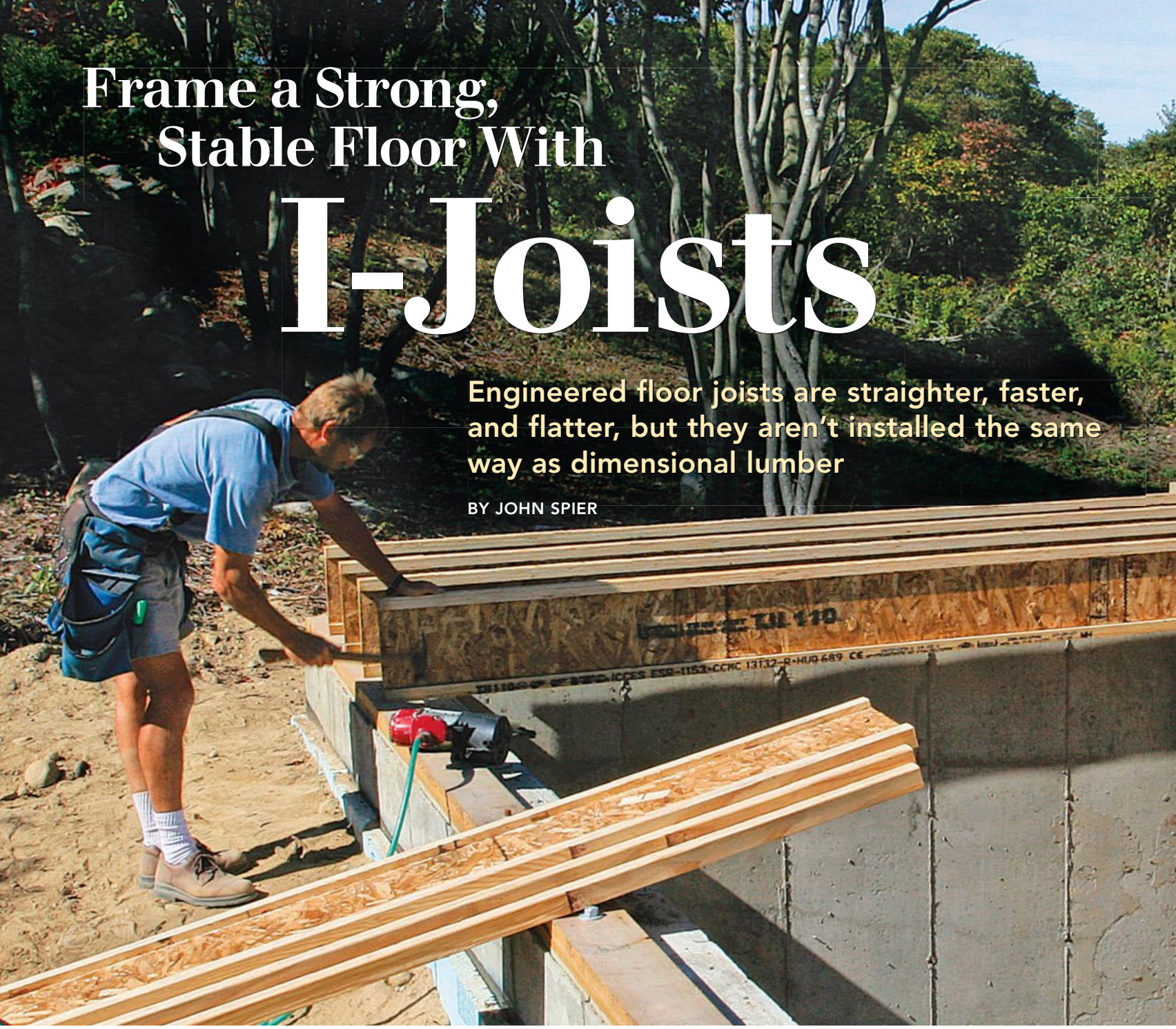
Frame a Strong, Stable Floor With I-Joists



Engineered floor joists are straighter, faster, and flatter, but they aren't installed the same way as dimensional lumber

BY JOHN SPIER

Manufactured I-joists are used in about 45% of new wood-frame construction, and that amount is expected to rise. I can't remember the last time I framed a new floor with dimensional lumber. To me, I-joists make more sense. They are straighter, stronger, and lighter, and they span longer distances than ordinary 2xs. They are also a more-efficient use of resources because they can be manufactured using lesser-quality trees. Of course, I-joists cost a bit more, but they also are much easier to install, meaning I get a big savings in labor.

