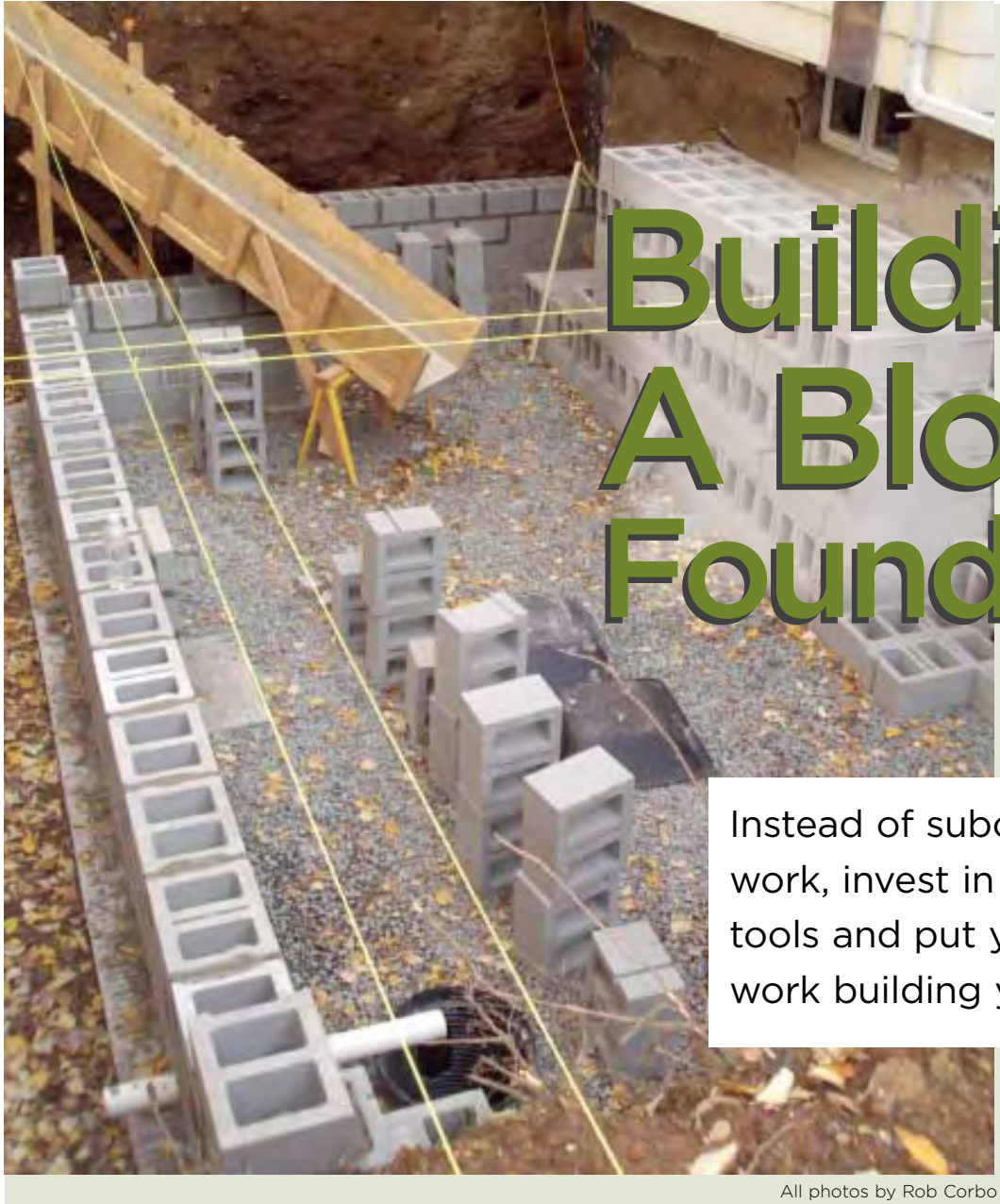


Building A Block Foundation

Instead of subcontracting the work, invest in a few masonry tools and put your own crew to work building your basements

All photos by Rob Corbo

by Rob Corbo

When our custom construction company builds additions, concrete block is our foundation of choice. All of the plans we bid on (most of which include full basements) specify block rather than poured foundations. And to keep our lives simple, we don't subcontract the work — we do it ourselves.

Such was the case with a two-story addition that we began building last year. Measuring approximately 15 feet by 26 feet, the addition expanded the home's existing kitchen, added a new entry and family room on the first floor, and created space for a new master bedroom suite above. With easy outside access through a bulkhead door and 8 inches more headroom than the existing basement, the new basement gave the homeowner a place to set up a long-anticipated woodworking shop.

