QUICK
Foundation Repair

by Carl Hagstrom

Foundations in my area of northeastern Pennsylvania often suffer from what I call middle-age syndrome — they start to bulge around the middle. Even though a slight bulge in a foundation wall may not be a structural concern, the cracks that typically accompany the bulge often open the door to moisture problems. And in time, just like that middle-age bulge, the problem will get worse if you don't take steps to head it off.

I recently built an addition on a seasonal cabin that was suffering from a deteriorating block foundation wall. The area around the failing wall was a perfect example of all the things that can contribute to foundation failure. There were no footer drains, the grade sloped towards the foundation, and roof runoff bypassed the leaf-clogged gutters and collected where the grade met the foundation. Each winter, when the saturated soil froze and expanded, it slowly and steadily forced the wall inward.

Since the corners of a foundation tend to brace the ends of a wall, the damage was confined to the center portion. The wall had some serious cracks (up to 3/8 inch wide) and an inward bulge of about an inch.

Mechanical Nightmare

Thinking about repairing the foundation from the interior made me wince. The small basement was used as a utility area, and the electrical service panel, the plumbing tree for all the waste lines, and the pressure tank and supply lines were all located along the failing wall. These would all have to be disconnected and moved during the repair.

Also, an internal repair would not address the lack of footing drains. To top it off, I was dealing with an overall structure that was marginal at best. Even though the building had sentimental value, the owners and I knew that an expensive repair would be difficult to justify. The goal was to salvage the foundation for as little cost as possible.

Working from the Outside

I decided to make the repairs from the outside. Since a footer drain had to be part of any solution, I knew I'd be exca-

This low-cost method saved a bulging block wall with poured concrete

vating a trench directly outside the wall, and installing a drain and gravel. My plan, while the trench was open, was to pour a new concrete wall directly against the existing block wall (see Figure 1). The new wall didn't have to be pretty — it just needed to reinforce and take the pressure off the existing wall.

I was confident that the existing wall was stable enough to serve as a form. If an old wall is too far gone, it may not be up to the task of functioning as a form for a new concrete wall. If you attempt a repair like this and have any doubts, be sure to get a second opinion from a qualified structural designer.

A typical poured concrete wall is formed on both sides, with wire ties preventing the concrete forms from pushing apart. Using the existing wall as one side of the form made sense, but I knew that somehow I would have to restrain the outside wall forms. Drilling through the existing wall to install wire ties was an option I didn't care to think about.

Since the trench was going to get filled with gravel after the wall was poured, I decided to use the gravel to brace the form as the concrete was poured. The plan was to use 3/4-inch treated plywood, then leave the forms in place after the concrete was poured. I knew this would require careful placement — pour a little concrete, then backfill with a little gravel — but I was confident that it would work.

My excavator dug the trench, and we wired up #5 bars 4 feet on-center vertically and 2 feet on-center horizontally (Figure 2).

Getting the Right Mix

My building supplier said he would deliver the treated plywood late that day, and 4 yards of 4,000-psi concrete was scheduled to arrive at 7 a.m. the next day. I ordered enough concrete to pour a 12-inch-thick wall. I doubt the wall needed to be a full 12 inches thick, but the site was located 40 miles from the concrete plant, and I was going to be charged for 4 yards of concrete whether I used it or not.

I ordered a 4,000-psi mix not because it's stronger, but because it contains a higher percentage of cement. The extra cement makes for a "fat" mix — one with plenty of cement paste, which reduces honeycombing (voids in the surface of the concrete). The extra cement would also make it easier to work up a nice finish on the visible portion of the wall that would end up above grade.

I would also need a dry mix, one with enough body to stand on its own. This would both reduce the blowout stress on the form and bridge any small gaps between the plywood sheets.

The Pour

As I was unloading tools the next morning, I realized that the treated plywood hadn't been delivered (just as I heard the faint whine of the Detroit diesel off in the distance). The nearest lumberyard was over an hour away, and there I was, coming down with a case of concrete fever.

We considered substituting some 7/16-inch OSB we had on the job, but rather than risk termite damage by leaving

Foundation Reinforcement

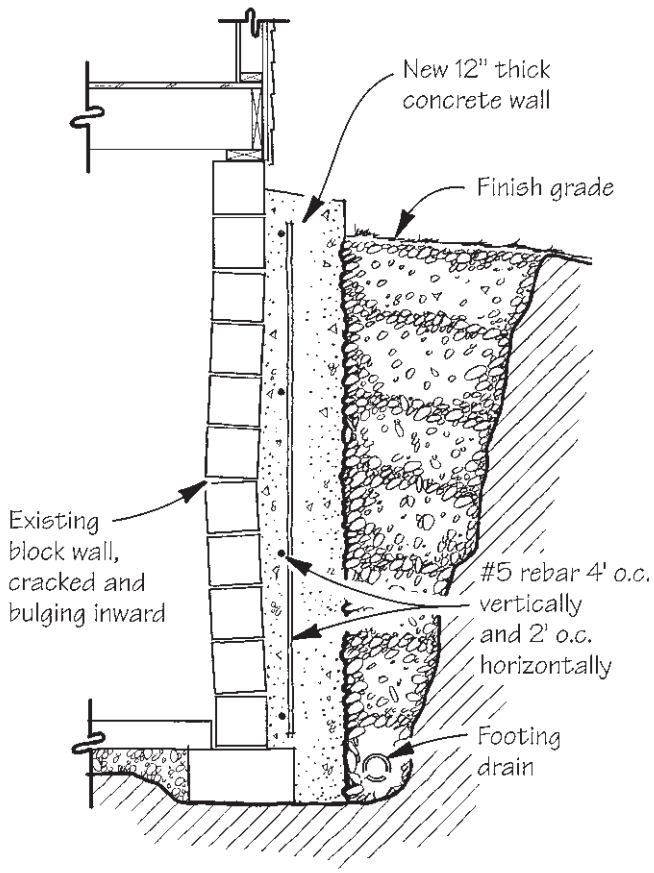

Figure 1. In this simple foundation repair, the new wall reinforces the existing buckling wall. The new drain system relieves water and frost pressure against the foundation.

Figure 2. After the trench was dug, the author installed #5 rebar 4 feet on-center vertically, and 2 feet on-center horizontally.



Figure 3. OSB backed with gravel provided a movable form for the stiff concrete mix (left). As the form filled with concrete, additional gravel was dumped against the panels (middle). The OSB was pulled up in one-foot lifts as the pour progressed (right).

Figure 4. The stiff mix was easy to mold and trowel at the top of the foundation, where 6 inches of the new foundation remained visible.

untreated panels in the ground, we came up with another strategy. We would use the OSB as a slip form.

We set the OSB in the bottom of the trench, about a foot from the foundation. We laid the footing drain in a bed of gravel just outside the form. I had the backhoe operator dump gravel in the trench until it just started to bear against the OSB, then we started pulling concrete out of the chute and into the form (Figure 3). We made sure the ready-mix operator kept the mix dry. I'm guessing I used a mix with a slump between 1 and 2. In more practical terms, the stuff didn't slide down the chute by itself; we had two guys with shovels working the chute, coaxing the stiff mud down.

One Foot at a Time

As the concrete rose in the form, I worked the pile of gravel with my feet, pushing gravel against the OSB, and matching the height of the concrete. I'd call for more gravel as needed, and when the concrete was about 16 inches deep, I grabbed the first sheet of the OSB and wrestled it back and forth, pulling it up about a foot. I went on down the line, pulling each sheet up a foot. It didn't take long to realize that the sheets that had the smooth side towards the concrete were easier to pull up.

I started the process again at the other end of the wall form: gravel as needed, about another foot of concrete, and a wrestling match with the OSB. After seven 20-minute rounds, the wall was poured and backfilled, and I was left with about 6 inches of concrete protruding above grade. As the exposed concrete set, I molded and troweled off the top of the wall (Figure 4)

The total cost of the repair was about $1,300, including about 60 feet of additional trench for the footer drain. The materials (backhoe time, drains, gravel, and concrete) ran about $800, and the labor about $500.

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