

# 130 - Foundation Form Set

## Material and Tools Needed:

1. Foundation Form Panels, Inside and outside Corners
2. Foundation stakes and bracing bars
3. 20 ft rebar sticks
4. Rebar ties, bender/cutter and spin tools
5. Foundation bolts
6. Wall tie down anchors – if specified by engineer
7. Foundation tie wires (correct size for foundation thickness specified by engineer)
8. 6D nails, 16D duplex nails.
9. Long 2x4 for whalers (horizontal braces running length of the foundation wall at top and bottom on outside of outside form). 8-10 ft 2x4s for diagonal braces
10. Laser level

## Most Common Mistakes:

1. Foundation dimensions do not match plan, not square or not level
2. Foundation is not where specified by surveyors.
3. Rebar is not evenly spaced between forms (too close to one side of forms) – especially at corner or doesn't have sufficient space in between.
4. UFER (ground rod) is forgotten

## Roles

1. Corner set team (2 staff)
2. Form setting teams (6-10 staff)
3. Concrete pump hose handler (1)
4. Rough level team (2-3)
5. Finish level team (2-3)

## Construction:

The following describes a simple rectangular foundation. If you have a foundation that has bump-outs and other more complex ins and outs, try to follow the process below for the largest rectangle in the foundation. After you have it properly located and square, measure offsets from that rectangle to create the other intersections and ins and outs.

The general “science” of foundation forms is to set and brace the outside forms so that they are rigid and do not move under the stress of heavy wet concrete. The inside forms are tied to the outside by the tie-wires. They expand inward under the weight of the concrete, stretching the tie wires tight. There is no bracing of the inside forms.

A foundation can be done 2 ways, depending on the bearing capacity of the soil, as determined by the soils engineer. If the bearing capacity is good, a somewhat wider foundation can be poured in one step. If the bearing capacity is poor, a wide spread footer needs to be poured, followed by a more narrow foundation being set on top of the spread footer.

If a spread footer was set prior to this work, you can do step 1 and skip to about step 6. The spread footer should have been located per the surveyor's marks. You need to snap lines on the spread footer for the outside of the bottom whaler. Then, shoot the bottom whaler to the footer using the rimfire nailer.

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1. While one team works on locating the foundation from survey stakes and setting the corners, another team can be oiling the forms. Use a rag and a small bucket for form release oil. Set each form up on a pair of saw horses and give each form a light coating of oil. Starting with the 32 inch forms, make pairs of oiled forms and take them into the hole in pairs. After all the 32 inch forms are used, make similar pairs of 24 inch forms.
2. Using the laser, verify the bottom of the excavation is flat. If there is a general tilt you will have to somehow shim the bottom of the forms at the low end. If there are some high points, you will have to dig them out to make the bottom acceptably level.
3. Nail together long 2x4s to make whalers for the bottom of each wall. Whaler should be the length of the wall plus 1.5 inches to allow for  $\frac{3}{4}$  inch form thickness at each end.
4. Before foundation form work begins, the surveyors will have set their stakes. Consult with construction manager to understand what stakes specify what points on the finished foundation. Typically, a pair of stakes will specify the outside of foundation for a given wall. Another pair of stakes will specify outside of wall for a perpendicular wall. From that, you can measure to find the other walls. So that the excavator can do his digging without tearing up the survey stakes, there may be an offset of several feet from the stakes to outside of wall.
5. Using the surveyor stakes, set string lines that are 6 inches beyond the outside of foundation.
6. Use a plumb bob to copy the corner intersections of your string lines to the bottom of the excavation. Mark with a nail. Do for all corners.
7. Using the heavy landscape chalk line, snap a line from each corner to each corner.
8. When you set your string line above, you offset outward by 6 inches. Measure in from your chalk-line by  $1\frac{3}{4}$  inches. That is a line that is the outside of the bottom whaler (6 inches minus  $3\frac{1}{2}$  inch for bottom whaler minus  $\frac{3}{4}$  inches for the thickness of the form) Snap new chalk lines.
9. Stake the bottom whaler with its outside edge on the 2<sup>nd</sup> chalk line you set above. This whaler is with its 3.5 inch side horizontal. Put a couple temporary stakes on the inside. Nail the whalers together at the corners.
10. Set corner forms and nail to the bottom whaler with 2 6d nails.
11. Attach the top whalers to these corner forms. Carefully align at the corners. If you get the upper and lower whalers attached dimensionally correct, it should be easy to get everything plumb. Insert a couple short scrap forms in the middle to reduce the sag of the top whaler. Nail the perpendicular whalers together at the corner with 2 16D duplex nails.
12. Attach 8-10 ft 2x4 braces to the top whalers in each direction at each corner. Drive stakes at the other end of these braces. Level the forms in both directions and nail the braces to the stakes.
13. You now have the outside corners of the foundation set. Double check dimensions and diagonals.
14. Fill in the forms in the outside of the wall. Insure you have enough of a given size form (mostly 24 in and 32 in) forms to make inside/outside pairs. If you do not watch this, you may have to later take things apart and redo them to have enough equal size inside/outside pairs.
15. Nail outside forms to top whaler using 6D nails. Maintain the same spacing from top of form to top of whaler. Remove any rock and dirt rubble at bottom of form. Dig as necessary if

