

INTRODUCTION

It is very important to know local regulations, covenants, restrictions, and zoning laws prior to laying out a project. Knowing these laws could save time, money and possible lawsuits. Accuracy is also essential in site layouts. The cost of redoing or making architectural changes may be prohibitive or unacceptable. Compare site layout to a journey. The first step may mean the difference between a successful journey and being lost.

**FOCUS
ASSIGNMENTS**

FOCUS ASSIGNMENTS

1. Examine the copies of local regulations, covenants, and zoning laws provided by your instructor.
2. Write a short paragraph on how these rules and regulations affect the laying out of a construction project.



**UNIT
OBJECTIVE**

After completing this unit, you will show the following competencies by mastering the activities on the Assignment and Job Sheets and by scoring at least 85% on the Written Test.

**SPECIFIC
OBJECTIVES**

1. Name factors pertinent to site layout.
2. Select from a list information used to lay out building lines.
3. State the purpose of batter boards.
4. Determine common methods used to square building lines.
5. Write layout dimensions on a plot plan. (Assignment Sheet)
6. Erect batter boards and locate building lines for a structure. (Job Sheet 1)
7. Lay out footings for a structure. (Job Sheet 2)
8. Set grade stakes for footings without forms. (Job Sheet 3)





OBJECTIVE 1

Optional Activities/
Resources in Instructor's
Guide

Name factors pertinent to site layout.

WORDS YOU SHOULD KNOW

building permit agreement between builder and city that specifies the type, quality, and extent of construction on structure to be erected

- Local regulations and covenants (zoning and restrictions)

EXAMPLES: Setback line; proximity to side property lines; elevation, size, shape, and proximity to surrounding buildings and areas

- Location of utilities

EXAMPLES: Electricity, sewers, gas, phone

- Presence of existing trees and shrubs

- Contour or shape of site

EXAMPLES: Flat, rolling, sloping

- Characteristics of soil

- Orientation of site

EXAMPLES: Relationship to other sites; north, east, south, and west boundaries; prevailing wind direction; solar-utilization possibilities



OBJECTIVE 2

Required Activities/
Resources
– Transparency

Optional Activities/
Resources in Instructor's
Guide

Select from a list information used to lay out building lines.



Your instructor will show you a transparency about building lines.

WORDS YOU SHOULD KNOW

easement	a vested or acquired right to use land, other than as a tenant, for a specific purpose; such right being held by someone other than the owner who holds the title to the land
setback line	line established by law, fixing exterior face of structure a minimum distance from right-of-way or property line

- Dimensions of property
- Setback from curb
- Setback from sidewalk
- Setback from property lines
- Distance from side boundaries
- Distance from rear property line
- Location and dimensions of easement(s)
- Dimensions (length and width) of building
- Orientation of building on lot (square or diagonal)
- Location of bench mark and grade



OBJECTIVE 3

Optional Activities/
Resources in Instructor's
Guide

State the purposes of batter boards.

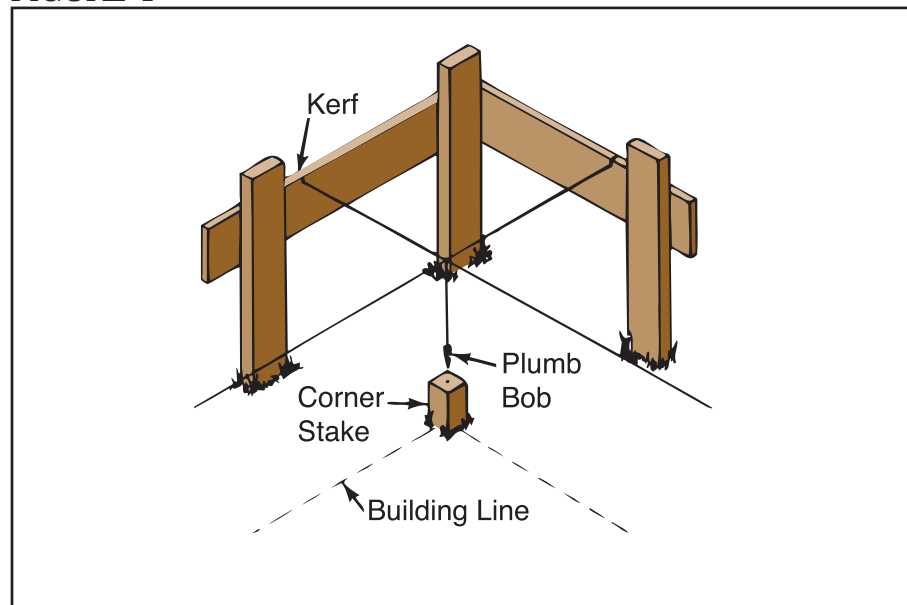
WORDS YOU SHOULD KNOW

batter board	temporary framework on which to stretch a line to assist in locating corners and building lines when laying out a building
excavating	removing soil for footing or for establishing a uniform grade
kerf	slight indentation made with a saw; used to hold line in place
ledger board	top horizontal board on batter board framework

- To provide a place for stretching a line used to establish building lines for excavation and construction

✓ **NOTE:** Steel stakes are sometimes used in place of batter boards.

FIGURE 1



OBJECTIVE 4

Optional Activities/
Resources in Instructor's
Guide

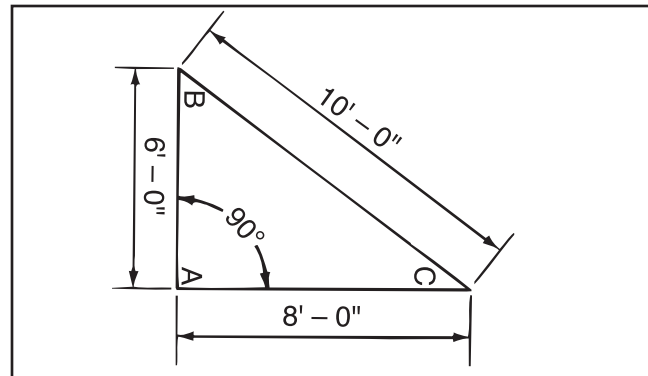
Determine common methods used to square building lines.

- **3-4-5 method** — Forming a right triangle using the largest multiple of 3-4-5 possible for the length of the lines being squared, and ensuring that the longest side of the triangle is the exact appropriate multiple of 5

✓ **NOTE:** Any multiple of 3-4-5 may be used (i.e., 6-8-10, 12-16-20, 24-32-40) depending on the size being checked.

EXAMPLES: Using 3-4-5 rule to square building lines 6'-0" and 8'-0", line BC will measure exactly 10 feet if lines AB and AC are square (Figure 2).

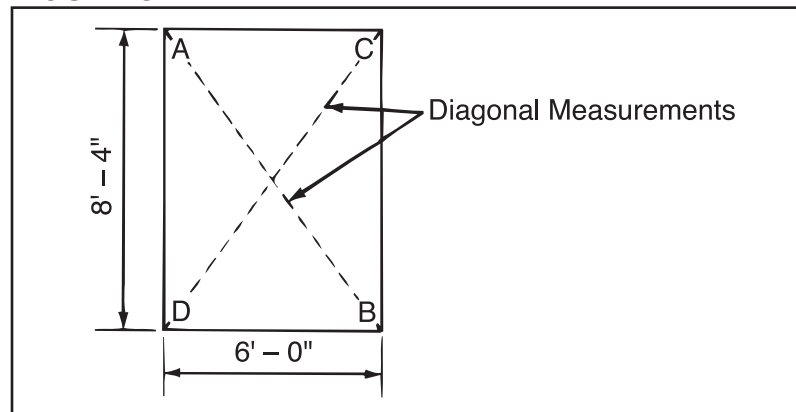
FIGURE 2



- **Diagonal method** — Measuring diagonally from the inside corners of the layout and ensuring that the diagonal lines are equal in length

EXAMPLE: Using the diagonal method to square building lines 6'-0" and 8'-0", lines AB and CD will be exactly the same measurement if building corners are square and if dimensions on opposite sides are exactly the same as each other (Figure 3).

