



CERAMIC TILE INSTITUTE OF AMERICA, INC.

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CTIOA Field Report 82-2

**SUBJECT: New Bricklike Tile Veneer Installation Procedures and Inspector's Checklist
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INTRODUCTION

In seeking to blend small to medium sized buildings into the surrounding area or create a warm, earth-like feeling, increasing numbers of architects and designers are turning to bricklike tile veneer for exterior cladding. This material is a durable, aesthetically pleasing product that, when installed properly, provides a most acceptable exterior veneer and a refreshing change from chrome and glass.

In recent months there have been a proliferating number of inquiries concerning the proper installation techniques and acceptable materials involved in the installation of tile that resembles brick. The typical tile unit is 2 3/16 inches by 7 1/2 inches. It is also manufactured in other sizes ranging up to 3 1/2 inches by 11 1/2 inches by 1/2 inch. Since a step-by-step evaluation of procedures and materials is often the most useful and effective means of presenting subject matter, we have reviewed the component parts involved in this type of installation over backings of masonry, concrete, steel and wood frame construction which are allowed in the Uniform Building Code. Included also is an inspector's checklist for evaluating proposed plans and to aid in on-site analysis of installation practices. Hand in hand with proper installation procedures is the question of the lasting quality of the installation. To aid in that determination we have developed, in conjunction with our consulting engineer, a tensile test procedure for evaluating bond strength of the tile veneer.

Installation Procedures

The methods for installing tile that resembles brick are not new; rather, they are the same time-tested systems that tile setters have been using for decades. The materials and procedures discussed in this article are in accordance with ANSI A 108.1 and A 108.5 for the installation of ceramic tile. Further, all suggested materials should be in accordance with ASTM testing standards (see bibliography for appropriate designations).

The mortar method for installing the tile veneer is covered in the 1982 edition of the

Uniform Building Code in Chapter 30, Section 3005, Adhered Veneer, The method is also described in U. B.C. Standard No. 30-1, 1979 Edition.

Isolating Tile Veneer From Masonry and Concrete

There are several methods for installing adhered tile veneer over masonry or concrete substrates. If the concrete or masonry is subject to minor cracking or cannot be properly prepared to have mortar and tile bonded to it, the following procedure would be recommended:

1. The masonry or concrete is isolated from the veneer installation by using a membrane such as Type 15 roofing felt or 4-mil polyethylene.
2. Galvanized 2.5-pound expanded self-furring metal lath is fastened securely to the concrete or masonry. The wire is attached by a low-velocity powder-actuated gun. Galvanized drive pins are used to attach the wire. The pins are driven through a washer or disc of sufficient diameter to catch three strands of wire, usually 1 inch in diameter. With regard to the length and spacing of the drive pins, the pin manufacturer should be consulted as to his recommendation, backed up with technical data, for each particular installation.
3. The scratch coat is then applied. This is to stiffen the wire and take up thickness if necessary. Scratch mortar should be a mix of three parts damp sand and one part portland cement, or four parts damp sand, one part portland cement and one-half part hydrated lime. The scratch coat should then be allowed to cure for a minimum of 24 hours.
4. The mortar bed should be mixed six parts damp sand, one part portland cement and one part hydrated lime.
5. When specified in a wet-set mortar method, ANSI A 108.1, the tile veneer should be soaked prior to installation so as to kill the suction of the tile and allow proper bonding. The tile veneer is bonded with a neat portland cement paste over the plastic bed. Each piece of veneer is back-buttered with the portland cement paste in addition to the coat over the plastic bed. (For a cutaway detail of this procedure, see [Figure 1-A](#).)
6. An acceptable alternative to this method would be the procedure as outlined in ANSI A 108.5. This method specifies that the tile veneer be bonded with a thinset or latex-type portland cement bonding mortar. This method allows the mortar bed to be prefloated and cover cured a minimum of 72 hours, after which the tile setter installs the veneer with a thinset or latex-type portland cement bonding mortar. Each piece of veneer is back-buttered with the bonding mortar in addition to a coat on the prefloated mortar bed.
7. The relative shear values would not be so dissimilar as to create an overwhelming advantage for one system over another. Rather, it could be left up to the tile contractor as to the method with which he would be most comfortable.

