RESCUING A Block Foundation

Hydraulically driven piers provide bearing for a settling foundation

From the 1950s through the '80s — before poured concrete became the norm — many homes in northern New England were built with concrete block foundations. Unfortunately, block isn't the best material for a long-lasting foundation in this area. Frost pressure, melting snow, and heavy clay soil put a lot of stress on block walls, and I see the resulting damage every day. Our company, Tri-State Basement Systems in Berlin, Vt., specializes in waterproofing and repairing leaking and damaged foundations.

by Steve Shackett and Scott Anderson

On a recent job, we were called to the home of a retired couple. The long side of their house had bowed in about 3 inches in the center, and the short

section of wall next to the garage door had sunk several inches (see Figure 1). When cracks in the plaster started showing up, they gave us a call.

Two-Part Repair

The repair and stabilization plan developed by our estimator called for two support piers to prevent the subsided footing from sinking further and three wall ties to pull the bulging foundation wall back in line.

Piers. To stabilize the footing, we use a push-pier jacking system from Grip-Tite Foundation Systems (877/474-7848, www.griptite.com). Hydraulic rams powered by a portable pump push steel posts into the ground until they develop sufficient bearing capacity. At this point, L-shaped brackets are bolted to the post and support the footing from below. The system works in principle a lot like an automotive bumper jack, except the lifting action is hydraulic rather than mechanical. While smaller repairs like this one are more common, we've also used the push-pier system to stabilize entire foundations built on poor soil.

Ties. Wall ties, the other half of the repair plan, are an inexpensive and effective solution to buckled walls. A large metal plate on the inside of the foundation wall and another below grade on the outside are connected by a threaded rod. As the nut on the rod is tightened, it gradually draws the plates closer together, straightening the wall. It works similar to the rail bolts used for joining sections of laminate countertop or handrail (Figure 2, next page).

Figure 1. Soil pressure pushed this block foundation to the point of near collapse. Inside, the wall bows in a little more than 3 inches at the center, pushing the electrical panel with it. Note the sunken wall next to the garage door.

Driving the Piers

Much of our foundation repair work can be done with minimal site disturbance and little excavation; this is one of the main selling points of our services. Still, lifting or stabilizing a sunken foundation requires excavating the area down to the footing. We try to do this with as little damage to landscaping as possible.

Once the area is excavated, the next step is getting the support bracket under the footing. We scrape just enough soil from under the footing to get the 3/4-inch-thick support bracket underneath. We check the footing to make sure that the bottom and the side of the footing in contact with the bracket are relatively smooth, so that the home's weight is distributed evenly. Sometimes moving the bracket a little to the left or right is all we need to get

