Adapting Stucco & Stone Assemblies to Changing Codes

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Description

With Pennsylvania’s Uniform Construction Code (UCC) updating to the 2018 ICC codes in early 2022, one of the critical changes that building professionals will need to consider involves stucco and stone wall assemblies. During the UCC code adoption process, provisions impacting stucco and stone were adopted based on language out of the 2021 International Residential Code. This session will dive into the changes that will have a significant impact on the design and installation of exterior plaster assemblies.

Learning Objectives

1. Review the code provisions adopted into the PA Uniform Construction Code that impact stucco and stone wall assemblies.
2. Discuss the impact of new lath installation provisions for exterior plaster assembly including fastener layout and spacing.
3. Examine the implications on building performance of new water-resistive barrier requirements that impact both stucco and stone assemblies.
4. Understand the new requirements for rainscreen gaps in stucco and stone wall assemblies, including associated material options, costs, and performance.
When is it Changing?

• Effective date for UCC code changes:
  
  February 14, 2022

When is it Changing?

• Phase-in period
  
  "Where a design or construction contract was signed before the effective date [2/14/22] of regulations for a subsequent Uniform Construction Code or International Fuel Gas Code issued under this act, the permit may be issued under the Uniform Construction Code or International Fuel Gas Code in effect at the time the design or construction contract was signed if the permit is applied for within six months of the effective date of the regulation or the period specified by a municipal ordinance, whichever is less."

Exterior Plaster - Stucco

Exterior Plaster Section will apply to hardcoat stucco and the adhered masonry veneer section (thin veneer stone, thin brick, etc.) will refer to parts of this as well.
Exterior Plaster Assemblies

• Exterior plaster provisions in the IRC were heavily modified in the 2021 version.
• These provisions were adopted by the UCC RAC to be included with the 2018 code adoption.

2021 IRC R703.7 Exterior Plaster (Stucco & Adhered Masonry Veneer)

• Installation of exterior plaster shall be in compliance with ASTM C926-2018B, ASTM C1063-2018B and the provisions of this code.

ASTM C926-18B Coincides with 2021 IRC Exterior Plaster

• Standard Specification for Application of Portland Cement Based Plaster
  • 1. Scope
    - 1.1 This specification covers the requirements for the application of full thickness Portland cement-based plaster for exterior (stucco) and interior work.
    - 1.2 This specification sets forth tables for proportioning of various plaster mixes and plaster thickness.
ASTM C1063-18B Coincides with 2021 IRC Exterior Plaster (including ASTM C1861 Lath Accessories)

• Standard Specification for Installation of Lathing and Furring

• 1. Scope
  - 1.1 This specification covers the minimum requirements for lathing and furring for the application of exterior and interior Portland cement-based plaster as in Specification C 926 or Specification C 841.

Exterior Plaster: Hardcoat Stucco and Adhered Masonry Veneer

• Stucco will follow the 2021 Exterior plaster section (703.7 Exterior plaster)
Exterior Plaster: Hardcoat Stucco and Adhered Masonry Veneer

- Adhered masonry veneer will follow the 2018 Section R703.12
- Adhered masonry veneer installation will refer to the 2021 Exterior Plaster section:
  - R703.7.1 which is installation of lath and all accessories
  - R703.7.3 water resistive barriers which will include a rainscreen drainage space

Building Science: Why Have There Been Moisture Failures?

Moisture Failures Appear First in Hygroscopic Claddings
What is a reservoir cladding?
- Materials that absorb moisture from the surrounding environment and have significant moisture storage capacity
- Examples:
  • Brick veneer
  • Adhered manufactured stone masonry veneer
  • Hardcoat stucco
  • Wood

Mid to late 90's: Something Changed

• Construction in the mid-to late-1990s changed?

• Problems began to surface in 2004 in Pennsylvania
Changes in Construction (Mid to Late 90's)

- Tighter buildings – larger moisture difference between inside and outside
- More insulation – Less energy flow – Less drying
- More windows – Lots of glass
- Variety of materials on same wall
- Vinyl windows – Insulated glass
- Central air – Cooler on the Inside (Inward vapor drive)
- OSB instead of plywood
- Contractors only applying scratch & finish
- Furring strips not used anymore
- Synthetic stucco? Less permeable?

