Interview: Rafter Framing With Wood I-Beams

For greater speed and longer spans, wood I-beams make good sense

Two men can easily position a 24-foot I-beam rafter. The wood I-beams are lightweight and straight enough that they don't need crowning.

Wood I-beam joists are becoming much more common in residential floor systems. But using the same components for roof rafters is met with some skepticism. For that reason, we went to Mike Hoch of Sunbuilt Homes in Champaign, Ill. He and his partner, Mark Hieronymus, build both spec and custom homes. They began using wood I-beams in their roof framing several years ago, and they have become loyal fans of those manufactured members. Here's what Hoch had to say about them.

JLC: *Why did you start using wood I-beams in your roofs?*

Hoch: We decided to try them because our house designs often call for rafters over 24 feet. At that length you pay a premium for Douglas fir, and it's a special order — no yard stocks 2x10s or 2x12s that long — and that means hoping they come in on time and in good enough condition to use.

JLC: *Is the quality difference between wood I-beams and dimensional lumber that noticeable?*

Hoch: This is the fourth house where we've used wood I-beams for rafters, and we think we've got the best looking roofs in town. We've only used Trus Joist's TJIs (see "Sources of Supply" at the end of the article), but they're the best framing material we've ever seen — dead straight and the same dimension each time. We don't even crown them. And we've never sent one back for defects.

With fir rafters, we inevitably ended up sending three or four back to the yard because of a 2-inch crown, loose knots, or severe checks. Then we twiddle our thumbs waiting for the new material to arrive.

JLC: *But in a direct cost comparison, doesn't dimensional lumber come up cheapest?*

Hoch: The labor we save handling the lighter I-beams helps outweigh any price difference. On the house we're building now, the TJIs cost about $500 more than solid 2x rafters. But one of these 9 1/2-inch-deep I-beams weighs about half what a 2x10 douglas fir rafter does. This means one man can easily handle a 30-footer. We figure that'll save us two days labor for our crew of three on our current job alone — plus a lot of Doane's pills.

JLC: *When don't you use wood I-beams on a roof?*

Hoch: If rafter lengths are below 20 feet and the lumberyard has a good supply of straight fir in stock, we'll consider using dimensional lumber. But we no longer think of wood I-beams just in terms of big jobs.

We recently did a hip-roofed room addition with a 22-foot horizontal clear span. We didn't want posts, and the house was designed for lots of skylights. We would have had to double up 2x12 rafters to get the strength needed. Instead, we used 11 1/2-inch wood I-beams, 2 feet on-center.

JLC: *Why not just use trusses?*

Hoch: If we had a one-story, gable-roofed house with no complications, we'd probably consider trusses. But generally, they're not a good option for us because of the kinds of houses we build.

We often tuck a second story under the roof. We could use scissor trusses, but we would lose precious space and we would still end up with a 12:12 pitch on the outside and a 6:12 sloping ceiling on the inside. You can really see the transition between the two around skylights.

We also like using wood I-beams because they're an efficient use of our forest resources — all the lumber in a tree is used to make them.

JLC: *Is there any trick to ordering wood I-beams?*

Hoch: We have to adjust our schedule a little to make sure that the yard has time to make up the order. It takes a little less than a week to get beams when that's necessary, but the yard usually keeps a large supply on hand.

Our yard buys directly from the manufacturer, so the beams come in as 60-footers. When we give the yard a cut list (we round up a couple of inches), the employees literally go out there with a chainsaw to fill the order. This can take a day or two if we need a lot of different lengths.

There are also some advantages to this system when it comes to price. With wood I-beams, you don't pay a premium for longer lengths — it costs the same per foot for a 10-footer as it does for a 50-footer — and you only pay for the length you need rather than ordering in two-foot increments as you do with solid-sawn lumber.

