Framing Floors With I-Joists

Once you get used to the details, you can frame faster and flatter with wood I-joists

by Scott Woelfel

Ten years ago, when my company was building its office, showrooms, and warehouse, I had to find a way to frame the floor over a 40-foot-wide span. I considered using open web floor trusses, but I wasn't crazy about the price and they weren't readily available. The salesperson at my local lumber supplier called my attention to wood I-joists, a product they'd recently begun to carry and support. Sufficiently impressed with the apparent capabilities of this new (at least to me) technology, I decided to give it a try, and I haven't had a moment's regret — we've since used I-joists exclusively for all of our floor framing.

There's no reason I can think of not to use them. Maybe they take a little getting used to at first, but we've used them so often, for so long, that the details have become routine.

Ordering I-Joists

When you work with I-joists, you're dealing with an engineered product with distinctly different performance characteristics from solid lumber. Although you can simply refer to span charts in the manufacturer's product brochure for basic joist sizing, it's best to consult a product

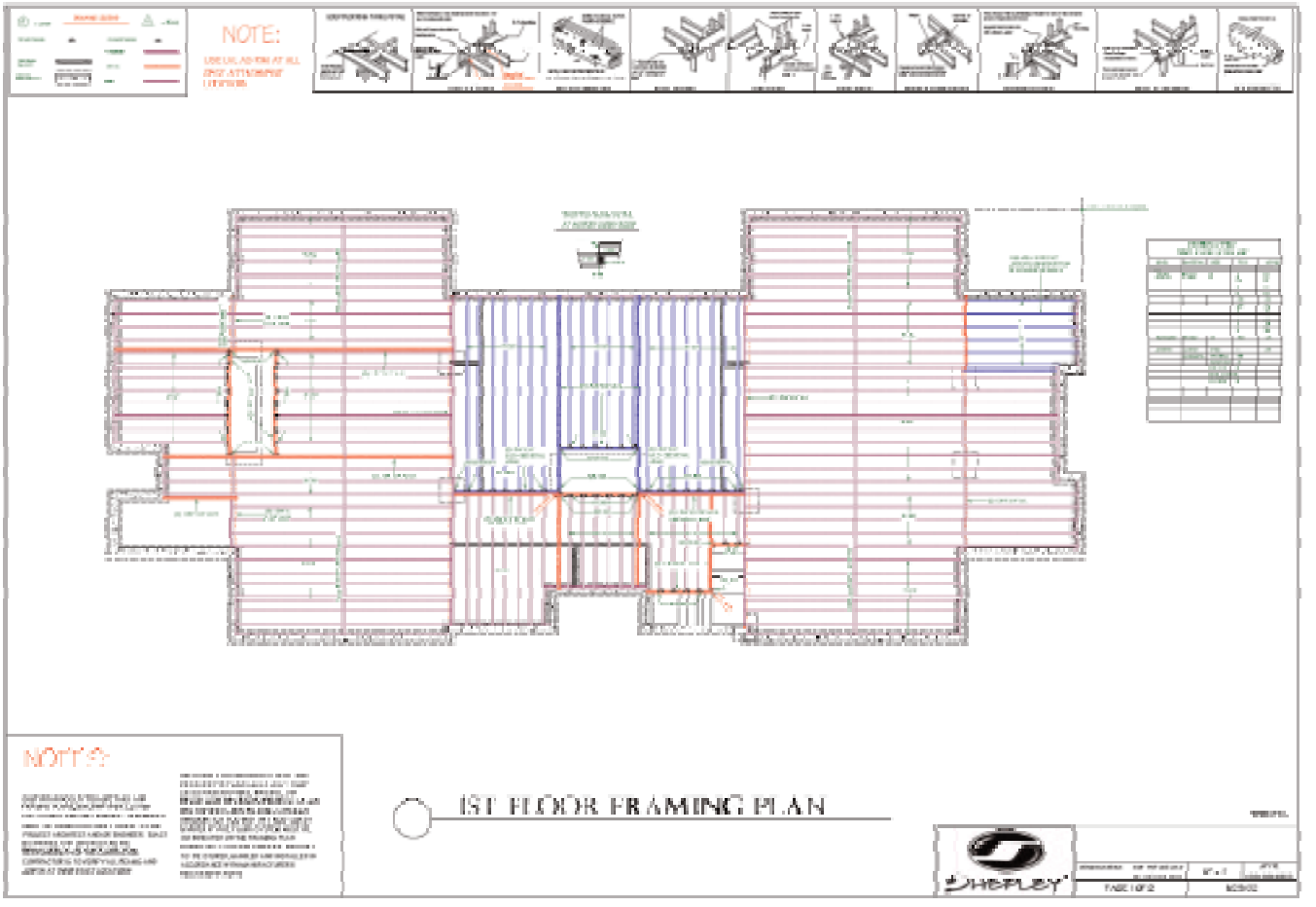

Figure 1. The distributor provides a floor framing plan and material takeoff using proprietary I-joist design software (above). The author checks this plan against the plumbing and hvac layout for possible conflicts before placing the order (right).

specialist before proceeding. Stairwell headers, doubled joists, cantilevers, long spans, and other framing complications call for some product-specific number crunching. You can't safely apply your old solid-lumber rules of thumb or "seat-of-the-pants" engineering. Typically, someone at the local lumberyard has been trained to design and specify I-joist framing systems, working with a takeoff from your plans, usually for no extra charge.

