Installing Floor Trusses

Parallel-chord floor trusses are more stable and span greater distances than stick framing, and speedier setup offsets their higher cost

by Brian Colbert

As a framing contractor, I think speed and efficiency are my most important considerations. I'm not wasteful, but I don't care as much about the cost of the material as the speed with which I can put it together. Although parallel-chord floor trusses are more expensive than conventional floor joists, my five-man crew can set the floor trusses for a 2,800-sq. ft. house and nail down the plywood subfloor all in one day, for labor savings of 25% over 2x joist installation. I believe those labor savings more than offset the extra expense. What's more, I believe we end up with a stronger floor.

There are several reasons that floor trusses can be installed faster. Trusses are engineered to exact lengths, so no blocking and cutting are required. As a bonus, their webbing—the diagonal and vertical 2x material inside the truss—provides more than enough room for wiring, plumbing and mechanicals, which means there should be no ill-planned cutting, boring or notching to repair later.

Trusses are not without their weaknesses—chiefly that they can't be cut or modified in any way—but their strength means fewer bearing walls, which also makes the job go faster. Trusses are relatively light and easy to handle, and they require no furring out for drywall. And you should have no callbacks because of squeaky or bouncy floors.

Also, trusses are more stable over long spans than conventional stick framing (photo above), and their open-web design makes adding wiring, plumbing and mechanicals simpler than wood I-joists. Also, the 3½-in. wide top chord of a floor truss provides plenty of nailing surface for the decking.

Trusses are engineered for each job—To order trusses, the general contractor gives the manufacturer's representative a complete set of plans. The representative then hands the plans off to an engineer, who designs the trusses based on the spans and the loads for my application. For instance, if a homeowner wanted to put a whirlpool in the master bath, the engineer might specify two trusses directly beneath the tub or drop the spacing down from 24 in. o. c. to 16 in. o.c. or even 12 in. o.c.

All floor-truss installations begin with this plan. On the plan, each truss is numbered or lettered to correspond to its location. Trusses arrive at the job site marked with numbers or letters that correspond to their place in the plan. When they're delivered, however, the trusses often are out of order. If we have a crane to lift them, we're in pretty good shape. But if we're lifting them by hand, it's a real pain when the trusses we need to set first are buried beneath the ones we'll set last.

I try to be on site when the trusses are unloaded. If I'm there, I can save my crew time by making sure that the trusses are unloaded in an organized manner. Usually, trusses are loaded on the truck in a way to make the most economical use of space. If 1 know the order in which I want the trusses unloaded, I can call the manufacturer's representative and ask to have the trusses loaded in a certain order. This type of sorting takes a lot of time at the plant, though, and not all fabricators are willing to go to the extra trouble.

As soon as the trusses arrive, I check each one and report any damage to the fabricator and to the engineer or architect overseeing the job: No one should try to repair a damaged truss. Also, the trusses should be set on blocks and stored as flat as possible to prevent them from deforming over uneven ground. If they're to be stored for an extended period, it's best to cover them with a tarp.

Even more important is the need to measure all the trusses against the plan as soon as they're delivered (top photo). I make sure we have the right spans, the right number of trusses and the right types. I've installed trusses on a dozen houses, and it's not uncommon for some trusses to be either too long or too short. Sometimes, this situation is the fault of the fabricator. Usually, though, such mistakes result from a lack of communication between the architect and the fabricator. Because it takes an average of one to two weeks for trusses to be delivered—twice that time in some areas or during peak times—it's

Make sure you get what you ordered. After inspecting each truss for damage, the author measures the trusses to make sure they're built according to the framing plan.

The sling distributes the weight in fourths. With one-quarter of the length of the truss remaining on each end, the crane sling connects to heavy pieces of rebar slipped through the webbing. A worker steadies the trusses and turns the bundle to ensure the trusses all face the right way.

not unusual for changes to be made in the design of the house during the interim.

In any event, an order of trusses often contains a small percentage of trusses that are either too long or too short—there may even be extra trusses. Even if I conclude that the fabricator is at fault, I'm still looking at a possible two-week delay before new trusses are delivered. That's a long time when I've got a crew standing by to frame the rest of the house.

On the job shown in this article, one section of trusses was 1½ in. too long. We had a choice of having the manufacturer take them back and deliver the correct lengths—and waiting two weeks or so for them—or working with what we had. We decided to set the trusses as delivered and to fur out the rear foundation wall with 2xs so that the siding would fit flush.

