TECHNICAL NOTES on Brick Construction
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Technical Notes 28A - Brick Veneer, Existing Construction
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INTRODUCTION

The application of brick veneer to existing construction is popular because it enhances the appearance and improves the performance of existing walls. Its most common application is in refinishing the exterior of one and two-family dwellings, and also in refacing the fronts of commercial buildings.

Brick veneer over existing construction consists of a nominal 3-in. (75 mm) or 4-in. (100 mm) thick brick wythe attached to an existing wall with metal ties in such a way that a 1-in. (25 mm) air space is maintained between the new brick veneer and the existing wall. New brick veneer can be applied to wood frame, metal, concrete or masonry structures.

This *Technical Notes* considers the application of brick veneer to various types of existing construction. The illustrations, however, show only brick veneer applied to existing wood frame structures. This is the most common application. Details for brick veneer applied to other types of construction are similar, the method of attachment varying with the type of existing construction.

PROPERTIES

In addition to improving the appearance of the existing structure, the application of brick veneer may also enhance many of the performance properties of the wall and structure to which it is applied.

Thermal Properties

The thermal properties of a wall are improved by the addition of brick veneer in two ways - the addition of mass and the reduction of infiltration. The application of brick veneer also provides an opportunity to add insulation if desirable.

Additional information on the thermal properties of brick veneer and brick masonry in general may be found in *Technical Notes* 28 Revised, and *Technical Notes* 4 Series.

Moisture Resistance

The moisture resistance of a wall can also be improved by the application of properly detailed and installed brick veneer. See *Technical Notes* 28 Revised, 7 Series and 21C for further information.

Fire Resistance

Constructing brick veneer over existing walls of combustible materials will decrease the possibility of externally initiated fires. Typical brick veneer wall assemblies have fire resistance ratings up to 2 hr.

Acoustical Properties

The addition of brick veneer to an existing wall will improve the sound transmission loss of the wall. This is due to the addition of mass and the discontinuity of the system. Further information is given in *Technical Notes* 28 Revised and *Technical Notes* 5A.

DESIGN AND DETAILING

Proper design and detailing of brick veneer applied to existing construction is very important to ensure that the wall assembly acts as it is intended. Areas of concern in design and detailing are structural performance, supporting the veneer, attaching the veneer to the existing structure, flashing and weepholes, movement provisions, framing around openings, and the top of the veneer.

Structural Design

Brick veneer is a non-loadbearing component of the wall assembly. In addition to its own weight, the only load that the brick veneer should carry is a proportionate share of any lateral loads. The wide differences between the stiffness characteristics of the brick veneer and those of the existing wall that usually occur result in the brick veneer carrying a disproportionate share of the lateral loads not considered in the design.

The height limitations for brick veneer are based on the past history of successful performance. Empirical height limitations are provided in Table 1.

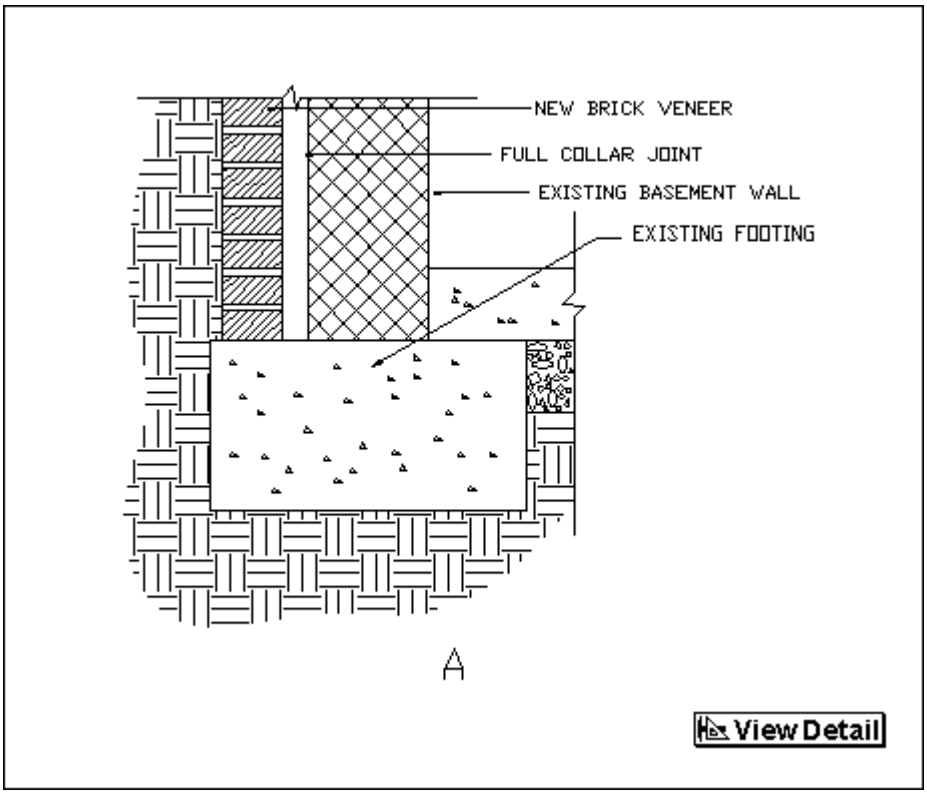
TABLE 1
Empirical Height Limitations for Brick Veneer