Review the plan. The first thing I do when I get a new plan is make a careful review of the framing requirements, locating all toilets, plumbing rough-ins, and any other element that creates a necessary deviation from uniform layout. You can't carve or modify an I-joist flange without destroying its structural integrity. I make my notes on the plan and hand it off to the engineered lumber specialist. He runs the numbers through proprietary I-joist design software (our lumberyard uses Boise Cascade's BC Calc) to generate a floor framing plan and a bill of materials (see Figure 1). When I get this plan, I check it over with my framer to make sure everything makes sense. If we have a question about any item or spec, we clear it up before placing the order.

Engineered system. I look at I-joists as part of a complete, prescriptive system. This system includes engineered rim joists, LVL girders and headers, solid I-joist bridging, and

glued and nailed T&G plywood subflooring. If the prints suggest substituting dimension lumber for any component of this prescriptive system, I'll ask the architect to reconsider. I-joists are dry, stable, and reliable, making them incompatible with solid-sawn lumber, which shrinks, twists, and splits. I see no reason to combine the two; it's asking for problems.

Getting the Squeaks Out

One of the few early problems we noticed with the I-joist system was a tendency of the joists, when butted and hung on a flush header, to squeak underfoot. We could easily observe and pinpoint this phenomenon from below during the framing stage. Now we set the header in place, line and brace it, then measure the joist span. We deduct about 1/4 inch from the span and cut the joists to that length. After first nailing all of the hangers to the header, using an I-joist offcut as a hanger gauge block, we drop the joists into place, making sure they don't contact the header, and nail them through the hanger only (Figure 2).

I've also heard complaints about I-joists squeaking in the joist hangers — I haven't had trouble with that, maybe because we're scrupulous about nailing every hole in the hanger. The Simpson ITT series hangers we use have a hammer-down tab that wraps the bottom flange in a steel grip, reinforced by a nail (Figure 3). A positive-placement nail gun takes most of the pain away.

Hasty nailing of the deck plywood can be another source of squeaks. Even with a 2 1/2-inch-wide flange, the gun nails can go astray and deflect out along the edge of the flange. When I walk the deck, I listen for squeaks and circle the spots. Before we put any ceilings up, somebody goes around and taps those nails back out. Subfloor adhesive is an integral component in the I-joist system, so properly placed nails stay put and quiet.

Hanger Tips

The top-hung Simpson's ITTs cost about the same as face-mount hangers, about $2 each, but install faster because you don't have to hold them to a line and they require fewer nails. Some builders I've talked to use standard hangers because they think that the upper tab of a top-hung hanger might create a bump in the smooth plane of the subfloor, but we haven't found that to be a problem.

One thing that can trip you up is the unequal width of LVL lumber — sometimes there's as much as 3/8 of an inch difference within a built-up beam. That can easily throw a top-hung hanger out of line. We typically power-plane the top edge of all our LVL members to avoid that problem (Figure 4, next page).

Rim Boards

Something to watch for is the irregular thickness of the engineered rim board, basically an oriented strand board product. When moisture gets to this material, it swells, affecting the inside span measurement. We've had to cut joists within the same run to different lengths to compensate. The best strategy is to take delivery of your rim stock as late as possible, keep it dry, and use it right away. Once it's installed and covered by the deck ply, it should be fine.

When the plan includes an attached exterior deck, I substitute an LVL plank for the rim board at the deck location to provide more substantial holding for the carriage bolts

Figure 2. To avoid floor squeaks, the author maintains a 1/4-inch gap between the hung I-joist end and the engineered header and makes certain that all holes in the joist hanger are properly nailed.

Figure 3. The joist hangers used by the author have a bendable tab that wraps the bottom flange of the I-joist, preventing movement.

Figure 4. LVL planks are somewhat irregular in width. Power-planing the top edge of a built-up header eliminates some bumps in the road.

Figure 5. A thin plastic custom cutoff guide carries an 8-inch-diameter saw over the 2 1/2-inch-wide flanges and recessed web without overly compromising the depth of cut.

that secure the deck ledger. This precaution isn't strictly necessary — the engineered rim board is approved for this application — but it's one I prefer to take.

Cutting and Handling

Cutting I-joists requires a jig, to bridge the 8-inch circular saw from flange to flange across the web. Trus Joist used to provide a handy plastic saw guide, but we can't seem to get them anymore. We're down to our last one in the company, and it's got a metal repair splice. Instead, the guys make custom guides out of lexan, a plastic panel that's durable and thin enough not to interfere with the depth of cut (Figure 5).

