

## UNIT IV - CONCRETE

### Lesson 7: Pouring Concrete Walls

**Competency/Objective:** Describe the procedure for pouring a concrete wall.

#### **Study Questions**

1. What tools are needed for pouring walls?
2. What are the form types available for walls?
3. How are forms constructed for walls?
4. How should reinforcement be installed in walls?
5. What are the procedures for pouring a wall?
6. What are methods of preventing water from entering a structure?

#### **References**

1. *Agricultural Structures (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1999, Unit IV.
2. Transparency Masters
  - a) TM 7.1: Plywood Forms
  - b) TM 7.2: Parts of a Form
3. Job Sheet
  - a) JS 7.1: Preparing Forms for a Concrete Wall



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### Lesson 7: Pouring Concrete Walls

#### TEACHING PROCEDURES

##### **B. Review**

Lesson 6 described procedures for curing concrete. So far in this unit, the focus has been on working with concrete slabs. Lesson 7, however, describes the construction of concrete walls. In particular, the construction of forms and the procedures used for pouring a concrete wall are discussed.

##### **C. Motivation**

Ask students how pouring a concrete wall would be similar to pouring a slab and how it would be different. Then ask them what problems might occur when pouring a wall that would not happen with a slab.

##### **D. Assignment**

##### **E. Supervised Study**

##### **F. Discussion**

1. When pouring a concrete wall, a number of tools are needed to do the job correctly. Have students list these tools.

##### **What tools are needed for pouring walls?**

- a) Trowel
  - b) Steel tamp rod
  - c) Shovel
  - d) Hand level
  - e) Tape measure
  - f) Circular saw
  - g) Hammer
2. Several types of forms can be used to construct a wall. Discuss the different types of forms. Use TM 7.1 to illustrate plywood forms.

##### **What are the form types available for walls?**

- a) Wood
  - 1) Most commonly used material
  - 2) Constructed of plywood made with an exterior glue

- b) Aluminum or metal
    - 1) Produce straighter walls because the metal does not bend from the weight of the concrete as much as wood does
    - 2) More expensive than plywood forms
  - c) Styrofoam
    - 1) Made of Styrofoam with steel mesh embedded in it to add strength to the form
    - 2) Is not removed after the concrete is poured; becomes a permanent part of the wall
    - 3) Have several advantages and disadvantages
      - (a) Advantages
        - (1) Less labor required
        - (2) Allows for construction in all types of weather
        - (3) Lightweight and snap together for easy construction
        - (4) Less bracing required
        - (5) Can run wiring and pipes through the forms easily
        - (6) Energy efficient
        - (7) Can be finished or painted with exterior paint
      - (b) Disadvantages
        - (1) Not reusable
        - (2) Much more expensive than wooden forms and slightly more expensive than the metal forms
3. Ask students how they would build forms to pour a concrete wall. TM 7.2 shows the different parts of a form. If possible, show them a sample snap tie and holder. Hand out JS 7.1.

### **How are forms constructed for walls?**

- a) Wood forms have several parts.
  - 1) Stake
    - (a) Typically made from a 2" × 4" board
    - (b) Placed 4 feet apart or less for strength
  - 2) Brace - Nailed to the stake and the form to help keep the forms vertical
  - 3) 1" x 4" tie - Keeps the two sides of the form apart to give the wall the desired thickness
  - 4) Sheathing
    - (a) Forms the sides of the form
    - (b) Typically made of plywood
  - 5) Wale
    - (a) 2" × 4" board that prevents the wall from bulging outward from the weight of the concrete
    - (b) Nailed to the form with the wide side down
  - 6) Holder
    - (a) Holds wales and snap ties in place
    - (b) Placed over the snap ties, and then wales are placed in the holder

