

Chapter I

Locating a Building

The term *layout* means the process used to locate and fix the reference lines that define the position of the foundation and outside walls of a building.

Selection of Site

Staking out (sometimes called a *preliminary layout*) is important. The exact location of the building has to be properly selected. It may be wise to dig a number of small, deep holes at various points. The holes should extend to a depth a little below the bottom of the basement.

If the holes extend down to its level, the groundwater (which is sometimes present near the surface of the earth) will appear in the bottom of the holes. This water will nearly always stand at the same level in all the holes.

If possible, a house site should be located so that the bottom of the basement is above the level of the groundwater. This may mean locating the building at some elevated part of the lot or reducing the depth of excavation. The availability of storm and sanitary sewers (and their depth) should have been previously investigated. The distance of the building from the curb is usually stipulated in city building ordinances, but this, too, should be known.

Staking Out

After the approximate location has been selected, the next step is to lay out the building lines. The position of all corners of the building must be marked in some way so that when the excavation is begun, workers will know the exact boundaries of the basement walls (see Figure 1-1). There are a couple of methods of laying out building lines:

- With surveyor's instrument
- By method of diagonals

The Lines

Several lines must be located at some time during construction, and they should be carefully distinguished. They include the following:

- The line of excavation that is the outside line
- The face line of the basement wall inside the excavation line

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Figure I-1 One way of laying out is with a hundred-foot tape. Metal tape is standard, but this new fiberglass one works well and cleans easily. (Courtesy of Stanley Tools.)

- In the case of masonry building, the ashlar line that indicates the outside of the brick or stone walls

In a wooden structure, only the two outside lines must be located, and often the line of the excavation is determined at the outset.

Laying Out with Transit Instruments

A *transit* is an instrument of precision, and the work of laying out with this instrument is more accurate than with other methods. In Figure 1-2, let $ABCD$ be a building already erected. At a distance from this (at right angle), building $GHJK$ will be erected. Level up the instrument at point E , making A and E the distance the new building will be from points A and B . Make points B and F the same length as points A and E . At this point, drive a stake in the ground at point G , making points F and G the required distance between the two buildings. Point H will be on the same line as point G , making the distance between the two points as required.

Place the transit over point G , and level it up. Focus the transit telescope on point E or F and lock into position. Turn the horizontal

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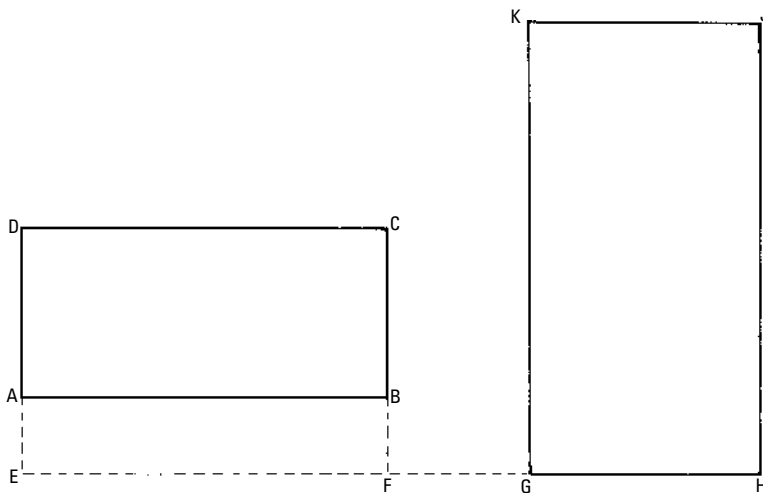


Figure 1-2 Diagram illustrating method of laying out with transit.

circle on the transit until one of the zeros exactly coincides with the vernier zero. Loosen the clamp screw and turn the telescope and vernier 90 degrees. This will locate point *K*, which will be at the desired distance from point *G*. For detailed operation of the transit (see Figure 1-3), see the manufacturer's instructions or information in the *Audel Carpenters and Builders Math, Plans, and Specifications* book of this series. (See the Introduction for more details on this series.) The level may be used in setting floor timbers, in aligning posts, and in locating drains.

