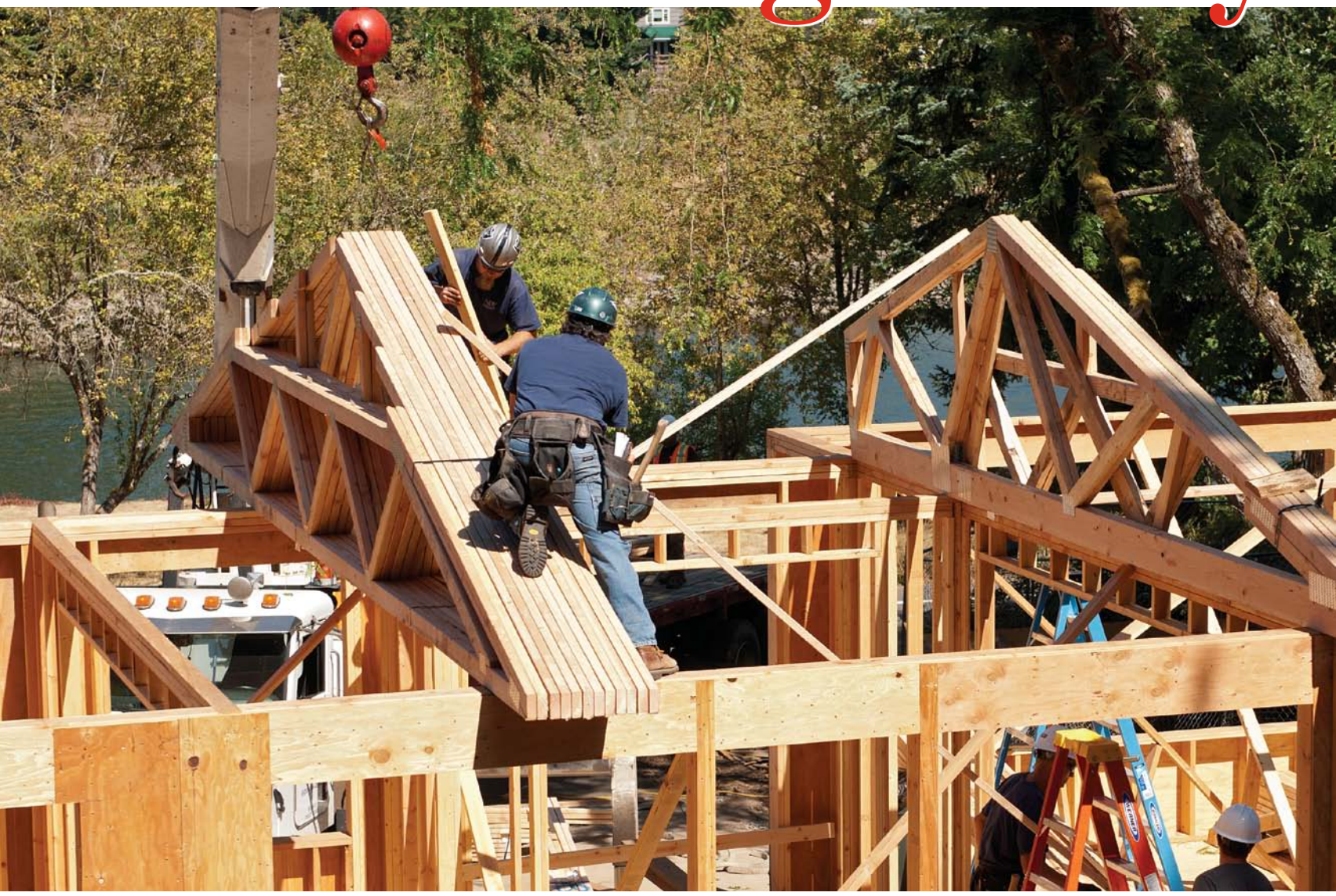
Framing Tricky



Speed production with trusses made for hips and valleys

BY PAUL JOHNSON AND NATHAN D. YOUNG

It's estimated that nearly 80% of the roofs on new houses are framed with trusses rather than conventional rafters. The reason for this is simple: Roof trusses are faster to install, which lowers labor costs and results in quicker occupancy. In seismically active areas, such as the Pacific Northwest region where we build, using trusses is generally the simplest way to build a complex roof that satisfies code and local inspectors. It has also been our experience that perhaps one framing crew in a dozen could efficiently stick-frame the complicated roof of a custom home like the one shown here.

On this job, the architect sent his detailed roof plan to the truss company, which used computer software to design the individual trusses and to plan the layout. Once the foundation was in place, a representative from the truss company checked the site for factors that would complicate delivery and took final measurements of the foundation. The truss package was delivered 10 days later.

