# How to Select and Use CONCRETE BLOCKS in Farm Building

By E. S. Holmes



**Circular 434**

**UNIVERSITY OF KENTUCKY**
**College of Agriculture and Home Economics**
**Agricultural Extension Division**

Thomas P. Cooper, Dean and Director

*For satisfactory building with concrete blocks--*

- Use only good-quality blocks
- Provide a good foundation on firm footing
- Mix the mortar the right way and tool the joints carefully
- Waterproof the wall below grade at time of construction
- Don't neglect above-grade waterproofing
- Plan the structure thoroughly before starting to build, and use good workmanship throughout—for it is not easy to correct mistakes in concrete-block buildings.

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# How to Select and Use Concrete Blocks in Farm Building

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Concrete blocks, if properly made and used, form strong, fireproof, durable buildings, though the walls must be waterproofed for basements and damp-proofed above ground. A wide variety of surface finishes can be used with the blocks. In general, they are rather economical in price. Care must be used in choosing a good block, however, for there are many blockmakers and the quality of blocks varies from plant to plant.

## Kinds of Blocks

Blocks may be classified according to the aggregate they contain. ("Aggregate" is the material used with cement and water to make the blocks.) Today there are on the market blocks made with limestone aggregate, cinder aggregate, slag or ore by-product aggregate, and sand-and-gravel aggregate. Because there is plenty of limestone in many parts of Kentucky, the block most commonly used in the state has limestone aggregate. Sand-and-gravel aggregate is used when these materials are found locally. The cinder block is not used much at present because of the scarcity of cinders. Kentucky has to import slag from other states for use in making slag blocks, but the material is cheap enough to find wide use. Assuming that they are high quality, a safe rule to follow is to use blocks found to be the cheapest in one's own community.

Some of the more common shapes and sizes of blocks are shown in Fig. 1. They are made also in many other sizes and shapes for special uses. Surface texture of the blocks varies from very fine, close texture to coarse, open texture, according to the selection, grading, and proportioning of the aggregate. Many designs can be made from these blocks, depending on the skill of the mason and the blocks available.

## Quality of Blocks

Quality, the important factor in block selection, depends on several things, but chiefly on the proportion of cement to aggregate and the correct proportioning of the materials that make up the aggregate. If a limestone aggregate is used, it must be graded from dust to particles that will pass through a $\frac{3}{8}''$ screen. For normal conditions a 1-to-8 mixture of proper sizes of aggregate makes blocks of sufficient strength.