Enhanced Drying Potential is Now Needed With a Rainscreen Gap

- Allows for Increased Drainage
- Allows a space for air to move. Creating more drying potential, called back ventilation.
- Allows for condensation to occur, and then drain and dry.
- Allows for the cladding and wall system to dry both ways to the rainscreen gap

Masonry Construction Taught Us This
2021 IRC 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 comply with Section R703.7.3.1 or R703.7.3.2.

*R703.2 = 2018 provisions

2018 IRC R703.2 Water-Resistive Barrier

• One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D226 for Type I felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. No.15 asphalt felt shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). Other approved materials shall be installed in accordance with the water-resistive barrier manufacturer’s installation instructions. The No. 15 asphalt felt or other approved water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

2021 IRC R703.7.3.1 Dry Climates

• In Dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:
  1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a water-resistive barrier complying with ASTM E2556-10, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier shall be directed between the layers.
  2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556-10, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water-absorbing layer, or a designed drainage space.

2021 IRC R703.7.3.2 Moist or Marine Climates

• In the Moist (A) or Marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:
  1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
  2. In addition to complying with Section R703.7.3.1, Item 2, drainage on the exterior of the water-resistive barrier shall have a drainage efficiency of not less than 90 percent, as measured in accordance with ASTM E2273-2018 or Annex A2 of ASTM E2925-17.
What is Grade D Building Paper?
- It is an asphalt saturated kraft paper with a minimum water resistance of 10 minutes by ASTM D779 and has a vapor permeability rating of more than 5 perms.

Felts do not meet code under exterior plaster "Stucco and Adhered Veneer"

One Layer Provided it Is Grade D 60 Minute Or meets ASTM2556 Type II, Then Place Rainscreen

What is a Rainscreen?
- A rainscreen is a system that provides an air space within a wall assembly to promote drainage and drying of that assembly
  - Accelerates the evaporation of undrained moisture behind exterior cladding
  - Helps to dry wall that accumulates moisture seasonally

Common rainscreen products / systems
- Furring strips
- Three-dimensional mesh
- A Rainscreen (Drainage Space is now required for exterior stucco and adhered veneer masonry)
Integrate Weep Screed With Water Resistant Barrier Over Vertical Leg

- Vertical leg must be minimum 3 ½"
- Terminates the wall
- Allows for a means of draining water from behind the drainage plane to the exterior. This is a flashing which must direct water to the exterior surface of cladding.
- Provides a capillary break for water that would wick up from the ground transported by masonry or stucco

ASTM C1063-18B Accessories
7.11.4 Lathing Accessory Water Management Requirements:

7.11.4.1 Where a defined drainage space is provided over the water-resistant barrier under lath and cement plaster, the ground dimension of lathing accessories with solid attachment flanges installed behind the water resistant barrier and defined drainage space to facilitate drainage, such as weep screeds, designated drainage screeds, expansion joints and drainage flashings, shall accommodate the defined drainage space dimension and specified cement plaster thickness.


3.2.3 drainage surface, n—the sloped or non-sloped, perforated or non-perforated surface element of a lathing accessory that facilitates a drainage function, by directing water from behind the stucco cladding to the exterior of the stucco cladding.

7.11.4.1 Where a defined drainage space is provided “ground dimension of lathing accessories”, shall accommodate the defined drainage space dimension and specified cement plaster thickness.

For 7/8” Stucco we need a minimum 5 mm (use ¼” drainage space) and minimum 7/8” for our stucco. Total ground thickness minimum 1 1/8” ground thickness.

For Adhered Veneer we need a minimum 5 mm (use ¼” drainage space) minimum ½” for scratch coat. Total ground thickness minimum ¾”.

Weep Screed ASTM C1063-18B

7.11.4.1 Where a defined drainage space is provided “ground dimension of lathing accessories”, shall accommodate the defined drainage space dimension and specified cement plaster thickness.