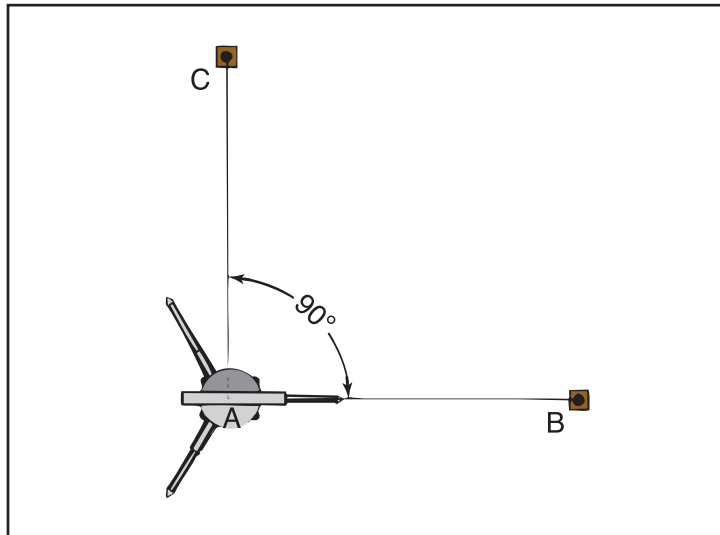
FIGURE 3



- **Transit method** — Setting the instrument exactly at the point where the right angle is to be, sighting a reference point on one line of the angle, setting 360-degree scale at zero, and establishing a second line of angle where the scale indicates a 90-degree arc has been completed

EXAMPLES: Using instrument to square corners of building lines, when instrument is at point A and sighted on a point on line AB, 360-degree scale will indicate that an arc of 90 degrees has been completed at line AC (Figure 4).

FIGURE 4



OBJECTIVE 5

Complete the Assignment Sheet.

OBJECTIVE 6

Complete Job Sheet 1.

OBJECTIVE 7

Complete Job Sheet 2.

OBJECTIVE 8

Complete Job Sheet 3.





Name _____ Score _____

OBJECTIVE 5

Write layout dimensions on a plot plan.

WORDS YOU SHOULD KNOW

plot plan drawing used to show location and size of structure(s), driveways, patios, property lines, utilities, and existing conditions

BASIC SKILLS



Reading



Mathematics



Employability

EQUIPMENT
AND SUPPLIES

- Pen or pencil

INSTRUCTIONS

Write the dimensions below in the correct places on the plot plan on the following page.

Property dimensions

- Front — 75'-0"
- Rear — 75'-0"
- East side — 99'-6"
- West side — 99'-6"

Building size — 65'-0" 54'-0"

✓ **NOTE:** Building should be parallel with boundary lines.

Bench mark — 100'-0"

Easement 5'-11" at rear of property

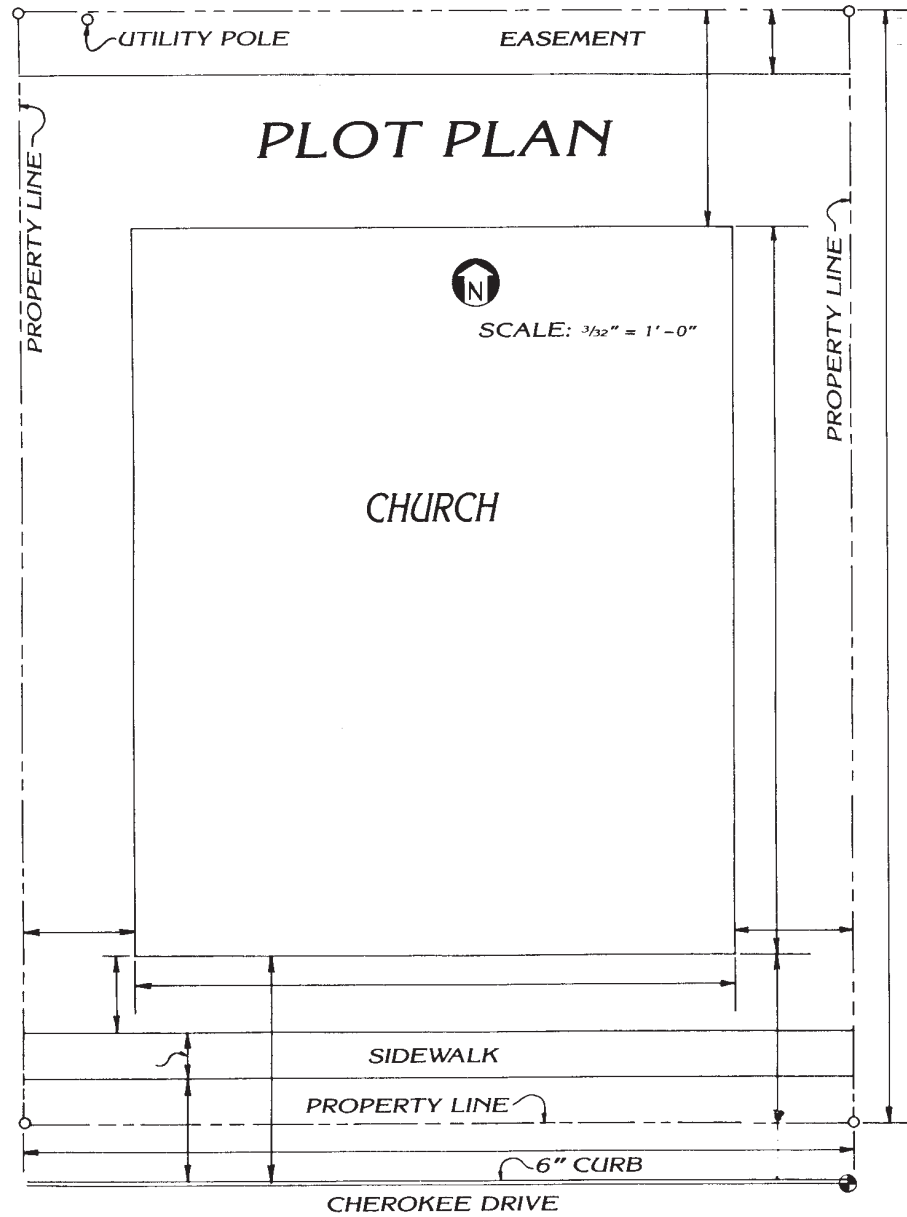
Sidewalk

- 4'-0" wide
- 6'-10" from building



Setbacks

- 20'-5" from center of curb
- 15'-0" from south property line
- 10'-2" from west property line
- 10'-10" from east property line
- 19'-6" from north property line



Name _____ Score _____

OBJECTIVE 6

Erect batter boards and locate lines for a structure.