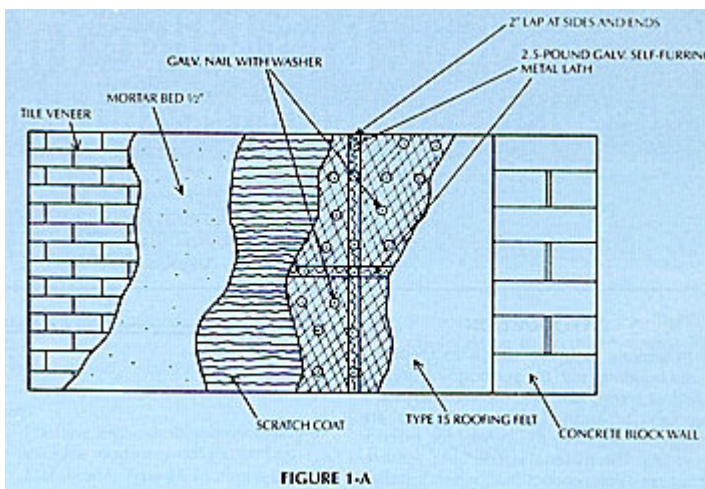
Installing the Veneer Over Dimensionally Stable Concrete or Masonry

1. If the masonry or concrete surface is dimensionally stable, clean and free of coatings, oil or wax, then two procedures of applying the tile veneer are acceptable.
 - A. One method, as depicted in [Figure I-B](#), shows a scratch coat and mortar bed being applied to a properly prepared masonry wall.
 - B. The second method, as shown in [Figure I-C](#), shows the tile veneer being bonded directly to a sand blasted concrete or masonry surface with a dry-set or latex bonding mortar.
2. To ensure a good mechanical bond between mortar and masonry or concrete, the surface must be thoroughly bush-hammered or given a heavy sandblast. A heavy sandblast requires use of a 16-grit sand. This is necessary for both systems.
3. It should be emphasized that 100 percent coverage is required on the back of the tile, regardless of the system, to ensure a tenacious bond and prevent efflorescence due to voids behind the tile. The 100 percent coverage is achieved by back-buttering each piece of veneer.
4. It should be noted that if the procedure shown in [Figure I-B](#) is used it could be specified in a wet-set method ANSI A 108. 1, or the mortar bed can be cured and the thinset method, ANSI 108.5, used.

Installing Tile Veneer Over Steel or Wood

1. Wood or steel stud construction can also be prepared to receive bricklike tile veneer.
2. Structural movement is a major consideration in this type of installation. When evaluating steel stud construction, maximum deflection under heavy loading must not exceed 1/360 of a span. That is to say that a wall 8 feet high must not be allowed to bow more than 1/4 inch. That deflection standard is also true of wood-frame construction.
3. With the proper stud construction in place, water-repellent gypsum sheathing would be applied to create a rigid substrate.
4. Gypsum sheathing should be attached with screws and spacing with regard to design wind load tolerances and other structural concerns as required in the Uniform Building Code.
5. The water-repellent gypsum then has to be covered with a waterproof material, either Type 15 roofing felt or 4-mil polyethylene. A minimum of 2-inch shingle-style lap is required to ensure proper waterproofing capabilities.

