THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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Adding Brick Veneer to Existing Construction

Abstract: This *Technical Note* presents information on adding anchored brick veneer and thin brick adhered veneer to existing construction. Considerations and recommendations for design, detailing, material selection and construction specific to retrofitting existing walls with brick veneer are presented. Other *Technical Notes* are referenced for general brick veneer construction information not specific to the retrofit of existing construction.

Key Words: adhered veneer, anchor, anchored veneer, brick veneer, design, existing construction, flashing, retrofit, re-veneering, thin brick, ties, walls, weeps.

SUMMARY OF RECOMMENDATIONS:

Preparation

- Inspect and repair existing siding as necessary to act as a water-resistive barrier
- Where existing siding cannot be readily repaired, wrap existing siding with a new water-resistive barrier
- Where neither option above is desired, remove existing siding and inspect and repair existing water-resistive barrier and sheathing as necessary, installing a new water-resistive barrier where none currently exists

Anchored Brick Veneer

- Provide drainage wall details, materials and workmanship in accordance with *Technical Note* 7 Series.
- Provide a minimum nominal 1 in. (25.4 mm) air space behind brick veneer
- Support:
  - Bear veneer on existing or extended footing or angle fastened to existing foundation wall
  - For angle support, provide corrosion-resistant angle; fasten angle to existing foundation wall with veneer anchors (ties) sized and placed in accordance with Table 2
  - Where no footing or foundation wall exists, consult a design professional
- Anchorage:
  - Select type and length of veneer anchor (tie) based on existing wall type
  - Place veneer anchors (ties) to penetrate existing sheathing and securely fasten into existing structural members
- Veneer construction:
  - Lap flashing at top of openings and base of veneer with existing exterior finish
  - Lap flashing at bottom of openings with existing sill
  - Provide open head joint weeps immediately above flashing at 24 in. (610 mm) o.c.
- Edge details:
  - At perimeter of veneer openings, return brick as necessary, install molding and sealant to close air space
  - At top of veneer, provide at least ¾ in. (19.1 mm) clearance to bottom of existing soffit, sealed at exterior edge
  - Use proper construction techniques

Thin Brick Adhered Veneer

- Provide details in accordance with *Technical Note* 28C
- Attach to existing wall with cement board, mortar or adhesive, or proprietary panel system provided by thin brick system manufacturer

INTRODUCTION

Brick veneer provides superior performance with many properties desired by designers, contractors and property owners, such as attractive appearance, high fire resistance, high resistance to water penetration, low thermal transmission rate, low maintenance and increased resale value. For a home or building clad in other materials, adding a brick veneer exterior can result in a significant improvement, as shown in Photo 1 and Photo 2.

Photo 1
Before

Photo 2
After

The scope of this *Technical Note* is limited to the addition of brick veneer to existing construction, primarily one- and two-family dwellings and townhouses, but the principles are applicable to all types of construction. For information regarding application to nonresidential or multifamily residential construction, contact a design professional.

APPLICATIONS

Brick can be added to new homes under construction or those that have not started construction, as well as existing homes currently clad in another material. In each of these cases, there is an option to reclad in anchored brick veneer or thin brick adhered veneer.

Brick Veneer Options

Anchored brick veneer is a non-loadbearing component, supported by the foundation and attached to the structure by anchors (ties) fastened to studs or embedded within masonry. Behind the veneer, an air space and water-resistive barrier direct water downward to flashing and weeps, providing an effective drainage wall system. The brick veneer bears on an existing or extended continuous footing, as shown in Figure 1, Figure 3 and Figure 4, or angles attached to an existing foundation wall, as shown in Figure 5.

Thin brick adhered veneer is attached to and supported by the backing wall or framing with thin set mortar or adhesive on cement board, as shown in Figure 2, lath and scratch coat, as shown in Figure 6, or a proprietary