Then again, nothing is perfect, and I-joists have a few disadvantages compared to standard dimensional lumber. They don't cope well with careless handling, they are more sensitive to moisture, and they shouldn't carry any load until they are fully sheathed. They also aren't as amenable to job-site change orders, and many lumberyards don't stock them.

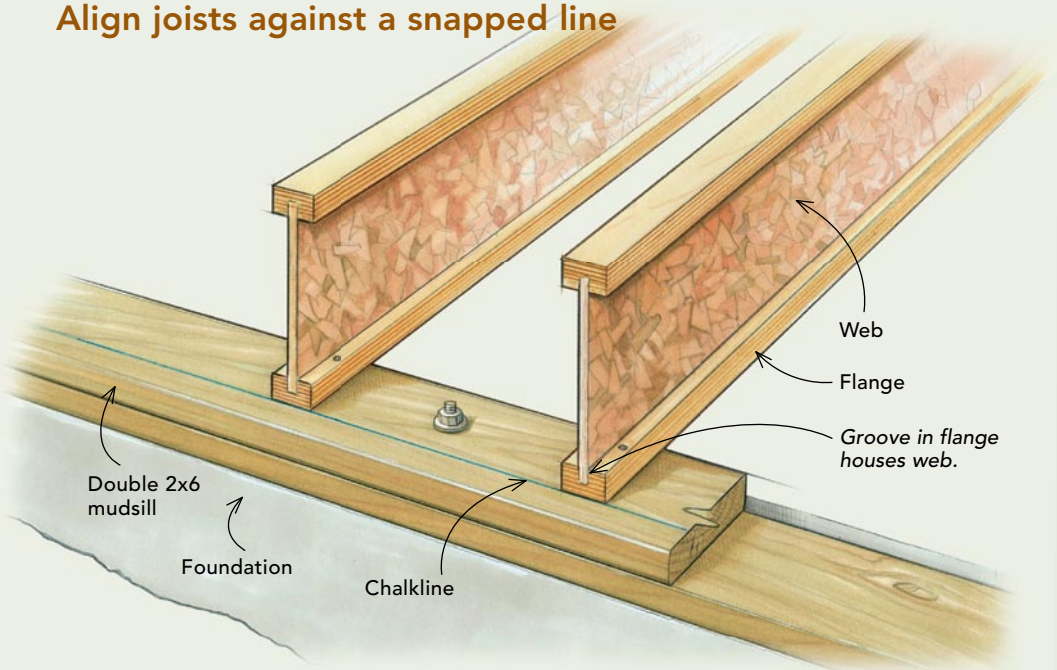
I-joists are part of a carefully planned floor system

With I-joists, *system* is the operative word. A floor framed with I-joists is designed as a package with all its components specifically located in the overall structure. This is different from conventional framing, where joist size is selected based on maximum span and then is used for an entire floor. In an I-joist floor, components have the same depth, but flange widths, joist spacing, and attachment details can vary throughout the system to make the most-efficient use of materials.