Blockwork doesn't require a large capital investment — just a few masonry tools and a mixer (we bought our electric mixer online at a substantial discount because of a slightly bent wheel). We don't need to own, rent, or store forms, and we never have to worry about a blowout.

We feel more comfortable building 8-foot-high basement walls with block than we do forming walls 8 feet high; doing all of the blockwork ourselves gives us more control over our schedule and the quality of our work.

Layout and Excavation

After laying out the addition according to the drawings and spray painting the ground to mark the approximate outside edge of the footings (Figure 1), we began our excavation. Digging 3 feet beyond the layout lines helped provide the room we'd need later for laying the foundation drain, parging, and waterproofing.

To protect a large nearby oak, we consulted a municipal forester, who recommended cushioning the tree's root system with a 4-inch layer of woodchips and saw-cutting all exposed roots 1 inch or larger in diameter (rather than ripping them out with the backhoe). We also did our best to distribute the backfill around the property to avoid burdening the root system with too much weight in any one place.

We established the exact depth of the dig by measuring the height of the existing basement from the floor to the underside of the sill, which came to 84 inches. Then we added 8 inches for additional basement headroom, 4 inches for the new slab, and 4 inches to allow for the underslab stone.

This put the bottom of the dig 100 inches below our benchmark, the underside of the existing sill (see illustration, page 3).

Once the excavator reached the existing footing, we used that as our reference point for the rest of the dig, verifying the depth with a laser level as we went.

Then it began to rain; over the next eight days, 10 inches came down. Fortunately, we were prepared — we'd extended the two leaders that served the gutters above the excavation to drain beyond the hole. The soil drained well, but we still lost three weeks to the rain and to clearing minor cave-ins.

Pouring the Footings

When things had dried out a bit, we returned to the job and set up our batter boards and string lines to represent the outside edges of the new 12-inch block foundation walls.

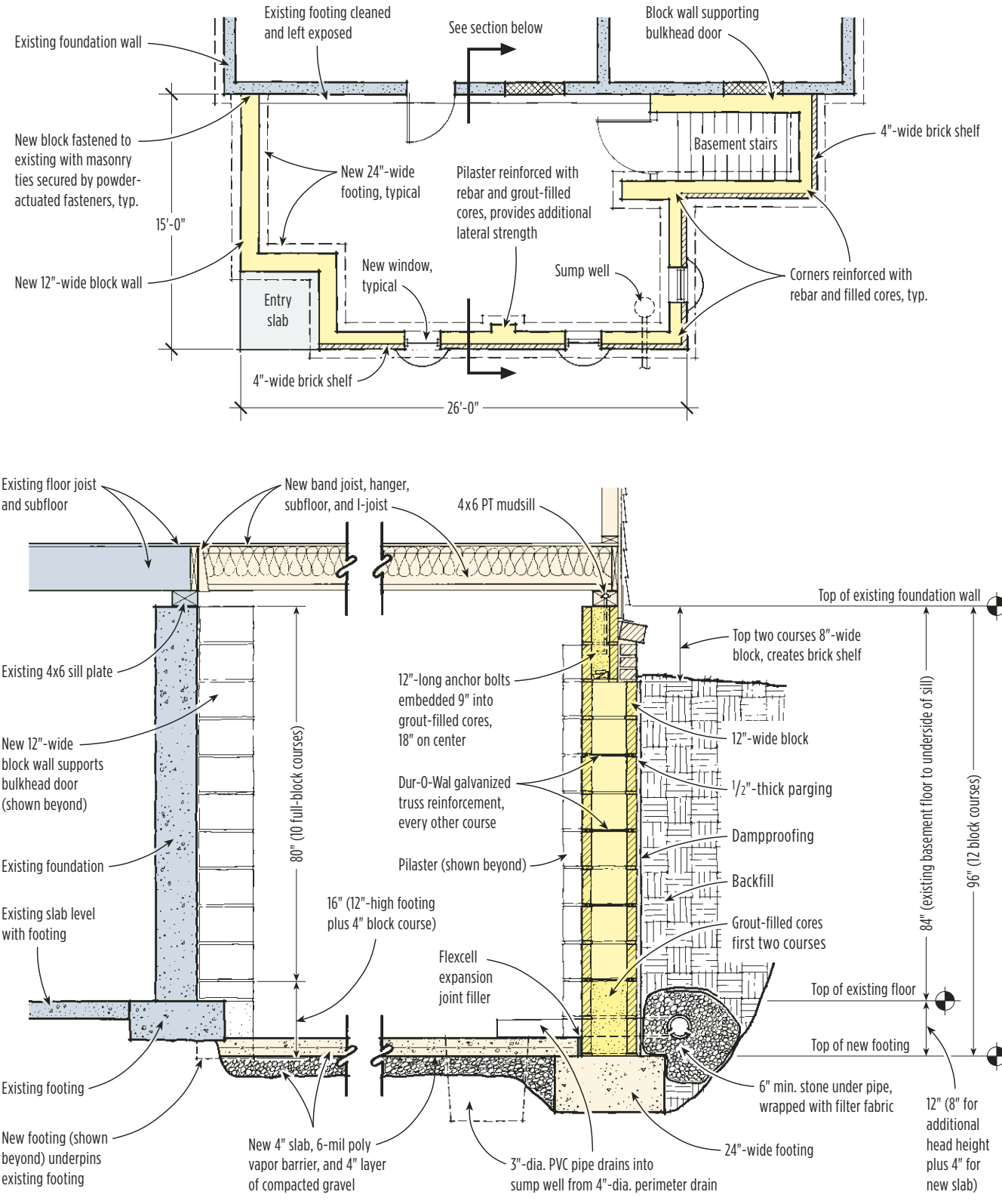
To create a brick ledge, the top two courses would be built with 8-inch block, so we also measured 4 inches inside the lines and ran parallel string lines to represent the last two courses of the narrower block.

