



Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer¹

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1. Scope*

1.1 This practice is intended to provide accepted procedures to designers and installers of adhered manufactured stone masonry veneer in residential and commercial construction. This information is meant to complement the specific installation instructions provided by manufacturers of adhered manufactured stone masonry veneers and recognized building codes, but is not meant to replace them. This practice does not address installation methods or techniques for all materials in the building envelope. This practice covers the installation of adhered manufactured stone masonry veneer units for application as adhered veneer to exterior and interior walls, columns, landscape structures and other structures suitable to receive adhered veneer. The units included in this practice are manufactured to meet the requirements of Specification C1670. This practice is limited to the installation of units. This practice does not cover all flashing or moisture management requirements. Refer to the applicable building code and project documents for additional flashing and moisture management requirements.

NOTE 1—The Masonry Veneer Manufacturers Association (MVMA) publication *Installation Guide for Adhered Concrete Masonry Veneer* provides generally accepted methods and details for installation and flashing.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 All workmanship and materials related to the installation of adhered manufactured stone masonry veneer units shall meet the requirements of the contract documents and building code having jurisdiction over the project.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applica-*

bility of regulatory limitations prior to use. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.²)

2. Referenced Documents

2.1 ASTM Standards:³

- C90 Specification for Loadbearing Concrete Masonry Units
- C270 Specification for Mortar for Unit Masonry
- C482 Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste
- C847 Specification for Metal Lath
- C926 Specification for Application of Portland Cement-Based Plaster
- C932 Specification for Surface-Applied Bonding Compounds for Exterior Plastering
- C933 Specification for Welded Wire Lath
- C979 Specification for Pigments for Integrally Colored Concrete
- C1032 Specification for Woven Wire Plaster Base
- C1059 Specification for Latex Agents for Bonding Fresh To Hardened Concrete
- C1063 Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
- C1180 Terminology of Mortar and Grout for Unit Masonry
- C1232 Terminology of Masonry
- C1325 Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
- C1384 Specification for Admixtures for Masonry Mortars
- C1670 Specification for Adhered Manufactured Stone Masonry Veneer Units
- C1714 Specification for Preblended Dry Mortar Mix for Unit Masonry
- E2556/E2556M Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment

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² Annual Book of ASTM Standards. Vol 04.01. See the section on Safety Precautions in the Manual of Cement Testing.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

2.2 Other Standards:

TMS 402/ACI 530/ASCE 5 Building Code Requirements for Masonry Structures⁴

TMS 602/ACI 530.1/ASCE 6 Specification for Masonry Structures⁴

ICC ES AC 376 Acceptance Criteria for Reinforced Cementitious Sheets Used as Wall and Ceiling Sheathing and Floor Underlayment⁵

2.3 ANSI Standards:⁶

ANSI A118.1-2013.1 American National Standard Specifications for Dry-Set Cement Mortar

ANSI A118.4-2013.1 American National Standard Specifications for Modified Dry-Set Cement Mortar

2.4 ICRI International Concrete Repair Institute:⁷

No. 310.2—1997 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays (formerly No. 03732). Concrete Surface Profile Chips.

2.5 Masonry Veneer Manufacturers Association:⁸

MVMA Installation Guide for Adhered Concrete Masonry Veneer

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *adhered manufactured stone masonry veneer, n*—the assembly of thin masonry units adhered to a backing with a cementitious mortar.

3.1.1.1 *Discussion*—Other names have been used for this product since it was developed and the Masonry Veneer Manufacturers Association can provide historic information regarding names.

3.1.2 *back butter, v*—the act of applying a setting bed mortar to the back of a masonry unit.

3.1.3 *brown coat, n*—in multiple coat stucco work, the second coat, applied over the scratch coat.

3.1.4 *drainage wall system, n*—a system installation that creates a physical planar air gap between cladding system and water resistive barrier.

3.1.5 *foundation weep screed, n*—an accessory used to terminate adhered manufactured stone masonry veneer at the bottom of exterior framed walls.