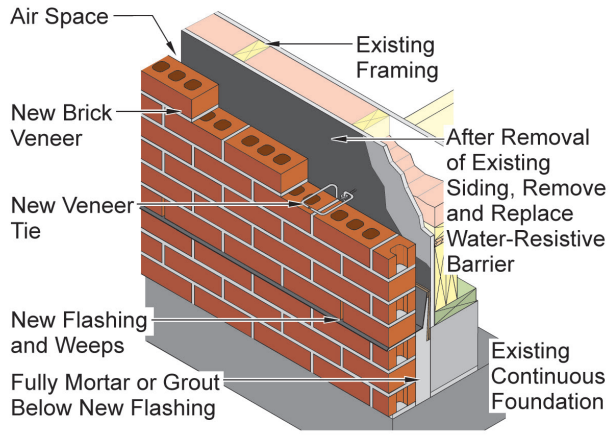


Figure 1
New Brick Veneer on Existing Construction

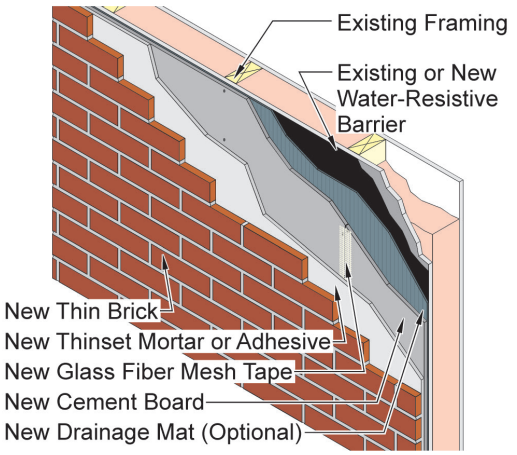


Figure 2
New Adhered Brick on Existing Construction

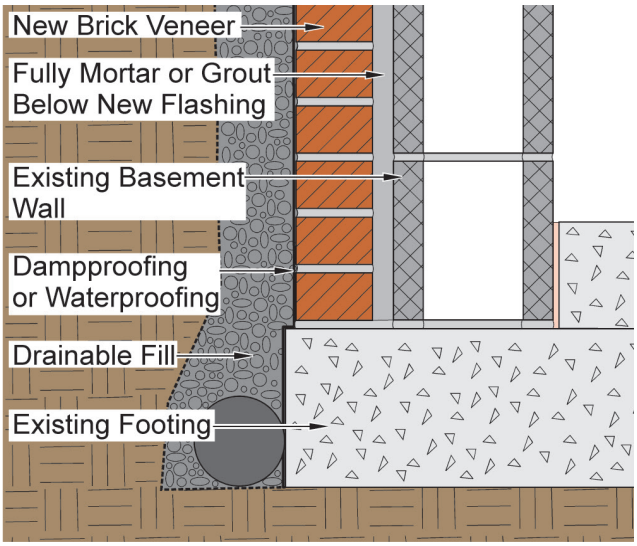


Figure 3
Brick Veneer on Existing Foundation

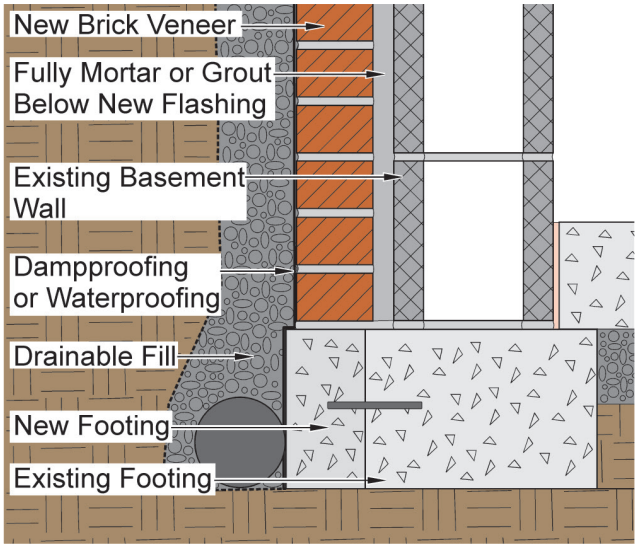


Figure 4
Brick Veneer on Footing Extension

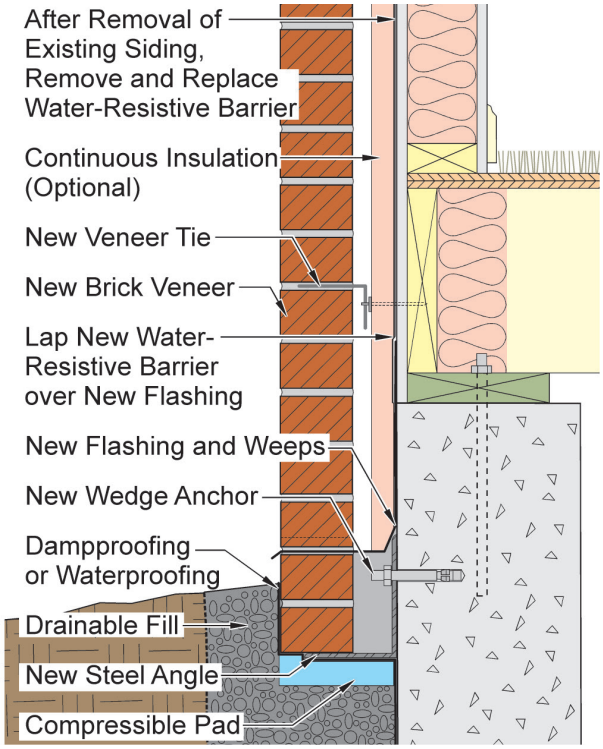


Figure 5
New Veneer on Steel Support

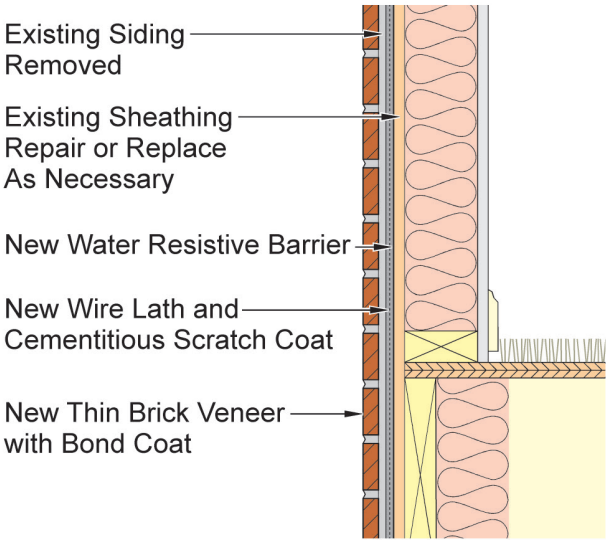


Figure 6
Thin Brick Adhered Veneer (Thick Set Method) on Existing Wood Studs

panel system. For substrate walls with framing, a water-resistive barrier separates the veneer from the wall framing. In direct-applied applications, the setting mortar and pointing mortar, in combination with the brick units, create a barrier wall system to manage water penetration.

Limited discussion of adding thin brick adhered veneer is included in this document. However, more detailed information on thin brick adhered veneer can be found in *Technical Note* 28C.

Building Plans Without Brick Veneer

Brick veneer may be added to drawings and plans where it currently is not included. When adding anchored brick veneer, the existing design can be modified. For an existing design with a continuous footing, the details and explanation presented herein are directly applicable. Where an existing design includes pier foundations without continuous footings, such as with most modular homes or in coastal construction, incorporating brick veneer may likely require the addition of a new footing and foundation wall. Guidance for various types of foundation wall construction can be found in the *Technical Note* 28 Series. Footing design should be coordinated with a contractor and/or design professional.