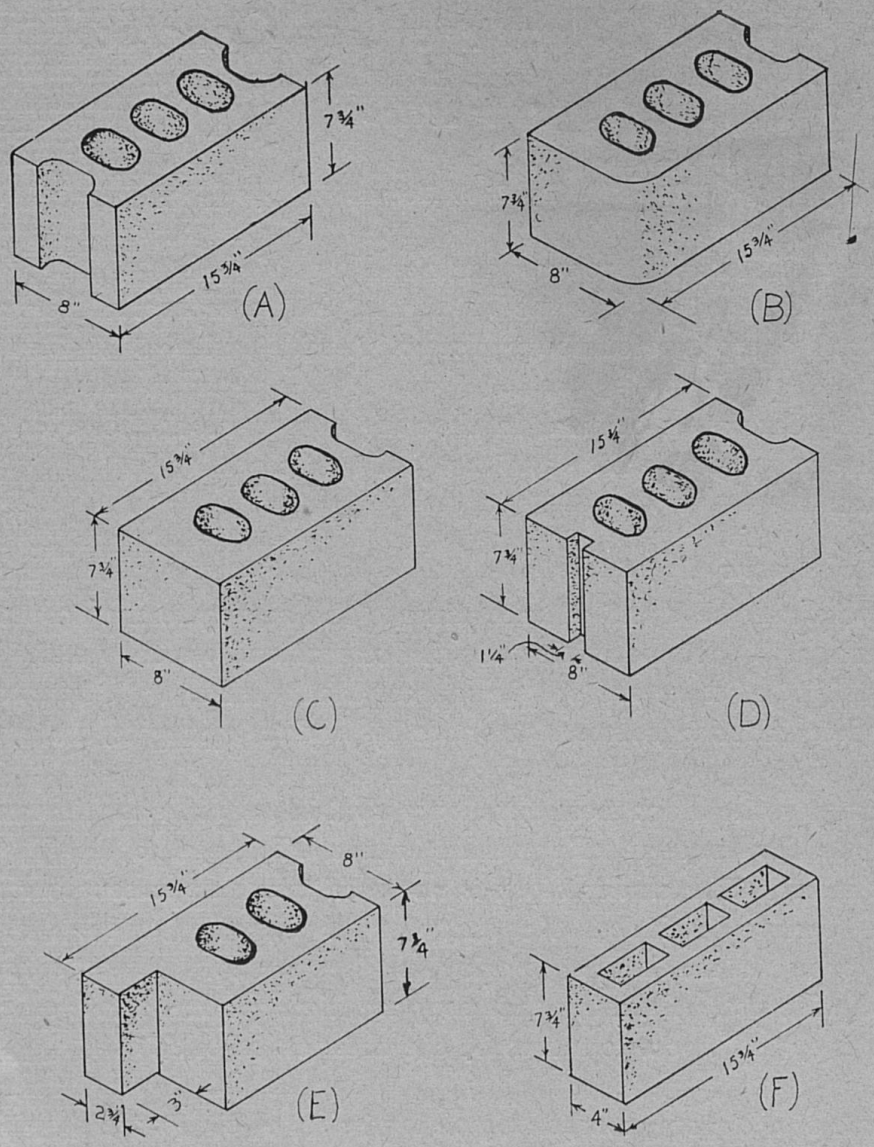


**Fig. 1.— Common shapes and sizes of blocks:**
**(A) Three-core block; (B) Streamline corner block; (C) Corner block; (D) Jamb block for steel sash; (E) Jamb block for wood sash; (F) Partition block.**

After the blocks are made, it is necessary to keep them damp for several days to cure them properly. The time for curing is normally 4 or 5 days but should be extended 3 to 5 days longer in cold weather. Under no circumstances should blocks be exposed to freezing temperature while curing. Steam curing for 24 hours, which is used by some of the larger companies, takes the place of damp curing.

Buyers with no special knowledge of concrete blocks can judge somewhat their quality by examining them for soundness and any tendency they may have to chip or pulverize easily.

One way to be sure of buying good blocks is to check the test ratings and buy only those that meet the requirements of the American Society for Testing Materials. Grade B blocks must have a compressive strength of at least 700 pounds per square inch, and Grade A 1,000 pounds, when laid in a wall. Test not later than 28 days after manufacture. These grades must also have a water absorption limit of approximately 6 pounds per block. A reliable blockmaker will be glad to show the purchaser reports of tests for quality made on his products.

If the builder does not plan to use the blocks for a few weeks after purchase, he should put them under a shed or cover with a tarpaulin to prevent exposure to rain or sunshine. Blocks that are too moist when put into a building will later dry and cause wall cracks, while blocks that are too dry will draw moisture out of the mortar joints, before the joints are cured, and thus cause the mortar to shrink or become powdery. Such walls are greatly weakened because the blocks are not firmly held together.

## How to Lay a Wall

Having an adequate foundation, though important with any building, is particularly important in buildings made with concrete blocks because of their great weight and the danger of cracks if the foundation moves. Factors determining the size of the foundation are (1) the weight of the building, (2) the maximum live loads to which the building will be subjected, and (3) the load-bearing capacity of the underlying soil. A rule of thumb method that fits Kentucky farm building conditions is to make the footing twice as wide as the width of the wall. The foundation should extend below the frost line to firm footing and be as nearly watertight as possible.

In laying the blocks, start at one corner of the footing or foundation. Spread mortar the full width of the block and place the corner block first (Fig. 1, B or C). Always lay the corners before laying the wall course. A course is one layer of blocks in the wall. After the first course has been laid, each following course is laid on mortar strips placed only along the edges as shown in Fig. 2. In building up the corners, use a mason's level to keep the wall plumb and straight and half lap the blocks above the course below (Fig. 3). Stretch a string between corners at a height corresponding to the top of the course being laid and proceed to build up the wall, using the string as a marker to level and align the wall (Fig. 3). If the building is to be subject to great outward thrusts, such as in grain bins, the walls should be reinforced with steel rods. Where such reinforcing seems necessary

