



Mudsill Layout for a Complex Foundation

Attention to detail makes the rest of the house easier to frame

BY MATTHEW ANDERSON

As a residential framing contractor on Cape Cod, I see many different styles and sizes of homes. Present design trends seem to be making the homes my crew and I work on increasingly complex—all the way down to the foundations, which, we are frequently finding, are no longer simple rectangles with an attached garage.

We recently framed a home, for instance, that included a walk-out basement with a stepped foundation, an angled bay off the back of the house, and multiple spaces in the home that required jogs in the foundation.

Regardless of style, size, or complexity, however, one thing has

remained constant: The frame must start off level and square to ensure an accurate build throughout the rest of the project.

BEFORE FRAMING BEGINS

The first thing we do—before we begin our layout—is clean the top of the foundation. Most of our projects are backfilled before we arrive, and the clean, sandy Cape soil limits the chances of foundation damage during backfilling. But the excavator always manages to leave sand along the tops of the walls. We sweep off the sand and then go over the concrete with a leaf blower so we're left with a clean, dry surface.

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Once the foundation is ready, we decide where to begin the layout to ensure the house will be square. On this project we were fortunate enough to be following a foundation contractor I've worked closely with in the past. After stripping the concrete forms, he checks every foundation with a rotary laser and lets the builder know if there are any areas of concern. This particular foundation had just one low spot, in a corner of the garage, that we easily corrected by adjusting the length of a couple of studs when we framed the garage walls.

ESTABLISH A BASELINE

A good rule of thumb for beginning the squaring process is to establish a baseline along the longest wall of the house. This particular house was basically a Cape with an addition off the left side, as well as a large garage with a connecting addition on the right-hand side. With most houses like this, the back wall runs

in a straight line for the length of the building, and we simply snap a chalk line along the whole length of that wall to establish our baseline. But the natural slope of this lot caused the builder to drop the back wall of the house to create a walk-out basement. With the back wall at a different elevation from the rest of the house, we came up with an alternative strategy for our baseline. Because of the many jogs in the front wall of the house, my foreman and I decided it would be best to stretch a string along its entire length to establish a baseline, and then pull parallel measurements from the string and snap lines for the various jogs in the front elevation.

To anchor the string, we tacked two blocks to the front left corner of the house using a powder-actuated nailer (1). The block along the side wall was for attaching the string, and a perpendicular block on the front wall located the exact position of the string. (We always use the inside edge of the plate for our baseline.) At the other end of



the house, we tacked a length of plate stock to the farthest wall of the garage. Because of the unusual jogs in the front of the house, the front of the garage was 3 feet in front of the end of the house where we'd attached our blocks, but 2 feet in back of the center section of the house. We measured back from the corner of the garage and marked the baseline location, which fell in the opening for a side door to the garage. Now we were able to stretch the baseline string over the entire length of the house (2).

Once we had this line established, it was easy to pull parallel measurements for each of the four walls along the front elevation (3). We then snapped chalk lines between each set of measurement marks.

PLUMB DOWN FOR THE DROPPED WALL

We also used the baseline string to establish parallel measurements for the back walls of the house. The back and front founda-

tion walls of the garage were at the same elevation, so we were able to follow the same process of pulling measurements and snapping a line for that wall. Laying out parallel lines on the dropped foundation wall, however, was a bit more involved, but extra sets of hands and a laser level made the process go quickly.

My foreman hooked a tape on a 2x6 block aligned with the baseline string. Standing on the back wall, I held the other end of the tape, keeping it level. Another crew member positioned the laser on a block on the dropped wall and moved the block until the plumb line was at the exact measurement (4), then marked the spot on the dropped wall. We repeated this process at the other end of the wall, which gave us two accurate points for snapping a second baseline along the dropped wall (5). We used this line to pull parallels for the other rear walls at that same foundation height. With parallel marks at the ends of all the front and back walls, we finished snapping our chalk lines along them.

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PERPENDICULAR WALLS

The next step was to establish lines for the walls that ran from the front to the back of the house, perpendicular to the lines we just snapped. We first checked the overall width of the house at the front to make sure the foundation didn't grow or shrink during the pouring process. Then we marked that width at the two front corners of the building. The garage was the largest part of this house with foundation walls at the same level on all sides, so we first squared its side walls to its front and back walls.