Since thin brick adhered veneer is supported directly by the wall framing, changes to the footings and foundation wall are not necessary. Additionally, due to the lighter weight of thin brick, further modifications to the existing design typically are not required.

Existing Construction

When adding new anchored or adhered brick veneer to existing construction, there are two general approaches: applying brick over the existing cladding or removing and replacing the existing cladding with brick.

Applying over Existing Cladding. In general, it is usually simpler to remove existing cladding rather than install over it. This is because an engineering analysis must be performed to evaluate the existing cladding as a substrate and to determine the design and attachment of the new masonry veneer. In addition, the new masonry veneer will require an increased effort to install.

New anchored brick veneer can be installed over existing cladding, including anchored or adhered masonry veneer, provided that the new veneer is adequately supported at the base, that the anchors (ties) for the new veneer are engineered and fastened to the substrate or framing—not to the existing cladding—and that a functional, code-compliant air space/drainage cavity is created. The face of the existing cladding will likely require retrofit to achieve adequate water resistance.

Adhered brick veneer can also be installed over existing cladding when cement board (Figure 2), a cementitious scratch coat with wire lath (Figure 6) or a proprietary panel system is used. The fasteners supporting the adhered brick substrate must be engineered and attached to the existing framing—not the existing cladding. Existing siding, such as wood, vinyl, aluminum and fiber cement siding, is not considered an acceptable substrate for a direct application of adhered brick veneer. Anchored masonry veneer may be an acceptable substrate for new adhered brick veneer if an engineering analysis determines that the bearing support and the existing anchor (tie) system provides adequate capacity. Any expansion joints, control joints or construction joints in the existing cladding must be incorporated at the same location in the new veneer in order to minimize cracking and delamination.

Replacing Existing Cladding. If the existing cladding is removed, the existing sheathing is not considered an acceptable substrate for a direct application of new thin brick adhered veneer. An acceptable substrate for receiving thin brick adhered veneer, such as cement board, cementitious scratch coat with wire lath or a proprietary modular panel system, will need to be installed over the sheathing. In the case of anchored brick veneer, once the existing cladding is removed, water-resistive barrier and flashing can be applied over the existing sheathing, and the construction of the brick veneer proceeds similar to a new construction application.

Structural Requirements. Generally, the strength and stiffness of the existing exterior walls of a building, whether wood frame, cold-formed metal frame or masonry, are sufficient as backing for anchored brick veneer or thin brick adhered veneer. Where exterior framing may allow excessive deflections, such as in cold-formed metal backing or premanufactured homes/metal buildings, stiffen the backing as necessary to meet current code requirements for deflection limits.

Water Penetration Resistance. In addition to structural preparations, the existing walls may need modification to include a water-resistive barrier and other code-compliant drainage materials. In the case where the existing construction does not include these materials, it will be necessary to install new drainage materials outside the existing siding or remove the siding entirely. If the siding is removed, either repair any existing materials behind the siding as necessary or install new materials. Existing sheathing should not be used alone as the water-resistive barrier.

PROPERTIES OF ANCHORED BRICK VENEER CONSTRUCTION

The following properties are true of virtually all types of brick veneer. While thin brick adhered veneer shares these properties, some properties, such as fire resistance, may be somewhat reduced compared with those of anchored brick veneer, which uses full-thickness units.

Aesthetics

Brick is a traditional sign of quality construction that will increase the value of an existing home or commercial structure. Brick is available in a large variety of sizes, colors, textures and coatings. Multiple bond patterns, colored mortars and details are available to create unique looks. For further information on brick sizes and bond patterns, refer to *Technical Note* 10 and *Technical Note* 30.

Thermal Performance

Adding brick veneer to an existing wall can increase thermal performance. Brickwork has a high thermal mass, storing and releasing heat slowly. As a result, walls with brick veneer require less insulation than walls without brick. Closed-cell rigid board insulation can be added over the existing wall behind the veneer to further increase thermal resistance. For further information regarding the thermal resistance of brick wall assemblies, refer to the *Technical Note* 4 Series.

Fire Resistance

Brickwork is a noncombustible material with excellent fire resistance. A nominal 3 or 4 in. (76 or 102 mm) brick wythe has a 1-hour fire resistance rating, significantly reducing the chance of fire spread [Ref. 4]. For additional information regarding the fire resistance of brick masonry, refer to *Technical Note* 16.

Acoustics

Brick veneer walls reflect a large portion of sound waves. The mass of the brickwork absorbs another portion of sound energy. For anchored brick veneer, the air space separates the brickwork from the existing wall, further reducing sound transmission. For additional information on sound transmission, refer to *Technical Note* 5A.

Moisture Resistance

Most modern anchored brick veneer is constructed as a drainage wall assembly, which contains an air space that separates the brick veneer from the backing. If wind-driven rain penetrates the veneer, the air space drains water down the interior face of the brickwork to flashing and weeps. A water-resistive barrier, installed on the exterior side of the backing or exterior sheathing, acts as a second line of defense against water penetration. For additional information regarding water penetration resistance, refer to the *Technical Note* 7 Series.

DESIGN AND DETAILING

Proper design and detailing of brick veneer added to a completed design or existing construction are essential to ensure the veneer's performance. Design and detailing considerations include supporting the weight of the veneer, attachment of the veneer to the existing structure, drainage and movement provisions, and details around openings.