Also, several of the trusses delivered to the job site were too short, which meant we had to frame kneewalls to fill the gap. That error was the result of a change in the plans that went uncommunicated to the truss manufacturer.

Trusses are fragile until they're installed—It's not necessary to lift the trusses in place with a crane, but the $80 per hour we pay seems like a bargain, given the speed with which we get them in place. If you're using a crane, however, it is critical that trusses be lifted correctly. When set in place and properly fastened, parallel-chord trusses are wondrously strong. Until they are properly set, however, they are fragile. A sling should hold the truss one-quarter the length of the truss from each end (bottom photo). We run heavy rebar or steel pipe through the webbing at those points and hook the crane's chains around the metal.

At this point, a good crane operator can be invaluable. If the operator knows his trade, he also knows where to set bundles of trusses in a way that makes the job easier for the crew. We were lucky on this job to have Charles Ellrey as our crane operator. Charles's 30 years of experience was a big help.

Even with a crane, the crew still has to move some trusses by hand. It's natural to want to turn trusses on their side when lifting them by hand. That's fine if they are under 15 ft. or so in length. But if they're longer than that, they can fold or snake out of form. What's more, if long trusses are temporarily set on their sides, they can sag enough to wedge themselves between their sills or plates. This is less of a problem if the bearing surfaces are 2x8 or greater.

Remember these few safety precautions—Trusses are held together by galvanized-metal plates, which are engineered for a particular load and span. The plates are punched through to form teeth, which are pressed into the inter-

Temporary braces prevent rollover. This bundle of trusses in the foreground may look stable, but without a temporary brace, they can roll over and cause serious injury. In the background, workers nail a temporary brace across trusses that have already been nailed down. Conventional joists were used in one section of the project because of the short span and light loads needed for that area.

sections of wood webbing and chords, holding them together. However, the teeth in these plates are razor sharp and can easily rip a chunk out of an ungloved palm.

Gloves are a nuisance, and most builders prefer to work without them. But when you're lifting and moving trusses, it's a good idea to wear leather gloves to protect vulnerable hands. Occasionally, we encounter loose plates, which can really deliver a nasty cut.

The main safety concern with floor trusses, however, occurs when they are set on the plates or bearing walls but not yet fastened or braced. If a bundle of eight or ten trusses is set down by the crane, we nail a brace across the tops of them to make them stable (photo above). I've seen more than one carpenter thrown down to the foundation floor by walking on unbraced trusses. Although it would seem that a bundle of trusses resting on 3½-in. wide chords would be steady, they can easily roll over. Even when floor trusses are nailed down, it's still not a good idea to walk over them unless you've nailed a temporary brace across them.

Start setting the trusses at an outside wall—Ladder-type trusses, which have all-vertical webs, are installed at outside walls (bottom photo, facing page). It's much easier to nail wall sheathing and siding onto vertical webs than onto diagonal webs. We set these farthest trusses first so that we're not walking over other trusses any more than necessary.

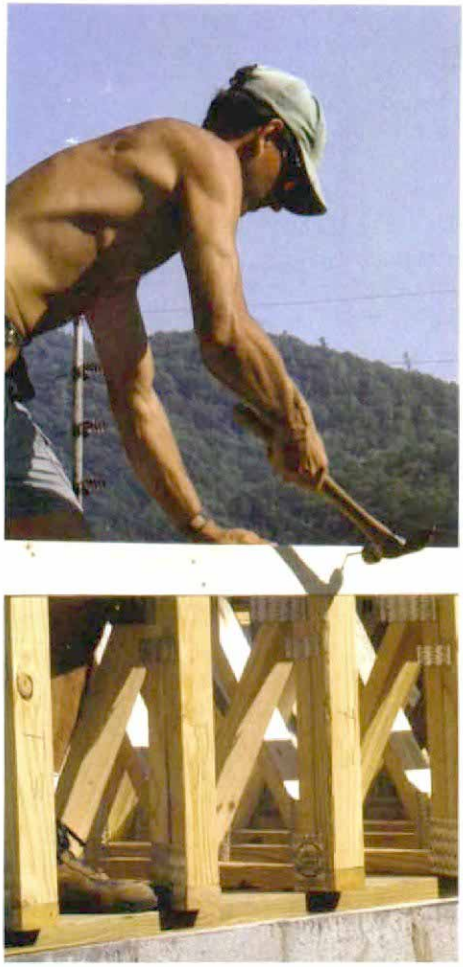
For safety reasons, it's necessary to brace the first truss. We usually nail a 2x4 diagonally to the mudsill and nail the top end of the 2x4 into that first truss. The brace should keep the truss from rolling over as we work over and around it.

