



# Manufactured Stone Veneer: Sticking to the Basics

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## Pennsylvania Housing Research Center

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- We conduct applied research, foster the development and commercialization of innovative technologies, and transfer appropriate technologies to the housing community.
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## Description

When considering the wide variety of cladding options available in residential construction, builders, designers, and clients must weight a multitude of characteristics. Although aesthetics and cost tend to dominate the conversation, cladding performance in relation to moisture and durability should also be considered. While the challenges associated with exterior plaster in the form of stucco have been well documented, the conversation has not extended much toward manufactured stone veneer. As a reservoir cladding, manufactured stone veneer assemblies must be designed with performance and durability in mind in order to provide clients with a sound investment. This webinar will take a closer look at the basics of wall performance and apply these concepts to manufactured stone veneer.

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## Learning Objectives

1. Review the fundamentals of building science, wall assembly design, and manufactured stone material properties in order to inform a discussion on durability and longevity.
2. Discuss existing code requirements and standards that dictate the installation of manufactured stone veneer, including the IRC, MVMA Installation Guide, and ASTM standards.
3. Analyze existing best practices and the challenges they present in terms of cost and constructability.
4. Present recommendations and considerations for builders and design professionals to aid in future design of durable, safe, and healthy homes with manufactured stone veneer cladding.



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## Manufactured Stone Veneer

- **2015 IRC**
  - **ADHERED STONE OR MASONRY VENEER.** Stone or masonry veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.
- **Traditional assembly:**
  - Scratch coat
  - Mortar & pointing mortar
  - Finish coat (adhered veneer)



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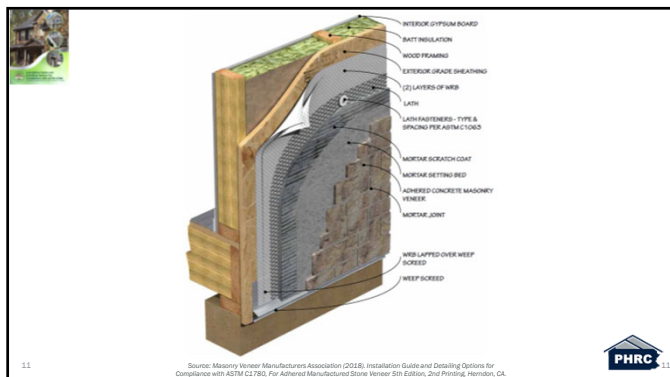
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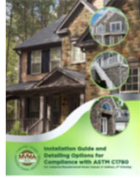
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## What are Current Requirements?



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## 2015 IRC Requirements

### • The 2015 International Residential Code includes requirements relating to:

- Water-resistive barriers
- Lath
- Clearances
- Flashing at foundations



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## Quick Guide – IRC Sections

- R703.7.3 – Water-resistive barriers
- R703.7.1 – Lath
- R703.12.1 – Clearances
- R703.12.2 – Weep screeds
- Manufacturers instructions – Installation



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## 2015 IRC Section R703.12 Adhered Masonry Veneer Installation

- Adhered masonry veneer shall comply with the requirements of Section R703.7.3 [exterior plaster – water-resistive barriers] and the requirements of Sections 12.1 and 12.3 of TMS 402/ACI 530/ASCE 5.
- Adhered masonry veneer shall be installed in accordance with Section R703.7.1 [exterior plaster – lath], Article 3.3C of TMS 602/ACI 530.1/ASCE 6 or the *manufacturer's instructions*.

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Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hills, IL.



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## Masonry Veneer Manufacturers' Association

- Affiliate of NCMA (National Concrete Masonry Association)
  - Many manufacturers use this document as their installation guide



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<https://ncma.org/building-solutions/manufactured-stone-veneer/>

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Source: Masonry Veneer Manufacturers Association (2018). Installation Guide and Detailing Options for Compliance with ASTM C1780, For Adhered Manufactured Stone Veneer 5th Edition, 2nd Printing, Henderson, CA.