Supporting Brick Veneer

The height limitations for anchored brick veneer above the foundation are based on the history of successful performance and depend on both the support offered by the backing and the design seismic or other lateral loads. Table 1 is based on tables R703.8(1) and R703.8(2) in the *2018 International Residential Code* (IRC) [Ref. 2]. Where the structure is located in Seismic Design Category D_0, D_1 or D_2, and the anchored brick veneer height exceeds one story, the existing framing system may need to be upgraded to meet the minimum requirements for wall bracing in IRC Section R602.10.6.5. For additional requirements for residential construction, refer to the IRC [Ref. 2], and for nonresidential refer to the *2018 International Building Code* (IBC) and the Building Code for Masonry Structures (TMS 402) [Ref. 1 and Ref. 5].

TABLE 1

Height Limitations for Anchored Brick Veneer

Seismic Design Category	Type of Backing	Empirical Height Limitations		
		Maximum Stories	Height at Plate, ft (m)	Height at Gable, ft (m)
A, B or C[a]	Wood frame	3	30 (9.14)	38 (11.58)
	Cold-formed metal frame	2	30 (9.14)	38 (11.58)
	Concrete or masonry	No specific limit		
D_0[b]	Wood frame	3[d]	30 (9.14)[d]	38 (11.58)
	Cold-formed metal frame	Not permitted		
	Concrete or masonry	No specific limit		
D_1[b]	Wood frame	3	20 (6.10)[e]	28 (8.53)[e]
	Cold-formed metal frame	Not permitted		
	Concrete or masonry	No specific height limit		
D_2[c]	Wood frame	2	20 (6.10)[e]	28 (8.53)[e]
	Cold-formed metal frame	Not permitted		
	Concrete or masonry	No specific height limit		

a. Veneer to be maximum 5 in. (127 mm) nominal thickness and maximum 50 psf (245 kg/m²) installed weight.
b. Veneer to be maximum 4 in. (102 mm) nominal thickness and maximum 40 psf (196 kg/m²) installed weight.
c. Veneer to be maximum 3 in. (76 mm) nominal thickness and maximum 30 psf (147 kg/m²) installed weight.
d. Maximum height of one- and two- story veneer limited to 20 ft (6.10 m) unless bottom 10 ft (3.05 m) is backed by concrete or masonry.
e. Maximum height may be increased to 30 ft (6.10 m) and 38 ft (11.58 m) in the gable if the bottom 10 ft (3.05 m) is backed by concrete or masonry.

When adding anchored brick veneer, its weight may be supported directly on either existing or new concrete foundations. Alternatively, where existing concrete or masonry foundation walls provide sufficient strength, the veneer may be supported by steel angles anchored to the existing foundation walls.

Concrete Footings

Where possible, support new brickwork with an existing concrete footing, as shown in Figure 3. If an existing footing is not wide enough to support the brick wythe (minimum bearing of two-thirds of the thickness of the wythe), the existing footing can be extended by placing new concrete at the same depth as the existing footing, as depicted in Figure 4. Provide reinforcement in any new concrete footing as required by the building code. Coordinate any modification to the existing footing with the local building official.

Steel Angles

An alternate method of supporting anchored brick veneer is by attaching a continuous corrosion-resistant steel shelf angle to the existing concrete or masonry foundation or basement wall. The preferred location of the horizontal leg of the angle is at or slightly above grade. If the angle is to be placed below grade and above the frost line, the space beneath the angle must be backfilled with freely draining granular material and a compressible pad to limit frost heave and to protect the angle from displacement. Refer to the *Technical Note* 7 Series for more information on detailing of brick veneer extending below grade. Anchorage of the shelf angle to concrete or masonry walls can be achieved either by wedge anchors, as depicted in Figure 5, or by using through-bolts.

When using through-bolts, seal the annular space around the shaft of the bolt to prevent water penetration. When using mechanical anchors secured in poured concrete or filled concrete masonry units, use maximum anchor spacing as defined in Table 2. Note that the angle size used will depend on the proposed distance from face of brick back to face of foundation wall. The horizontal leg of the angle must be long enough to allow a minimum of two-thirds of the brick thickness to bear on the angle. Attach angles through holes centered at two-thirds the height of the angle using noncorrosive shims as necessary.

TABLE 2
Maximum Spacing Between Anchor Bolts Supporting Angle, in. (mm)[a]

Brick Height, ft (m)	Drop-In Anchors		Wedge Anchors or Through-Bolts[b]	
	½ in. (12.7 mm) diameter	⅝ in. (15.9 mm) diameter	½ in. (12.7 mm) diameter	⅝ in. (15.9 mm) diameter
4 (1.2)	42 (1067)	48 (1219)	48 (1219)	48 (1219)
6 (1.8)	28 (711)	48 (1219)	42 (1067)	48 (1219)
8 (2.4)	20 (508)	36 (914)	32 (813)	45 (1143)
10 (3.0)	18 (457)	28 (711)	24 (610)	36 (914)
12 (3.7)	14 (356)	24 (610)	21 (533)	30 (762)
Min. embedment, in. (mm)	2 (51)	2⅜ (60)	2¼ (57)	2¾ (70)
Min. edge distance, in. (mm)	2½ (64)	3⅛ (79)	2½ (64)	3⅛ (79)

a. Assumes steel equal leg angles, ⅜ in. (9.5 mm) thick, maximum leg dimension of 5 in. (127 mm), used in 10 ft. (3.0 m) sections with ½ in. (12.7 mm) gap between sections.
b. Minimum embedment not applicable to through-bolting.

This method of supporting veneer with retrofit steel angles may not be suitable for some applications and may require review by a qualified design professional. Loads applied to the angle and foundation wall should be carefully considered, as well as the strength of the foundation wall itself. Special consideration should be given to the eccentricities of the applied loads, especially when acting in conjunction with existing soil backfill loads. In general, this method of support should be confined to one-story structures where the total height to the top plate does not exceed approximately 12 ft (4.3 m).