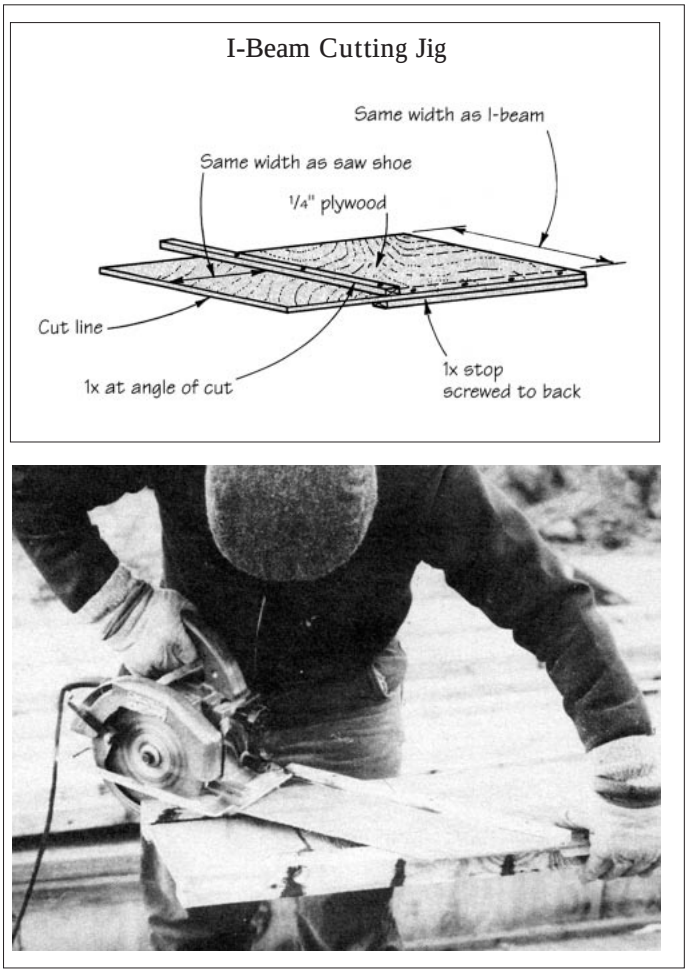

Figure 1. *Hoch came up with this jig (top) to simplify marking and cutting I-beams. For plumb and cheek cuts, he holds the jig as you would use a Speed Square for crosscutting (above).*

JLC: *What questions did you have the first time you used I-beam rafters?*
Hoch: The usual — how were we going to tie them together, how much blocking were we going to have to do, and how much of a pain in the neck would cutting them be?

When connecting wood I-beams, you must fill in between the flanges with solid blocking to stiffen the I-beam and create a flush nailing surface. We usually fill in on either side of the rafter with 3/4-inch OSB or plywood. Once you have framed a few houses with wood I-beams, this blocking becomes second nature.

JLC: *What about cutting?*
Hoch: That requires a little more effort, but I devised a jig that works well both for commons and compound angle cuts (see Figure 1). I make it out of a 12-inch-wide 2-foot-long scrap of 1/4-inch lauan plywood. I screw a stop along a bottom edge to hold the jig against the I-beam like a Speed Square, and another on top at the angle of cut to use as a guide for the shoe of my saw.

You can also use a radial arm saw or Sawbuck if you have a lot of rafters to cut. Either way, safety glasses are a good idea — wood I-beams throw a lot of splinters.

JLC: *Where did you go to get your questions answered when you were starting out with I-beams?*
Hoch: When questions came up, we called our area technical rep. When he couldn't deal with something over the phone, he came out to the site. We've found his suggestions very helpful in solving engineering questions, particularly on our first job. Most manufacturers' literature is very helpful, too. Some manufacturers also hold informational seminars for builders, architects, and engineers.