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excavation is not level.

16. From the inside, insert tie-wires – 2 each on top, middle and bottom rows. A 2<sup>nd</sup> person runs foundation bars horizontally through the loops on these wires, on the outside of the form. Be aware of any blockouts in the foundation and do not put wires in that area. Blockouts are typically for garage doors, walk doors and beam pockets.

Bars should start and end in the middle of forms, not edge of forms. The top, middle and bottom bars should not all end in the same place. There should be some stagger.

17. Cut, bend and tie rebar. Consult with site supervisor. Typically, there are 2 on the upper wires and 2 on the lower. In areas of blockout, instead of on the upper wires, the rebar goes on the middle wires. Where there are rebar intersections, they must overlap each other by 18” minimum. Securely tie the rebar on the wire using tie wires and spin tool. There should be 3 equal spaces side to side (outside form to bar 1, bar 1 to bar 2 and bar 2 to inside form). Be sure, when you tie on the rebar that you keep the tie wires perpendicular to the form. Else, the tie wires will not align to the holes in the inside form.
18. Determine how high the concrete will be poured. This is usually determined by the construction manager. The foundation needs to be extend up 6 to 8 inches above the finish landscape grade. Estimating the finish grade at this early time is not easy. Snap a line on the outside form at the top of concrete point. Use the laser to be sure this line is level. Drive 6D nails through the form toward the inside on this line, about a foot apart. When concrete is poured these nails will be used as a gauge to get the top of concrete level and at the correct height.
19. Insert the inside forms. Start with the inside corner forms.

The routed-out slots in the “stock” inside/outside form pairs were done for an 8 inch wall thickness. We may or may not be doing 8 inch wall thickness. If the tie-wires are in slots for 8 inch wall, the forms will not swell out to the desired thickness, even if you put in the longer tie-wires. The foundation will end up pinched in the corner and then stretch out to the desired thickness a few feet out from the corner.

To handle this problem, new slots may need to be routed in the inside forms. This may result in the inside form extending further than the outside form on one or both sides. Do not trim the inside forms. Instead, find an older less valuable form and rip it so that form pairs line up for the remainder of the wall span.

All tie wires (6 for smaller forms, 9 for larger) must align to the holes in the inside form. Insert form bars, as done on the outside forms.