Nominal Thickness of the Brick Veneer, in (mm)	Empirical Height Limitations		
	Stories	Height at Plate, ft (m)	Height at Gable, ft (m)
3 (75)	2	20 (6. 10)	28 (8. 53)
4 (100)	3	30 (9. 14)	38 (11. 58)

Supporting Brick Veneer

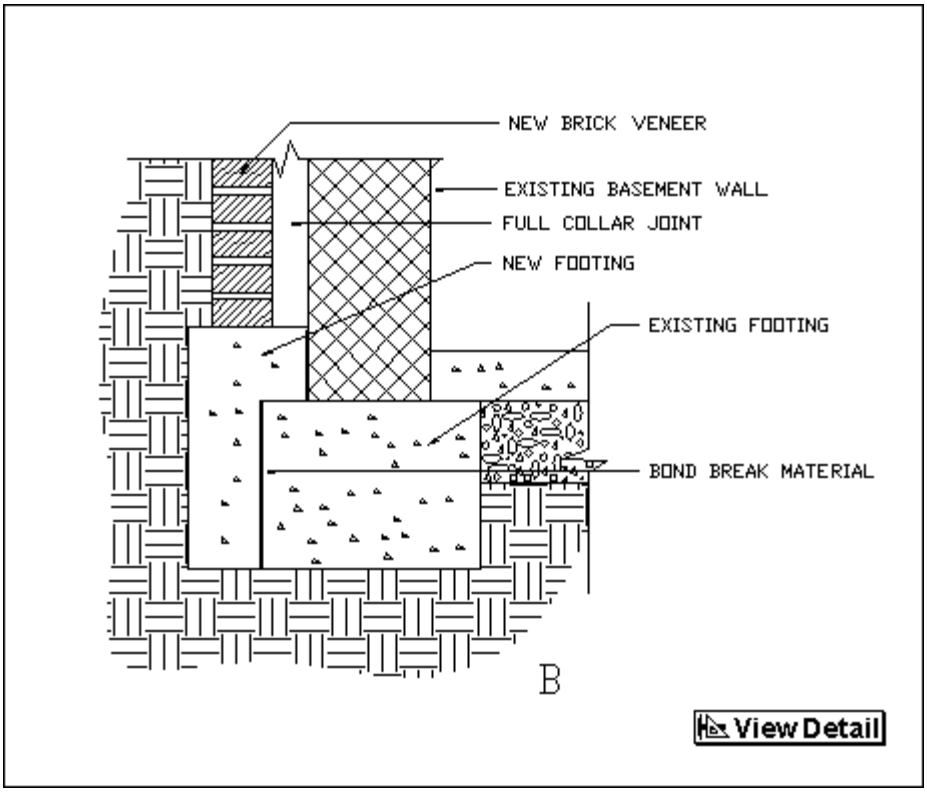
Brick veneer may be supported directly on either existing or new concrete foundations. Alternatively, it may be supported on steel angles anchored to existing concrete or masonry walls.

