BUILDING WITH BRICK

Detailing for Permanence and Elegance

BY HARRIS HYMAN

Brick is *the* class building material for residential projects. And its reputation is well deserved. Brick is solid and, if not permanent, certainly long-lasting and fireproof. It is also sound-deadening—reducing noise from both outside and within the house, and creating a sense of peace. And it is expensive: a two-person crew would have trouble laying up more than 50 or 60 square feet of brick wall in a day. The cost and the craftsmanship involved add to its air of nobility.

Veneer vs. Structural

Two forms of brickwork are common in residential construction: true brickwork and brick veneer. True brick walls are formed completely of brick. An interior framework that carries the wall finish—and nowadays the insulation—is attached to the masonry. True brickwork is now quite rare for new construction in New England, and nearly all residential brickwork is veneer.

Brick veneer is a layer of brickwork applied over a wood-frame building. Veneer retains much of the solidity and firmness of true brick, but is much less costly. And this is not its only attraction: wood-frame buildings are much easier to insulate, with space for conventional insulation and a surface to attach the vapor barrier to.

Brick veneer is not structural. This is where it departs from the traditional use of masonry as a material that holds up the building. The brick veneer must be connected to the frame building, which is done most often with ties. These are small pieces of metal nailed to the wood structure and embedded in every fifth or sixth row of mortar.

Ties generally do their job despite their tendency to rust and deteriorate. Although they are important as a safeguard, in actual fact they bear little load. Most of the load of the brickwork goes straight down onto the foundation, and very little is perpendicular to the walls. At least a couple of ties are likely to remain intact on each segment of wall after 50 years, and this is all that is needed.

The brickwork is also held to the framing by the window and door casings, which span from the wood frame to the brick veneer.

Headers and Arches

The real problem with masonry comes in framing openings. In wood construction, headers present no problem and are often the most over-built part of a house. Little strength is typically required over windows and doorways.

In brick construction, however, the headers must support the brickwork above the window (Sketch 1). Structural designers usually assume that the header must support a triangle of masonry over the window. The weight of the brickwork outside this triangle is supported by the vertical sides of the windows; if all the bricks in the triangle were removed, the building would continue to stay up.

There are two systems for headers over openings: lintels and arches. Lintels are beams directly over the openings, which support the masonry triangle and whatever floor supports lie within the triangle. Lintels carry these loads directly to the posts. Arches are compressed by the masonry triangle and transfer the weight to the posts, but also apply a sideways thrust to the masonry beyond the posts.

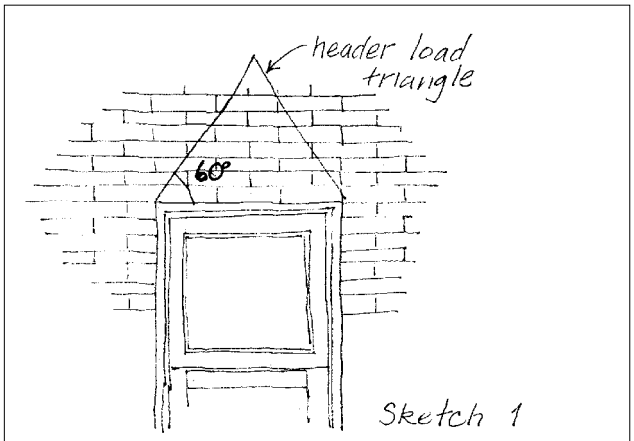
Either steel or bond beams are generally used for lintels (Sketch 2). Lintels were once cut from large pieces of stone, but these were both expensive and structurally unsound, and there are many instances where they have failed. The preferred lintel is angle iron of relatively thin stock. If the steel is thin enough, it can be embedded in the mortar joint. This retains the brick-to-brick spacing.

The size of the angle iron depends on the width of the opening, with wider openings requiring more steel. For brick-veneer construction, a 3x3x3/16-inch angle will typically span a 6-foot opening; a 3x3x5/16 will span 7 feet; and a 4x3x5/16-inch angle will span 8 feet. These calculated lintel supports are *only* for the brickwork above the opening, and will *not* hold the weight of any flooring or roof loads.