JLC: *Does your rep get involved with the roof design before you submit the plans?*
Hoch: In the first house where we used wood I-beam rafters, the framing was very tricky, and we had an engineer design the entire package. But on subsequent houses, we've gotten all the necessary information from the technical manual and our rep. On one house, our rep came up with a modification to the

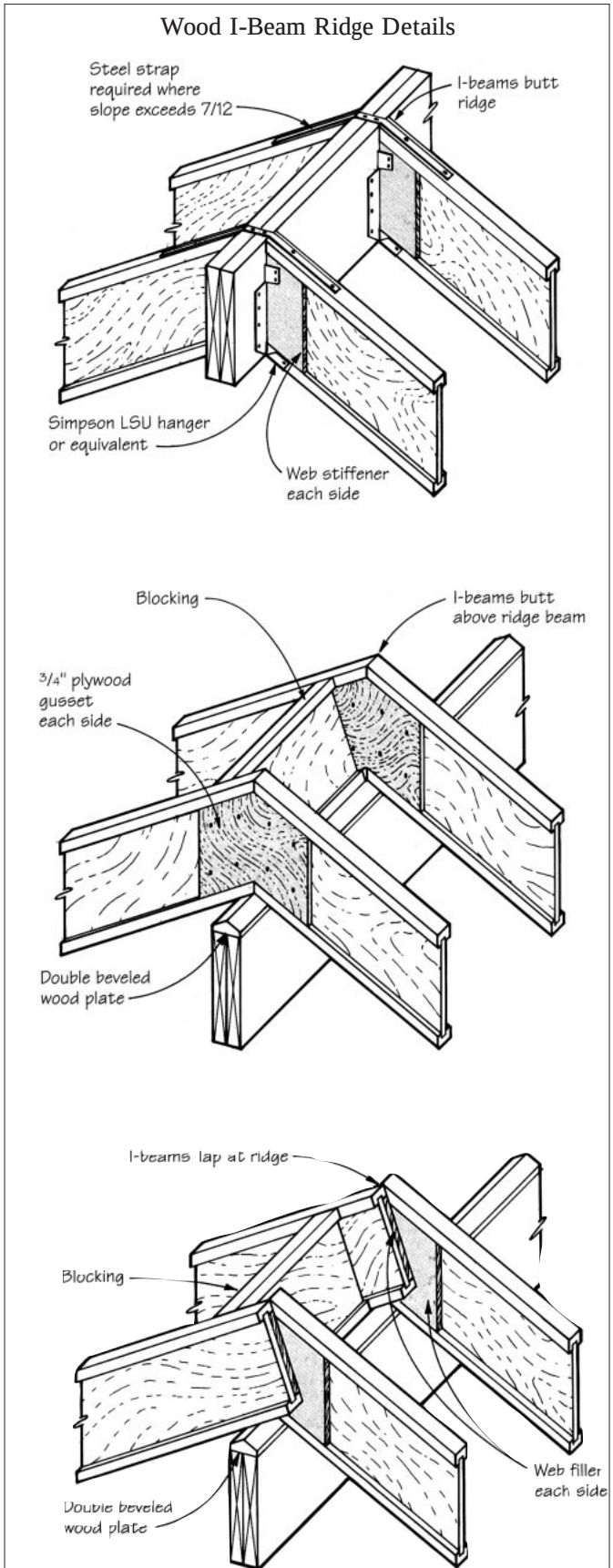

Figure 2. ***Three common ridge details.*** *For a flush ceiling at the ridge, make plumb cuts in the rafters and tie them together with steel straps (top). The author typically exposes the ridge in the room and connects the I-beams with plywood gussets (middle). A similar approach laps the beams over the ridge (bottom).*