6. The metal lath should then be securely fastened to the studs in conformance with the Uniform Building Code. Self tapping panhead or buglehead, Type S screws are recommended, and they should be a minimum of 1 inch in length and have a wide head capable of catching three strands of wire. The lath should be not less than 2.5 self-furring galvanized metal lath. It should be lapped a minimum of 2 inches on all sides.
7. **Note:** Inspectors should be aware that rib lath or paperbacked wire is unacceptable as a backing for tile. This is because both types of lath have an inherent quality of creating a weakened plane joint that will telegraph cracking through to the tile. It is felt that this type of installation, even though it has a solid backing, requires a scratch coat to add strength and rigidity to the system. The scratch coat should be cured a minimum of 24 hours before applying the setting bed.
8. The 1982 Uniform Building Code, Section 3005 (d), states: 'A paste of neat portland cement or half portland cement and half graded sand shall be applied to the back of the exterior veneer units and to the setting bed and the veneer pressed and tapped into place to provide complete coverage between the mortar bed and the veneer unit.'
9. An alternative method which has been tested and approved by the Ceramic Tile Institute is the application of tile that resembles brick over a cured prefloated mortar bed with thinset or latex-type portland cement bonding mortar. One hundred percent coverage is required in order to ensure a tenacious bond and prevent efflorescence from occurring due to voids behind the tile. This requires back-buttering the units. With installation procedures in conformance with the proper codes and standards, any one of the methods discussed in this article will yield a beautiful and lasting installation.



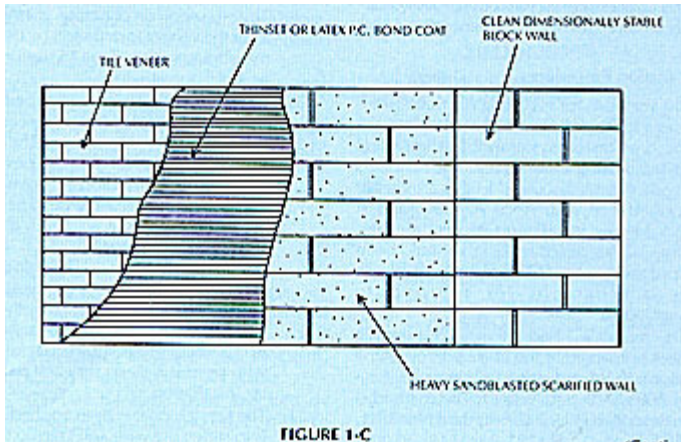
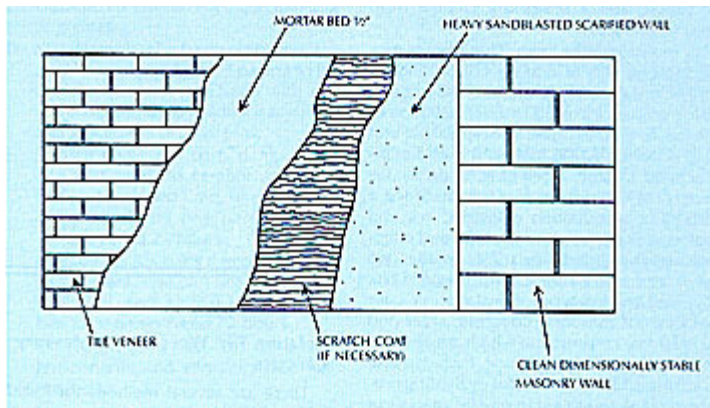


FIGURE 1-C

Tensile Testing Procedure

If bonding strength measurements are required prior to, during or after the installation in order to determine the effectiveness of either the bonding material or installation procedure, the most logical procedure is a tensile strength test developed by Smith-Emery Company's testing laboratories in conjunction with the Ceramic Tile Institute.

The test procedure is as follows:

1. A 6-inch by 6-inch by 1/2-inch piece of milled steel is attached to a section of the wall by means of an epoxy bond mortar.
2. In the center of that steel plate is a threaded area to receive a 1/2-inch pipe.
3. The pipe has a "T" configuration so as to receive two pneumatic jacks, one on either side of the test section.
4. The tile must be saw cut on four sides of the steel plate to the surface of the masonry or mortar bed.
5. Calibrate the dial indicators and exert an increasing pressure until the unit fractures from the wall.

Shear tests can also be made; however, they require the removal of much more of the installation. In evaluating an installation, the tensile test seems to be a truer test of the system's performance characteristics. Relative values can be assigned tensile and shear tests. For example, a unit receiving 50 psi in a tensile test would be equivalent to much more than 50 psi shear value. But we recommend that 50 psi tensile value be required.