Foundations. The brickwork should extend down to the existing foundation where possible, as shown in Fig. 1a. If the existing foundation is not sufficiently wide to support the entire thickness of the brick wythe, a new foundation, as shown in Fig. 1b, can be installed at the same depth as the existing foundation. A bond break should be installed between the existing and new foundations to allow for any differential movement.



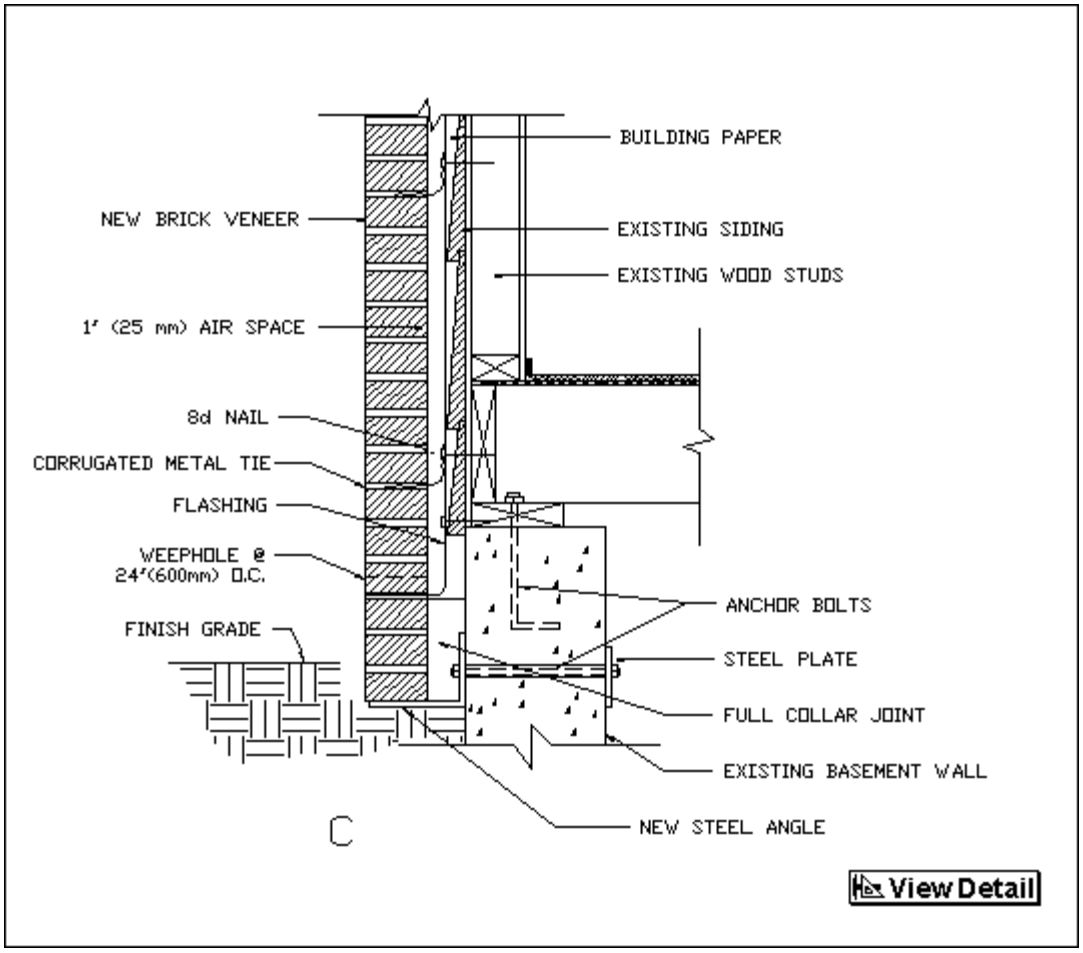
Typical Foundation Details

FIG. 1a



Typical Foundation Details

FIG. 1b



Typical Foundation Details

FIG. 1c

Steel Angles. An alternate method of supporting the brick veneer is shown in Fig. 1c. This requires attaching a continuous corrosion-resistant steel angle to the existing foundation or basement wall. The angle should be installed at or slightly below grade. Installing the angle below the frost line will decrease the possibility of deleterious effects resulting from freeze-thaw actions. The angles should be attached to existing basement or foundation walls constructed of concrete or masonry. Angles should *never* be anchored to wood plates or framing members.