Attachment

The brick veneer must be securely attached to the existing construction throughout its height using veneer anchors (ties). When using adjustable two-piece W1.7 (MW11) wire or 22-gage corrugated anchors (ties), provide one anchor (tie) for each 2.67 ft² (0.25 m²) of wall area. Anchors (ties) must be fastened through the existing siding and sheathing (if present) into the framing or structural backing. As such, the fasteners used to attach the anchors (ties) will need to be longer and/or larger than those used in new construction. Depending on the applicable code (IRC or IBC), the maximum spacing of anchors (ties) cannot exceed 24 in. (610 mm) horizontally or vertically for residential construction and cannot exceed 32 in. (813 mm) horizontally or 18 in. (457 mm) vertically for nonresidential construction. These spacing limits apply both above and below grade.

Supporting Lateral Loads

Lateral loads push or pull a wall surface due to forces from wind and earthquakes. The addition of brick veneer, when properly attached, does not affect the ability of the existing construction to resist wind pressures. The wind loads on the brickwork are considered to be transferred through the anchors (ties) into the existing walls, just as if the veneer had not been added. Seismic loads, which are based on wall stiffness and weight, among other factors, can be significantly affected by the addition of the veneer. For all buildings in areas defined by the building code as Seismic Design Categories A and B, as well as detached one- and two-family homes in Seismic Design Category C, there are no requirements associated with the addition of the veneer. The height limitations in Table 1 were established based on the seismic resistance of wood stud framing. In all other cases, a local building official and/or design professional should be consulted to determine if modification of the existing exterior walls is needed to accommodate the seismic loads induced by the new veneer.

Flashing and Weeps

Flashing details, similar to those depicted in Figure 5 and Figure 7, are essential to brick veneer construction. In order to divert the moisture out of the air space through the weeps, continuous flashing is installed at the bottom of the air space and above grade. Where the veneer continues below grade, completely fill the space below the flashing with mortar or grout. Install flashing at the heads and sills of all openings and wherever the air space is interrupted. Extend the vertical leg of the flashing up a minimum of 8 in. (203 mm) such that the top edge of the flashing is lapped by the water-resistive barrier. Extend the horizontal leg of the flashing to, and preferably beyond, the face of the brick veneer. Where the flashing is not continuous, such as at window or door heads and sills, the ends should be turned up approximately 1 in. (25.4 mm) to form an end dam.

Install weeps in the head joints immediately above all flashing. The maximum recommended spacing of open head joint weeps is 24 in. (610 mm) on center. Refer to the *Technical Note* 7 Series for additional discussion of flashing and weeps.

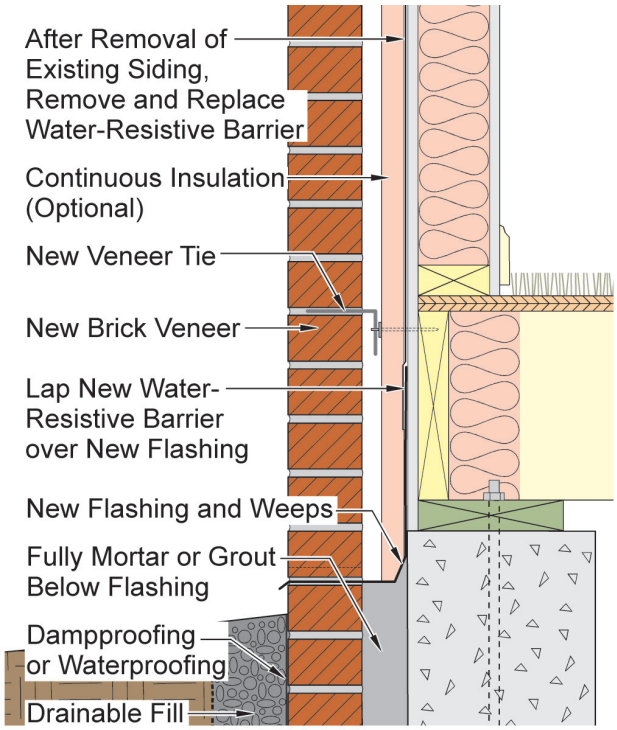
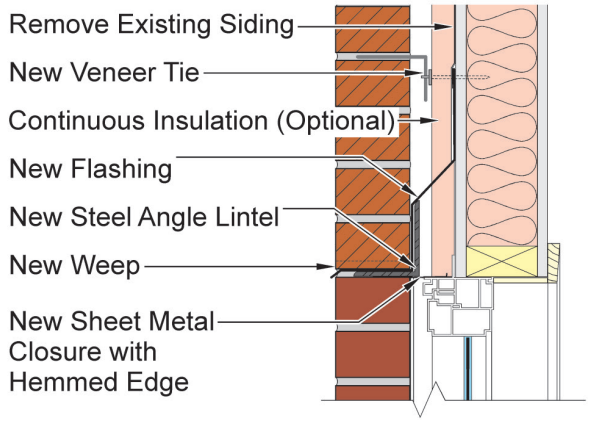


Figure 7
Base Detail

Framing Around Openings

Typically, openings in an added veneer are constructed similarly to those in new construction, with existing window trim and details left in place behind the new veneer. Where new water-resistive barrier is added, it should be integrated with existing or new window opening details that include lapping existing or new flashing. At the window ledge, the new brick sill is made sufficiently deep to span the new air space and tuck under the existing sill, as shown in Figure 8. Maintain a minimum ¼ in. (6.4 mm) gap below the existing sill to allow for potential brick