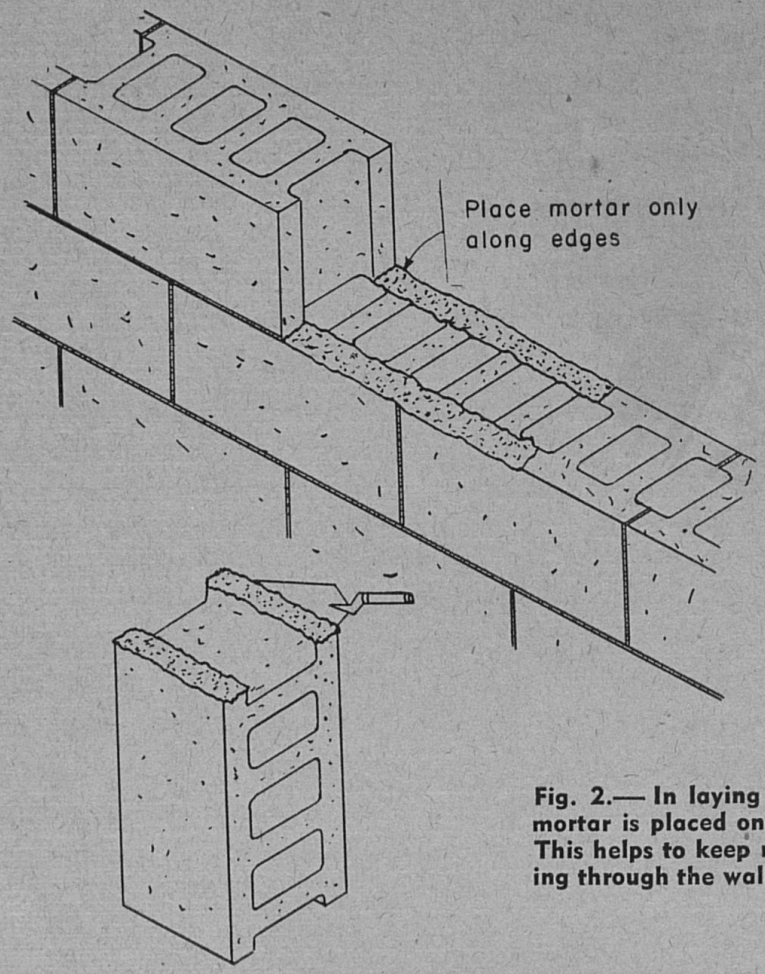


**Fig. 2.— In laying up the block wall, mortar is placed only along the edges. This helps to keep moisture from passing through the wall.**

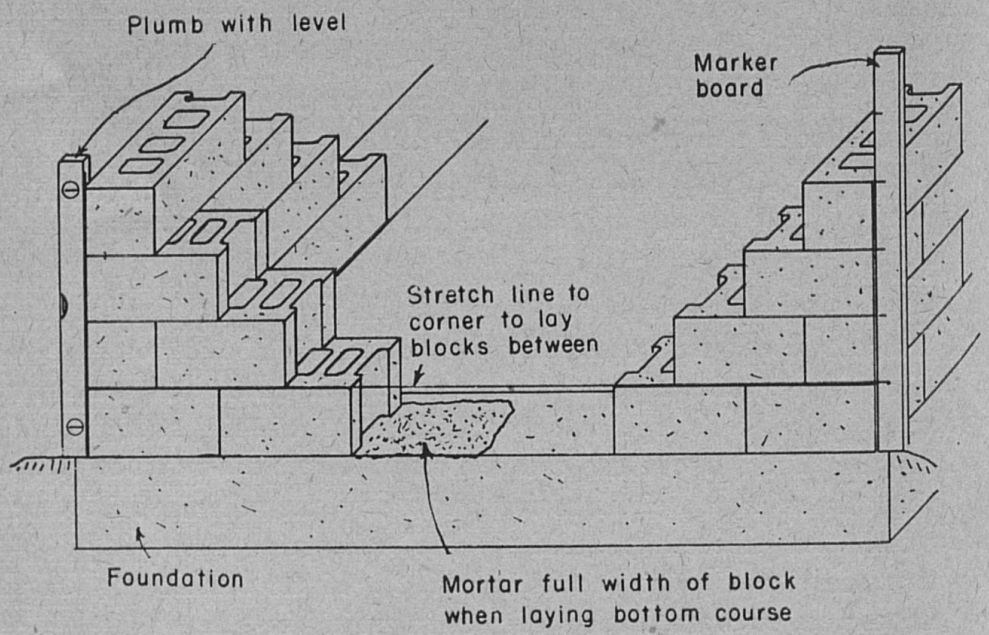


**Fig. 3.— Detail showing how each course is kept plumb and straight and how laying of the bottom course differs from the others.**

it is advisable to get a competent engineer to figure out the amount of steel needed and its proper spacing in the walls.