Method of Diagonals

All that is needed in this method are a line, stakes, and a steel tape measure. Here, the right angle between the lines at the corners of a rectangular building is found by calculating the length of the diagonal that forms the hypotenuse of a right-angle triangle. By applying the following rule, the length of the diagonal (hypotenuse) is found.

Rule: The length of the hypotenuse of a right-angle triangle is equal to the square root of the sum of the squares of each leg.

Thus, in a right-angle triangle *ABC*, the hypotenuse is *AC*,

$$AC = \sqrt{AB^2 + BC^2}$$

Suppose, in Figure 1-4, *ABCD* represents the sides of a building to be constructed, and it is required to lay out these lines to the

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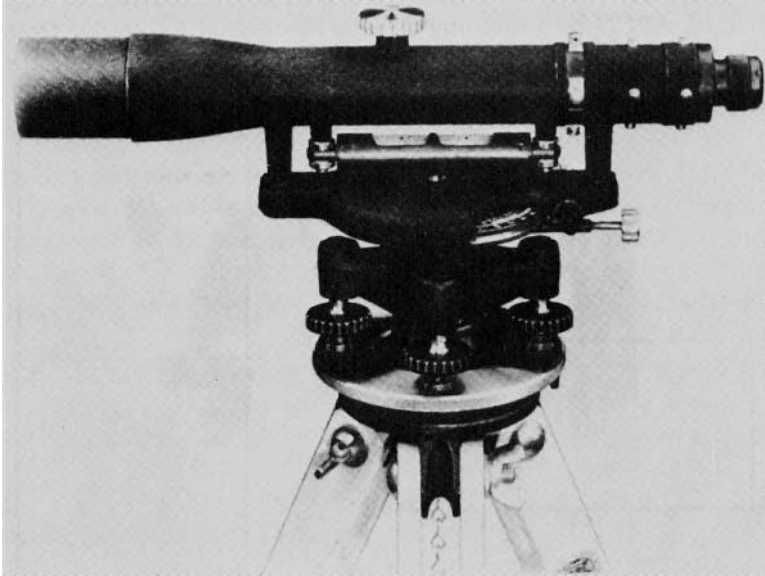


Figure I-3 Transit, used by builders, contractors, and others for setting grades, batter boards, and various earth excavations.

dimensions given. Substitute the values given in the previous equation as follows:

$$AC = \sqrt{30^2 + 40^2} = \sqrt{900 + 1600} = \sqrt{2500} = 50$$

To lay out the rectangle of Figure 1-4, first locate the 40-foot line AB with stake pins. Attach the line for the second side to B , and measure off this line the distance BC (30 feet), point C being indicated by a knot. This distance must be accurately measured with the line at the same tension as in A and B .

With the end of a steel tape fastened to stake pin A , adjust the position of the tape and line BC until the 50-foot division on the tape coincides with point C on the line. ABC will then be a right angle, and point C will be properly located.

The lines for the other two sides of the rectangle are laid out in a similar manner. After getting the positions for the corner stake pins, erect batter boards and permanent lines (see Figure 1-5). A simple procedure may be used in laying out the foundations for a small rectangular building. Be sure that the opposite sides are equal

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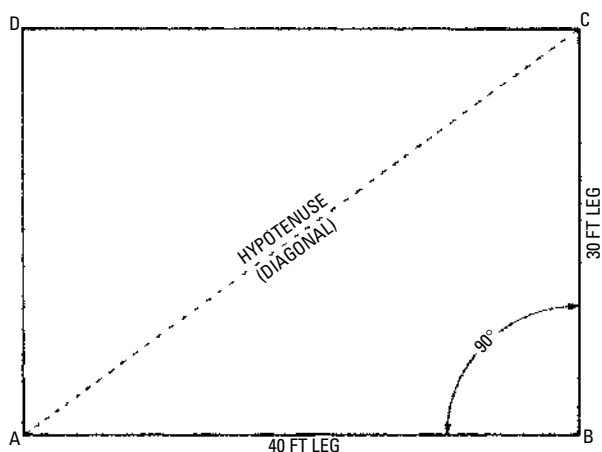


Figure I-4 Diagram illustrating how to find the length of the diagonal in laying out lines of a rectangular building by using the diagonals method.

and then measure *both* diagonals. No matter what this distance may be, they will be equal if the building is square. No calculations are necessary, and the method is precise.