This means for 7/8” Stucco we need a minimum 5 mm (use ¼” drainage space) and minimum 7/8” for our stucco. Total ground thickness minimum 1 1/8” ground thickness.

For Adhered Veneer we need a minimum 5 mm (use ¼” drainage space) minimum 1/2” for scratch coat. Total ground thickness minimum ¾”.

Locate the bottom edge of the weep screen lathing accessory not less than 1 in (25mm) below the joint formed by the foundation and framing.
2018 IRC Section R703.7.2.1 Adhered Masonry Veneer Section Flashing at Foundation

- **R703.12.1 Clearances.** On exterior stud walls, adhered masonry veneer shall be installed:
  - Minimum 4 inches (102mm) above the earth.
  - Minimum 2 inches (51 mm) above paved areas; or
  - Minimum ½” (12.7mm) above exterior walking surfaces which are supported by the same foundation that supports the exterior wall.

- **R703.12.2 Flashing at foundation.** A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48mm) or 26-gage galvanized or plastic with a minimum vertical attachment flange of 3 ½ inches (89mm) shall be installed to extend a minimum of 1 inch (25mm) below the foundation plate line on exterior stud walls in accordance with Section R703.4.

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**Weep Screed Not Used**

**Weep Screed Installed Properly**
Install Rainscreen Drainage Gap Over Water Resistive Barrier

Install Lath Over Rainscreen Drainage Gap
**Expansion Gap Between All Dissimilar Substrates**

- ASTM C1063 7.11.7 Casing Bead—Install a casing bead lathing accessory or other suitable means, at locations to separate cement plaster from dissimilar materials, penetrating elements, load bearing members and to avoid transfer of structural loads.

- ASTM C926 7.3.4 Separation shall be provided where plaster abuts dissimilar construction materials or openings. (See A2.1.3.)

- ASTM C926 A2.1.3 Sealing or caulking of V-grooves, exposed ends, and edges of plaster panels or exterior work to prevent entry of water shall be provided. “Good Practices to caulk the Joint”


Casing Bead Installation All Penetrations

- Casing With Expansion Flange Ready to Caulk
- Casing Bead On Top Of Rainscreen
- Under Sill of Penetration
- Up Opposite Side of Penetration
- Integrate Under Strip Cap of Window
- Installed
Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063-2018. Expanded metal, welded wire, or woven wire lath shall be attached to wood framing members or furring. Where the exterior plaster is serving as wall bracing in accordance with Table R602.10.4, the lath shall be attached directly to framing. The lath shall be attached with 1 1/2-inch-long (38 mm), 11-gage nails having a 7/16-inch (11.1 mm) head, or 7/8-inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring and not more than 24 inches (610 mm) on center between framing members or furring, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C1063-2018. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Section R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Section R703.15, R703.16, or R703.17.
ASTM C1063-18B

- Staples and nails shall penetrate wood framing not less than ¾”.
- Screws used to attach metal plaster base to metal framing members shall project not less than 3/8 in. (10 mm) through the metal framing member.
- A1.1 All wood-based sheathing shall be installed with a 1/8-in. (3 mm) minimum gap around all panel edges and between openings for doors and windows.

NOTE A1.1—This 1/8-in. (3 mm) gap is intended to accommodate expansion. Linear expansion that is not accommodated by an expansion gap can cause stress on the stucco membrane resulting in stucco cracks.

ASTM C926 7.3.3 Portland cement-based plaster shall be applied on furred metal plaster base when the surface of solid backing consists of gypsum board, gypsum plaster, wood, or rigid foam board-type products. *Not Flat* *Also called dimpled lath and self-furred SF*

ASTM C1063 Shall be 2.5 Lb lath on sheathed framed walls 16" and 24" on center.