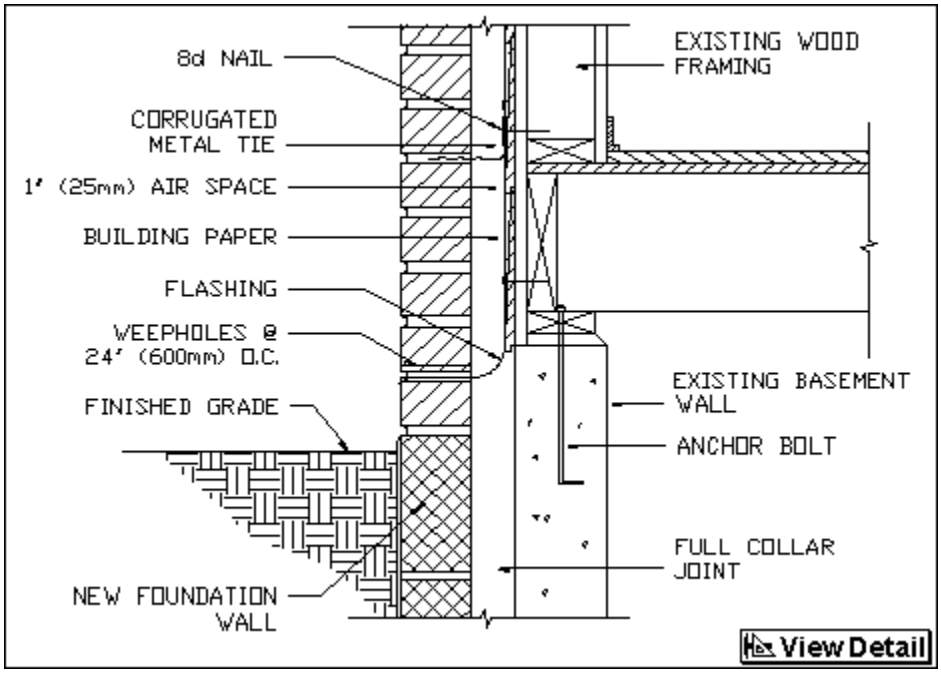
This method of support should be used with *caution.* A careful analysis of the loads being applied to the angle should be made. Special consideration should be given to the eccentricities of the applied loads. The sizing and spacing of bolts must be carefully computed, taking into account not only the loads to be carried, and their resulting eccentricities, but also the strength of the foundation wall itself. In general, this method of support should be confined to one-story structures where the total height to the plate does not exceed approximately 14 ft (4.3 m).

Attachment

The brick veneer must be securely attached to the existing construction. Provide one tie for each 2 2/3 sq ft (0.24 m^2) of wall area. The maximum spacing of ties, either horizontally or vertically, should not exceed 24 in. (600 mm) o.c. This tie spacing applies above and below grade. The above-grade spacing may be reduced to one tie for each 3 1/4 sq ft (0.30 m^2) of wall area for one and two-family dwellings not exceeding one story in height.

