



Installation Guide and Detailing Options for Compliance with ASTM C1780

for Adhered Manufactured Stone Veneer
4th Edition 1st Printing



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Disclaimer

This Guide addresses generally accepted methods and details for the installation of Adhered Manufactured Stone Veneer. To the best of our knowledge, it is correct and up to date. However, the document is designed only as a guide; and it is not intended for any specific construction project. The MVMA and NCMA makes no express or implied warranty or guarantee of the techniques, construction methods or materials identified herein.

It is understood that there are alternative means or methods that might be required and/or recommended based on project conditions, manufacturer's recommendations, or product characteristics.

This Guide for builders, architects, designers, masons, installers and other construction professionals illustrates typical applications of Adhered Manufactured Stone Veneer. Details in this guide that address the installation and detailing of Adhered Manufactured Stone Veneer and its interface with other building components are not intended as specific recommendations. It is the responsibility of all design and construction professionals to determine the applicability and appropriate application of any detail to any specific project.

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About

Masonry Veneer Manufacturers Association (MVMA), an affiliate of NCMA, represents the adhered manufactured stone veneer industry's manufacturing companies and their suppliers. The mission of the organization is to advance the growth of the manufactured masonry veneer products industry through proactive technical, advocacy, and awareness efforts.

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Definitions

Adhered Manufactured Stone Veneer (AMSV) — lightweight, architectural, non load-bearing product that is manufactured by wet cast blending cementitious materials and aggregates, with or without pigments, admixtures, or other materials to simulate the appearance of natural stone and other masonry materials.

Note: The MVMA recognizes there are many names used to describe Adhered Manufactured Stone Veneer products. Adhered Manufactured Stone Veneer is used commonly throughout the industry and by some manufacturers. In the International Building Code, Adhered Manufactured Stone Veneer products are referred to as Adhered Masonry Veneer. In the ICC-ES Acceptance Criteria, AC51, the product is called Precast Stone Veneer. This guide will use AMSV (Adhered Manufactured Stone Veneer) when referencing the product.

Backup — The interior or exterior assembly to which AMSV systems are installed.

CMU — Concrete masonry unit.

Coating — A material applied to the surface of an AMSV assembly following construction for aesthetic purposes or to enhance one or more physical properties, such as resistance to staining or moisture penetration.

Corrosion (Degradation) Resistant — A material that is intrinsically resistant to degradation or physically or chemically treated to be so under expected exposure conditions. Examples include plastic-based materials stabilized for exposure to UV light, galvanized ferrous metals, and stainless steel.

Fasteners — Corrosion resistant hardware used to secure lath, screed, and flashing materials to backup system.

Flashing — Corrosion resistant material used to restrict the seepage of water around any intersection or projection of materials in an assembly.

Lath — Corrosion resistant mesh building material fastened to the substrate to act as base for adhering mortar.

Mortar — A mixture of cementitious material, water, and aggregate, with or without the addition of admixtures or additives to alter one or more plastic or hardened properties, used to bond masonry construction materials together and fill spaces between.

Pointing Mortar — Mortar mixture used to fill joints and cavities in AMSV construction, also called grouting mortar.

Mortar Scratch Coat — Base coat of mortar used during the installation of AMSV; cross-raked to improve bond of subsequent mortar layers.

Mortar Screen — Sheet material installed to prevent the mortar scratch coat from filling the drainage space behind the AMSV assembly.

Mortar Setting Bed — Mortar used to adhere the AMSV to the substrate or scratch coat.

Water Resistive Barrier (WRB) — Material used to restrict the transmission of water to the surface behind.

Abbreviations

Blk'g — Blocking

Lbs. — Pounds

Mfr's — Manufacturer's

Min. — Minimum

P.T. — Pressure treated (wood preservative)

Req'd — Required

SAF — Self Adhering Flashing

References

AC38 — ICC-ES Acceptance Criteria for Water Resistive Barriers

AC51 — ICC-ES Acceptance Criteria for Pre-Cast Stone Veneer

AC275 — ICC-ES Acceptance Criteria for Glass Fiber Lath used in Cementitious Exterior Wall Coating or Exterior Cement Plaster (Stucco)

ANSI Accredited Evaluation Service — An ANSI accredited (or equivalent) third-party organization that issues an evaluation report affirming a specific building product meets building code requirements.

International Code Council — Evaluation Service (ICC-ES) — An organization that performs technical evaluations on building products, components, and construction methods for building code compliance. In the case where the building code is silent or ambiguous as to a product's requirements or a specific construction method, ICC-ES may develop "Acceptance Criteria" (AC) for the product or construction method. www.icc-es.org

International Building Code (IBC) — Building code that provides minimum requirements for safety, health, and welfare of life and property from hazards of the built environment. The provisions of this code apply to the construction, alteration, addition, replacement, repair, use and occupancy of all buildings except one and two family dwellings, and single-family townhomes not more than three stories in height. www.iccsafe.org

International Residential Code (IRC) — Building code that provides minimum requirements for safety, health, and welfare of life and property from hazards of the built environment. The provisions of this code apply to the construction, alteration, addition, replacement, repair, use and occupancy of detached one and two family dwellings and single-family townhomes not more than three stories in height. www.iccsafe.org

ANSI — American National Standards Institute, www.ansi.org

ANSI A118.1 — American National Standards Institute Specifications for Dry-Set Portland Cement Mortar

ANSI A118.4 — American National Standards Institute Specifications for Modified Dry-Set Cement Mortars

ANSI A118.15 — American National Standards Institute Specifications for Improved Modified Dry-Set Cement Mortar

TMS 402 — Building Code Requirements for Masonry Structures (TMS 402/ACI 530/ASCE 5). This standard is produced through the joint efforts of the American Concrete Institute (ACI), the Structural Engineering Institute of the American Society of Civil Engineers (SEI/ASCE), and The Masonry Society (TMS). Also referred to as the Masonry Standards Joint Committee (MSJC) Code. www.masonrysociety.org.

References (continued)

TMS 602 — Specification for Masonry Structures (TMS 602/ACI 530.1/ASCE 6). This standard is produced through the joint efforts of the American Concrete Institute (ACI), the Structural Engineering Institute of the American Society of Civil Engineers (SEI/ASCE), and The Masonry Society (TMS). Also referred to as the Masonry Standards Joint Committee (MSJC) Specification. www.masonrysociety.org.

Foam Sheathing Committee of the American Chemistry Council, Guide to Attaching Exterior Wall Coverings Through Form Sheathing to Wood or Steel Wall Framing. www.FSC.AmericanChemistry.com

ICRI — International Concrete Repair Institute, Technical Guideline No. 310.2. www.icri.org

ASTM International — ASTM is a developer of technical standards for products, systems, and services. www.astm.org

ASTM C270 — Standard Specification for Mortar for Unit Masonry

ASTM C482 — Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste

ASTM C847 — Standard Specification for Metal Lath

ASTM C932 — Standard Specification for Surface Applied Bonding Compounds for Exterior Plastering

ASTM C933 — Standard Specification for Welded Wire Lath

ASTM C979/C979M — Standard Specification for Pigments for Integrally Colored Concrete

ASTM C1032 — Standard Specification for Woven Wire Plaster Base

ASTM C1059/C1059M — Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete

ASTM C1063 — Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster

ASTM C1325 — Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

ASTM C1384 — Standard Specification for Admixtures for Masonry Mortars

ASTM C1670 — Standard Specification for Adhered Manufactured Stone Masonry Veneer Units

ASTM C1714/C1714M — Standard Specification for Preblended Dry Mortar Mix for Unit Masonry

ASTM C1780 — Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer

ASTM E2556/E2556M — Standard Specification for Vapor Permeance Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment

ASTM D226/D226M — Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and Water Proofing

Summary Tables

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Wood or steel stud. Spacing of studs no more than 16 inch (406 mm) on center. Rigid Sheathing: Gypsum wall board Plywood OSB Cement Board* Fiber Board Note: Continuous insulation installed over rigid sheathing is limited to a maximum of $\frac{1}{2}$ inch (13 mm) thickness.	Minimum of two separate WRB layers. See Water Resistive Barrier, Discussion Section.	Minimum 2.5 lb/ft ² (1.4 kg/m ²) or 3.4 lb/ft ² (1.8 kg/m ²) self-furring corrosion resistant lath (ASTM C847) Or 18 gauge woven wire mesh (ASTM C1032) or heavier Or Alternate lath acceptable with a product evaluation acceptance report showing compliance to ICC-ES AC 275.	Corrosion resistant fasteners (ASTM C1063) minimum $\frac{3}{4}$ inch (19 mm) nail penetration into wood framing member, or minimum $\frac{3}{4}$ inch (19 mm) staple penetration into wood framing member, or minimum $\frac{3}{8}$ inch (9.5 mm) penetration of metal framing member.	Mortar, nominal $\frac{1}{2}$ inch (13 mm) thick. See mortar section in this Guide for additional information and permitted mortar types. "Scratch" surface when somewhat firm.

*See additional installation options for AMSV over cement board in the interior applications discussion.

Summary Tables (continued)

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Clean Concrete, Masonry / CMU, Stucco Scratch Coat (1 st layer of cement plaster), or Stucco Brown Coat (2 nd layer of cement plaster). Note: walls / surfaces must be clean and free from release agents, paints, stains, sealers, or other bond-break materials that may reduce strength of mortar adhesion.	Note: A WRB may be needed to prevent moisture from penetrating the wall.	Install lath if there is a question or concern regarding ability of veneer to adhere to wall (see additional discussion under Surface Preparation Section): 2.5 lb (1.1 kg) or 3.4 lb (1.5 kg) self-furring $\frac{3}{8}$ inch (9.5 mm) ribbed corrosion-resistant lath (ASTM C 847) Or 18 gauge woven wire mesh (ASTM C 1032) Alternate lath acceptable with a product evaluation acceptance report showing compliance to ICC-ES AC 275.	If lath is applied, use corrosion resistant fasteners (ASTM 1063).	If a scratch coat is required use a nominal $\frac{1}{2}$ inch (13 mm) thick. See mortar section in this Guide for additional information and permitted mortar types. "Scratch" surface when somewhat firm.

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Existing Concrete, Masonry / CMU, Stucco, or Brick (structurally sound) (e.g. painted or not clean) If the wall system is effectively cleaned and with adequate surface roughness, see the table above.	Note: A WRB may be needed to prevent moisture from penetrating the wall.	2.5 lb (1.1 kg) or 3.4 lb (1.5 kg) self-furring $\frac{3}{8}$ inch (9.5 mm) ribbed corrosion-resistant lath (ASTM C847) Or 18 gauge woven wire mesh (ASTM C1032) Alternate lath acceptable with a product evaluation acceptance report showing compliance to ICC-ES AC 275.	Use corrosion resistant fasteners (ASTM C1063).	Nominal $\frac{1}{2}$ inch (13 mm) thick. See mortar section in this Guide for additional information and permitted mortar types. "Scratch" surface when somewhat firm.

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Metal Buildings or other surfaces / wall construction not listed above. See manufacturer for recommendations regarding sheathing.	See manufacturer for recommendations.			

This guide focuses on the installation of AMSV systems for backup assemblies addressed in the tables above. Other backup systems, such as structural insulated panels (SIPs), may require a specifically-designed system of installation for AMSVs. AMSV systems should not be installed over deteriorating or unsound backup assemblies or exterior insulation and finishing systems (EIFS).

Workmanship

This Installation Guide assumes that construction personnel have knowledge of the materials described and their proper methods of installation.

Prior to commencing activity related to the scope of this Guide, review all adjacent products and other work that precedes the installation of AMSV to ensure that proper workmanship is reflected and that there are no recognizable errors or deficiencies.

Quality

A successful project requires the use of quality materials, proper detailing for the application, and a high standard of care during installation. Unfortunately, the execution of these components in the field can be subject to value-engineering resulting in materials being selected based solely on price and installation techniques that focus on speed rather than quality. While the performance of AMSV systems depends upon all three of these components, field workmanship issues tend to be the dominate source of problems when performance issues surface in the field. Installing AMSV in accordance with the recommended practices of this guide and ASTM 1780 helps to ensure AMSV systems perform as intended for decades.

Building Code Requirements

Building code requirements vary from area to area. Check with local authorities for building code requirements for your area and application. Carefully read all sections of this guide and follow the manufacturer's installation instructions before proceeding with your AMSV application. In the event the manufacturer's installation instructions conflict with the intent of statements made in this document, contact the manufacturer for additional guidance.

Project Site Requirements

Jobsite safety is outside of the scope of this guide, however, users should always follow proper job site safety requirements including local, state, and federal laws when installing AMSV products and systems.

Material Requirements

Flashing

All flashing and flashing accessories must be corrosion resistant and integrated with the WRB materials (if present). For exterior

applications flashing must be installed at all through wall penetrations and at terminations of AMSV installations. Flashing is not required for interior applications of AMSV systems not exposed to water. For interior applications that are exposed to water, treat as an exterior assembly.

Rainscreen Drainage Plane Systems

Rainscreens are optional building techniques that are used to improve the drainage of incidental water behind the cladding and reduce drying time. Rainscreen products (such as drainage mats or formed polymer sheeting) or construction techniques (such as strapping or furring) that create a capillary break/air space between the cladding and the primary water resistive barrier can be effectively incorporated into AMSV applications. Refer to the manufacturer's recommendation for rainscreen / drainage system applications with adhered manufactured stone veneer wall systems. Building codes may allow a single layer of a water resistive barrier when a drainage space is incorporated in the wall system (i.e. rainscreen). Requirements for rainscreens vary by region. Verify local jurisdictional requirements regarding the use and application of rainscreens.

Weep Screeds and Casing Beads

Weep screeds and casing beads must be corrosion resistant, with weep screeds having a minimum vertical attachment flange of 3.5 inches (89 mm) that terminates behind the water resistive barrier (if present). The minimum thickness of metal weep screeds and casing beads should not be less than 0.0179 inches (0.45 mm) (26 gage) or less than 0.050 inches (1.3 mm) for plastic weep screeds or casing beads.

Lath

Multiple lath materials have been used successfully for the installation of AMSV systems, including:

- 2.5 lb/yd² (1.4 kg/m²) (or heavier) self-furring metal lath meeting ASTM C847;
- $\frac{3}{8}$ inch (9.5 mm) rib (high rib), 3.4 lb/yd² (1.8 kg/m²) (or heavier), self-furring metal lath meeting ASTM C847;
- Welded wire lath complying with ASTM C933;
- 18 gauge (or heavier) woven wire mesh meeting ASTM C1032; or
- The lath product is consistent with the AMSV manufacturer's installation instructions and has an evaluation acceptance report from an accredited evaluation service showing compliance with ICC-ES Acceptance Criteria 275 (AC275), or equivalent.

All lath and lath accessories must be corrosion resistant, consisting of either galvanized or stainless steel materials or consisting of materials complying with AC 275. All lath material must be self-furred or use self-furring fasteners. Refer to the Summary Table of this guide for specific lath and fastener recommendations.

Fasteners

Corrosion resistant fasteners are used to secure flashing and lath to the backup system. A variety of fasteners are available

such as staples, screws, and nails, provided the heads or washers of these fasteners are large enough to not pull through the lath and the fastener is of sufficient length to penetrate into the supporting material. For specific fastener selection criteria, refer to ASTM C1063.

- **Wood framing** - Corrosion resistant staples, corrosion resistant roofing nails, or corrosion resistant screws and washers, of sufficient length to penetrate a minimum of $\frac{3}{4}$ inch (19 mm) into framing members.
- **Metal framing or panels** - Corrosion resistant, self-tapping screws with sufficient length to penetrate $\frac{3}{8}$ inch (9.5 mm) through metal studs or panels.
- **Masonry or concrete walls or panels** - Corrosion resistant concrete screws or powder actuated fasteners (or cap fastener).

Mortar

Mortars used for the installation of AMSV systems can be grouped into three different categories; scratch coat, setting bed, and pointing mortars. Depending upon the type of mortar used and whether it is batched on site or delivered premixed to the project, each mortar must meet minimum requirements as described below:

- **Scratch Coat Mortars** – Scratch coat mortars are applied directly to the lath or substrate to which AMSV systems are adhered. As the name implies, this first layer of mortar is intentionally scratched or roughened before hardening to provide enhanced mechanical bond between the scratch coat and setting bed mortars.
 - Site Mixed: Meeting the requirements of ASTM C270 Type N or Type S.
 - Preblended: Meeting the requirements of ASTM C1714/C1714M Type N or Type S.
- **Setting Bed Mortars** – After the scratch coat mortar has cured sufficiently, the setting bed mortar is used to adhere the AMSV units to the backing. The setting bed mortar is applied directly to the scratch coat, to the back of the AMSV units (back-buttering), or a combination of both application methods.
 - Site Mixed: Meeting the requirements of ASTM C270 Type N or Type S.
 - Prepackaged/Preblended: Meeting the requirements of ASTM C1714/C1714M Type N or Type S, ANSI A118.1, ANSI A118.4, or ANSI A118.15.
- **Pointing Mortars** – Pointing mortars, also referred to as grouting mortars or mortar used to grout mortar joints, are used to fill the joints between individual AMSV units once the setting bed mortar has sufficiently cured. Not all AMSV systems incorporate mortar between the units, while others allow the distance between units to be varied to create alternative architectural finishes.
 - Site Mixed: Meeting the requirements of ASTM C270 Type N or Type S.
 - Premixed: Meeting the requirements of ASTM C1714/C1714M Type N or Type S.

In some cases additives or admixtures are added to mortars to modify one or more plastic or hardened properties of the mortar; for example to increase mortar workability, to increase water repellency characteristics of the mortar, or to increase the bond strength of the mortar. Mortars specified to comply with either ASTM C270 or ASTM C1714/C1714M that contain such modifiers must also comply with the additional requirements of ASTM C1384. If used, bonding agents must also comply with ASTM C932 or ASTM C1059 and coloring pigments must comply with ASTM C979/C979M. As not all mortar additives are compatible or interchangeable, consult with mortar or additive manufacturers to ensure compatibility of mortar and admixture components.

Additional Mortar Considerations

When considering mortar selections, verify the mortar can provide a minimum shear bond strength of at least 50 lb/in.² (345 kPa) when tested in accordance with ASTM C482, is consistent with the stone manufacturer's recommendations, and is suitable for installation of adhered concrete masonry veneer. Prepackaged/preblended mortars should be mixed and installed per mortar manufacturer's instructions.

Mortars mixed with higher amounts of cement will tend to be less workable and may be prone to increased shrinkage cracking, but will provide greater bond strength. Type N mortars are generally easier to work with than Type S mortars due to the higher cement content of Type S mortars.

The above setting bed mortar mixes are suitable for most veneer installations; however polymer modified mortars and mortars complying with ANSI A118.4 or ANSI A118.15 achieve higher bond strengths than traditional unmodified ASTM C270 Type S or Type N mortar. Modified mortars are better suited for challenging installations or where increased bond strength is desired. Examples of these installations include, but are not limited to: tight-fit applications, tilt-up construction, direct bond to concrete masonry, direct bond to cement board, or hot weather conditions.

Surface Preparation

Verify that the surface to which the AMSV is to be installed is structurally sound, free of any coatings or materials that would inhibit bonding, and capable of supporting the intended AMSV system. The majority of the discussion and details in this guide focuses on the installation of AMSV systems on backup systems consisting of wood or steel framing with rigid sheathing and concrete or concrete masonry construction; however, virtually any backup system can be used when properly designed and prepared to receive AMSV systems. Additional considerations are reviewed in the following discussion.

Masonry walls, poured-in-place concrete walls, and concrete tilt up panels must be free of dirt, waterproofing, paint, form oil, or any other substance that could inhibit the mortar bond and must readily accept/absorb water in order to achieve good bond. The International Concrete Repair Institute, (ICRI), provides guidance for concrete surface preparation and assessment. The surfaces intended to receive AMSV units must have a rough

texture to ensure good mortar bond. Refer to ICRI Technical Guideline 310.2 for additional information on concrete surface preparation, including information on Concrete Surface Profile (CSP), a standardized method to measure concrete surface roughness. A CSP equal to or greater than 2 is usually acceptable for the installation of AMSV over concrete and masonry assemblies. If necessary, cleaning may be done with power washing or mechanical methods (i.e. shot or bead blasting). If a bondable surface cannot be achieved, attach lath and scratch coat before installing AMSV.

This guide does not address the installation of AMSV systems over open stud backup systems. Additional information on the use of AMSV systems in conjunction with open stud construction is available in previous editions of this guide.

Wall Systems with Exterior Continuous Insulation

AMSV may be installed on walls insulated with continuous insulation such as foam insulation. Lath attachment methods described in this guide are generally considered acceptable when AMSV is installed over continuous insulation up to $\frac{1}{2}$ inch (13 mm) thick. Installation of AMSV over continuous insulation greater than $\frac{1}{2}$ inch (13 mm) thick generally requires an engineered fastening system.

The Foam Sheathing Committee of the American Chemistry Council (www.americanchemistry.com) has published a "Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing" that may provide guidance when engineering a fastening system for AMSV (<http://fsc.americanchemistry.com/Building-Code/Installation-of-Cladding/Guide-to-Attaching-Exterior-Wall-Coverings.pdf>).

Water Resistive Barrier

Where a water resistive barrier (WRB) is required, it should be installed in two separate layers in shingle fashion, starting from the bottom of the wall. The inner layer of WRB should be installed, along with flashings, to create a drainage plane. The outer layer of WRB is intended to keep the scratch coat from contacting the inner layer of WRB. The upper layer of the WRB should lap on top of the lower layer by a minimum of 2 inches (51 mm). The vertical joints of the WRB should be lapped a minimum of 6 inches (152 mm). Inside and outside corners must be overlapped a minimum of 16 inches (406 mm) past the corner in both directions. The WRB should be installed in accordance with the manufacturer's recommendations and be integrated with all flashing accessories, adjacent WRBs, doors, windows, penetrations, and cladding transitions.

Acceptable WRBs:

- Minimum two separate layers of any of the following: No. 15 felt complying with ASTM D226 for Type 1 felt, Grade D paper complying with ICC-ES AC38, house wrap complying with ICC-ES AC38, WR complying with ASTM E2556/E2556M, or any combination of two separate layers of these materials. One layer of paper-backed lath meeting requirements for Grade D paper may be substituted for the outer layer.

- Continuous insulation may be substituted for the inner layer of WRB provided it is installed and sealed and/or taped in accordance with the insulation manufacturer's installation instructions and has an evaluation service report from an accredited evaluation service recognizing it as a WRB. Continuous insulation is commonly applied on the exterior side of the framing or on the exterior side of sheathing, runs continuously, and has minimal thermal bridging. Ensure WRB(s) selected are intended for wall applications. Some WRB's intended for roofs are not appropriate for walls. For example, 15 pound felt is not the same product as No. 15 felt.

Lath

Metal lath should be applied horizontally (perpendicular to framing, if present) per manufacturer's instructions, and should overlap a minimum of 1 inch (25 mm) at the horizontal and vertical seams. The ends of adjoining lath places should be staggered. Metal lath is usually installed with the lath "cups" (keys) facing up. With the cups up, the lath feels rough when sliding the hand vertically down the wall, and feels smooth when sliding the hand up the lath.

Lath should be wrapped around inside and outside corners a minimum of 12 inches (305 mm). Lath should be fastened every 6 inches (152 mm) vertically on each stud or similar spacing on concrete or masonry wall surfaces. Do not end lath at corner framing.

Alternate lath should be installed per the manufacturer's instructions.

Flashings/Weep Screeds/Casing Bead/Movement Joints

All flashing and accessory detailing pieces should be corrosion resistant.

Verify that all flashing, including roofing kickout flashing, has been properly installed. Although roof flashings are not part of the wall cladding system, they are necessary for proper water management. Flashing material should extend above horizontal terminations, roofing material, and drainage planes or drainage products.

All flashing material should be integrated with water resistive barriers to prevent water penetration into structure. The WRB should overlap the weep screed flange.

Movement Joints - Different elements and materials within any structure move differently in response to applied loads or as a result of fluctuations in temperature or moisture content. In determining if and where movement joints may be needed as part of an AMSV installation, consideration should be given to where differential movement is expected—for example, at the intersection of dissimilar materials; or where movement may be concentrated—for example, at the transition between a framed backup assembly and a concrete masonry assembly. Additional information is available in "Are Control Joints Needed with Adhered Concrete Masonry Veneer" through MVMA's website: www.masonryveneer.org.

Plan ahead with the various trades to integrate flashing and water resistive barriers to effectively shed water down and out of the wall system. This may require the preceding trade on the job to install flashing or WRBs for integration with the next trade on the job.

Clearances

- On exterior stud walls, weep screeds and other base flashings should be held a minimum of 4 inches (102 mm) above grade or a minimum of 2 inches (51 mm) above paved surfaces such as driveways, patios, etc. This minimum can be reduced to $\frac{1}{2}$ inch (13 mm) if the paved surface is a walking surface supported by the same foundation supporting the wall.
- On exterior stud walls where the AMSV continues down a concrete or CMU foundation wall, and where a weep screed is incorporated into the wall-to-foundation transition, at the bottom maintain minimum 2 inches (51 mm) clearance from grade, or $\frac{1}{2}$ inches (13 mm) clearance from a paved surface.
- On exterior stud walls where the AMSV continues down a CMU foundation wall, with WRB and lath installed down to the weep screed at bottom, maintain a minimum 4 inches (102 mm) clearance from grade, or 2 inches (51 mm) clearance from a paved surface.
- Where AMSV is applied over an exterior concrete or CMU wall, maintain 2 inches (51 mm) clearance from grade or $\frac{1}{2}$ inches (13 mm) from a paved surface.
- Over an exterior concrete or CMU wall that is not enclosing conditioned space (e.g. landscape walls, pillars, columns, etc) maintain a minimum 2 inches (51 mm) clearance from grade or $\frac{1}{2}$ inches (13 mm) clearance from a paved surface.

Interior Applications

Interior applications in non-wet locations (areas not exposed to water) for AMSV are similar to exterior applications with the following alternatives:

- Two layers of WRB are not necessary behind the lath and scratch coat. A single layer of WRB may protect moisture sensitive materials during AMSV installation.
- Cement backer board complying with ASTM C1325 may be substituted for other substrates (i.e. wall board or plywood), WRB, lath, and scratch coat. The cement backer board should be installed per the manufacturer's instruction. The AMSV should be installed per this guide – see Grouted Adhered Manufactured Stone Veneer Application or Tight Fitted Adhered Manufactured Stone Veneer and the Mortar and Premix Mortar sections. Latex-Portland cement mortars complying with ANSI A118.4 must be used for installation of AMSV to cement backer board. Follow the mortar manufacturer's instructions.
- Interior applications are not subjected to the same fluctuations in temperature and moisture as exterior applications. As such, the criteria for clearances used for exterior applications are typically not necessary. Nevertheless, differential movement between different materials must still be accounted for.
- Flashings, weep screeds, and casing beads are not necessary.

Installation of Adhered Manufactured Stone Veneer

Prior to commencing installation of AMSV, ensure that the WRB and flashing are properly installed and integrated with each other. Refer to the flashing details, referenced in this guide, for detailing around windows, doors, through-wall penetrations, and AMSV terminations.

After the lath is installed, apply a nominal $\frac{1}{2}$ inches (13 mm) thick layer of mortar ensuring the lath is completely encapsulated with mortar. The mortar should be applied with sufficient pressure and thickness to fully embed the lath in mortar. Once the mortar is thumbprint hard, scratch (score) the surface horizontally to create the mortar scratch coat.

Moist curing the mortar scratch coat will help reduce cracking and ensure proper hydration during curing. Before applying AMSV, the mortar scratch coat should be dampened so that the surface appears wet but free of standing water.

Before installing AMSV, lay out a minimum of 25 square feet (2.3 m^2) at the jobsite so there is a variety of sizes, shapes, and colors from which to choose. Mixing AMSV sizes, shapes, textures and color will allow for variety and contrast in the design to achieve the desirable finished project. Follow AMSV manufacturers recommendations regarding mixing of product to achieve desired results.

The following guidance for grouted and tight-fit application of adhered masonry veneer applies to conventional Type N and Type S mortars. If a polymer modified mortar is used, some of the working properties and installation techniques may vary from those of conventional Type N or Type S mortars. Consult the mortar manufacturer for guidance and instructions.

Grouted Adhered Manufactured Stone Veneer Application

Tip: Installing AMSV from the top down will minimize cleanup requirements.

Prior to the application of mortar to the scratch coat or the back of the AMSV, the scratch coat and back of the AMSV should be moistened so that the surfaces appear damp but are free of standing water.

The back of each AMSV should be entirely buttered with mortar to a nominal thickness of $\frac{1}{2}$ inches (12.7mm). Cover the entire back of the AMSV, not just the perimeter. Buttered AMSV should be firmly worked onto the scratch coat and slid slightly back and forth or with a slight rotating motion to set the AMSV. Polymer modified mortars, complying with ANSI A118.4, may have a different "feel" than regular/common mortars.

Achieve mortar squeeze out in a volume that results in a full setting bed covering the scratch coat completely. As an alternative to the back-butter only method, mortar may be troweled onto the scratch coat, completely covering the scratch coat. Or both mortar application techniques may be combined. The resulting thickness of the scratch coat and setting bed should be nominally 1 inch (25 mm) measured from the outer surface of the WRB to the back surface of the unit.

With the proper mortar mix, moisture content, and scratch coat preparation, the installer will feel the mortar start to grab within a few seconds of the setting movement process. At this point, no further movement of that AMSV should be made as bonding will be broken. If the AMSV is inadvertently moved after initial set has begun, it should be removed, mortar scraped off the back of the AMSV and scratch coat, and then reinstalled following the application process.

Grouting the joints should be completed only after there is sufficient cure time of the installed AMSV units; when mild contact with AMSV units will not break the bond to the backup system. Grouting may be done with a grout bag, filling joints to the desired depth, ensuring that mortar is forced into all voids. Grout should be "thumbprint hard" before tooling the joints. The curing time required before the grout is ready will vary significantly with temperature and humidity. Use a wooden raking stick or pointing tool to tool the joints to the desired depth. Extra precaution should be taken while tooling so the surface of the AMSV is not damaged. Clean off remaining grout debris on the AMSV surface with a dry, soft-bristled brush.

To prevent mortar smearing, DO NOT use a wet brush to treat uncured mortar joints.

Tight Fitted Adhered Manufactured Stone Veneer Application

Refer to Mortar section for additional guidance regarding mortar selection. For this installation technique, refer to the Additional Mortar Considerations section.