BASIC SKILLS



Reading



Mathematics



Employability

**EQUIPMENT
AND SUPPLIES**

- Claw hammer
- Crosscut hand saw
- Power handsaw and extension cord equipped with a ground-fault circuit interrupter



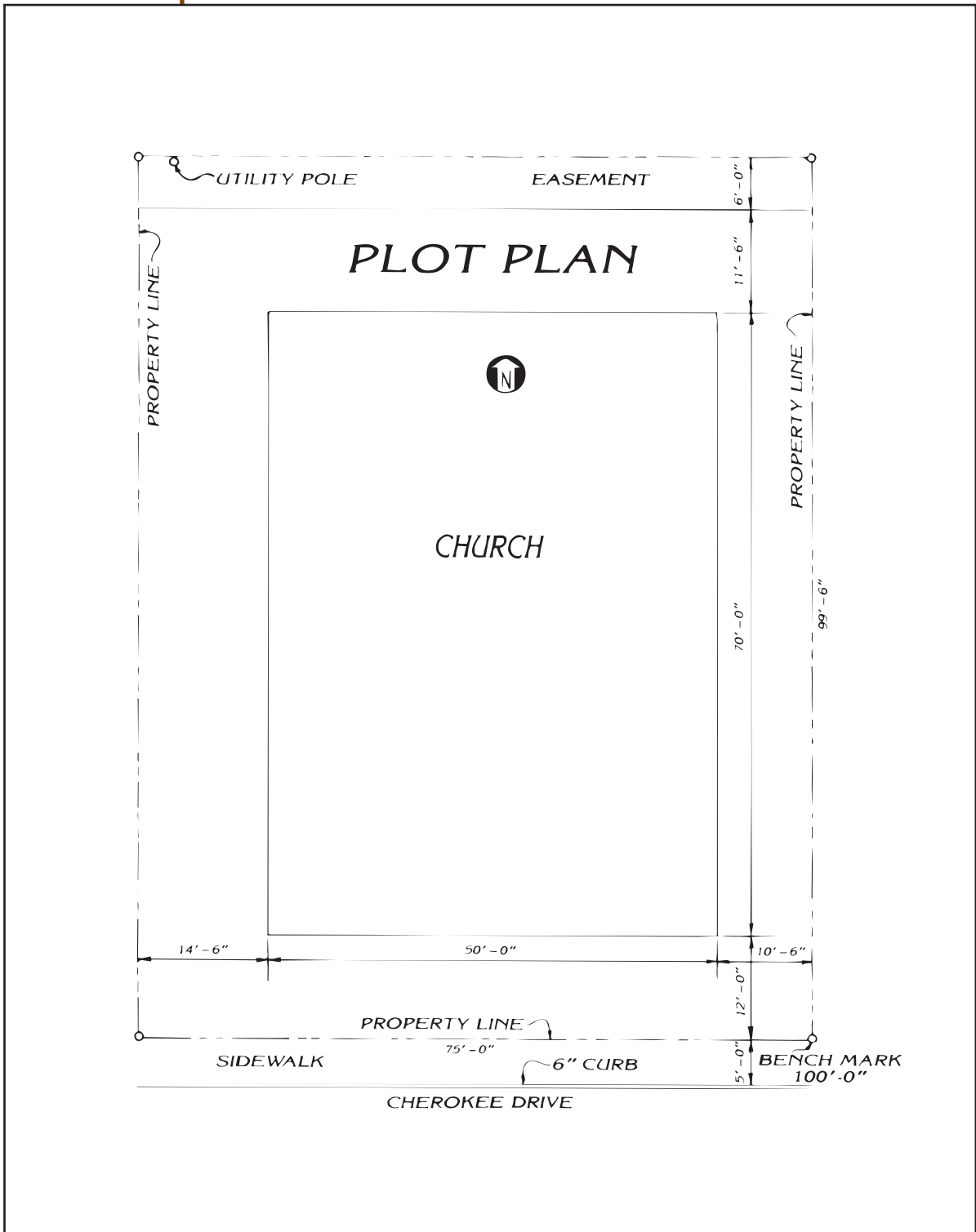
CAUTION: Wear eye protection when operating power handsaw.

- Builder's level, transit and rod
- String line
- Rule and tapes
- Pencil
- Plot plan
- Batter board stakes, 2 x 4's
- Ledger boards, 1 x 6's
- Braces, 1 x 4's
- Corner stakes, 2 x 2's
- 8d box nails
- Personal protective equipment

✓ **NOTE:** Refer to C.F.R. 1926.28 Sub part C in regards to Personal Protective Equipment.



FIGURE 1



PROCEDURE

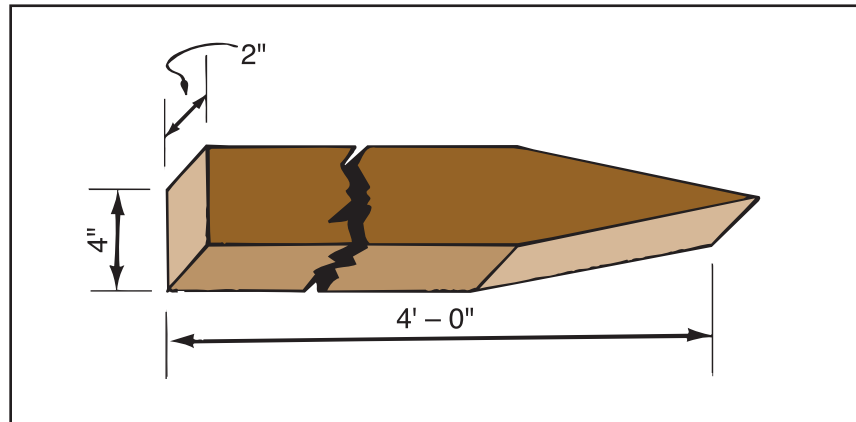
✓ **NOTE:** The procedure outlined in this job sheet is just one of several acceptable methods.

Yes No

1. Cut material to size.

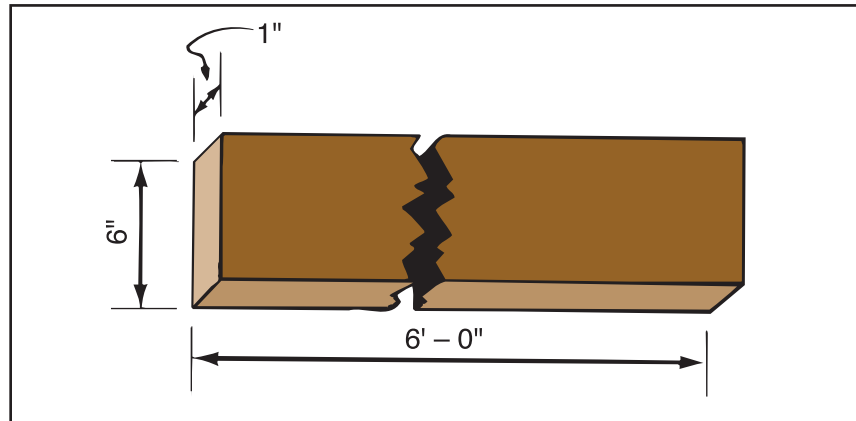
A. Cut the batter board stakes to the dimensions and configurations shown in Figure 2.