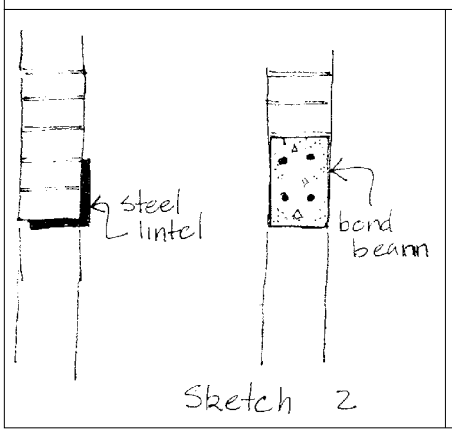
Bond beams are reinforced concrete beams, often constructed from concrete block. For smaller openings—5 feet or less—a bond beam made from blocks with four pieces of #4 rebar will generally do the job. Larger openings can be spanned with a prefabricated bond beam, or a beam can be designed with a little engineering. With larger openings, it's important not to push the structure too much, since the lintel load increases with the fourth power of the size of the opening; that means an 8-foot opening will place 16 *times* more stress on a lintel than a 4-foot opening will.

Arches over openings are more elegant—and usually more costly—although experienced masons can build them over small (3 feet) openings quite rapidly with prefabricated falsework (the wooden form that supports the partially laid-up arch). The most common arches are segmental and jack arches (Sketch 3). While segmental arches can span enormous distances, jack (or flat) arches are stable only up to about 30 inches without special engineering.

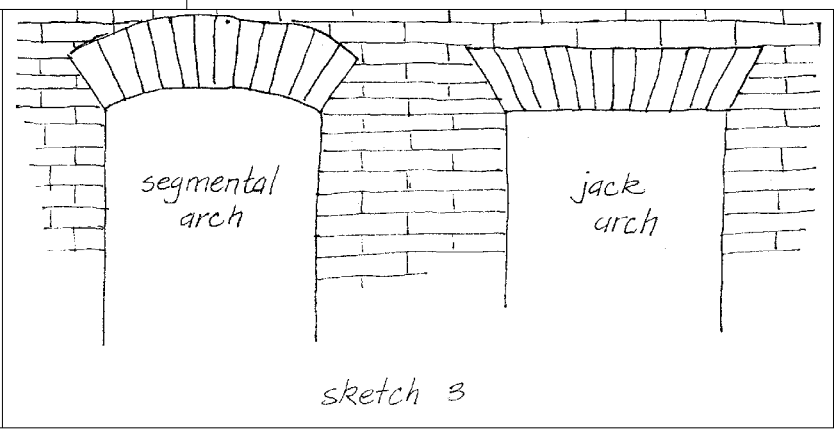
Arches impose a stylistic limitation in not allowing windows too close to the end walls. To provide enough wall section to resist lateral forces, an arched window should be away from the corner of the wall by at least the span of the opening (Sketch 4).



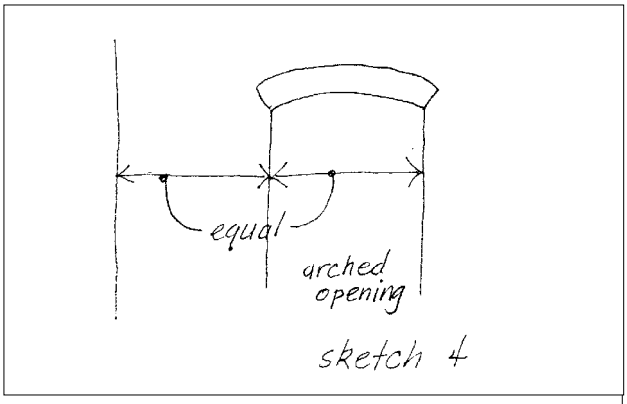
Sketch 1



Sketch 2



sketch 3



I like brick arches; they remind me of growing up in the city.

Moisture, the Enemy

Moisture has always been a problem with masonry construction. The temperature drop through the width of the brick creates a dew line where moisture from inside the building begins to condense. Just outside this dew line, the condensed moisture freezes within the permeable brick itself. High moisture levels and freeze-thaw cycles will eventually destroy the brick.

The advent of modern heating systems that kept buildings warm had the effect of moving the dew line farther to the outside of the brickwork. This moved the freezing closer to the exterior surface, which hastened deterioration.

Interior insulation has the opposite effect and pulls the dew line inward. In cavity walls (two wythes of brick separated by a couple of inches of open space) or brick--veneer walls, the inside of the outer brick layer becomes the dew line. Moisture condenses on the inner surface and drips down. This water is released through weep holes in the bottom of the brick wall.

During construction or repointing, these weep holes often become clogged and stop working. Masons have told me of deteriorated woodwork behind brick veneer, although I've never seen this for myself. I suspect we'd see more problems if brick veneer were more common in this part of the country.

I think brick construction will continue at a low level in the Northeast, much as it has over the past 40 years. Its popularity will occasionally surge and dip, according to fad and fashion. As the older masons retire and are not replaced, it will become more arcane and expensive. Nevertheless, brick will persist as the quality building material. ■

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BRICK VENEER DETAILS

Materials

Severe-weather-grade (SW) facing brick, conforming to ASTM C-216, should be used in veneers because the veneer is isolated from the rest of the wall and exposed to temperature extremes. Type N mortar should be used, consistent with the principle that a builder should select the lowest-strength mortar that is compatible with the structural requirements.

Anchorage

For anchoring a brick veneer to a wood-frame back-up, corrugated metal ties are used. Corrugated ties must be at least 22 gauge, 7/8 of an inch wide, 6 inches long, and corrosion resistant. Corrosion-resistant wire ties of at least 9 gauge should be used in tying brick veneer to metal studs.

The ties must permit vertical and horizontal movement parallel to the plane of the wall, but resist tension and compression perpendicular to the plane of the wall.

The spacing of brick-veneer ties should not exceed 16 inches horizontally and 24 inches vertically. Figures 1 and 2 show how brick veneer is tied to wood- and metal-stud back-up systems. Wire ties should be attached through the sheathing and into the metal studs with corrosion-resistant self-tapping screws.

Nails used to attach corrugated metal ties to a wood-frame back-up should he driven at least 1 1/2 inches into the wood to prevent the nail from pulling out. The length of the nails will be determined by the thickness of the sheathing or insulation over the wood frame. All ties should be embedded at least two inches into the mortar joints of the veneer.

Flashing and Weep Holes

Proper installation of flashing and weep holes is the key to a brick-veneer wall's resistance to moisture penetration. Only the best materials should be used for flashing because of the difficulty and expense of replacing it should it fail. Sheet metals, bituminous membranes, plastics, and combinations of these materials are suitable for flashing; aluminum and asphalt-impregnated felt paper are not.

Flashing and weep holes should be located at the bottom of the wall and at all openings. They must be above grade at the bottom of the wall in order to drain properly. if the veneer continues below the flashing, the space between the brick and the back-up should be fully grouted to the height of the flashing.

Weep holes may be formed in several ways: by omitting part or all of the head joint at the level of the flashing when constructing the veneer; by using forming materials, such as oiled rods; or by using materials that are left in place, such as rope wicks or plastic tubes.

Caulking and Sealants

Numerous types of caulking and sealants are available. The material selected should be highly flexible and durable, such as silicone or urethane sealants. Oil-based caulking compounds are not generally recommended.

Outside joints at the perimeter of exterior door and window frames should be 1/4 to 3/8 inch wide, and should be cleaned to a depth of 3/4 inch. These joints should he solidly filled with an elastic sealant or caulking compound, and forced into place with a pressure gun. A compressible fill, such as backing rope, should he placed in deeper joints prior to caulking.

Construction

There are empirical height limitations on brick veneers (see Table 1).

Table 1. Height Limitations for Brick Veneer

Nominal Thickness of Brick Veneer (inches)	Stories	Height at Plate (feet)	Height at Gable (feet)
3	2	20	28
4	3	30	38

The illustration shows a typical foundation detail, The foundation wall supporting a brick veneer should be approximately the same

Flashing for brick should be set on a thin bed of mortar and covered with mortar. At a windowsill, flashing should turn up at the ends (top) at least an inch to contain any collected water. If rope-wick weep holes are used (middle), they should be no more than 16 inches apart. The final brick is tipped in at the proper slope of at least 1/4 inch per foot (bottom).

thickness as the veneer wall assembly.