Mortar mix for joining any blocks below grade should contain 1 measure of portland cement and 3 measures of mortar sand. (Add 10 pounds hydrated lime per sack of cement to make a more workable mortar.) Mortar mix for blocks above grade may have 1 measure of portland cement, 1 measure of lime putty or hydrated lime, and 6 measures of mortar sand. Another satisfactory mix for above-grade work is 1 measure of masonry cement meeting federal specifications and 3 measures of mortar sand. Each of the above must have enough water to make a workable mix. Thin mortar joints between $\frac{3}{8}''$ and $\frac{1}{2}''$ are best because such joints produce a stronger, more watertight wall – and a wall is no stronger than its weakest joint. To be sure of a watertight joint, always avoid raked, stripped, and struck joints. Concave and V joints, Fig. 4, made by compressing the mortar enough to make a tight bond between the mortar and block unit are most satisfactory. This is known as tooling. Don't do the tooling until the mortar is stiff enough to hold its shape.

## Treating Weather-Exposed Walls

The importance of waterproofing outside walls cannot be overemphasized. Doing this at the time of construction is much easier than doing it later. For waterproofing below grade, cement plaster or hot asphalt should be used. Cement plaster should be at least $\frac{1}{4}$ inch thick. If the soil area around the building foundation is poorly drained, provision should be made for drainage as shown in Fig. 5. The tile must lead to a suitable outlet. For waterproofing above grade, several waterproofing treatments are available, such as melted wax, metallic stearate, or wax dissolved in a suitable solvent, and portland cement paints. These products are handled by many companies selling paints. Two coats of portland cement paint seem to be the most satisfactory and durable for normal conditions. Asphalt emulsions and special paints also are now available for special wall applications, but some of these are too costly to be practical for most farm uses.

Prevention of condensation of air-borne moisture on the inner side of weather-exposed walls, especially in residences and buildings housing farm animals, is a problem to which few builders give enough consideration. Good ventilation of the building helps prevent this condensation. If the building is poorly ventilated, moisture can be kept from passing into the wall by treating the wall with an aluminized asphalt paint, two coats of portland cement paint, or other

