Part II

Building Stem Wall Foundations

Continuous steel reinforcement ties the poured concrete walls to the footings

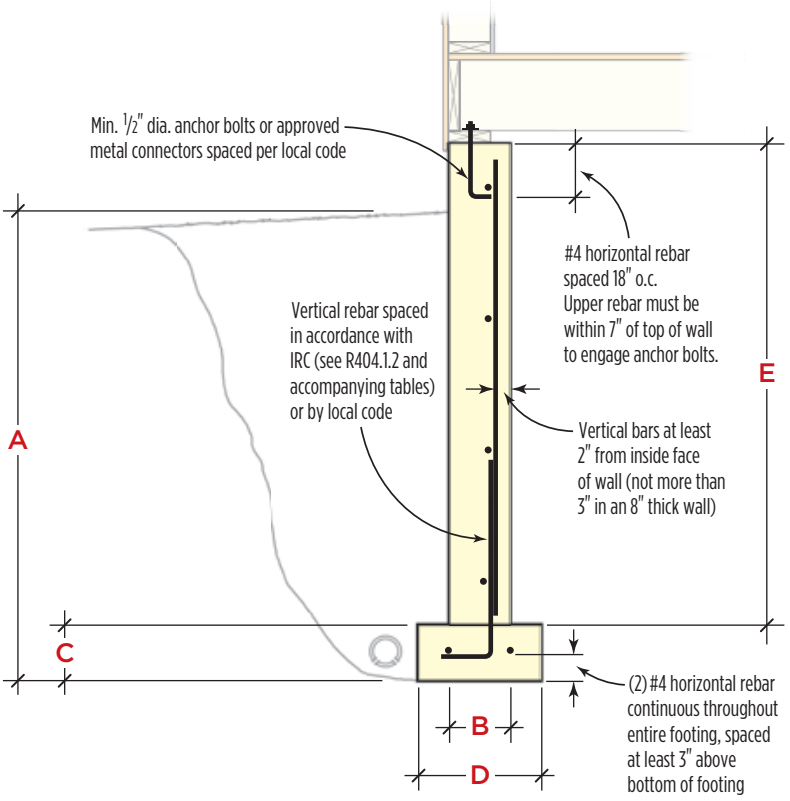
by Tim Uhler

[Editor's note: this is the second part of a two-part story; Part I appeared in the February issue.]

Before we form any walls, we scatter our 2-foot-by-8-foot MDO (medium density overlay) Plyform panels along the outside and inside of the footings (**see Figure 1, page 55**). These forms are actually made of plywood, with a special MDO facing that increases their durability and prevents the grain of the plywood from transferring to the concrete. Plyform panels are available in various thicknesses; the ones we use are $1\frac{1}{8}$ inches thick and very heavy, so scattering them in advance allows us to simply roll them over and into place as we work.

Following the engineer's plans or prescriptive guidelines, we connect wall rebar to the rebar already installed in the footings. In our area, the schedule for 2-foot-tall walls — the size we typically build — calls for vertical rebar 48 inches on-center, with

Sizing and Reinforcement Guidelines



Min. Requirements for Foundations Supporting Bearing Walls

# of floors supported by foundation	A (distance below grade)	B (min. wall thickness)	C (min. footing thickness)	D (min. footing width)
1	12"	6"	6"	12"
2	12"	6"	6"	15"
3	12"	8"	8"	23"

Min. Wall Requirements (Grade 60 Reinforcement Steel)

B (min. wall thickness)	E (max. wall height)	Horizontal rebar	Vertical rebar
6"	24"	(1) — #4 rebar	#4 rebar at 48"o.c.
6"	36"	(2) — #4 rebar at 18"o.c.	#4 rebar at 48"o.c.
6"	60"	(4) — #4 rebar at 18"o.c.	#4 rebar at 24"o.c.
8"	48"	(3) — #4 rebar at 18"o.c.	#4 rebar at 48"o.c.
8"	72"	(4) — #4 rebar at 18"o.c.	#4 rebar at 48"o.c.
8"	108"	(6) — #4 rebar at 18"o.c.	#7 rebar at 36"o.c.
10"	108"	(6) — #4 rebar at 18"o.c.	#6 rebar at 36"o.c.

Under normal soil conditions, prescriptive guidelines can be used to size footings and foundation walls and determine vertical and horizontal steel reinforcement schedules. The guidelines shown here are contained in the author's local building code (Kitsap County, Wash.), which was amended from Sections R403 and R404 of the IRC.

a single continuous horizontal rebar at the top of the wall (see illustration, left). Taller walls require more steel (**Figure 2**).

We work in two-man teams when forming walls, preferably with a third laborer available who can find — or cut — pieces as we go. Since the Plyform panels cost about $40 apiece, we're reluctant to cut them to fit. Usually we don't have to, since we've accumulated an assortment of sizes over the years. We also won't cut a piece of panel to fit gaps that are less than 1 foot wide. Instead, we span these short gaps with sections of galvanized sheet metal that we keep on hand just for this purpose.

I like to form the longest wall first, starting at a corner. One carpenter nails two 8-foot-long panels together with a single duplex nail (for easier disassembly later on) to form the outside corner, while another nails two 4-foot-long panels together — again, with a single nail — to form the inside corner. From there, we work outward in both directions. This approach staggers the interior and exterior panel joints, which makes the walls straighter and stronger.

When we formed the footings (as described in Part I of this article), we installed Rap-I-Form metal form clips (awardmetals.com) in the wet concrete. As we assemble our form, we place additional form clips on the footing so every panel will have a clip within 2 to 4 inches of each end, to keep the panel ends from spreading. At the top, we clip only enough to hold things together while we form. Later, we'll come back and add enough clips so that they are spaced about 2 feet apart.