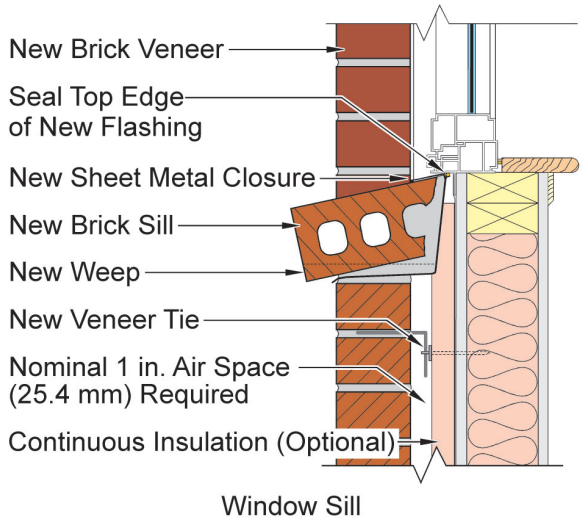


Figure 8
Window Head and Sill Details

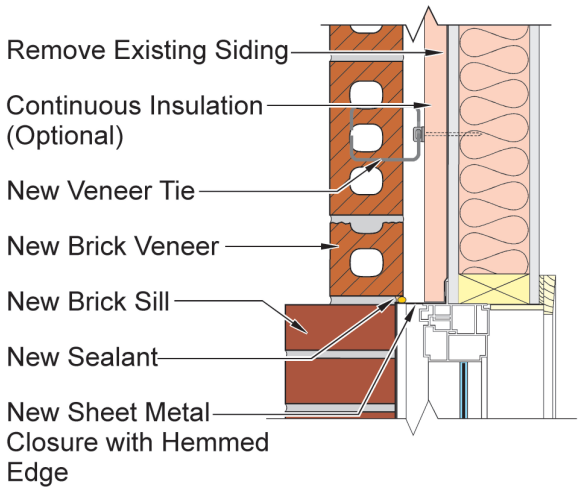


Figure 9
Window Jamb Detail

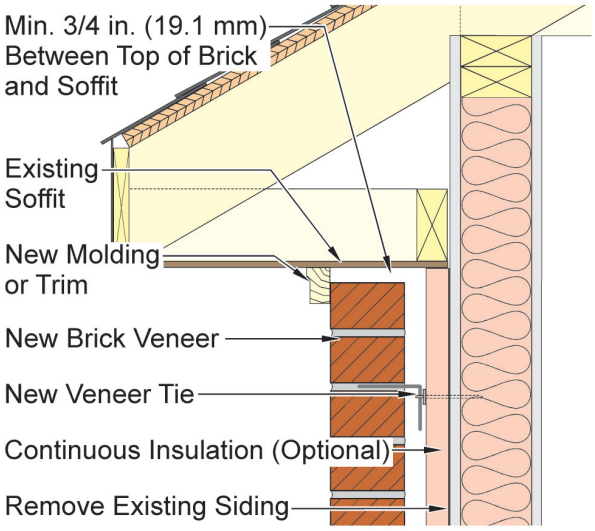


Figure 10
Eave Detail

expansion. When an existing wood window is present, install a new molding deep enough to cover the air space at the top and sides of the opening. When existing metal or vinyl windows are present, install a new hemmed sheet metal closure to cover the air space, as depicted in Figure 8 and Figure 9.

Steel angles, which are commonly used as lintels, support veneer over door and window openings. Reinforced brick masonry or precast concrete are also alternatives. Steel angle lintels must bear a minimum of 4 in. (102 mm) onto adjacent masonry. For further information on the design, detailing and material selection of various types of lintels, refer to *Technical Note* 31B.

Top of the Veneer

A typical detail for the top of the brick veneer at an existing eave is shown in Figure 10. Maintain a minimum ¾ in. (19.1 mm) clear space between the top of the last course of brick and the bottom of the soffit. Cover this space with a new molding strip, or otherwise close the opening. If the eave is insufficient to fully cover the top of the veneer, then extend it to protect the top of the brick.

Movement Provisions

Differential movements due to temperature, moisture, shrinkage and creep are ordinarily insufficient in small brick veneer buildings to require that movement joints or other provisions be installed. For large structures, such

as commercial buildings and large single-family houses, the design should include considerations of potential differential movements and proper details to accommodate them. Design and details for differential movement may include expansion joints, flexible anchorage, joint reinforcement, bond breaks and sealants. These items and their applications are discussed in the *Technical Note* 18 Series and the *Technical Note* 28 Series.

MATERIALS

The proper selection of quality materials is essential to the satisfactory performance of a brick veneer wall assembly. No amount of design, detailing or construction can compensate for the improper selection of materials.

Brick

New brick added to existing construction should conform to the applicable ASTM requirements. For anchored brick veneer, comply with ASTM C216, *Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)*, or ASTM C652, *Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)* [Ref. 3]. Grade SW brick is recommended for all anchored brick veneer applications. Anchored brick veneer typically consists of nominal 3 or 4 in. (76 or 102 mm) thick units. For thin brick adhered veneer, comply with ASTM C1088, *Standard Specification for Thin Veneer Brick Units Made from Clay or Shale*, Grade Exterior [Ref. 3].

Generally, salvaged brick are not recommended since their original properties are not readily determined and they may not provide the strength and durability required for satisfactory performance. For further information on salvaged brick, refer to *Technical Note* 15.