The back of the AMSV and the scratch coat should be moistened with the surfaces appearing damp but free of standing water.

The back of each AMSV should be entirely buttered with mortar to a nominal thickness of $\frac{1}{2}$ inch (13 mm). Cover the entire back of the AMSV, not just the perimeter. Buttered AMSV should be firmly worked onto the scratch coat and slid slightly back and forth to set the AMSV.

Achieve mortar squeeze out in a volume that results in a full setting bed which covers the scratch coat completely. As an alternative to the back-butter only method, mortar may be troweled onto the scratch coat, completely covering the scratch coat. Or both mortar application techniques may be combined. The resulting thickness of the scratch coat and setting bed should be nominally 1 inch (25 mm) measured from the outer surface of the WRB to the back surface of the unit.

With the proper mortar mix, moisture content and scratch coat preparation, the installer will feel the mortar start to grab within a few seconds of the setting movement process. At this point, no further movement of that AMSV should be made as bonding will be broken. If the AMSV is inadvertently moved after initial set has begun, it should be removed, mortar scraped off the back of the AMSV and scratch coat, and then reinstalled following the application process.

Tight fitted AMSV should be applied from the corners toward the middle of a wall, and from the bottom toward the top of the wall.

Cold Weather Application

AMSV applications should be protected from temperatures below 40°F (4°C) during and immediately following installation. The use of anti-freeze admixtures to lower the freezing point of the mortar is not recommended. Accelerating admixtures shall comply with ASTM C1384; accelerating admixtures containing calcium chloride are not recommended. AMSV pieces containing visible frozen moisture shall not be installed.

The cold weather practices defined in TMS 602 should be followed for the installation of AMSV systems.

Hot Weather Application

If the environmental conditions during installation exceed 90°F (32°C) additional water may be needed on the scratch coat surface and the backs of the AMSV being applied. Providing shade and/or frequent misting of the wall may be required. Consult with mortar manufacturer to determine if hot weather mortar mix options are available. The hot weather practices defined in TMS 602 should be followed for the installation of AMSV systems.

Cleaning the Adhered Manufactured Stone Veneer

Refer to AMSV manufacturer recommendations on cleaning and maintenance. Do not use harsh chemicals for cleaning, such as acid, or use abrasive tools such as wire brushes or power washers.

Coating Adhered Manufactured Stone Veneer

Refer to the AMSV manufacturer for recommendations regarding the use of sealants or other topically applied coatings used for water penetration resistance, graffiti resistance, or surface sealing.

Alternative Installation Methods / Materials

This guide covers common installation practices for AMSV systems. Alternative installation materials and methods not included in this guide may be introduced into the marketplace. Example: Exterior installation methods using cementitious adhesive mortars with a direct application to a substrate that may include cement board and / or coatings applied as loadbearing bonded water-proof membranes.

Alternative installation materials and methods along with their test methods and evaluation criteria are being developed. As a designer, contractor, or installer, you may wish to utilize these materials and/or methods in lieu of the recommended methods included in this guide. Users should verify that the alternative method(s) will meet or exceed the recommended installation practices presented in this guide.

Refer to manufacturer's recommendations for additional information regarding the use of alternative installation methods or materials.

Cautions

The following precautions should be taken to ensure a successful and durable AMSV installation.

- Do not subject AMSV to direct or frequent water contact. For example, avoid allowing sprinklers to directly spray onto the surface. Also, downspouts or drainage pipes should be placed so that water is not frequently moistening the AMSV units.
- Do not subject AMSV to contact with de-icing materials, salt, or other harsh chemicals. Prolonged exposure to these conditions may discolor the AMSV or result in surface damage.

Figure 1. Installation Over Wood Framing

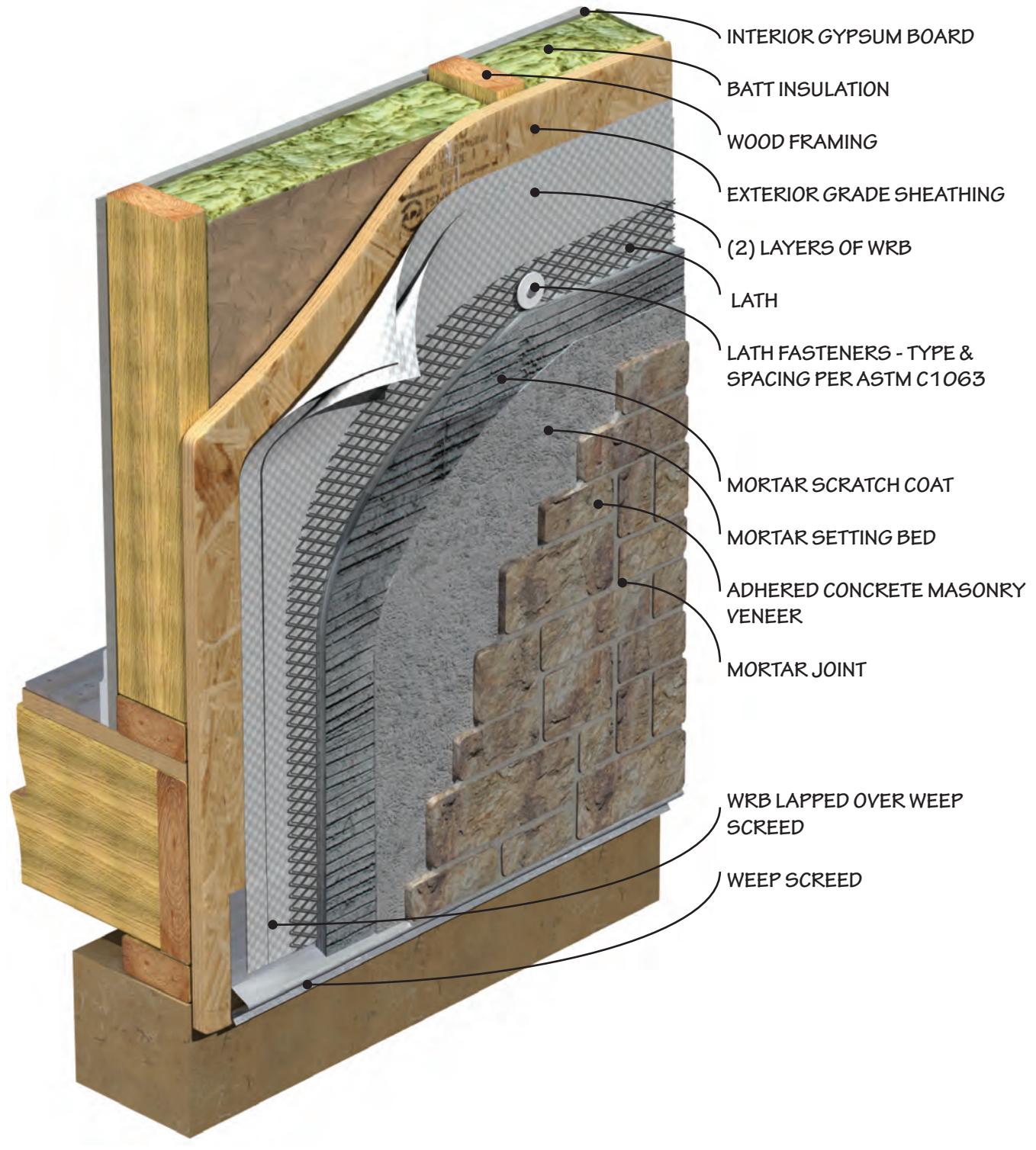


Figure 2. Installation Over Concrete Masonry Units

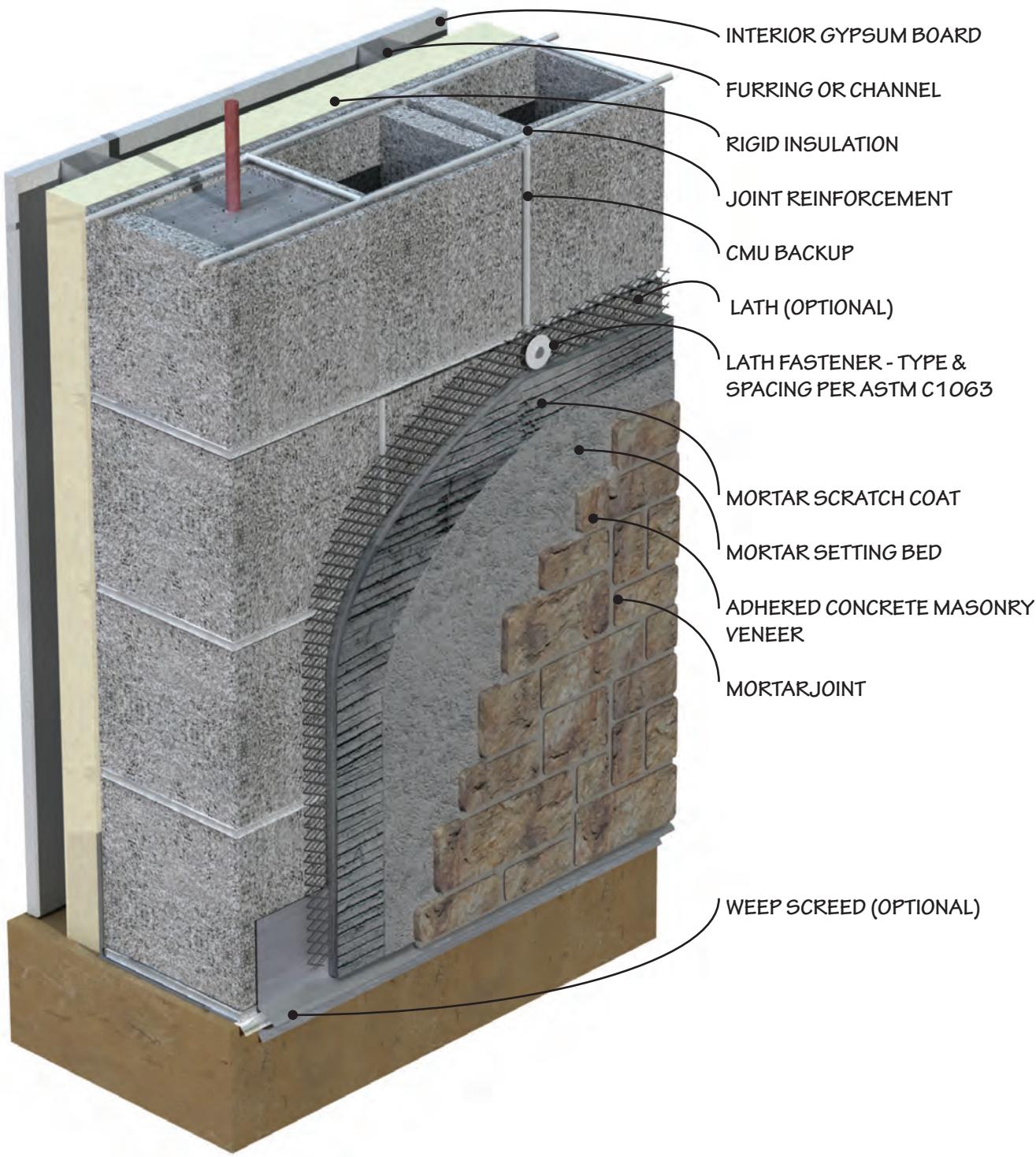


Figure 3. Wall Assembly

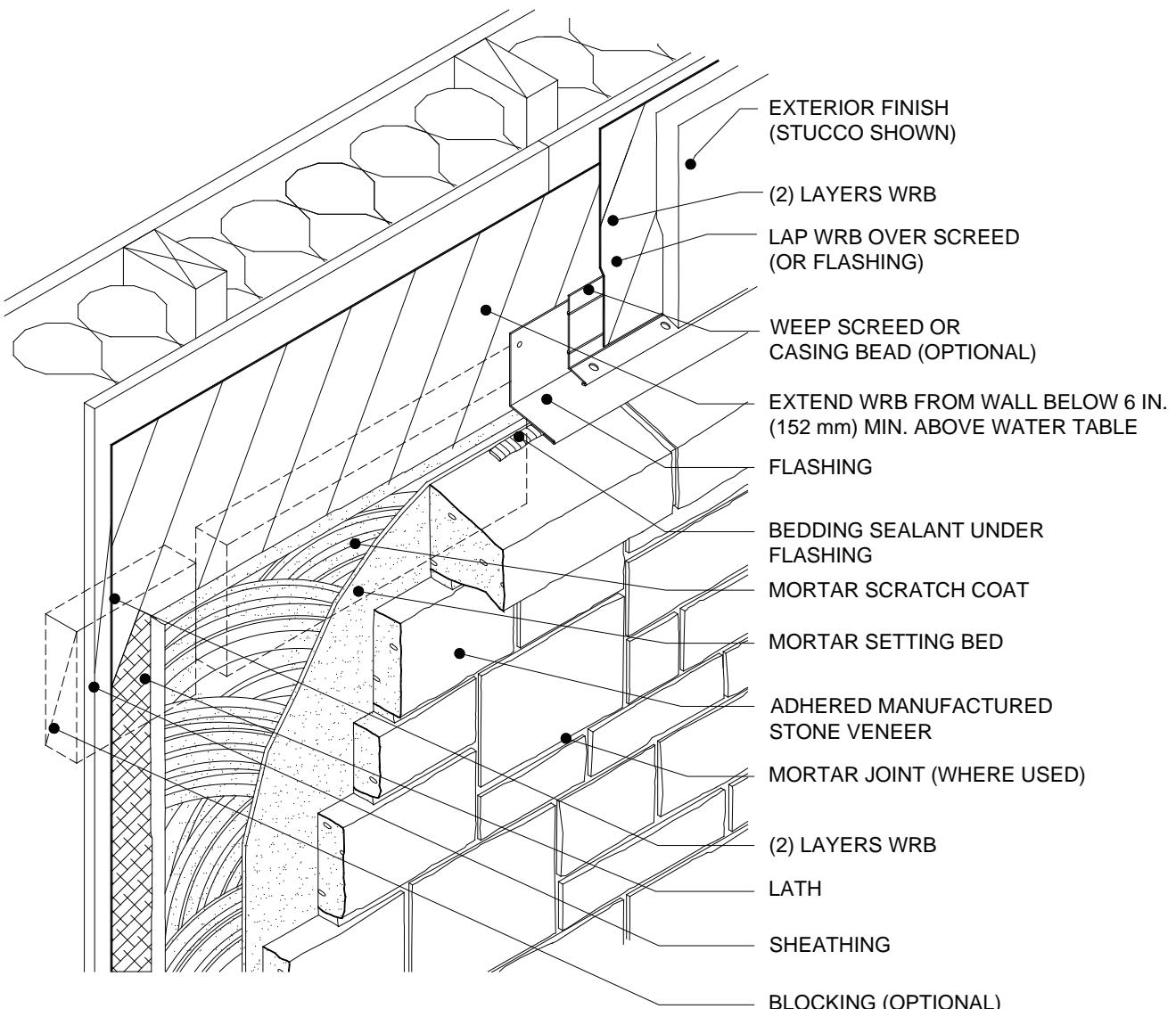
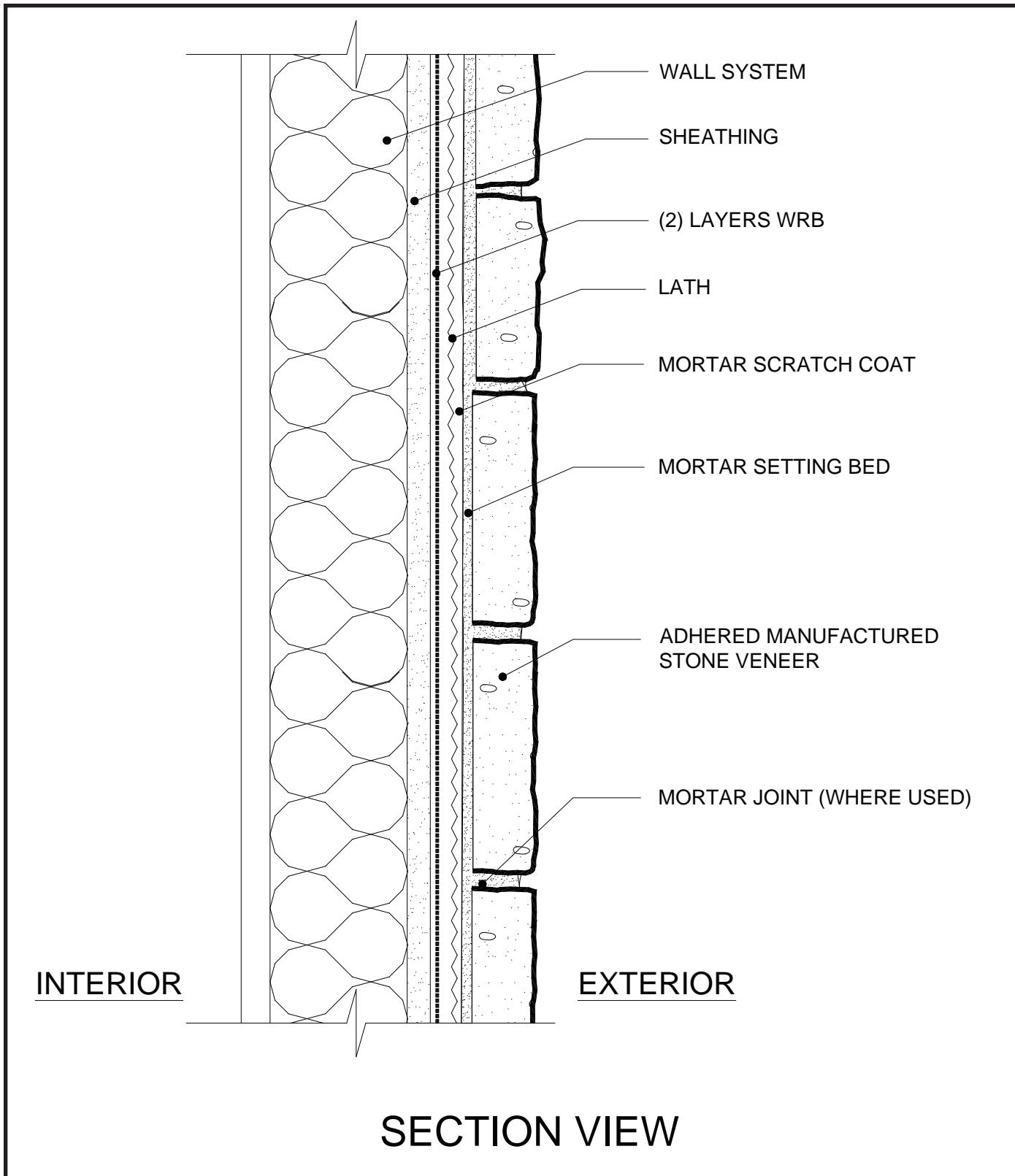
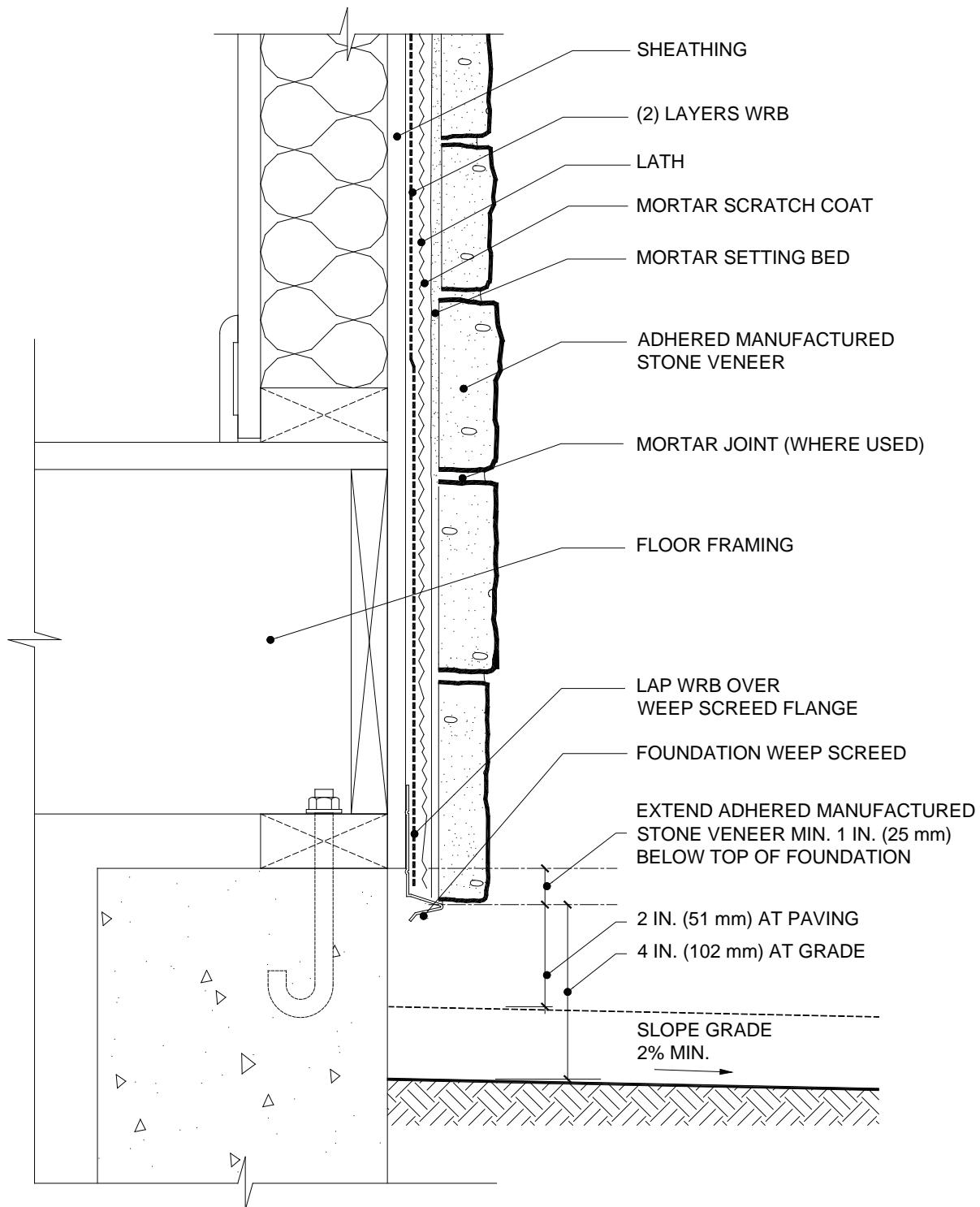


Figure 4. Typical Wall Section



Note: layering of sheathing, water resistive barrier, lath, scratch coat, and adhered manufactured stone veneer.

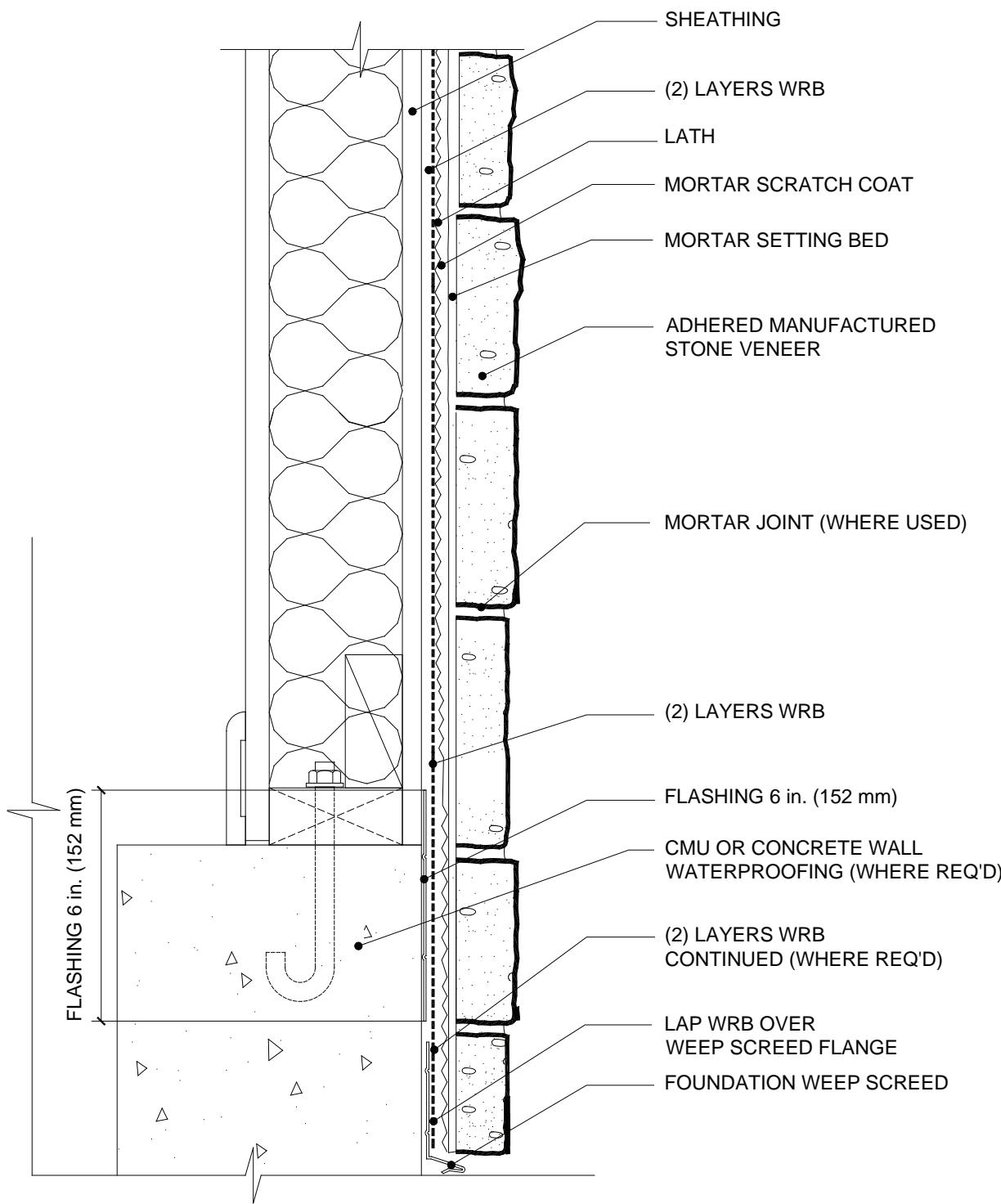
Figure 5. Foundation Wall Base



SECTION VIEW

A minimum 4 in. (102 mm) gap is required at the base of the stud wall to grade and a minimum 2 in. (51 mm) gap is required at base of the stud wall to a paved surface.