Stabilizing a Block Foundation

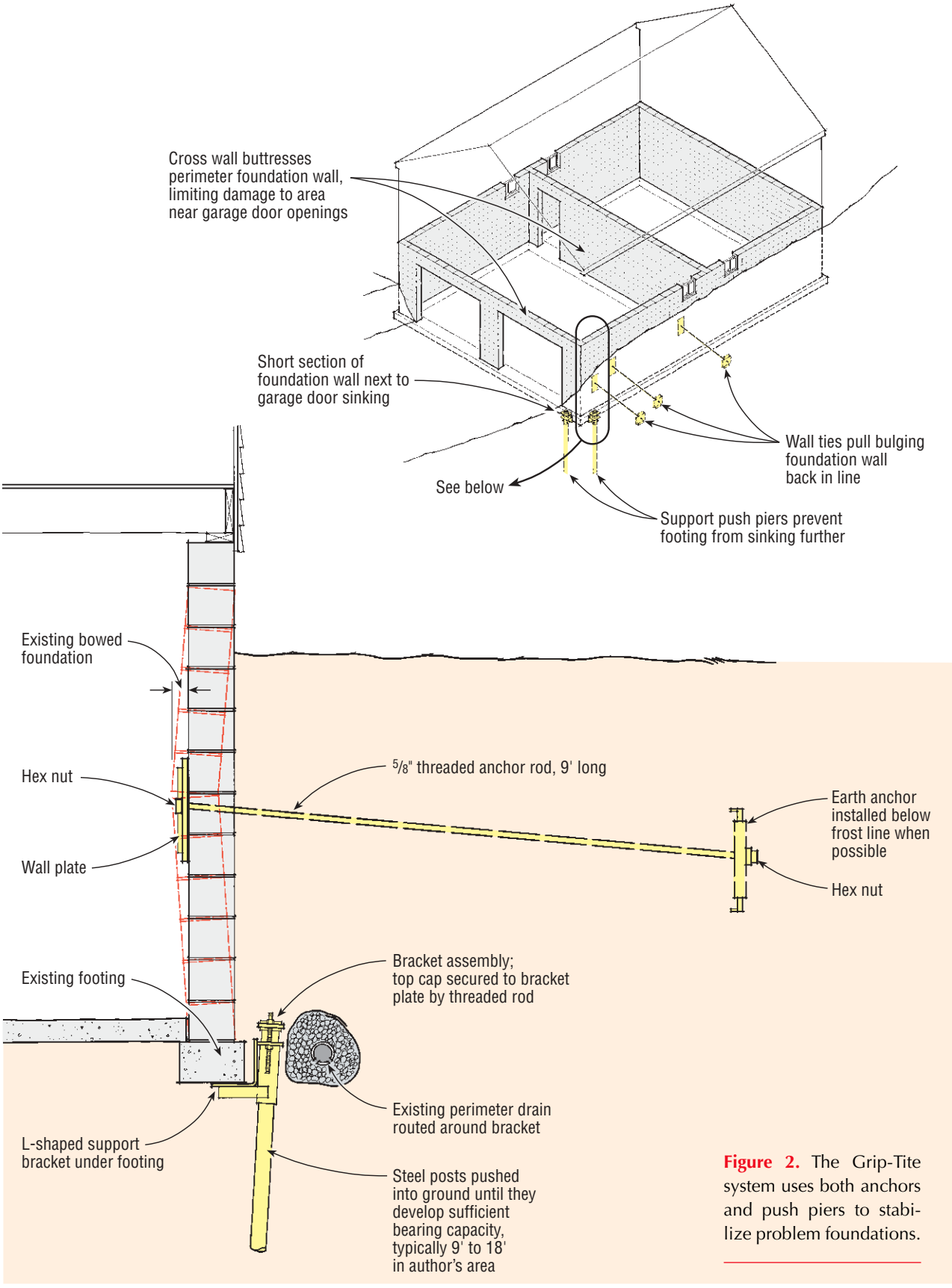

Figure 2. The Grip-Tite system uses both anchors and push piers to stabilize problem foundations.

Figure 3. It's important that the footing rest squarely on the angled bracket; otherwise, the concrete could crack while it's lifted. Here, a rotary hammer with a 3-inch chisel is used to square up the sides and bottom of the footing. In extreme cases where one side of the footing is thicker than the other, steel shims are used to level the bottom.

away from a cobble or other surface irregularity. Unfortunately, on the job shown here, the trench-poured footing was pretty rough, so we had to use a rotary hammer with a chisel bit to square it as best we could (Figure 3).

With the bracket under the footing, we slide the first tube into position and set the hydraulic ram into the trench (Figure 4). The ram weighs about 120 pounds and requires all available help. We hook it over the top of the support bracket and connect the hoses to the portable hydraulic pump. The L-shaped bracket, with one of its legs under the footing, prevents the ram from rising as it drives the steel posts.

Figure 4. After the bracket and steel pipe are in place (top left and right), the author uses a magnetic angle finder to ensure that the hydraulic ram is pushing the pipe at the proper angle (above). Once everything is in the proper position, the ram is brought into the trench and hooked over the support bracket. Once again, the angle is checked and wood wedges and shims are placed between the house and the ram to ensure everything stays in the correct position (right).

The tubes are driven at a slight angle with the bottom pointing in toward the house, which distributes the home's weight more directly over the bearing point. The pipes come in 3-foot sections, but the hydraulic ram can travel only 15 inches at a time, so driving each section is a two-step process (Figure 5).

The hydraulic pump's pressure gauge shows us when the piers are deep enough; in most cases we stop at about 4,000 psi. In our area, getting to strata with that kind of bearing typically takes three to six pipe sections (9 to 18 feet). One member of our three-person crew controls the pump with a remote control, and it's his job to keep an eye on the needle. It's important that the operator is paying close attention because the pressure often shoots up rapidly when the pier enters solid ground. We keep a watchful eye on things and listen to the pump motor while it's running. A change in the motor's pitch signals the pump is working harder and can mean the house might start moving. It's important to go slow and steady; sudden movement can crack a foundation.

Connecting the support bracket to the post requires that the top of the post be cut close to the top of the bracket, so we cut it in place with a reciprocating saw. Because the last section of post (where the bracket is attached) is under the most strain, we add a steel insert for reinforcement, which is also cut to length using a recip saw and a clamp-on guide (Figure 6). Once the reinforcement is in place, we move on to the next pier, following the same procedure until all of the piers are installed.