With the lines in place, we plumbed down into the excavated hole with a plumb bob and marked the outside edges of the foundation on the soil. Using these markings, we laid out the 24-inch-wide footings, which extended 6 inches out from either side of the 12-inch-wide foundation wall.

The bottom of the footings needed to be 8 inches lower than the excavated hole (or 24 inches below the top of the existing footing), so we hand-dug an 8-inch-deep by 30-inch-wide trench in which to form our 12-inch-high by 24-inch-wide footing (Figure 2, page 4). This left 4 inches of footing above the excavated surface,

Figure 1. The spray-painted lines represent the approximate outside edge of the addition's footing; the excavator dug 3 feet beyond them to allow room for laying the foundation drain, parging, and dampproofing. Woodchips were used to cushion the impact of the excavator on a nearby tree's root system.

Block Foundation Details



which would accommodate the 4-inch layer of 3/4-inch-diameter stone we'd lay down before pouring the basement slab.

Besides providing a necessary base for the slab, the stone created a mud-free surface to work off during foundation blockwork.

We ripped 12-inch-wide strips of 5/8-inch plywood for the form walls, and used 30-inch-long form pins to secure them. As we installed the form walls, we used a spirit level and our transit to keep the top of the forms at the correct elevation (Figure 3).

To meet code, we used "chairs" to carry the footing rebar, keeping the rebar 3 inches inside the forms. (Rebar driven into the ground or extending outside concrete is subject to corroding, wicks water, and generally weakens the structure.) For footings, we usually run two lines of parallel rebar throughout and space perpendicular pieces every 12 inches, tied off with wire.

As we proceeded, we took the precaution of

Figure 2. After excavation, the author's crew dug the 8-inch-deep footing trench by hand, using the top of the existing footing as a benchmark.

Figure 3. Placed in an 8-inch-deep trench dug into the bottom of the excavation (left), the footings were reinforced with parallel lengths of 1/2-inch rebar wired together and held off the ground and away from the form edges by chairs (center). For safety, the author's crew makes it standard practice to cap exposed stakes and rebar (right).

Figure 4. A plywood chute made it easier to place concrete for the footings (far left). Later, the chute was used to slide stone (left) and block into the hole, and to pour the basement slab.

capping the pins. Since caps are cheap and take only a few minutes to install, we've gotten in the habit of always capping both the pins and the rebar. Not only does this make for a safer site — it scores points with inspectors on what is typically their first visit to the project.

For the footing pour, we constructed a plywood chute to carry the concrete into the hole (Figure 4). While the truck's own chute and extensions could reach the hole, they stopped 7 feet above our footings; more concrete would end up on the ground than in our wheelbarrows. With two men running wheelbarrows from the truck to the chute, two men running wheelbarrows in the hole, and one man working the 3,000-psi concrete into the forms, the plywood chute allowed for a very organized and rather calm pour.

Later on, we also used it to slide the stone and block into the hole.