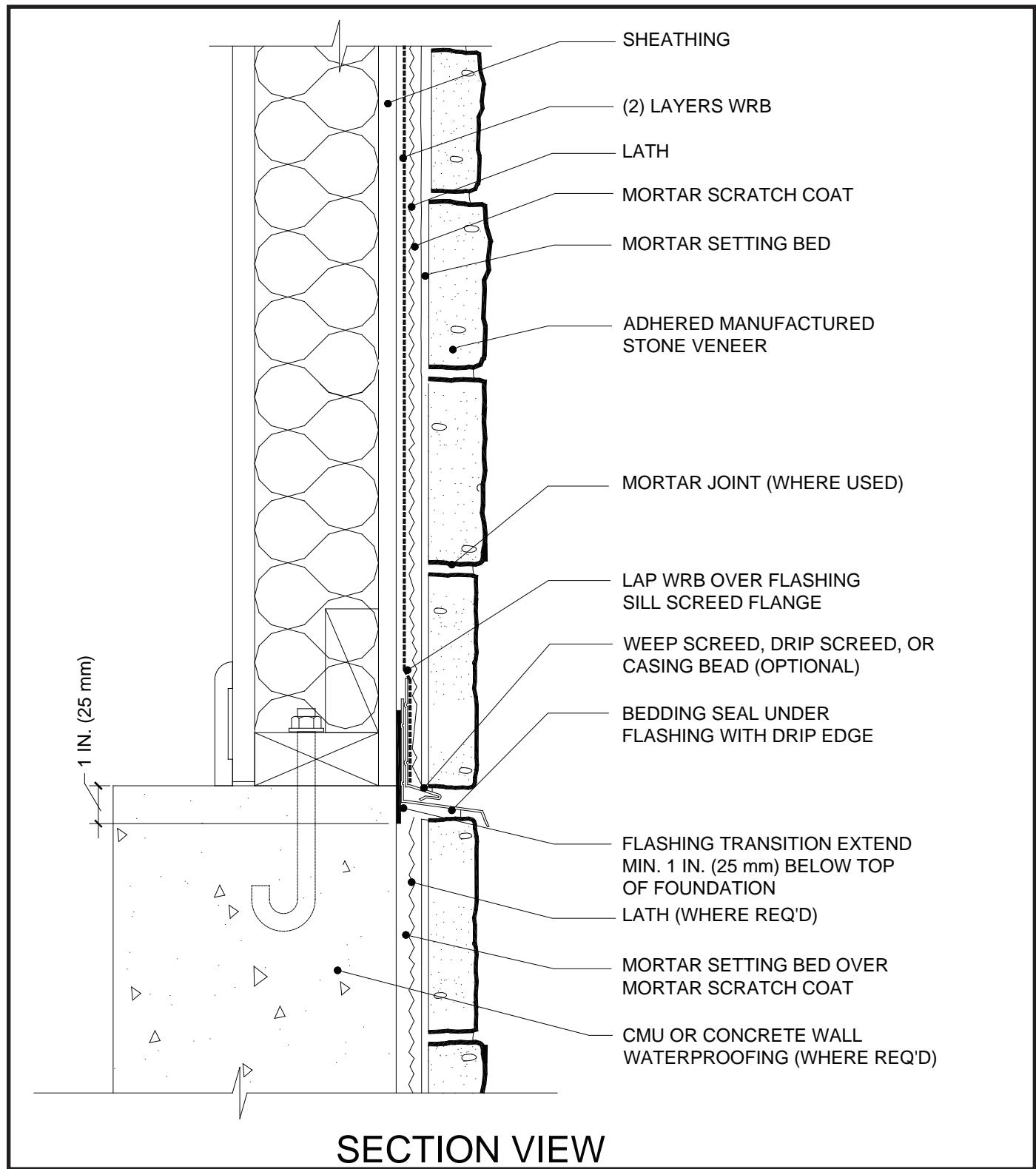
Figure 6. Foundation Wall Base - AMSV Overlapping Foundation



SECTION VIEW

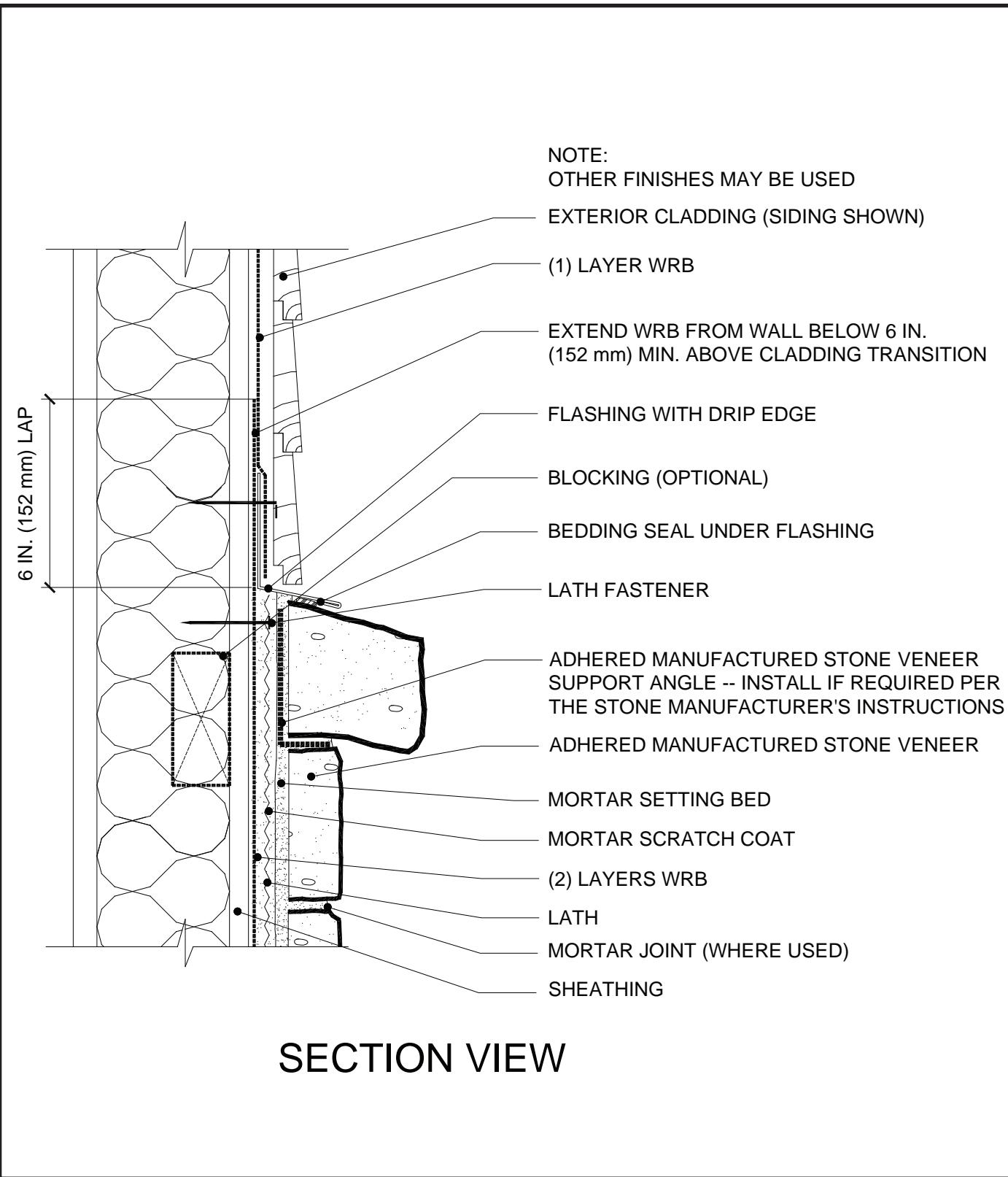
AMSV may overlap foundation wall with careful installation of flashing and WRB. This installation may continue down foundation wall to grade clearance.

Figure 7. Foundation Wall - Transition to AMSV Continuing Down Foundation



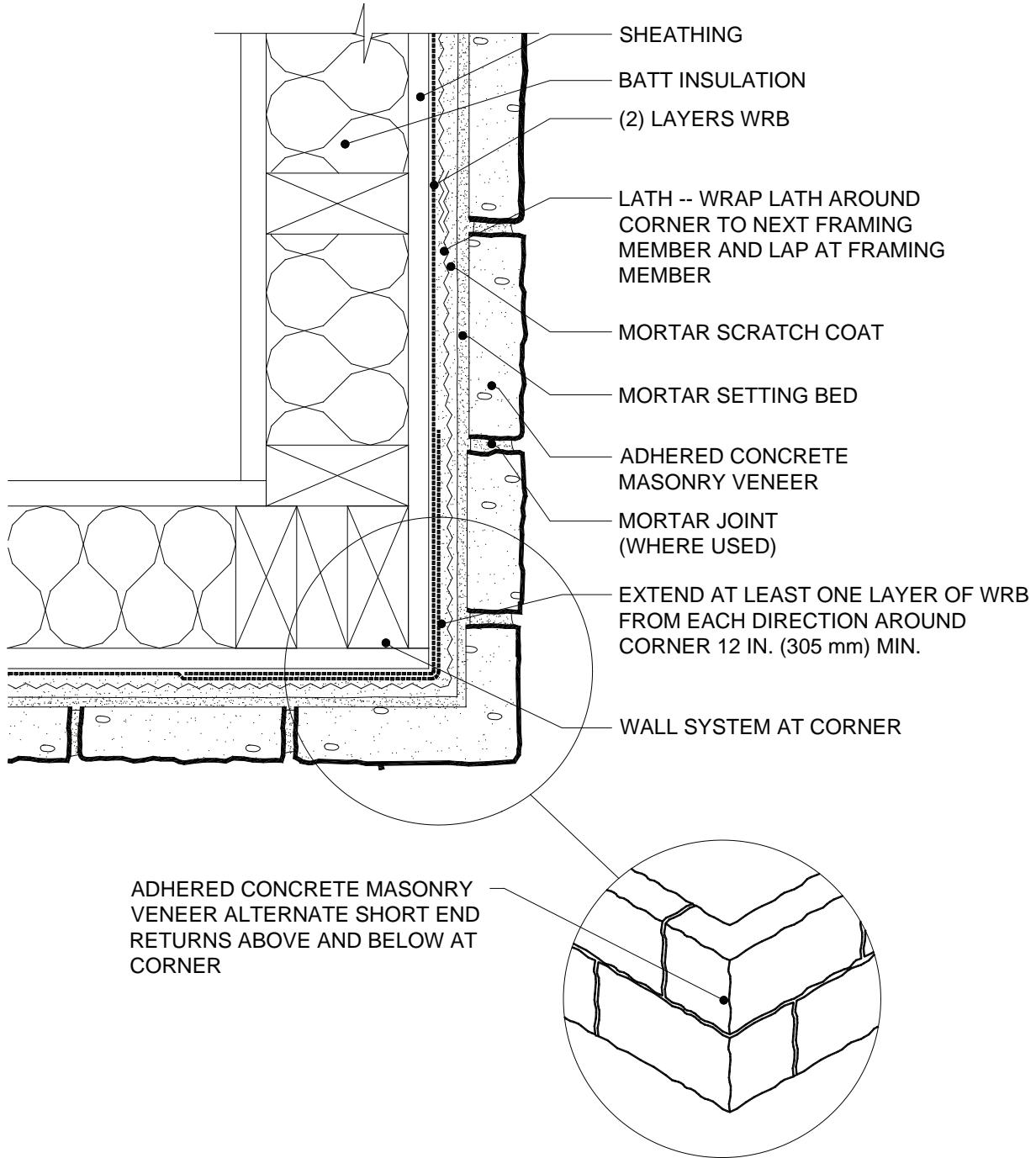
AMSV may continue down the foundation with the incorporation of a flashing transition with careful installation of WRB and flashing.

Figure 8. Cladding Transition



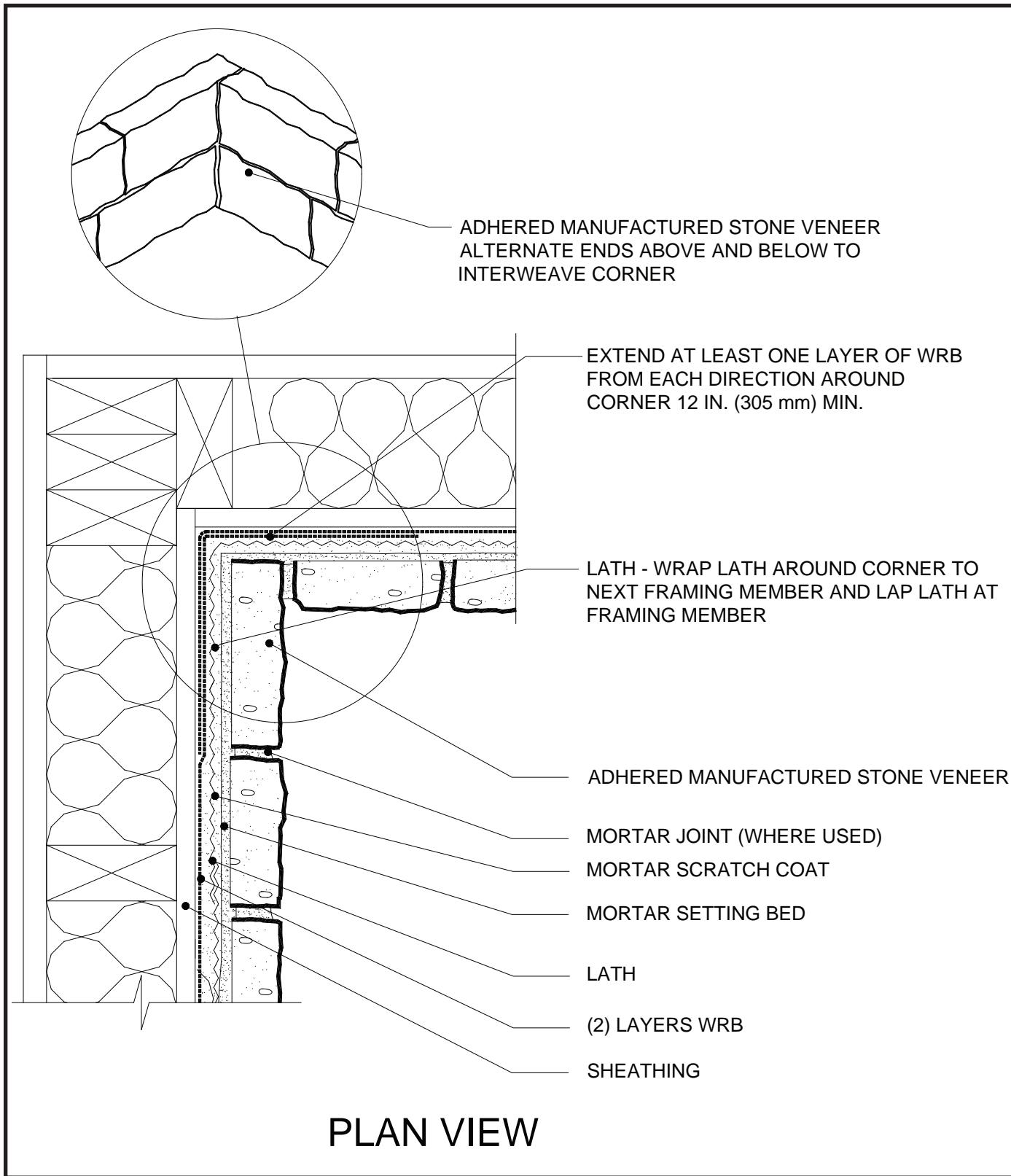
Flashing should be installed prior to the adhered manufactured stone. Water resistive barrier laps over the vertical leg of flashing for positive drainage. Optional support angle shown. Verify installation requirements with adhered manufactured stone veneer manufacturer.

Figure 9. Outside Corner



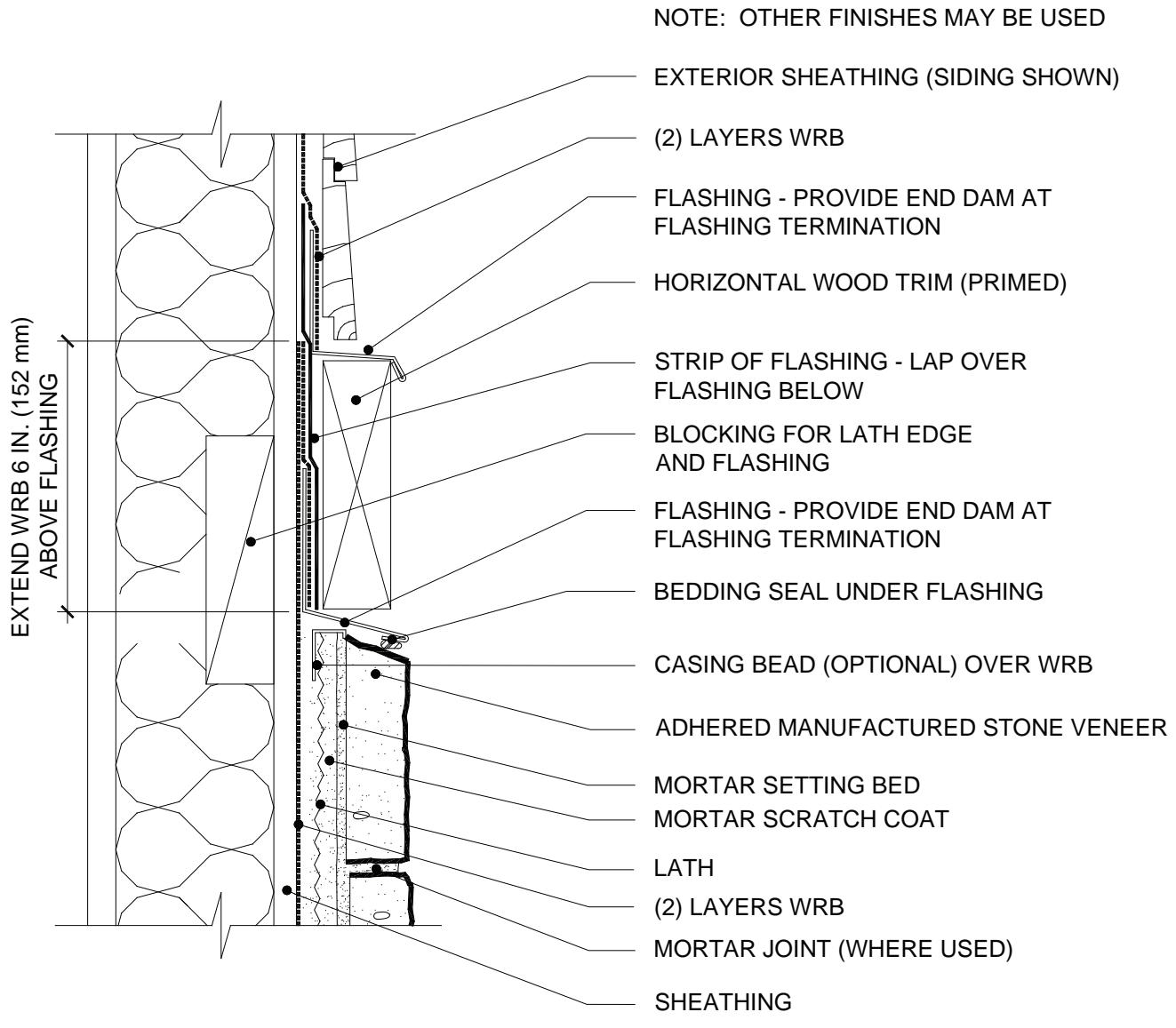
Randomly alternate short end returns above and below at the corner. Lap lath around the corner to the next framing member.

Figure 10. Inside Corner



Randomly alternate ends above and below to interweave the corner. Double wrap water resistive barrier around both sides of the corner. Lap lath to the framing at least 12 inches (305 mm) to the next framing member.

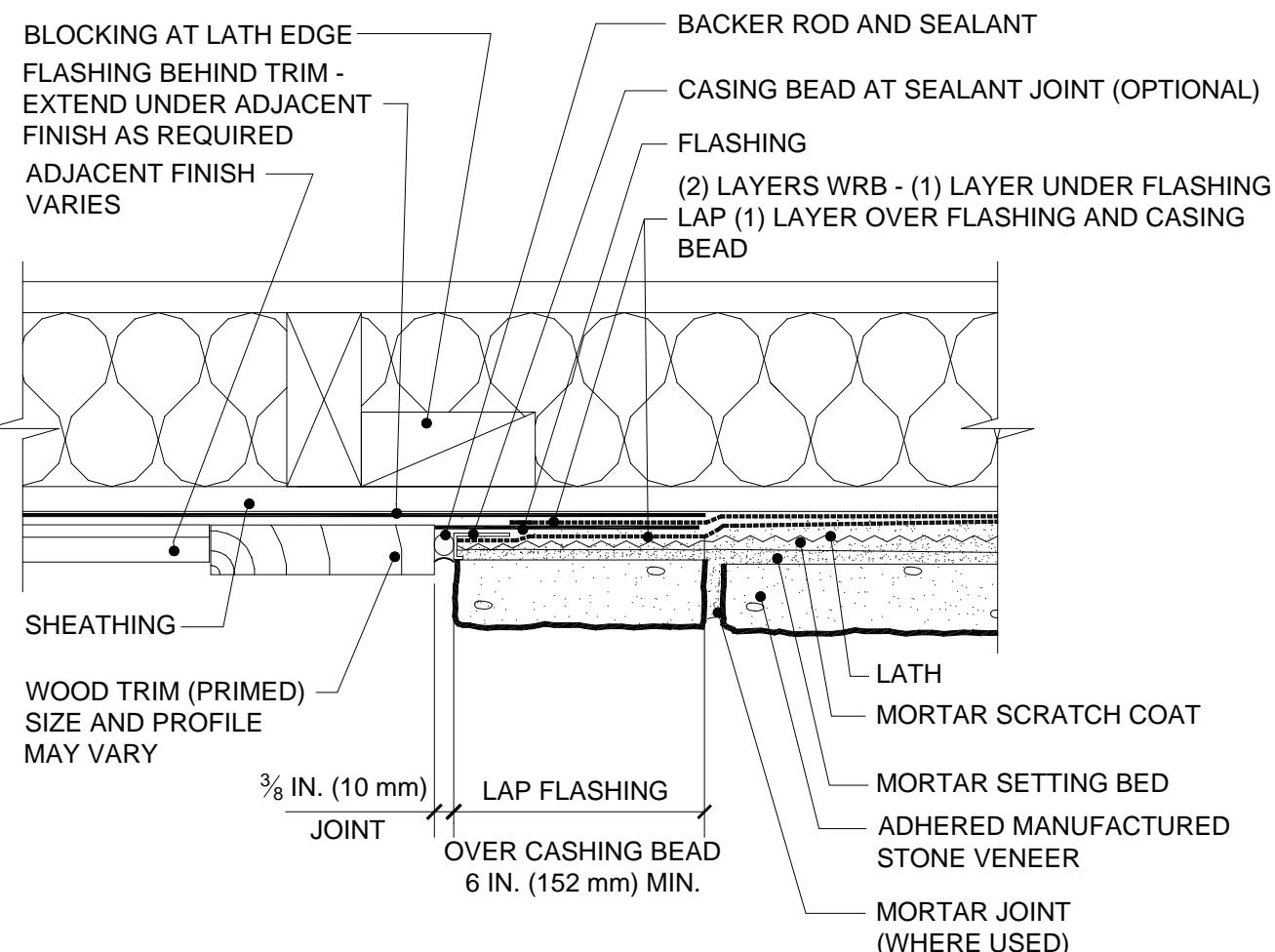
Figure 11. Horizontal Transition



SECTION VIEW

Note: flashing is lapped shingle-fashion with corrosion resistant sheet metal. A bedding seal is used under the corrosion resistant sheet metal next to the adhered manufactured stone veneer.

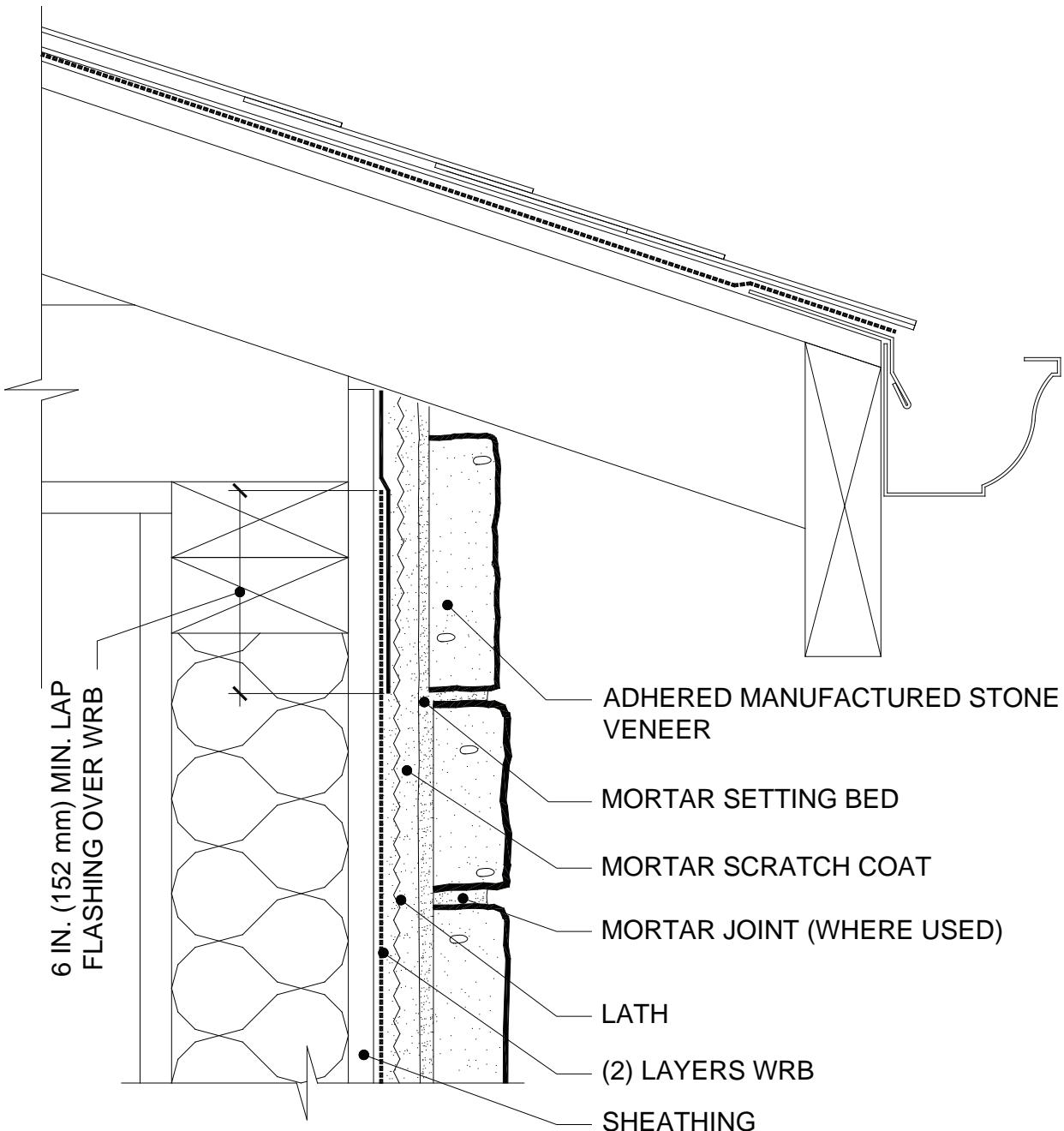
Figure 12. Vertical Transition



PLAN VIEW

Flashing extends under the adjacent finishes. A $\frac{3}{8}$ in. (10 mm) minimum gap should be used between finishes.

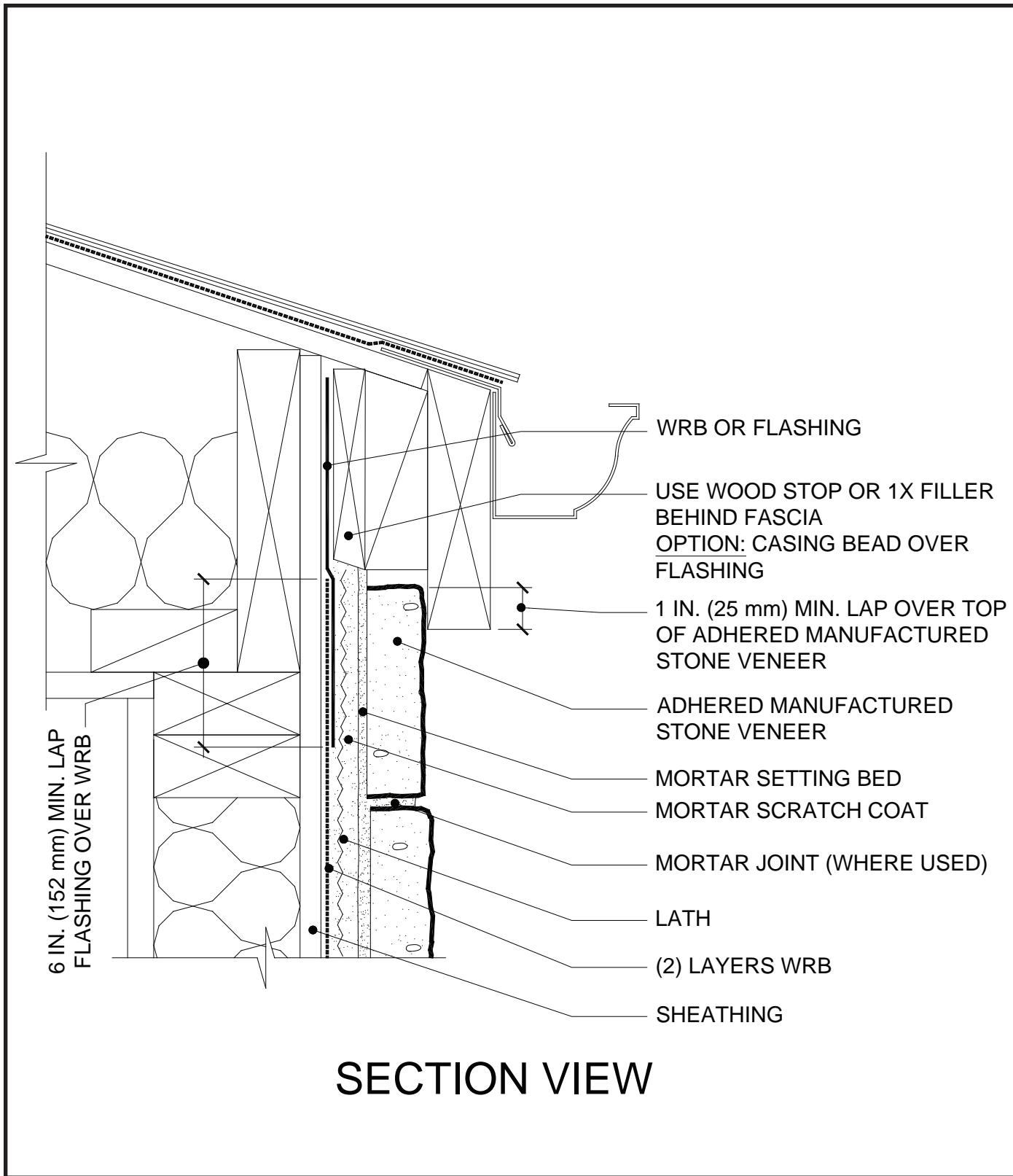
Figure 13. Open Eave - Overhang



SECTION VIEW

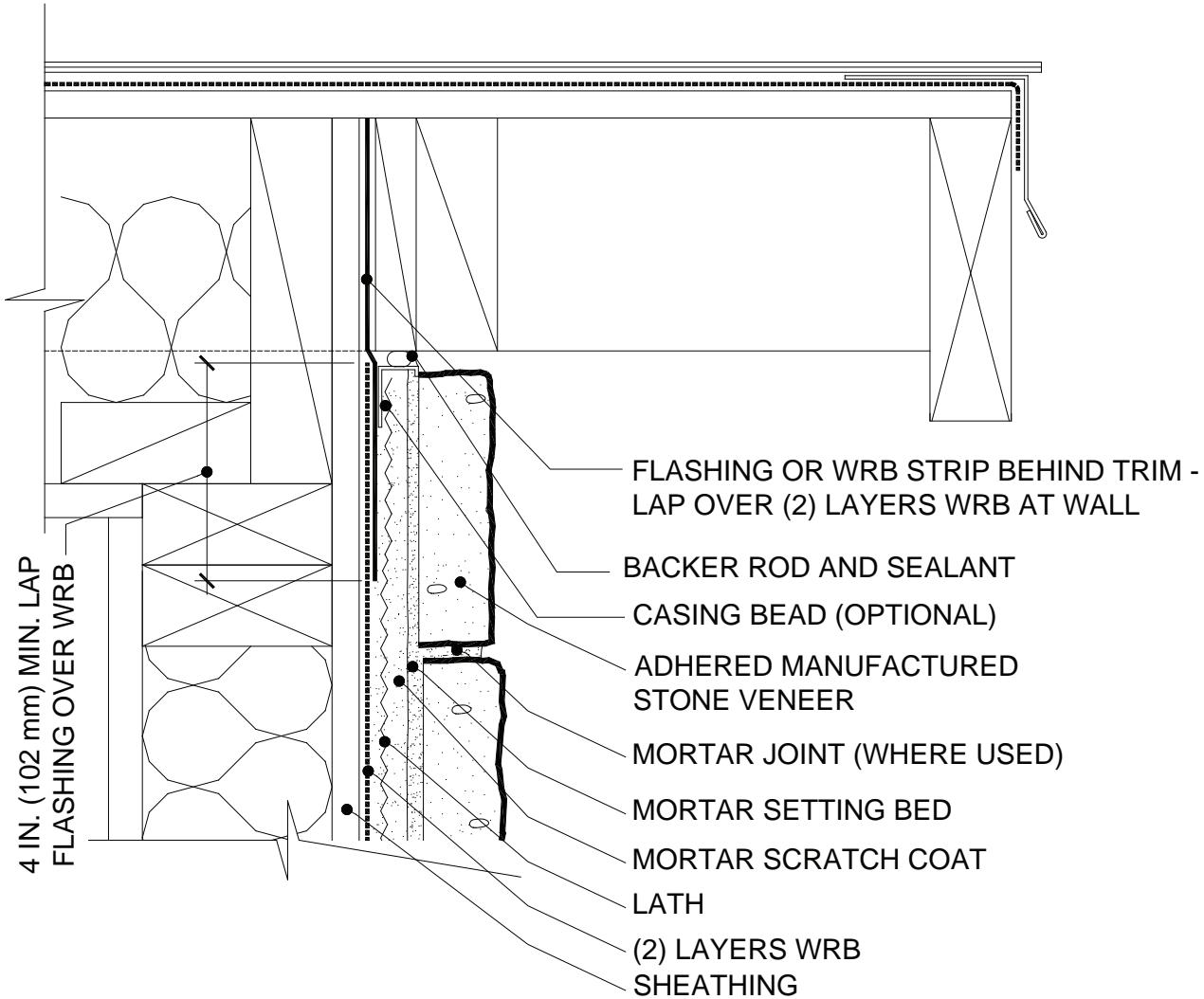
Water resistive barrier should be in place prior to soffit installation followed by adhered manufactured stone veneer.