After setting a row of trusses—say the first third in a row—we nail a temporary brace across the top chords. This brace provides a reasonably stable surface for walking. Once we've set a 16-ft. row of trusses, it's time to nail the permanent 2x4 ledgers into the pockets provided at the ends of the trusses (photo top left, facing page).

Occasionally—based on the design-load conditions—one or more strongback braces may be required. These braces are usually 2x6s that run vertically inside the open webs from truss to truss, resting against the bottom chord. A strongback brace usually is required when size or lumber grade of the truss has been exceeded. If a strongback is required, those instructions will accompany the truss delivery.

Orientation of trusses is a critical factor—Bottom bearing and top bearing are the two main types of floor trusses. Top-bearing trusses have extended top chords, which rest on the sill or plate, allowing the rest of the truss to hang below. These trusses are helpful when the height of the building is a concern. Bottom-bearing trusses—which we show in this article—rest on the bottom chord like a conventional joist. Either way, it's important to make sure that the trusses are turned the right way when, end for end, they are set on a bearing surface. Usually, there's a number or mark painted on one end of each truss to signify which end goes which way.

One reason the trusses must be oriented correctly is so that the webbing aligns. The webbing usually contains squared chase openings for heating and ventilation ducts, so it's critical



A permanent ledger connects the trusses. Once a 16-ft. row of trusses is nailed down, 2x4 ledgers can be fastened to the notches provided at the ends of the trusses.

This square chase doesn't align. Several trusses were inadvertently installed backward and had to be reversed so that the square duct chase would align.

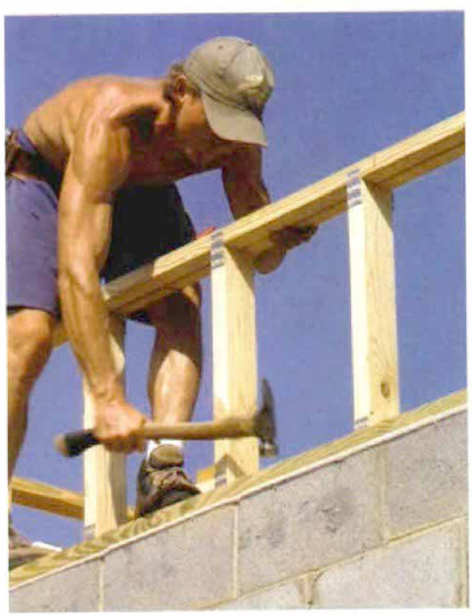
that these squares be aligned before the trusses are nailed in (photo top right).

There is another good reason why it's important to orient floor trusses as planned. Trusses often are required to make multiple spans from plate to plate, over one or more bearing walls. In order for them to work in this fashion, trusses are designed with special load-bearing points that have been built into them. If one truss is to meet another truss over an interior bearing wall, one truss will have a ledger pocket, and the other truss will have an overlapping top chord, which fits into the pocket for nailing the two trusses together (photo top left, p. 82). Truss manufacturers typically identify the load-bearing points on these interlocking trusses with a spray-painted mark or a tag at the points that fall over the walls.

When things don't go according to plan on the job site—*Metal Plate Connected Wood Truss Handbook* (Wood Truss Council of America; 608-274-4849) warns that "drilling holes and notching may cause immediate deflection of the truss and possibly contribute to the collapse of the entire structure. If drilling or notching seems necessary, a truss-design engineer must be contacted to review the consequences of such field modifications."

Clearly, builders are not to do anything to trusses except install them. Yet there are times when it's necessary to modify a truss—if ever so slightly—without waiting for an engineer's okay. The most common modification occurs when the truss gets set over an anchor bolt. You either drill a hole in the bottom chord of the truss to fit it over the bolt, or you move the truss one way or the other and put the rest of the joists off layout. We prefer to drill out the bottom chord carefully to accept the bolt.

Another common problem I've faced is when the bearing point of the truss does not line up with the bearing surface of an interior wall. Our truss maker staples a piece of orange paper to each bearing point. On this job, the maker fabricated the trusses and located the bearing points based strictly on the plans provided. However, the plumber failed to rough in the



Ladder trusses go along outside walls. Ladder trusses are made specifically for outside walls, where their vertical webs make an easier target for sheathing and siding nails than diagonal webs would be.

