REPAIRING A Bulging Foundation

by Gene Lorson

This commonsense approach uses concrete deadmen on the outside to stabilize a buckling basement wall

Soils in the Hope, Kan., area where I live and work are tough on foundations. While the expansive clay soils aren't as bad as in some parts of the country, they still cause bulges and cracks in many foundations. In the 35-plus years I've been a contractor, I've worked on more than a dozen of these damaged foundations. Every job is different, so we use several techniques, depending on the situation.

One of the most effective methods I know is to tie a bulging wall to a mass of reinforced concrete outside the foundation. Rods are run through the foundation wall and embedded in some form of concrete deadman placed below the frost line and outside the building. The deadman's weight and surface area work like a boat anchor to counteract the pressure exerted by the heavy soil. When we don't have room for the deadman method, we sometimes pour a

Figure 1. Cutting the existing porch slab prevented the concrete pieces from seesawing and damaging the siding. The crew used a leaf blower to remove dust and make it easier to see the blade and cut line.

Figure 2. To avoid the risk of running a jackhammer on an elevated slab, the excavation sub used an improvised ram to break up the concrete. When the slab and foundation were gone, the smaller pieces close to the house were removed with a sledgehammer.

new heavily reinforced wall inside the existing foundation. Both methods work and have advantages. On one recent job, we used both.

On one section of the house, the original foundation — poured without any steel and weakened by age — had bowed about 2 inches toward the inside. I decided to repair and reinforce this area with the deadman method. The plan was to connect the bulging foundation to a new porch footing with steel rods. The weight of the new porch foundation would provide plenty of extra mass to resist the heavy soil.

A second section of the foundation lacked anything as heavy as a porch foundation to connect to, but it did have a convenient window for getting concrete inside. In that section, we decided to pour a heavily reinforced wall inside the existing foundation for additional strength.

To make sure that both plans were workable and that the existing foundation was otherwise suitable for supporting a two-story house, we consulted with an engineer and arranged a site visit. After getting the engineer's approval, we started the job.

Getting Down to Demolition

The first section of foundation was below an existing concrete porch. I was concerned that removing the existing porch slab would damage the house or siding as the pieces were broken up. To prevent damage, we used a gas-powered cutoff saw with a diamond blade to cut the slab close to the house (see Figure 1). Once most of the pieces had been broken up and hauled away, we removed the smaller pieces, using a little more finesse than the improvised ram attached to my subcontractor's backhoe (Figure 2).