FIGURE 2



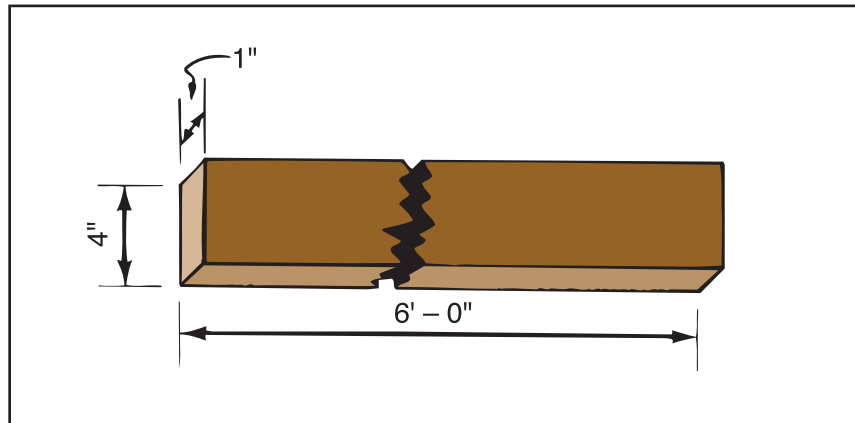
B. Cut ledger boards. (Figure 3)

FIGURE 3



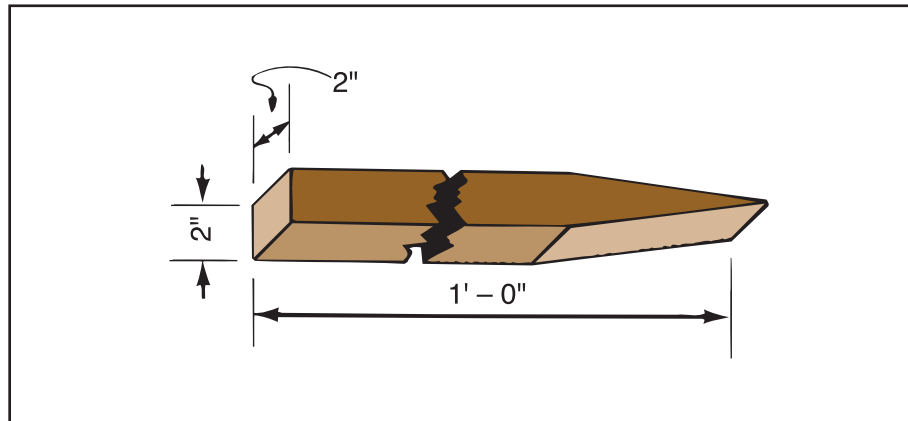
C. Cut braces. (Figure 4)

FIGURE 4



D. Cut the corner stakes to the dimensions and configurations shown in Figure 5.

FIGURE 5



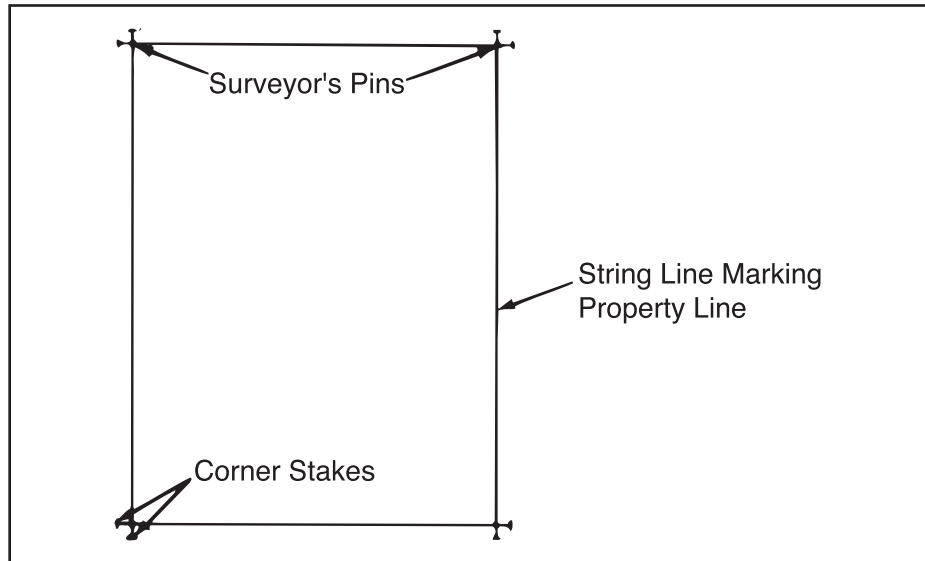
Yes No

2. Mark the property lines with the string line.
- A. Locate the surveyor's pins marking the four corners of the property.
 - B. Set the corner stakes beside the surveyor's pins. (Figure 6)
 - C. Attach the string line to the corner stakes. (Figure 6)

✓ **NOTE:** Leave the property string line in place until the exact building lines have been established.



FIGURE 6

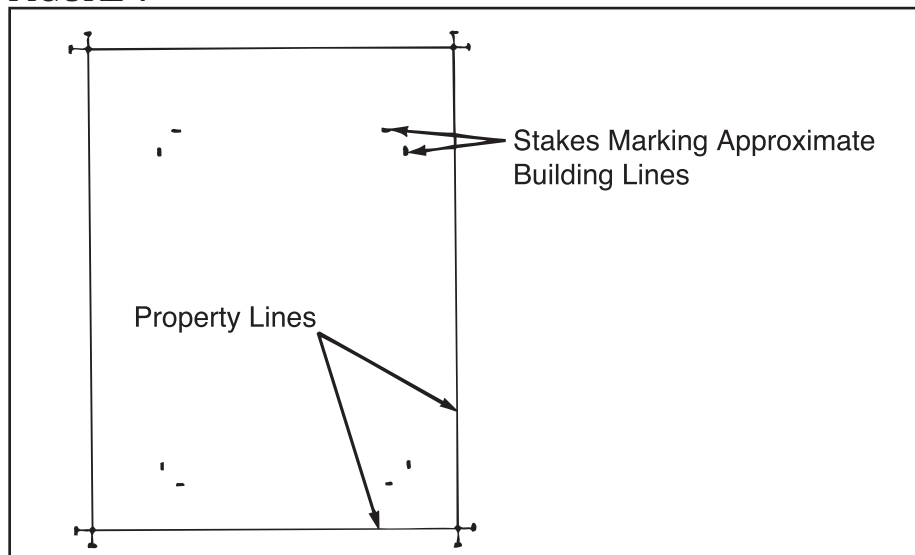


Yes No

3. Mark the approximate location of the building lines with the string line.
- A. Using the property lines and the plot plan as reference, measure to determine the approximate location of the building lines; mark the approximate building lines by driving at least two stakes along each line. (Figure 7)

✓ **NOTE:** Nails or other temporary markers may be used to mark these lines.

