BUILDING LAYOUT AND FOUNDATION

CHAPTER 4

The details of layout and planning are essential to proper construction of a building. Layout prepares the site for the foundation which must be planned and completed for each building being constructed. This chapter introduces the carpenter to the tools, materials, and techniques used in the effective accomplishment of these vital layout and planning functions.

LAYOUT

Layout techniques are described in the following paragraphs. The following are the most commonly used layout tools and materials:

- *A string line is used* to distinguish the dimensions of the building layout.
- *A sledgehammer is used* to sink corner stakes or batter boards and posts.
- *A posthole auger is* used to dig the holes required to set posts properly in some soils.
- *A handsaw is* used to cut batter boards and posts.
- *An ax or a hatchet is* used to sharpen batter-board posts and stakes.
- *A hammer is* used for building batter boards.
- *A chalk line is* used to deposit chalk on the surface in order to make a straight guideline.
- *A 100-foot/30-meter tape is* used for measuring diagonally (usually in a 100 foot length) and for laying ou excavation or foundation lines.
- *Tracing tape is* used for laying out excavation or foundation lines. The tape is made of cotton cloth approximately 1 inch wide. It usually comes in a 200 foot length.
- *A carpenter's level is* used to level a surface and to sight level lines. It may be used directly on the surface or with a straightedge.
- *A line level* has a spirit bubble to show levelness. The level is hung from a taut line. It gives the greatest accuracy when it is placed halfway between *the* points to be leveled.
- *An automatic level* measures approximate differences in elevation *and can* establish *grades* over *limited* distances. The landscape, level bubble, and index line *are* seen *in* the tube.
- *8d nails are* used to secure string line to batter boards.
- *A plumbing bob is* used to locate the corners of the building dimensions.
- *A framing square is used* to check the squareness of lines.

LAYING OUT A RECTANGULAR BUILDING SITE

Working from an established line, such as a road or a property line (line AB in Figure 4-1) that is parallel to construction, establish the maximum outer perimeter (AB, CD, AC, BD) of the building area.

Measure away from the front line (AB) along the side lines (AC and BD) the distances (AO and BO) desired to the dimension of the project that is to run parallel to the front line.

Stretch a line tightly from point O to O. This line will mark the project's frontage.

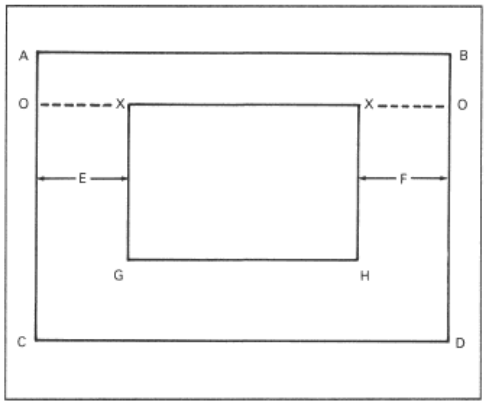


Figure 4-1. Laying out a rectangle

Measure in from lines AC and BD along line OO one-half the difference between the length of line OO and the desired length of the project. The points (X and X) will constitute the front corners of the project.

The two distances OX and XO establish the distances E and F. Extend lines from the two front corners, X and X, parallel to AC and BD at the distances established as E and F for the required depth of the project. This provides the side lines of the project (XG and XH).

Joining the extreme ends of side 111 XH will provide the rear line (GH) of the project.

After the four corners (X, X, G. and H) have been located, drive stakes at each corner. Batter boards may be erected at these points either after the stakes have been set or while they are being set. Dimensions are determined accurately during each step.

LAYING OUT AN IRREGULAR BUILDING SITE

Where the outline of the building is other than a rectangle, the procedure in establishing each point is the sam as described for laying out a simple rectangle. However, more points have to be located, and the final proving of the work is more likely to reveal a small error. When the building is an irregular shape, it is advisable to first lay out a large rectangle which will comprise the entire building or the greater part of it. This is shown in Figure 4-2 as HOPQ When this is established, the remaining portion of the layout will consist of small rectangles, each of which can be laid out and proved separately. These rectangles are shown as LMNP ABCQ, DEFG, and IJKO in Figure 4-2.

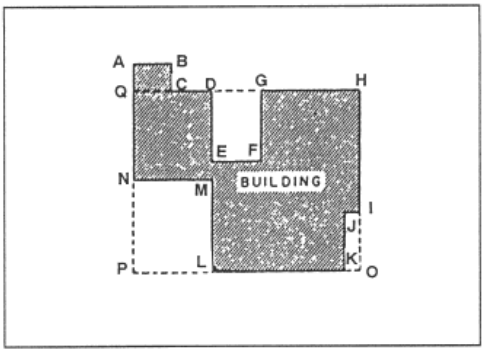


Figure 4-2. Laying out irregular projects

SETTING BATTER BOARDS

Batter boards are a temporary framework used to assist in locating corners when laying out a foundation. Batter-board posts are made from 2 x 4 or 4 x 4 material; corner stakes are made from 2 x 2s. Batter boards a made from 1 x 4 or 1 x 6 pieces.