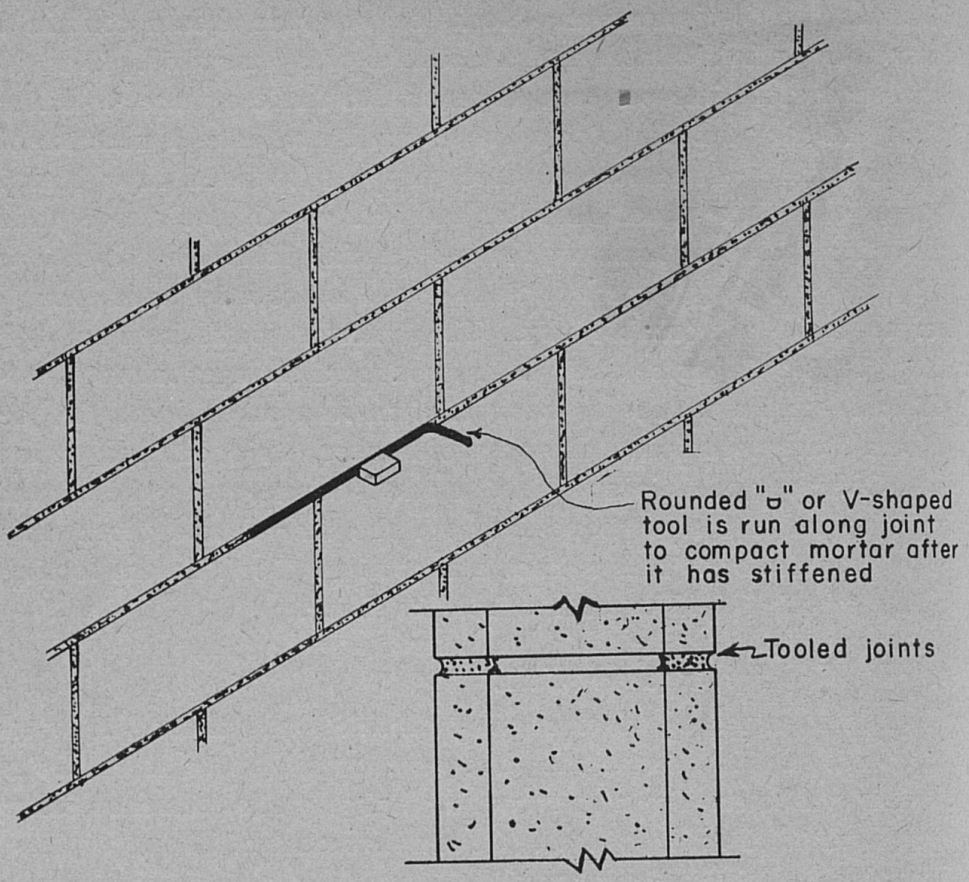


**Fig. 4.— Proper tooling of the joints makes for a more uniform and more water-tight wall.**

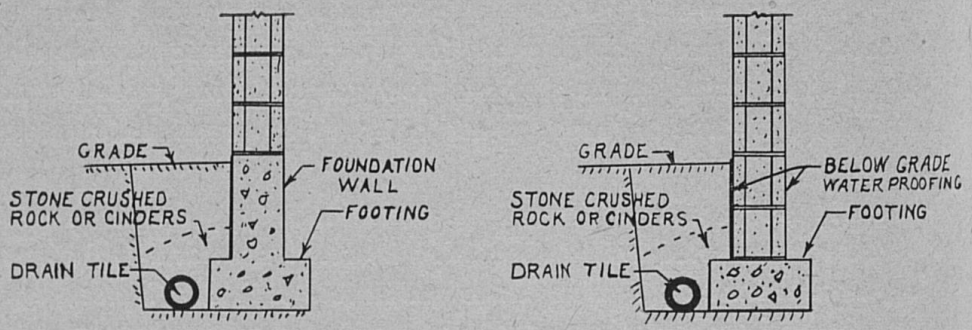


**Fig. 5.— In locations where there is any possibility of soil water seepage, drain tile leading to an open outlet is necessary at the lower part of the footing.**

waterproof coating. Sometimes buildings such as homes and dairy barns need more insulation than the wall alone gives. Filling the cores of the blocks with a granular insulating material reduces heat loss 20 to 25 percent and likewise reduces condensation of moisture on the inside surface. Another treatment is to surface the inner side of the outside walls with moisture-proof insulation board. Fig. 6 shows how insulation board may be fastened to furring strips.

Good workmanship, good blocks, and correct mortar mixes are essential in construction of all kinds of cement-block walls. The walls of many farm buildings can be constructed without any special treatment. In those buildings where it will be detrimental to have damp