Using I-joists saves time. Because a single worker can easily sling a 40-foot joist, you can quickly spread your joists, and with less fatigue. The side-to-side floppiness of an I-joist can give you a little trouble when you're trying to send it across the span, especially the first piece. The best way is to catch the first joist's flange over the edge of the rim board and slide it to the opposite side of the deck. Once you roll your first joist into position and secure it, you can ship the rest of the joists out across the top flange of the preceding pieces (Figure 6). As the promotional literature says, every joist is dead-straight on edge, so you don't spend any time culling or crowning the framing material. And, because you can get I-joists delivered in lengths up to 48 feet, center laps can be eliminated, cutting out a lot of material handling.

If the I-joists aren't stored on edge, as recommended, but are laid flat on uneven terrain, they can take a side-to-side set, so you still have to pay attention and use layout marks when you plywood the deck.

Installation Details

Solid blocking is required at mid span in an I-joist floor and is easy to precut because of the predictable

flange dimension and resulting space between joists. We'll do a quick count and cut a bunch of the blocks at once. On our current job, the entire first floor system is ledgered inside the foundation, to bring the finished floor closer to the final grade level. So, instead of rim joists, we used a lot of pressure blocks to hold the joists upright on the sill (Figure 7). I precut most of these in the shop on a radial arm saw. We convert jobsite offcuts into blocking by running them through a table saw, because they're too short and awkward to handle with a circular saw and guide. Cross-cutting against a fence is not considered a safe table saw procedure. We do it anyway, however — slowly and carefully.

The computer-generated layout plans usually represent the blocking as a solid line, but we find it's easier to nail the blocking if it's staggered on either side of the centerline. Although staggering is common in solid-lumber framing, I double-checked this modification with my engineered lumber specialist to make sure we weren't compromising the system.

Web stiffeners. Certain applications call for web stiffeners to be added to the joists — for example, under a load-bearing partition, or when sistering two joists together. Occasionally, the local inspector requires us to close the gap left between the blocking and the joist flanges to create a firestop (Figure 8, next page). We comply by packing out the web. This, and any two-sided web stiffener requirement, is a bit of a pain to do. The rim-joist material, at 1 inch thick, is ideal for packing the web out flush to a $2^1/_2$-inch-wide flange, but manufacturer's specs call for the nails to be clinched, or bent over, where they penetrate on the back side. The best way we've found to pack the web is to clamp stiffeners to both sides of it simultaneously and shoot them together. This leaves a $2^3/_8$-inch gun nail fully embedded and eliminates all that clinching.

Figure 6. The floppiness of a long I-joist is controlled by feeding it out along the edge of the preceding member to the opposite side.

Figure 7. Pressure blocking holds the joists upright on a recessed, inset mudsill.

Keep off. Even with blocking installed, attempting to walk the I-joists is a habit you want to break — it's that or your neck. All of the I-joists' stiffness is in the vertical orientation; if you try to walk the flanges, the joists can twist and buckle sideways and dump you. Always stand on the deck sheathing, not on the joists. Running a course of temporary 1x bracing every 6 to 8 feet is the recommended precaution to prevent

rolling. We also loose-lay lengths of the engineered rim-joist material to serve as temporary walkways. The rim material isn't a scaffold plank and should never be used as one, but it spans less than 14 inches between joists in this application.

Drilling and Modifying

I-joists have a series of 1 1/2-inch-diameter perforated knockouts in the web, which, if you pay close attention to the end-for-end joist alignment, supposedly makes cross-joist plumbing and wiring runs a relative breeze. Actually, this is usually a better idea in theory than in practice. The lumber distributor cuts the I-joists to rough length for delivery, we hope from a common end, typically using a chainsaw. The painted factory end is immediately identifiable. The knockouts are spaced roughly 12 inches on center, but closer to one flange than the other, so you also have to pay attention to the up-down orientation if you want to take advantage. When working with the joists on site, we try to make sure the factory ends are all together before we start measuring and cutting. If you mix ends, the knockouts won't line up and they'll be mostly useless (Figure 9). Of course, if you're cutting two joists out of a single length, you're not going to let the knockout location restrict you, anyway; after all, how tough is it to drill through a 7/16-inch-thick OSB web? You can drill up to a 1 1/2-inch-diameter hole anywhere in the web without compromising its performance.

You can cut an amazing amount of material out of the web, too, even from flange to flange, but not just anywhere or as much as you like. If you have to accommodate a duct or other large-diameter penetration, contact the product specialist for specific modification and cutting parameters. But you can modify I-joists in ways that would destroy a sawn-lumber joist.

Adding web stiffeners, and squash blocks under bearing partitions, and becoming familiar with the special capabilities and limitations of I-joists can seem like a lot of extra bother. But those requirements are actually a minor aspect of I-joist application and are more than offset by the ease, speed, and superior performance provided by the system as a whole. I wouldn't go back to a sawn-lumber floor frame.

Figure 8. In some jurisdictions, the inspector may require a fireblock in the gap left where one I-joist butts perpendicular to another.

Figure 9. Taking advantage of the utility knockouts is a secondary consideration to maximizing materials. When it's practical, cutting joists from the factory end ensures automatic hole alignment for cross-joist wiring or plumbing runs, but in the effort to maximize materials, this is not always possible.

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