Expansion Joints

1. Expansion joints are an area which is often neglected or under-designed.
2. *The Standards of the Tile Trade** and Section AN 3.8 of ANSI A 108.1 call for expansion joints to be specified in the following manner:

AN 3.8.1., Location on Drawings: "Indicate the location and dimensions of expansion joints, when required, in tile work on the project drawings. Also provide details showing filler and backup materials for project drawings."

AN 3.8.2., Exterior Work: "Locate expansion joints in exterior tile work on walls and floors not more than 16 feet (5m) on center both ways on horizontal and vertical surfaces, over all construction or expansion joints in the backing, and where backing materials change."

Note: Masonry and ceramic products expand and contract. Fortunately, they do so at approximately the same rate. Therefore, 1/2-inch-wide expansion joints must be detailed 16 feet on center both horizontally and vertically. These joints are to be cut through the tile, mortar bed and wire, but not through waterproofing paper. They are to be backed up with a closed-cell, polyethylene, backer rod. A two-part polyurethane or silicone sealant, with a Shore A hardness of 35, is neatly placed in the joints.

AN 3.8.3., Interior Work: "Provide expansion joints in the tile work over all construction or expansion joints in the backing and where backing materials change. Where tile floors abut rigid walls and at intervals of 24 to 36 feet (7 to 11m) in large floor areas. Expansion joints are mandatory for quarry tile and paver tile but may be omitted in other tile on dimensionally stable backings at the discretion of the architect."

CONCLUSION

The details and procedures outlined in this report are time-tested methods which will render the attractive, durable and trouble free type of installation on which the tile industry has built a reputation.

The best installation method for any particular job must be evaluated on the basis of performance need, structural design, weather considerations and other variables which may enter into the decision-making process.

INSPECTOR'S CHECKLIST

In order to assist you we have designed an inspector's checklist for evaluating the different installation methods for bricklike tile veneer.

- I. Isolation and installation of tile veneer over masonry or concrete to receive tile veneer.
 - A. Flashing and membrane necessary to exclude moisture from mortar bed.
 - B. Membrane, Type 15 roofing felt or 4- mil polyethylene.
 - C. Galvanized self-furring metal lath 2.5 or greater.
 - D. Metal lath attached with powder-actuated low-velocity guns. Spacing to be 8 inches on center. Check with pin manufacturer as to holding capability and placement of drive pins.
 - E. Scratch coat, four parts damp sand, one part portland cement and one- half part hydrated lime, or three parts damp sand and one part portland cement cured 24 hours.
 - F. Mortar bed, six parts damp sand, one part cement, one part lime. (if thinset method is used, ANSI A 108.5, mortar bed to be damp cured 72 hours.)
 - G. Expansion joints 16 feet on center horizontally and vertically (see [Figure I-A](#)).
- II. Preparation and installation of tile veneer over dimensionally stable masonry or concrete to receive tile veneer in the thinset method.
 - A. Must be over clean, dimensionally stable masonry or concrete.
 - B. Surface must be thoroughly bushhammered or receive a heavy sandblast (minimum 16-grit sand).
 - C. Maximum variation in surface 1/8 inch in 8 feet 0 inch from required plane.
 - D. Thinset of latex-type portland cement bonding mortar conforming to ANSI A I 1 8.1 and A I 1 8.4, respectively.
 - E. Expansion joints 16 feet on center horizontally and vertically (see [Figure I-C](#)).
- III. Preparation and installation of tile veneer over dimensionally stable masonry or

