Installing a Twenty-Foot Header

Retrofitting a half-ton steel I-beam into an existing house calls for careful shoring and lifting

by Bjorn Billings

As a framing and finish subcontractor working in the suburbs north of New York City, I get my share of interesting remodeling projects. One recent favorite was a two-story addition on the back of a conventional two-story colonial. The first floor of the addition doubled the size of the existing kitchen; upstairs we added a new laundry and a master bath complete with a 6-foot whirlpool tub.

Generally speaking, the framing was straightforward, but as with any remodel there were complications. The biggest challenge was the nearly 20-foot-wide opening we had to create to connect the first floor of the new space to the existing kitchen. Because the addition is on the eaves side of the house, I had to temporarily support the second floor and roof loads while I prepared the opening and installed a new structural-steel header.

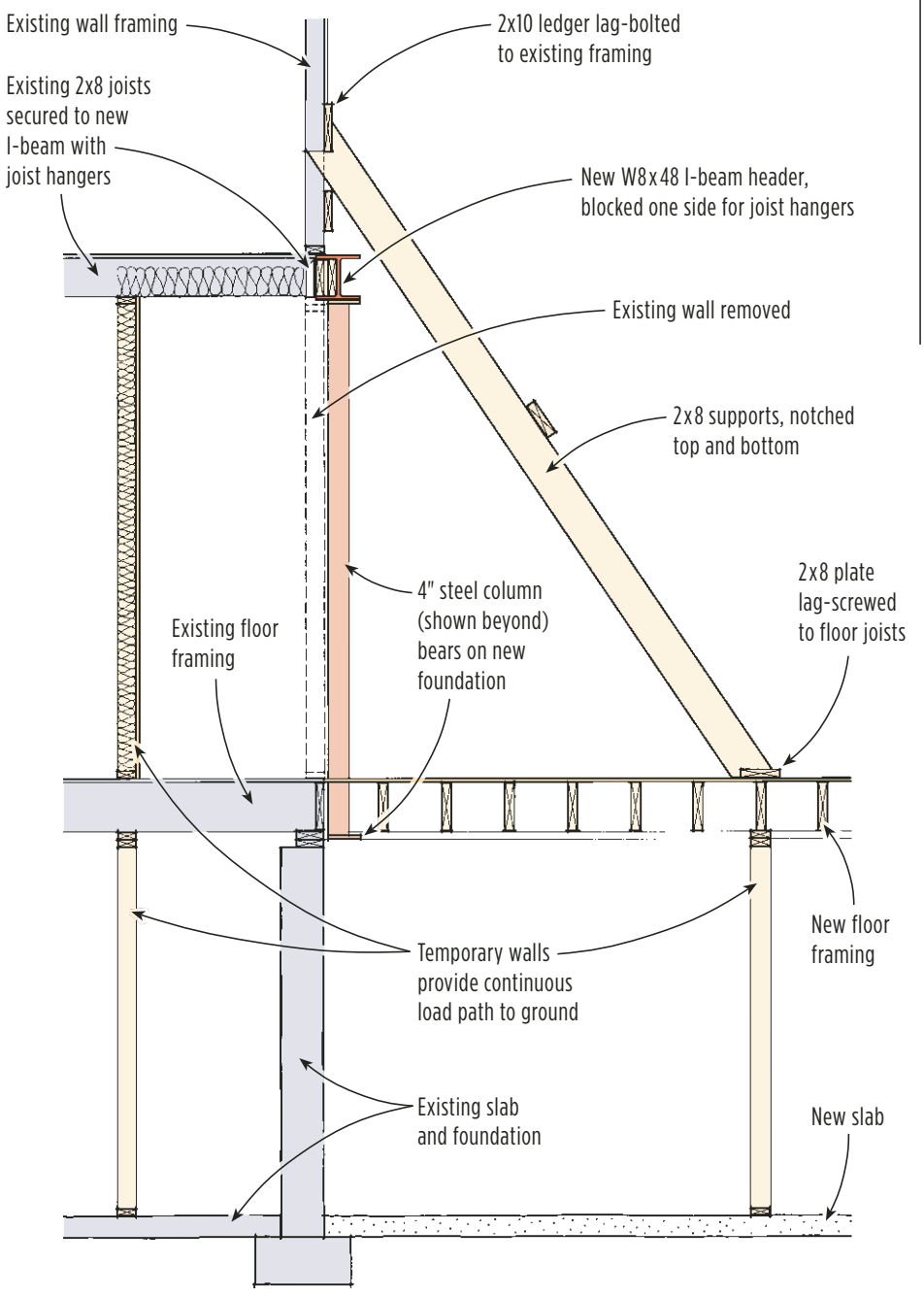

Figure 1. Before opening up the exterior bearing wall, the author provided temporary support for the second-floor and roof loads with a temporary stud wall on the inside and angled supports on the outside. The interior support wall was sheathed and insulated to provide weather protection for the house, which was inhabited during the project.

Figure 2. A 2x10 ledger fastened to the studs with 1/2-inch lag screws serves as an attachment point for the 2x8 diagonal braces (above left). A second ledger beneath the top end of the braces keeps them snugly in place and helps prevent splitting. A sheathed, insulated 2x4 wall on the inside picks up the second-story floor loads (above).

Providing Temporary Support

Looking at the plans, I knew we'd need a temporary stud wall inside the existing space to shore up the house while I installed the W8 x 48 I-beam header specified by the architect. To leave working room, I wanted to keep the temporary wall about 3 feet inside the exterior wall (see Figure 1, page 2).

Concerned that this might create an unstable cantilever, I also decided to install diagonal supports on the outside — like the kind of temporary supports you'd use to hold up a porch roof while you rebuilt the floor. This meant building a temporary wall under the floor of the addition to provide a continuous load path for the diagonal braces to the ground.

In building the temp wall on the inside, I decided to cover it with 1/2-inch plywood and install fiberglass batts to give the homeowners — who were