The first step in building an I-joist floor is having it designed. I provide lumber suppliers with complete sets of building plans, which

Drawings: Bob La Pointe

Align joists against a snapped line

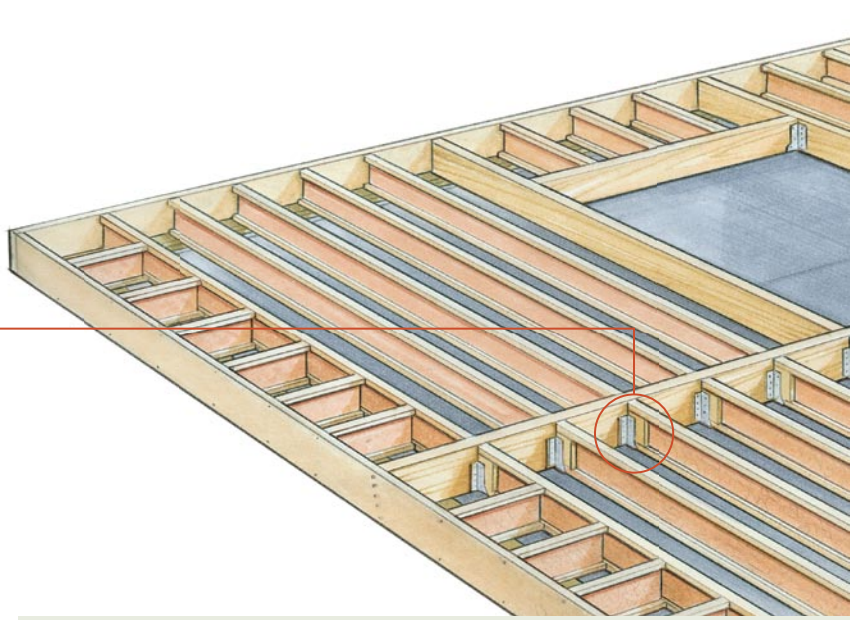


In most cases, I-joists are nailed to the mudsill before the rim joist is installed. Assuming everything is squared up in advance, I start by snapping a chalkline 1⅜ in. from the outside edge of the mudsill. This allows enough room for the 1¼-in.-thick engineered rim joist to swell, which it always seems to do (inset photo right). Measure the distance from the beam (or other terminating point) to the chalkline on the mudsill at each joist location, subtract about ⅛ in., and mark each length on the mudsill. The ⅛-in. gap will be on the hanger end of the joist and helps to prevent squeaks in the finished floor.

GANG-CUTTING I-JOISTS WORKS BEST

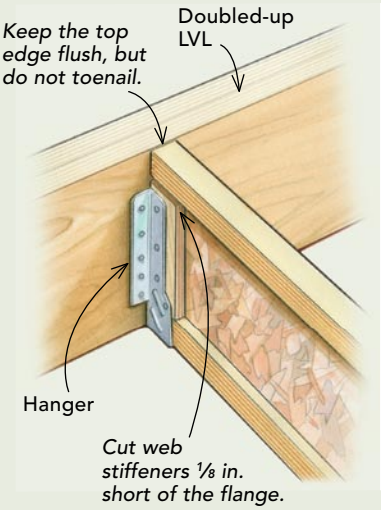
Bundles of I-joists often arrive on site with one end factory square and the other end looking as if it were cut by an unemployed logger with a dull chainsaw. Because I usually need to cut the joists to length anyway, I keep the factory-square ends together and cut off the other ends.

I find that I-joists are ideally suited for gang-cutting. As shown above, I can set them up on edge on a pair of sawhorses, align the ends, square a line, and use a circular saw to cut through the flanges along one edge of the stack. Then I roll each joist down and use the kerf on the flange as a reference to finish the rest of the cut. I cut 9½-in. and 11⅞-in. I-joists using a large Speed Square as a saw guide. Wider joists need to be marked with a framing square. If the flanges are too wide for the cutting depth of my circular saw, I roll the saw over the edge of the I-joist to finish the cut (bottom photo).



Attach the hangers to the joists

For I-joists that require metal hangers on one end, I install the hardware on the joist right after I cut the joist to length. A metal-connector nailer like the one shown here (www.bostitch.com) really speeds up this process. For this job, I had to install web stiffeners on each I-joist before attaching the hanger. I made the stiffeners from plywood offcuts.



they pass along to one or more engineered-lumber vendors. In a week or two, each vendor sends me floor-framing plans and quotes for the I-joists, beams, blocking, hardware, and other material.