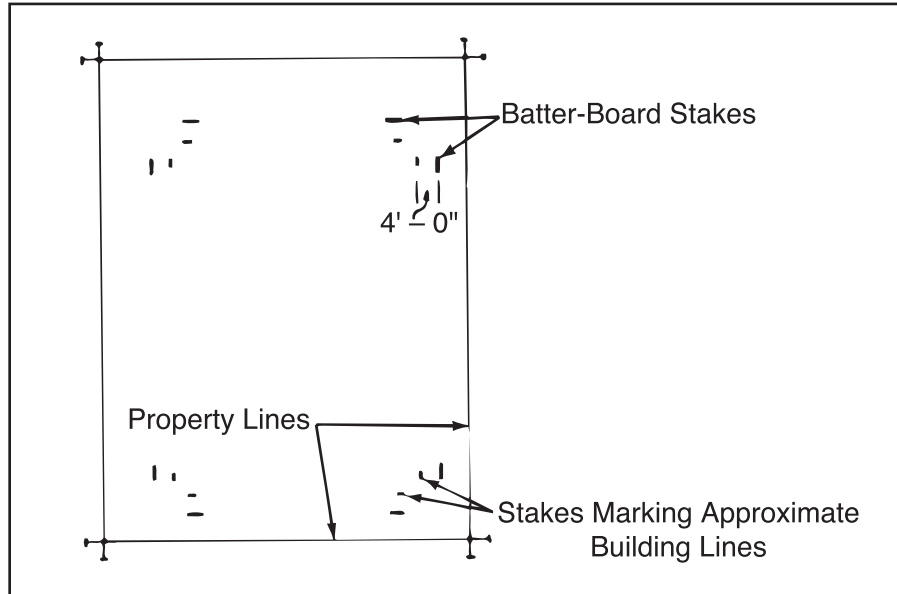
FIGURE 7



- B. Erect the batter boards.
- C. Measure a point at least 4 feet behind each stake marking the approximate building lines; drive a batter board stake at each point. (Figure 8)

✓ **NOTE:** When setting batter board stakes for large structures, set the stakes at least 20 feet outside the approximate building lines to leave work room for heavy equipment.

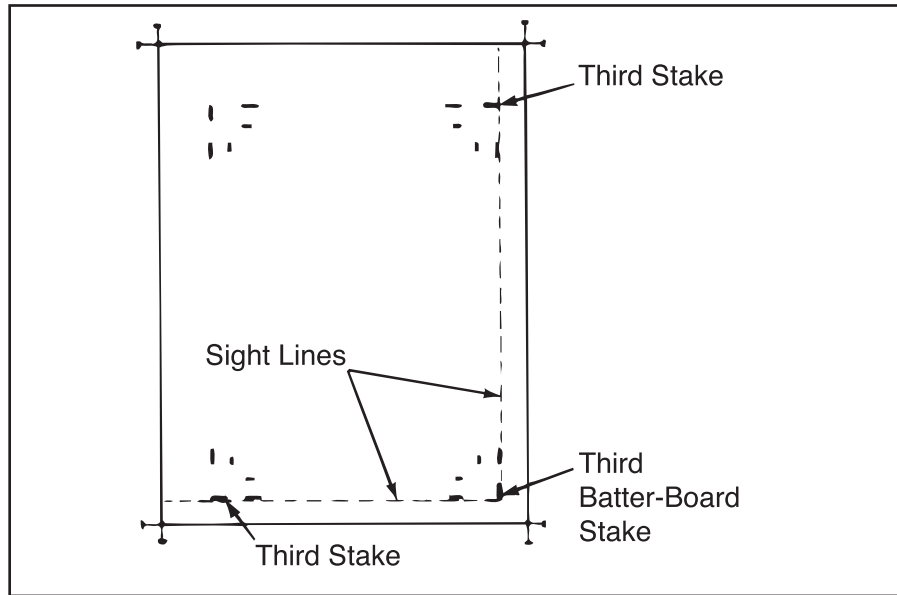
FIGURE 8



- D. To determine the location of the corner stake for each batter board, sight a line parallel to the two batter board stakes on each line of angle; drive the third batter board stake where the two lines intersect. (Figure 9)



FIGURE 9



- E. Use the builder's level to establish the elevation on each batter board stake.
- F. Nail the ledger boards at the correct elevation on the batter board stakes. (Figure 10)
- G. Nail the braces to the batter board stakes if necessary. (Figure 10)

✓ **NOTE:** Braces are used when the soil is loose or when the batter board stakes must be taller than 3 feet.

FIGURE 10

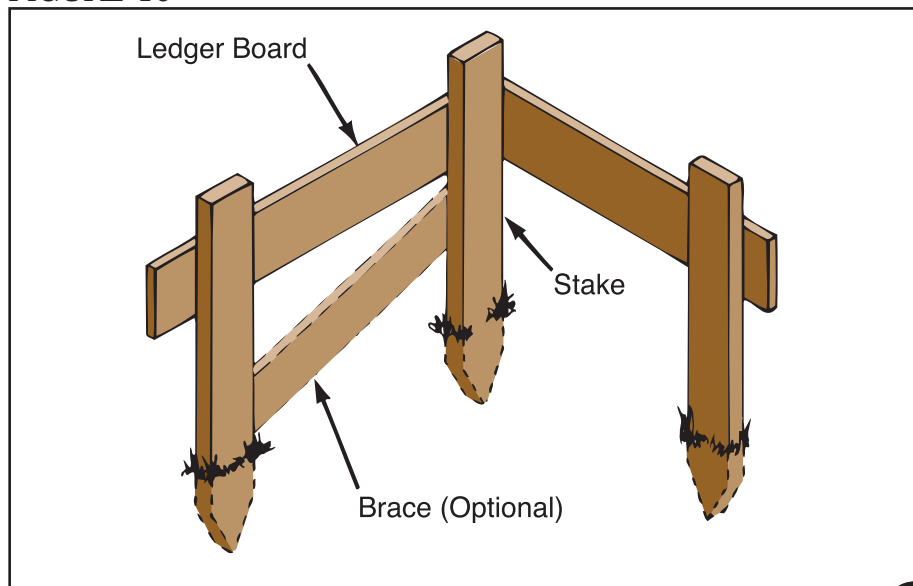
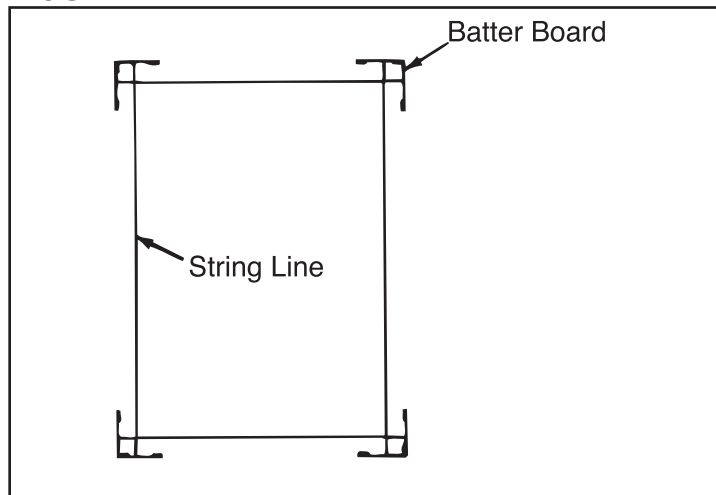
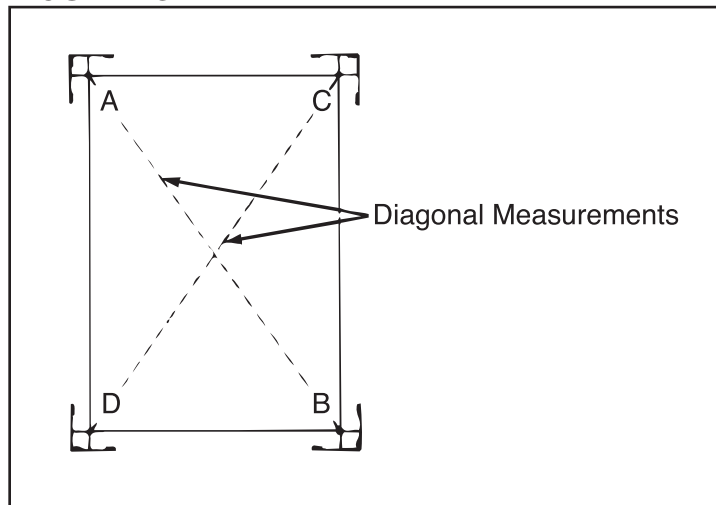


FIGURE 12



- C. Check the squareness of the corners by using diagonal method (Figure 13), 3-4-5 method (Figure 14), or the transit method (Figure 15), and adjust the string lines as necessary.