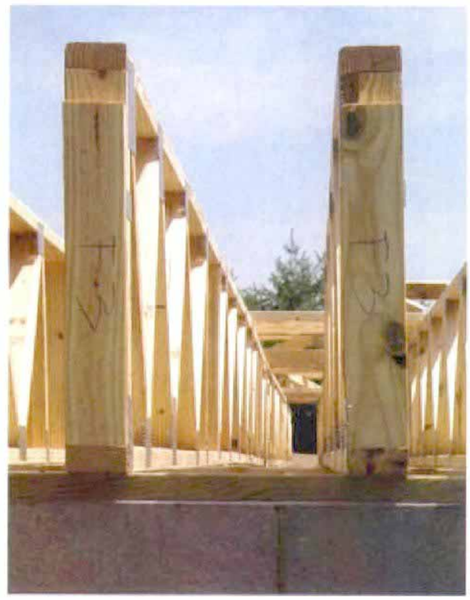
Truss design provides bearing points. Load-bearing points are identified on the truss by a spray-painted mark or a tag and must fall over the bearing surface, such as this partition wall. When two trusses meet over a wall, one truss will have a pocket, and the other truss will have an overlapping top chord that fits into the pocket.

Pry a wayward chord into place, then nail. Although the bottom chords are nailed according to layout, the top chords often need to be forced into plumb. While one man pries the chord into place, another nails the plywood to it.

plumbing on one section exactly as called for. So when we built the load-bearing wall that would hide those drains and supply lines, the wall was off from the plan about 2½ in., which meant the bearing points of our trusses were off. If we had known in time that the walls were that far off, we could have communicated that to the fabricator, who would have relocated the bearing points.

In such a case, I recommend getting an engineer's opinion. He may specify additional bracing or plywood gussets between the wall and the truss.

Another, although minor, problem that often occurs is when the bottom chords of trusses that are longer than 10 ft. or 15 ft. contain a distinct camber that prevents their contact with the bearing walls below (top photo below). Rather than



The camber in these bottom chords isn't a problem. Sometimes the bottom chords of long trusses contain a distinct camber that prevents their contact with the bearing walls below (top photo). The author levers the truss over the layout marks (bottom photo) and drives a nail into the bearing surface on both sides of the truss to hold it in place.

forcing the chord down to the bearing surface and nailing it in, we pry the truss over the layout marks on the bearing wall using a 2x4 lever. Then we drive a nail into the top plate of the bearing wall on both sides of the truss, thus holding it over the mark (photo bottom right, facing page). That way, the weight of the house will settle the truss in the right spot.

There's no special trick to nailing trusses—In general, there are no special requirements for nailing floor trusses. We usually toenail two nails through the bottom metal plate into the bearing surface. We also add two nails straight through the bottom chord into the top plate or sill. This type of fastening is sufficient for ordinary live and dead loads. The plywood subfloor and exterior sheathing form a box with the trusses that keep them in place. However, when you get into wind loads, seismic loads and headered openings, trusses often need special anchors or hangers (sidebar below). A number of companies make both anchors and hangers required for special truss installations (Simpson Strong-Tie, 800-999-5099; KC Metals, 408-436-8754; Semco, 800-737-7327; Kan't Sag, 800-328-5934). However, whenever special hardware is required for installation, the truss manufacturer usually supplies it.

Nailing down the subfloor over floor trusses is a breeze. Almost anybody can hit the broad side of a 2x4 with a nail. One thing to remember, though, is that with particularly long trusses, the top chord may be out of plumb with the bottom chord even after the truss is set. In other words, the top chord may have bowed to one side, which can be a problem when it's time to nail down the subfloor.

We solve this problem by using a level to plumb the top chord on the first truss. Then we brace that truss, set the first sheet of plywood on it and nail the plywood to it. From that reference point, we pencil layout marks on the plywood to show us where the top chords should be. We use a 2x4 to lever the top chords into position. One person pries the truss into position (photo bottom left, facing page) while another nails the plywood to the top chord. Rim joists or band joists are unnecessary when using parallel-chord floor trusses. The plywood wall sheathing does the job instead. □

Brian Colbert is a builder in Boone, North Carolina. Photos by Steve Culpepper.