3.1.5.1 *Discussion*—This accessory shall have a sloped, solid, or perforated, ground or screed flange to facilitate the removal of moisture from the air gap and a vertical attachment flange not less than 3½ in. (89 mm) long.

3.1.6 *full setting bed, n*—mortar bed of specified thickness, covering the complete back of units and free of voids.

3.1.7 *scratch coat, n*—the first coat of mortar or hydraulic cement based plaster applied to a base and then scratched to create additional bonding area and mechanical interlock.

3.1.8 *setting bed, n*—the mortar used to bond units to a prepared surface or scratch coat.

3.1.9 *sheathed frame substrate, n*—wood or metal/steel framing covered by a building code approved sheathing material.

3.1.10 *thumb-print hard, adj*—description of mortar joints to determine their readiness for tooling determined when the mortar will retain the imprint of a thumb but no mortar is transferred to the thumb.

3.1.11 *tight fit joint, n*—a joint created when units are installed with edges touching or less than ⅜ in. (10 mm) distance between units.

3.1.11.1 *Discussion*—Many units have varied and random edges which make it impossible to define specific minimum or maximum joint space.

3.1.12 *water resistive barrier (WRB), n*—a material behind an exterior wall covering that is intended to resist liquid water that has penetrated the exterior covering from further intruding into the exterior wall assembly.

3.2 Refer to Terminology C1180 for additional terminology for mortar and Terminology C1232 for additional terminology for masonry.

4. Materials

4.1 Adhered manufactured stone masonry veneer shall comply with the following requirements:

4.1.1 Units shall comply with Specification C1670.

4.2 Water Resistive Barrier shall comply with Specification E2556/E2556M.

4.3 Lath shall comply with one of the following:

4.3.1 Expanded metal lath shall be corrosion resistant, shall have a minimum weight of 2.5 lb/yd² (1.4 kg/m²) and shall comply with the requirements of Specification C847.

4.3.2 A ⅜-in. rib, expanded metal lath shall be corrosion resistant and shall have a minimum weight of 3.4 lb/yd² (1.8 kg/m²) and shall comply with the requirements of Specification C847.

4.3.3 Woven wire mesh shall be corrosion resistant, shall be a minimum of 18 gauge, and shall comply with the requirements of Specification C1032.

4.3.4 Welded wire lath shall be corrosion resistant and shall comply with Specification C933.

4.3.5 Non-metallic lath material shall be corrosion resistant, with a published evaluation report from an ANSI accredited evaluation service that rates the lath as acceptable substitute for the above listed laths and be rated for use behind adhered manufactured stone masonry veneer.

NOTE 2—It is acceptable to use lath materials that comply with 4.3 that also provide a paper backing which complies with the requirements of 4.2.

4.4 *Cement Board*—Cementitious Backer Units shall comply with Specification C1325. Cement boards shall have been

⁴ Available from The Masonry Society (TMS), 105 South Sunset Street, Suite Q, Longmont, CO 80501, <http://www.masonrysociety.org>.

⁵ Available from ICC Evaluation Service, 3060 Saturn Street, Suite 100 Brea, California 92821, <http://www.iccsafe.org>.

⁶ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁷ Available from International Concrete Repair Institute (ICRI), 38800 Country Club Drive Farmington Hills, MI 48331, <http://www.icri.org>.

⁸ Available from Masonry Veneer Manufacturers Association (MVMA), 13750 Sunrise Valley Drive Herndon, VA 20171, <http://www.masonryveneer.org>.

evaluated for exterior use in accordance with ICC-ES Acceptance Criteria AC 376 by an ANSI-accredited evaluation service.

4.5 Mortar:

4.5.1 Mortar shall comply with one of the following:

4.5.1.1 Type N or Type S of Specification **C270**.

4.5.1.2 Type N or Type S of Specification **C1714**.

4.5.1.3 ANSI A118.1-2013.1 or ANSI A118.4-2013.1.

NOTE 3—Mortar may be specified by the proportion method or the property method of Specification **C270**.