FIGURE 13



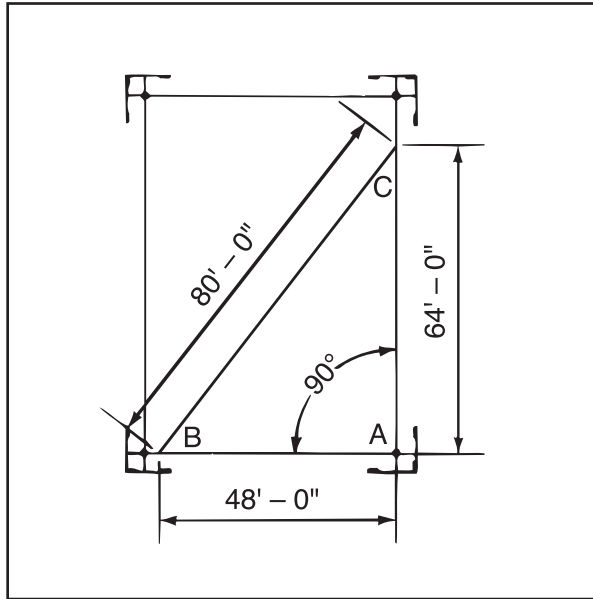
Diagonal Measurements

If the corners of the building lines are square, both diagonal measurements (line AB and line CD) will be exactly the same.

✓ **NOTE:** Be sure that the dimensions on the sides are exactly the same as the ones on the opposite sides.

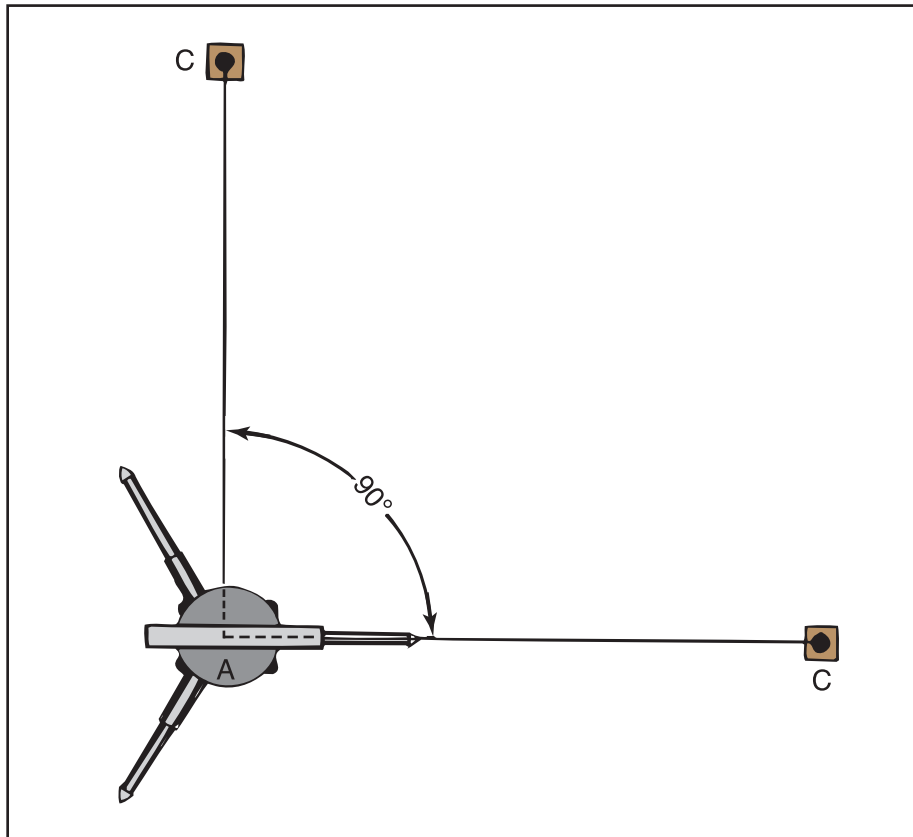


FIGURE 14



If angle A is square and the measurements are exact, line BC will measure exactly 80 feet (using the 48-64-80 multiple of 3-4-5).

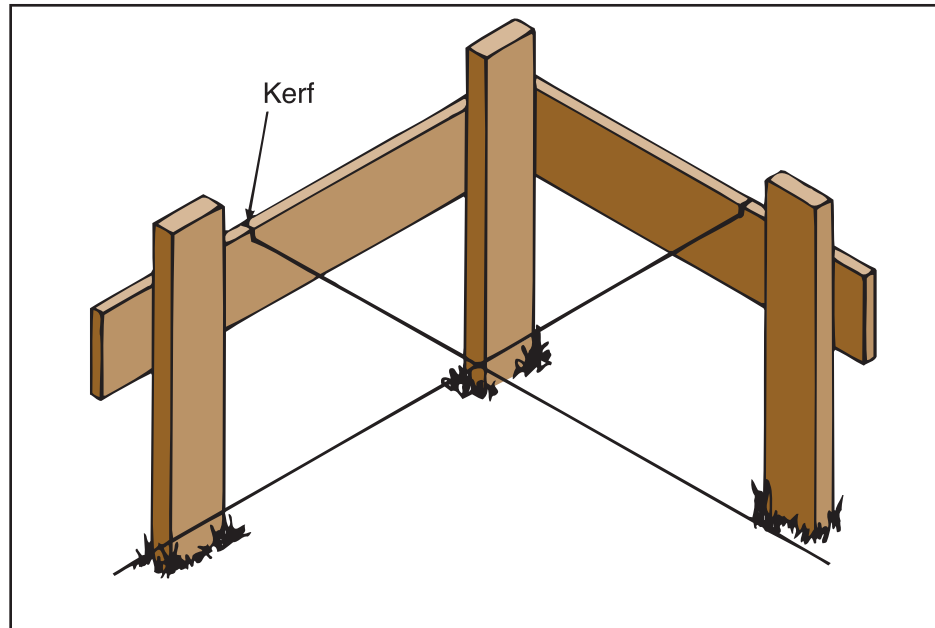
FIGURE 15



If angle A is square, when the instrument is at point A and sighted at point B on line AB, the 360-degree scale will indicate that a 90-degree arc has been completed at line AC.

- D. After corners have been squared, saw a kerf in the ledger boards at the exact squared location; attach the string to the kerf to keep the string from shifting. (Figure 16)

FIGURE 16



Yes No

5. Have the instructor check your work.
6. Clean the work area and return tools and equipment to proper storage.



SKILL TEST RECORD

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

<u>Batter boards correct and solid</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
<u>Layout on batter boards is square</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
<u>Corners of building lines are square</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>

AVERAGE RATING

Evaluator note: To obtain an average rating for the Profile of Training Mastery, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

- 4 Skilled** — Can perform job with no additional training
- 3 Moderately Skilled** — Has performed job during training program; limited additional training may be required
- 2 Limited Skill** — Has performed job during training program; additional training is required to develop skill
- 1 Unskilled** — Is familiar with process, but is unable to perform job

EVALUATOR'S COMMENTS



Name _____ Score _____

OBJECTIVE 7

Lay out footings for a structure.