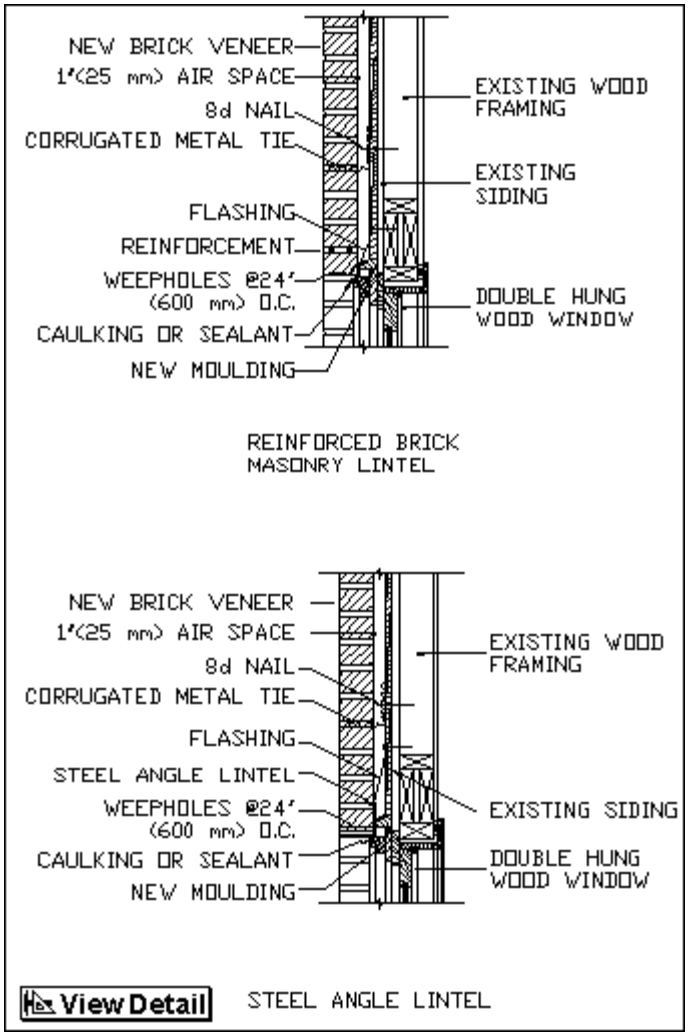
Flashing and Weepholes

Good flashing details, similar to those shown in Figs. 1c, 2, and 3 are essential to brick veneer construction. In order to divert the moisture out of the air space through the weepholes, continuous flashing should be installed at the bottom of the air space. The flashing must be at or above grade. Where the veneer continues below grade, the space between the veneer and the existing construction should be completely filled with mortar or grout. Flashing should also be installed at the heads and sills of all openings, and wherever the air space is interrupted. The flashing should extend through the face of the brick veneer to form a drip. Where the flashing is not continuous, such as at heads and sills, the ends should be turned up approximately 1 in. (25 mm).



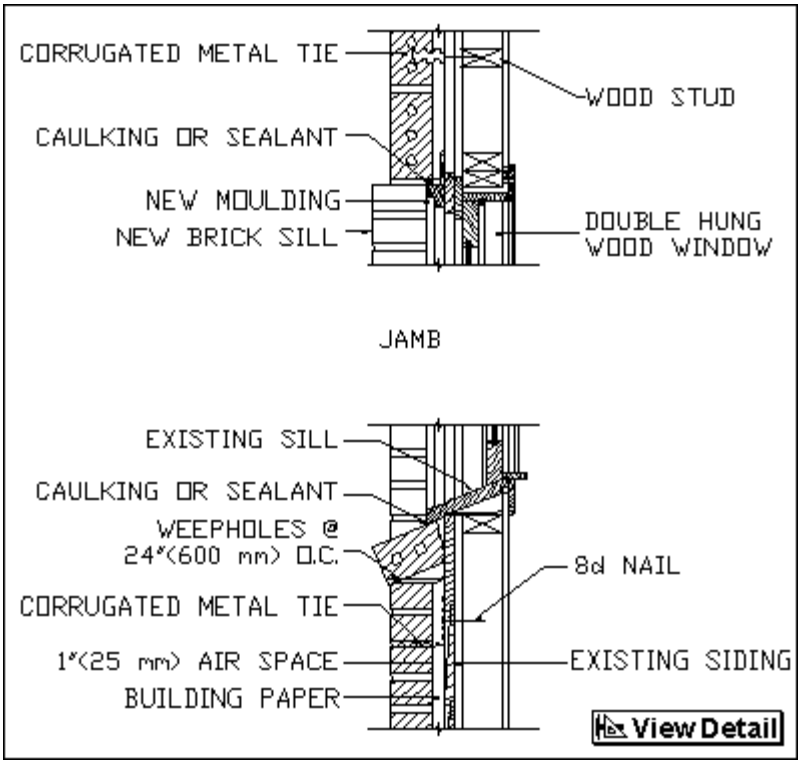
Base Detail

FIG. 2



Typical Lintel, Jamb, and Sill Details

FIG. 3a



Typical Lintel, Jamb, and Sill Details

FIG. 3b

Weepholes should be located in the head joints immediately above all flashing. The maximum spacing of the weepholes should be 24 in. (600 mm) o.c. When wick materials are used in the weepholes or when the flashing does not extend through the face of the brick veneer, the spacing of the weepholes should not exceed 16 in. (400 mm) o.c. Additional discussion of flashing and weepholes may be found in *Technical Notes* 7 Series.