Figure 3. A sandwich of pressure-treated lumber and plywood bolted to one side of the I-beam provides a nailer for joist hangers (far left). Knocking the corners off the 2x8 allows it to sit tight to the I-beam's web (left).

Figure 4. After determining that the 8½-inch-deep beam wouldn't fit within the home's existing floor system, the author used a Fein MultiMaster to remove the subfloor for an additional ⅝ inch of clearance (above). Here, the opening is ready to receive the beam (above right).

living in the house during the job — some weather protection.

Luckily, the GC took care of removing the asbestos siding from the area where the addition was going; to get started, we just had to pull off the sheathing and remove an existing window and door. Before installing the diagonals, we fastened a temporary 2x10 ledger above the new opening, using ½-inch lag screws. We predrilled the studs to prevent splitting, and used plenty of 16d commons as well.

After placing the 2x8 diagonals, we attached a second ledger underneath to prevent them from slipping and to contain the inevitable splits at the notches (Figure 2, page 3). We nailed them off at their bases to a plate secured to the floor framing.

Prepping the Opening

The day before we were to install the header, I made a trip to my steel fabricator to double-check measurements and fasten a wood nailer for joist hangers to the web (Figure 3, page 3). To be on the safe side, I decided to use pressure-treated material for the nailers in case condensation ever forms on the cold steel.

Meanwhile, back on site, members of the crew cut out the opening in the exterior wall and removed the band joist in preparation for the I-beam. When they were doing this, they noticed that the existing second-story floor joists were 2x8s — not 2x10s as the architect had assumed. That meant the 8½-inch-deep I-beam wasn't going to sit flush with the bottom of the existing framing. To gain some additional clearance, we cut away the ⅝-inch subfloor above the header (Figure 4).

A quick phone call to the steel fabricator alerted him just in time that the columns would need to be 5/8 inch longer than the original measurement.

Even with the subfloor cut out, the beam was not going to disappear into the framing. Still, it was close enough that adding strapping to the existing kitchen ceiling would allow us to create the flush ceiling the architect had planned.

