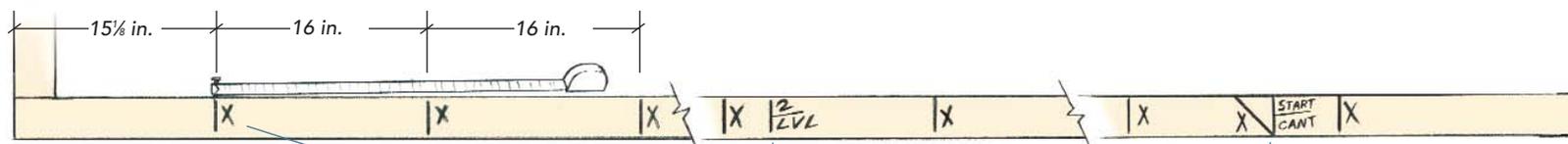




# The Well-Framed



## ADJUST THE LAYOUT BEFORE IT'S TOO LATE

First, lay out the mudsill for the regular 16-in. on-center joists. Then locate additional elements, such as cantilevers, stairs, plumbing drains, and large ducts. You may need to adjust the joist spacing based on these additional elements. It's easier to make changes now than later.

Begin the layout on a long, straight section of the foundation. Place the first mark 15½ in. from the end for a 1½-in. I-joist (or 15½ in. for a solid-wood joist). From there, mark every 16 in. to the other end.

Stair openings require heavier framing (often doubled-up joists). Here, two LVLs are indicated.

Cantilevers, which require joists to extend beyond the mudsill, are labeled to indicate their angle and starting point.





BY JIM ANDERSON

**W**alking across a newly framed floor for the first time is a milestone in any framing project. Finally, there's something to stand on that doesn't squish beneath your boots. It's flat and strong, and because there's a floor to stand on, the rest of the project will move ahead much more quickly. But whether you're using common lumber or I-joists (sidebar p. 58), it takes a well-coordinated effort to get any floor to the point where you can walk on it.

Before you start driving nails, it's important to collect as much information as possible about the locations of the joists, posts, beams, point loads, cantilevers, plumbing vents, drains, and HVAC ducts on the floor-framing plan. Whether those details come from the architect, you, or somewhere else, the floor-framing plan needs to reflect the house as it's going to be built.

# Floor

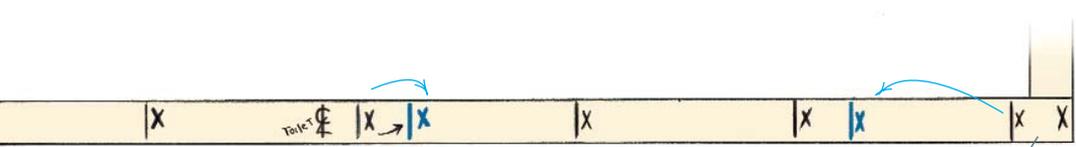
Whether it's the floor of a big house or a small addition, an accurate layout and efficient techniques promote smooth installation

Having all this information in one place allows you to overlay—in pencil—the big immovable parts of the house on top of each other. This step will catch most if not all the big mistakes that can be made early on. It's a lot easier to erase than it is to remove and replace.

## Transfer the details from the plans to the mudsills

First, I check the joist spacing on the floor-framing plan, usually 16 in. or 19.2 in. on center (o.c.) and transfer that to the mudsills. Measuring from the end of the house (usually beginning with the longest uninterrupted run), I mark the edge of the first joist  $15\frac{1}{8}$  in. from the end for  $1\frac{3}{4}$ -in. I-joists (16 in. minus half the joist thickness). This places the center of the first joist at 16 in.

Then I mark 16 in. o.c. (or whatever the proper spacing is) from the first mark to the other end of the house. I do this on the front and back walls; then I check the layout marks



If a plumbing drain, furnace flue, or duct can't be moved and it's too close to a joist, move the joist. Moving it an inch or two is better than cutting the joist and framing around the pipe.



If the last joist bay is less than 12 in., make it a full 16 in. to allow plumbers, HVAC, and electricians more room.



Bearing (or squash) blocks are installed at all point loads. But to avoid confusion with other layout marks, they aren't located and installed until after the rim joist is in place.



## WHY I PREFER I-JOISTS OVER SOLID WOOD

I remember the first time I saw I-joists, those long, floppy things. They seemed so flimsy and light that I thought they would have trouble holding up the sheathing, not to mention the walls that would go on top of them.

They have more than proven me wrong, however. The main advantages are that I-joists are dimensionally stable and very straight. The web (the wide middle section) of an I-joist is cut from oriented strand board (OSB), thin strands of wood oriented in the same direction and glued together. Because glue surrounds all those strands of wood, you can expect less shrinking and swelling and very consistent joist sizes (usually within  $\frac{1}{16}$  in.).

You also can cut much-larger holes into I-joists than into solid lumber; holes up to 6 in. are allowed in the center of the span of a 9½-in. I-joist. Elsewhere along the web, 1½-in. holes are provided in perforated

knockouts. Holes in solid lumber can be no more than one-third the total width.