When the porch was gone, I had the excavator scrape

Porch Footings Do Double Duty as Deadmen

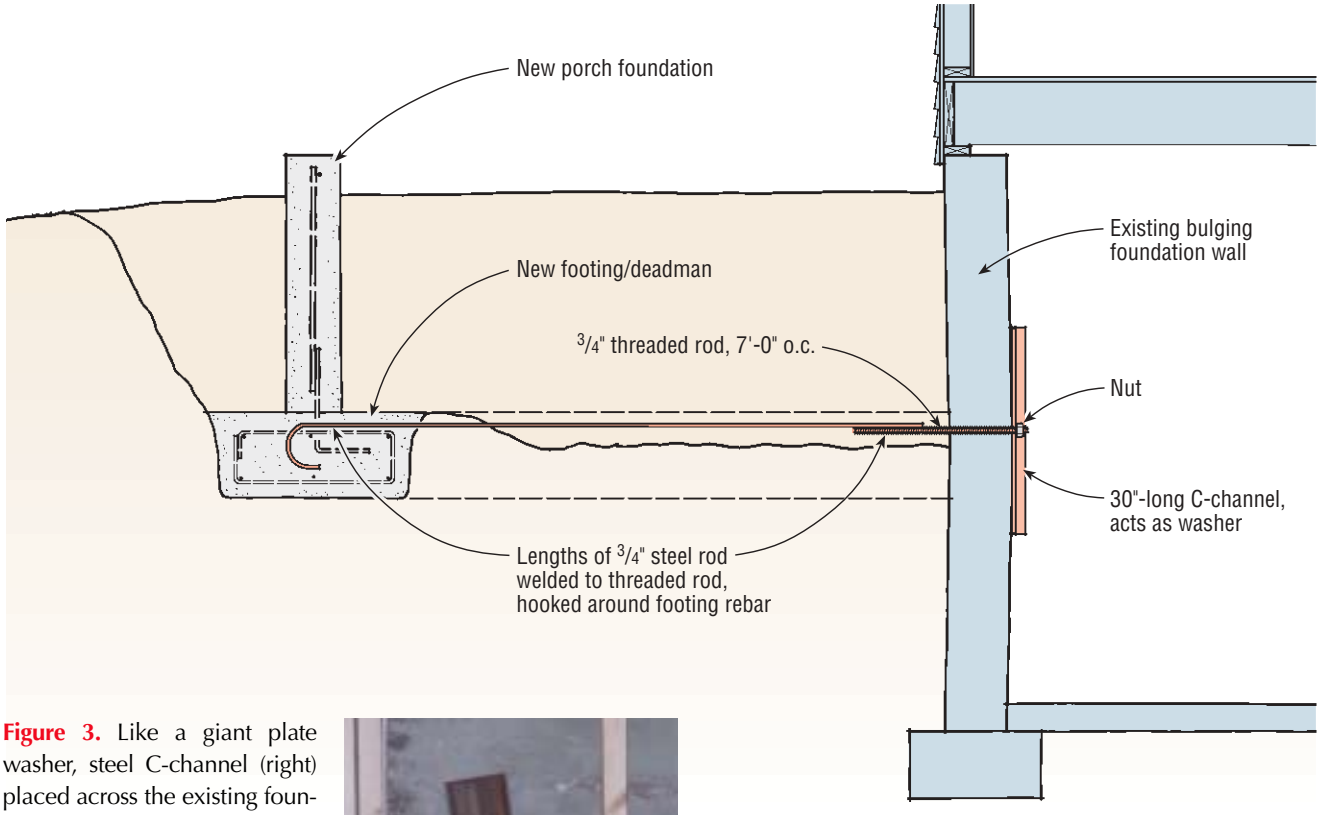

Figure 3. Like a giant plate washer, steel C-channel (right) placed across the existing foundation's weak area spreads the resisting force from the concrete deadman outside. Threaded rod passing through the foundation wall (below left) is welded to steel rods that hook around the rebar in the deadman (below right).

away the soil from the damaged foundation and trench below the frost line for the new porch footing. I wanted to keep the bearing capacity of the soil, so we were careful not to over-dig.

Tying Off

Using a rotary hammer, we drilled through the foundation wall in four spots, about 7 feet on-center. I inserted lengths of 3/4-inch threaded rod and bolted them to 30-inch pieces of heavy-duty steel channel. The channel would act like a huge washer, and the threaded rod would make it easy to bring the assembly under tension once the footings and foundation were in place (Figure 3). With the threaded rod running through the wall to the exterior, I had a local welder attach it to lengths of hot-rolled steel that were hooked around the rebar, reinforcing the new porch footing.

Making a Deadman

Once all the reinforcing steel was in place, I ordered concrete for the footing (Figure 4, next page). We used a

Figure 4. The heavily reinforced deadmen (top left) act as footings (top right) for the new front porch (above), which adds its weight to the resisting force.

stiff mix; although I didn't do a slump test, I estimated it at around 2 or 3 inches. A stiff mix is tough to work around rebar, but I wanted the concrete as strong as possible. Fortunately, we could get the chute all the way around the pour, so at least we didn't have to drag the concrete through the rebar. We used a vibrator to prevent voids, plunging and removing it about every 12 inches. While the footings set up, we went to work on the other damaged section of the foundation, where we had to form and pour a new reinforcing wall on the inside.

A New Wall Inside

The second section of foundation in need of repair was bowing worse than the section behind the porch. We didn't have anything as massive as the porch to act as a deadman on this section of basement. My engineer and I decided that stabilizing the basement wall on the inside with a new poured reinforced wall would work well. We would also tie the existing bowed wall to two concrete deadmen outside.