It's important to review the engineer's floor-framing plans carefully, especially to make sure that they work with the builder's plans. Sometimes the engineers miss a key element and design a framing plan that doesn't accommodate the plumbing or the ductwork, or they might specify some details that experience has taught me to avoid. On the other hand, an engineer sometimes simplifies and improves the structure by coming up with a framing plan that I hadn't envisioned.

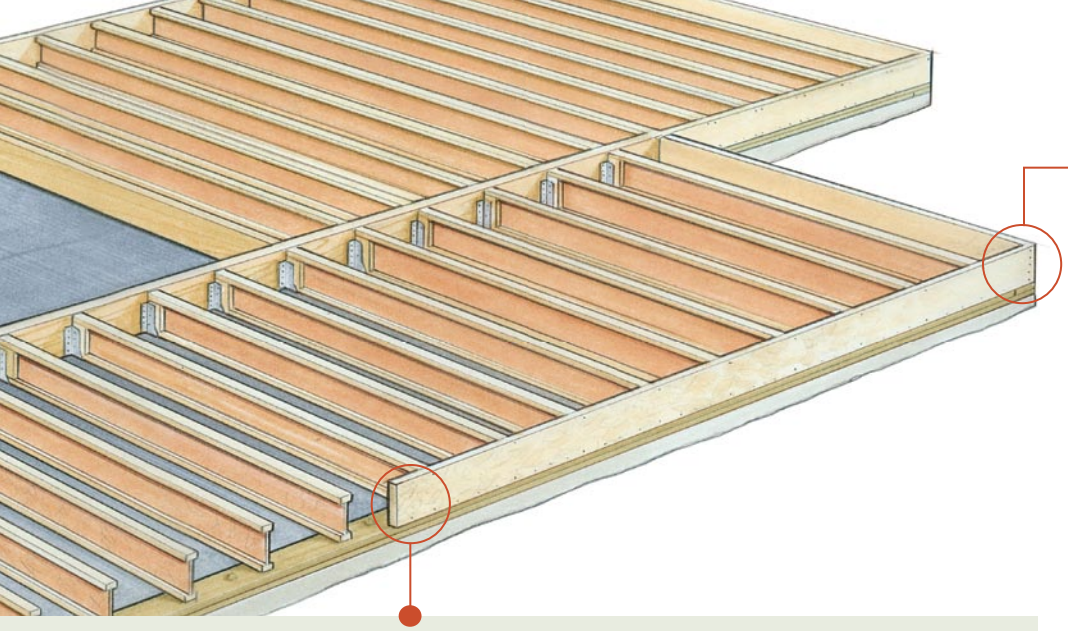
I also review the attached materials list carefully. If the engineer has specified a lot of mixed, short-length pieces, I often combine them into longer lengths that can be cut to length on site. The longer lengths are easier to handle, reduce waste, and give me a margin for error if I make a cutting mistake later or find a damaged piece in the pile. Blocking panels, which are short lengths of joist used to transfer loads over bearing walls, are often listed as a pile of separate 2-ft.-long I-joists, but I can save myself some money by getting these short pieces out of cutoffs instead.

I also always buy one extra of the longest joist just in case; if I don't use it, I can return it. I check the beams, too, because I often can combine them into continuous lengths that are stronger and can be installed faster. Finally, I check the hardware list. If the engineer has specified hardware items that I'm unfamiliar with, I look them up in the catalog to see how they are installed.

Snap lines, install beams, then move to the floor joists

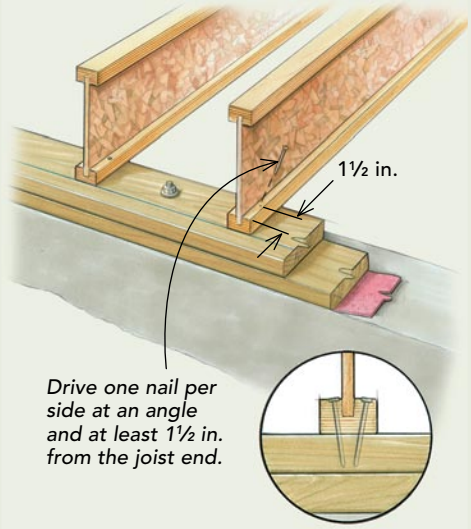
All floor framing starts with, and depends on, mudsills or wall plates that are straight, level, and square, so check for these conditions first. I start an I-joist floor by snapping layout lines along the mudsills and across any intermediate walls or beams. This step is easier to do when nothing is in the way, and it helps to keep the work straight later. Remember to recheck the plans for any interference with toilet

