Retrofitting A Structural Ridge

Reinforced light-gauge steel beams provided the strength needed to open up the attic in this small home

by Kipton Tewksbury

The clients wanted me to transform the attic of their 70-year-old Arlington, Mass., home into a finished bedroom. The attic, which until now had been used for storage, ran the length and width of the house — 36 feet by 26 feet. There were no knee walls; the rafters spanned from the ridge all the way down to the eaves. The ridge was 9 feet 4 inches off the floor, with collar ties 2 feet below the ridge. The clients were hoping to get rid of the collar ties and add skylights to create a more open living space.

Sounds simple enough, but there was a problem. In most cases where the rafters meet the floor at the eaves, the floor joists serve as ties, but in this house the rafters weren't tied to the joists. In fact, the rafters sat on top of the attic deck, so tying them to the joists wasn't a realistic option. Even if it had been, a stairwell

perpendicular to the joists would have eliminated lateral support in the center of the house.

If we wanted to remove the collar ties, we would need to install a structural ridge beam.

That created yet another problem. Our structural engineer specified a ridge consisting of three 10-inch-deep LVLs placed side by side. Not only would such a beam be hard to work with, requiring that the three sections be drilled and bolted together, but the end product would look so bulky in this relatively small space as to nearly defeat the point of creating an open ceiling.

New Product to the Rescue

To solve both problems, I decided to try something new. Not long before, I had gotten an unsolicited mailing from Metwood Building Solutions of Boones Mill, Va. (540/334-4294, www.metwood.com). Metwood makes steel framing components, one of which — the TruSpan beam — is a hollow rectangular beam made from 14-gauge cold-formed steel (see Figure 1). Its cross section consists of two C-sections that have been welded together, with steel reinforcing bar at each corner. By beefing up the internal reinforcing (stepping up from No. 4 to No. 9 rebar, for example), Metwood can increase a beam's carrying capacity somewhat without making it bigger.

