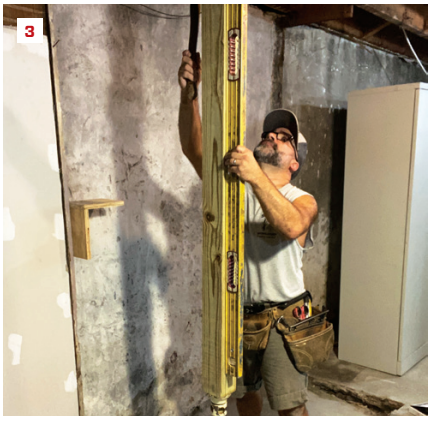
Pinning Column Footings to Broken Ledge

BY EMANUEL SILVA

More than a few of my jobs have been for clients who contacted me after reading one of my *JLC* articles. That was the case for this project, which involved replacing four structural support columns in the basement of a three-story house built in 1895. My client, who had just purchased the house, was concerned about cracks in the basement's concrete slab floor that were radiating out from each column, as well as about some dips in the flooring at the first-floor level and a few binding pocket doors. The scope of work included additional columns as needed to address these issues.

Other contractors had looked at the job but declined to take it on; I'd done similar work before (see "Shoring a Sagging Floor," Mar/12), so I knew what to expect. Still, this was one of my most challenging basement projects, with a concrete floor consisting of two slabs poured at separate times, one on top of the other, over a subbase of broken-up ledge. The bases of the four steel columns were bearing on the stone substrate and buried beneath the two slabs, so the concrete needed to be broken up just to remove the embedded columns.

I started by assembling cribbing from 8-foot-long 4x4 pressure-treated posts cut into 2-foot sections. Solid support is needed for the 20-ton screw jacks that I use to lift floor framing enough to remove a support post **(1)**, and because basement slab floors are rarely level or smooth, I always shim the assembled cribbing carefully **(2)**. Then, while jacking up the temporary 4x4 supports, I check them frequently for plumb in both directions **(3)**. The cribbing at each



Cribbing assembled from 4x4 posts **(1)** and shimmed level either with composite shims (where the gap was less than 1/2 inch) **(2)** or with sawn stock supported the author's 20-ton screw jacks during the project **(3, 4)**. The bases of the existing columns were buried under the basement slab, which had to be chipped away prior to removal of the columns **(5)**. Focusing on one column at a time, the author then used a rotary hammer to enlarge the openings in the slab for new footings **(6)**.

Photos by Emanuel Silva

The author drilled holes in the large rocks remaining embedded beneath the slab **(7)** for 1/2-inch rebar dowels **(8)** and epoxy adhesive **(9)** to pin the new footings to the subbase. To form raised piers, he carefully cut 10-inch-diameter tube forms into 6-inch lengths **(10)** prior to mixing up bags of concrete and filling the holes **(11)**. Only one of the footing holes was rock-free; here, the author reinforced the concrete footing with a rebar grid placed about a third of the depth of the hole **(12)**.

location would be in place for about a week, during which time a lot of weight would bear on the assembly. With plumbing, waste lines, and gas supplies at stake, a major shift in the position of the building could be catastrophic, so I worked slowly and carefully to make sure everything was solid, flat, level, and plumb as I proceeded.

I space a pair of temporary supports about 4 feet apart when I'm removing a column and typically jack up existing framing no more than 1/4 inch—just enough to take the weight off the column. To make sure that the temporary supports don't shift positions relative to each other, I set up a laser level in a convenient location, mark a reference elevation on each support post, and check the marks periodically **(4)**.

After breaking away enough of the slab with a rotary hammer to remove the old column **(5)**, I enlarged the opening in the slab to 30 inches square **(6)**. Then the hard part began: removing enough of the underlying soil and broken ledge to provide solid bearing for a new concrete footing. In some cases, the rocks were large enough and extended far enough underneath the slab that attempting to remove them would have caused the edge of the slab to collapse. So, for each of the nine new footings that were needed to replace the four original ones, I had to make a careful judgment about what material could be removed and what could remain.

I loosened rocks and dirt with a small shovel and grub hoe, then switched to a flat bar and my hands to remove as much as I could from each hole. But the key to clearing the holes was a wet/dry vac fitted with a 2-inch-diameter hose, which quickly sucked up loose dirt and small stones as long as the soil wasn't too damp.

Normally, I reinforce footings with a grid of #4 rebar **(12)**, but for eight out of the nine new footings, I instead drilled a series of 5/8-inch-diameter holes at least 4 inches deep into the larger rocks **(7)**. Then I squirted epoxy adhesive into the holes and filled them with 8-inch lengths of rebar **(8, 9)** to tie the new concrete footings to the subbase.

To raise the base of each new column above the level of the existing slab, I used short lengths of 10-inch-diameter tube footing

The author inserts a cardboard tube footing form into the wet concrete **(13)**, centering it with a weighted string fastened to the beam above **(14)**. After filling the form with concrete, inserting rebar, and leveling the form **(15)**, he screeded and troweled the top of the pier smooth **(16)**. A pair of overlapping 2x4s **(17)** were used to get an accurate length for cutting the new column to fit **(18)**.

forms to create monolithic footings and piers. I used a length of aluminum flashing to mark the cut line for each 6-inch-long section, then slowly scored my mark with a sharp utility knife so that the tops of the cardboard forms would have a clean edge, making it easier to screed the tops of the piers smooth **(10)**.

For each 30-inch-square-by-12-inch-deep footing, I had estimated about 15 80-pound bags of concrete (though I used less because of the irregular stone remaining in most of the holes), which I mixed up one bag at a time **(11)**. After filling a hole, tamping it with a shovel to remove air bubbles, and screeding the new concrete flush with the old slab, I embedded a 6-inch-long footing form about 3 inches into the wet concrete to create a raised pier **(13)**. To make sure the piers were centered underneath the column locations, I hung a washer tied to a string from a screw driven into the framing. I filled the form with concrete, then inserted additional short lengths of rebar into the pier **(14)** before leveling it and screeding the top smooth **(15)**.

I typically wait about a week for new concrete to cure before placing any weight on it. In the meantime, I screwed a couple of braces to the temporary support posts and moved on to the next column location on this project **(16)**.

To find a precise measurement for the length of the new columns, I used a couple of shorter lengths of 2x4 to make an adjustable story pole **(17)**, positioned the column base on the footing, and screwed the Springfield plate column cap to the beam. By resting the bottom of one 2x4 on the dimpled plate column base, pushing the other 2x4 up tight against the column cap, and marking a reference line across both 2x4s, I could then transfer the exact length to the column.

On this project, I installed 4-inch-diameter Lally columns (which are considerably stronger than typical 3 1/2-inch-diameter columns), using a large aluminum pipe wrench to hold them in place while I cut them to length **(18)**. I ended up installing nine new columns: four to replace the original ones and the rest to provide additional support for the floor framing.

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