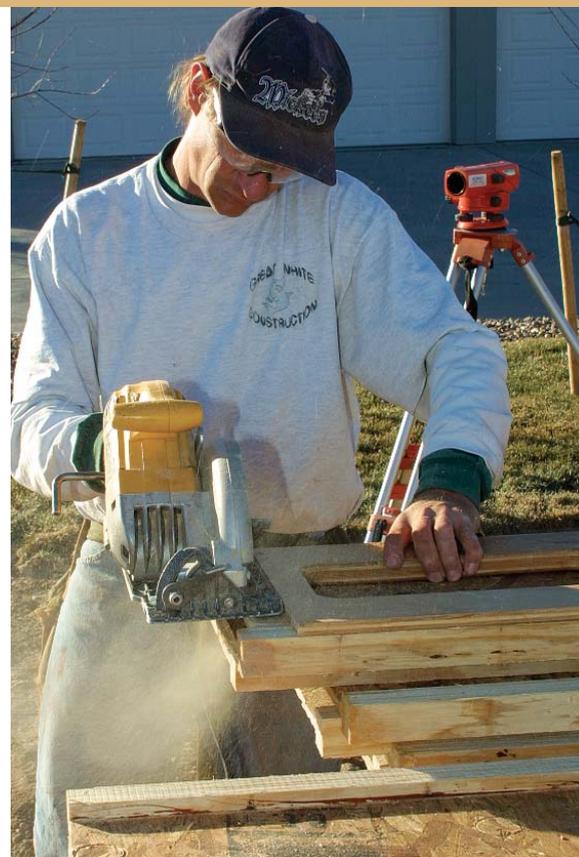
I-joists must be handled carefully; upright is best, or supported in a

couple of places if carried flat. They're light, come in lengths up to 60 ft., and can span long distances as part of an engineered floor system. Best of all, they cost about the same as lumber; in the longer lengths, they actually cost less.



## AFTER SQUARING ONE END,

*Square one end of each joist while sorting and stacking. Because I-joists are cut to approximate length at the lumberyard, it is easier just to square one end as you are sorting them.*



on both ends to make sure that they are the same. If they are within  $\frac{1}{4}$  in., I leave it; if not, I double-check the layout and make adjustments. I also mark the location of stairs, load-bearing members, and cantilevers on the mudsill.

### Leave room for pipes and ductwork

If the layout mark for the last joist is within a foot of the endwall, I move it to allow room for plumbing, electrical, or HVAC in what is often an important joist bay. I usually just measure and mark 16 in. from the edge of the mudsill back toward the center of the house.

I also make sure that none of the plumbing fixtures or flue chases lands on a joist. This is another opportunity to double-check myself. It's a lot easier to move the joist now than it is to move it later or repair damage from a determined plumber with a chainsaw. I usually allow a minimum of 12 in. between joists for furnace flues, which provides 2 in. of clearance on each side for an 8-in. furnace flue. Even though 1 in. on each side meets the building code here in Denver, I figure that where heat and wood are concerned, more room is better.

Again, I create this space either by moving the joist off the 16-in. o.c. layout or, when that isn't practical, by cutting the joist just short of the flue and supporting it with a header tied into the joists on each side of the one that's cut.

Plumbing drains and supply lines are zero-clearance items, so I can have wood right next to them. I locate the fixtures on the plan, and if a joist is on or near the centerline of the drain, I move the joist 1 in. or 2 in. in one direction or the other. If I have two fixtures close together and moving a joist away from one drain places it beneath an-

## SPREAD THE JOISTS AND CUT THEM TO LENGTH IN PLACE



**Position the square ends of each joist to the chalkline (the rim-joist line) and tack them into place along their 16-in. o.c. layout lines. Later, the 8d nail will act as a hinge when the joists are stood upright.**

other, I open the spacing a little more (and double the joist) so that both drains lie within a slightly oversize bay.

### **Prepare material according to where it's needed**

Wood I-joists come from the yard in a large bundle; the rim material and any LVLs usually are strapped to the top. With a helper, I move the LVLs to sawhorses for cutting to length and to install joist hangers.

We move the rim joists to the top of the sheathing or to the ground, and place stickers beneath so that we can lift them easily later. Then we square one end of all the wood I-joists with a simple jig (photo top right, facing page; "Tips & Techniques," *FHB* #154, p. 30) as we take them off the pile and sort them by length and location. When I finish with the I-joists, I build any LVL headers and add joist hangers if they're needed.

After the prep work is done, I usually call in a crane to set all the steel beams that will carry the first floor and to spread all the presorted stacks of joists and LVLs to their appropriate locations. I also move the sheathing to within 3 ft. or 4 ft. of the foundation so that I don't have to carry it any farther than necessary.

After placing the steel, I make sure that the layout on the beams matches what is on the walls. I check the layout by pulling a string from front to back to verify that the layout marks on the front and back walls intersect the marks on the beams. I also make sure that the beams are straight and flat, and make any necessary adjustments.