20. Set blockouts and/or beam pockets as necessary.
21. There are usually 1 or 2 mid-span beam support pads. Form these pads. The center of these pads lines up with the beam pockets in the foundation. Usually, these pads are reinforced with 5/8 rebar.
22. About every 4 ft set a 2x4 outside brace. Use the string line to insure forms are straight, nail brace to foundation stake, as you did on the corners.
23. If this foundation is going to be used with 1<sup>st</sup> floor floor joist in Simpson hangers (as contrasted to rimjoist sitting on top of the foundation), then it is more important that the inside edge of the foundation be straight and free of bulges in and out. If that is the case, attach an inside top

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whaler using 2 6D nails per foundation form.

24. Verify everything is straight and strong.
25. If there are any odd gaps between forms in the walls, cut strips from old scrap forms and screw in place.
26. If there are any gaps between the bottom of forms and the bottom of excavation, cut scraps to cover those gaps. Secure those scraps against the form using a steel stake.
27. Pour concrete. On a larger foundation, you use a concrete pump to evenly distribute the concrete from the truck to all areas of the forms. Level the wet concrete using the laser. Especially watch that the corners and other intersections are level.
28. Set bolts to be centered in the mudsill (typically 2x4 or 2x6), 2 inches high and 1 ft from corners and 4 ft for run of the wall. If this foundation will have the floor joist in hangers that are attached to the inside edge of the mudsill, you may have need to set 2 rows of bolts – one for the inside mudsill and one for the outside mudsill
29. After concrete is cured, snip the tie wires, remove the braces and whalers and remove the forms. Snap off the ends of the tie wires sticking out of the concrete.

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## Safety

- |    |                        |   |   |
|----|------------------------|---|---|
| 45 | Struck By              | Rimfire nailer powerful enough to penetrate most material   | Safety Glasses Required<br><br>Risk is that rimfire nail is propelled by a powder charge (like used in a gun). This is far more powerful than any other nail gun we use. A rimfire nail could blow right through wood walls or floors and strike someone quite some distance away.<br><br>Brief the team that rimfire is to fired only if set against wood that is directly against steel or concrete |
| 46 | Struck By              | Power tools sawdust or other objects shot toward eyes   | Safety Glasses required with any power tools  |
| 47 | Tools - Hand and Power | Circular Saw - wood propped between 2 supports, cut in the middle, blade is pinched, kickback causes injury | When using a circular saw, short end of the cut is left to fall away. Do not make a cut in-between 2 supported ends. If someone is holding the drop-away end, he/she must lightly support it, letting it sag as the cut is made<br><br>No cutting with wood propped over a worker's foot or supported by hand.  |
| 48 | Tools - Hand and Power | Circular Saw - arms, legs etc too close to cut  | Common practice among carpenters is to support the cut with their foot. This is not accepted practice at Habitat. Cut to be done on saw horses or otherwise supported away from body  |

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72	Power Tools	Lose control of router and cut arms, hands, etc	The router is a dangerous tool. The router bit is exposed. If a worker comes in contact with the spinning tip of the router, he/she could be badly hurt. Be careful that you not drop the router and that it has stopped before you set the tool down.
57	Lifting	lift too much, lift with back instead of knees, cause back strain	Site supervisor brief team to be cautious
60	Hazardous Material	Foundation forms are coated with form release oil. This makes it easier to remove the forms after the concrete has set. Foundation form oil can be irritating to skin, dangerous if spashed/sprayed in eyes and should not be inhaled.	Wear gloves when handling forms. The person spraying form oil should be careful to not spray on self or other workers. Wash with soap and water if it gets on your skin.
61	Hazardous Material	Concrete is semi caustic. It can cause substantial drying & cracking of skin.	Wear gloves when working with concrete. Wash your hands promptly if you get concrete on them.

I have heard and understood the briefings on how to use the tools required for this activity. I have heard and understood the methods we use to do this activity

Date \_\_\_\_\_

\_\_\_\_\_ Instructor Name \_\_\_\_\_ Signature

\_\_\_\_\_ Name \_\_\_\_\_ Signature