Figure 14. Open Eave - Flush



Water resistive barrier should be in place prior to soffit installation followed by adhered manufactured stone veneer.

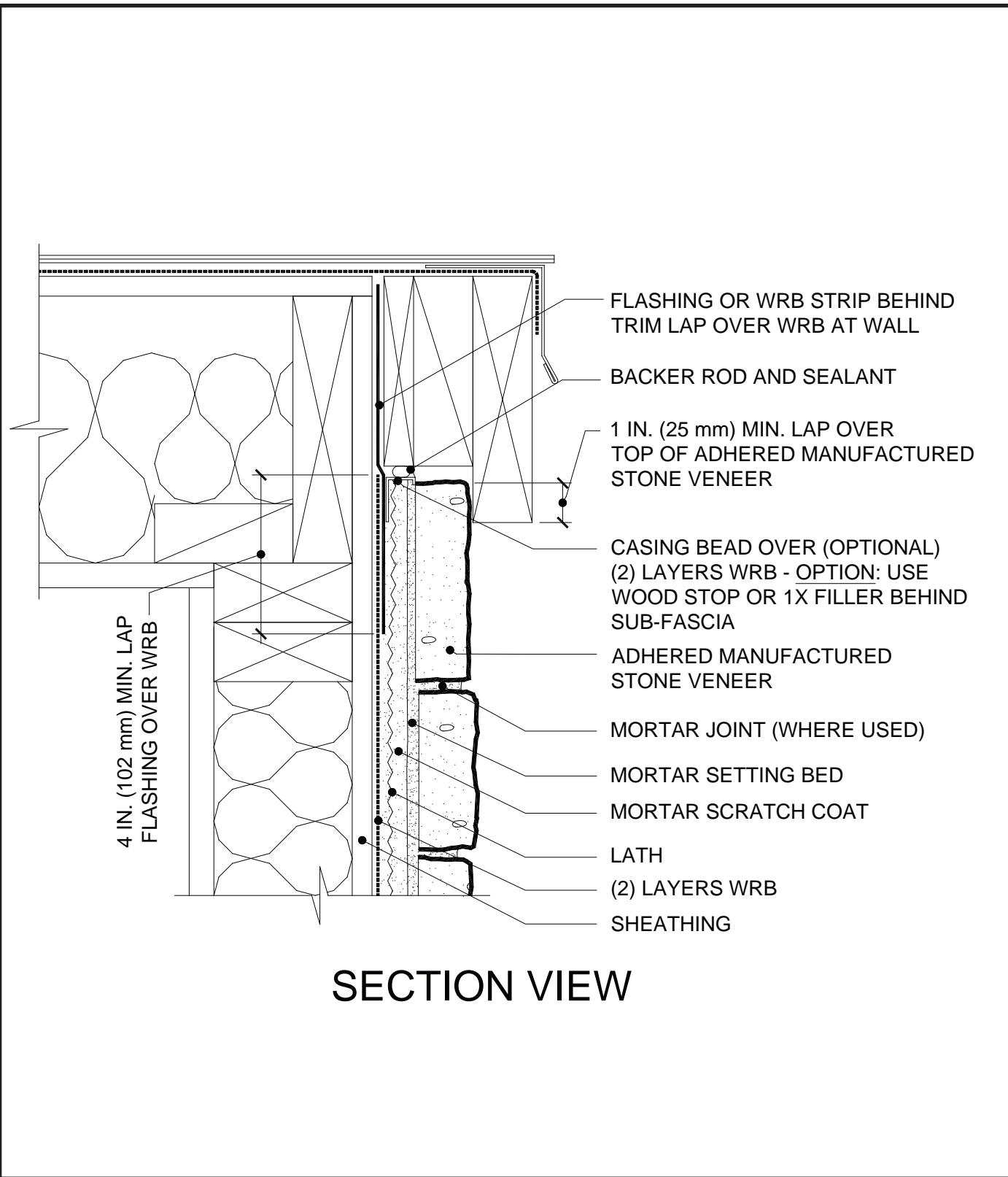
Figure 15. Rake - Overhang



SECTION VIEW

The intent of these details is to limit exposure to wind driven rain.

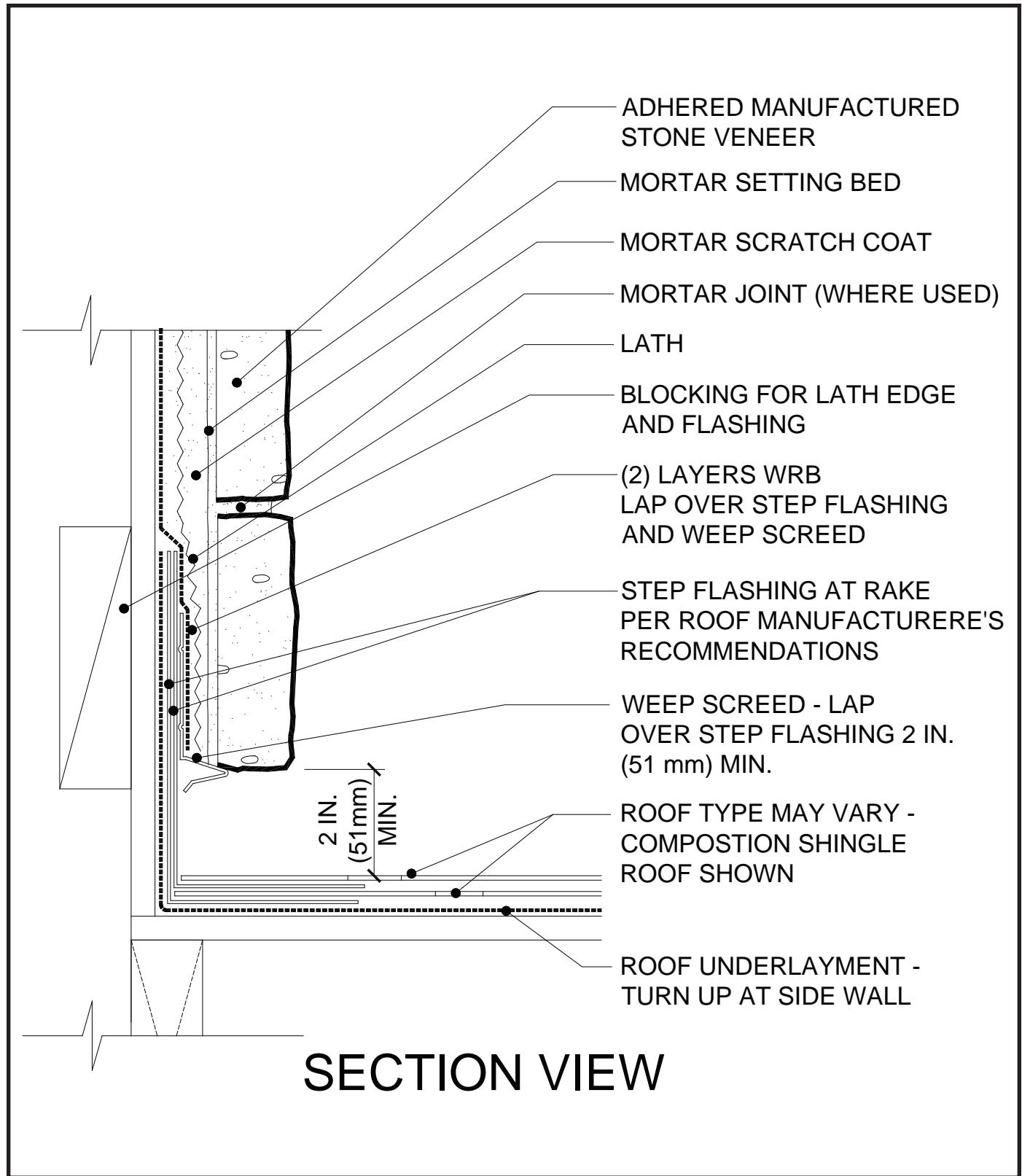
Figure 16. Rake - Flush



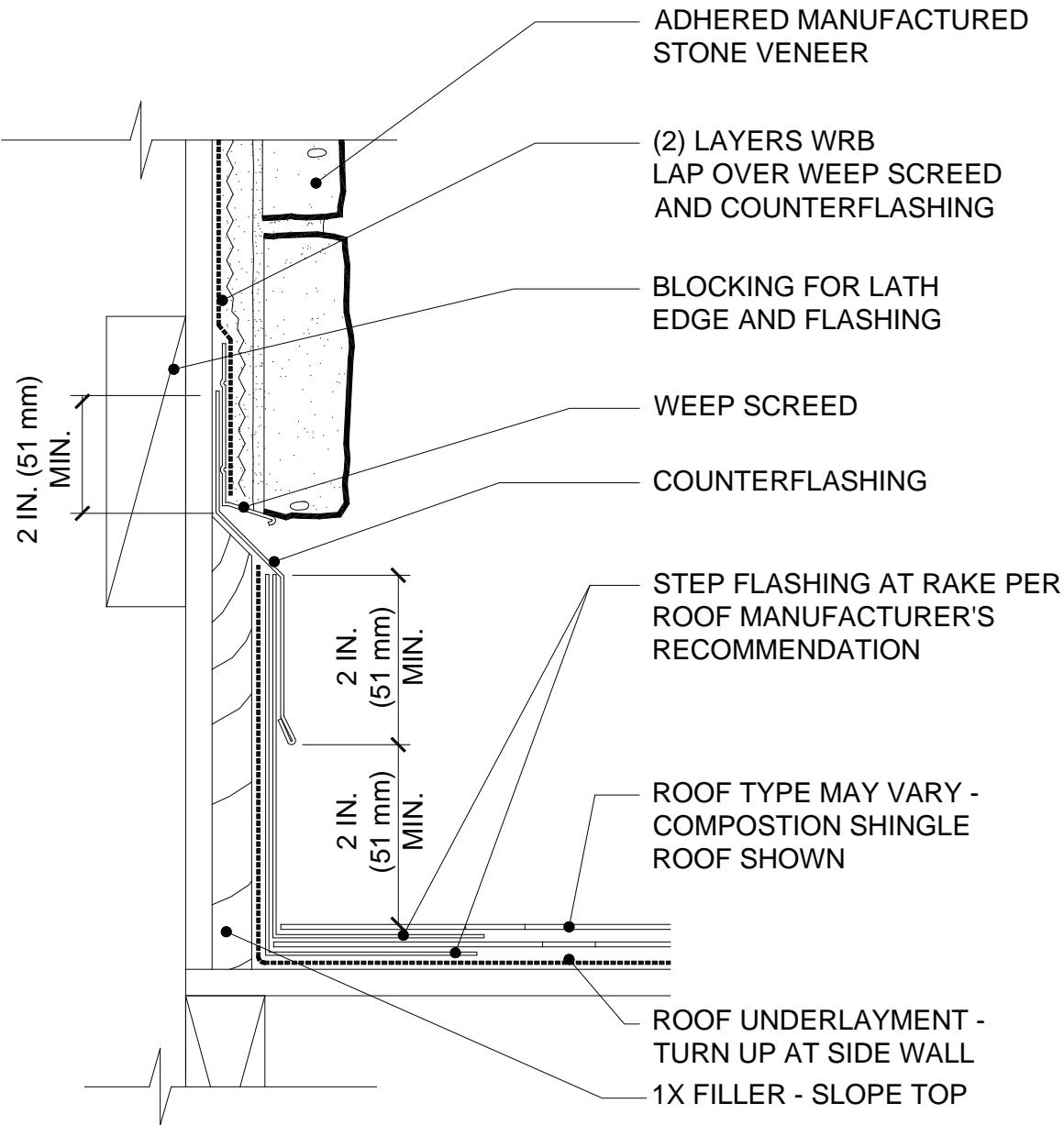
SECTION VIEW

Note: the use of backer rod and sealant.

Figure 17. Side Wall - Composition Shingles

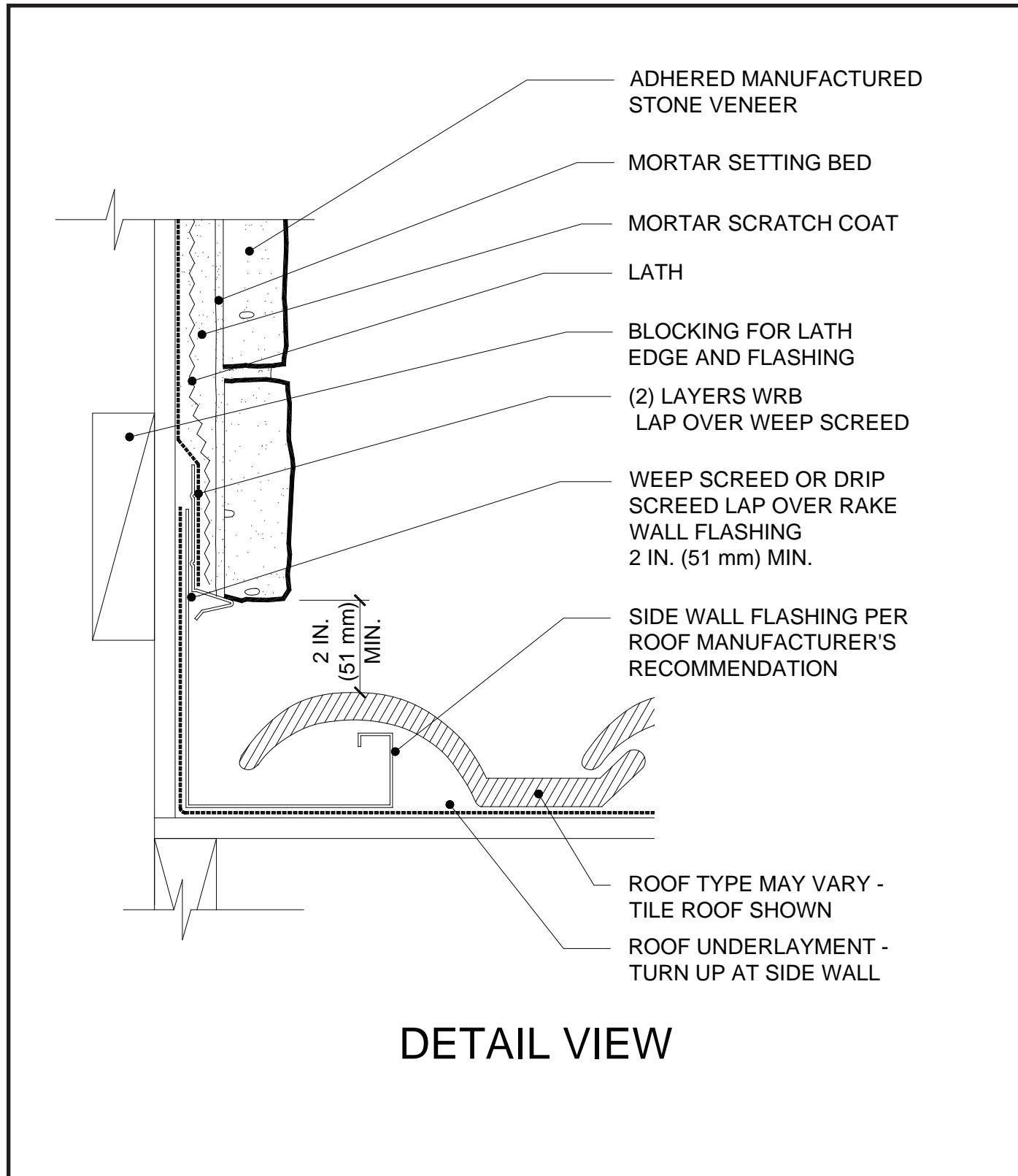


Water resistive barrier laps over step flashing and weep screed.

Figure 18. Side Wall - Composition Shingles Curbing**SECTION VIEW**

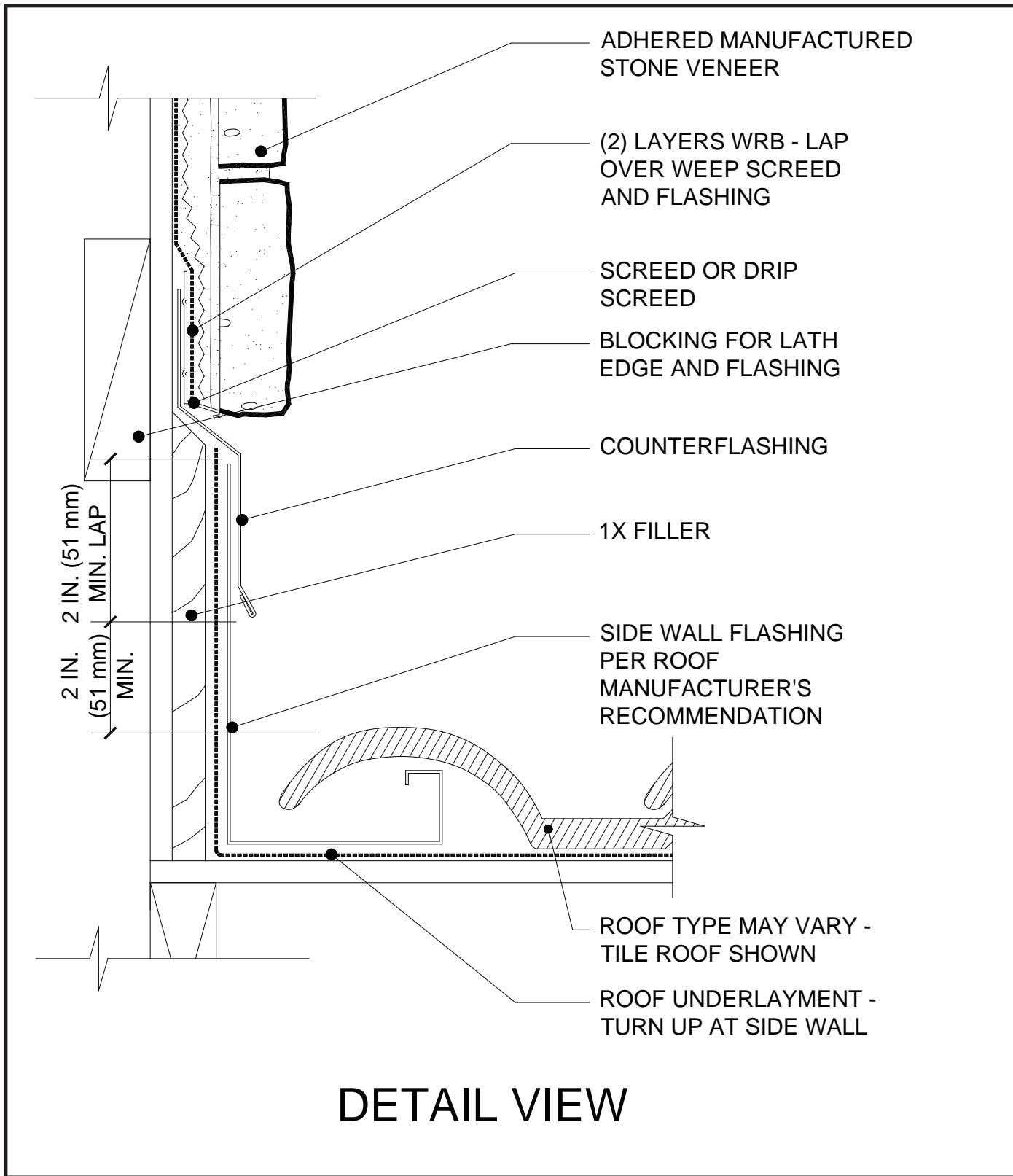
This detail includes base trim. Note the counterflashing between trim and adhered manufactured stone veneer.

Figure 19. Side Wall - Tile Roofing



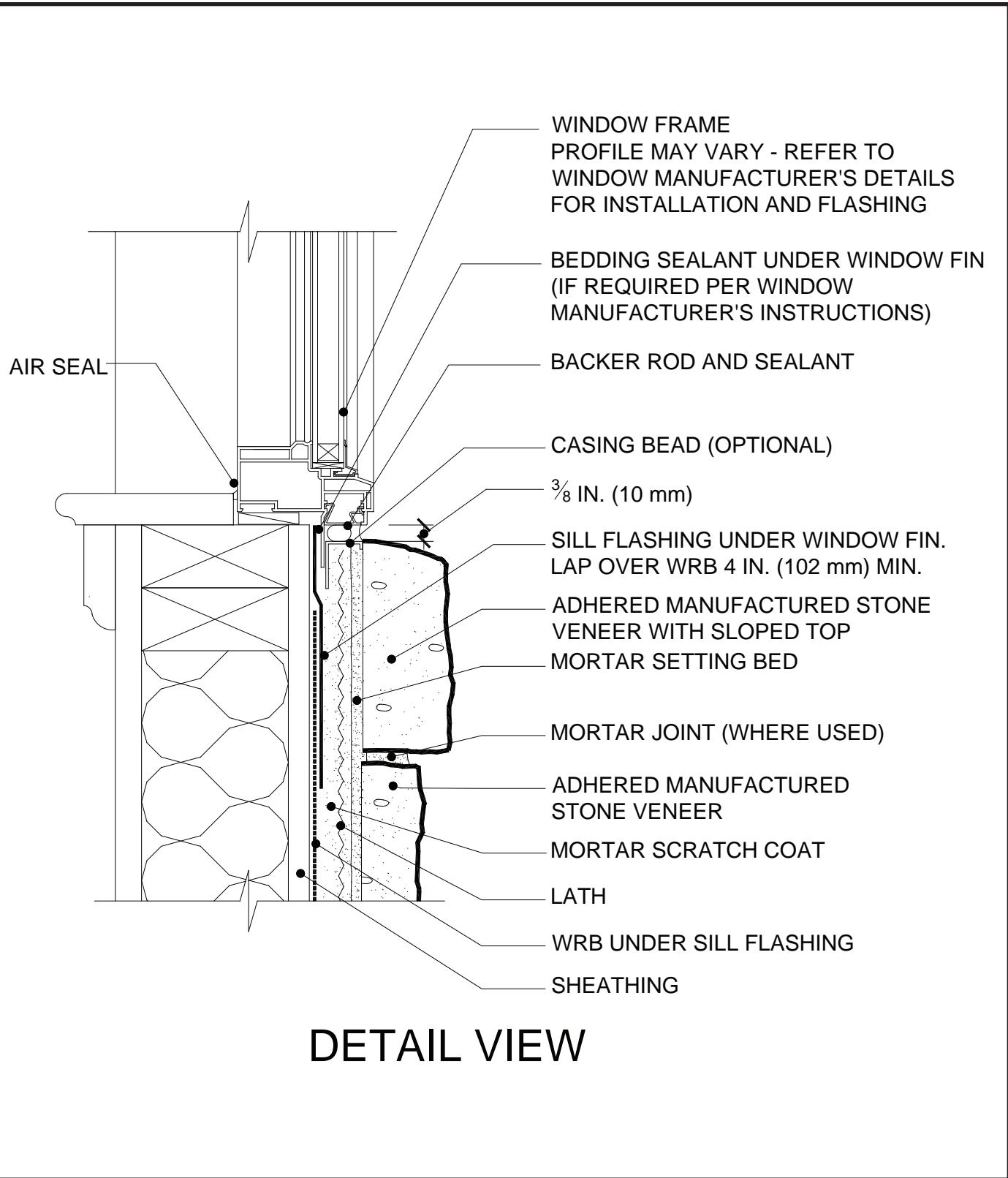
Water resistive barrier laps over step flashing and weep screed.

Figure 20. Side Wall - Tile Roofing Curbing



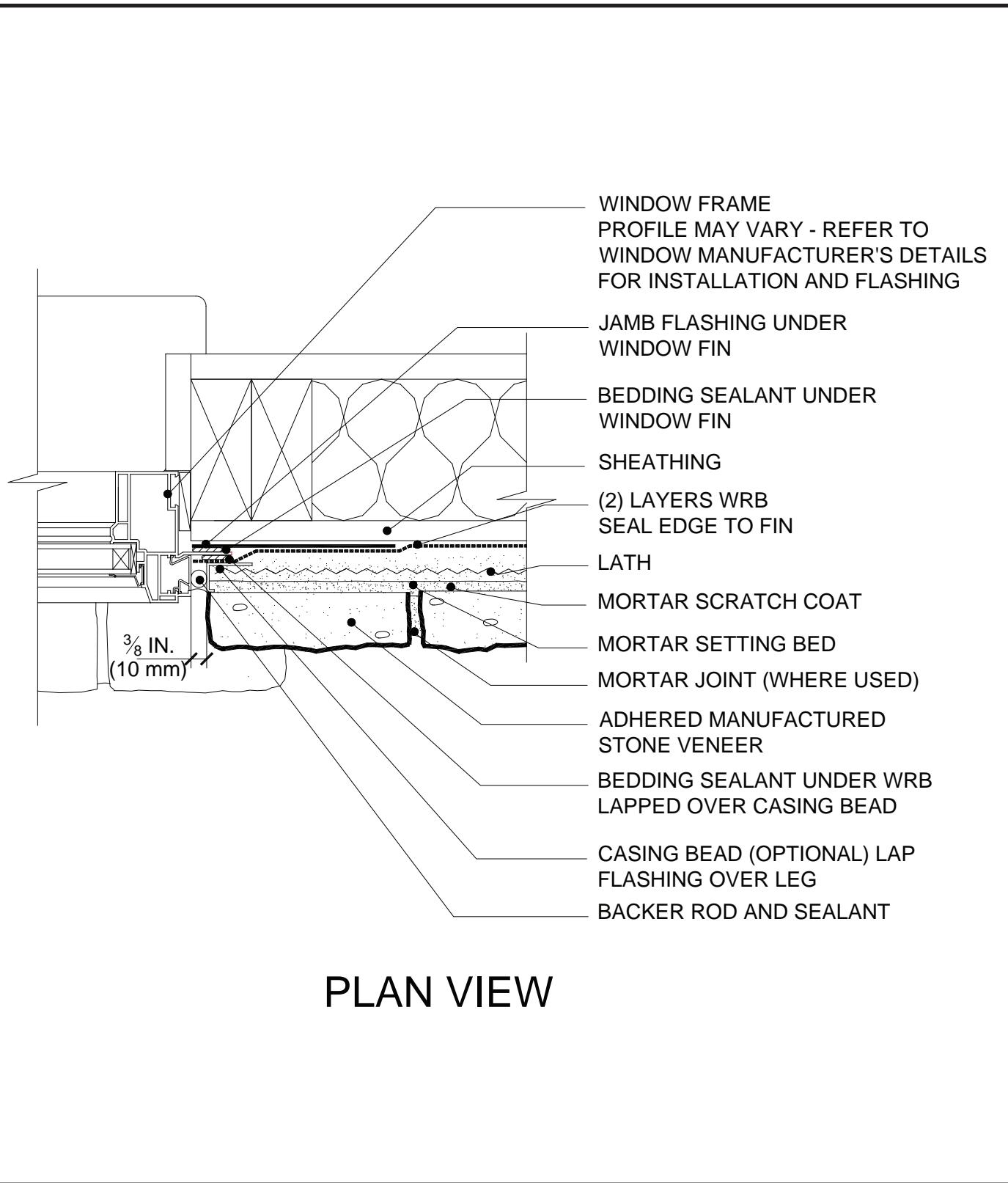
This detail includes curbing. Note the counterflashing between trim and adhered manufactured stone veneer.