Staking Procedures

Corner stakes are driven to mark the exact corners of the project. Excavating for a foundation will disturb the stakes, so batter boards are set up outside the boundary established by the stakes to preserve definite and accurate building lines. Heavy cord or fine wire is stretched from one batter board to another to mark these lines.

Location of Batter Boards

Figure 4-3 shows how to locate batter boards. Right-angle batter boards are erected 3 or 4 feet outside of each corner stake. Straight batter boards are erected 3 or 4 feet outside of the line stakes.

Construction of Batter Boards

Right-angle batter boards should be fastened to the posts after the posts are sunk. Since the boards should be at the exact height of the top of the foundation, it may be desirable to adjust the height by nailing the boards to the stakes after the stakes have been sunk. Right-angle batter boards may be nailed close to perpendicular by using a framing square and should be leveled by means of a carpenter's level before they are secured. Then, angle saw cuts may be made or nails driven into the tops of the boards to hold the lines in place. Separate cuts or nails may be used for the building line, the foundation line, the footing line, and excavation lines. These grooves permit the removal and replacement of the lines in the correct position.

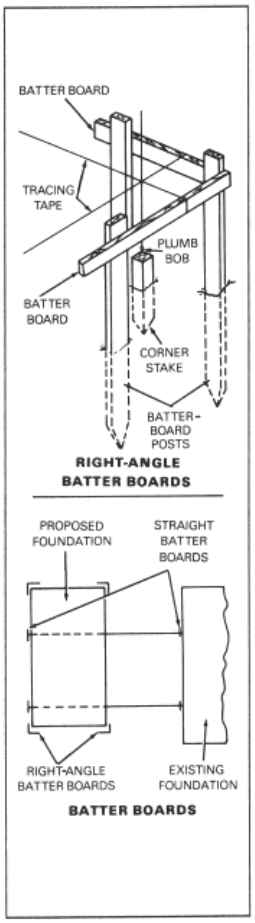


Figure 4-3. Locating batter boards

EXTENDING LINES

The following procedure applies to a simple layout as shown in Figure 4-4, page 4-4, and must be amended to apply to different or more complex layout problems:

Step 1. After locating and sinking stakes A and B. erect batter boards 1, 2, 3, and 4. Extend a chalk line (X) from batter board 1 to batter board 3, over stakes A and B.

Step 2. After locating and sinking stake C, erect batter boards 5 and 6. Extend chalk line Y from batter board 2 over stakes A and C to batter board 6.

Step 3. After locating and sinking stake D, erect batter boards 7 and 8. Extend chalk line Z from batter board 5 to batter board 7, over stakes C and D.

Step 4. Extend line O from batter board 8 to batter board 4, over stakes D and B.

Where foundation walls are wide at the bottom and extend beyond the outside dimensions of the building, the excavation must be larger than the laid-out size. To lay out dimensions of this excavation, measure out as far as required from the building line on each batter board and stretch lines between these points, outside the first layout.

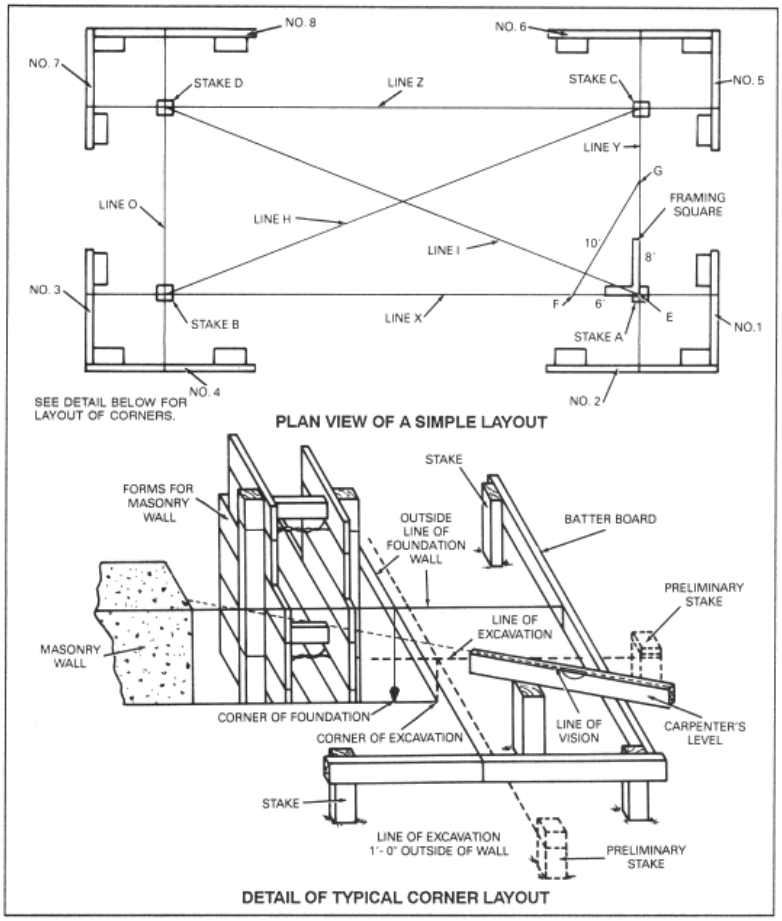


Figure 4-4. Laying out building lines from batter boards

The lines may be at a right angle where they cross the corner layout stakes, found by holding a plumb bob ov the corner layout stakes and adjusting the lines until they touch the plumb-bob line. All lines should be checked with a line level or a carpenter's level.