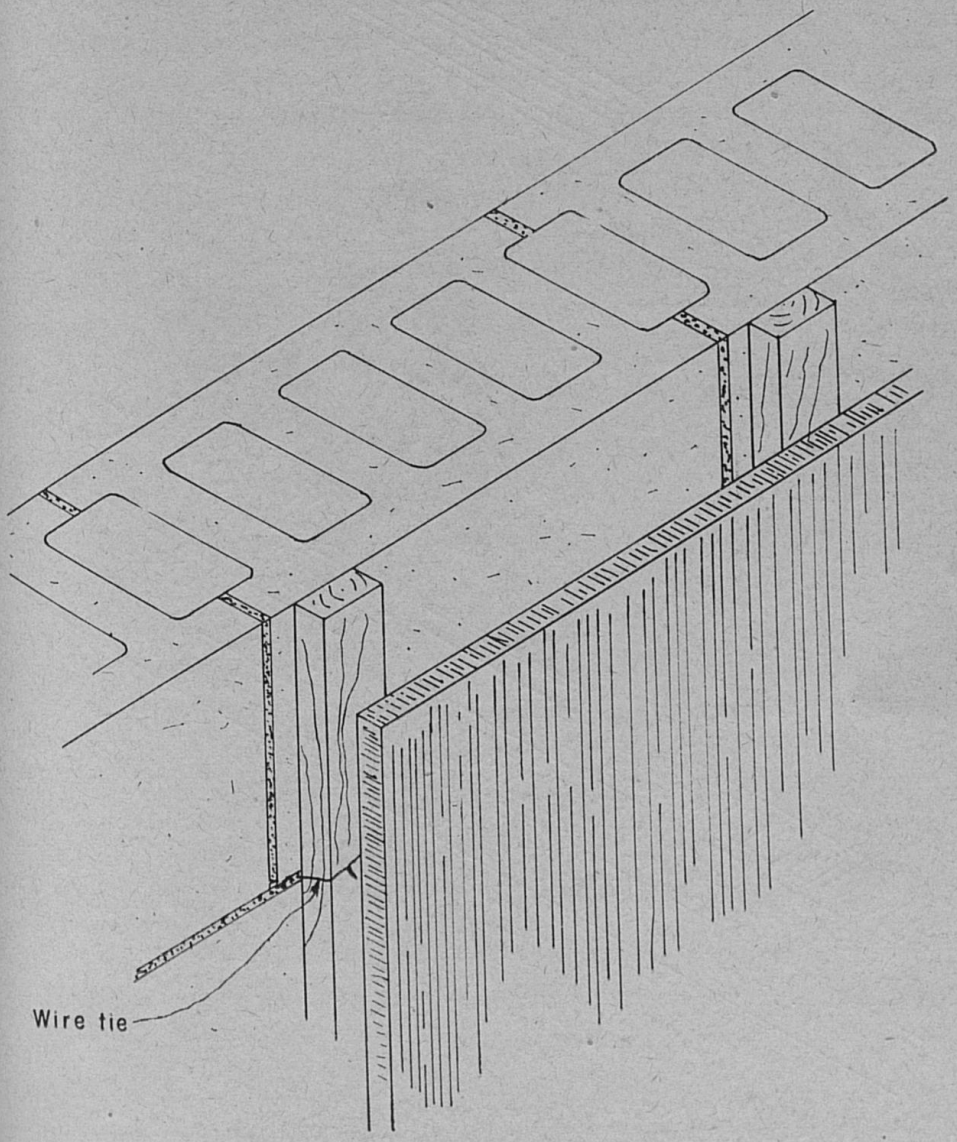


**Fig. 6.— Adding insulation board. The furring strips are held in place by wire laid in the mortar. Insulation board is to be nailed to furring strips.**

walls, a damp-proof treatment and sometimes insulation are necessary. In the home, many interior finishes or combinations of finishes are used, such as plaster, portland cement paint, insulation board (Fig. 6), varnishes, and artistic designs.

## Construction Details

Fig. 7 shows a common practice used in building around doors. The door frame must be well braced in place and the blocks set against it. Bolts to hold the frame in position must be spaced to fit