Points on Layout

For ordinary residence work, a surveyor or the city engineer is employed to locate the lot lines. Once these lines are established, the builder is able to locate the building lines by measurement.

A properly prepared set of plans will show both the contour of the ground on which the building is to be erected and the new grade line after the building is done. A convenient way of determining old grade lines and establishing new ones is by means of a transit, or with a Y level and a rod. Both instruments work on the same principle in grade work. As a rule, masonry contractors have their own Y levels and use them freely as walls are constructed, especially where levels are to be maintained as the courses of material are placed.

In locating the grade of the earth around a building, stakes are driven into the ground at frequent intervals and the amount of fill indicated by the heights of these stakes. Grade levels are usually established after the builders have finished, except that the mason will have the grade indicated where the wall above the grade is to be finished differently from the wall below grade. When a Y level is not

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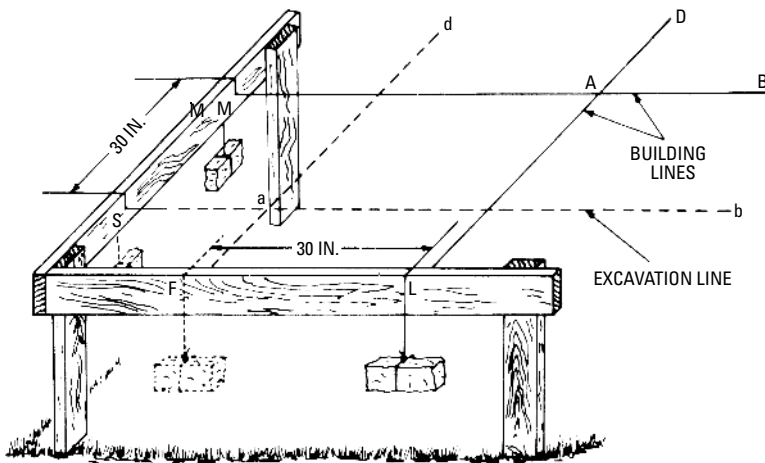


Figure I-5 Permanent location of layout lines made by cutting in batter boards (boards marked S, M, F, L). Slits L and M locate the building lines. Approximately 30 inches away are lines F and S, which are excavation lines.

available, a 12- or 14-foot straightedge and a common carpenter's level may be used, with stakes being driven to "lengthen" the level.

Summary

The term *layout* means the process of locating a fixed reference line that will indicate the position of the foundation and walls of a building.

A problem sometimes encountered is groundwater. It is sometimes present near the surface of the earth and will appear in the bottoms of test holes, generally at the same level. If possible, a house should be located so that the bottom of the basement floor is above the level of the ground water.

After the location of the house has been selected, the next step is to lay out or stake out the building lines. The position of all corners of the house must be marked so that workers will know the exact boundaries of the basement walls.

There are several ways to lay out a building site. Two of these are with a surveyor's instrument and with diagonal measurements. When laying out a site, several lines must be located at some time during construction. These lines are the line of excavation (which is the outside line), the face line of the basement wall inside the

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excavation line, and, in the case of a masonry building, the ashlar line (which indicates the outside of the brick or stone wall).

Review Questions

1. What is groundwater?
2. Name two methods used in laying out a building site.
3. What is the difference between laying out and staking out?
4. What is the line of excavation?
5. What is the ashlar line?
6. What is the advantage of using a fiberglass measuring tape in the field?
7. How is a transit used in the layout of a basement?
8. What has to be done by the surveyor before the developer can lay out houses?
9. When are grade levels established?
10. What are batter boards?