Photo bottom right, facing page: Krysta S. Doerfler



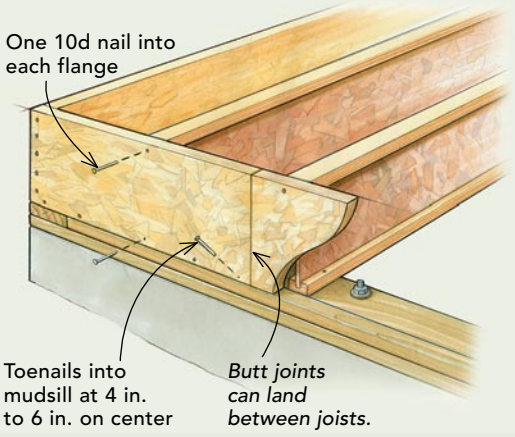
Angle nails into sills and plates

I-joists that are not carried in hangers are fastened to the mudsill or top plate with nails driven at an angle through the flanges. If the joists will be hung from a beam on one end, one person supports the hardware end of the joist and tacks it in place with a couple of nails. The person near the mudsill confirms that the end of the I-joist lands on the chalkline before both ends are permanently fastened.



Aim for the flanges

With the joists already in place, it's easy to install the engineered rim joist. The rim joist should be nailed to both the top and bottom flange of each I-joist and toenailed to the mudsill. A butt joint between two pieces of engineered rim doesn't need to land on a joist.



LOCATE HOLES AND NOTCHES WITH CARE

In conventional framing, the size and location of holes cut through the floor joists for running utilities are defined by the building code. I-joists are different. Except for cutting to length, the flanges of an I-joist can't be cut, drilled, or notched. Most I-joists come with knockouts punched in the webs for running pipes and wiring. If you need to cut additional holes, they must be located in the web of the I-joist and must meet the manufacturer's guidelines, which vary from project to project. This information will be provided to you, typically in the form of a pamphlet attached to the I-joists.

Luckily, holes that were cut too large can often be repaired with U-shaped metal braces like ReWeb (www.matrixengineered.com). For even more flexibility, Georgia-Pacific's XJ 85 joists (www.gp.com) are manufactured with large holes (photo left).

Reinforce with blocking panels

Blocking panels are short lengths of I-joist used to transfer loads and to stiffen the floor assembly. In the photo above, panels are installed between an I-joist and a rim joist that is cantilevered beyond the foundation. I cut the blocking panels to fit and secure them by driving toenails into the flanges. There is no need to notch the blocking panels to fit against the webs, just the flanges. The drawing at right shows a more typical blocking-panel installation at a cantilevered bay window. The engineering for any type of cantilever will be done for you.

Do not nail the top flange; let the subfloor tie it together.

flanges or tub and shower drains. I-joists can't be easily notched or headed off later.

If big beams are incorporated in the floor system, I install them next because they are easier to move into position and brace securely before the joists get in the way. Often, beams and headers are used to form openings such as stair or chimney holes, which come next. Once I install these components, I can get to work on the I-joists.

Because these joists are fairly stable when nailed to the plates and sills through their flanges, I can install them before the rim joists. If I'm working on mudsills, I snap a line on one sill and hold the joist ends to it. If I'm building on a wall that has been braced straight, I scribe a line on the top plate.

Joists that attach to a flush beam or a header using hanger hardware can and should be cut a bit short; ⅛ in. is about right. The hangers are forgiving, and tightly fitting joists can push things out of alignment. They also tend to become squeaky spots in the finished floor.