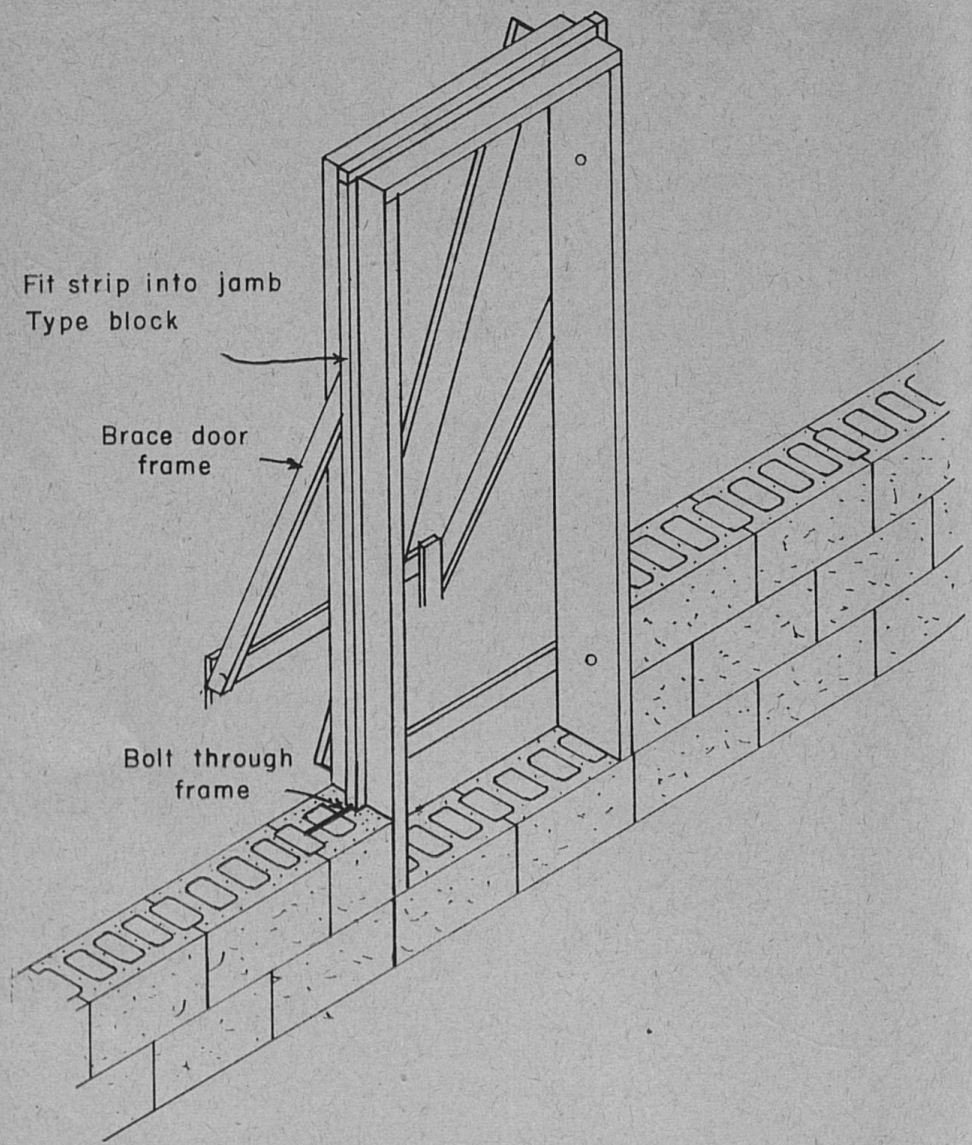


**Fig. 7.— Temporary bracing of the door in its corrct position is necessary before the wall can be set. Bolts through the door frame extending into the mortar joints help to secure the door.**

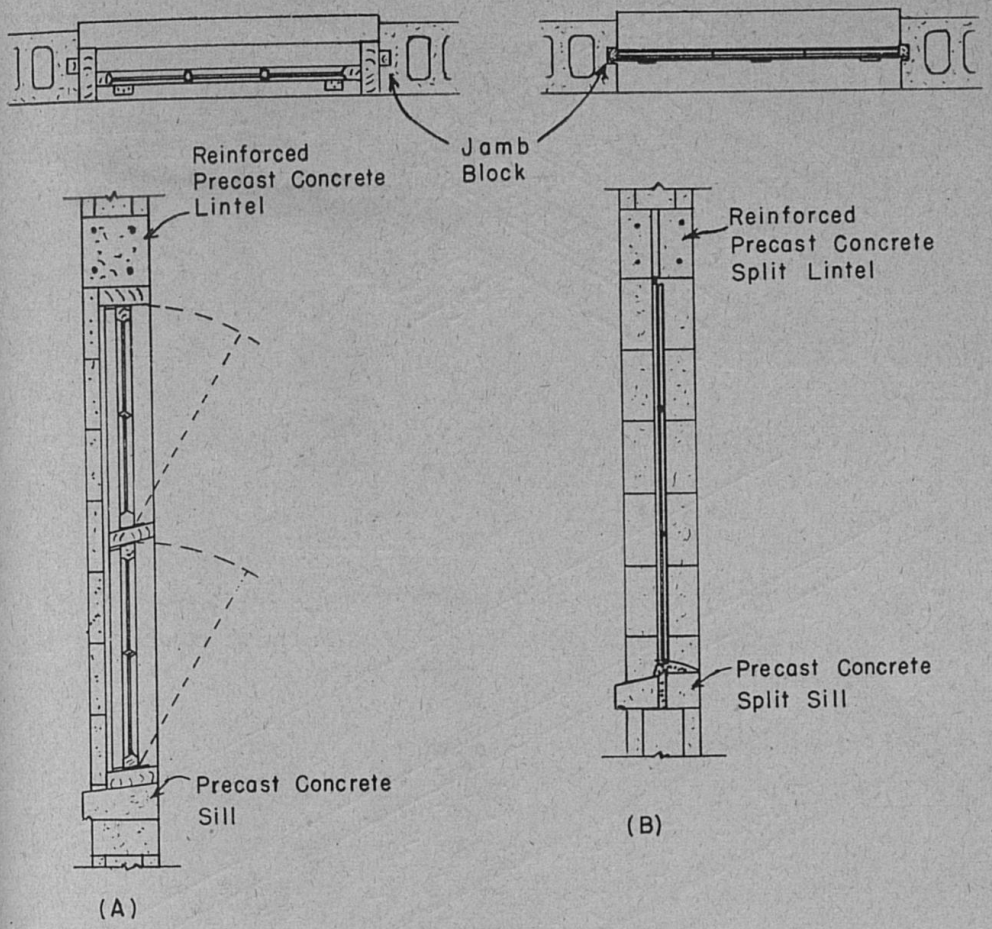


**Fig. 8.— Placing of wooden frames differs from putting in steel frames in that the wooden frames are bolted into the mortar joints similar to the way in which a door is secured, while steel frames have flanges extending into the split sill and lintel and into the outer cores of the blocks. The flanges are secured in mortar.**

into the mortar mix between courses. Though jamb blocks are shown in the sketch, ordinary blocks will work satisfactorily. Details for building around wood framed windows are shown in Fig. 8A and steel framed windows in Fig. 8B. Lintels, the horizontal top pieces over each door and window, are usually made of reinforced concrete and can be obtained from the blockmaker.