Many building codes permit a nominal 8-inch foundation wall under single-family dwellings constructed of brick veneer, provided the top of the wall is corbeled, as shown in the illustration.

Most codes require that the total corbel cannot be more than two inches, with individual corbels projecting no more than one-third the height of the brick unit. The top corbel course must not be higher than the bottom of the floor joist, and should be a full header course.

During construction, care should be taken to keep exposed portions of partially completed walls dry. Moisture in masonry walls can dissolve salts that may be present in the masonry, possibly causing efflorescence.

As with all brick masonry construction, good workmanship is essential to assure the benefits of brick. This means full and tight mortar joints with full bonding of mortar to brick. Brick joints should be concave or V-notched. Other joints do not provide enough moisture resistance. It is also essential that the minimum one-inch space between the veneer and the back-up be preserved and kept clean. ■

Concave or V-notched joints help the joints resist moisture and look good.

Figure 1

Jamb detail for brick-veneer wall with wood-frame back-up

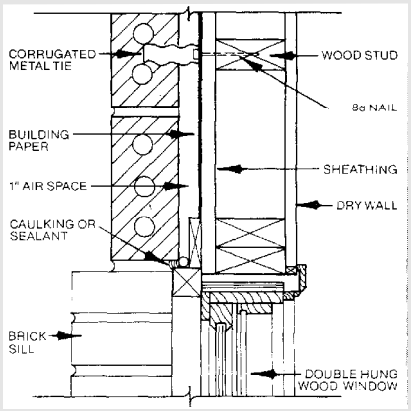
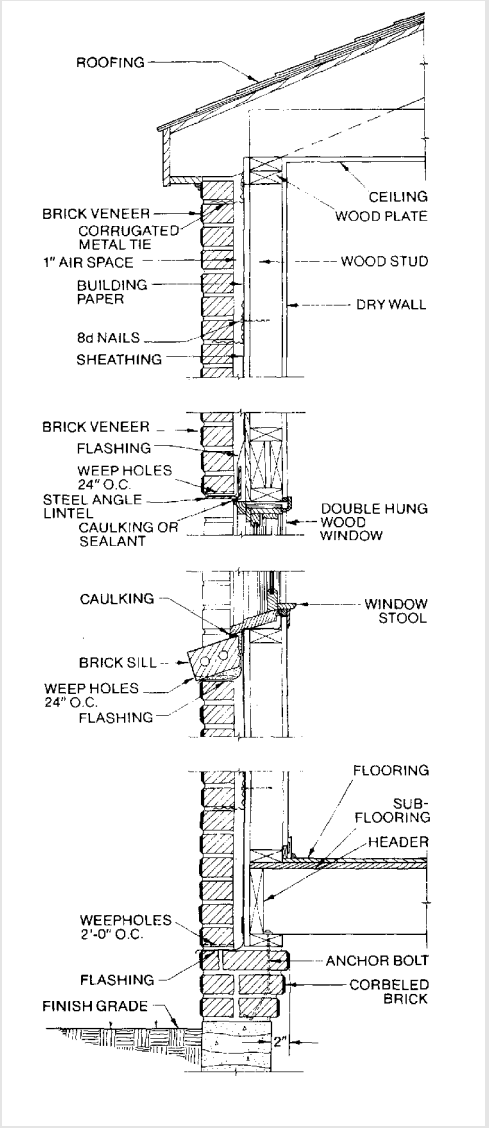


Figure 2

Brick-veneer wall, wood-frame back-up



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Technical Notes 7A, "Flashing Clay Masonry"

Technical Notes 7B, "Moisture Control in Brick & Tile Walls—Rain Penetration"

Technical Notes 8B, "Mortar for Brick Masonry—Selection and Controls"

Technical Notes 28 Rev., "Brick Veneer—New Construction"

Technical Notes 31B, "Structural Steel Lintels"