More Requirements For Lath

- ASTM C1063 Shall be 2.5 Lb lath on sheathed framed walls 16" and 24" on center.
- Must meet G847 Specification for metal lath “minimum width of lath 27” and minimum length is 97” *weight 2.5 Lb or 3.4 Lb Plus or minus 10%.*
  *Galvanized metal lath shall have a G60 coating in accordance with specification A653/A653M.*

2021 IRC R703.7.1 Lath

- Fastening pattern is to be minimum every 7" vertically on the framing members. Which is a change from 2015 code.
- "Fastening between wood framing members shall not be prohibited"
- The code has recognized it is difficult not to fasten between framing members by accident. Good practice is to reduce amount of fastener holes by trying to avoid fastening between framing members.

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Make Sure it is the Correct Lath!

- Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063-2018B.

- **703.7.1.1 Furring.** Where provided, furring shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum 3/4-inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063-2018B. Furring shall be spaced not greater than 24 inches (600 mm) on center and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Plastering with cement plaster shall be in accordance with ASTM C926-2018B. Cement materials shall be in accordance with one of the following:

1. Masonry cement conforming to ASTM C91-2018, Type M, S or N.
2. Portland cement conforming to ASTM C150-2018, Type I, II or III.
3. Blended hydraulic cement conforming to ASTM C595-2018, Type IP, IS (< 70), IL, or IT (S < 70).
4. Hydraulic cement conforming to ASTM C1157-11, Type GU, HE, MS, HS or MH.
5. Plastic (stucco) cement conforming to ASTM C1328-12.

Plaster shall be not less than three coats where applied over metal lath or wire lath and shall be not less than two coats where applied over masonry, concrete, pressure preservative-treated wood or decay-resistant wood as specified in Section R317.1 or gypsum backing. If the plaster surface is completely covered by veneer or other facing material or is completely concealed, plaster application need be only two coats, provided the total thickness is as set forth in Table R702.1(5).

On wood-frame construction with an on-grade floor slab system, exterior plaster shall be applied to cover, but not extend below, lath, paper and screed.

The proportion of aggregate to cementitious materials shall be as set forth in Table R702.1(3).
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.

Adhered masonry veneer shall be installed in accordance with Section R703.7.1 [exterior plaster – lath], Article 3.3C of TMS 602 or the manufacturer’s instructions.

12.3.2.1 Unit sizes- Adhered veneer units shall not exceed 2 5/8 in (66.7 mm) in specified thickness, 36 in. (914 mm) in any face dimension, nor more than 5 ft sq. (0.46 msq) in total face area, and shall not weigh more than 15 psf (75 kg/msq).

12.3.2.2 Wall area limitations – The height, length, and area of adhered veneer shall not be limited.

12.3.2.3 Backing- Backing shall provide a continuous, moisture-resistant surface to receive the adhered veneer. Backing is permitted to be masonry, concrete, metal lath and Portland cement plaster applied to masonry, concrete, steel framing, or wood framing.

12.3.2.4 Adhesion developed between adhered veneer units and backing shall have a shear strength of at least 50 psi (345 kPa) based on gross unit surface area when tested in...
Building code requirements for masonry structures TMS402/602-16

- **3.3 C. Placing adhered veneer**
  - 1. Brush a paste of neat Portland cement on the backing and on the back of the veneer unit.
  - 2. Apply Type S mortar to the backing and to the veneer unit.
  - 3. Tap the veneer unit into place, completely filling the space between the veneer unit and the backing. Sufficient mortar shall be used to create a slight excess to be forced out between the edges of the veneer units. The resulting thickness of the mortar in back of the veneer unit shall not be less than 3/8 in (9.5 mm) nor more than 1 ¼ in. (31.8 mm).
  - 4. Tool the mortar joint with a round jointer when the mortar is thumbprint hard.

Adhered Masonry: What does “Manufacturer's Instructions” Mean?

- **R703.12 Adhered Masonry Veneer.** Adhered Masonry Veneer—Shall be installed in accordance with section 703.7.1, article 3.3C of TMS602 or the with manufacturers instructions.

- **Definition in the IRC 2018 Code**
  - 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.
Adhered Veneer Manufacturers Recommendations

- Manufacturers may ask you to do more than is required in the codes discussed.
- One common addition is that they may require a polymer modified mortar to be used to increase adhesion.
- Some products may only be for use interior.
- Always check their recommendations.

Questions?

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