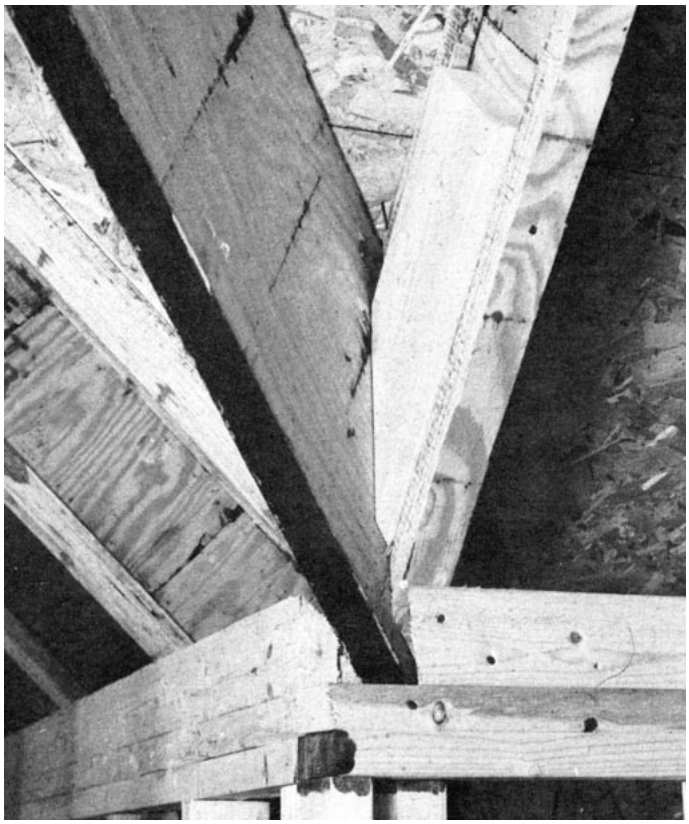

Figure 3. *This I-beam jack rafter is blocked with a scrap 2x to increase its bearing on the LVL valley beam. Hoch saves the blocking work for rainy days after the shell is complete.*

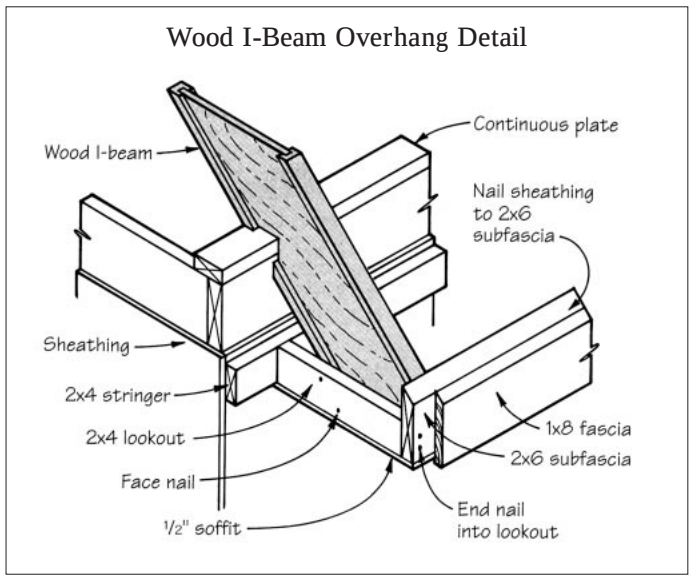

Figure 4. *This detail — modified from the technical manual — creates a very stable 24-inch overhang without a lot of cross bracing and blocking.*

roof framing plan that saved us about $1,000.

JLC: *Any reluctance on the part of building departments to accept this engineering or wood I-beams in general?*
Hoch: The building and safety departments are reluctant to approve anything new. We were the first ones in the city to use wood I-beams, so we had to answer all the questions.

The inspector's main objection had to do with fire safety — he was concerned that I-beams burn faster than 2x material (although not too many firemen are going to be climbing around on a 12:12 pitch). He also wanted to require cross bracing at the plate in between the rafters. The manual shows this bracing, but when you read the fine print, you realize it's only necessary with 14- and 16-inch-deep I-beams. Although we were able to convince the inspector that the rafters won't tip once the plywood is on, we do apply cross bracing if it's windy, just in case.

JLC: *Speaking of wind, wood I-beams have a reputation for acting like sails in a stiff breeze.*
Hoch: They do flex a lot, but then anything 30 feet long and a foot wide isn't going to be much fun to carry when it's windy.