Laying the Blocks

After we'd had a little fun sliding close to 600 blocks down the chute for stacking, we set up our mixer, brought in sand and Type S mortar, and got down to business laying block. Once again, we dropped a plumb bob from the lines above, this time marking the foundation corners

Figure 5. The bottom block course was set in a full bed of mortar, creating a strong bond between the footing and blockwork. The corners were done first, using the string lines for reference.

on the new footings. Then we snapped chalk lines between the corners to represent the outside edge of the block foundation.

Project manager Danny DoCouto started the blockwork by setting the corners, laying the blocks in a full bed of mortar. Then we strung masonry lines between the corner blocks and laid the rest of the first-course blocks, using the strings to keep the courses straight and leveling each block with a 2-foot spirit level (Figure 5, page 5). The elevation at the top of the first course measured 88 inches — exactly 11 courses of block — below the top of the existing foundation. If we matched the existing sill, joist height, and subfloor, the floor of the addition would match that of the existing house.

During the first-course run, we had to install a 3-inch-diameter PVC pipe that would later connect to the foundation drain and bring water into the basement sump well. I've never been comfortable with the idea of allowing water to drain into a basement, but on a flat site there's no alternative: Water that's 8 feet down won't gravity-flow anywhere else.

At the building inspector's suggestion, we installed the PVC pipe in the foundation wall rather than through the footing, where it can cause weakening and cracking. We notched the first-course block with a diamond-blade–equipped grinder, locating the notch high enough in the block that the pipe would clear the poured slab. After setting the first and second courses, we filled the block cores with concrete along the entire run.

The plans called for a set of basement stairs on the south side of the addition, with one side abutting the existing foundation wall. Therefore, we needed to build a section of block wall next to the existing foundation to help carry the bulkhead door. First, though, we had to underpin the part of the old footing that was exposed during excavation and form up a new footing. (Eventually, we'd have to underpin the length of the exposed existing foundation wall, but for the moment we wanted to keep our focus on the block, so we concentrated on the stair area.)

To keep on course with the rest of the foundation, we formed up a 12-inch footing (Figure 6), then used 4-inch solid block to bring us up to 16 inches above the new footing, the equivalent of two block courses.

A story pole marked off in 8-inch increments (the height of each course) helped keep us on track for succeeding courses. Each day, we'd set up the transit and mark our story pole, working off the existing footing. As a second check, we also measured down from the existing sill, exposed earlier.

Our daily ritual consisted of setting up the transit and marking the story pole, setting corners, running lines, leveling blocks, checking walls for plumb — with a level and plumb bob from the lines above — and checking the distance to the sill, making sure it was divisible

Figure 6. To support a new block wall for the bulkhead door capping the basement stairs, the existing footing was underpinned and a new 12-inch-high footing formed and poured.

Figure 7. To strengthen the block foundation, workers placed rebar in all the corners, grouted the cores, and used Dur-O-Wal wire mesh on every other course. A pilaster of interlocking block reinforced with rebar at the midpoint of the longest wall provided additional lateral strength.

by 8. If we were off, we'd adjust the 3/8-inch-thick mortar joint to correct the wall height.

As we laid up the block, we used Dur-O-Wal galvanized truss reinforcement (Dayton Superior, 800/323-0090, www.dur-o-wal.com) on every other course to laterally strengthen the foundation. At the corners, we dropped in rebar and filled the cores solid with grout all the way to the top. Where new block adjoined old, we fastened ties to the existing foundation with a .27-caliber Remington powder-actuated fastener.

For additional lateral reinforcement, we built a pilaster midway through the longest wall; we crisscrossed the blocks, installed rebar, filled the cores, and ran the Dur-O-Wal through the pilaster (Figure 7).

For the last two courses, we switched from 12-inch to 8-inch block to create the brick shelf for the brick façade that would cover the foundation, installing brick ties between the two courses in preparation for the brickwork (Figure 8). The brick shelf ended at the entrance to the mudroom door, where a poured platform stoop

Figure 8. Except for at the mudroom entrance (in foreground), the top two courses were built with 8-inch block to leave room for a 4-inch-wide brick shelf.

would provide a step into the house.

Brick would also be used to frame the basement window openings.

Parging and Water Management

We parged the below-grade portion of the walls using the same basic 2½-to-1 sand/mortar mix that we use to lay our block, spread evenly over the entire foundation ½ inch thick (Figure 9). Adhesion is always tricky, and the exact mix always needs adjustment for temperature, humidity, and the wetness of the sand.

Before applying the mortar, we used a mason's brush to splash and spread water on the block. Then we troweled on the mortar, screeding it smooth with a straight board. A lot of mortar falls during this process, but we pick most of it up and reuse it. As we proceed, we keep an eye on the work that's already been done, watching for the right time to wet-sponge-float the wall.