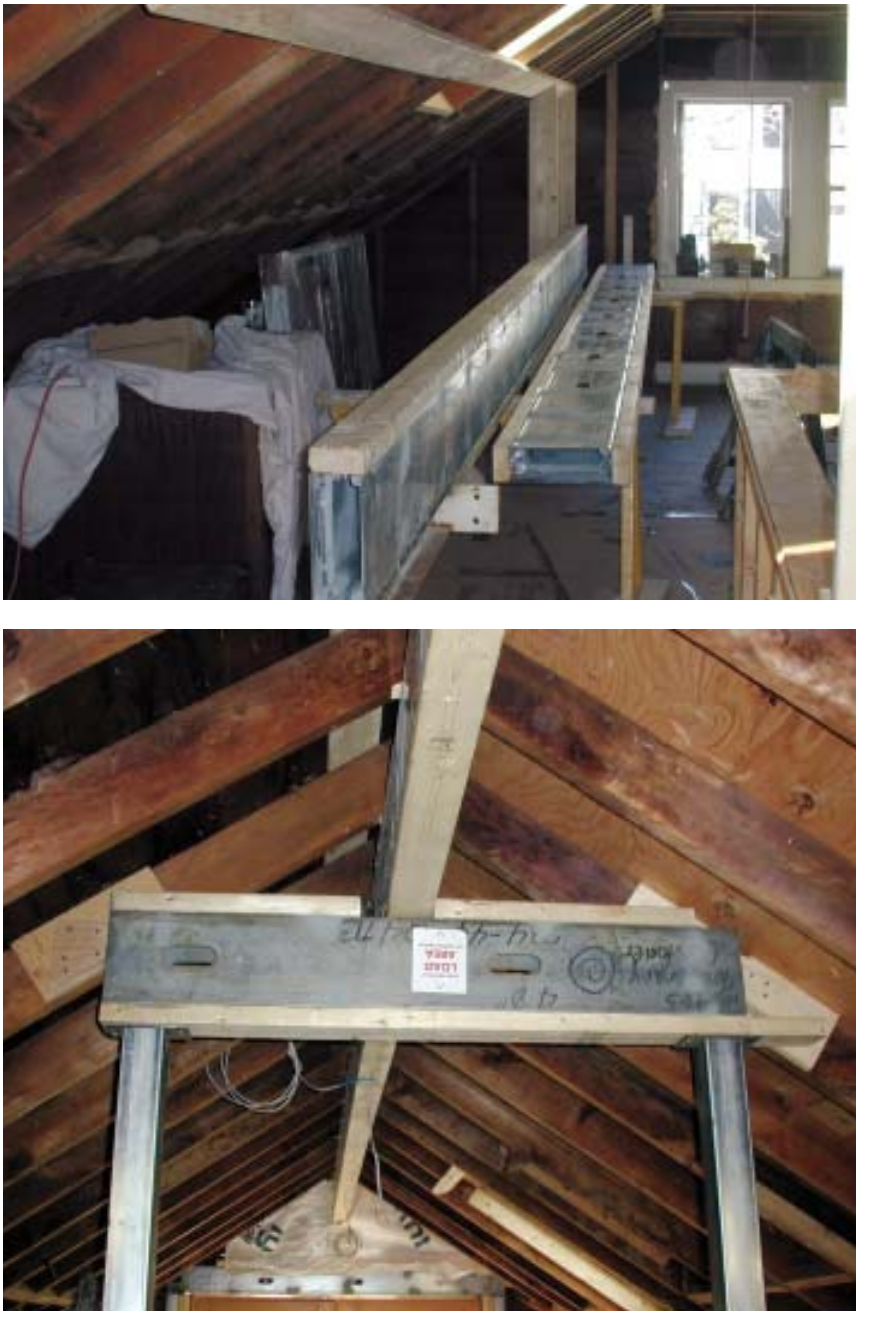


Figure 1. To keep the depth of the structural ridge to a minimum, the author chose Metwood TruSpan beams, which are made from cold-formed steel with internal reinforcing bar welded on for extra strength. The beams can be ordered with two-by nailers on top and bottom for fastening to wood framing.

After reading the company's literature and talking with its field rep, I decided that the TruSpan beams would be stronger, lighter, more compact, and easier to install than comparable LVLs or steel I-beams. The manufacturer's load calculations showed that, in some cases, a $7\frac{1}{4}$-inch-deep TruSpan beam could bear the same weight as a 16-inch-deep LVL. As for

weight, our ridge beam weighed about 22 pounds per lineal foot, compared with 50 per lineal foot for a steel I-beam and even more for an LVL. And the fact that you can buy it with 2-by nailers on the top and bottom edges meant we could use normal wood connectors for making attachments.

It seemed to be the solution we were looking for.

Cautious Engineering

A Metwood engineer with a Massachusetts license specified the beam's size and internal reinforcement. My engineer was not familiar with the product, so he asked us to order a beam that was somewhat stronger than Metwood's specs. Since this merely required more internal reinforcement — rather than a bigger beam — I agreed.

The ridge wasn't the only place we used this product. There would be a French door at one end of the attic and a window at the other, and we specified Metwood headers for both.

We would also need a supporting structure near the center of the attic. That's because the ridge's weight and length required us to order it in two sections, one 17 feet long and the other 22 feet long. The joint where they met would need some bearing beneath it, which we provided using a 4-foot-long 7½-inch-deep Metwood beam supported at each end by 3-inch-diameter posts that straddled the stairwell. Fortunately for us, there were bearing walls on either side of the stairwell, so we didn't have to add posts below, a step that would have made the job a lot more complicated.

The clients were concerned that this middle structure would dominate an otherwise light and airy space, but that wasn't the case. The header and posts were a smaller diameter than we would have needed if we'd used wood, so there was less visual impact.

Those of you quick with the math will notice that 17 feet and 22 feet add up to 39 feet, while the ridge itself is only 36 feet long. We cantilevered 3 feet of the 22-foot-long section beyond the French-door gable end, and welded a 4-inch-by-4-inch steel I-beam to it. The I-beam holds a hoist trolley, which the owner can use to lift furniture three stories up from the garden at the back of the house.

Beam Installation

We had the most fun unloading the beams from a common carrier truck, then getting them through the window into the attic.

