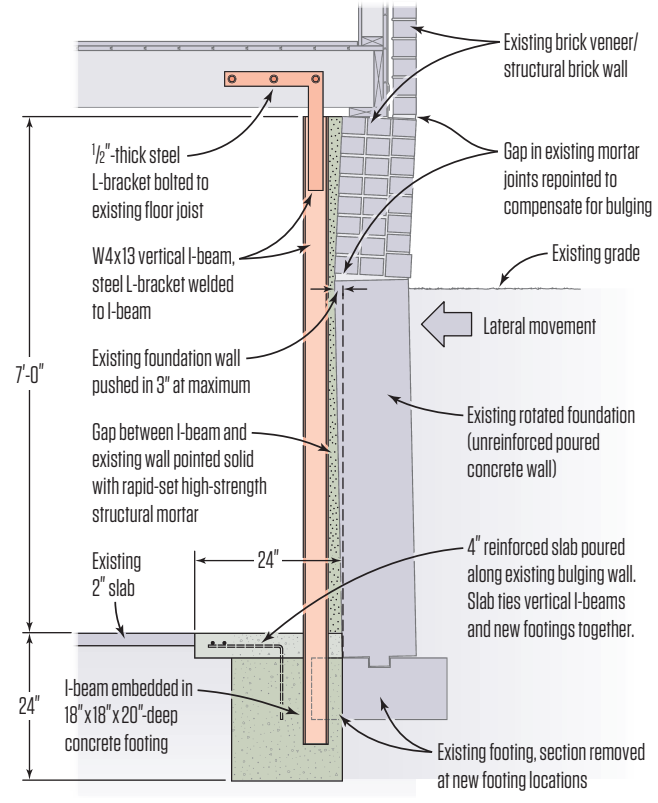
Reinforcing a Bulging Foundation



Photos by Jake Lewandowski; illustration by Tim Healey

A Cure for a Bulging Foundation

BY JAKE LEWANDOWSKI

Working for my company, Great Lakes Builders, is never boring. We are called in to do just about any kind of structural repair you can imagine, and foundation problems are common among the projects we do.

Recently, we were called in to reinforce the foundation on a home built in the middle of the last century—before soil analysis, concrete reinforcement, and engineering became commonplace. The foundation on this home was unreinforced poured concrete from grade down to a footing below the basement floor. Above grade, a brick masonry wall extended up more than 2 feet to support the framing for the first floor.

The poured foundation was solid, but over time, one wall had rotated inward more than 3 inches at its maximum **(1, 2)**. In plan, the foundation was plumb at the corners and bowed in at the middle. To stabilize the foundation wall, we installed six vertical I-beams, anchored in concrete footings at the base and bolted to the first-floor framing above (see Reinforcing a Bulging Foundation, left, and photos on pages 14 and 15). After securing the I-beams in place, we filled the tapered gaps between them and the existing wall with high-strength structural mortar.

Structurally, we needed only five vertical beams. But adding one more beam and changing the spacing kept the beams away from the basement windows. In addition to calling for the vertical structural members, the engineer specified that we install a 24-inch-wide by 4-inch-thick steel-reinforced concrete slab along the entire length of the bulging foundation wall.

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This foundation had rotated inward considerably, and the resulting bulge was visible from both the interior **(1)** and the exterior **(2)**. The solution, shown in the illustration, was to install a series of six vertical steel I-beams—anchored in concrete below and attached to the floor framing above—to resist any further lateral movement.

The crew laid out the positions of the vertical beams on the basement walls **(3)**. After snapping a line across the slab and scoring it with a saw, they removed rectangular sections of the existing slab and dug holes for the beam footings. They then ground the paint off the foundation wall at each beam location **(4)**. The beam footing holes were 24 inches deep and extended 18 inches from the foundation wall **(5)**.

Next, the crew placed each beam in its footing hole on a temporary block that set the beam 6 inches from the bottom of the hole. They rough-plumbed the beam with one flange touching the bulging wall. A flat L-bracket had been welded at the top of each beam with 3/4-inch holes as specified by the engineer. They drilled through the joists and drove high-strength 3/4-inch bolts at each hole location **(6)**. After removing the 6-inch block and leaving the beam temporarily suspended from the joist, they poured concrete to within 4 inches of the top of the slab **(7)** and gave each beam a final check for plumb **(8)**.

Before filling in the tapered gaps between the beams and the foundation wall, the crew sprayed liquid bonding agent on the bare concrete to help maximize adhesion **(9)**. They then packed structural mortar into the gaps, making sure to fill them completely **(10)**.

When all the beams were set and the concrete cured, the crew removed the rest of the slab between the wall and the line they scored earlier with a saw **(11)**. They added #5 rebar along the excavated trench and attached it to pieces of rebar that they had bent over and embedded in the concrete anchors **(12)**. To complete the project, the crew poured concrete in the trench flush with the rest of the basement floor **(13)**. Anchored at the base and tied into the floor framing above, the vertical beams will stabilize the foundation and resist any further inward movement.