- (c) Holds the entire form together
  - 7) Snap tie
    - (a) Specially constructed pieces of wire that run through the wall
    - (b) Helps hold the forms the correct width apart
    - (c) Has a wider spot that allows the holder to clamp tight on it without slippage
  - 8) Spreader
    - (a) Typically consists of a 2" × 4" board cut to a length that is equal to the thickness of the wall
    - (b) Placed inside the form to keep its sides apart while the concrete is poured
  - 9) Wire tie
    - (a) Hold the forms the correct width apart
    - (b) Used on the ends of a form
    - (c) Constructed of twisted wire
  - 10) Key - Groove made in a footing that allows the concrete from the walls to bond to the concrete in the footing
  - 11) Marker nails - Driven through the form from the outside to mark the desired height of the concrete if it will not be poured to the top of the form
  - b) Start by standing the sheathing upright where the wall will be poured.
  - c) The holders, snap ties, and wales should be put on to hold the two sides together.
  - d) Spreaders can be added on the inside of the form.
  - e) Stakes are placed in the ground about 5 to 8 feet away from the form.
  - f) The braces are cut to the correct distance to reach the stakes.
  - g) The form should be checked using a level to make sure it is level and plumb.
  - h) The braces are nailed to the forms and the stakes to hold the forms in the correct position.
  - i) The wire ties are placed on the ends of the forms
  - j) The 1" x 4" ties are secured to the ends of the forms with duplex-head nails.
  - k) The forms must be square, because if they are not the building will not be square; the diagonal method is used to check whether they are square.
  - l) All of the pieces on the form must fit tightly together, and the forms must be strong, so they should be checked for weak spots prior to pouring the concrete.
    - 1) Usually occur at corners or where two forms meet
    - 2) Can be braced using additional 1" x 4" ties and duplex-head nails attached diagonally across the corners, or across the joint where the forms meet
  - m) High quality lumber must be used in constructing forms because weak spots from cracks, knot holes, or other problems will reduce the strength of the form.
4. Once forms have been constructed, reinforcement should be added in the walls to make them stronger. Ask students how they would reinforce the walls. How should the rebar be inserted?

### **How should reinforcement be installed in walls?**

- a) Walls are typically reinforced with rebar.
  - b) The rebar should be placed in the middle of the wall at an equal distance from each side of the form.
  - c) It should not stick out the top.
  - d) Rods are placed length-wise through the walls, spaced 8 to 12 inches apart.
  - e) Rods are driven vertically in the ground every 4 feet to support the horizontal rods.
  - f) The vertical and horizontal rods are tied together using thin wire.
5. Once the reinforcement is in place, it is time to pour the concrete. Ask students how they would fill the forms. Where would they start? How would they level the concrete? How is a structure connected to the concrete used in a foundation?

**What are the procedures for pouring a wall?**

- a) Before filling the forms with concrete, they should be lightly oiled to prevent the concrete from sticking.
- b) The concrete is then poured from one end or corner, working along the wall, with the corner being filled before moving on.
- c) Enough concrete should be poured in one spot to fill the form before moving so that the concrete does not have to be shoveled backward to fill low spots.
- d) Spreaders must be removed as the form is filled.
- e) When the form is filled to the desired level, the steel tamp rod is run up and down through the concrete to help work out air bubbles.
- f) After each of the walls has been poured, the top surface of the concrete must be smoothed and leveled using a small trowel or a board cut the width of the wall; the tool is worked along the top of the forms in a process similar to screeding.
- g) After the first wall has been leveled and smoothed and the surface starts to dry, anchor bolts can be inserted into the concrete.
  - 1) Standard bolts placed with the head of the bolt in the moist concrete to anchor the wooden portion of the structure
  - 2) At least  $\frac{1}{2}$  of an inch in diameter and typically 4½ to 5 inches long
  - 3) Generally set at least 2 inches into the concrete
  - 4) Straight when placed in the concrete
  - 5) Spaced 4 to 6 inches apart along each side of the building, with one bolt set in from the corner near each end of a wall; the distance between them depends on wind loads
  - 6) Placed where they will not interfere with the upright studs in the walls
- h) Before the forms are removed, concrete walls should cure for at least one week, preferably longer.
- i) When the concrete has cured enough, the forms are removed.
  - 1) Loosen all holders and wales
  - 2) Remove braces and stakes
  - 3) Remove sheathing
  - 4) Twist snap ties back and forth until they break or snap off
  - 5) Fill holes left in the concrete by wire ties with cement paste

6. Ask students what can be done to prevent water from entering a structure.

**What are methods of preventing water from entering a structure?**

- a) Vapor barrier - specially constructed protective material attached to the inside of the underground portion of a concrete wall to eliminate condensation
- b) Waterproofing materials
  - 1) Painted on the outside of a wall
  - 2) Typically made of polyurethane, rubber, tar, or other waterproofing compounds
  - 3) May also consist of a layer of polyethylene plastic glued to the outside of the wall that will repel water from the soil
- c) Waterstop - synthetic material placed between concrete construction joints to stop water from entering through the joints
- d) Drainage pipes - placed around the structure to move excess water away

**G. *Other Activities***

Observe a concrete wall being poured at a construction site. Discuss the construction of the forms and the techniques used when pouring the concrete.

