installation over FPIS, where used as a means of cladding installation, shall comply with the locally applicable building code, approved design, or an approved attachment method complying with the cladding connections resources at [continuousinsulation.org](#). Cladding attachment to furring shall comply with the cladding manufacturer installation instructions and the locally applicable building code.
- 9.13 Fire safety requirements for walls with FPIS shall comply with the locally applicable building code and approved construction documents. Refer to [DRR 1202-01](#), [DRR 1202-03](#), and [DRR 1202-04](#).
- 9.14 It is the user's responsibility to ensure the wall assembly as a whole and all specified materials or components (as generally represented in this research report) are properly integrated as a system that complies with all applicable building code provisions, approved construction documents, manufacturer installation instructions, and good construction practice.
- 9.15 It is the user's responsibility to determine appropriate construction sequence and inspection sequence to ensure a quality installation that meets or exceeds the administrative and functional intent of the building code. Items that will be concealed during construction, such as the WRB layer and flashing, should be inspected and functionally verified prior to concealment. A functioning WRB layer and flashing system and other necessary weather-resistive barrier components should be installed to prevent moisture intrusion prior to installation of wall cavity insulation, vapor retarders, and interior finishes. It is the responsibility of the user to ensure materials are dry prior to wall enclosure.
- 9.16 At a minimum, this product shall be installed per **Section 6** of this DRR.
- 9.17 When required by adopted legislation and enforced by the [building official](#), also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:
- 9.17.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an [approved source](#), shall be approved when signed and sealed.
  - 9.17.2 This report and the installation instructions shall be submitted at the time of [permit](#) application.
  - 9.17.3 The review of this report by the AHJ shall comply with [IBC Section 104](#) and [IBC Section 105.4](#).
  - 9.17.4 These Foam Plastic Insulating Sheathing (FPIS) products have an internal quality control program and a third party quality assurance program in accordance with [IBC Section 110.4](#), [IBC Section 104.7.2](#),<sup>29</sup> [IBC Section 1703](#), [IRC Section R109](#),<sup>30</sup> and [IRC Section R109.2](#).
  - 9.17.5 The application of these Foam Plastic Insulating Sheathing (FPIS) products in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by [IBC Section 110.3](#), [IRC Section R109.2](#), and any other regulatory requirements that may apply.

- 9.18 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, “the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new material or assemblies as provided for in Section 104.2.3,”<sup>31</sup> all of IBC Section 104 and IBC Section 105.4. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing<sup>32</sup> stating the nonconformance.
- 9.19 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

## 10 Identification

- 10.1 The Foam Plastic Insulating Sheathing (FPIS) products listed in **Table 1** are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at the respective FSC member websites provided at [americanchemistry.com/industry-groups/foam-sheathing-committee-fsc](http://americanchemistry.com/industry-groups/foam-sheathing-committee-fsc).

## 11 Review Schedule

- 11.1 This report is subject to periodic review and revision. For the latest version, visit [drjengineering.org](http://drjengineering.org).
- 11.2 For information on the status of this report, please contact [DrJ Engineering](http://DrJ Engineering).

## Notes

- <sup>1</sup> For more information, visit [drjengineering.org](http://drjengineering.org) or call us at 608-310-6748.
- <sup>2</sup> [2021 IBC Section 1702](#)
- <sup>3</sup> Alternative Materials, Design, and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review <https://www.justice.gov/atr/mission> AND [2021 IBC Section 104.11](#).
- <sup>4</sup> [2021 IBC Section 1706](#)
- <sup>5</sup> The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice: [2021 IBC Section 1706.1](#).
- <sup>6</sup> [2021 IBC Section 1707.1](#)
- <sup>7</sup> [2021 IBC Section 1703.4.2](#)
- <sup>8</sup> [2021 IBC Definitions: Approved Agency](#)
- <sup>9</sup> [2021 IBC Definitions: Approved Source](#)
- <sup>10</sup> All ideas, engineering analysis, and test data are proprietary [intellectual property \(IP\)](#) and [trade secrets \(TS\)](#) and should not be provided to anyone. In particular, public regulatory officials are subject to freedom of information act requests – [federal and state public records acts](#). This means that IP and TS will be in the public domain when any information is provided. In addition, each state also has legislation that mimics the federal [Defend Trade Secrets Act 2016 \(DTSA\)](#), where providing test reports, engineering analysis, and/or other related IP/TS is subject to [prison of not more than 10 years and/or a \\$5,000,000 fine or 3 times the value of the IP and TS](#). To follow DTSA and to comply with state public records and trade secret legislation requires approval through [ANAB ISO/IEC 17065 accredited certification bodies](#) or [approved sources](#). For more information, please visit <http://www.drjengineering.org/AppendixC> and <https://www.drjcertification.org/cornell-2016-protection-trade-secrets>.
- <sup>11</sup> <https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional> AND <https://apassociation.org/list-of-engineering-boards-in-each-state-archive/>
- <sup>12</sup> [2021 IBC Section 104](#)
- <sup>13</sup> [2021 IBC Section 104.11](#) AND [2021 IBC Section 105.3.1](#)
- <sup>14</sup> [2021 IBC Section 1707.1](#)
- <sup>15</sup> <https://www.justice.gov/crt/deprivation-rights-under-color-law> AND <https://www.justice.gov/atr/mission>
- <sup>16</sup> Unless otherwise noted, all references in this Listing are from the 2024 version of the codes and the standards referenced therein. This material, product, design, service, and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.
- <sup>17</sup> Furring as shown in **Figure 3** is optional unless specifically required for the cladding installation (e.g., horizontal furring for wood shake and shingle installation). Furring is recommended for applications where additional drainage and ventilation of cladding is preferable and where FPIS thickness exceeds approximately 2".
- <sup>18</sup> See the stucco provisions in [IBC Section 2510.6](#) and [IRC Section R703.7.3](#) regarding water resistant barrier (WRB) application. WRB Layer 1 is not necessary where FPIS with taped joints is used as the WRB Layer 1. WRB Layer 2 is not necessarily required where self-furring lath is used to create a drainage space and separate the PC Stucco from bonding to the WRB surface. However, WRB Layer 2 is recommended to provide added protection WRB Layer 1 during installation of lath.
- <sup>19</sup> See the stucco provisions in [IBC Section 2510.6](#) regarding WRB application. The WRB layer would not be required if the FPIS were approved and specified as a WRB and joints sealed with an approved tape or sealing method.
- <sup>20</sup> An alternative is to specify a separately supported deck. For additional information, see [IBC Section 1604.8.3](#), [IRC Section R507](#), and AWC TR 12.
- <sup>21</sup> Deck ledger connect to house through FPIS must be designed.
- <sup>22</sup> [2021 IBC Section 104.11](#)
- <sup>23</sup> See Code of Federal Regulations (CFR) [Title 24 Subtitle B Chapter XX Part 3280](#) for definition.
- <sup>24</sup> [2021 IBC Section 104.11](#)
- <sup>25</sup> [2021 IRC Section R104.11](#)
- <sup>26</sup> [2021 IFC Section 104.10](#), [2018 IFC Section 104.9](#)
- <sup>27</sup> Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC [Section 201.4](#) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.
- <sup>28</sup> [2021 IBC Section 1707.1](#)
- <sup>29</sup> [2021 IBC Section 110.4](#)
- <sup>30</sup> [2021 IRC Section R104.4](#)
- <sup>31</sup> [2021 IBC Section 104.11](#)
- <sup>32</sup> [2021 IBC Section 104.11](#) AND [2021 IBC Section 105.3.1](#)