JLC: *Doesn't that "flexibility" become a problem when you cut through the flange for a birdsmouth?*
Hoch: How you handle birdsmouths is critical with wood I-beams. You can cut into the web slightly, as long as the bottom flange of the beam bears completely on the top plate and you're not making any other cuts into the I-beam along its length. Because the flange is crucial to the strength of the rafter, cutting more than one birdsmouth is not recommended.

JLC: *How do you handle kneewalls then?*
Hoch: We rip a long, continuous wedge and nail it onto the top plate of the kneewall. This provides full bearing for the rafters.

JLC: *How about connections at the ridge?*
Hoch: The most common ridge connection — which produces a finished interior — is to plumb cut the I-beams at the ridge and then tie them together over the top with a metal strap (see Figure 2, facing page). But on that first house, our clients didn't mind the ridge beam dropping down into the room, so we butted the rafters on top of the ridge and connected them with gussets. This detail worked out well for us and we've stayed with it.

JLC: *What do you use for gussets?*
Hoch: We cut a one-piece, V-shaped gusset from 3/4-inch OSB or plywood; it fits between the flanges and should run at least a foot down each side of the ridge. Each rafter pair requires two gussets — one on each side.

We mass-produce them by cutting three or four patterns that are 1/4 inch or so smaller than the area they cover. (You don't want to have to use a saw or a sledge up there to get them to fit.)

Once we've checked the pattern pieces, we lay them out on three pieces of plywood or OSB screwed together and use a circular saw to cut 50 or so pieces at a time. We nail each one with a dozen 8s, which are clinched on the back side. We've found it easiest to install all the rafters first and then go back to nail the gussets.

JLC: *Backing up a bit, what's your framing sequence and how do you deploy your crew when setting I-beam rafters?*
Hoch: We start by stringing a line and setting our ridge beams. Once these are in place and braced, we set scaffolding on the second floor deck so my partner Mark has a solid place to work at the ridge.

Once we nail a double-beveled wood plate to the top of the ridge beam, we're ready to go. I cut rafters on the ground and hand them up to Marty, one of our carpenters who's positioned on the second floor deck near the plate. He's armed with a Senco pneumatic nailer and drives two 10d or 12d nails through the flange into the plate at the birdsmouth. We set about a third of the rafters, then Marty goes around to the other side and we set that side.

JLC: *How are the rafters nailed at the ridge?*
Hoch: We use two 16d sinkers at the ridge — one on each side of the web. These are driven by hand; having a nail gun at the ridge is more trouble than it's worth. Either way, though, you need to nail the rafter in the right spot the first time because pulling nails out of the flanges isn't an easy task.

JLC: *Do you ever use hangers?*
Hoch: No, we haven't found it necessary with an exposed ridge. But the hardware is widely available now and should be used if the rafters abut the ridge.

JLC: *How do you handle hips and valleys?*
Hoch: Basically, the same way as in conventional framing, with the exception that web stiffeners are required on both sides of the jack rafters where they meet the hip or valley rafter. This blocking can be installed after all rafters have been set; in fact, we often save this task for a rainy day after we've run the sheathing (see Figure 3).

For longer hip and valley rafters we use LVL beams. On smaller houses or for short valleys, regular framing lumber works fine too.

JLC: *How about dormers?*
Hoch: Again, the procedure isn't much different than with conventional lumber. We double-up the I-beams on either side of the dormer, then frame conventionally with 2x6s.

JLC: *How do you detail overhangs?*
Hoch: On our gable ends we typically have small overhangs — just 8 inches. But the technical literature does give a detail for outriggers.

At the eaves, the technical manual shows a lot of cross bracing and blocking to support the fascia. We've modified their detail somewhat and found it a lot more practical for our 24-inch overhangs (see Figure 4).

We start by cutting a bevel to match the pitch of the roof on the top edge of our 2x6 subfascia. Then we nail through the sheathing into the beveled 2x so that it hangs from the sheathing. If you're not using a nail gun, this requires another pair of hands to "buck" the underside of the 2x6 with a hammer to absorb some