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## ASTM Standards

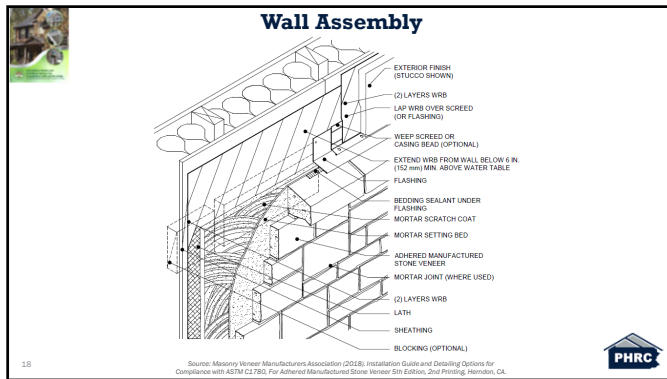
- **ASTM C1670**
  - Standard Specification for Adhered Manufactured Stone Masonry Veneer Units
- **ASTM C1780**
  - Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer

• *Note: These ASTM standards are NOT referenced in the 2015 IRC*

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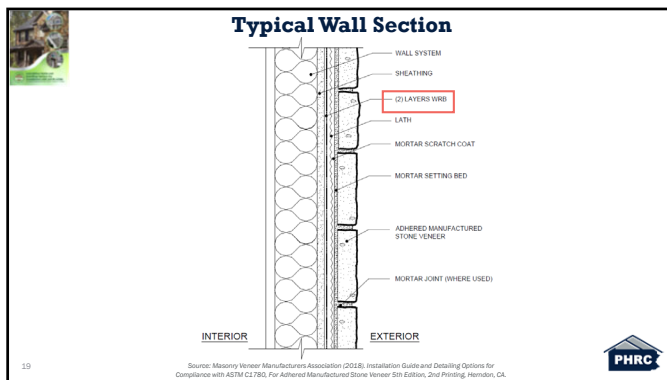
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### What is a Drainage Plane?

- Control layer in an exterior wall assembly that serves as the primary surface for bulk moisture to drain down to an exit point in the enclosure
  - Water-managed systems
- Water-resistive barrier (WRB)

Source: Masonry Veneer Manufacturers Association (2018), Installation Guide and Detailing Options for Compliance with ASTM C1785, For Adhered Manufactured Stone Veneer 5th Edition, 2nd Printing, Henderson, CA.

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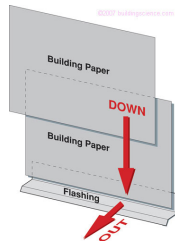
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## How Does a WRB Function?



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Source: LeBunker, Joseph (2006). BLD-105: Understanding Drainage Planes, Westford, MA.



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## 2015 IRC Section R703.12.3 Water-Resistive Barrier

- A water-resistive barrier shall be installed as required by Section R703.2 and shall comply with the requirements of **R703.7.3**.
- The water-resistive barrier shall lap over the exterior of the attachment flange of the screed or flashing provided in accordance with Section R703.12.2.

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Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, IL.



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## 2015 IRC Section R703.7.3 Water-Resistive Barriers

- Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to **two layers of Grade D paper**. **The individual layers shall be installed independently** such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.
- **Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

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Source: International Code Council (ICC). (2014). 2015 International Residential Code, Country Club Hill, IL.



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## MVMA: WRB Requirement

- “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**.
- **Acceptable WRBs:**
  - Two layers of WRB complying with ASTM D226, E2556, or approved equal.\*

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Source: Masonry Veneer Manufacturers Association (2018), Installation Guide and Detailing Options for Compliance with ASTM C2763, For Adhered Manufactured Stone Veneer 5th Edition, 2nd Printing, Norwalk, CA.



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## WRB Material Properties

- **No. 15 / No. 30 felt**
  - ASTM D226
- **Grade D building paper**
  - UU-B-790
- **Plastic house wraps**
  - ES Reports (“other approved water resistive barrier”)

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## WRB Material Properties - Felt

- **Asphalt Felt**
  - Used to be identified by weight (15-pound felt = 15 pounds / 100 SF)
  - Modern felts weigh between 7-14 pounds / 100 SF
- **ASTM D226 weight requirements:**
  - No. 15 felt = 11.5 pounds / 100 SF
  - No. 30 felt = 23 pounds / 100 SF



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Source: Holladay, Martin (2013). All About Water-Resistive Barriers, GreenBuildingAdvisor.com.