**H. *Conclusion***

Pouring concrete walls is a common task in constructing buildings, especially for houses with basements or crawl spaces. Constructing the forms correctly will make for straighter, stronger walls that will make building the structure much easier. Pouring the concrete in the forms is a relatively easy task, although it is necessary to carefully work out all air bubbles and smooth the top surface. After one week, the forms can be removed, and other construction can continue.

**I. *Answers to Activity Sheet***

**J. *Answers to Evaluation***

- 1. a
- 2. c
- 3. b
- 4. d
- 5. Wood, metal, or Styrofoam
- 6. To keep the concrete from sticking to the form
- 7. At corners or where two forms meet
- 8. Students should give answers similar to the following.
  - a) Prevents the wall from bulging outward from the weight of the concrete
  - b) Helps hold the forms the correct width apart

- c) Marks the desired height of the concrete if it will not be poured to the top of the form
- 9. Answers may include any two of the following: trowel, steel tamp rod, shovel, hand level, tape measure, circular saw, or hammer.
- 10. Standing the sheathing upright where the wall will be poured



EVALUATION

**Circle the letter that corresponds to the best answer.**

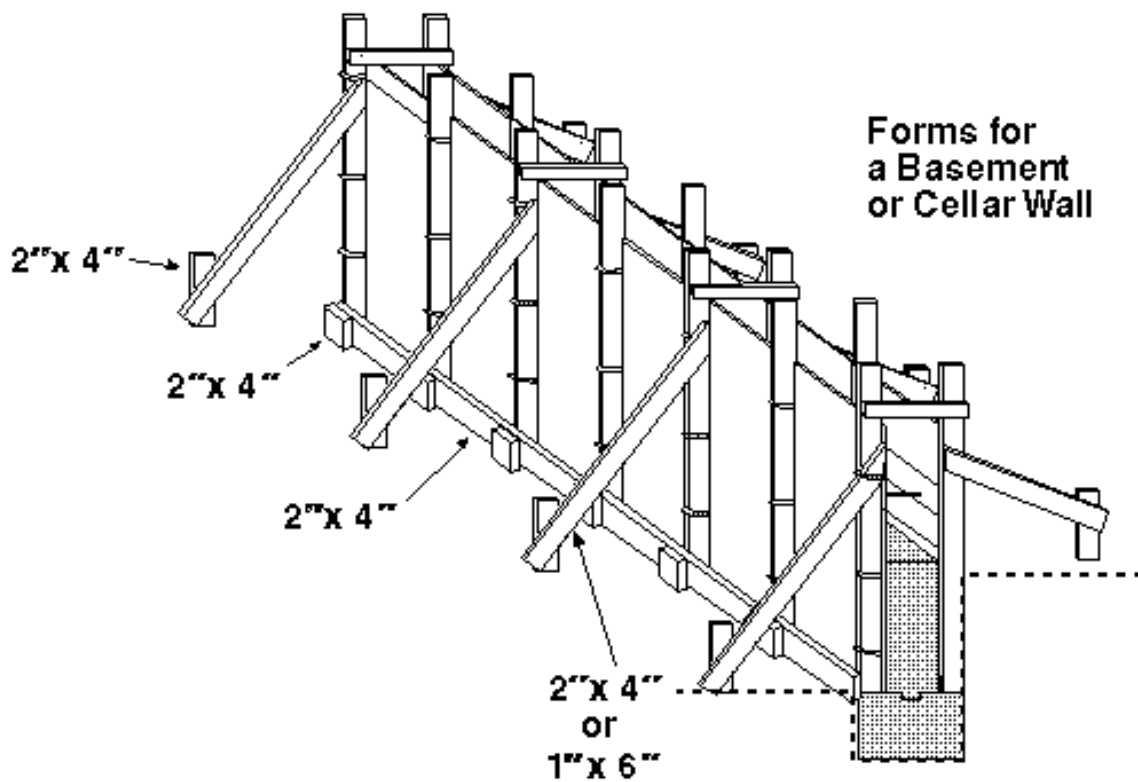
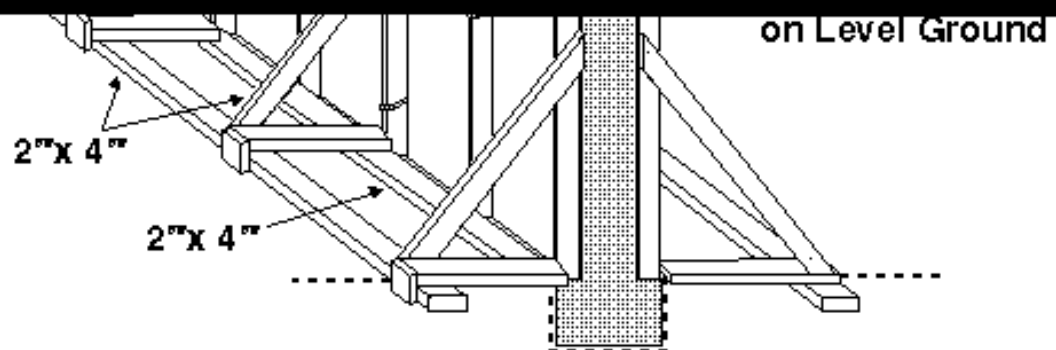
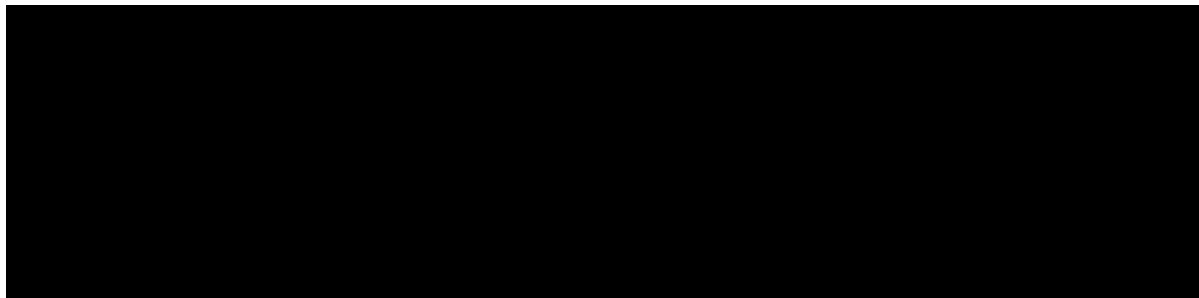
1. The protective material attached to the inside of the underground portion of a concrete wall to eliminate condensation is called:
  - a. Vapor barrier.
  - b. Water stop.
  - c. Water repellant.
  - d. Moisture barrier.
2. What connects the wooden portion of a house or building to the concrete?
  - a. Metal straps
  - b. Weight
  - c. Anchor bolts
  - d. Wood screws
3. How far apart should the rebar be placed inside the wall to reinforce it properly?
  - a. 4 to 8 inches
  - b. 8 to 12 inches
  - c. 12 to 16 inches
  - d. 16 to 20 inches
4. Concrete in walls should be allowed to cure for a minimum of:
  - a. 1 day.
  - b. 3 days.
  - c. 5 days.
  - d. 1 week.