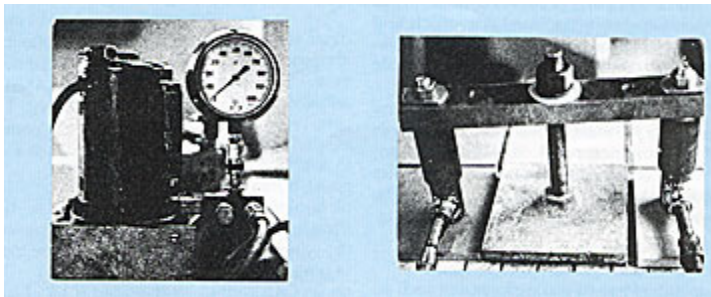
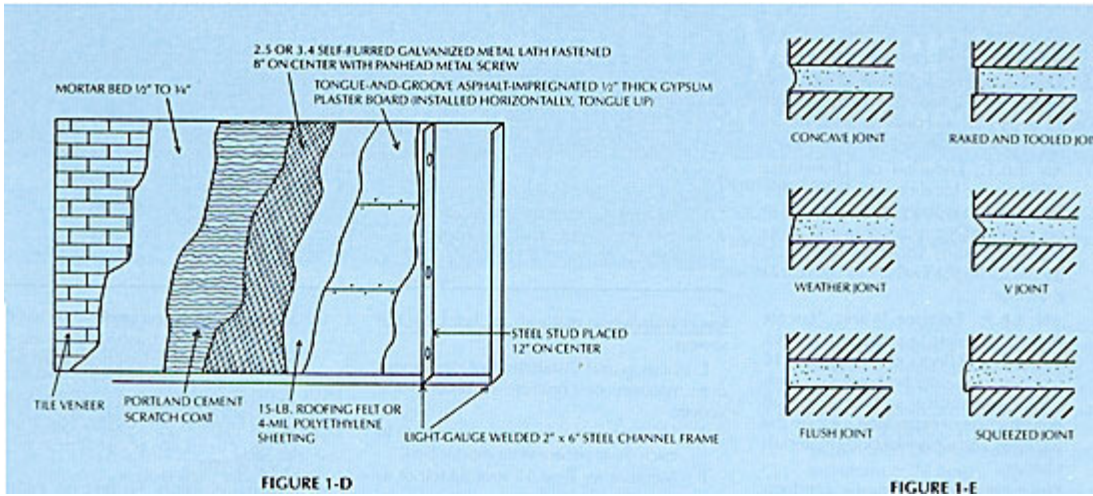
concrete to receive tile veneer in the mortar method.

- A. Masonry or concrete must be clean, sound and dimensionally stable.
- B. Cannot be used over cracked or improperly prepared concrete or masonry.
- C. Surface must be properly scarified by sandblasting or bushhammering to ensure bond between mortar bed and wall.
- D. Mortar bed must be 3/8 inch to 3/4 inch in thickness as per ANSI A 108.1 and cover cured in accordance with ANSI A 108.5.
- E. Expansion joints 16 feet on center horizontally and vertically (see [Figure I-B](#)).

IV. Preparation and installation of tile veneer over wood or steel stud construction.

- A. Over drywall, braced wood studs or load-bearing steel studs 16, 18 or 20 gauge, 16 inches on center.
- B. Maximum deflection NOT to exceed 1/360 of the span.
- C. Membrane, Type 15 roofing felt or 4-mil polyethylene shingle lapped 2 inches on all sides.
- D. Expanded self-furring galvanized metal lath, 2.5 pounds or greater.
- E. Scratch coat cure time - 24 hours (see [Figure 1-D](#)).
- F. Mortar bed
 - 1. Tile wetset (ANSI A 108.1) in plastic bed.
 - 2. Tile, thinset or latex-type portland cement mortar or prefloat bed (ANSI A 108.5).
- G. Expansion joints 16 feet on center horizontally and vertically.

V. Acceptable grout joint configurations (see [Figure 1-E](#)).



BIBLIOGRAPHY

All materials to conform to appropriate ASTM or ANSI designations.

1. Portland cement.....ASTM C 150
2. Hydrated lime
.....ASTM C 206 or 207, Type S
3. Sand.....ASTM C 144
4. WaterPotable
5. Dryset bonding mortar....ANSI A 118.1
6. Latex-type portland cement
bonding mortar.....ANSI A II 8.4
7. Metal lath (exterior).....ANSI A 42.3
8. Type 15 roofing felt.....ASTM D 226

Reprints of this article and inspector's checklist are available separately or together at no cost from the Ceramic Tile Institute, 700 North Virgil Avenue, Los Angeles, CA 90029, (213) 660-1911.