After removing the temporary sill that held the baseline string, we measured the side wall and marked the position of the inside edge of the plate (6). Then, making the assumption that the foundation contractor had gotten the dimensions correct, we did the same with the front wall of the garage (7) and marked the opposite corner. With the corners of the garage marked out, we pulled diagonal measurements to ensure the layout was perfectly square (8).

CHECKING FOR SQUARE

Before the days of mobile-phone apps, we checked for square by plotting out a 3-4-5 triangle in three simple steps: 1) measure the longest multiple of 3 along one wall; 2) measure the same multiple of 4 along the wall you're trying to make perpendicular; 3) mark the point where the diagonal distance between the two marks intersects the same multiple of 5.

But with a mobile-phone app or a construction calculator, you can simply enter the exact measurement of both walls, and the program gives you the diagonal measurement. On this foundation, the diagonals were off by only $\frac{1}{4}$ inch—a pretty small amount in the scheme of things. Nevertheless, we corrected by shifting the back corner slightly, then double-checked our diagonals until they were perfect (9). Once the four corners of the garage were properly marked, we snapped chalk lines for the two side walls of the garage (10). We now had our perpendicular guidelines for the rest of the house.



LAYING OUT THE REMAINING WALLS

As had been the case earlier, pulling parallel measurements along the front of the house—where the foundation height was consistent—was easy. To make the process go more quickly, we refastened the mudsill for the garage sidewall using the line we'd just snapped (**11**). Then it was simply a matter of one crew member holding the tape on the mudsill, while a second person marked the measurement on the foundation at both ends of each wall (**12, 13**). Where those marks intersected the lines we'd snapped earlier were the corners for each jog in the foundation.

We had already marked the front left corner (at the opposite end of the house from the garage), so we marked the same measurement at the back just before the foundation began to step down (**14**). To locate the back corner of the house on the stepped foundation, we again used three sets of hands and a laser (**15**). One person held the end of the tape on the back corner of the garage, while a second crew

member stretched the tape. Then a third crew member set the laser on a block and moved it until the plumb beam was at the exact measurement for the overall width of the house. With this final step, we had now established the major corners of the house, and we focused our attention on laying out the rest of the details.

FINISHING UP THE LAYOUT

One way we sped up the final part of the layout was to attach the sill stock to the foundation of the walk-out wall before locating the key points on the wall. We let the stock run by the corner of the foundation so that we could mark the exact length of the wall directly on the sill (**16**).

Having this sill in place was also handy when it came time to lay out the angled bay on the walk-out wall. We pulled a measurement from the corner of the house (on the stepped foundation) to the center of the bay, and again plumbed down with the laser level and

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marked the center on the sill stock that extended through the bay. Then I transferred the center mark to the outside wall of the bay with a framing square against the sill stock. With accurate center points, it was easy to lay out inside and outside dimensions, and then connect the points.

The walk-out wall extended across the entire back of the house, except for a rectangular volume that bumped out behind the garage. To lay out that area, I worked off the mark that we'd made earlier at the corner of the foundation where the rectangle began. We had used the original reference line along the walk-out wall to lay out the rear wall of the rectangle, so we just needed to lay out the two perpendicular walls. As with the garage, I used a mobile-phone app to get the diagonal measurement to locate the two outside corners (17). Then it was just a matter of pulling parallels from these two points to complete the foundation layout.

We finished snapping the sill lines and installed the remaining

sill plates with the sill seal already stapled to the sill stock as it went down (18). (At this stage, we temporarily fasten the sills to the foundation with a powder-actuated nailer. Later, after the floor framing is complete, we'll use special bolts to permanently attach the sills.)

We run continuous sill everywhere the framing will touch the concrete foundation, including on vertical walls where the foundation steps down (19). We make sure those sills are plumb before they are anchored. When all the sill stock is attached to the foundation, we saw off any overhanging extra where we'd left the stock long (20).

An efficient crew—like this one—that specializes in layout and placement of sills can do this work in only a couple of hours. By lunch time that day, we'd already gotten a good start on framing the lower walls.

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