Movement Provisions

Provisions to accommodate differential movement due to temperature, moisture, shrinkage, and creep are not ordinarily required in small brick veneer buildings. For structures larger than 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 *Technical Notes* 18 Series, 28 Revised and 21 Series.

Framing Around Openings

Typical lintel, jamb, and sill details are shown in Fig. 3. New brick sills can usually be constructed so that the existing sill overlaps the new brick sill.

New moulding installed at the existing jambs and heads of openings should extend the framing enough so that the air space between the brick veneer and the existing construction can be properly sealed.

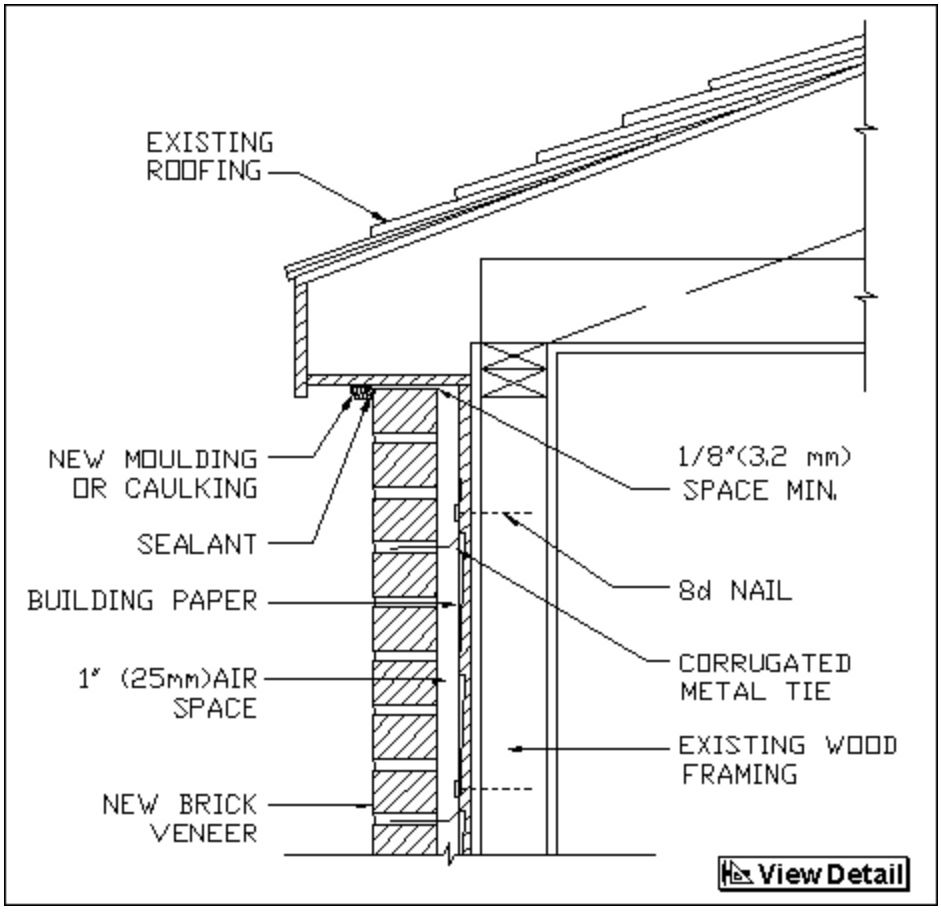
Lintels may be of reinforced brick masonry, steel angles, or precast concrete. Reinforced brick masonry and steel angle lintels are the most commonly used in brick veneer construction.

The minimum required bearing length for steel angle lintels is 4 in. (600 mm). The spans and sizes of steel angle lintels may be modified by fireproofing requirements in local building codes.

Further information on the design, detailing and material selection of lintels may be found in *Technical Notes* 17H and *Technical Notes* 31B Revised.

Top of the Veneer

A typical detail for the top of the brick veneer at an existing cave is shown in Fig. 4. There should be at least a 1/8 - in. (3.2 mm) clear space between the top of the last course of brick and the bottom of the soffit. This space should be covered with a new moulding strip and sealant or caulking. If there is insufficient eave to properly cover the top of the veneer, provisions must be made to extend the cave.