BASIC SKILLS



Reading



Mathematics



Employability

**EQUIPMENT
AND SUPPLIES**

- Foundation plan and floor plan
- Sledgehammer
- Claw hammer
- Crosscut hand saw
- Power handsaw and extension cord equipped with a ground-fault circuit interrupter



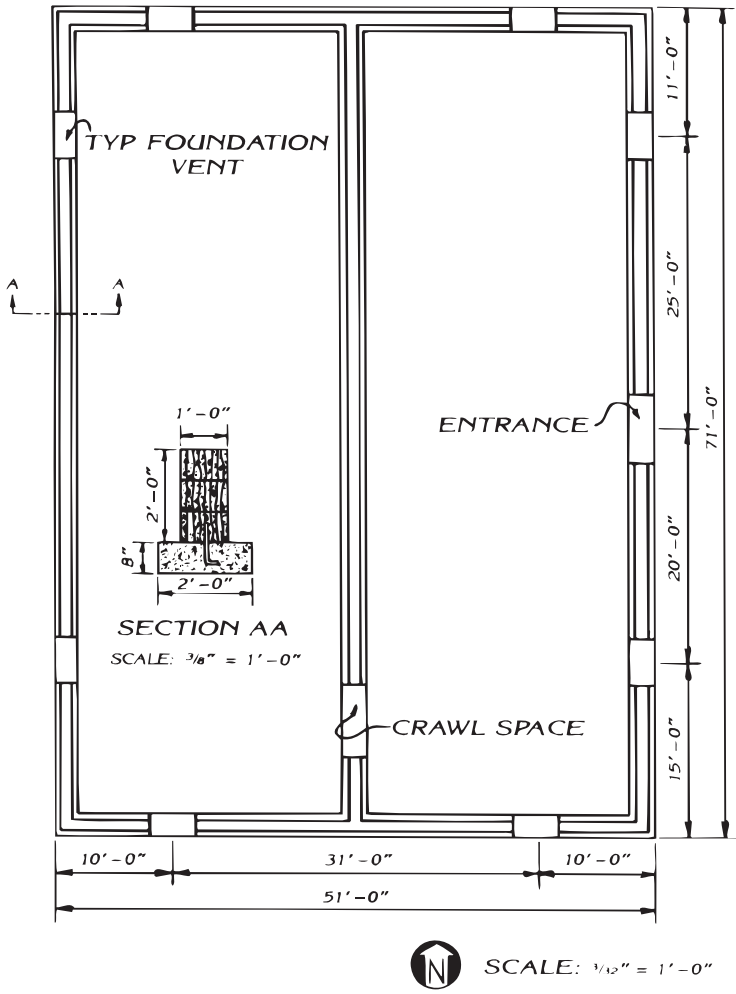
CAUTION: Wear eye protection when operating power handsaw.

- Folding rule or metal tape
- Builder's level and rod
- Plumb bob
- String line
- Pencil
- Corner stakes, 2" x 2" x 12"
- Footing-line stakes, 2" x 4" x 18"
- 8d box nails
- Form boards
- Material for spreader boards
- Personal protective equipment

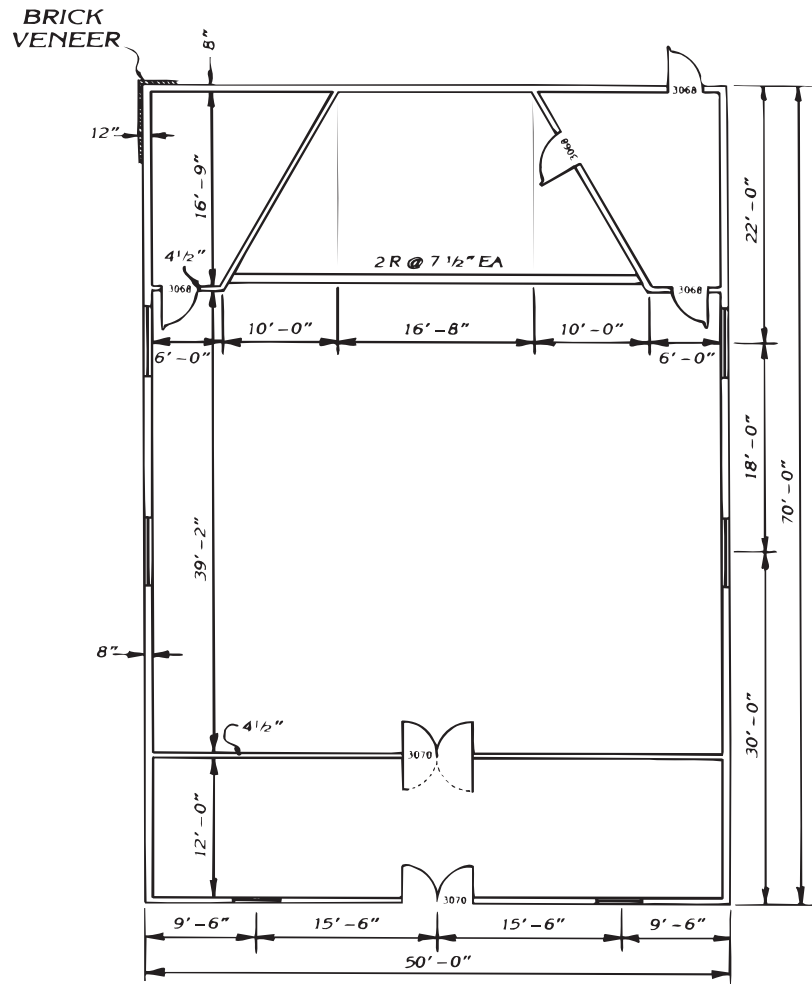
✓ **NOTE:** Refer to C.F.R. 1926.28 Sub part C in regards to Personal Protective Equipment.



FOUNDATION PLAN



FLOOR PLAN



SCALE: 3/32" = 1'-0"

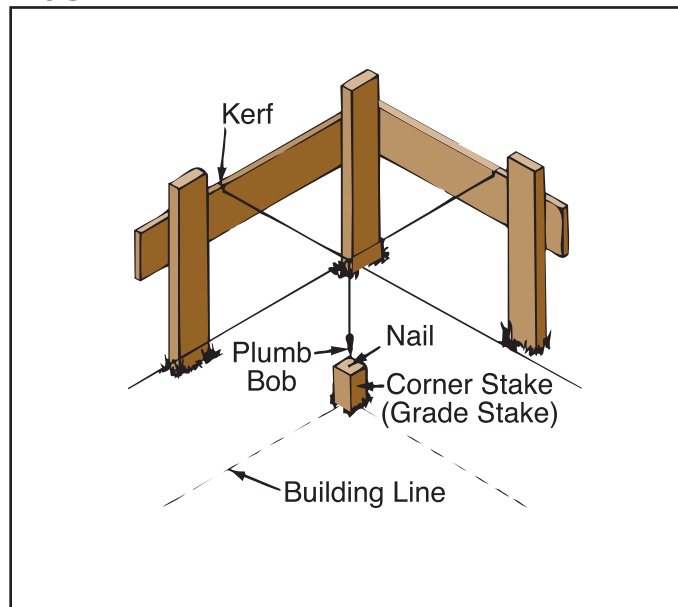


PROCEDURE

Yes No

- 1. Locate building lines. (see Job Sheet 1).
- 2. Locate and drive the grade stakes.
 - A. Plumb down from the intersection of the string lines marking each corner of the building lines; drive the corner stakes (grade stakes) at these points. (Figure 1)
 - B. Use a builders level to establish grade.
 - C. Drive a nail in the top of each grade stake to locate exact point of intersection. (Figure 1)