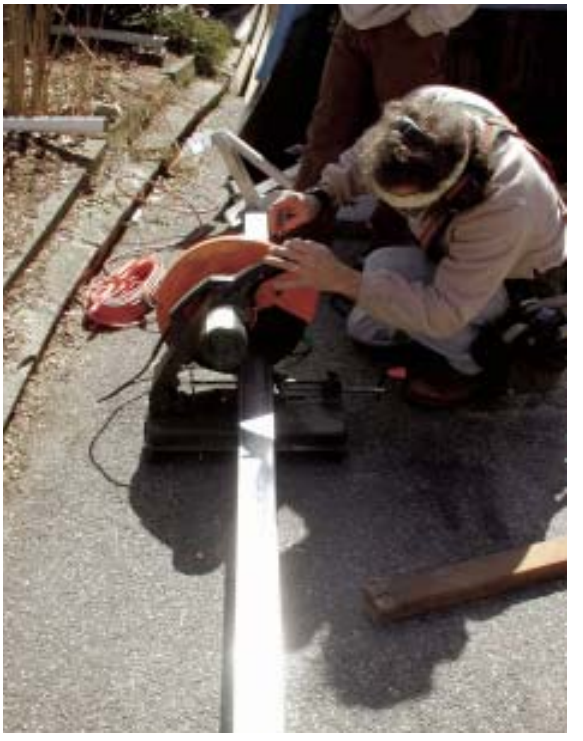
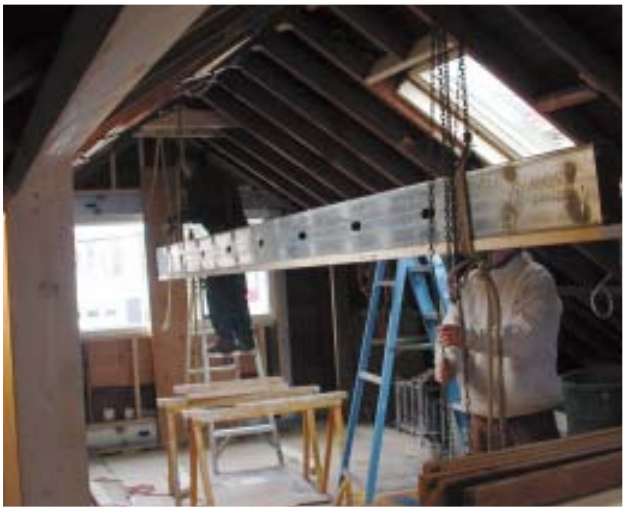


Figure 2. The Metwood beam can be cut easily with an abrasive blade on a chop saw (top) and trimmed with a grinder (above).

Using ladders and boards, we created an angled slide from ground level up to the window, then winched each beam up the slide. Because we are a two-person crew, the homeowner and a neighbor helped us get the beams through the window.

We had to trim a couple of inches off one of the beams, but it wasn't difficult; we simply used an abrasive metal blade in the circular saw (Figure 2, page 3). Since the 2x4 nailers don't count for the beam's load capacity, we removed the top one so that the beam would sit up higher off the floor. We left the bottom flange so we could screw drywall to it.

We used a chain fall and ratchet straps to hoist the beams close to the ridge, installed temporary collars underneath to



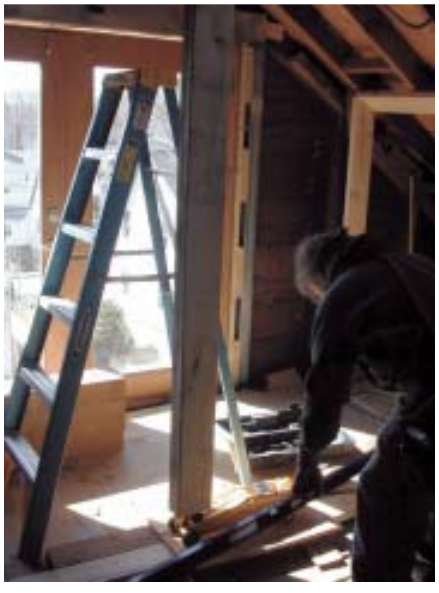


Figure 3. Temporary collars supported the chain hoist and ratchet straps (above left) used to lift the beams as high as possible, where they were supported from beneath with additional cross ties (above). A hydraulic jack (left) finished the job.

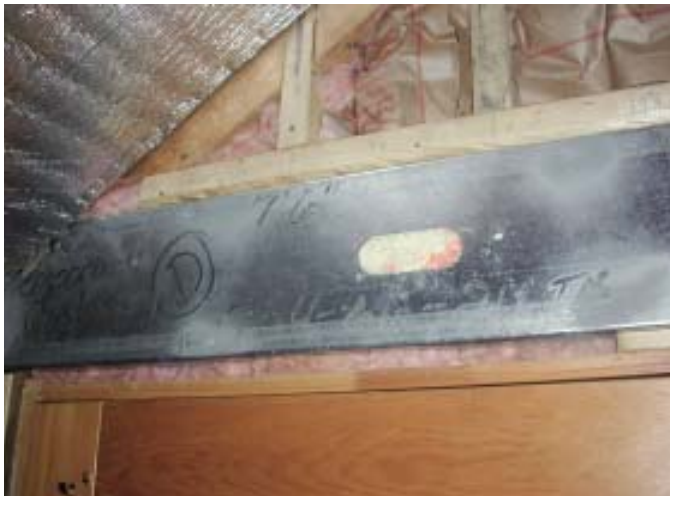


Figure 4. The Metwood headers for the gable walls came with punch-outs that allowed the author to insulate the cavities with spray foam.

hold them, then used a hydraulic jack to seat them as tightly against the peak as we dared (Figure 3, page 4). The rafters were not all in the same plane — they weren't even the same exact height — so we had to use shims in places, the biggest gap being about 5⁄8 inch.