With the use of a special block (Fig. 1E) joists are easily placed in the walls as shown in Fig. 9. The limitation of this arrangement is that the joists are not fastened to take care of the outward wall thrust such as sometimes occurs from spreading roofs and stored grain.

Bolts, head down, are placed in the top course of blocks with a mortar mix to tie the plate to the wall (Fig. 10). Paper is packed in the block cores below the level of the bolt head to hold the mortar mix until it hardens. Under normal conditions, ½″x14″ bolts spaced 4′ apart are sufficient.

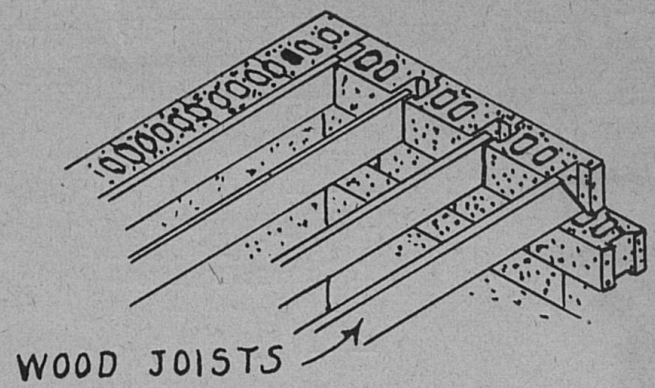


**Fig. 9.— Special blocks are required for fitting joists into the wall.**

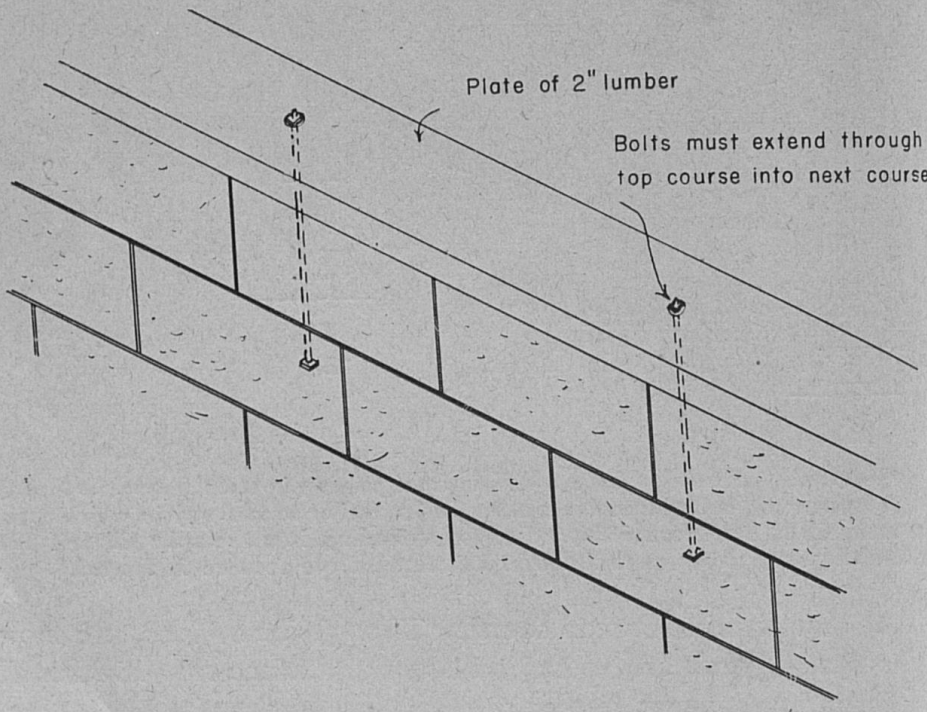


**Fig. 10.— Upon completion of a block wall, it is necessary to add a wooden plate in the manner shown. This plate furnishes a base to which the roof may be tied.**

Where partitions are to be of wood, bolts or metal ties should be placed in the mortar joints as the blocks are laid in the outside walls. Masonry partitions 4″ or 8″ thick may be built without ties.

**Further information on construction with concrete blocks can be obtained from the Agricultural Engineering Section, College of Agriculture and Home Economics, Lexington.**

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