Figure 21. Window Sill



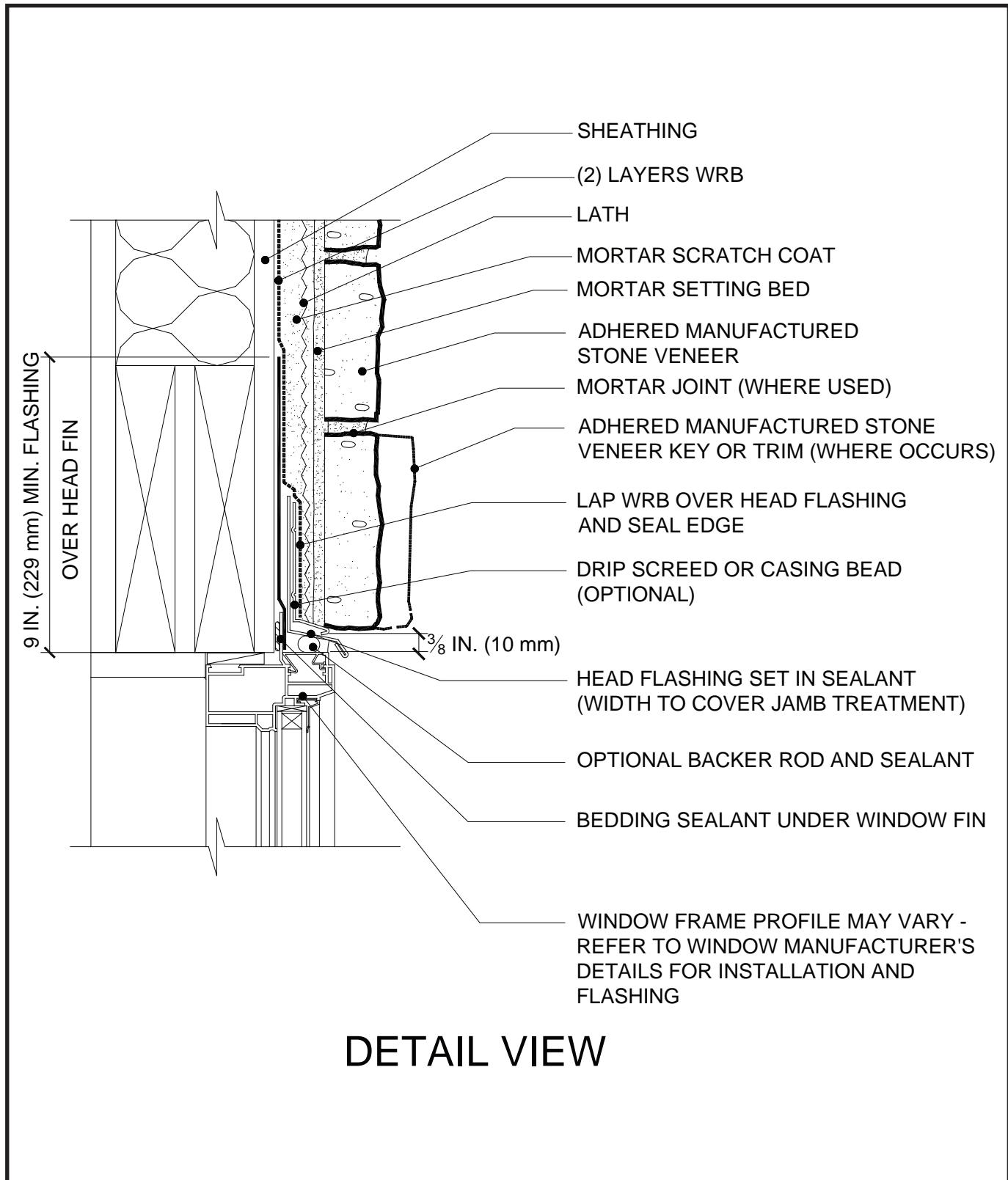
Rough openings must be properly flashed prior to window installation. Tuck water resistive barrier under flashing at sill. Sill flashing should drain to the exterior of the primary WRB or to exterior of adhered manufactured stone veneer.

Figure 22. Window Jamb



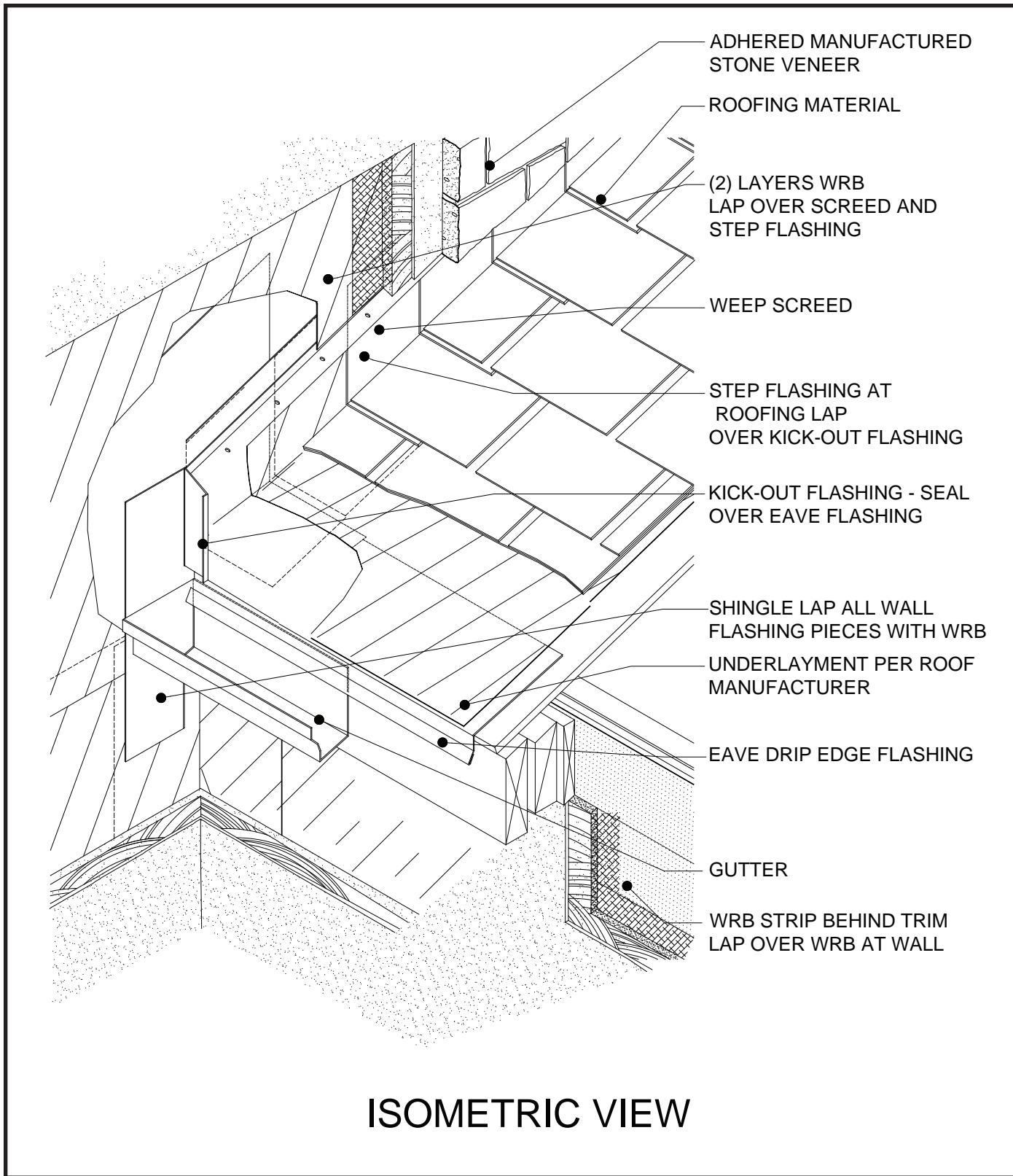
Rough openings must be properly flashed prior to window installation. Backer rod and sealant between the window frame and the adhered manufactured stone veneer allows for movement between the dissimilar materials.

Figure 23. Window Head



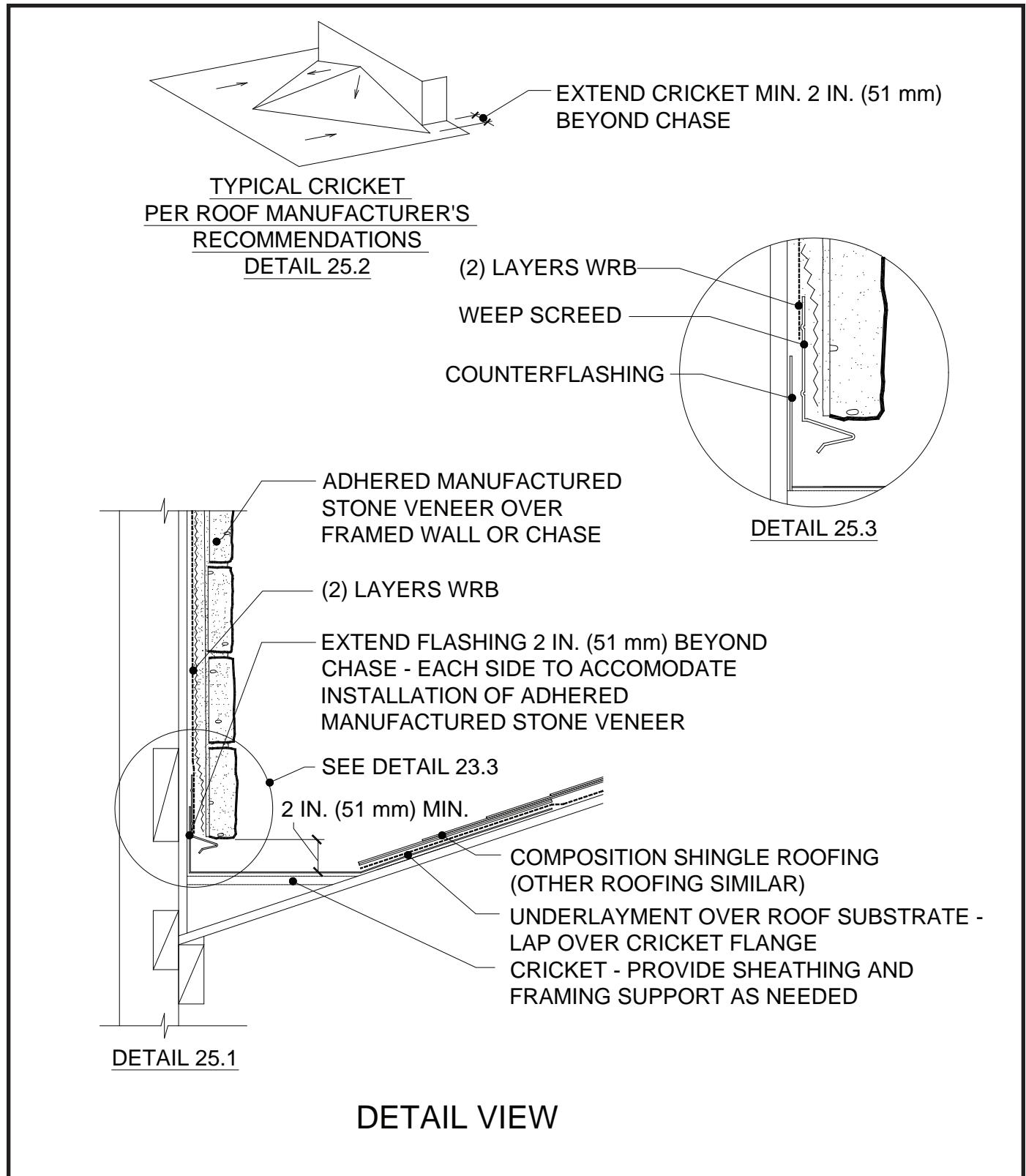
Flashing and WRB installed shingle fashion may be complimented with self-adhered flashing to seal WRB to window frame.

Figure 24. Kick-Out Flashing



Kickout flashing should be sized properly to accommodate thickness of AMSV. Integration of WRB, flashing and kick-out critical.

Figure 25. Cricket



A cricket up-slope of a roof penetration, such as a chimney, helps direct water around the penetration.

Figure 26. Chimney Chase

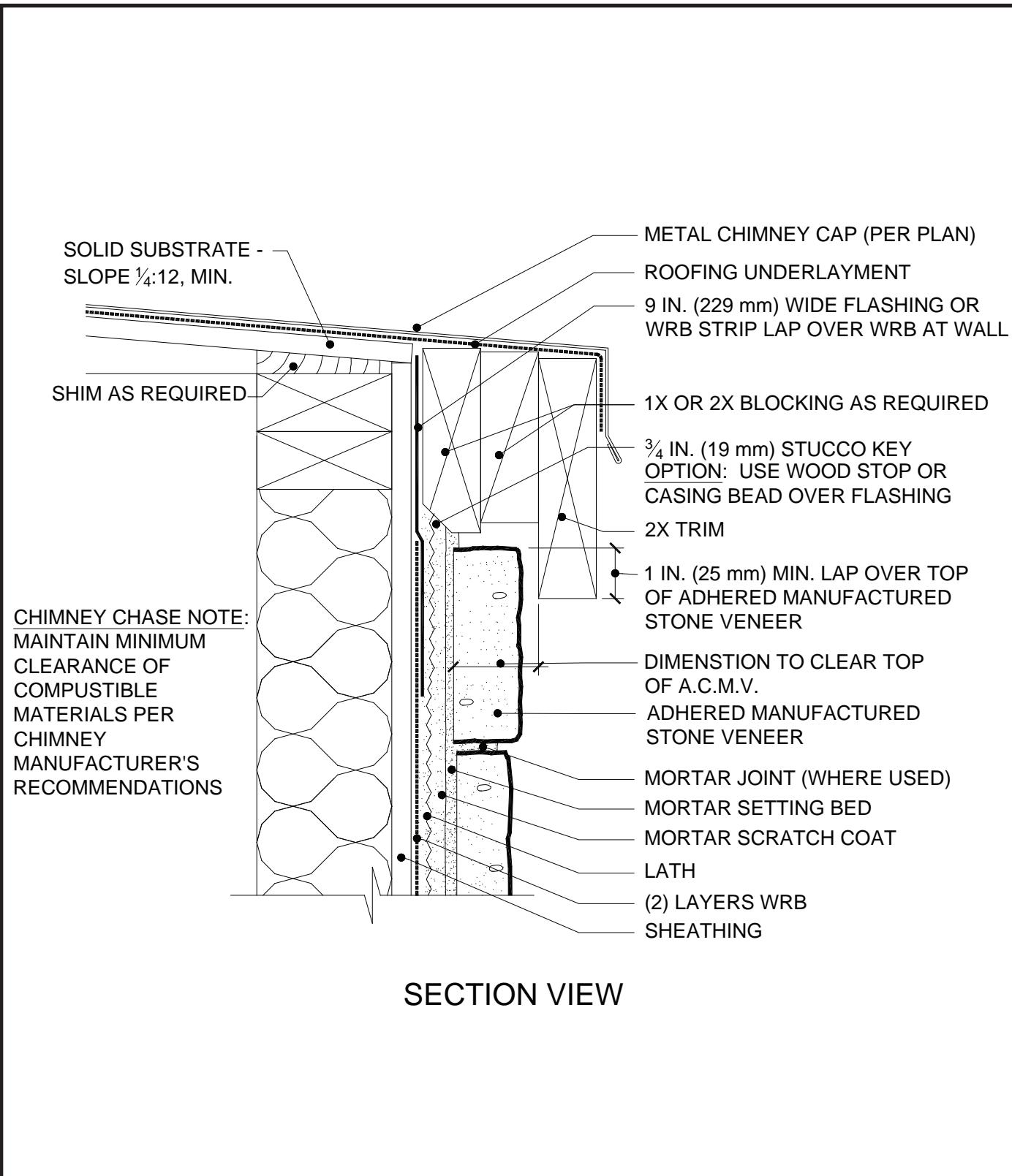
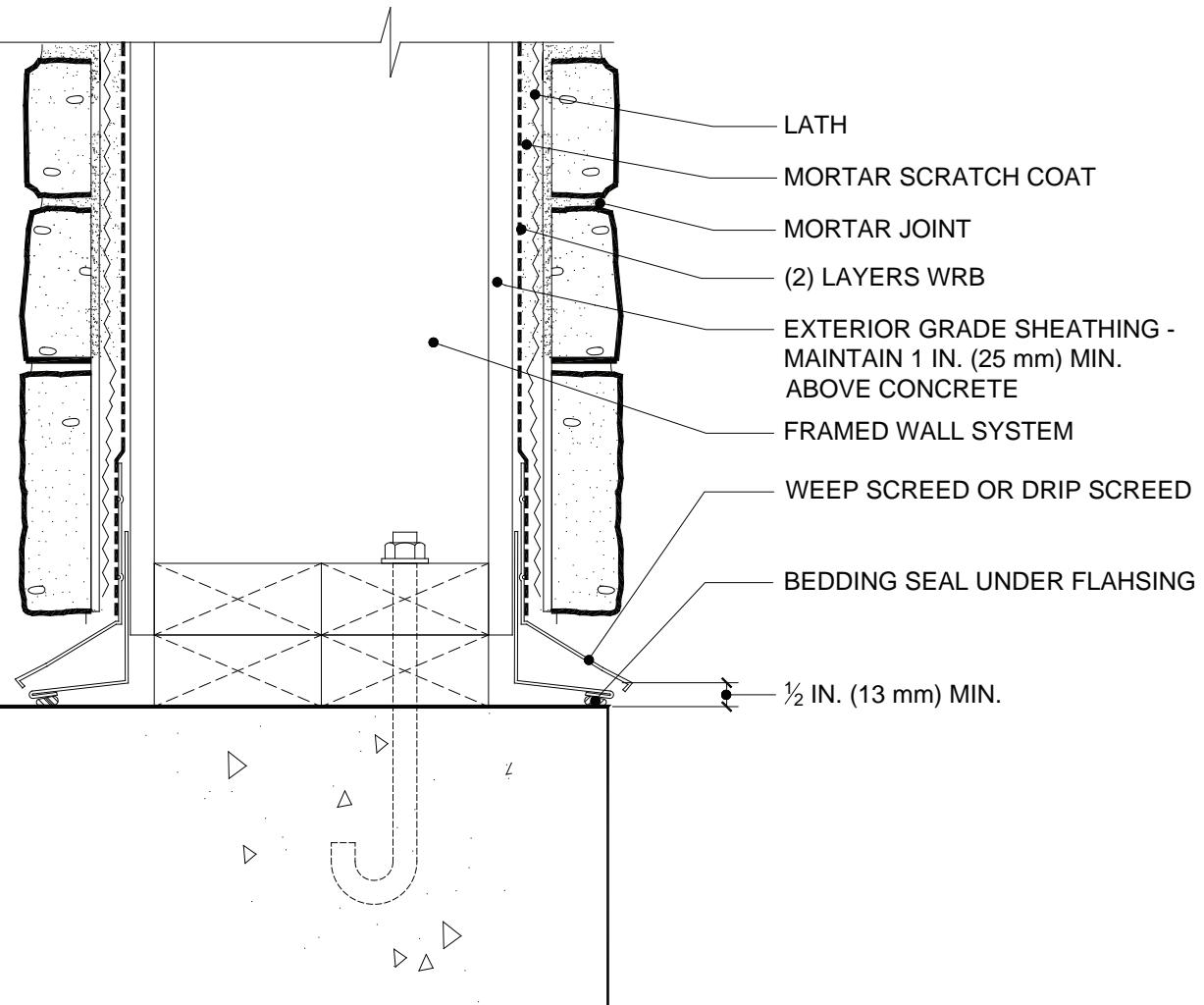


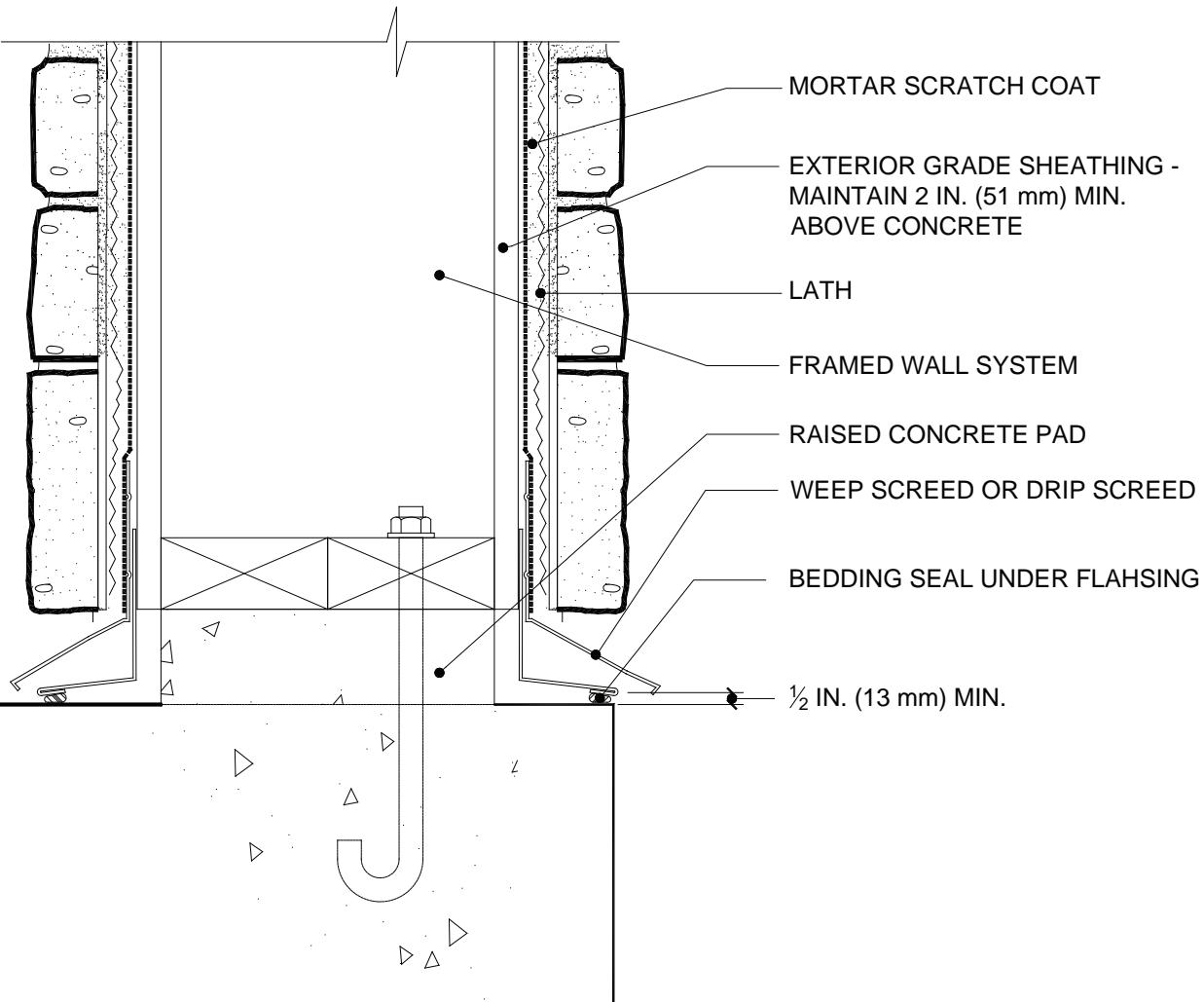
Figure 27. Column Base



SECTION VIEW

A minimum one half inch (13 mm) clearance should be maintained at all sides of the base. All column materials to be exterior grade. Do not extend flashing past edge of AMSV for safety reasons.

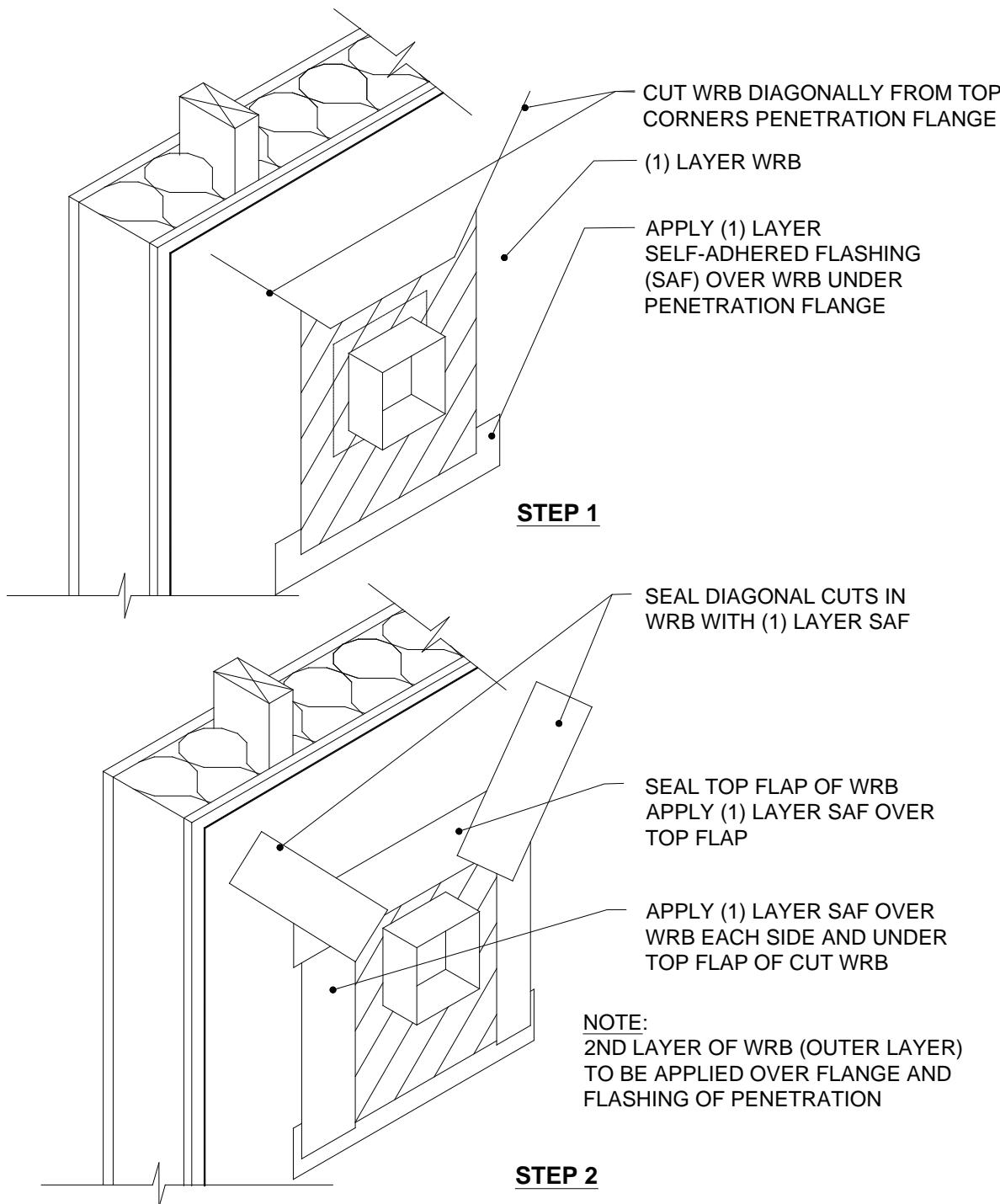
Figure 28. Raised Column Base



DETAIL VIEW

Adhered manufactured stone veneer may overlap the raised concrete pad, but a clearance of one half inch (13 mm) should be maintained at all sides of the base. Do not extend flashing past edge of AMSV.

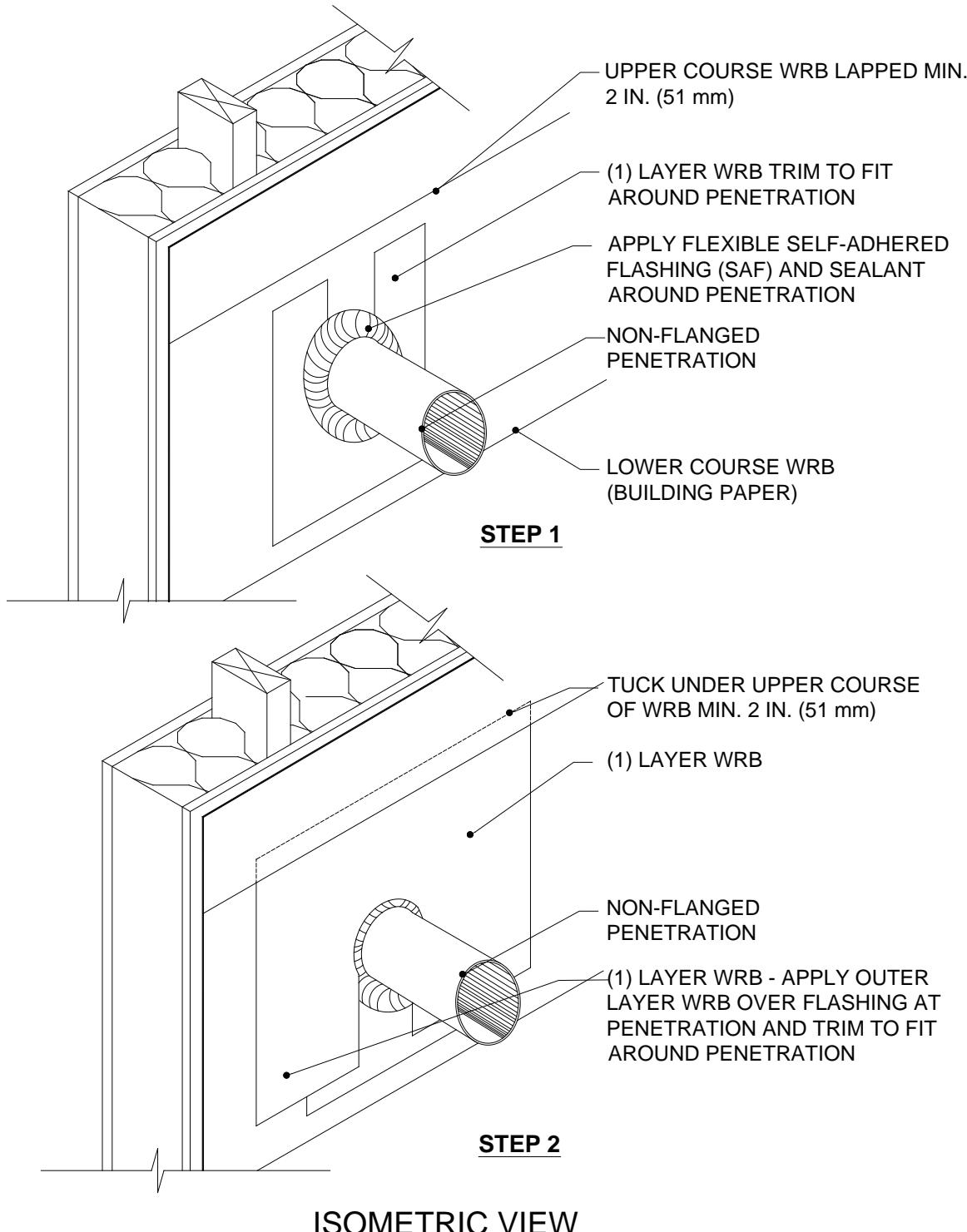
Figure 29. Penetration, Flanged



ISOMETRIC VIEW

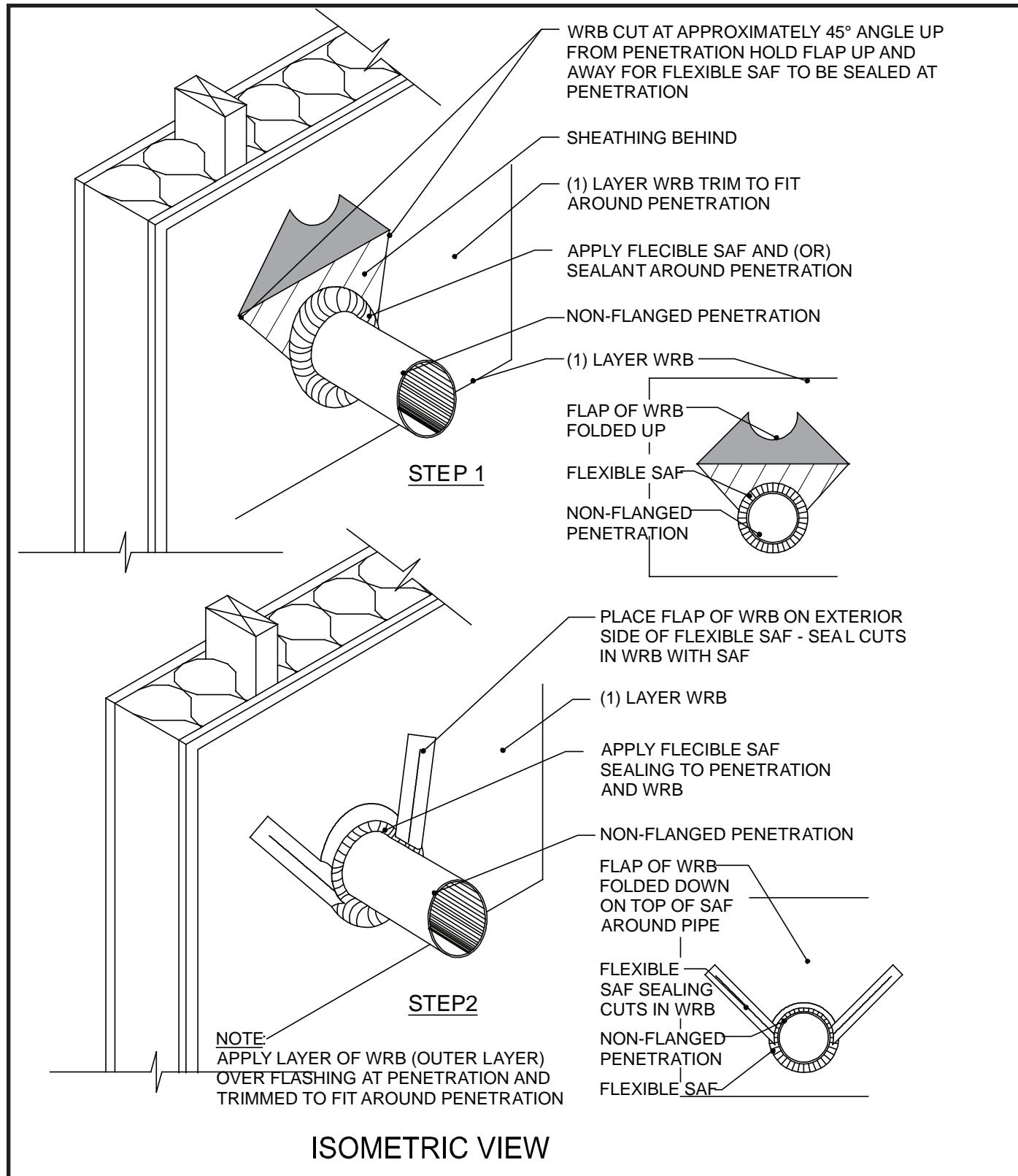
Penetration with flanges can be incorporated into the wall system by applying WRB in a watershed fashion and sealing cuts in the WRB with self-adhered flashing. Drawing illustrates installation with housewrap WRB. Installation with building paper WRB would be similar but instead of 45 degree cuts, fit last piece of WRB on top of flanges and tuck under WRB course above penetration (similar to Step 2 in Fig. 31.).