Mortar

Selection of an appropriate mortar helps to ensure durable brickwork that meets performance expectations. Mortar Type and mortar material selection should consider multiple aspects of a project, including design, brick or masonry materials, exposure and required level of workmanship. Improper mortar selection may lead to lower performance of the finished project. Mortars are classified by ASTM C270, *Standard Specification for Mortar for Unit Masonry* [Ref. 3], into four Types: M, S, N and O. These four Types of mortar may be made with portland cement, masonry cement, mortar cement or blended cements, some of which are combined with hydrated lime. Type N mortar is recommended for most brick veneer applications. Type M portland cement-lime mortar is recommended for brick veneer below grade, where the brickwork is in contact with earth. Mortars for brick masonry are discussed in more detail within the *Technical Note* 8 Series.

Veneer Anchors (Ties)

The type of anchor (tie) system used with anchored brick veneer depends on the construction of the existing wall. Corrugated metal anchors (ties) are permitted to be used only with wood frame backing with a limited air space. Metal wire anchors (ties) are required for cold-formed metal frame and concrete/masonry backing systems, as well as wood frame backing where the air space exceeds 1 in. Several types of anchors (ties) that may be used in anchored brick veneer applied to existing construction are shown in Figure 11.

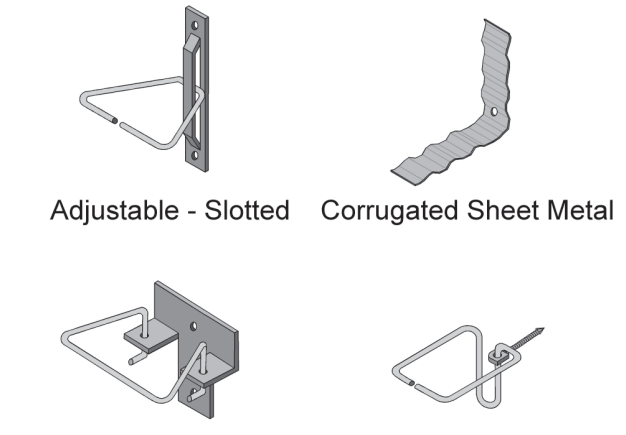


Figure 11
Veneer Anchors (Ties)

Corrugated Metal Anchors (Ties). Corrugated anchors (ties) must be corrosion resistant and have a thickness of at least 0.03 in. (0.8 mm, 22 gage), a minimum width of ⅞ in. (22.2 mm), and a length of

6 in. (152 mm). Corrugated metal anchors (ties) should comply with ASTM A1008/A1008M, *Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability* [Ref. 3].

Metal Wire Anchors (Ties). Steel wire anchors (ties) must be at least wire size W1.7 (9 gage) and corrosion-resistant. Metal wire anchors (ties) should comply with ASTM A1064/A1064M, *Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete* [Ref. 3].

Corrosion Resistance

Corrosion resistance for veneer anchors (ties) and shelf angles is usually provided by a zinc coating, or by using stainless steel. To ensure adequate resistance to corrosion of anchors (ties), coatings or materials should conform to the following standards:

Zinc Coatings – Hot-Dipped Galvanized
ASTM A123/A123M or A153/A153M, Class B (for carbon steel shelf angles)
ASTM A153/A153M, Class B (for sheet metal anchors or ties)
ASTM A153/A153M, 1.50 oz/ft² (458 g/m²) (for wire anchors or ties)

Stainless Steel – AISI Type 304 or Type 316
ASTM A480/A480M or A666 (for shelf angles)
ASTM A240/A240M or ASTM A480/A480M (for sheet metal anchors or ties)
ASTM A580/A580M (for wire anchors or ties)

Anchor (Tie) Fasteners

The existing wall construction will influence the type of fastener used to attach anchors (ties). Some systems have manufacturer-specific attachment hardware for each type of backing. Where no manufacturer requirements are given, the following general guidelines apply. Refer to the *Technical Note* in the 28 Series that corresponds to the wall assembly type for more information about the appropriate anchors (ties) and fasteners.

Wood Frame. Use corrosion-resistant screws or nails to attach corrugated metal anchors (ties) to wood frame construction. Use minimum No. 10 screws and 8d ring shank nails long enough to penetrate at least 1½ in. (38 mm) into the wood studs after passing through existing siding and sheathing.

Metal. Use corrosion-resistant, self-tapping metal screws, No. 10 minimum, to attach the wire receiver or strap to metal construction. The screws should penetrate into the metal studs at least three threads past the inner face of the metal thickness.

Concrete or Masonry. Veneer anchors (ties) can be attached to existing concrete or masonry walls with minimum ³⁄₁₆ in. (4.8 mm) masonry screws long enough to be embedded at least 1½ in. (38 mm) or ⅜ in. diameter expansion bolts. Note that anchorage into hollow masonry requires verification of anchor capacity by an engineer. Use corrosion-resistant fasteners and anchors (ties) sufficiently embedded to provide the necessary capacity to resist lateral loading.

Other Wall Types. For pole buildings, pre-manufactured metal buildings, or other forms of construction where structural members are widely spaced and lateral load resistance is provided mainly by the exterior skin, coordinate the anchorage type and layout with a design professional.

Steel Angles

Steel for angles supporting new brick veneer at the foundation wall should conform to ASTM A36 and be treated or coated for corrosion resistance. Bolts or other fasteners used to connect the steel angle to the structural frame should also be corrosion resistant. Steel angles for lintels should be a minimum ¼ in. (6.4 mm) thick with at least 3 in. (76 mm) legs made of steel conforming to ASTM A36. For more information regarding steel lintels for brick masonry, refer to *Technical Note* 31B.

Flashing and Weeps

Selection of superior flashing materials is recommended since replacement in the event of failure will be costly and difficult, if not impossible. Flashing materials must be waterproof, durable, and resist puncture and cracking

during and after construction. To promote drainage, flashing should extend beyond the face of the brick to form a drip. Flashing materials for use with brick veneer may be plastic or rubber membranes, sheet metals, or a combination of these materials. Materials such as asphalt-impregnated felt paper, polyethylene sheeting, building paper and housewraps are not recommended as flashing materials.