Just as in the area behind the porch, we drilled through

Concrete Deadman With Interior Reinforcement Wall

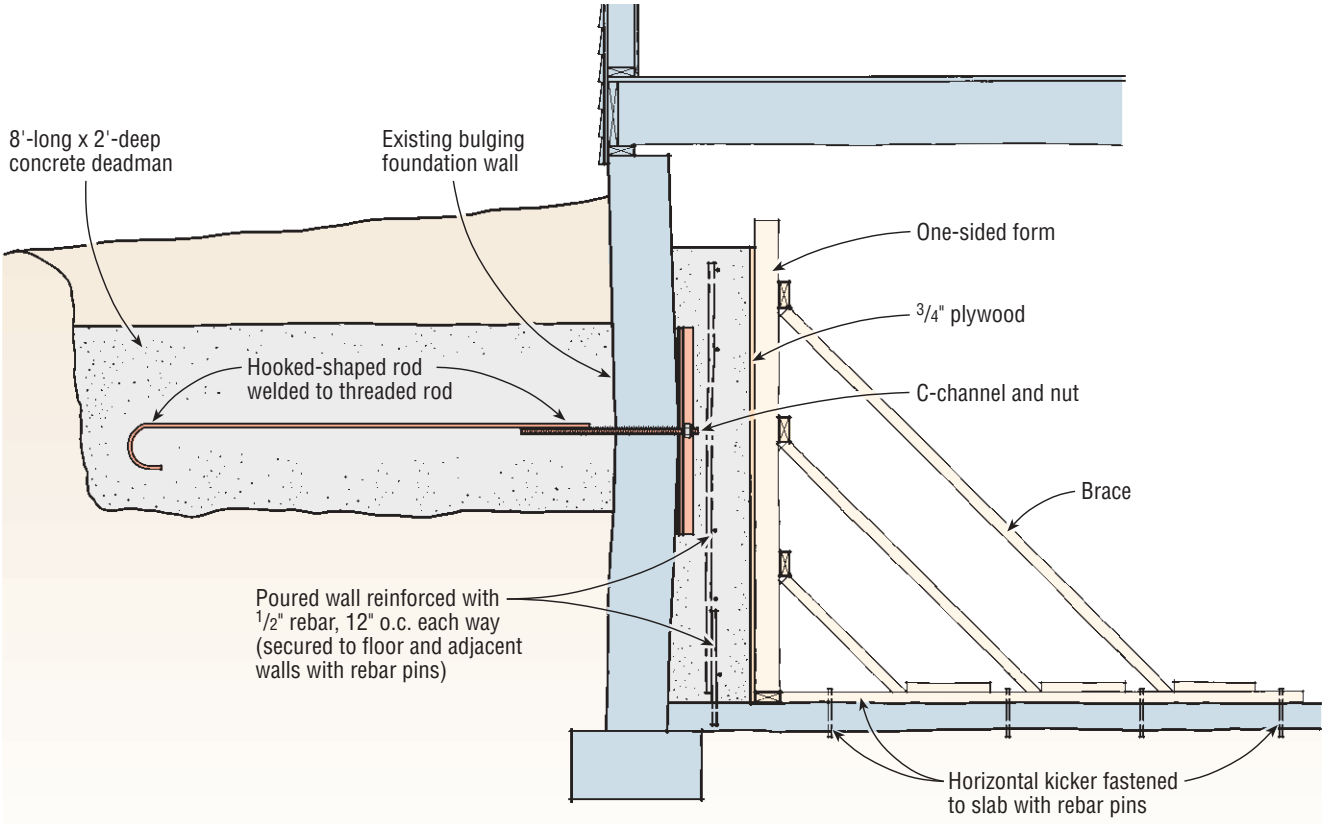

Figure 5. Four-foot-deep trenches (above) partially filled with concrete anchor the steel channel "plate washer" in this section of the foundation. The new reinforced concrete wall, poured in a one-sided form, consolidates the existing wall (drawing, top).

the wall and inserted 3/4-inch threaded rod about halfway up the wall, then welded it to rebar placed in two 8-foot-long trenches (Figure 5). The two concrete-filled trenches would ultimately be hidden below grade. We poured the trenches, then tightened up the nuts on the steel channel.

For the new wall, we placed 1/2-inch rebar placed on 1-foot centers horizontally and vertically. We secured the reinforcing grid by tying it to 1/2-inch rebar pins drilled into the adjacent walls and floor (Figure 6, next page). After the rebar was tied off, we could really see how much the wall had bowed — about 4 inches in the center.

One-Sided Form

While I've never had a blowout, pouring one-sided forms always makes me a little nervous. Adequate bracing is essential. My customer had maintained her good humor throughout the earlier process, but I thought two yards of slumping concrete sitting in the basement might be too much for her to take. To keep the concrete behind the form, we fastened six horizontal kickers to the floor about 18 inches on-center, using 6-inch pieces of rebar drilled into the floor.

Figure 6. After tightening the nuts on the steel channel, the author placed a grid of 1/2-inch rebar (top left) behind a carefully braced one-sided form (top right). To prevent the form from moving, the kickers along the floor were secured with 6-inch lengths of rebar driven into drilled holes in the existing slab every 18 inches (above).

Pouring Inside the House

When the day of the pour came, I double-checked the forms and waited for the truck. The day before, we had built a small chute to help get the concrete inside. Once the truck was on site, I checked the mix. I wanted a stiff mix to minimize the strain on our one-sided form. What we got was perfect; we literally had to drag it down the chute. We originally planned to make the pour all at once, but when we got about two-thirds of the way up, I heard a little creak coming from the formwork. It was probably nothing to worry about, but rather than risk disaster, I decided to finish the pour the next day. Once the forms were stripped, we drove the pins securing the formwork below the floor and patched the holes.

Both repairs turned out well, and my customer was happy with the results. While we couldn't straighten the foundation entirely, the inside is straight and true, and I'm pretty sure it's stronger than the original foundation ever was.

***Gene Lorson** is the owner of Lorson Builder near Hope, Kan.*