4.5.2 Admixtures shall comply with Specification **C1384**.

4.5.3 Bonding agents shall comply with Specification **C1059** or Specification **C932**.

4.5.4 Mortar coloring pigments shall comply with Specification **C979**.

4.6 Lath fasteners shall comply with Specification **C1063**.

4.7 Foundation weep screed shall comply with Specification **C1063**.

4.8 Stucco system scratch or brown coat, when used as the adhered manufactured stone masonry veneer scratch coat, shall comply with Specification **C926** up to the brown coat without application of the finish coat.

4.9 Water used for mixing mortar or dampening units, scratch coat, or masonry surface shall be clean and free of amounts of oils, acids, alkalies, salts, organic materials, or other substances that are deleterious to mortar or any metal in the wall.

5. Ambient Conditions

5.1 *Hot and Dry Conditions*—If the ambient conditions exceed 100°F (37°C) or 90°F (32°C) with a wind velocity greater than 8 mph (12.9 km/h) comply with the hot weather construction requirements of local building code, the recommendations of adhered manufactured stone masonry veneer unit manufacturer and hot weather construction provisions of TMS 602/ACI 530.1/ASCE 6. If there is a contradiction among documents, local building code shall prevail.

5.1.1 When adhered manufactured stone masonry veneer is applied in hot or dry weather, before applying mortar, moisten the scratch coat with a fine spray of water or a wet brush to prevent excessive absorption of water from the mortar. The scratch coat shall appear wet but without free water on the surface. Units shall also be moistened following the requirements of **7.2.1**.

5.2 *Freezing or Low Temperatures*—Accelerating admixtures shall comply with Specification **C1384**. Anti-freeze admixtures to lower freezing point of mortar shall not be used. Accelerating admixtures containing calcium chloride shall not be used. If the ambient conditions are below 40°F (4°C), the installation shall comply with the cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6.

6. Substrate/Surface Preparation

6.1 The substrates and preparation that follow are typical and field proven applications. Installation over any other substrate requires the approval of the unit manufacturer.

6.1.1 Alternative surface preparation shall be tested in accordance with Test Method **C482** as modified by this practice. The minimum shear bond strength between the unit and the prepared surface shall be 50 psi (0.34 MPa). Refer to the modifications outlined in **Appendix X1**.

6.2 Masonry:

6.2.1 Install units directly on masonry that is clean and free of paint, dirt, sealers, loose or spalling material.

6.2.2 All masonry surfaces that are dirty, painted, coated with curing compounds or surface sealed, shall be cleaned by power washing, sandblasting, beadblasting or appropriate solvent to form a substrate suitable for bonding. If the surface condition cannot support direct application, install lath. If masonry wall exhibits spalling, cracking or general deterioration, the wall shall be evaluated by the designer of record for integrity before proceeding.

6.3 Wood/Metal Framing:

6.3.1 *Water Resistive Barrier (WRB) Installation*—Install two separate layers of WRB outboard of the sheathing material, in accordance with the WRB manufacturer's installation instructions. Each layer is not required to be the same material. The WRB shall be integrated with all flashing materials in such a manner that prevents penetration of water beyond the WRB. WRB shall overlap a minimum 6 in. (152 mm) at vertical joints and a minimum 2 in. (50 mm) at horizontal joints and shall be applied in shingle fashion. WRB fasteners shall be spaced in accordance with the water resistive barrier manufacturer's installation instructions.

NOTE 4—Some building code jurisdictions allow a single layer WRB when a drainage wall system is used. This is an acceptable installation when the drainage wall system meets the requirements of Section **10** of this practice.

6.3.2 Sheathed Frame Substrate:

6.3.2.1 *Foundation Weep Screed*—Install foundation weep screed in accordance with Specification **C1063**.

6.3.2.2 *Lath*—Install lath which meets the requirements of **4.3** in accordance with Specification **C1063**, or the alternate lath manufacturer's installation instructions, or the project design documents.

NOTE 5—In order to facilitate embedment of lath in mortar, some lath products will require furring. Furring and self-furring lath are addressed in Specification **C1063**, Table 3.