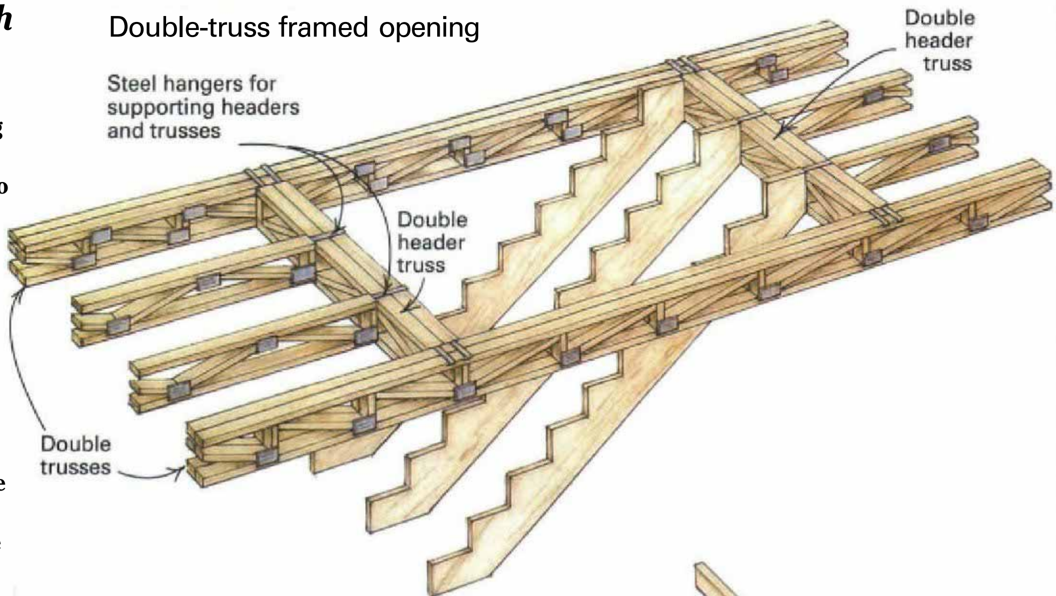
Framing openings with floor trusses

Conventional framing around a fireplace, chimney or other opening requires headers that are either hung from joists or nailed directly to the joists. Truss framing provides several options for framed openings. I'll briefly describe the two most prevalent types.

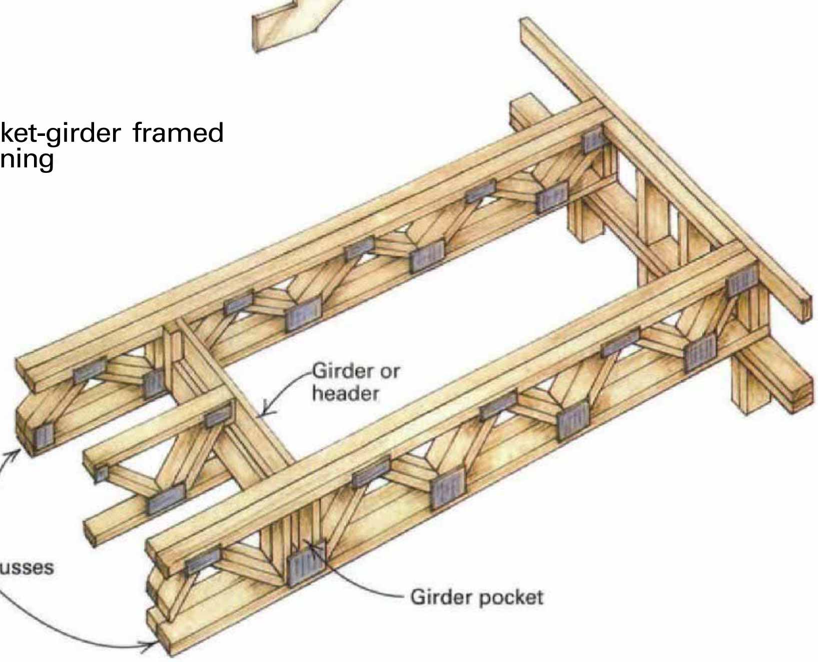
The most common method of framed openings that we use calls for double trusses on all sides of the opening (top drawing). This method is similar to conventional framing, except that only trusses are used. The longer spans on the sides of the opening are doubled, and the smaller double trusses that enclose the front and back of the opening are hung off those longer trusses. Special double-wide truss hangers are usually provided by the truss manufacturer.

The other common method involves specially made trusses that include a pocket for a girder to header off one or two sides of the opening. These could require double trusses perpendicular to the header. If double trusses are used, the girder, or header, slides through both trusses (bottom drawing). If single trusses frame in the two sides of the opening, the girder or header—which can be a glulam, microlam, laminated-veneer lumber or built-up 2xs—slides through the pockets of as many trusses as it takes to distribute the load adequately.—*B.C.*

Double-truss framed opening



Pocket-girder framed opening



Drawings: Christopher Clapp