**Complete the following short answer questions.**

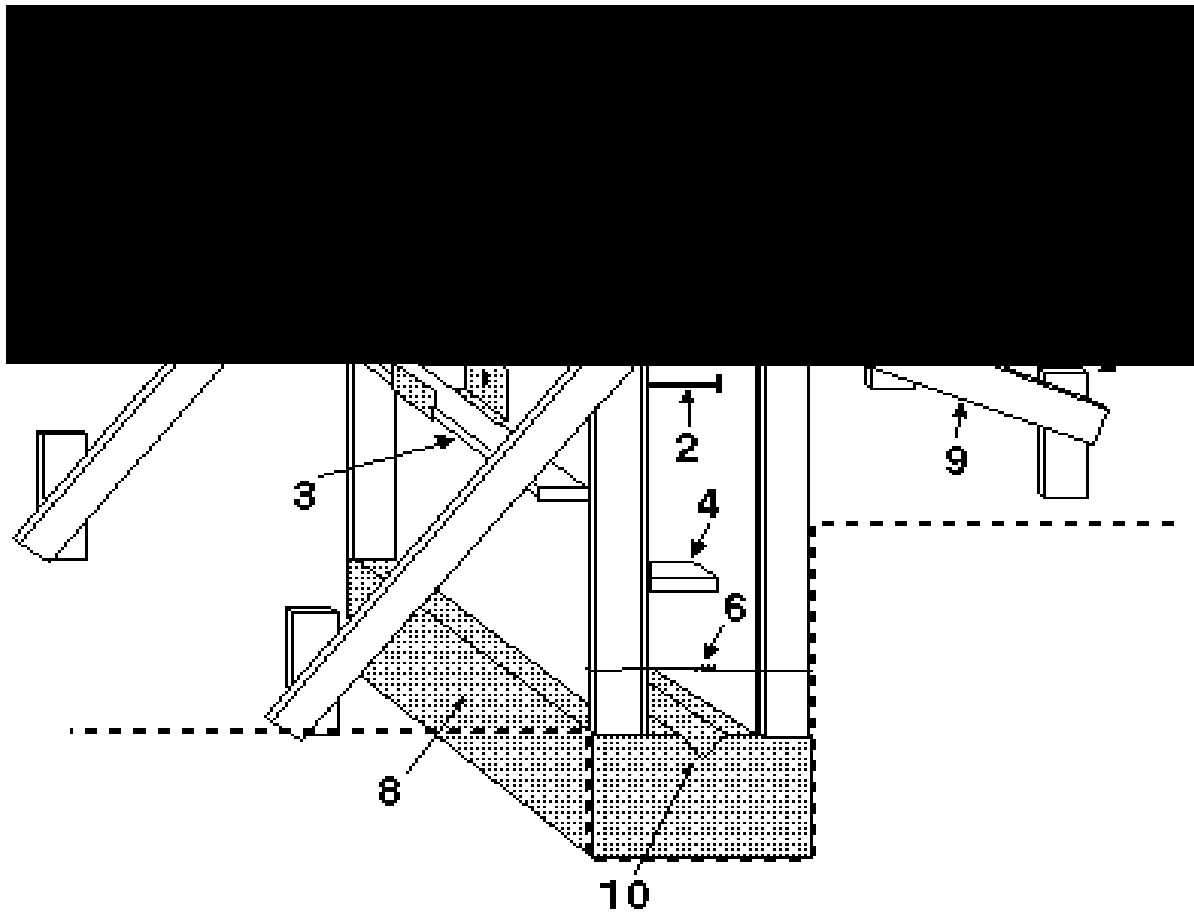
5. What are the three main types of wall forms?
  - a.
  - b.
  - c.

6. Why should forms be lightly oiled before the concrete is poured?
7. Where do weak spots usually occur on forms?
8. What is the purpose of each of these parts of a wall form?
  - a. Wale -
  - b. Snap tie -
  - c. Marker nail -
9. What are two tools needed for pouring concrete walls?
  - a.
  - b.
10. What is the first step in assembling forms?

# Plywood Forms



## Parts of a Form



- |              |                 |
|--------------|-----------------|
| 1. Holder    | 7. 1" x 4" Tie  |
| 2. Tie Snap  | 8. Footing      |
| 3. Wale      | 9. Brace        |
| 4. Spreader  | 10. Key         |
| 5. Sheathing | 11. Stake       |
| 6. Tie Wire  | 12. Marker Nail |



## Lesson 7: Pouring Concrete Walls

Name \_\_\_\_\_

**Preparing Forms for a Concrete Wall****Objective:** Construct and set up the forms to pour a concrete wall.**Materials and Equipment:**

Plywood  
16d duplex-head nails  
4 snap ties  
8 snap tie holders  
2 8-foot 2" × 4" boards for wales and braces  
1 4-foot 1" × 4" board for ties  
Wire for wire ties  
2" × 4" scraps for spreaders  
Electric drill and bits  
Level

**Procedure:**

1. Using the plywood provided, cut the sheathing for the two sides of the form. The wall should be 4 feet by 4 feet.
2. Using the drill, drill holes for the snap ties in the sheathing. Drill the holes to provide maximum strength by using only four snap ties.
3. Place the snap ties through the holes, and place the holders over the ends of the snap ties.
4. Add spreaders inside the form.
5. Add wales to the outside of the form.
6. Nail the 1" × 4" ties to the end of the form.
7. After setting the forms in the location indicated by your instructor, drive stakes in the ground about 4 feet from the bottom of the form.
8. Cut four braces to run from the top and bottom of the form to the stakes at each corner.
9. Using the level to check that the forms are straight, nail the braces to the form and stakes.
10. Double check to make sure that everything fits tightly and is square.
11. If your instructor permits, as an additional challenge, construct forms in cooperation with another group to form a 90-degree corner from the two forms.

