Unit 4  Brick Masonry

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Figure 4-1 Basic Vocabulary of Bricklaying
Figure 4-2  The Procedure for Building Brick Walls

The procedure for building brick walls. This example is a single wythe of running bond.

(A) The construction of a brick wall begins with the laying of leads. The leads establish the wall planes and course heights.

(B) The bricks between the leads are laid to a line, a heavy string stretched taut between line blocks at each lead.

(C) When the entire wall is laid to the level of the top of the leads, a second set of leads is laid, and the entire process is repeated as many times as necessary.
A reinforced brick load bearing wall is built by installing steel reinforcing bars in a thickened collar joint, then filling the joint with Portland cement grout. The cleanout holes shown here are used in the high lift method of grouting.
Masonry is the material of earth, taken from the earth and comfortably at home in foundations, pavings, and walls that grow directly from the earth. With modern techniques of reinforcing, however, masonry can rise many stories from the earth, and in the form of arches and vaults, masonry can take wing and fly across space.
The most ancient of our building techniques, masonry remains labor intensive, requiring the patient skills of experienced and meticulous artisans to achieve a satisfactory result. It has kept pace with the times and remains highly competitive technically and economically with other systems of structure and enclosure, the more so because one mason can produce in one operation a completely finished, insulated, load bearing wall, ready for use.
Passage A

Masonry is durable. The designer can select masonry materials that are scarcely affected by water, air, or fire, ones with brilliant colors that will not fade, ones that will stand up to heavy wear and abuse, and make from them a building that will last for generations.
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Among the masonry materials, brick is special in two respects: fire resistance and size. As a product of fire, it is the most resistant to building fires of any masonry unit. Its size may account for much of the love that many people instinctively feel for brick: a traditional brick is shaped and dimensioned to fit the human hand. Hand sized bricks are less likely to crack during drying or firing than larger bricks, and they are easy for the mason to manipulate. This small unit size makes brickwork very flexible in adapting to small-scale geometries and patterns and gives a pleasing scale and texture to a brick wall or floor.
Figure 41 shows the basic vocabulary of bricklaying. Bricks are laid in the various positions for visual reasons, structural reasons, or both. The simplest brick wall is a single wythe of stretchers. For walls two or more wythes thick, headers are used to bond the wythes together into a structural unit. Rowlock courses are often used for caps on garden walls and for sloping sills under windows, although such caps and sills are not durable in severe climates. Architects frequently employ soldier courses for visual emphasis in such locations as window lintels or tops of walls.
The problem of bonding multiple wythes of brick has been solved in many ways in different regions of the world, often resulting in surface patterns that are particularly pleasing to the eye. We can see some structural bonds for brickwork, among which common bond, Flemish bond, and English bond are the most popular. On the exterior of buildings the cavity wall, with its single outside wythe, offers the designer little excuse to use anything but running bond.
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Part Ⅱ  Passages  Passage A

Inside a building, safely out of the weather, one may use solid brick walls in any desired bond. For fireplaces and other very small brick constructions, however, it is often difficult to create a long enough stretch of unbroken wall to justify the use of bonded brickwork.
Part II Passages Passage A

The process of bricklaying is summarized as follows: the first course of bricks for a lead is bedded in mortar, following a line marked on the foundation. As each lead is built higher, the mason uses a spirit level to make sure that each course is level, straight, plumb, and in the same plane as the rest of the lead. A mason’s rule or a story pole is also used to check the heights of the courses. A lead is then finished. A mason lays brick to a line stretched between two leads. When laying to a line, there is no need to use a level or rule.
Part II  Passages  Passage A

The laying of leads is relatively labor intensive. A mason’s rule or a story pole that is marked with the course heights is used to establish accurate course heights in the leads. The work is checked frequently with a spirit level to assure that surfaces are flat and plumb and courses are level. When the leads have been completed, a mason’s line (a heavy string) is stretched between the leads, using L shaped line blocks at each end to locate the end of the line precisely at the top of each course of bricks.
The laying of the infill bricks between the leads is much faster and easier because the mason needs only a trowel in one hand and a brick in the other to lay to the line and create a perfect wall. It follows that leads are expensive as compared to the wall surfaces between, so that where economy is important the designer should seek to minimize the number of corners in a brick structure.
Wall Types