Typical Eave Detail

FIG. 4

SELECTION OF 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

Nominal 3-in. (75 mm) or 4-in. (100 mm) thick brick, conforming to ASTM C 62 or ASTM C 216, should be used for brick veneer. Grade SW brick is recommended because the brick wythe is isolated from the remainder of the wall by the air space, thus exposing it to the maximum temperature extremes.

Salvaged brick should not be used because they may not provide the strength and durability necessary for satisfactory performance. The use of salvaged brick is discussed in *Technical Notes* 15.

Mortar

The use of the correct mortar is very important to the successful performance of brick veneer. Portland cement-lime mortars are recommended because they have a long history of proven performance. Portland cement-lime mortars for brick masonry are discussed in *Technical Notes* 8 Series.

Type N portland cement-lime mortar is recommended for brick veneer, except that Type M portland cement-lime mortar should be used for brick veneer below grade, where the brickwork is in contact with earth

Ties

The type of tie system which should be used with brick veneer will depend on the construction of the existing wall. Corrugated metal ties may be used with wood frame backup. Metal wire ties should be used elsewhere. Several types of ties which may be used in brick veneer applied to existing construction are shown in Figs. 2a through 2d in *Technical Notes* 28 Revised.

Corrugated Metal Ties. Corrugated metal ties should be corrosion-resistant. They should be at least 22 gage, 7/8 in. (22 mm) wide and 6 in. (150 mm) long.

Metal Wire Ties. Metal wire ties should be at least 9 gage and corrosion-resistant. It is recommended that 3/16 - in. (4.7 mm) diameter metal wire ties be used to fasten the brick veneer to a structural frame. Metal wire ties should comply with ASTM A 82 or A 185.

Corrosion Resistance. Corrosion resistance is usually provided by copper or zinc coating, or by using stainless steel. To ensure adequate resistance to corrosion, coatings or materials should conform to:

Zinc-Coating of Flat Metal-ASTM A 153, Class B-3;

Zinc-Coating of Wire-ASTM A 116, Class 3;

Copper Coated Wire-ASTM B 227, Grade 30 HS;

Stainless Steel-ASTM A 167, Type 304.

Tie Fasteners

The type of fastener used to attach the ties to the existing wall will also depend on the construction of the existing wall.

Wood Frame. Corrosion-resistant nails should be used to attach the corrugated metal ties to wood frame construction. The nails should penetrate at least 1 1/4 in. (40 mm) into the wood studs.

Metal. Corrosion-resistant, self-tapping metal screws should be used to attach metal wire ties to metal construction. The screws should penetrate at least 1/2 in. (13 mm) into the metal.

Concrete or Masonry. There are several methods of attaching the metal wire ties to existing concrete or masonry walls. The ties may be attached with lag bolts and expansion shields or masonry nails. The fasteners and anchors should be corrosion-resistant.

Steel Angles

When a continuous steel angle is used to support the new brick veneer at the foundation wall, it should be of steel conforming to ASTM A 36, and should be treated or coated to resist corrosion. Bolts or other fasteners should also be corrosion-resistant.

The sizing of the angle, and the sizing and spacing of the bolts should be determined by structural analysis.

Steel angles for lintels should be a minimum 1/4 in. (6.2 mm) thick with at least 3-in. (75 mm) legs and the steel should conform to ASTM A 36. For information on steel lintels for brick masonry, see *Technical Notes* 31B Revised.

Flashing

Flashing materials for use with brick veneer may be bituminous membranes, plastics, sheet metals, or combinations of these. It is best to select only superior materials because replacement in the event of failure will be costly, if not impossible. Asphalt impregnated felt paper should *not* be used as a flashing material. For a more complete discussion on the various types of flashing, see *Technical Notes* 7A Revised.

Weepholes

Weepholes are formed by inserting a material into the mortar joint, or by omitting all or part of the head joint. Forming materials, such as well-oiled rods, are removed to leave an unobstructed opening. Other forming materials, such as plastic tubes or rope wicks, may be left in place. Sometimes metal screening, fibrous glass, or other materials, are placed in open weepholes, but this should not be done indiscriminately. Materials such as metal screening can corrode and cause staining of the masonry.