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## WRB Material Properties – Grade D

- **Asphalt-Impregnated Kraft Paper**
  - Uses lighter weight paper than asphalt felt
- **Grade D comes from 1968 Federal Standard UU-B-790**
  - "Federal Specification; Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellant and Fire Resistant)"
    - Grade D = Water-vapor permeable
- **Specified according to ASTM D779 Water Holdout Test (20 / 30 / 60 minute)**



Source: Holladay, Martin (2013). All About Water-Resistive Barriers. GreenBuildingAdvisor.com.

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## WRB Material Properties – Plastic

- **Polyolefin Fabric**
  - Polyethylene
  - Polypropylene
- **Two Categories:**
  - Perforated
    - Punched holes allow water vapor passage
  - Non-perforated
    - Allow water vapor to pass between fibers of plastic fabric



Source: Holladay, Martin (2013). All About Water-Resistive Barriers. GreenBuildingAdvisor.com.

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## WRB Material Properties

- **What can happen with a single layer of house wrap or building paper behind exterior plaster?**
  - Scratch coat can **bond to WRB**, reducing or eliminating its ability to function as a drainage plane
  - Drainage plane becomes next interior layer, typically exterior sheathing (OSB or plywood)



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## WRB Bond Development



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## Scratch Coat and Drainage Channels



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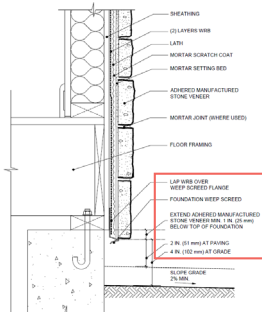
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## Foundation Wall Base



Source: Masonry Veneer Manufacturers Association (2018). Installation Guide and Detailing Options for Compliance with ASTM C1789. For Adhered Manufactured Stone Veneer 8th Edition, 2nd Printing, Herndon, VA.



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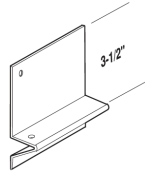
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## Weep Screed

- Terminates the wall
- Allows for a means of draining water out of the drainage plane
- Provides a capillary break for water that would wick up from the ground transported by masonry or stucco



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## 2015 IRC Section R703.12.2 Flashing at Foundation

- A corrosion-resistant screed or flashing of a minimum 0.019 inch (0.48 mm) or 26-gage galvanized or plastic with a minimum vertical attachment flange of 3-1/2 inches (89 mm) **shall be installed** to extend a minimum of 1 inch (25 mm) below the foundation plate line on exterior stud walls in accordance with Section R703.4.



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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL

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## MVMA: Weep Screed Requirement

- *“Weep screeds and casing beads must be corrosion resistant, with weep screeds having a minimum vertical attachment flange of 3.5 inches that terminates behind the water resistive barrier (if present).”*



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Source: Masonry Veneer Manufacturers Association (2018), Installation Guide and Detailing Options for Compliance with ASTM C1780, For Adhered Manufactured Stone Veneer 8th Edition, 2nd Printing, Herndon, VA

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### Weep Screed Not Used



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### Weep Screed Installed Properly



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### 2015 IRC Section R703.12.1 Clearances

- On **exterior stud walls**, adhered masonry veneer shall be installed:
  1. Minimum of 4 inches (102 mm) above the earth;
  2. Minimum of 2 inches (51 mm) above paved areas; or
  3. Minimum of ½ inch (12.7 mm) above exterior walking surfaces that are supported by the same foundation that supports the exterior wall.



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## MVMA: Clearance Requirement

- *“On exterior stud walls, weep screeds and other base flashings should be held a minimum of 4 inches above grade or a minimum of 2 inches above paved surfaces.”*

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Source: Masonry Veneer Manufacturers Association (2018), Installation Guide and Detailing Options for Compliance with ASTM C2763 For Adhered Manufactured Stone Veneer 8th Edition, 2nd Printing, Norwalk, CA.



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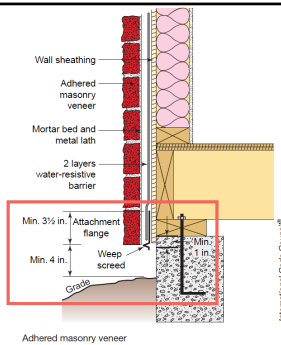
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Image Source: International Code Council, (2012), 2012 Significant Changes to the IRC, ICC, Country Club Hill, IL.