Walls constructed of brick, stone, concrete masonry, or combinations of masonry units can be used to support roof and floor structures of wood light framing, heavy timber framing, steel, sitecast concrete, precast concrete, or masonry vaulting. Because these masonry walls (usually called, simply, bearing walls) do double duty by serving also as exterior walls and interior partitions, they are often a very economical system of construction as compared to systems that carry their structural loads on columns of wood, steel, or concrete.
When used as exterior walls of buildings, masonry walls must be designed not only to support structural loads, but also to resist water penetration and the transfer of heat between indoors and outdoors.
A masonry load bearing wall may be classified in three different ways, according to how it is constructed:

- It may be either reinforced or unreinforced.
- It may be constructed entirely of one type of masonry unit, or it may be a composite wall, made of two or more types of units.
- It may be either a solid masonry wall or a masonry cavity wall.
Reinforced Masonry Walls

It may be either a solid masonry wall or a masonry cavity wall. Reinforced Masonry Walls Load bearing masonry walls may be built with or without reinforcing. Unreinforced walls cannot carry such high stresses as reinforced walls and are unsuitable for use in regions with high seismic risk, but such walls have been used in the United States to support buildings as tall as 16 stories.
In a multistory building of masonry load bearing wall construction, the top floor walls support only the load of the roof. The walls on the floor below support the loads of the roof, the top floor, and the top floor walls. Each succeeding story, counting downward from top to bottom, supports a greater load than the one above, and an unreinforced masonry bearing wall must therefore grow progressively thicker from top to bottom.
With steel reinforcing, this thickening can be reduced or eliminated entirely, with substantial savings in labor and materials, and much taller buildings may be constructed. The number, locations, and sizes of the steel reinforcing bars are determined by the structural engineer for each building.
The engineering design of masonry load bearing walls is governed by codes, a standard established jointly by the American Concrete Institute and the American Society of Civil Engineers. This document establishes quality standards for masonry units, reinforcing materials, metal ties and accessories, grout, and masonry construction. It also sets forth the procedures by which the strengths and stiffnesses of masonry structural elements are calculated.
Reinforced brick masonry (RBM) is analogous to reinforced concrete construction. The same deformed steel reinforcing bars used in concrete are placed in thickened collar joints to strengthen a brick wall or lintel. A reinforced brick wall is created by constructing two wythes of brick 2 to 4 inches (50100mm) apart, placing the reinforcing steel in the cavity, and filling the cavity with grout.
Grout is a mixture of Portland cement, aggregate, and water. ASTM C476 specifies the proportions and qualities of grout for use in filling masonry load bearing walls. It is important that grout be fluid enough that it will flow readily into the narrow cavity and fill it completely. The excess water in the grout that is required to achieve this fluidity is quickly absorbed by the bricks and does not detract from the eventual strength of the grout as it would from concrete poured into formworks.
Passages  Passage B  

Posttensioned Masonry Walls

Posttensioning is increasingly used in masonry buildings instead of ordinary vertical reinforcing bars. Posttensioning utilizes special high strength steel reinforcing elements that take the form of either threaded rods or flexible tendons. These are anchored into the foundation and run vertically through the masonry wall, either in a cavity between wythes or in the cores of concrete masonry units.
After the wall has been completed and the mortar has cured, each rod or tendon is stretched very tightly and anchored in its stretched condition to a horizontal steel plate that applies compression to the wall. Posttensioning rods are threaded so that each may be stretched by tightening a nut against a steel plate at the top of the wall. Tendons are stretched by a special hydraulic jack and then anchored in their stretched condition with the aid of a steel chuck that grips the wires of which the tendon is made.
In either case, this tensioning of the reinforcing places the entire wall under a vertical compressive stress that is considerably higher than would be created by the weights of the masonry and the floors and roofs that it supports. The effect of posttensioning is to strengthen the wall more than is possible with ordinary reinforcing a wall of the same thickness. This allows the use of thinner walls with fewer grouted cores, which saves material and labor.