A bigger challenge was preserving the addition's clear-span second floor with only 8 1/2 inches of depth to work with. After consulting with a structural engineer, the architect specified 8-inch steel C-channel joists on 12-inch centers; the joists would have to be doubled up under the tub.

Figure 5. A chain hoist attached to the temporary ledger supplied lift (top photos). After the hoist maxed out, a pair of heavy-duty ratchet straps finished the job (above).

Manhandling the Steel

At 48 pounds per foot, our 19-foot 8-inch header weighed almost 1,000 pounds. We rolled it off the truck on PVC pipes to get it into position, then used a chain hoist to raise it (Figure 5).

We strapped the chain hoist to the temporary 2x10 ledger, found the balance point on the beam, and carefully lifted, keeping an eye on our ledger and shoring as we went.

When it became obvious that we would max out the chain hoist capacity, we finished the lifting with a couple of 1,000-pound-capacity ratchet straps.

The architect planned for the beam's support posts to bear on the addi-

Figure 6. Four-inch steel columns with welded caps and base plates support the beam at each end. Note the 1/2-inch-drive ratchet's drift handle, used for lining up the predrilled bolt holes (above). The column bottoms (above right) would be secured later with one 1/2-inch wedge anchor each; the inside hole landed too close to the edge of the concrete for drilling.

tion's new concrete foundation. This worked out well; at a little over 8 inches wide, the I-beam wouldn't fit inside the existing 2x4 framing anyway.

Once the beam was in near-final position, we slipped in the 4-inch-square columns and bolted everything together (Figure 6). We'd had the columns made to exact length, which made it a little tough to get the beam into place. We used a post on a bottle jack to lift first one end of the beam (and the house, too) and then the other end, so we could get the column bases seated.

We didn't have to worry about cracking the plaster in the bath above as we

Figure 7. The author used conventional face-mount hangers nailed to the header to support the joist ends on the existing part of the house (above). With the hangers installed and the post bases fastened to the foundation, the ledger and 2x8 supports came down. The temporary wall was left in place to keep the house clean and offer weather protection (right).

Figure 8. Eight-inch-deep steel joists on 12-inch centers provide a clear-span ceiling in the kitchen. The doubled joists on the right side of the photo at left support the whirlpool tub. The steel band joist is visible between floors (above).

jacked, because the whole space was being demoed anyway. (Next time, as my fabricator suggests, we'll make the posts ½ inch short to gain a little play, then add shims underneath once the beam is in place.)

Only then — when the beam had solid bearing — did we remove the ratchet straps. We checked the posts for plumb, then installed a couple of wedge anchors through the base plates into the foundation.

Installing Joist Hangers

Next we attached the existing second-floor joists to the beam. To maintain a consistent ceiling plane, we jacked each joist individually to the proper height, toenailed it snug, and installed the hanger. We used a powder-actuated tool to fasten the exterior wall plate above to the top of the header. Finally, with everything secure, we took down the diagonal bracing so we could frame the rest of the addition (Figure 7, page 6).

Finishing the Framing

The rest of the framing was a piece of cake — except for the time spent dealing with the steel floor joists (Figure 8).

If you're used to working with wood, steel framing takes a lot more time. You cut with an abrasive cutoff saw, and all the connections have to be made with an impact driver and self-tapping screws. It took a while to align the precut holes for plumbing and electrical rough-in, and we had to install a row of blocking midspan.

Figure 9. The addition didn't just furnish extra space; it dramatically improved the appearance of the original rear facade. Inside (bottom), the new kitchen.

Still, despite the complications, the steel joists were a pretty good solution, especially considering we ended up with a 19-foot span that supports a tile floor and a 70-gallon tub.

Cost of the Steel

The steel beam and posts cost about $1,200 and took less than eight hours to install, including the time spent installing the temporary bracing, plating the web, and preparing the opening.

We hid the steel posts supporting the I-beam in the 2x6 walls of the addition. The addition's roof and overhang details had been designed to match the existing house (Figure 9), and once the entire house was sided with vinyl, the addition looked as if it had been there forever.

Bjorn Billings *owns Billings Carpentry and Construction in Nyack, N.Y.*