FIGURE 1



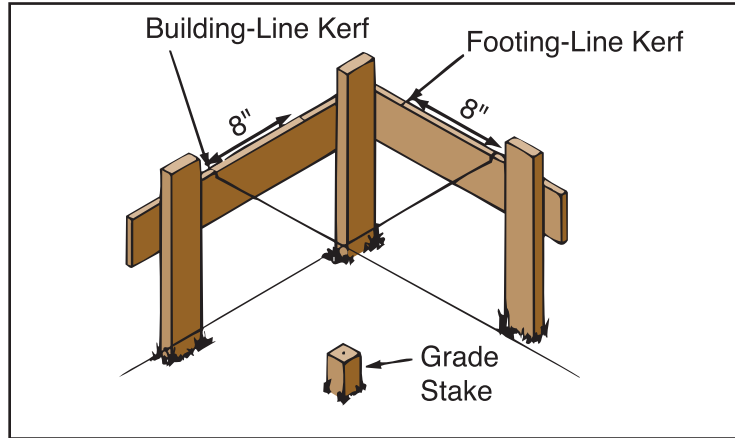
- 3. Establish the footing lines on the batter boards.
 - A. Determine from the foundation plan and floor plan how far outside of the building lines the footing forms will extend.
 - ✓ **NOTE:** Since footings are 2 feet wide and the finished walls are 8 inches thick, the footing lines will have to be set 8 inches both ways from the building lines.



Yes No

- B. Measure over 8 inches from building-line kerf; mark this measurement on top of the batter boards and a saw kerf on this mark. (Figure 2)

FIGURE 2

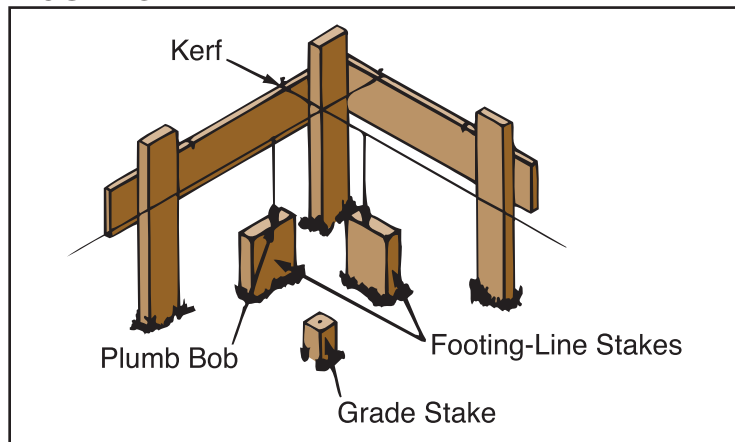


- C. Drive a nail into the ledger board at kerf.
✓ NOTE: The nail at this point will help distinguish the footing line from the building line.
- D. Perform this procedure on all batter boards.
- E. Move the string line from the building-line kerfs to footing-line nails and stretch from one footing-line nail to the next, continuing around the proposed structure.

4. Set form stakes.

- A. Use the plumb bob to locate the position of the footing-line stakes at each corner of the proposed structure. (Figure 3)

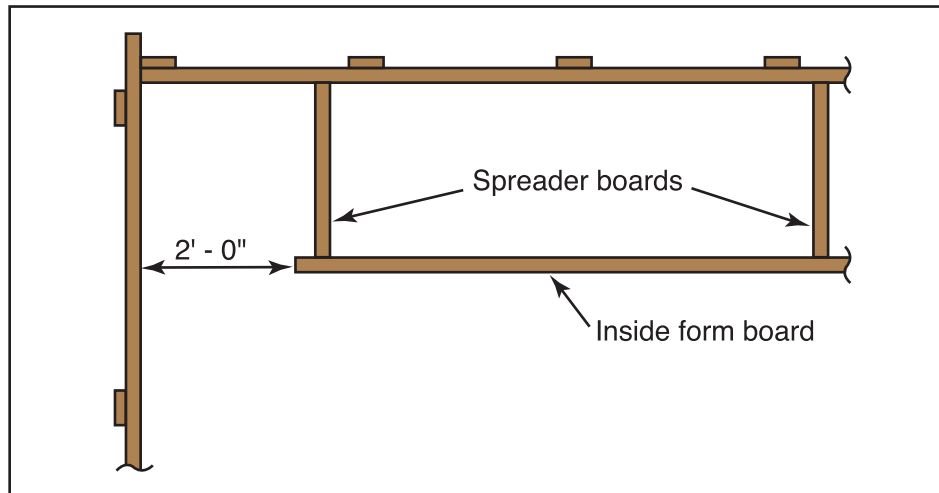
FIGURE 3



Yes No

- B. Transfer grade from grade stakes to the footing-line stakes.
- C. Remove the grade stakes.
- D. Attach a string line to stakes; stretch the line tightly from one footing-line stake to the one on the opposite end of the footing; center the line on the grade that was transferred to those stakes.
- E. Lay out form boards along the footing line.
- F. Holding the form to line, drive the stakes to grade and nail at correct elevation.
- G. Cut two spreader boards 2 feet long and place them against the outside forms; set the inside form board against these spreaders. (Figure 4)

FIGURE 4



- H. Set stakes for the inside form.

✓ **NOTE:** When driving stakes against the inside form, drive stakes straight down so that there is no force against the form which would tend to move the outside form out of line.

- I. Continue setting stakes and nailing forms to grade until all the forms are set.

- 5. Have the instructor check your work.
- 6. Clean the work area and return tools and equipment to proper storage.



SKILL TEST RECORD

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

<u>Footing forms are straight and solid</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
<u>Forms are correct distance apart</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
<u>Forms are on grade</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>

AVERAGE RATING

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EVALUATOR'S COMMENTS





Name _____ Score _____

OBJECTIVE 8

Set grade stakes for footings without forms.

BASIC SKILLS



Reading



Mathematics



Employability

EQUIPMENT AND SUPPLIES

- Foundation plan
- Sledgehammer
- Builders level and rod
- Folding rule or metal tape
- 30 each — 18-inch-long reinforcing bars (rebars) to use as grade stakes

✓ **NOTE:** x 4 or 1 x 4 stakes could also be used as grade stakes.

- Personal protective equipment

✓ **NOTE:** Refer to C.F.R. 1926.28 Sub part C in regards to Personal Protective Equipment.

PROCEDURE

✓ **NOTE:** After footings have been excavated, it is necessary to set grade stakes for concrete.

Yes No

1. In the center of the footing excavation, drive stakes every 8 feet to 10 feet.
2. Set each stake at grade.
- A. While an assistant shoots the grade with a builder's level, hold the rod on top of the stake.
- B. Remove the rod and drive the stake with the sledgehammer until the top of the stake is approximately on grade.
- C. Hold the rod on top of the stake and check the grade.



Yes No

D. Continue driving the stake and rechecking the grade until the stake is on grade.

E. Continue this procedure until all grade stakes are driven and on grade.

3. Have the instructor check your work.

4. Clean the work area and return tools and equipment to proper storage.



SKILL TEST RECORD

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Stakes proper distance apart and in center of footing	4	3	2	1
Top of stakes are on grade	4	3	2	1
Time standard for a 4 rating is 1 hour or less	4	3	2	1

AVERAGE RATING

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EVALUATOR'S COMMENTS