Securing the Brackets

When all the posts are in the ground, we leave the hydraulic cylinder connected to the final post installed and attach smaller hydraulic cylinders to the posts installed earlier (Figure 7, next page). This important step equalizes the loading on both piers. These smaller cylinders have just about

Figure 5. When the hydraulic ram bottoms out, it's retracted and a 15-inch section of pipe is inserted to finish driving the steel post. Driving a post all the way into the ground takes about five minutes. This particular project required four pipe sections per pier.

Figure 6. A reciprocating saw with a heavy-duty blade cuts the last section of pipe to length. A saw guide provided by the pier manufacturer ensures a square cut so there's no settling later. With the post cut to length, a steel insert is also cut to length using the same saw guide. The insert is slipped inside the top of the pier for additional reinforcement.

Figure 7. After both piers are in place, a second small hydraulic ram is attached to the hydraulic pump and attached to the first post (right). With both rams connected, pressure is applied to equalize the loading on the two posts (below). Once the bolts are tightened with a pair of adjustable wrenches, the hydraulic cylinders are removed (bottom right).

4 inches of travel, so we use them only for equalizing the bearing pressure between all the posts. On larger jobs, we can connect up to 16 cylinders at a time, allowing us to work on foundation walls as long as 40 feet. On the job shown here, there were only two piers, so the process went quickly. With the pump connected to both cylinders, we again brought the pressure to 4,000 psi. With both piers under equal pressure, we bolted the caps that lock the piers in their final position. We then moved on to the second part of the job, the bulging foundation wall.

Installing Wall Ties

Grip-Tite's wall ties consist of two 24-inch steel plates connected by a section of 3/4-inch galvanized rod. One wall plate is placed in the center of the bulge inside the building and the other goes in a hole outside, buried about 9 feet away from the foundation in virgin soil (Figure 8, next page). Tightening the nut on the threaded rod draws the two plates together and straightens the wall. In this case, the outside earth anchor was located about 36 inches

Figure 8. To bring the bulging wall back into line, the author uses a wall plate and an earth anchor connected by a threaded rod — the wall plate goes against the inside face of the wall; the earth anchor goes in a hole in the ground outside (below right). A hardened point screwed on to the end protects against thread damage as the rod is driven (left).

below grade in a 2-foot-diameter hole, which we dug with an auger, saving the sod so we could replant it later.

Wall ties go in pretty easily. The only difficulty is lining up the threaded rod so that it hits in the center of the hole outside. We look for pipes and wires running to the outside and use them as landmarks, but if there's nothing close to the hole, we measure off a house corner. We drill through the block with a 7/8-inch bit on our rotary hammer. The proprietary rods are 9 feet long, and the manufacturer offers 4 1/2-foot extensions that connect with a coupling. The extensions are handy when we have to locate the holes outside around obstacles such as sidewalks, trees, and decks.

Grip-Tite recommends a pneumatic demolition hammer for driving the rods; we have one, but sometimes it's easier just to use a sledgehammer, which is fine for most soils. A pair of hex nuts on the threaded rod prevents thread damage while driving it, and a hardened conical tip on the other end breaks through most obstructions without a problem. It's usually just a matter of driving the rod until it appears in the

Figure 9. A plastic sleeve over the end of the rod (right) prevents the threads from catching on the block instead of transferring the force to the wall anchor. The three bolts are tightened incrementally with a torque wrench (below) to gradually move the wall back in line without breaking the block. After the bolts are tightened, the soil in the hole outside is compacted (bottom) to prevent water from collecting there and causing frost movement.

hole outside. Having a second person steady the rod makes it easier to hit, and a spotter on the outside watching the hole prevents us from driving the rod too far — it's tough pulling it back toward the house.

Before installing the washer and nut, we slip a plastic sleeve over the threaded rod (Figure 9). Once all of the ties are in position and hand-tightened, I use a torque wrench to tighten the bolts in 10-pound increments until the wall is back in place or we reach 80 foot-pounds.

We can often bring bulging block walls back in line without any excavation, but it's obviously easier when there's no soil pushing back. So when we have a hole already dug, as on this job, we tighten the wall ties before backfilling. In this case, we were able to almost eliminate the 3-inch bulge in the center of the wall.

Once all the wall ties are tight, we backfill the holes in 6-inch lifts, using a hand tamper to compact the soil.

Cost

One advantage of a Grip-Tite repair is that it generally costs less than other methods. The foundation work on this house cost about $3,000 and was completed over three days. The next-door neighbors, whose home was built at the same time and had a similar problem, spent more than $15,000 having their bulging foundation wall completely rebuilt.

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