It's easy enough to drill into the metal beams with self-tapping screws, which we did with the sheathing on the outside of the headers in the end walls. Inside, we just screwed the drywall to the wood nailer. We installed the three skylights, creating some visually interesting shadows on the ridge beam, which otherwise fades into the walls. The electrician was easily able to drill through the Metwood beams to run wires for the overhead lights and fan.

Because we were installing the steel headers in exterior walls, we were concerned about thermal bridging. Fortunately, Metwood informed us that we could order the beams with punch-outs every couple of feet, which we did. Before hanging our drywall, we used these punch-outs to fill the beams with expanding foam insulation (Figure 4, page 4).

The cost for all the Metwood materials was about $3,200. An LVL ridge beam and solid wood window and door headers would have cost somewhat less, but would have taken more work to install. Once I added in labor, the installed cost for each system was about equal.

More important than cost, I believe we got a better job than we could have with a conventional wood approach. The Metwood beams let us open up and reframe this attic to make a very pleasant bedroom (Figure 5). Adding knee walls a few feet in from the eaves created a large storage area. The job was less work than with wood, both because of the weight and the general ease of installation. I wouldn't hesitate to use this product in the future.

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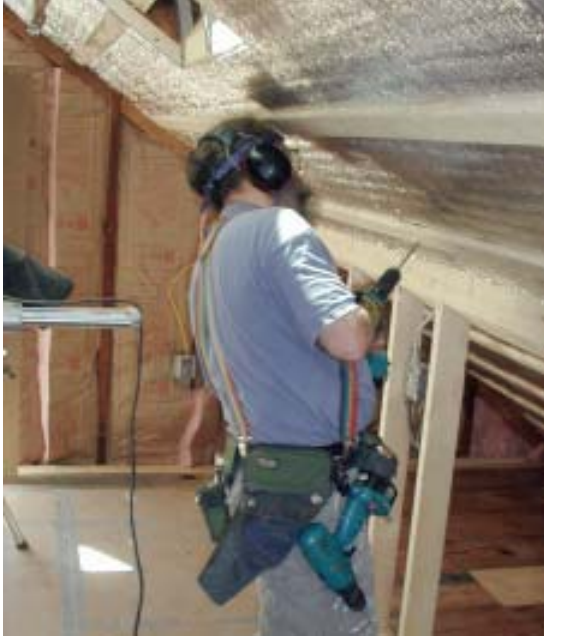

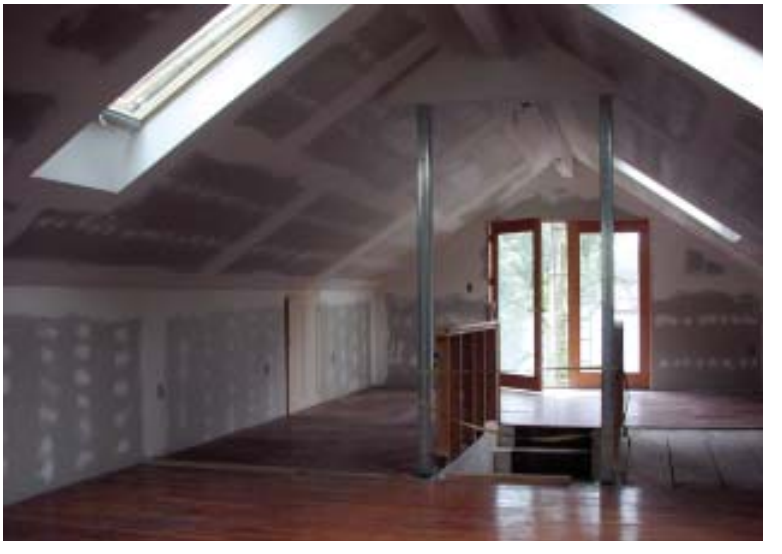

Figure 5. With the ridge in place, insulation (top) and drywall (center) were straightforward. At last, home sweet teenage home (above).