Figure 30. Penetration Non-Flanged, with Building Paper WRB



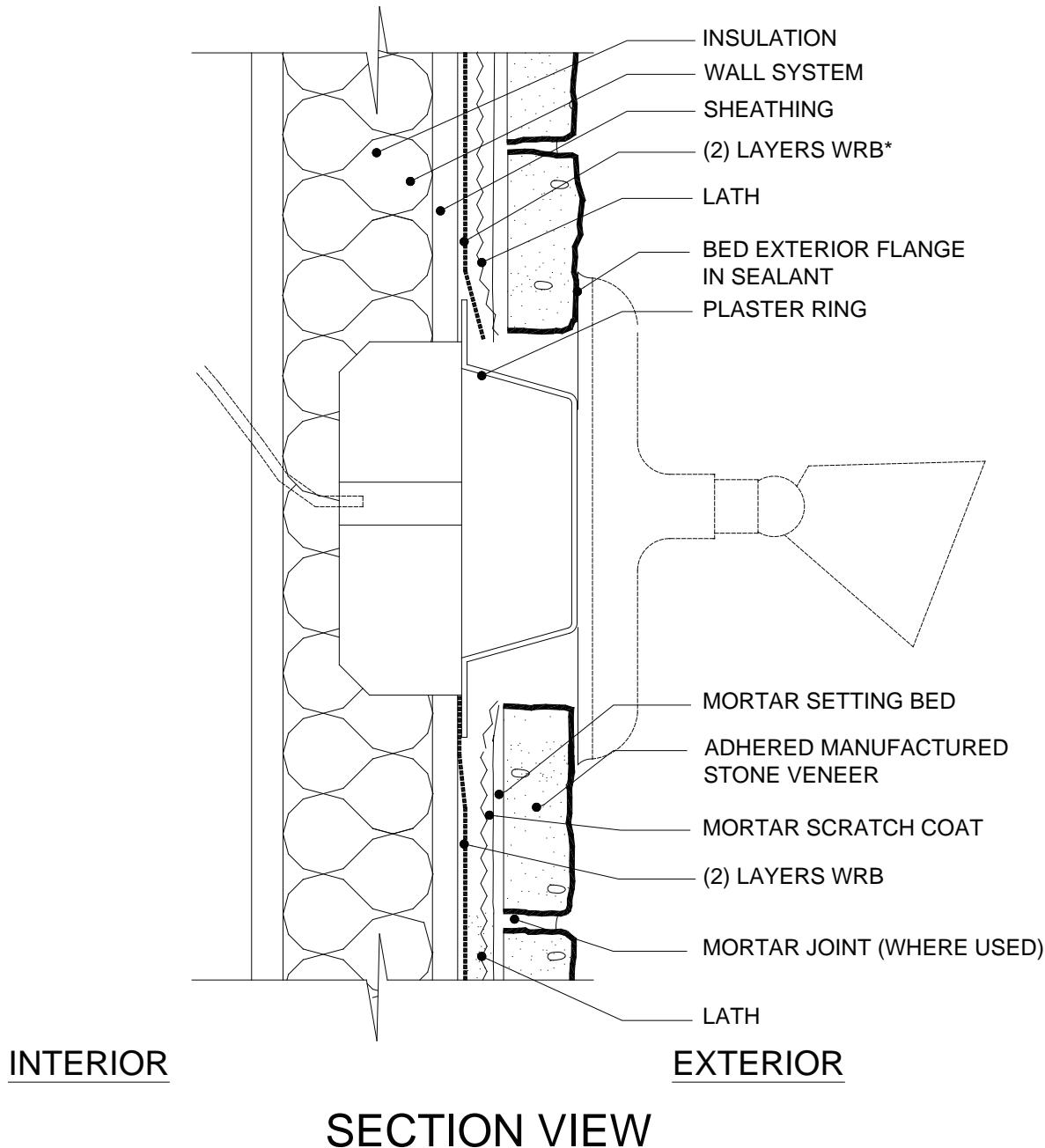
Flexible self-adhered flashing and WRB installed in a watershed fashion help prevent water infiltration.

Figure 31. Penetration Non-Flanged, with Housewrap WRB



Flexible self-adhered flashing around the penetration and WRB lapped in a watershed fashion help prevent water infiltration.

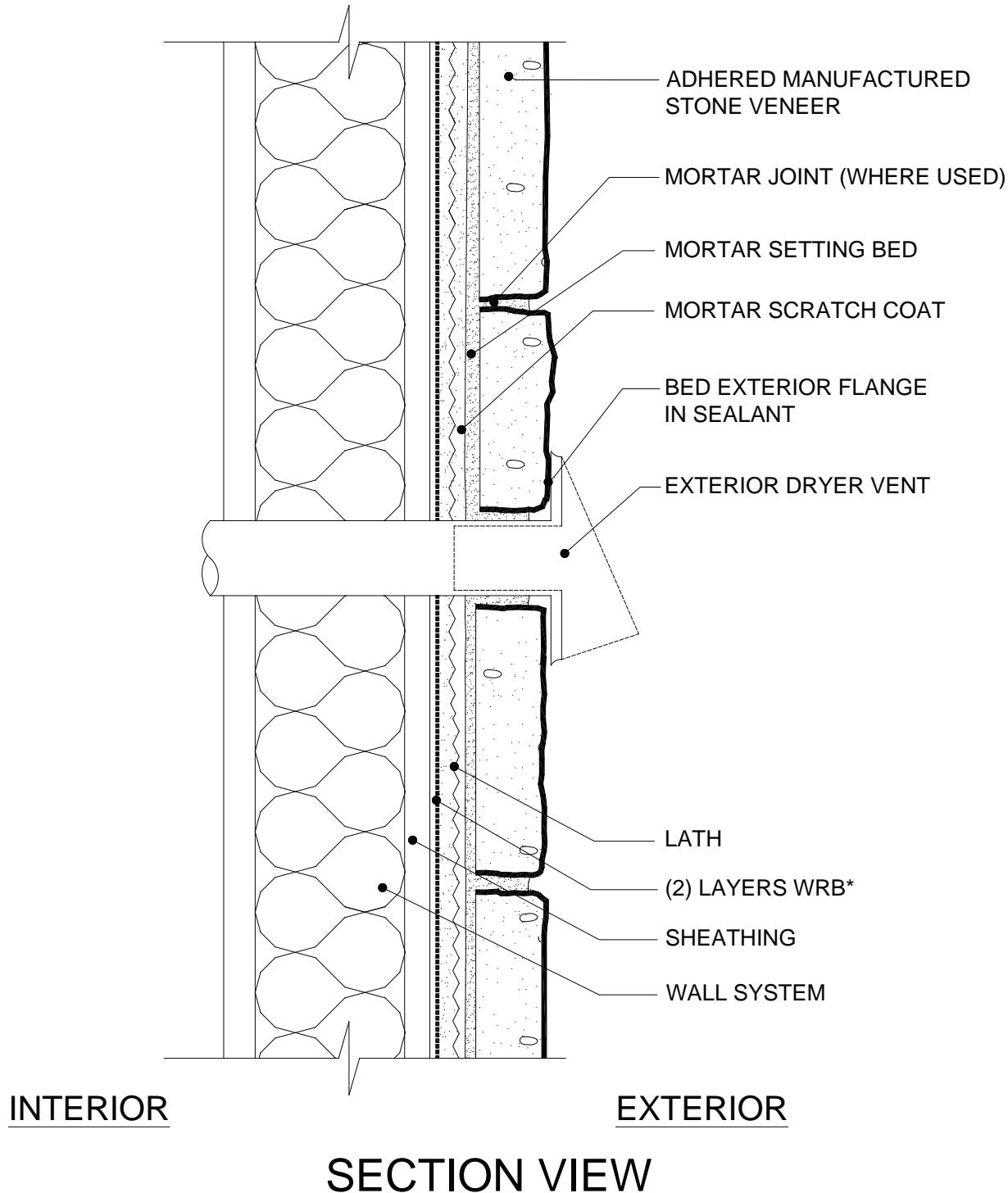
Figure 32. Penetration, Fixture



*SEE FIGURES 29, 30, AND 31 FOR FLASHING OPTIONS.

Plaster rings should be affixed over the service box to bring the face of the box flush with the adhered manufactured stone veneer. Bed the exterior flange in sealant. Water resistive barrier should be installed snugly around the plaster ring flange.

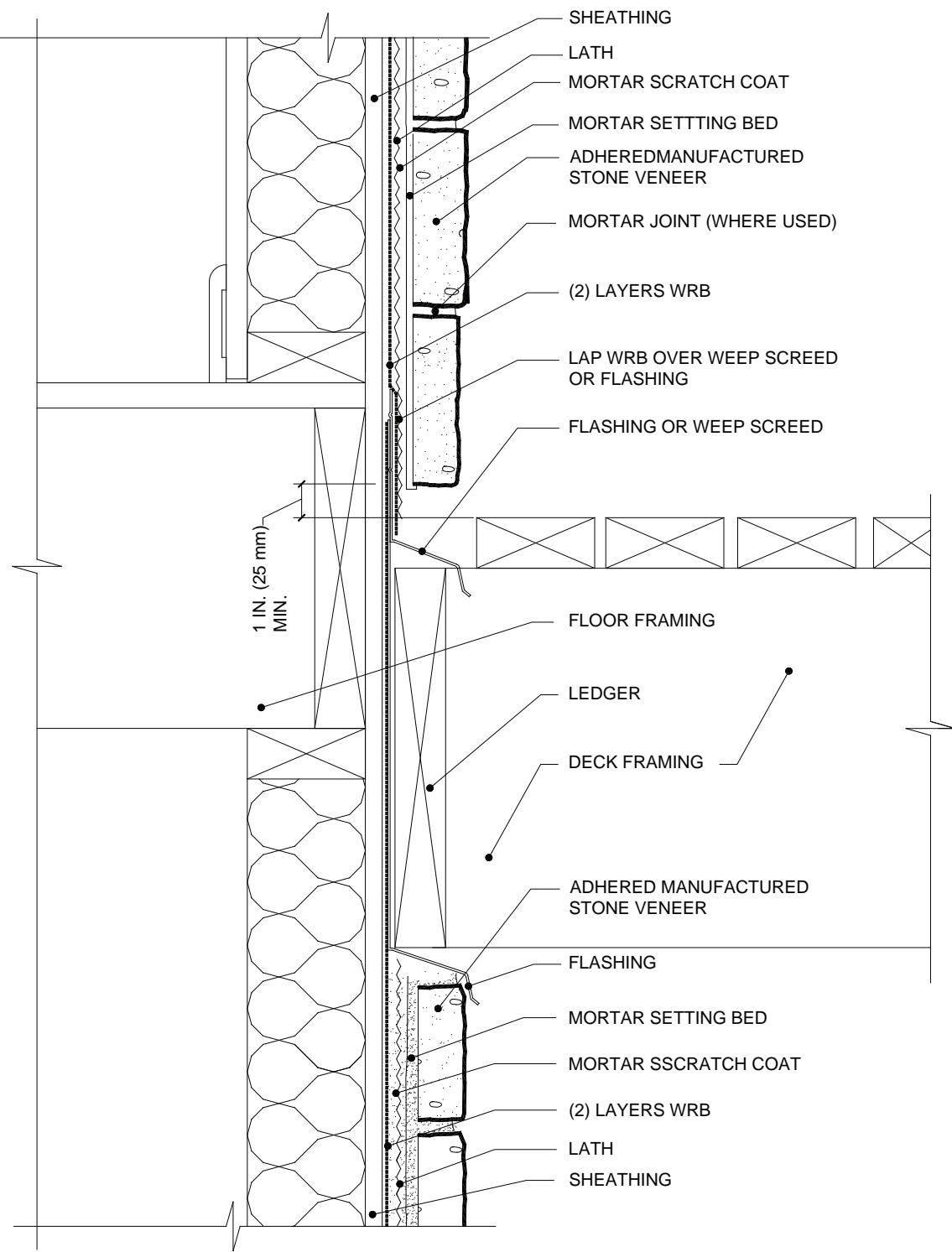
Figure 33. Penetration, Dryer Vent



*SEE FIGURES 29, 30, AND 31 FOR FLASHING OPTIONS

Bed all covers, flanges, and escutcheons in sealant before fastening to the wall.

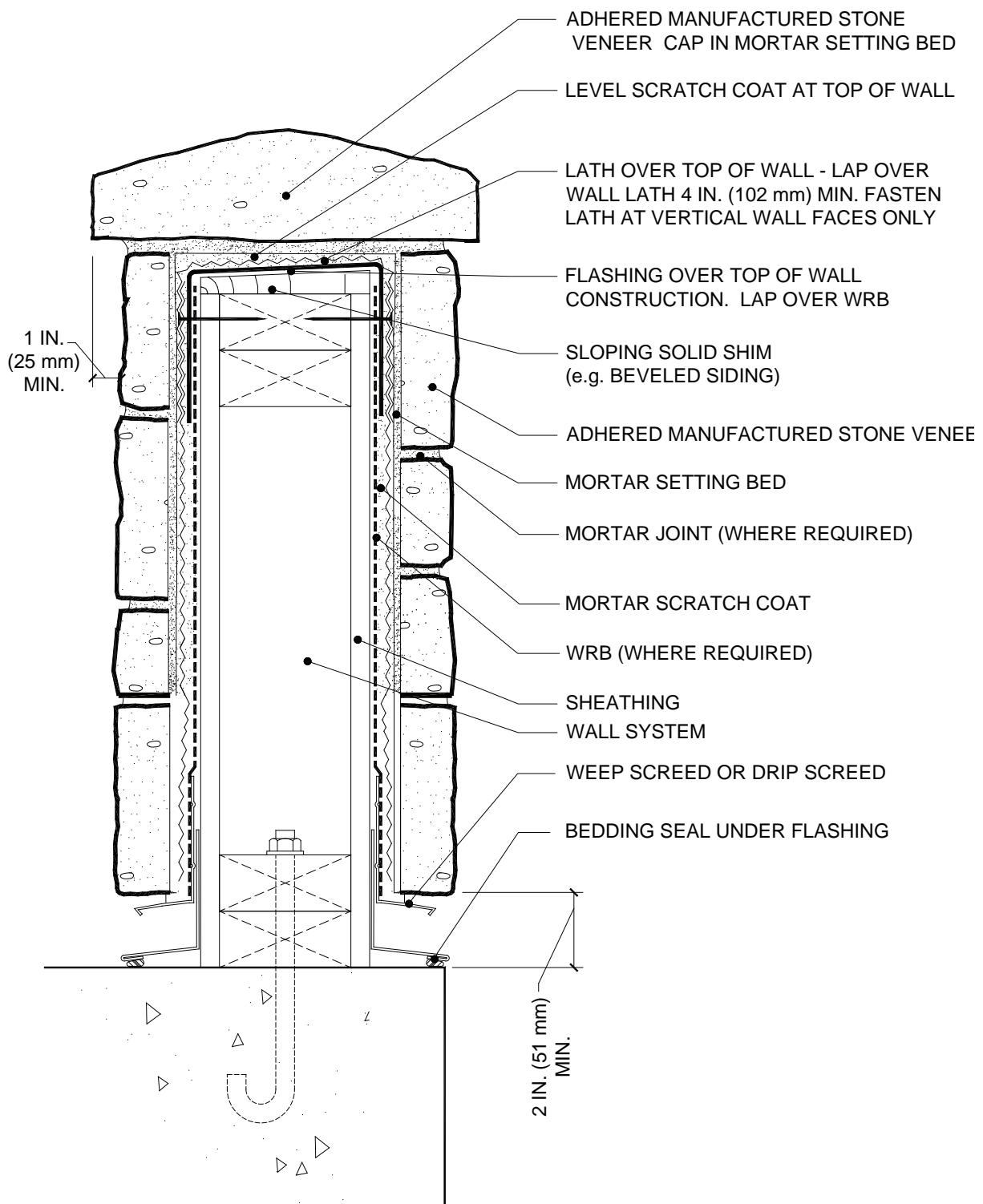
Figure 34. Deck Termination



SECTION VIEW

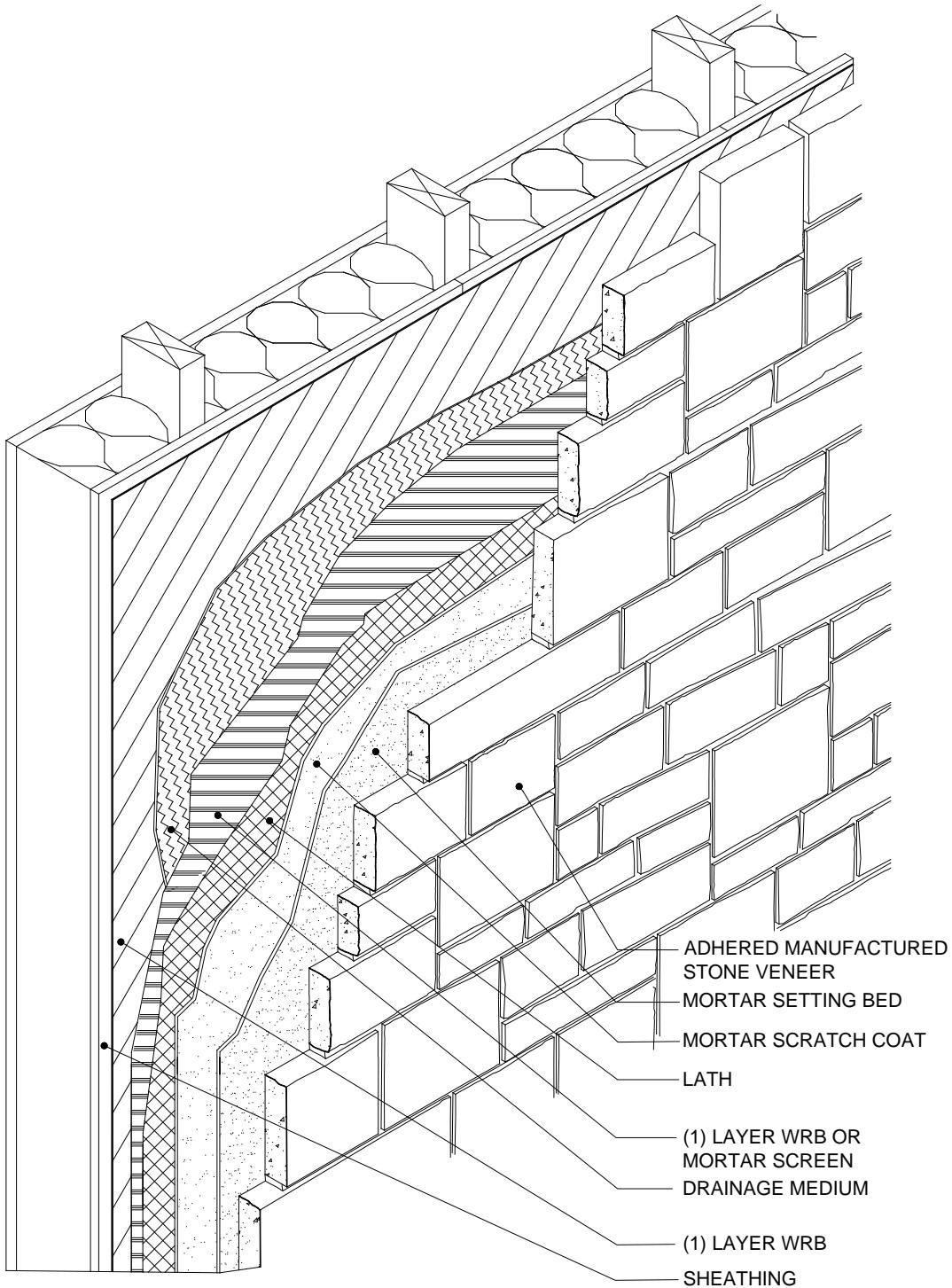
Lap water resistive barrier over weep screed and floor framing to manage water intrusion. Provide gap between adhered manufactured stone veneer and decking for drainage. Water management at the deck ledger boards is critical, and may vary based on the building design.

Figure 35. Wall Cap



A sloping solid shim should top the wall under the flashing and lath. Flashing should lap the top of the wall. Lath should lap over the top of the wall but be fastened only to vertical wall faces.

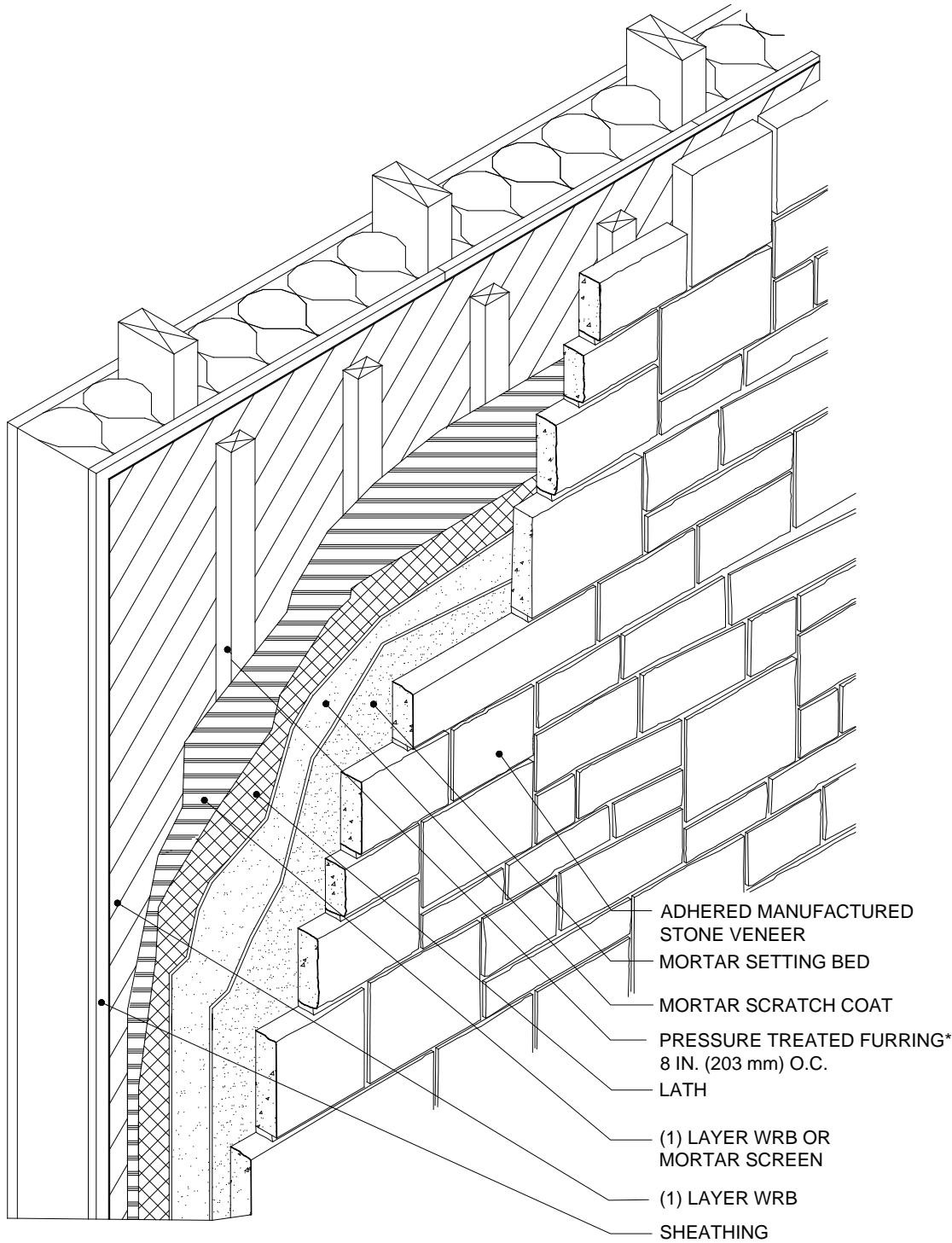
Figure 36. Wall Assembly - Optional Rainscreen System - Drainage System



ISOMETRIC VIEW

A rainscreen system incorporating a drainage medium (drainage mat or formed polymer sheeting, etc.) on the exterior side of the primary WRB.