Tall walls. If we're building on a sloped site and need taller walls, or if the owner simply wants a taller crawlspace, we can stack the 2-foot-wide panels horizontally to form 4-foot or 6-foot walls. Access to the interior of the foundation can get tricky once we start stacking form panels, though, so we plan our work carefully, first completing long 2-foot-tall sections across the back and sides of the foundation before going any higher.

We set the second or third row of panels on snap ties laid across the tops of the lower forms, following the same spacing as our form clips (**Figure 3**). Wedge-shaped "shoes" driven between the snap ties and the forms tighten them against the ties' internal washers. The ties leave a 3/16-inch gap between the forms where the water will leak out as we pour, but we just scrape the overflow off, and the gaps make it easier to strip the forms.

When stacking forms, we use the same-size panels in each row so the vertical joints line up. This speeds up forming, since once we know what sizes are on the bottom, we can grab two of each. It also makes the forms easier to strip. And if any of the concrete is exposed, straight joints look nicer.

When walls are taller than 6 feet, we orient our forms vertically (**Figure 4, next page**). This requires closer spacing of the form clips on the footing to prevent the bottom of the wall from blowing out under the load of the concrete, and we make sure clips are placed an inch or two from each panel edge. Vertically, we place snap ties in slots cut at 1-, 2-, 4-, 6-, and 7-foot intervals along the long edges of the panels. This has proven to be a good spacing for keeping the panels from bulging as the concrete is placed.

If we are pouring a 9-foot-high wall, we stack one-foot-wide panels on snap ties at the top. When pouring 10-foot-high walls, we stack 2-foot-wide panels on top.

Figure 1. Workers finished up the steelwork before scattering the heavy Plyform panels, with one continuous row of horizontal rebar about 3 inches up and another row at the top of the verticals.

Figure 2. Reinforcement schedules for tall walls typically call for horizontal rebar on 12-inch to 18-inch centers depending on site conditions and structural requirements.

Figure 3. To build 4-foot or 6-foot-tall foundation walls, the author stacks his forms horizontally on snap ties laid across each lower course. Aligning the stacked panel joints vertically speeds installation and makes it easier to strip the forms later.

Figure 4. The author forms 8-foot-tall walls vertically, placing snap ties in slots located 1, 2, 4, 6, and 7 feet along the panel edges.

Figure 5. A reference line snapped within the top inch or two of the forms indicates the elevation of the top of the wall. The author tacks a 3d finish nail every 12 to 16 inches along the snapped lines to make them easier to find during the pour.

Figure 6. Even though the mix from the line pump is smooth and easy to work with, the author's crew still spends a few moments flattening out the concrete and patting down stray aggregate while installing hardware.

At inside corners, we drill through the inside panels and poke snap ties out on the same 1-2-4-6-7 spacing so that these weak points have plenty of support. To make sure there's enough room for wedges, we space the holes about 3 inches off the inside corner. We reinforce outside corners with metal plumber's strapping about every 2 feet vertically. Then we line the tops of the walls to make sure they are straight, brace them as needed, and double-check the diagonals.

Shooting grade. Once the wall forms are built, I set up the laser so that it's about one foot taller than the form. Then I mount the detector on a 1x2 stake and go around the forms marking level. Keeping the top of the concrete within the top one inch of the form makes it much easier to trowel. We mark the form every 25 feet or so, which eliminates any sag in the string when we snap lines (usually in white chalk for bet-

ter visibility). Then we tack 3d finish nails every 16 inches along the snapped lines to indicate final grade (**Figure 5**).

The pour. The line pump operator controls both the speed and the accuracy of the pour. But I can help him by assigning a crew member to work with him, mainly to make sure he keeps the concrete right at the elevation line. Meanwhile, I watch the forms. Usually only two of us need to be on site for the pour, but if the walls are taller than 4 feet, I like to have an extra guy on hand to minimize the need to climb over the forms or in case something goes wrong (**Figure 6**).

Since the concrete mix that comes out of the line pump is super smooth, we don't need to vibrate the forms. If we're using a regular mix with larger aggregate, we work the concrete as we go, shoving a 1-by up and down into the forms to move the water to the edge.

After the concrete has firmed up for 30 minutes or so, we trowel the top smooth, then set our J-bolts or Simpson MASA mudsill anchors (which we prefer) about 48 inches on-center. If hold-down bolts are specified, we've already placed them in the forms using Simpson AnchorMate Anchor Bolt holders (strongtie.com) prior to the pour (**Figure 7**).

Before leaving for the day, we scrape any wet concrete off all of the inside corners and from the top of the footings to make stripping the walls easier. Depending on the time of the pour and the weather, we'll either come back to strip the walls the next day or wait a couple of days to let the concrete firm up (**Figure 8**). Afterward, we oil the daylights out of the forms before storing them at our shop under tarps. The forms last forever if they're taken care of.

We've started framing as early as the day after we strip the forms, but usually we wait a few days, especially with taller walls (**Figure 9**).

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Figure 7. The author prefers Simpson MASA mudsill anchors over traditional anchor bolts for fastening the framing to the foundation. In the rush of the pour, this shear brace template was installed upside-down, so the author will just pop it out after the concrete has set up.

Figure 8. Workers scrape the panels clean as they strip the forms from the foundation. Later, they'll oil the panels before storing them.

Figure 9. Before installing the mudsills, the author uses a scraper to smooth out any trowelling irregularities on the top of the stem walls.