CONSTRUCTION

Supports

Foundations. Supporting brick veneer on new or existing foundations requires excavating down to the existing foundation. The excavation must be sufficiently wide for the brickmason to work. Prior to placing the masonry on an existing foundation, the foundation should be brushed clean of loose soil and debris.

Angles. When constructing brick veneer on continuous corrosion-resistant steel angles, the first course of brick should be laid 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 better insulate the existing exterior walls. The insulation materials used should comply to the criteria discussed in *Technical Notes* 21A.

Rigid insulation may be installed directly over the existing finish prior to erecting the new brick veneer. A 1-in. (25 mm) air space should be maintained between the brick veneer and the rigid insulation. If the existing wood frame or metal stud walls contain little or no insulation, the existing siding of the wall may be removed so that insulation can be installed within the wall. The materials removed from the existing wall may be reapplied.

Workmanship

Good workmanship is necessary to achieve satisfactory performance of brick veneer. The veneer must be properly constructed if the expected performance of the masonry is to be obtained.

Mortar Joints. There is no substitute for the complete filling of *all* mortar joints that are intended to receive mortar. Partially filled mortar joints result in leaky walls, reduced strength of the masonry, and may contribute to cracking and spelling due to freezing and thawing in the presence of moisture. All joints intended to receive mortar should be completely filled as the brick are laid.

Keeping the Air Space Clean. It is essential to maintain a 1-in. (25 mm) air space between the brick veneer and the existing wall, and to keep it clean of mortar protrusions, droppings, and other foreign materials. If mortar falls into the air space, it may form "bridges" for moisture and thermal transfer, or it may fall onto the flashing and block the weepholes.

Tooling of Joints. Weather tightness and textural effect are the basic considerations of mortar joint finish selection and execution. Tooling the joint properly helps the mortar adhere to the edges of the brick units and seal the wall against moisture penetration. The use of concave, V, or grapevine joints is recommended. The joints should be tooled when the mortar is "thumb-print" hard. Additional information on joints may be found in *Technical Notes* 21C.

Flashing and Weepholes. Flashing materials must be carefully installed to prevent punctures or tears. The flashing must be securely attached to the existing wall and should extend through the face of the brick veneer. Weepholes should be installed in the head joints immediately above all flashing.

Tie Placement. Secure attachment of the ties to the existing wall is a necessity. The ties must be of sufficient length to provide a minimum 2-in. (50 mm) embedment into the bed joints. Ties should be placed in the bed joints and should be completely surrounded by mortar.

Caulking or Sealants. Caulking joints at the perimeter of exterior door and window frames should not be less than 1/4 in. (6 mm) nor more than 3/8 in. (10 mm) wide. They should be cleaned for a depth of 3/4 in. (20 mm). The joints should be properly primed before placing caulking compound or sealant. The caulking or sealant should be placed with a pressure gun.

Cleaning. If the brick veneer is properly and carefully constructed, cleaning the brickwork can be kept to a minimum. Most of the cleaning can be done by dry cleaning methods or by washing the wall with plain water. Refer to *Technical Notes* 20 Revised for information on cleaning brick masonry.

Protection

Storage of Materials. Masonry units should be stored off the ground to avoid contamination by dirt and ground water, which may contain soluble salts. They should be covered by a weather-resistant membrane to keep them dry.

Mortar materials should also be stored off the ground and under cover. If these materials are exposed to moisture, they may become useless for constructing the brick veneer. Flashing, ties and other materials should also be protected from the weather.

Protection of Walls. Partially completed walls must be protected from the elements. This can be done 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 prevent the wall from becoming saturated, thus decreasing the possibility of efflorescence, and other deleterious effects caused by moisture in brick masonry.

SUMMARY

This *Technical Notes* provides the basic information required to properly select materials, design, detail, and construct brick veneer over existing construction. Further information about the properties of brick veneer and concepts not unique to brick veneer over existing construction is discussed in *Technical Notes* 28 Revised.

The information and suggestions contained in this *Technical Notes* are based on the available data and the experience of the technical staff of the Brick Institute of America. This information should be recognized as recommendations and suggestions which, if followed with good judgment, will result in brick veneer wall assemblies that perform successfully. Final decisions on the use of details and materials as discussed are not within the purview of the Brick Institute of America, and must rest with the project designer, or owner, or both.