6.3.2.3 *Scratch Coat*—Install a scratch coat with a minimum thickness of ½ in. (13 mm). The scratch coat shall be applied with sufficient material and pressure to fully engage and encapsulate the lath and with sufficient thickness of material to allow for scoring the surface. As soon as the scratch coat becomes somewhat firm the entire surface shall be scored in the horizontal direction only.

6.3.3 Open Studs, Non-Solid Sheathing and Metal Building Panels:

NOTE 6—Non-solid sheathing description is intended to address products such as foam sheathing, fiberboard sheathing, and other sheathing products that would not resist the force used to press units onto scratch coat, resulting in detrimental lath movement.

6.3.3.1 *Foundation Weep Screed*—Install foundation weep screed in accordance with Specification **C1063**.

6.3.3.2 Lath—Install paperbacked 3.4 lb (1.54 kg) $\frac{3}{8}$ in. (10 mm) rib lath in accordance with Specification **C1063** unless the design documents provide other criteria. Paper backing must meet **4.2** to be considered one of the WRB layers.

NOTE 7—Paperbacked lath is an effective method to prevent mortar from reaching insulation cavity in open stud construction or space between ribs in metal building panels. A separately applied layer of WRB can serve the same purpose. Non-solid sheathing applications do not require paperbacked lath as there is no air space to be filled by mortar.

6.3.3.3 Scratch Coat—Install a scratch coat with a minimum thickness of $\frac{1}{2}$ in. (13 mm). The scratch coat shall be applied with sufficient material and pressure to fully engage and encapsulate the lath and with sufficient thickness of material to allow for scoring the surface. As soon as the scratch coat becomes somewhat firm, the entire surface shall be scored in the horizontal direction only. This scratch coat shall be cured for at least 48 hours prior to the unit installation. Scratch coats shall be evenly dampened with water just prior to placing units. There shall be no free water on the surface when units are applied.

NOTE 8—The purpose of a 48 hour cured scratch coat in the applications outlined in **6.3.3** is to assure a firm surface to install the units. These applications would otherwise not have a firm substrate to resist the force of pressing units into place, leading to lath movement, causing bond failure on previously installed units.

6.4 Cement Board Installations—Cement boards as described in **4.4** shall be installed over approved sheathing (see **6.3.1**). Cement board shall be installed per design requirements and manufacturer's recommendations. Polymer modified mortars meeting ANSI A118.4 as specified in **4.5.1.3** shall be used for application of adhered manufactured stone masonry veneer units over cement board.

6.4.1 Joint Treatment—Joints in cement board shall be treated per manufacturer's recommendation with polymer modified mortars meeting ANSI A118.4 as specified in **4.5.1.3** and 2-in. wide alkali-resistant fiberglass mesh tape for interior application and 4-in. wide alkali-resistant fiberglass mesh tape for exterior applications.

6.5 Existing Cured Stucco (as a replacement for adhered manufactured stone masonry veneer scratch coat):

6.5.1 Install units over an un-modified stucco scratch or brown coat that has not been slicked or burned. All materials and installation must meet the requirements of Section **4**.

6.5.2 Any existing cured stucco system which does not meet the surface requirements of **6.2** and **6.3** shall have lath and scratch coat applied for unit installation.

NOTE 9—The purpose of **6.5.2** is to assure the bonding surface is clean and bond ready and that water management systems are present in the existing stucco system. The steps required to treat as a new installation include installation of any or all of the following: weep screed, WRB, lath, scratch coat.

6.6 Cast-in-Place Concrete or Precast Concrete Tilt-up Walls:

6.6.1 Install units over concrete surfaces that are rough, clean, and free of paint, dirt, sealers, curing compounds, release agents, loose, or spalling material. If a bond-ready surface cannot be achieved, install lath and scratch coat.

NOTE 10—Roughness of the surface can be evaluated using ICRI No.

310.2—1997 Concrete Surface Profile chips equal to or greater than two.

6.7 Lath:

6.7.1 Lath shall be furred away from vertical supports or solid surfaces at least $\frac{1}{4}$ in. (6 mm). Self-furring lath meets this furring requirement.