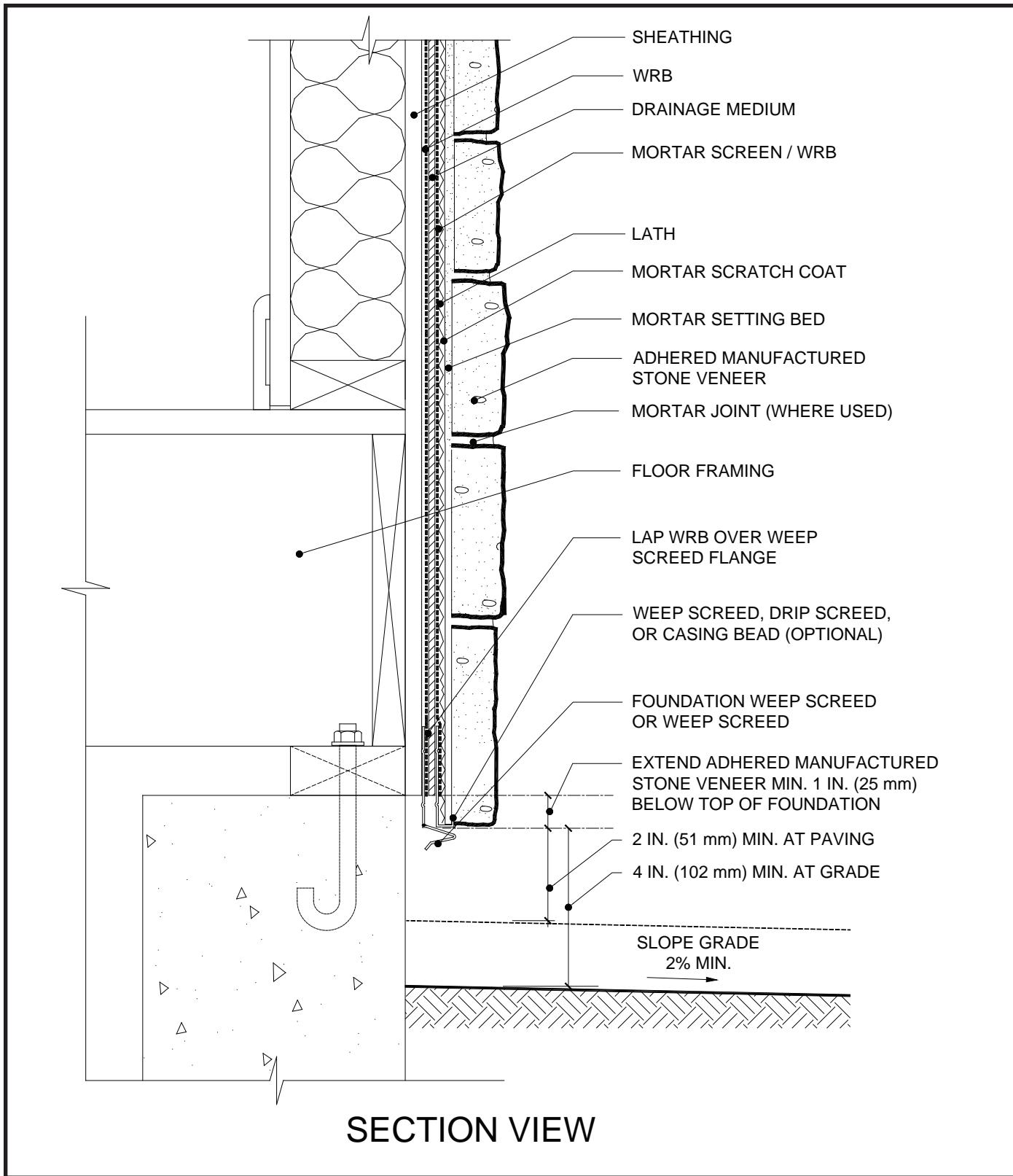
Figure 37. Wall Assembly - Optional Rainscreen System - Strapped



ISOMETRIC VIEW

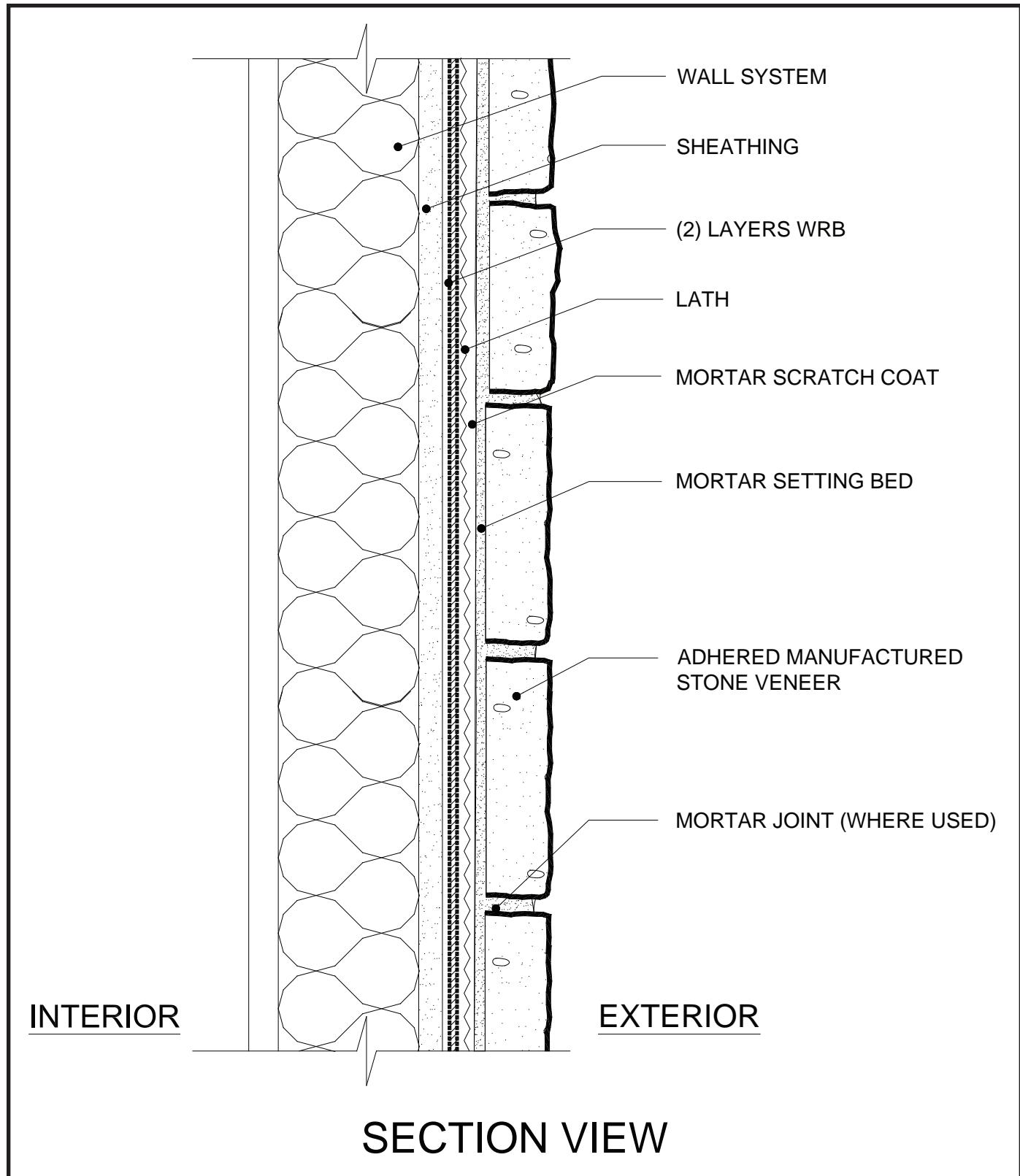
A rainscreen system of vertical strapping / furring creates a vertical gap between the primary WRB and the mortar screen / WRB on the back of the scratch coat. *Furring fastened into framing and into nailable sheathing between framing.

Figure 38. Foundation Wall Base - Optional Rainscreen System



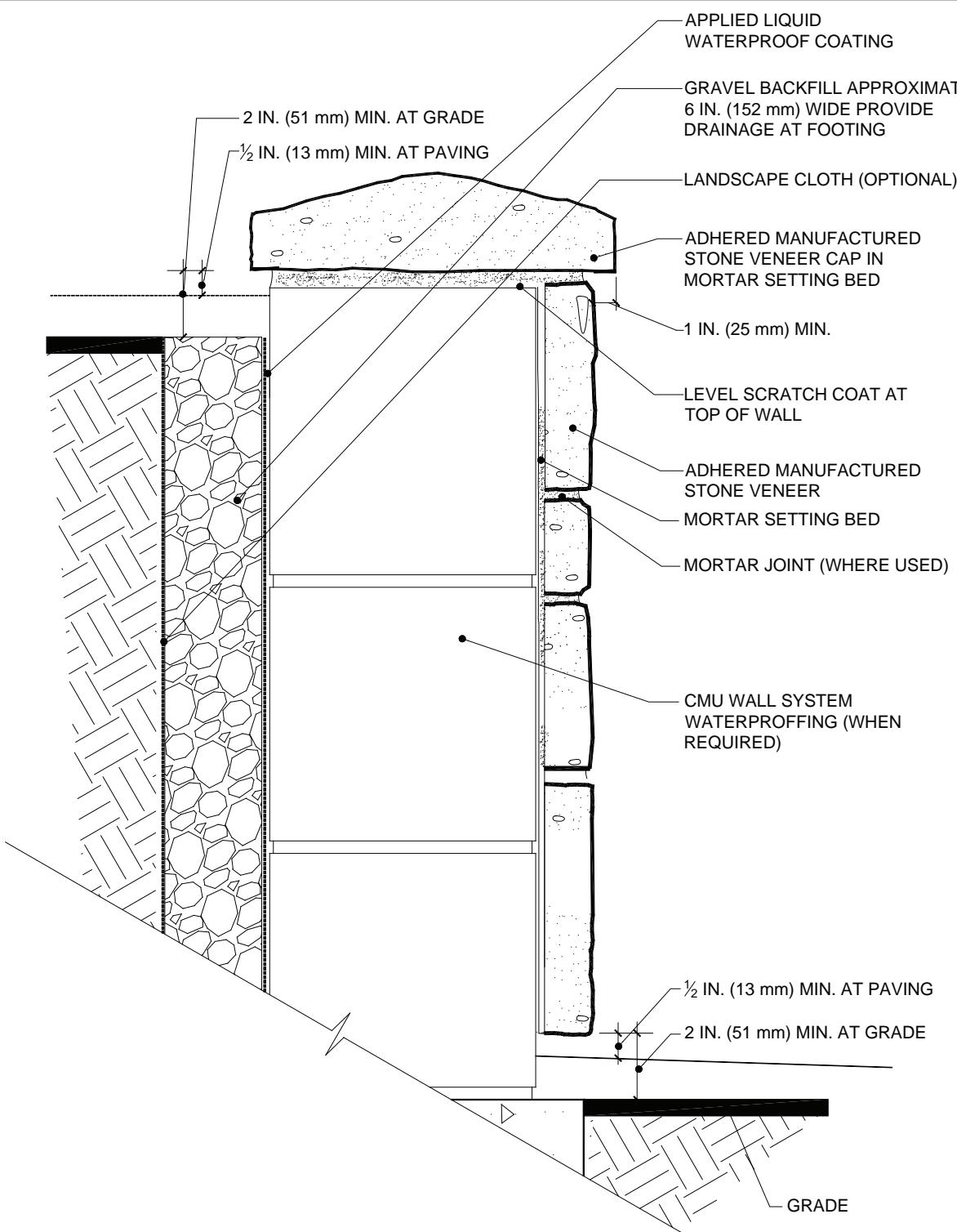
The "Drainage Medium" of this wall section represents rainscreen products (such as drainage mats or formed polymer sheeting, etc.) or construction techniques (such as strapping or furring).

Figure 39. Typical Wall Section - Optional Rainscreen System



The "Drainage Medium" of this wall section represents rainscreen products (such as drainage mats or formed polymer sheeting, etc.) or construction techniques (such as strapping or furring).

Figure 40. Retaining Wall (CMU)



SECTION VIEW

Adhered masonry veneer offers attractive aesthetics to retaining walls.

Figure 41. Wall-Section Interior Over Cement Backer Board

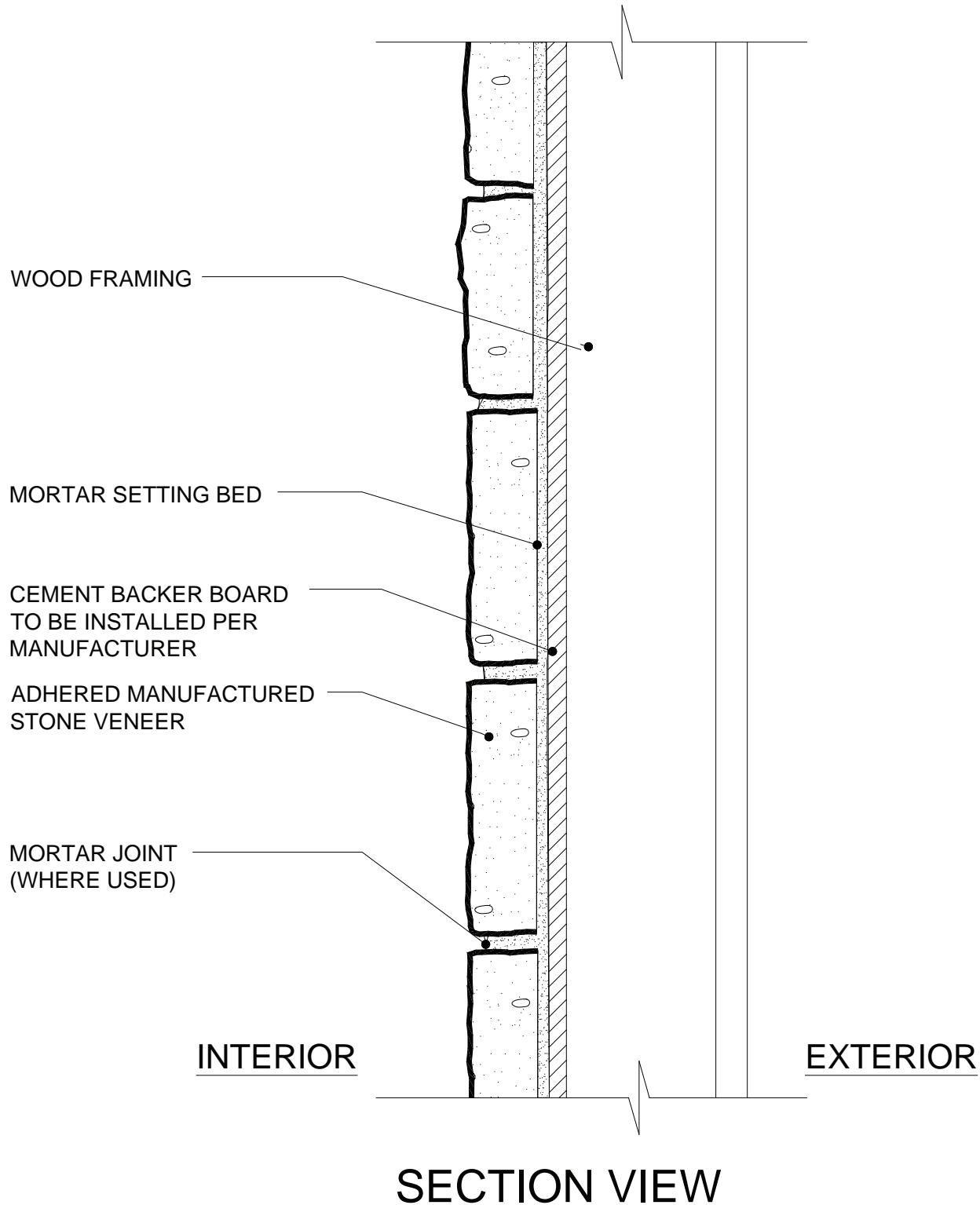


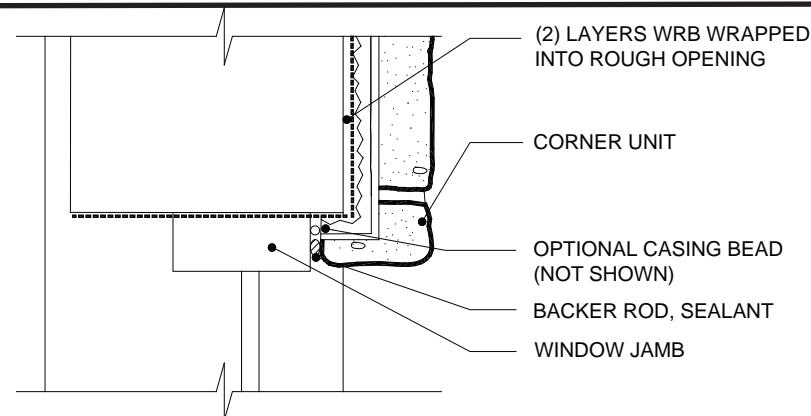
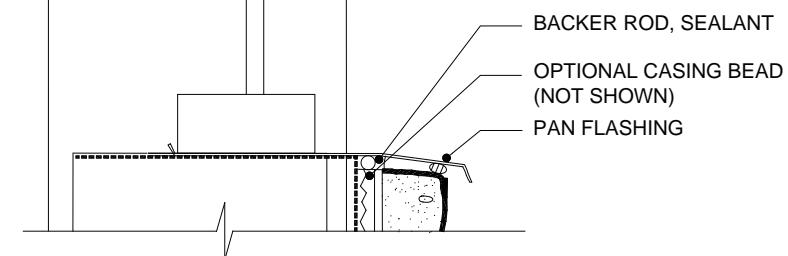
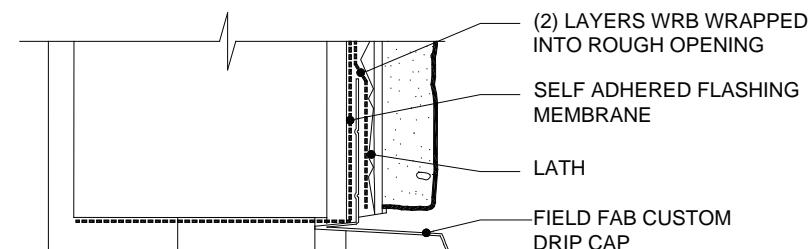
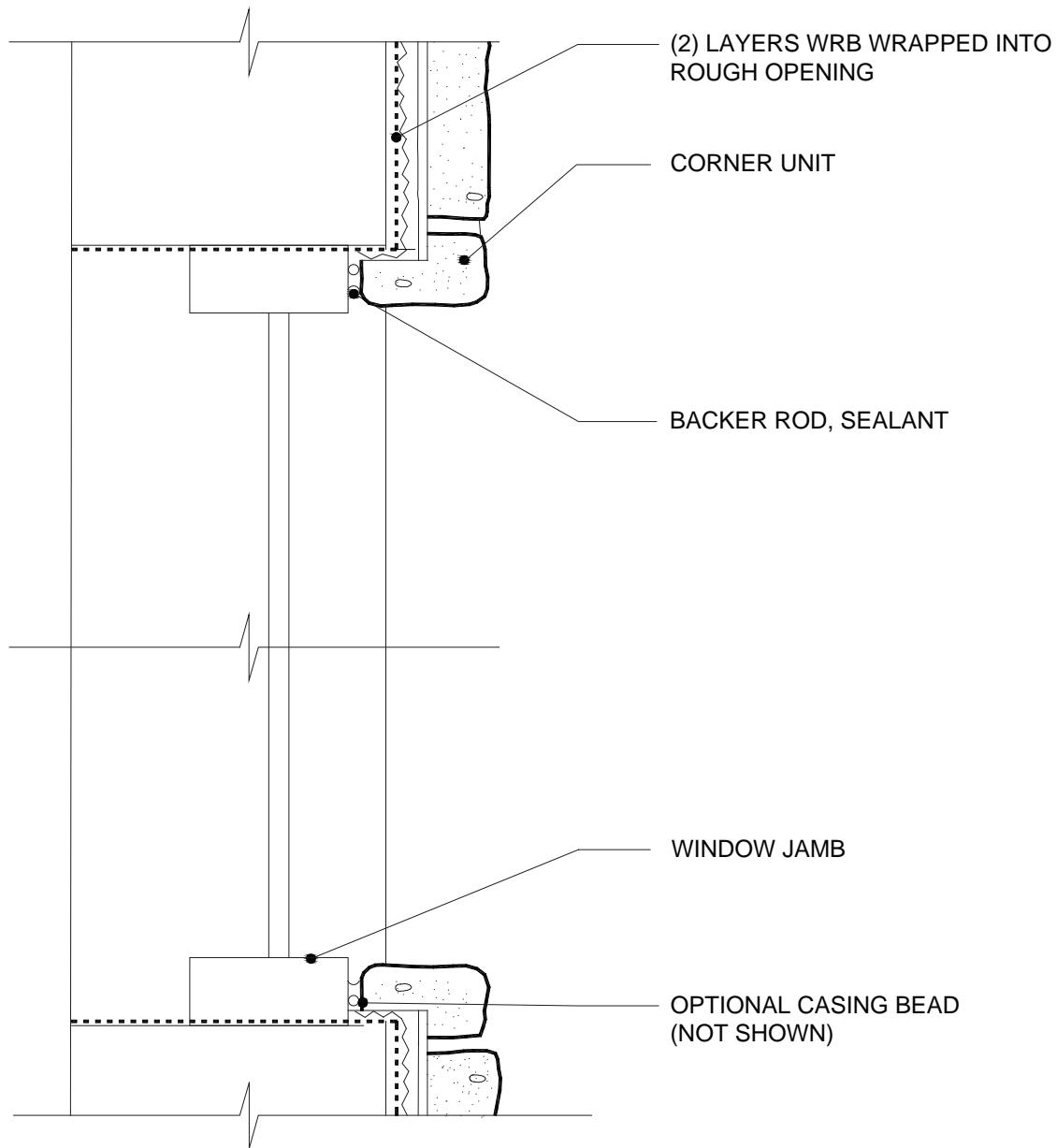
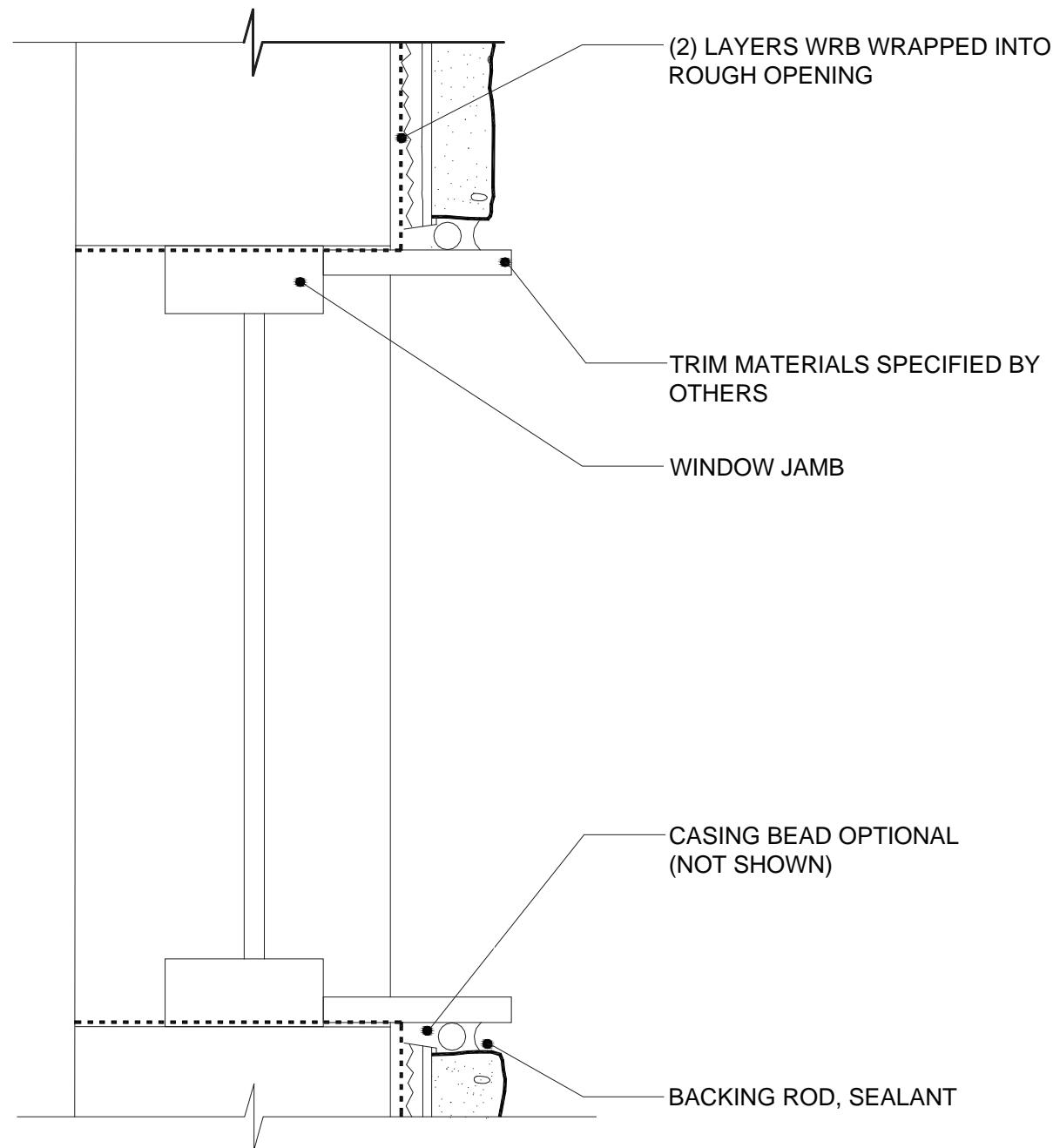
Figure 42. Forward Mounted Commercial Window**JAMB DETAIL****SECTION VIEW**

Figure 43. Forward Mounted Commercial Window—Top View



NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

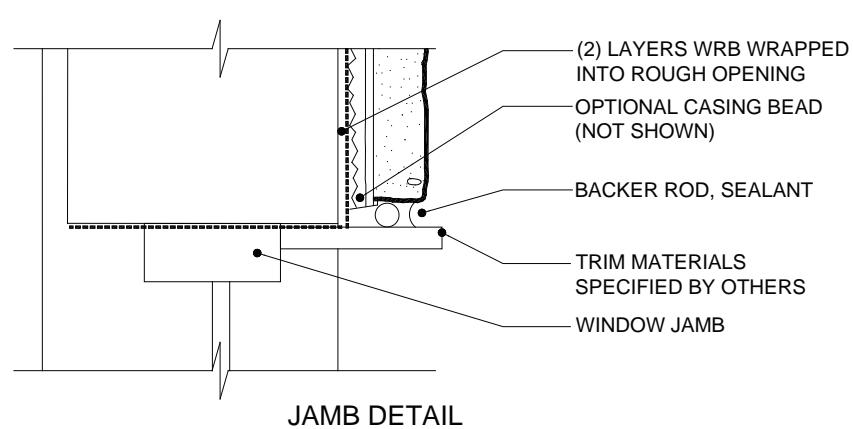
SECTION VIEW

Figure 44. Commercial Storefront Window—Top View

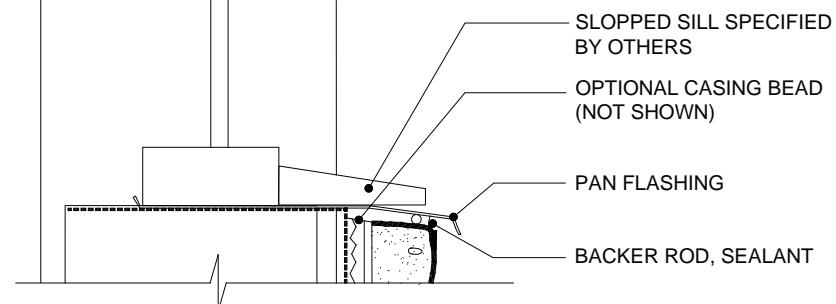
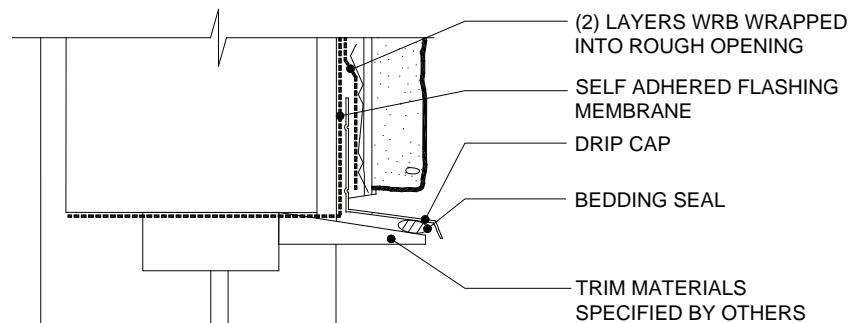
NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

SECTION VIEW

Figure 45. Commercial Storefront Window

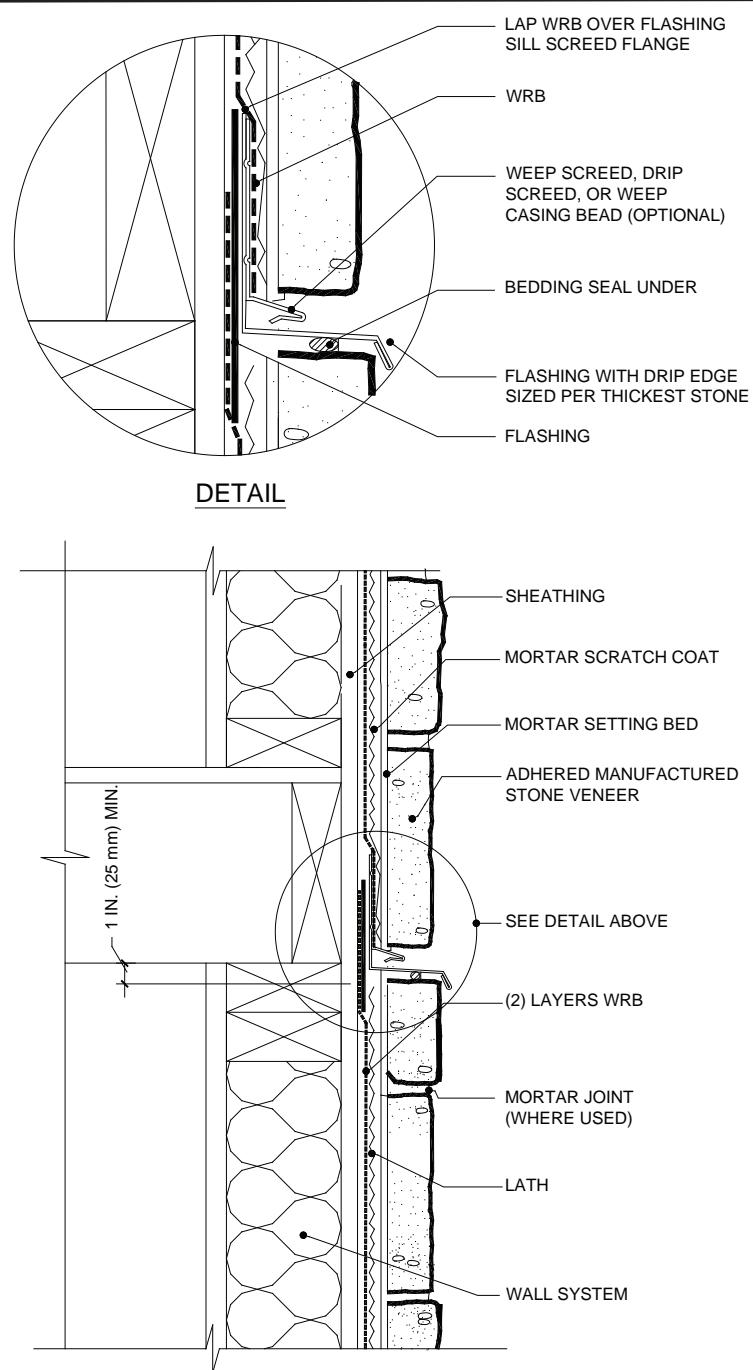


JAMB DETAIL



SECTION VIEW

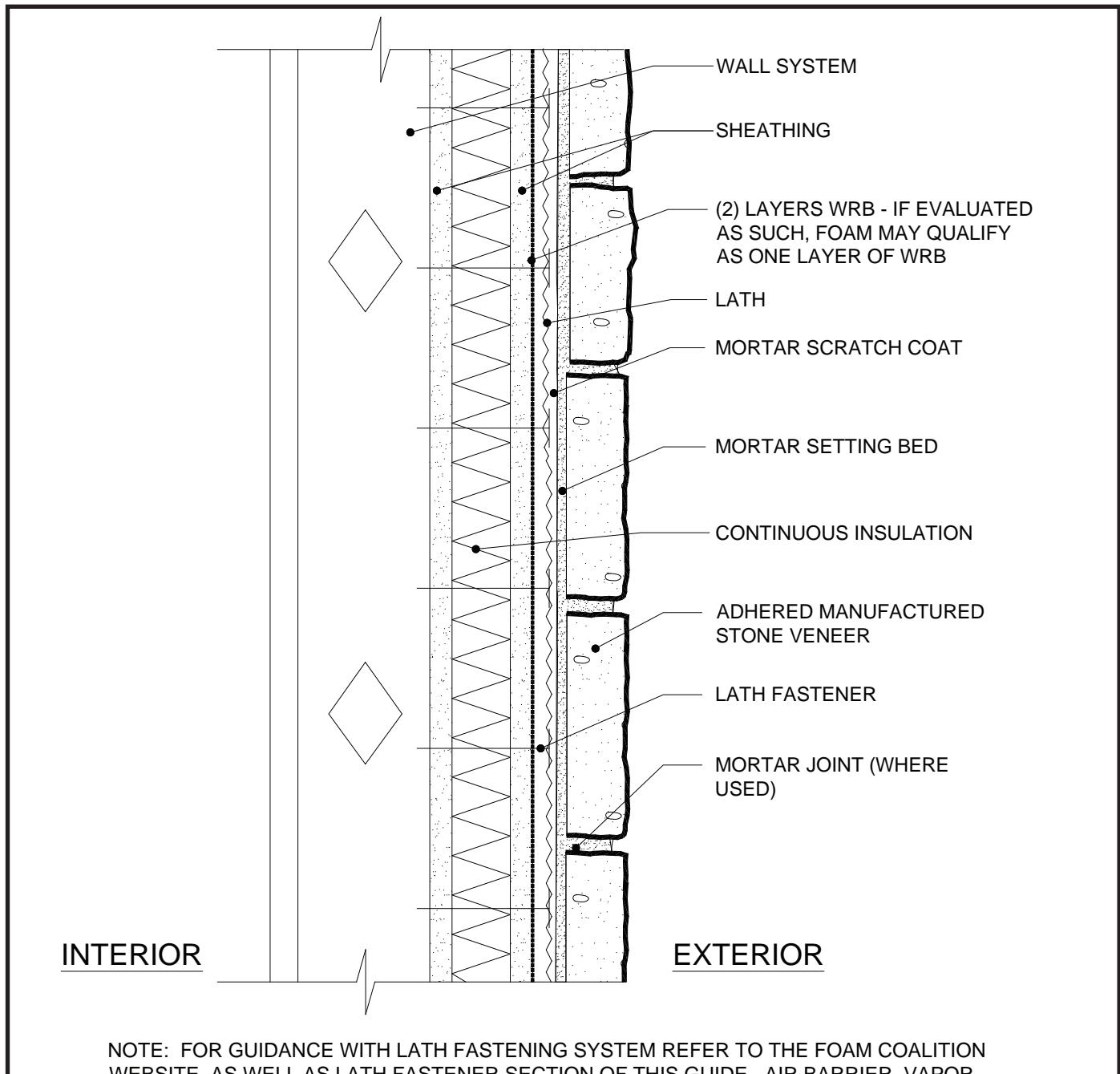
Figure 46. Wall-Section Multi-Floor Joint Detail



NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

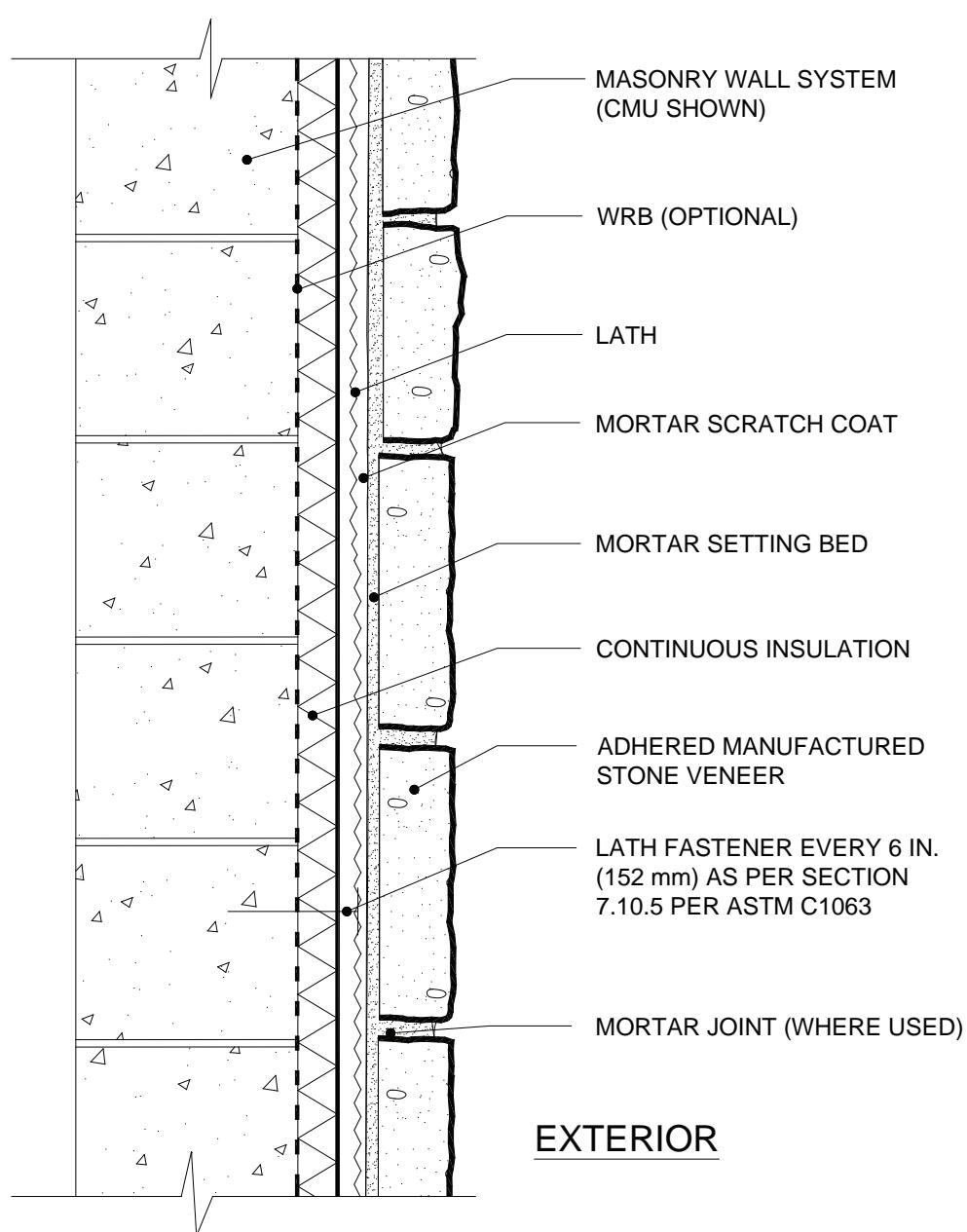
SECTION VIEW

Figure 47. Wall-Section Over Rigid Insulation with Additional Sheathing



NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

SECTION VIEW

Figure 48. Wall—Section Over Continuous Rigid Insulation CMU

NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

SECTION VIEW

Figure 49. Wall-Section Inside Corner with Stucco—Top View

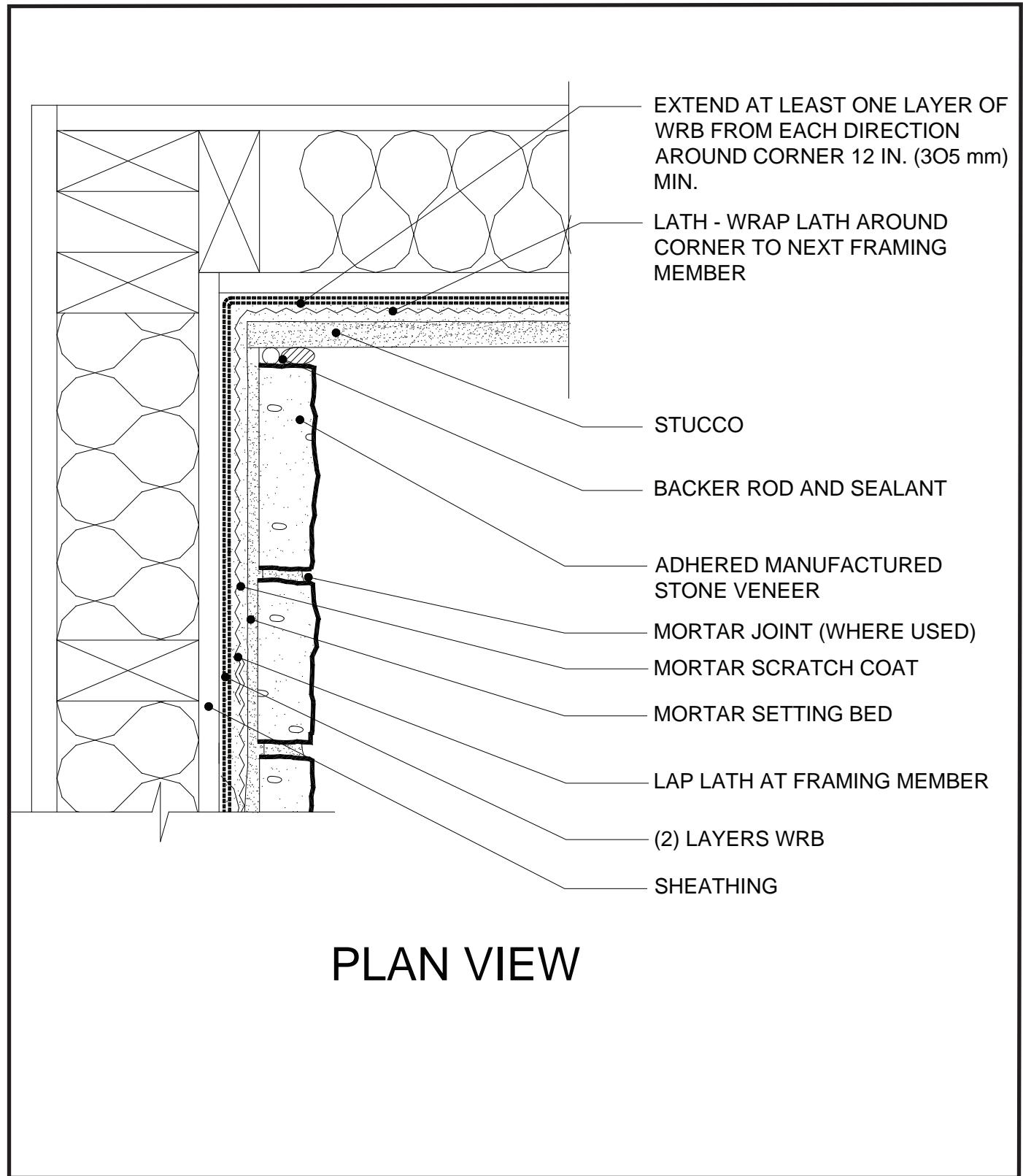
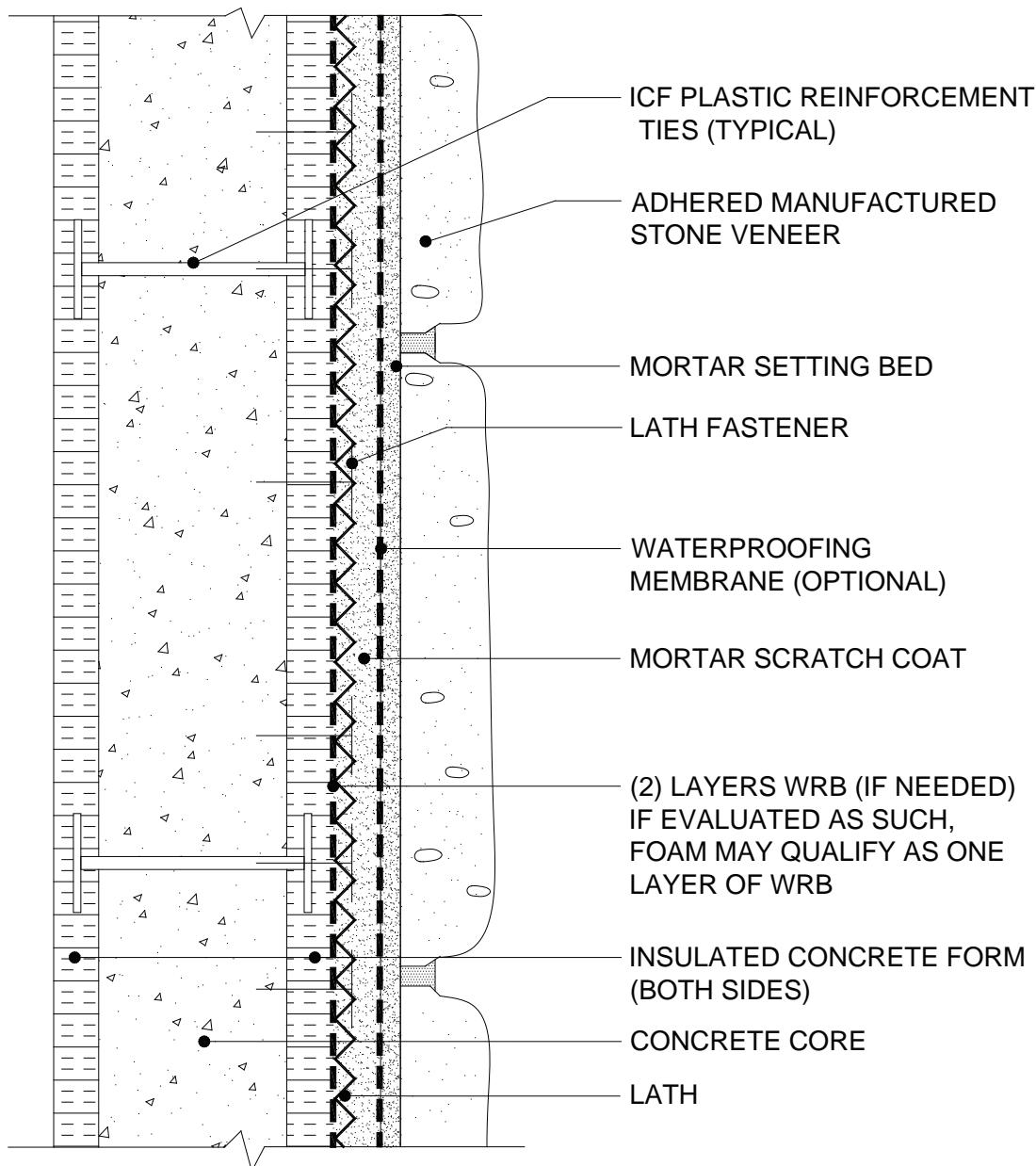


Figure 50. Wall-Section Insulated Concrete Form (ICF)–Top View



NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

SECTION VIEW

Figure 51. Wall-Section Over Continuous Rigid Insulation with Z Channels—Top View

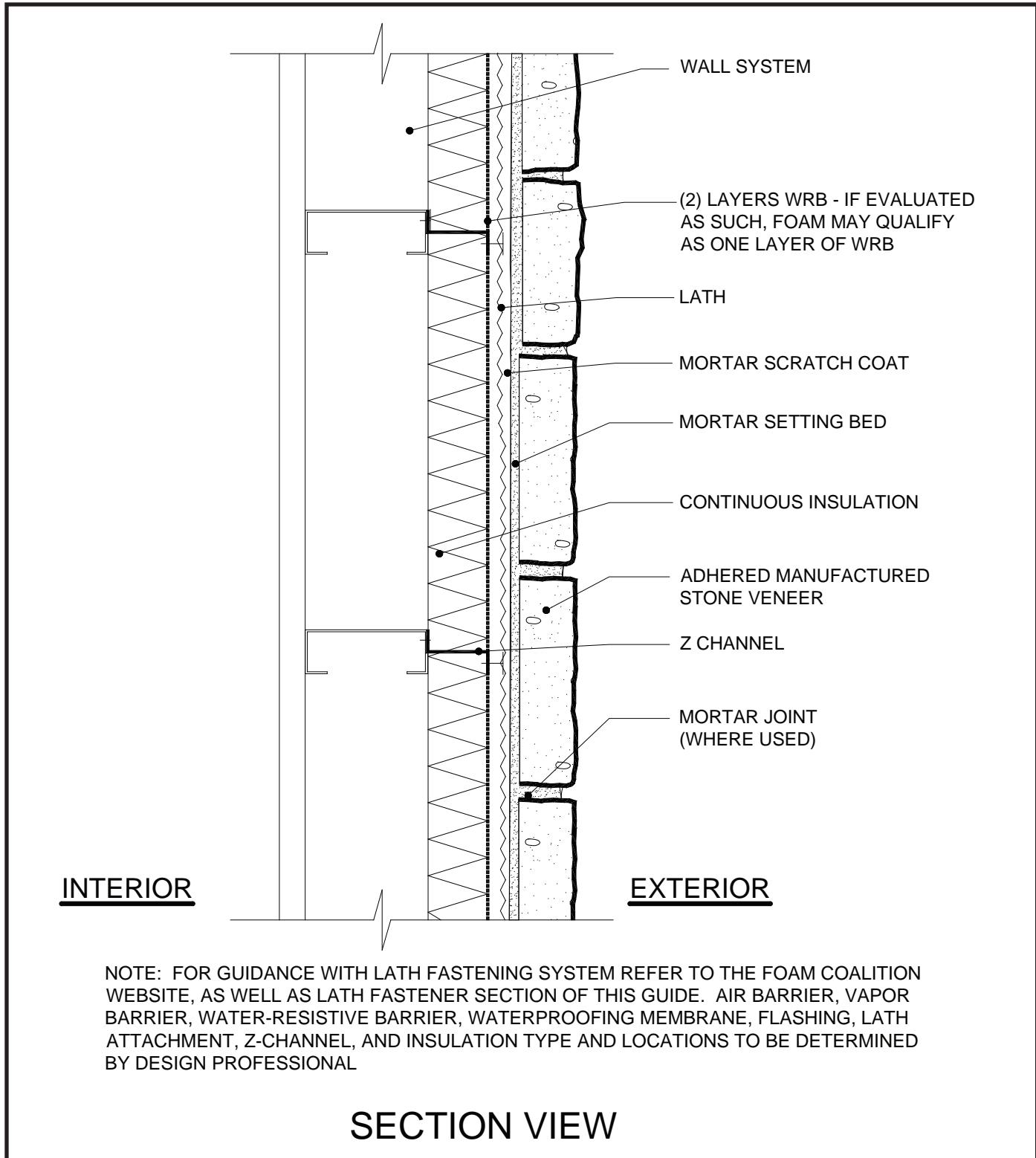
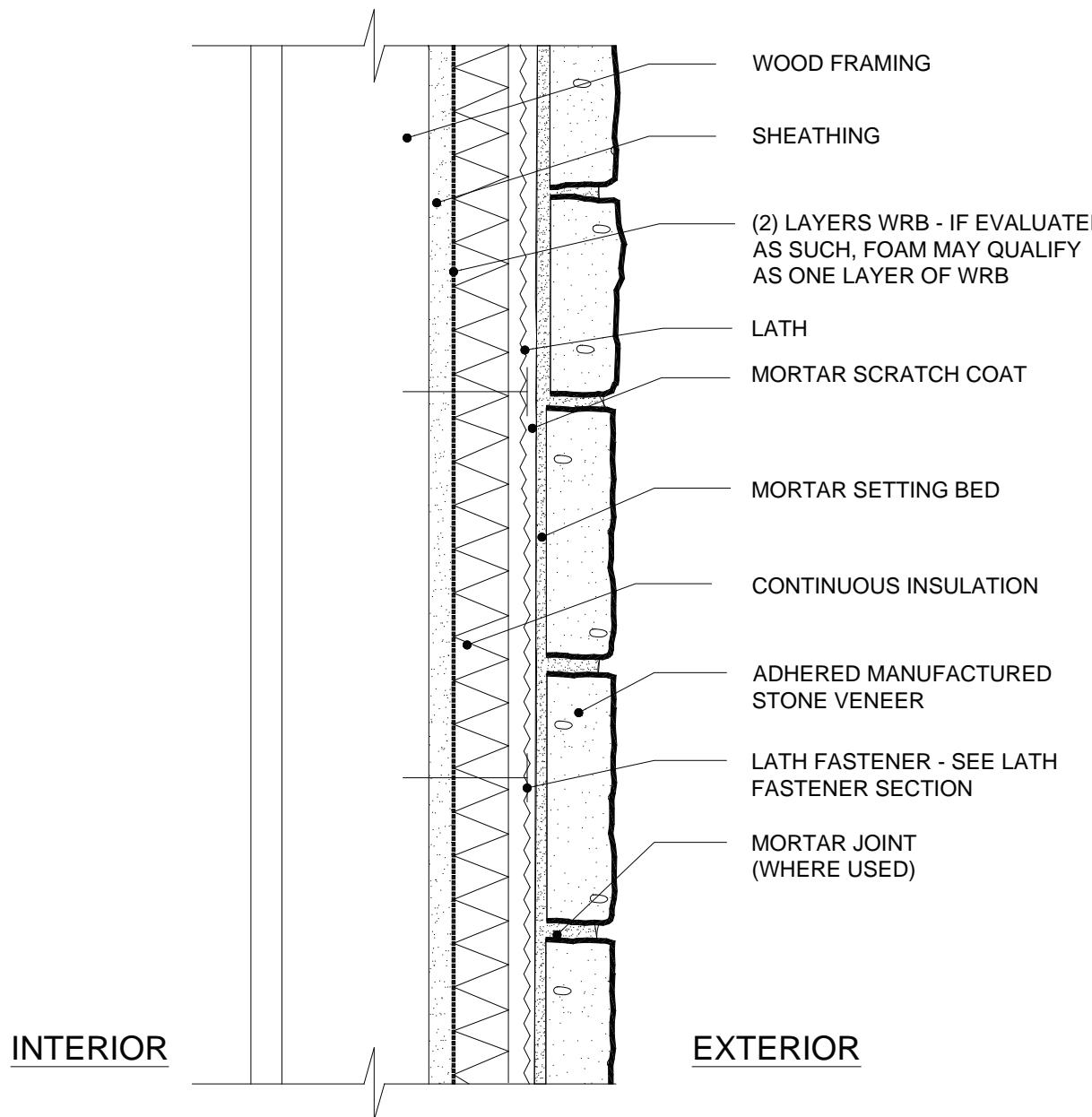


Figure 52. Wall-Section Over Continuous Rigid Insulation



NOTE: FOR GUIDANCE WITH LATH FASTENING SYSTEM REFER TO THE FOAM COALITION WEBSITE, AS WELL AS LATH FASTENER SECTION OF THIS GUIDE. AIR BARRIER, VAPOR BARRIER, WATER-RESISTIVE BARRIER, WATERPROOFING MEMBRANE, FLASHING, LATH ATTACHMENT, Z-CHANNEL, AND INSULATION TYPE AND LOCATIONS TO BE DETERMINED BY DESIGN PROFESSIONAL

SECTION VIEW

Figure 53. Wall-Section Parapet with Stone Cap

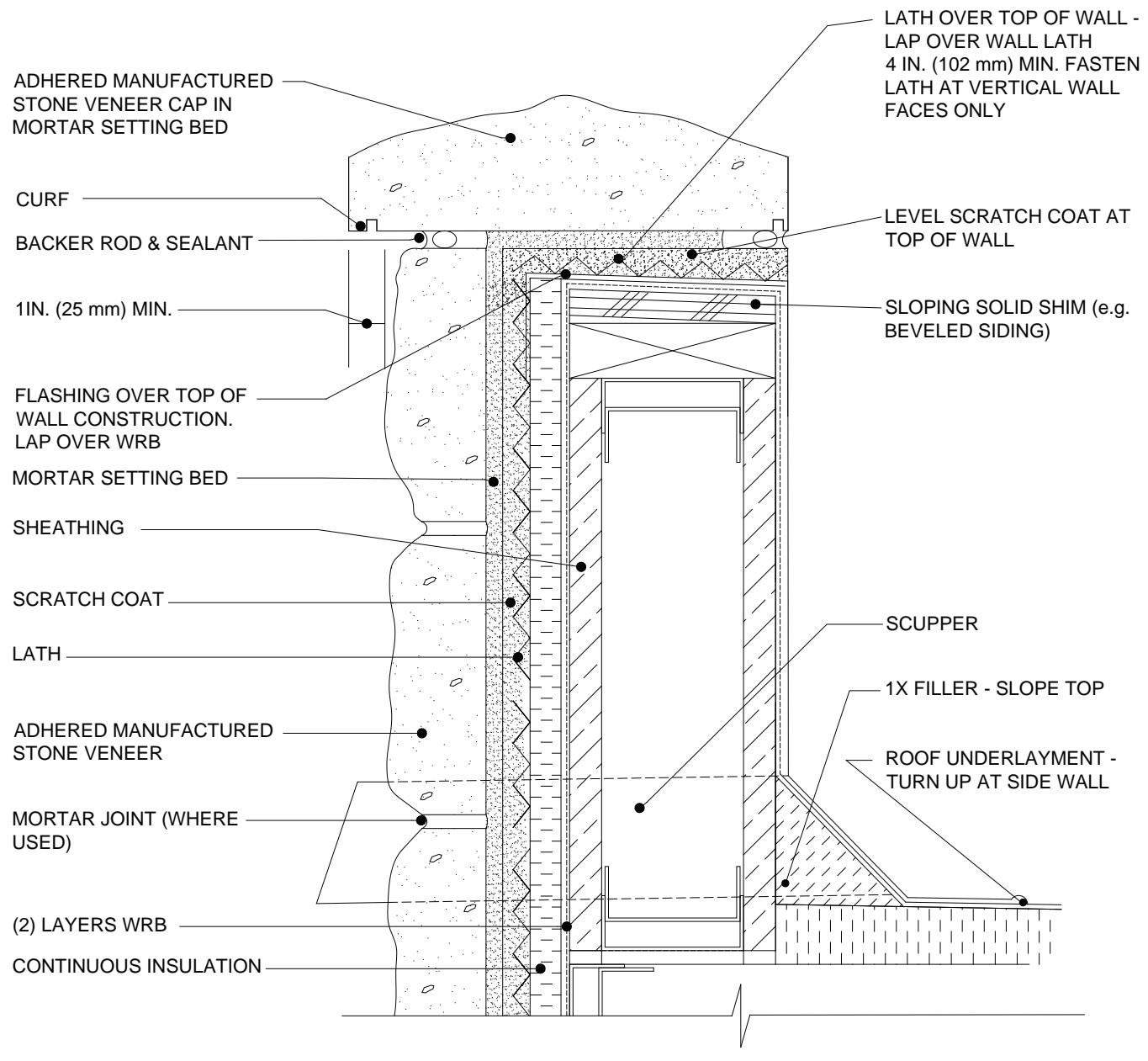
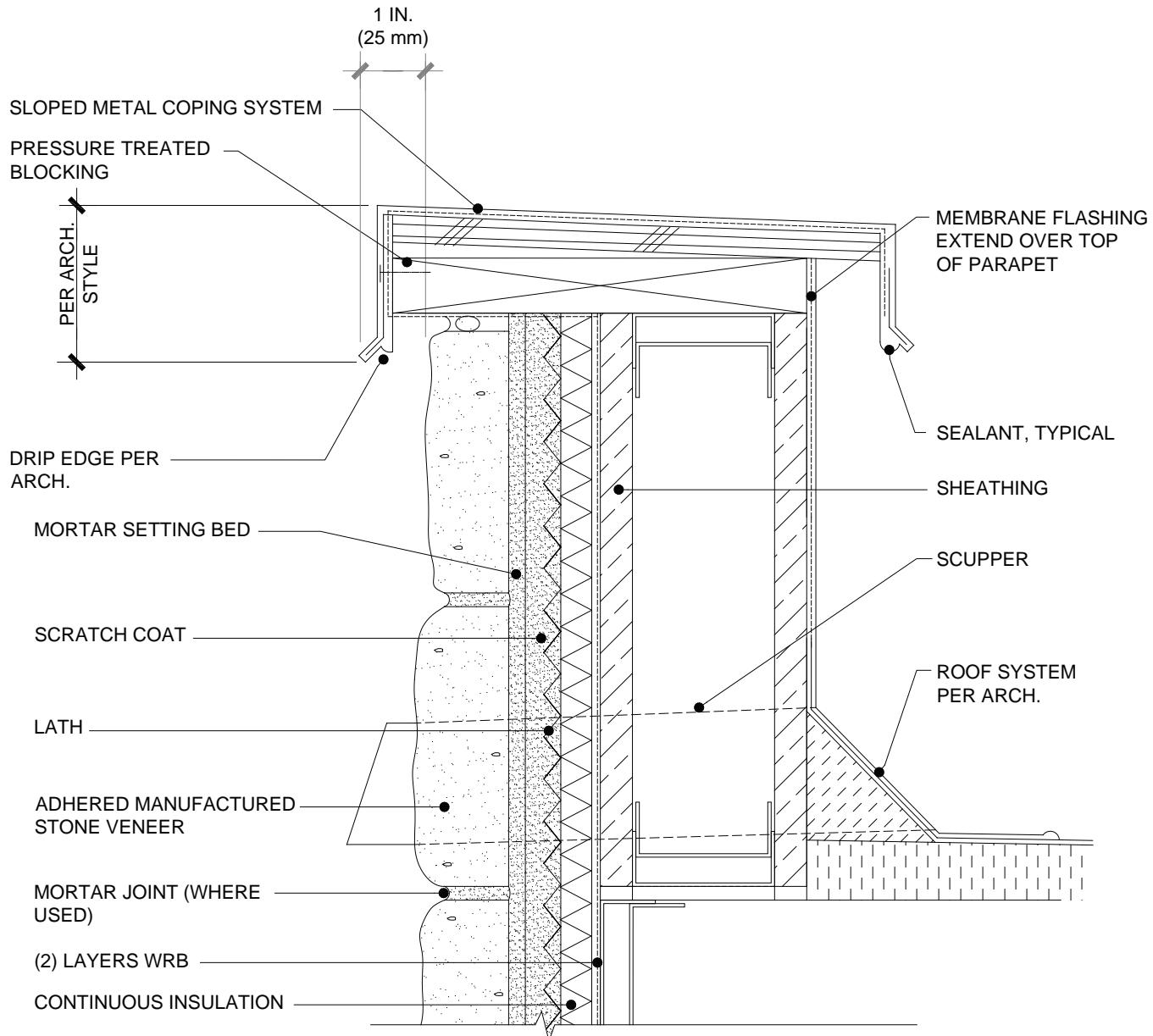


Figure 54. Wall-Section Parapet with Steel Cap



Notes:

