# Designing and building pilasters

## Venerable technique adds needed stiffness to masonry walls

*By Kenneth A. Hooker*

Engaged columns, so prevalent in classical architecture, do more than simply add visual rhythm to long masonry walls. Called *pilasters*, these masonry elements serve structural as well as ornamental functions. And though today's versions typically lack the decorative bases and capitals of historical precedent, they remain an effective way to increase masonry's structural capacity.

Strong in compression but relatively weak in tension, plain (unreinforced) masonry supports vertical loads easily but has considerably less capacity to resist lateral loads from wind or seismic activity. Lateral support can be provided by horizontal elements, such as floor and roof diaphragms, or by vertical elements such as shear walls within the building. Steel reinforcement and grout in a wall also add strength and stiffness.

Incorporating pilasters, i.e. thicker, stronger wall sections, at intervals along the wall is an alternative way to provide lateral support, in cases where other methods are impractical or uneconomical. For warehouses or industrial buildings that require high ceilings and unobstructed interior spaces, for example, pilasters can provide needed stiffness at lower cost than uniformly

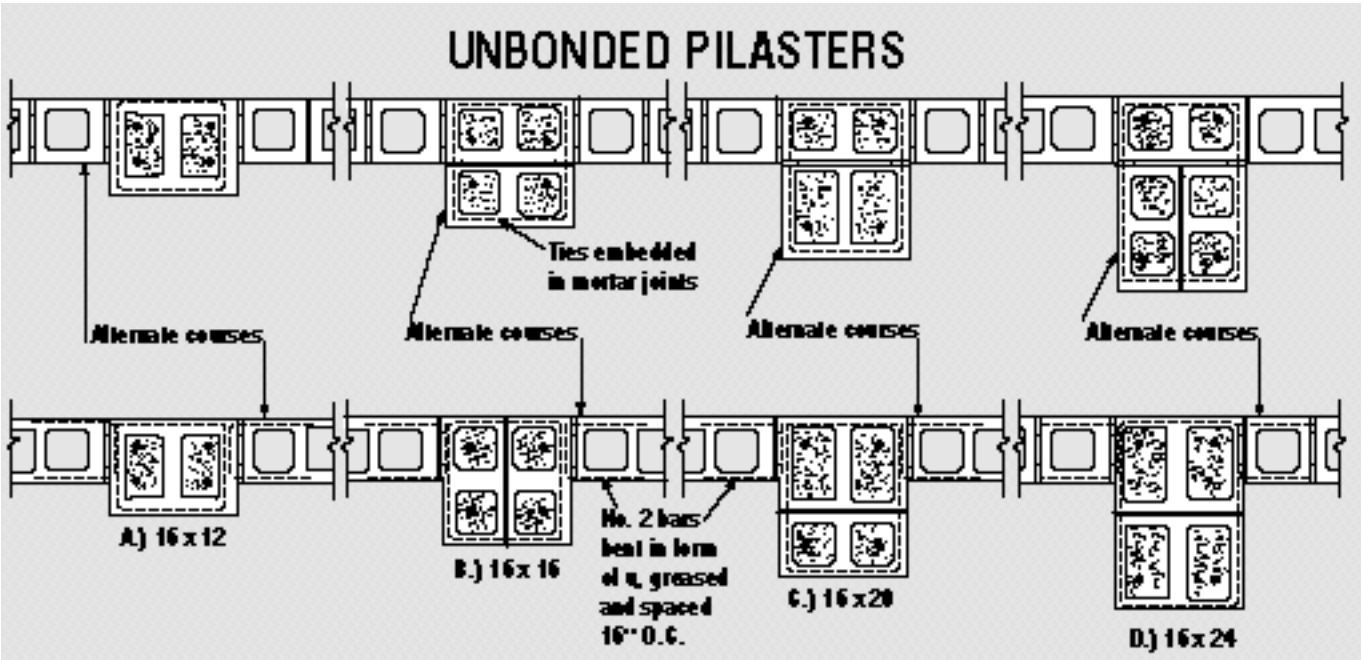
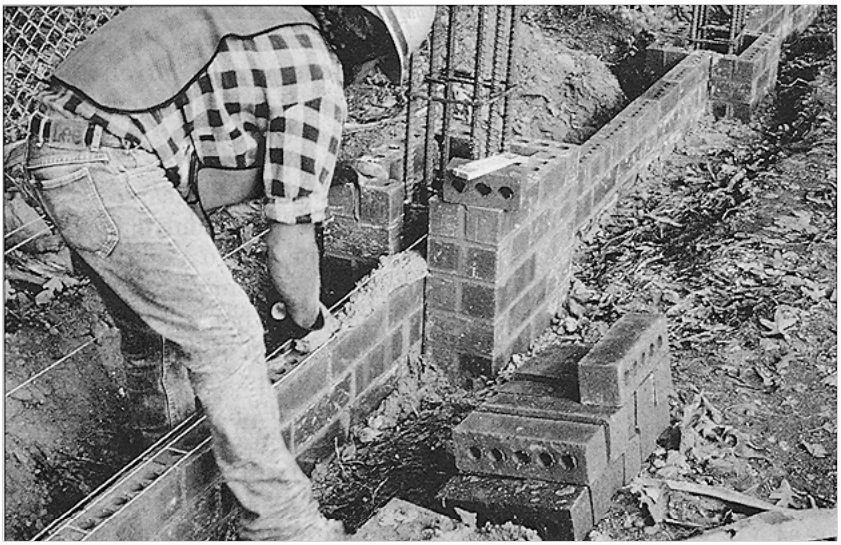



**Figure 2. Typical bonded and unbonded pilaster layouts for concrete masonry walls.**



This highway noise barrier wall under construction shows an unbonded, reinforced brick masonry pilaster that provides lateral support for the single-wythe brick panels.


Span between pilasters

**Maximum ratio of unsupported length to nominal thickness**

| Construction | Max. L/T |
|---|---|
| Bearing walls | |
| Solid or solidly grouted | 20 |
| All others | 18 |
| Nonbearing walls | |
| Exterior | 18 |
| Interior | 36 |

*Source: Ref. 5*

**Figure 1. In empirically designed walls, pilaster spacing is based on maximum length-to-thickness ratios.**

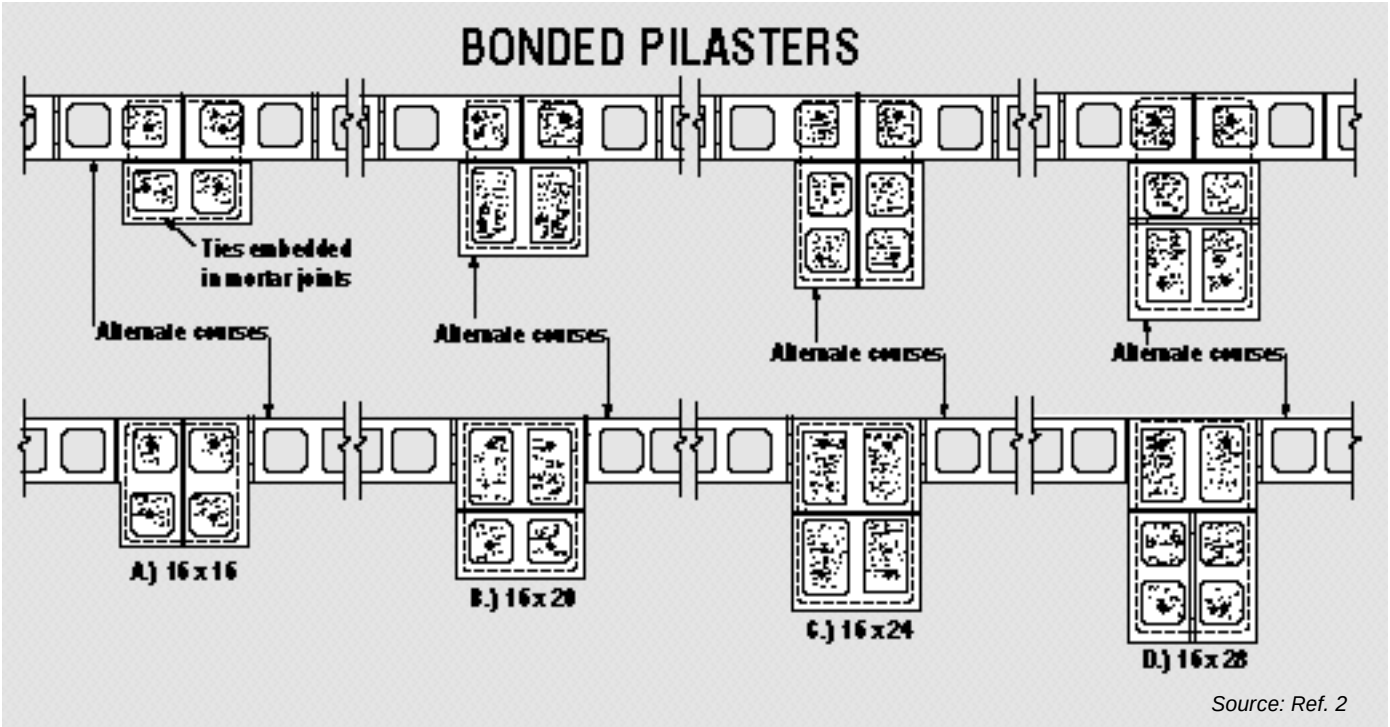
distributed reinforcement, and without the expense and wasted space of thicker masonry. In many such cases, they also are used to support vertical loads imposed by roof trusses or beams. Pilasters also are commonly used in free-standing masonry garden or noise barrier walls that have no horizontal support at the top.

## Design requirements

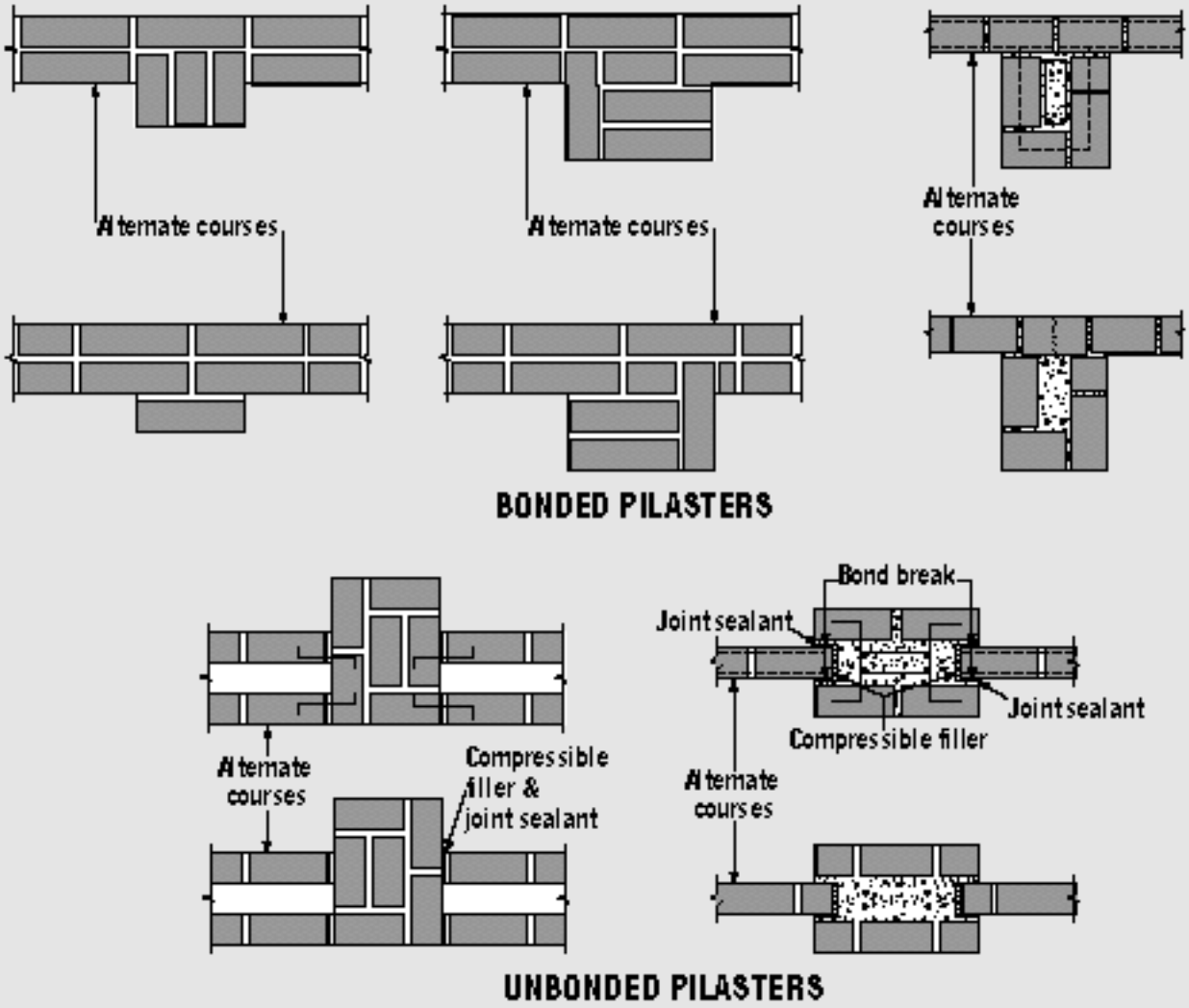
In walls designed empirically, the placement of pilasters is governed by maximum length-to-thickness ratios. The table in Figure 1 shows these ratios for both loadbearing and non-loadbearing walls.

For engineered design of walls with pilasters, you need to determine the magnitude of lateral loads and how they will be transmitted to the pilasters by the adjacent wall panels. Axial loads imposed by beams or trusses supported on pilasters also will affect the pilasters' behavior and should be considered in the design. More complete and detailed information on the analytical design of pilasters is available in Refs. 1, 2, and 3.

Pilasters can be built of solid units or of hollow units, with or without grout, or reinforced and grouted. In hollow-unit construction, however, pilasters typically are grouted and reinforced, be-

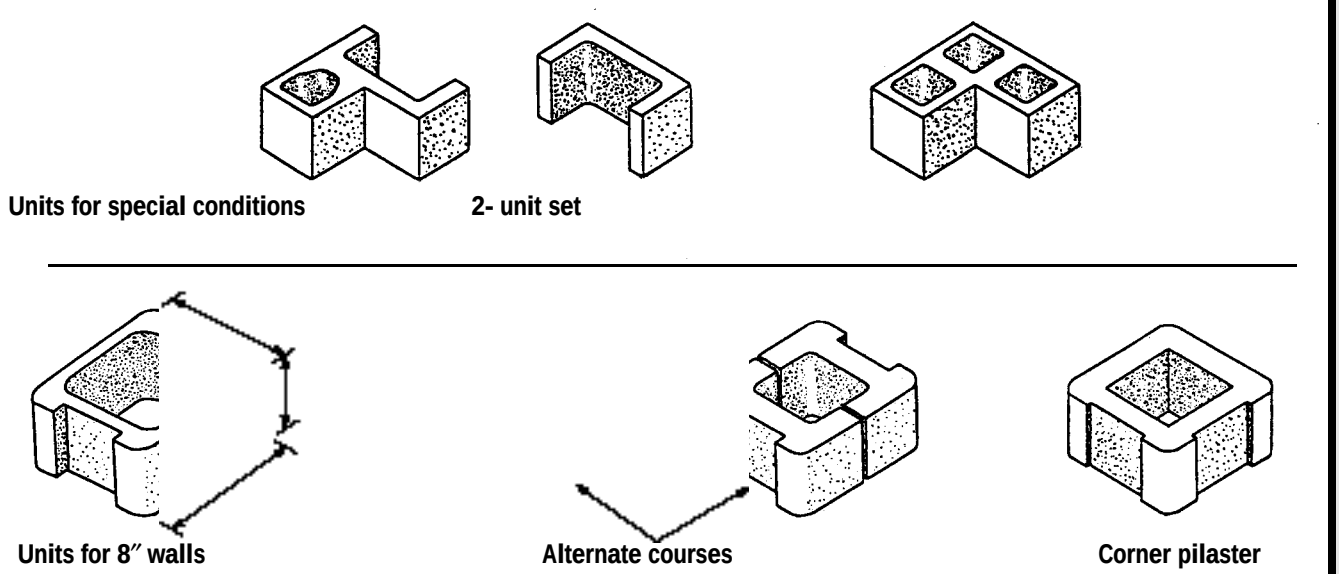



*Source: Ref. 2*




*Sources: Ref. 4 and BIA*

**Figure 3. Typical bonded and unbonded pilaster layouts for brick walls.**




*Source: Ref. 6*

**Figure 4. Special units for pilaster construction.**

cause they are acting as flexural members. Vertical reinforcement greatly increases their flexural strength.

A pilaster may be centered in or through the wall, fully offset from the wall, or somewhere in between. Those that are built within the wall's thickness are called hidden or flush pilasters; those that project on one side only are called interior or exterior pilasters. Although there is some difference in the structural behavior of pilasters in different positions relative to the wall, in practice, the placement often is determined more by aesthetic preference or interior space requirements than by structural considerations.

## Bonded or unbonded

Pilasters most often are constructed as an integral part of the wall, with units laid in a coursing pattern that keys in with the wall's running bond. In some cases, however, it can be preferable to build the pilaster unbonded to provide for crack control. Figures 2 and 3 show some typical layouts of both bonded and unbonded pilasters.

An unbonded pilaster would be used when a control joint is located adjacent to a pilaster in a concrete masonry wall. Another example is when a reinforced pilaster in an otherwise unreinforced clay masonry wall is designed to carry heavy vertical loads. Making the pilaster unbonded can relieve shear and tensile stresses that could result from differential movements between the pilaster and the wall (Ref. 4).

In either case, a suitable mechanical connection must be made between the pilaster and the wall to ensure the transfer of lateral loads. Under empirical design, codes require that wire ties at least ¼ inch in diameter be embedded in bed joints at 16 inches o.c. vertically to provide the structural connection.

The soft joint between a clay brick wall and an unbonded pilaster should be filled with a compressible material to accommodate expansion of the brick. For control joints at pilasters in concrete masonry, U-shaped wire ties with greased legs in the mortar joints will allow in-plane movement while resisting lateral loads.

## Reinforcement details

The size and number of vertical reinforcing bars in a pilaster will depend on the structural requirements. Bars need to be positioned with enough clearance from the masonry units to allow grout to flow around the bars.

If pilasters are used to carry large axial loads, they act as columns and thus must meet prescriptive requirements for masonry columns. The MSJC code (*Building Code Requirements for Masonry Structures, ACI 530/ASCE 5/TMS 402*) requires a minimum of four vertical bars enclosed by horizontal wire ties at least ¼ inch in diameter, spaced no more than 16 inches o.c. vertically. Other prescriptive requirements may apply depending on the pilaster's size and use.

## Special units

Most pilaster configurations can be built using combinations of standard units, but a variety of hollow units are produced especially for building pilasters (see Figure 4). These can ease construction by reducing the number of units needed, providing more open space for reinforcing and grout, and eliminating the need to thread units over reinforcing bars. When considering the use of special pilaster units, check with a local supplier on the availability of particular shapes. And plan the layout carefully to make sure to order everything you need; many special units require different configurations to be used in alternate courses.

Whether built with standard or special units, pilasters are an element of traditional masonry construction that contemporary designers can use to serve both aesthetic and functional purposes.


**References**

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