7. Application of Units

7.1 General Installation:

7.1.1 Except as required in **6.3.3.3**, apply the units after the scratch coat becomes thumb-print hard. Scratch coats that have become dry shall be evenly dampened with water prior to placing units. There shall be no free water on the surface when unit is applied.

7.1.2 Set the units in a full setting bed mortar. Mortar between the unit and the prepared backing surface shall be a minimum thickness $\frac{1}{2}$ in. (13 mm).

7.1.3 The total thickness to include setting bed mortar and scratch coat shall not exceed $1\frac{1}{4}$ in. (32 mm).

NOTE 11—Varying of setting bed mortar thickness may be required to adjust uneven substrate or compensate for a fading surface when installing units on curved surfaces.

7.2 Setting the Units:

7.2.1 Bonding surface of unit shall be moistened prior to application. Units shall appear wet but without free water on any surface.

7.2.2 Setting Standard Units with Mortar Joint Width $\frac{3}{8}$ in. (10 mm) or Greater—Units shall be installed using Method A (see **7.2.2.1**) or Method B (see **7.2.2.2**) or a combination of A and B to achieve setting bed with complete coverage of the back of the unit and full contact between the mortar settings bed, unit, and prepared backing surface.

7.2.2.1 Method A—Back butter the unit, using sufficient mortar and pressure to fill texture and voids in back of unit. While setting bed mortar is wet, press and work the unit onto the backing with enough pressure to force mortar to squeeze out around the entire perimeter of the unit.

7.2.2.2 Method B—The mortar setting bed shall be installed by trowel application $\frac{1}{2}$ to $\frac{3}{4}$ in. (13 to 19 mm) thick directly to the prepared backing surface. Back butter the unit, sufficient mortar and pressure to fill texture on and voids in back of unit. While setting bed on the prepared backing surface is plastic, press and work the unit into the setting bed with enough pressure to force mortar to squeeze out around the entire perimeter of the unit. Limit mortar setting bed open time and work only an area that can be covered before mortar skins over. Time and area will depend on mortar and weather conditions.

7.2.3 Setting Units with Tight Fit Joints—Units shall be installed using Method A or Method B or a combination of A and B from **7.2.2** to achieve setting bed with complete coverage of the back of the unit and full contact between the mortar setting bed, unit, and prepared backing surface. Before placing next unit, compact or remove the squeezed out mortar to allow adjoining unit to butt tightly. There shall be mortar between the units but the joint will be less than $\frac{3}{8}$ in. (10 mm).

8. Pointing and Finishing Joints

8.1 Once units have been installed, if additional mortar is required, add mortar to fill in joints. When the mortar is

thumb-print hard, tool mortar to desired joint shape and depth. Setting time will vary depending on ambient temperature and humidity and wall temperature.

8.2 Refer to unit manufacturer for joint types and finishing methods.

NOTE 12—Joints that are tooled in a concave or v-groove profile when thumb-print hard tend to form fewer surface bond separations between the mortar and the unit and therefore are more likely to be more resistant to water penetration than joints formed with other tooling methods.

9. Cleaning

9.1 Once mortar is sufficiently set, use a dry brush to clean excess mortar. Do not use a wet brush to treat mortar joints or clean excess mortar.

9.2 Do not use acid based products to clean mortar or units. Refer to unit manufacturer recommendations regarding cleaning with pressure washer, cleaning agents, and brushes.

10. Special Applications

10.1 *Applications Over a Designed Drainage Space or Drainage Wall System*—Unless otherwise required by the

applicable building code, the system shall create a minimum drainage gap of $\frac{3}{16}$ in. (5 mm) and maximum drainage gap of $\frac{3}{4}$ in. (19 mm). Lath fasteners shall meet the requirements of Specification **C1063**, and shall be capable of supporting the adhered manufactured stone masonry veneer system weight in the cantilevered position equal to the thickness of the drainage wall system materials.

NOTE 13—A drainage wall system may be a design choice or a requirement of the applicable building code.