We gave the parging a week to cure, then brushed on a coat of cold asphalt. The parging fills the pores in the block, and dampproofing provides one more layer of defense against moisture entering the basement walls.

Because the asphalt makes such a sticky mess, we like to give the bituminous coating time to dry before installing the foundation drain. But the sooner you get the drain in, the sooner you can backfill. To keep sediment from building up in the pipe over time, we put filter fabric down before the stone went in, and then wrapped the stone and pipe with it.

We pitched the pipe from the corners of the addition to the sump well ½ inch to ¾ inch for every 10 feet, with the perforated side facing down so that rising water could enter and gravity-flow to the well.

Basement Slab

To prepare for the basement slab, we installed Flexcell expansion-joint filler (Knight-Celotex, 800/596-9699, www.aknightcompany.com) around the foundation's interior perimeter,

Figure 9. Parging — applying a ½-inch-thick layer of mortar with a trowel and screeding it smooth with a straightedge — helped seal the porous surface of the concrete-block foundation (right), while a brushed-on coat of cold asphalt (far right) dampproofed the wall.

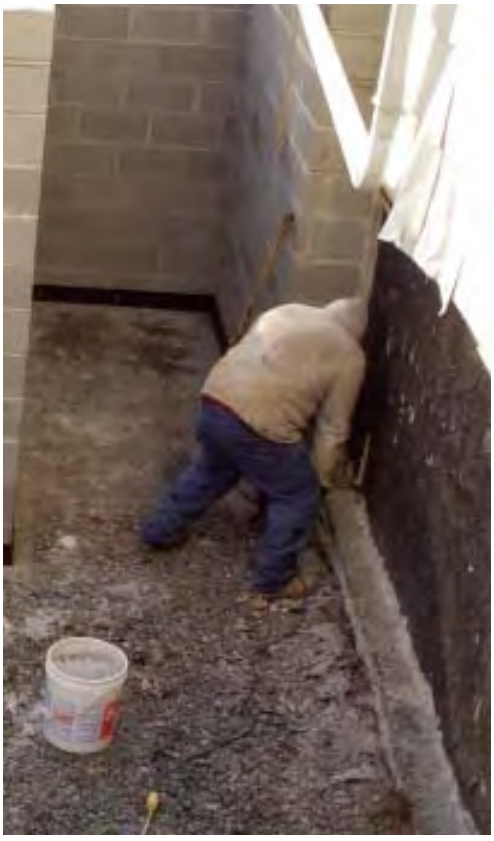


Figure 10. Before pouring the basement slab, workers attached lengths of expansion joint filler to the interior perimeter of the block wall (left), then laid down a 6-mil poly vapor barrier and wire mesh (below). Sheets of plywood and plastic protected the walls from splashing concrete (bottom).

fastening the 4 inch-high material to the wall with our Remington. The expansion joint provided us with a thickness reference and screed point for pouring the slab (Figure 10).

We also cleaned up the existing footing with a chipping gun in preparation for underpinning, mixing the debris in with the loose stone. Then we placed 6-mil poly in the hole as a vapor barrier, with wire mesh on top.

We set up our chute again, but this time it didn't matter if concrete ended up on the ground. We didn't want it splashing on the basement walls, though, so we used plywood and plastic to protect them during the pour.

At first we used wheelbarrows to move the concrete to the far corners, and then we just let the material pour into the hole, working it with a jigger bug to vibrate the stones down and away from the surface. We bull-floated the slab and, after the concrete had cured slightly, continued

to work the slab with hand floats.

The following day we backfilled the foundation in 2-foot lifts, dumping in 2 feet of dirt at a time and compacting it with a jumping jack until we reached the brick shelf. We compacted by hand, intentionally keeping the backhoe away from the hole for fear of putting too much lateral pressure on the foundation (Figure 11).

Finishing Up

To set the anchor bolts, we filled the cores of the top two courses, using busted block to create a barrier and keep the grout from dropping all the way to the bottom. Then we set our 12-inch anchors 9 inches into the grout, leaving 3 inches exposed (Figure 12). The anchors were spaced 18 inches on center, doubled up at the corners.

We counterbored the bolt holes to accept the washers and nuts holding down the sill, which made it easier to install the joists (no notching required) and safer to walk the sills.

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Figure 11. The wall was backfilled and hand-compacted in 2-foot lifts to avoid putting too much lateral pressure on the foundation.

Figure 12. The anchor bolts were set into grout-filled cores so that only 3 inches were left exposed (left). Then the bolt holes were counterbored to accept the nuts and washers (above).