### **Spread joists to the layout marks and roll them upright**

With one person on each side of the foundation, we quickly position the joists on their layout marks, with the square-cut end aligned on



**After aligning the joists, snap a chalkline and cut them to length in place. Beware of anchor bolts lurking below when making this cut.**

## ROLLING AND NAILING JOISTS

**You can do this alone, but it sure goes quicker with two.** With one person at each end, stand the joists upright and put them on their layout marks. Drive one 10d nail through the flange on each side of the joist into the mudsill (or pony wall).

**The rim joist goes on after the joists are in place.** The rim joists are cut and nailed to the mudsill every 8 in. with a 10d nail.



“...We start from one end of the house, roll the joists, and nail them in place ... we usually can stand the joists for 40 lin. ft. of floor in about 10 minutes.”

the rim-joist line snapped along the mudsill (top photos, p. 59). Then we tack each joist in place with an 8d nail to keep it in place. It's easier to set the joists to the line first and then install the rim joist later. After tacking down all the joists, we prepare to cut the other end of the joists in place. We snap a chalkline that is 1½ in. from the outside of the mudsill, which becomes the cutline.

Cutting the joists to their finished length is as simple as running the saw along the chalkline using the I-joist cutoff guide (bottom photo, p. 59). The scrap of wood lands in front, where it's available for use as a piece of blocking.

We position one person in the front and one in the back, and starting from one end, we stand all the joists and nail them in place (top photo). The 8d nail that had held the joist in place now acts as a hinge for it. We usually can stand all of the joists for 40 lin. ft. of floor in about 10 minutes.

On each end of the I-joist and at the center beam, we put one 10d nail on each side of the joist through the flange into the mudsill. We keep the nails as far from the end of the joist as possible to avoid splitting the I-joist's flange. After standing the joists, we add the rim boards, cutting and nailing as we work our way around the house (bot-

tom photo). We put one 10d nail through the rim into the top and bottom flange of each I-joist.

Once the rim joist goes up, the last thing to do before sheathing is to add bearing blocks, also known as squash blocks (photo bottom right, p. 57). One person details the rim joist for bearing blocks, and another follows behind and nails them in place.

Bearing blocks are required anywhere that concentrated loads land on the joists, such as doorways or where a post supports a beam. We also put them at all inside corners because 90% of the time, this spot is a bearing point.

### **Stack sheathing on the floor as soon as possible**

We snap the line for the first course of sheathing 48½ in. from the outside edge of the rim joist. It's held back a little from the rim to account for any inconsistency in the rim joist.

Before we begin nailing the sheathing, we look for joists that may have been moved from the 16-in. o.c. layout. If our plywood joints are able to avoid them, sheathing will go much faster. After deciding on a starting point, we spread construction adhesive on top of the joists. Then we lay the first row and two sheets of the second row

## IF THE FRAMING IS GOOD, THE SHEATHING GOES FAST

**Lay the first row of sheathing plus two more sheets; then move the rest of the stack onto the floor. It takes about 10 minutes to move 40 sheets; it's much quicker than having to climb up and down to get every sheet.**

**DON'T BE AFRAID TO HIRE A CRANE**



Many people associate cranes only with big commercial jobs, such as skyscrapers or shopping malls. But today cranes are commonly available for residential work, and anybody can hire one.

With a crane and one helper, I can set all the steel for a house and distribute stacks of pre-sorted materials to where they're needed. This process usually takes about 1½ hours (\$180 here in Denver). This easily is cheaper than paying labor to move all that material, and we get to the framing faster.



(photo above). This approach creates a little staging area where we can stack the rest of the sheathing.

We sheathe over to the steel beams in the center and add any bearing blocks and joist blocking when we get there (photo right). Waiting until the floor is partially sheathed before installing blocks is a lot easier and safer than trying to balance on unbraced joists.

We cut all the blocks and spread them across the edge of the sheathing (next to the beam), starting at one end and grabbing them off the sheathing as we go. Layout marks for each joist on the plywood's edge keep the joists straight and plumb, and the spacing for blocking consistent. When we have a finished basement, we also add wall ties as we work our way across the floor, which keeps us from having to walk across unsupported joists.

When we get to a stair rough opening, we sheathe over it and brace the plywood seams. Not only is this approach safer, it also creates more usable floor space when we start framing walls. Before we stand any walls that surround the stair opening, we open it up again. If the hole is too large to sheathe over, we add a safety rail.

### Lay as many full sheets as possible

As we sheathe, we lay as many full sheets as possible (making the fewest number of cuts). I've found that running the sheets long at the ends and cutting to a chalkline snapped along the rim (photo right) turns out a better product than measuring and cutting the pieces to fit individually.

I pull the chalkline in an extra ½ in. from the outside of the rim; this eliminates ever having to cut the rim line again. One person starts at a corner of the house and snaps all the rim lines; the other follows behind with the saw. The rim joist is first straightened and then nailed to the sheathing every 6 in. □

Jim Anderson is a framing contractor in Littleton, Colo.  
Photos by Chris Green.



**Sheathe your way over to where blocking is needed. Do not walk across unstable joists or work from a ladder below the floor. Sheathe over to the beam, then add the joist blocking.**



**Cut the sheathing in place. Run sheets long at the ends, snap a chalkline, and cut off the excess. This process is faster and turns out a better floor than cutting each piece to fit.**