NOTE 14—For optimum performance, the gap shall be drained at all terminations and penetrations and ventilated at top of wall section. WRB, flashing, and weep systems shall be installed in shingle fashion.

10.2 *Exceptions for Interior Applications:*

10.2.1 A scratch coat is not required.

10.2.2 A single layer of WRB is permitted.

10.2.3 Minimal to no mortar between veneer units in tight fit application is permitted.

11. Keywords

11.1 adhered; backing; cementitious; masonry; mortar; unit; veneer

APPENDIX

(Nonmandatory Information)

X1. SHEAR BOND STRENGTH DETERMINATION

X1.1 *Scope*—This appendix provides information to allow a more knowledgeable decision regarding application method options and meeting the building code requirements for shear bond strength.

X1.2 The Building Code Requirements for Masonry Structures, TMS 402/ACI 530/ASCE 5, requires that adhesion developed between adhered veneer and backing shall have a shear strength of at least 50 psi (345 kPa) when tested in accordance with Test Method **C482**. This test method, as written, only tests the bond capability of the unit.

X1.3 The shear bond strength of units to bonding mortar/backing surface, matching the project specification, can be determined by laboratory test using Test Method **C482** as modified by this practice.

X1.4 *Test Method C482 Modification*—The mortar bed specified in Sections 9.1.1 and 9.1.2 of Test Method **C482** shall be replaced with one of the following methods:

X1.5 Specification **C270** mortar, Type S or N, meeting the proportion or property specification. The mortar bed shall be cured in the mold for 48 hours in ambient laboratory conditions.

X1.6 A smooth face concrete masonry unit that meets the requirements of Specification **C90**, Table 2. The concrete masonry unit shall be cut to a coupon with dimensions the same as the inside dimensions specified in subsection 6.1 of

Test Method **C482**. The surface shall be flat with typical molded surface texture. Split face or roughened surfaces shall not be used.

X1.7 Units shall be moistened to simulate the application procedure of this practice.

X1.8 The bonding mortar shall be applied to the unit and to the substrate to simulate application procedures of this practice. The unit shall be immediately applied to the substrate procedures outlined in **7.2** of this practice.

X1.9 Cure specimens at 70 to 77°F and 45 to 55 % relative humidity.

X1.10 Test four specimens at an age of 28 days after unit installation. Data from tests conducted at an age of less than 28 days are acceptable only if the tested shear bond strength equals or exceeds the specified shear bond strength.

X1.11 The key as described in Test Method **C482**, subsection 6.4 shall be modified to a stock as follows. The width and height of the stock shall be $\frac{3}{4}$ by $\frac{3}{4}$ in. The length of the stock shall be a minimum of $4\frac{1}{2}$ in., not to exceed 5 in. The stock shall sit over the unit and setting bed mortar joint.

X1.12 Test reports shall indicate the shear bond strength and the mode of failure as either mortar substrate interface, mortar, or mortar unit interface.

X1.13 Test reports shall indicate methods used from **Appendix X1** and **7.2.2** of this practice.

SUMMARY OF CHANGES

Committee C15 has identified the location of selected changes to this standard since the last issue (C1780-14) that may impact the use of this standard. (February 15, 2015)

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|---|---|
| (1) New standards were added to the Referenced Documents section. | (4) Revised 7.1.2 and Note 11 , and added 7.1.3 relating to setting bed thickness. |
| (2) Added 4.4 and 6.4 . | |
| (3) Revised 6.3.2.3 and 6.3.3.3 relating to scratch coat thickness. | |

Committee C15 has identified the location of selected changes to this standard since the last issue (C1780-13) that may impact the use of this standard. (July 1, 2014)

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|--|---|
| (1) Removed the acronym AMSMV from the standard. | (4) Deleted 4.1.2 to remove redundant requirements for units. |
| (2) Subsection 2.3 was modified to cite specific ANSI standards referenced. | (5) Added 4.3.2 to include $\frac{3}{8}$ in. rib lath to the material section. |
| (3) Updated footnote for TMS designations in 2.2 . | (6) Added 6.1.1 , relocated language previously found in 6.6.1 related to shear bond testing. |

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