Weeps are required immediately above flashing at all locations. Open head joint weeps are recommended. Open head joint weeps may have noncorrosive plastic, mesh or metal screens or vents installed if desired. Such weeps can serve a dual function of allowing water to drain while also allowing air to enter the cavity, resulting in more drying action and helping to keep insects out. For more information about flashing and weeps, refer to the *Technical Note* 7 Series.

CONSTRUCTION

Supports

Footings. Supporting brick veneer on an augmented or existing footing requires excavation. The excavation must be sufficiently wide for the mason to work and sufficiently stepped, braced or shored to avoid collapse. Remove loose soil and debris from the existing footing with a brush prior to placement of masonry.

Shelf Angles. When constructing brick veneer on continuous corrosion-resistant steel angles, lay the first course of brick in a mortar setting bed. This provides a means to compensate for any variations and misalignment of the steel angles.

Installing Additional Insulation

Applying brick veneer over existing construction offers an opportunity to increase the amount of insulation in the existing exterior walls. The insulation materials used should comply with the criteria discussed in *Technical Note* 28D.

Rigid insulation may be installed directly over the existing finish prior to constructing the new brick veneer. Maintain a minimum 1 in. (25.4 mm) air space between the brick veneer and the rigid insulation. If the existing wood or cold-formed metal framing contains little or no insulation, then the existing siding of the wall may be removed to install new insulation within the wall. Replace any materials removed from the existing wall with appropriate new materials to provide a water-resistive barrier. When insulation is added between the brick and the backing, wire veneer anchors (ties) are required instead of corrugated anchors (ties) due to the increased width of the drainage cavity.

Workmanship

Good workmanship is necessary to achieve satisfactory performance of brick veneer. For additional information regarding workmanship, refer to *Technical Note* 7B.

Mortar Joints. Completely fill all bed and head joints with mortar. Keep the air space and weeps as clean and free of mortar and mortar droppings as possible to achieve adequate drainage. Tool mortar joints to enhance the water resistance of the wall by consolidating the mortar. Joints should be properly tooled when the mortar is “thumbprint” hard, with a jointer tool slightly larger than the joint. Concave, “V” or grapevine joints are recommended for the most water-resistant brickwork.

Flashing and Weeps. Securely attach flashing to the existing wall with its top edge lapped under water-resistive barrier. Extend the flashing to the face of the brick veneer (or beyond when a drip is used) and install weeps immediately above all lines of flashing.

Anchor (Tie) Placement. Embed anchors (ties) a minimum of 1½ in. (38 mm) into the bed joints and completely surround with at least ⅝ in. mortar cover from the exterior.

Sealants. Provide sealant joints for expansion at the perimeter of exterior door and window frames not less than ¼ in. (6.4 mm) wide. Remove old sealant, dirt, debris, loose paint or coatings to a minimum depth of ¾ in. (19.1 mm). Prime joints and install backer rod before placing sealant. Apply the sealant with a pressure gun.

Protection

As with any brick masonry construction, protect materials from weather before and during construction. Store brick and mortar materials above the ground and under cover. Store flashing, anchors (ties) and other components indoors or in a shed or trailer, or otherwise protected from weather. During construction, protect partially completed walls by securely attaching a strong, weather-resistant membrane to the existing structure and allowing it to overhang the brickwork by at least 2 ft (0.61 m). This will help keep excessive moisture out of the wall and materials, decreasing the possibility of efflorescence and other deleterious effects.

MAINTENANCE

Most brickwork is virtually maintenance-free. If properly designed, detailed and constructed, minimal brickwork maintenance is required. However, brick veneer added to existing wall systems should be inspected periodically to ascertain performance and identify any potential problems. Inspections are recommended on a seasonal basis or on an annual basis at a minimum. Such inspections should address sealant joints, plumbness of the wall, cracking, etc., to identify repairs and corrections before severe issues develop. For additional information regarding maintenance, refer to *Technical Note* 46.

SUMMARY

This *Technical Note* provides the basic information required to properly select materials, design, detail and construct brick veneer over existing construction. Added veneer relies on proper support at its base and at the anchors (ties) connecting it to the existing framework of the building. Intact existing siding materials can remain in place, with water penetration resistance provided by a new air space, water-resistive barrier and flashing details. If these recommendations are followed, existing buildings can attain the aesthetic, thermal, acoustic and fire-resistive benefits of brick veneer.

> *The information and suggestions contained in this* Technical Note *are based on the available data and the experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information discussed in this* Technical Note *are not within the purview of the Brick Industry Association, and must rest with the project architect, engineer and owner.*

REFERENCES

1. *2018 International Building Code*, International Code Council Inc., Country Club Hills, IL, 2018.
2. *2018 International Residential Code*, International Code Council Inc., Country Club Hills, IL, 2018.
3. *Annual Book of Standards*, ASTM International, West Conshohocken, PA, 2019:

Volume 1.03

A1008/1008M	Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability

Volume 1.04

A36/A36M	Standard Specification for Carbon Structural Steel
A1064/A1064M	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

Volume 4.05

C216	Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
C270	Standard Specification for Mortar for Unit Masonry
C652	Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C1088	Standard Specification for Thin Veneer Brick Units Made from Clay or Shale

4. Borchelt, J.G., and Swink, J., “Fire Resistance Tests of Brick Veneer/Wood Frame Walls,” 14th International Brick/Block Masonry Conference, Sydney, Australia, 2008.
5. *Building Code Requirements for Masonry Structures* (TMS 402), The Masonry Society, Longmont, CO, 2016.
6. *Specification for Masonry Structures* (TMS 602), The Masonry Society, Longmont, CO, 2016.