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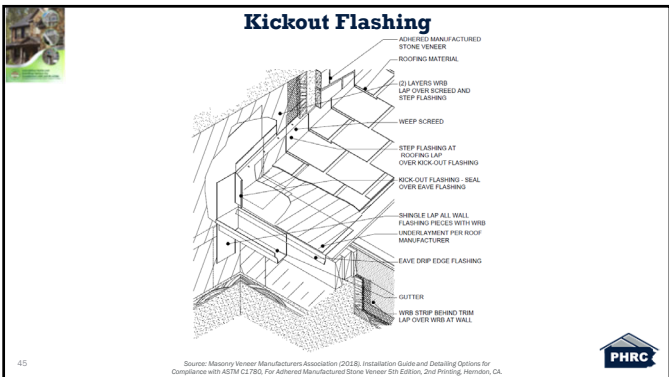
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## 2015 IRC Section R903.2.1 Roof Flashing Locations

- Flashing shall be installed at wall and roof intersections and where there is a change in slope or direction. Flashing shall be installed to divert water away from the eave where a sloped roof intersects a vertical sidewall.

• **Note:** This now applies to all roofing types.

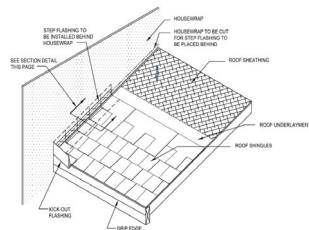
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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



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## 2015 IRC Section R903.2.1 Roof Flashing Locations



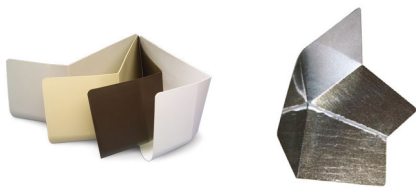
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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



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## Kickout Flashing



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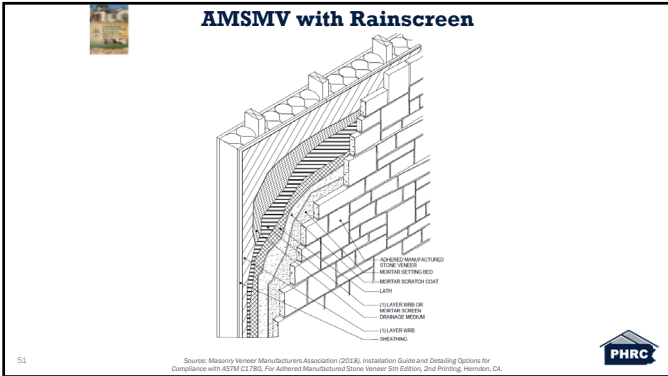
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## What is a *Rainscreen*?

- A rainscreen is a *system* that provides an air space within a wall assembly to promote drying of that assembly once wet
  - Accelerates the evaporation of undrained moisture behind exterior cladding
  - Helps to dry wall that accumulates moisture seasonally
- How big of an air space?
  - 1/4" to 3/4" w/ventilation openings at top and bottom of wall

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## What is a *Rainscreen*?

- Common rainscreen products / systems
  - Furring strips
  - Three-dimensional mesh
  - Wrinkled or modified house wraps?

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## What is a *Rainscreen*?



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## What might be a *Rainscreen*?



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## What is a *Rainscreen*?

- Rainscreen systems can be used for many different cladding types (siding, stucco, etc.)
  - Effective with "reservoir" type claddings
- Note: Rainscreen systems are *above code* options



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## WRB in Exterior Plaster Assembly

- **R703.6.3 Water-resistive barriers.**
  - Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive *vapor-permeable* barrier with a performance at least equivalent to *two layers of Grade D paper*.
  - **Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60 minute Grade D paper and is separated from the stucco by an *intervening, substantially non water-absorbing layer or designed drainage space*.



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### 3D Mesh Rainscreen



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### Summary

- Code requirements addressing MSV have changed significantly over the past 10 years
- Properties of materials used in MSV assemblies have also changed, affecting assembly durability and performance
- Above code design / installation practices can reduce risk
- Continued MSV wall failures will lead to further changes in code requirements and best practice



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### Questions?

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Thanks to Steve Long (E.R. Long Associates) and Bill Dare (Spotlight Home Inspection) for sharing their photos!



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