I-joists that require web stiffeners and hangers on one or both ends can be cut and prepped assembly-line style (drawings and photos, p. 65). I set up a couple of heavy-duty sawhorses with air hoses and nail guns at each end. This way, I can gang-cut the joists, install the necessary stiffeners or hardware, and move the joists into position. I generally cut and prep the joists in sets, then install them in the same order.

The rim joist goes on after the joists are in place

Unlike I-joists, engineered LSL (laminated strand lumber) or LVL (laminated veneer lumber) rim joists are not delivered in specific lengths. They simply show up as a bunch of stock pieces.

Engineered rim-joist stock is usually 1¼ in. thick. But it often swells, so I allow 1⅜ in. for it. Besides, it's much easier to tap a rim joist out a bit than it is to trim the end of an I-joist to eliminate a bump in the building. Rim joists need to be nailed according to a fastening schedule, typically with one 10d nail into each joist flange and toenails into the mudsill or plate every 4 in. to 6 in. I use full-length rim-joist pieces in the corners and fill in the middle with shorter lengths.

Joints between pieces of engineered rim joist can be butted together anywhere, even between I-joists. A word of caution: Nailing through the rim joist and into top flanges can be dangerous. The target is small, and there is no good alternative to having one hand in the line of fire. Awareness, caution, and a sequentially firing nail gun are helpful here. After the rim joists are in place, install the blocking, squash blocks, and any necessary cantilever reinforcements (sidebar above).

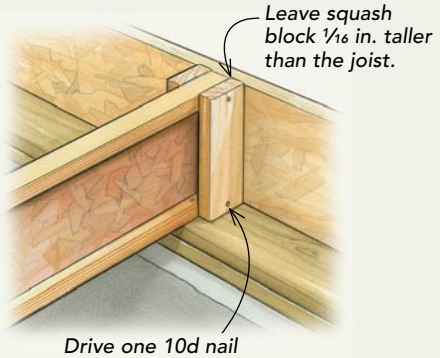
A subfloor locks the joist layout and finishes the floor

Installing a subfloor over an I-joist frame is almost the same as installing it over a conventional frame, but there are a few important differences. Unlike a conventional floor, where the starting edge of the plywood subfloor is held back ¼ in., the subfloor over an engineered rim needs to be full thickness (no tongue) and flush to the outside edge.

Because I have to cut off the tongue and start with a ripped sheet anyway, I check the overall width of the floor and the locations of large jogs or openings. I often can plan a starter-course width that allows for efficient use of rips and cutoffs.

Attach squash blocks where needed

To keep I-joists from being overloaded by concentrated loads from above, the engineer's floor-framing plans require dimensional-lumber squash blocks in key areas of the floor.



Engineered subfloor panels usually have layout marks that you can use, but be careful not to miss any of the small shifts in joist spacing that you might have made for plumbing or other details. I run most of my subflooring long over the ends and into the openings, snapping lines and trimming it later. Also, be aware of any top-flanged metal joist hangers when you're cutting subflooring in place. I leave many of the edges and ends unnailed until they are trimmed straight. This enables me to make delicate adjustments with a sledgehammer where needed. □

John Spier is a builder on Block Island, R.I., and the author of *For Pros By Pros: Building with Engineered Lumber* (The Taunton Press, 2006). Photos by Justin Fink, except where noted.

A subfloor completes the system

Unlike installing a subfloor over a dimensional-lumber frame, an engineered system requires that the edge of the tongue-and-groove subfloor panel be full thickness, flush with the outside edge and in full contact with the rim joist below. Every floor plan is different, but for this project, it made sense to snap a chalkline 46 in. from the outside edge of the rim joist and start the first row there. After I lay a thick bead of construction adhesive on the top edge of each joist, the subfloor panels are laid out and tacked in place; butt joints should land over the top of a joist. Once the first row of subflooring is tacked in place, I snap a chalkline along the outside edge and rip off the overhanging tongue so that the panels are flush to the rim joist. Then I go back and finish nailing or screwing each panel every 6 in. on center. A sledgehammer comes in handy for persuading sheets to fit together tightly, but I hammer against a scrap block to protect panel edges from damage. As shown at right, a little boot pressure is helpful to align the joists with the layout marks before fastening.