SQUARING LINES

The two methods commonly used for squaring extended lines are the 6-8-10 method and the diagonal metho

The 6-8-10 Method

After extended lines are in place, measure line EF for a distance of 6 feet (Figure 4-4). Measure line EG for a distance of 8 feet. Adjust the lines (Y and X) until FG equals 10 feet. Multiples of 6-8-10 may be used for large layouts; for example, 12-16-20 for a layout 50 feet by 100 feet. For accuracy, never start with a measurement of less than 6 feet.

The Diagonal Method

If the layout is rectangular, lines H and I, cutting the rectangle from opposing corners, will form two triangles as shown in Figure 4-4. If the rectangle is perfect, these lines will be equal in length and the corners perfectly square. If lines H and I are not equal in length, adjust the corners by moving the lines right or left until H and are equal.

FOUNDATIONS

Foundations vary according to their use, the soil-bearing capacity, and the type of material available. The material may be cut stone, rock, brick, concrete, tile, or wood, depending on the weight the foundation is to support. Foundations may be classified as wall or column (pier) foundations.

WALL FOUNDATIONS

Wall foundations (Figure 4-5) are solid their total length and are usually used when heavy loads are to be carried or where the earth has low supporting strength. These walls may be made of concrete, rock, brick, or cut stone, with a footing at the bottom. Because of the time, labor, and material required to build it, this type wall will be used in the TO only when other types cannot be used. Steel-rod reinforcements should be used in all concrete walls.

Rubble stone masonry is used for walls both above and below ground and for bridge abutments. In military construction, it is used when form lumber for masonry units is not available. Rubble masonry may be laid up with or without mortar; if strength and stability are desired, mortar must be used.

Coursed rubble is assembled of roughly squared stones in such a manner as to produce approximately continuous horizontal bed joints.

Random rubble is the crudest of all types of stonework. Little attention is paid to laying the stone in courses. Each layer must contain bonding stones that extend through the wall. This produces a wall that is well tied together.

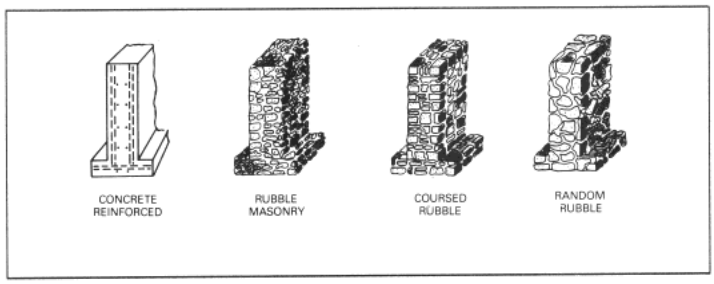
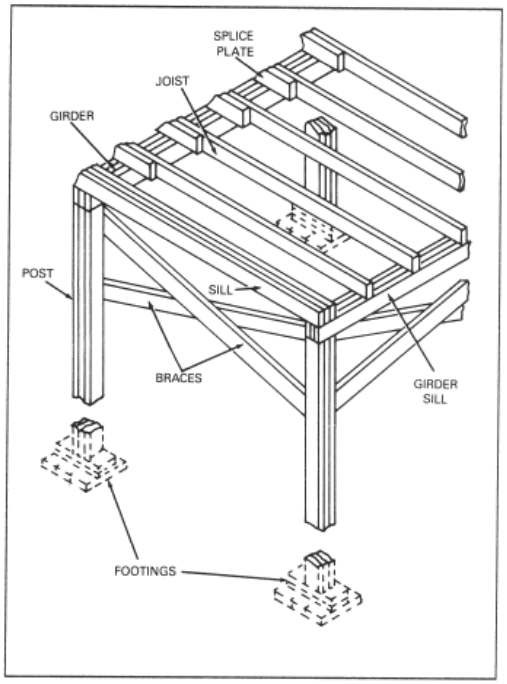


Figure 4-5. Foundation walls

COLUMN OR POST FOUNDATIONS

The use of column or post foundations constructed from masonry or wood saves time and labor. The posts or columns are spaced according to the weight to be carried. In most cases, the spacing is 6 to 10 feet apart. The sketches in Figure 4-6 show the different types of posts with appropriate types of footing. Wood posts are generally used, since they are installed with the least time and labor. When wood posts extend 3 feet or more above the ground, braces are necessary (Figure 4-7).



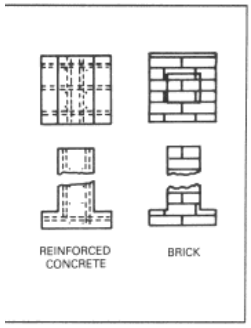


Figure 4-7. Posts with braces