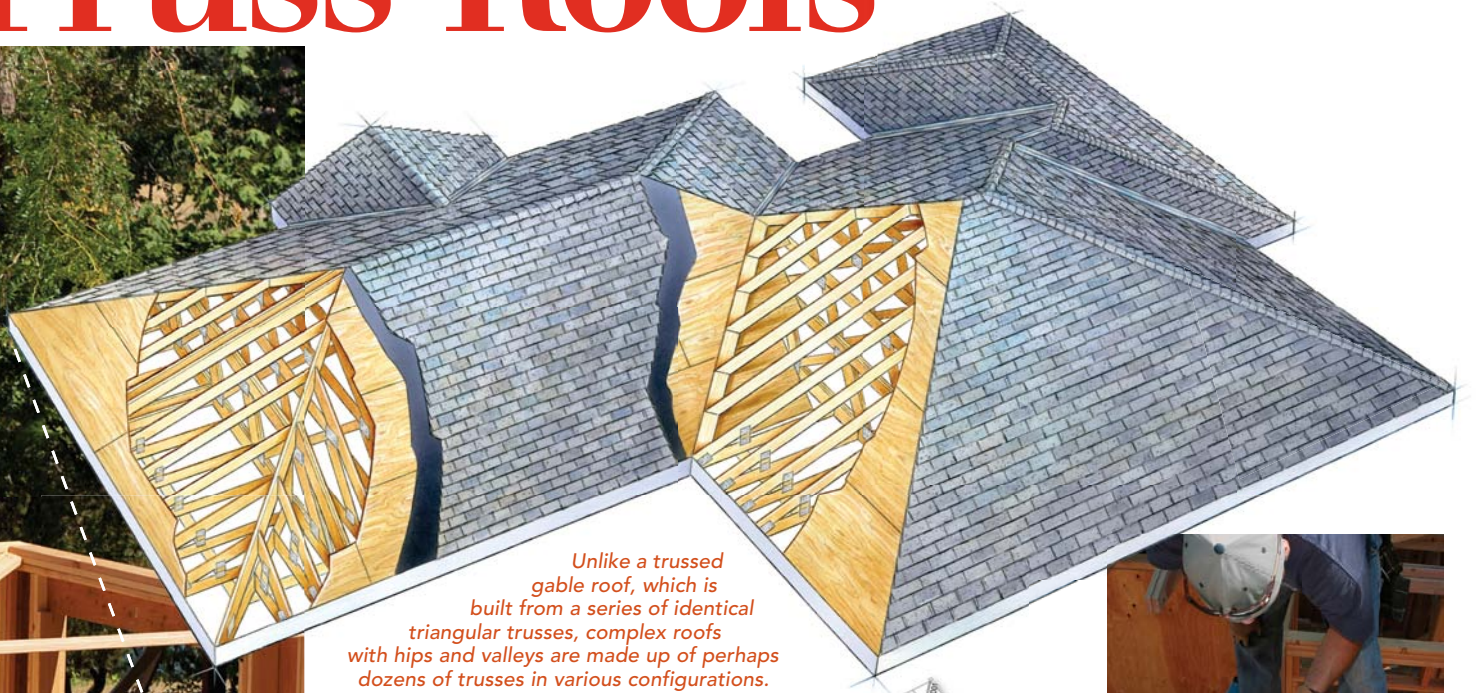
Make a plan for delivery

Depending on their length, trusses may arrive on a flatbed truck that has an onboard crane, or they may be delivered on a semi and unloaded with a separate crane.

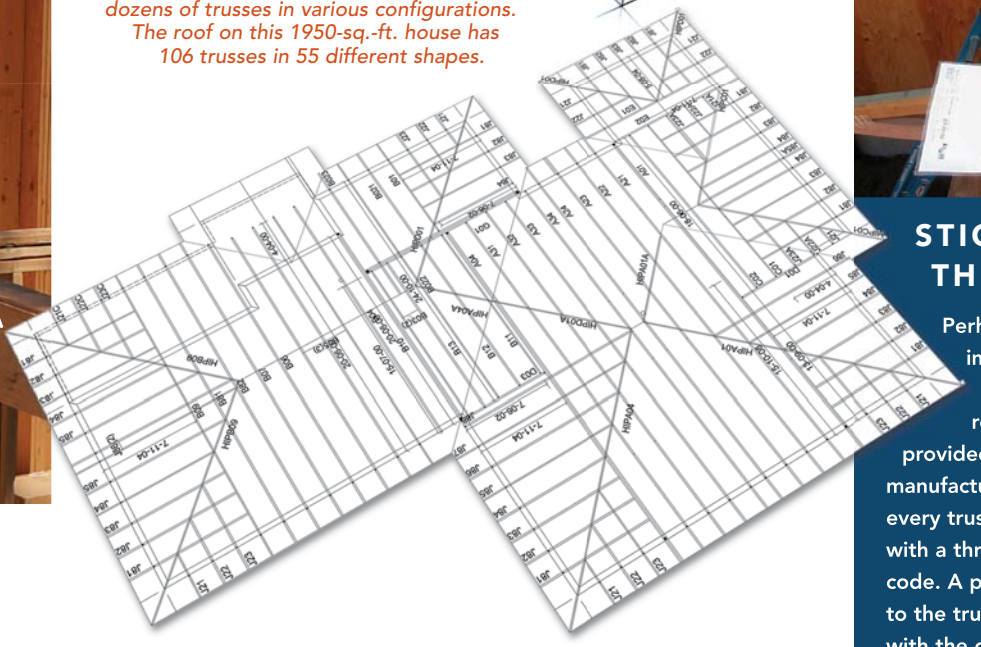
On this project, they came on a 60-plus-ft. flatbed with an onboard crane. Even with this big truck, the trusses still stuck

Photo this page: Nina Johnson. Drawings facing page: Don Mannes.

Truss Roofs



Unlike a trussed gable roof, which is built from a series of identical triangular trusses, complex roofs with hips and valleys are made up of perhaps dozens of trusses in various configurations. The roof on this 1950-sq.-ft. house has 106 trusses in 55 different shapes.



STICK WITH THE PLAN

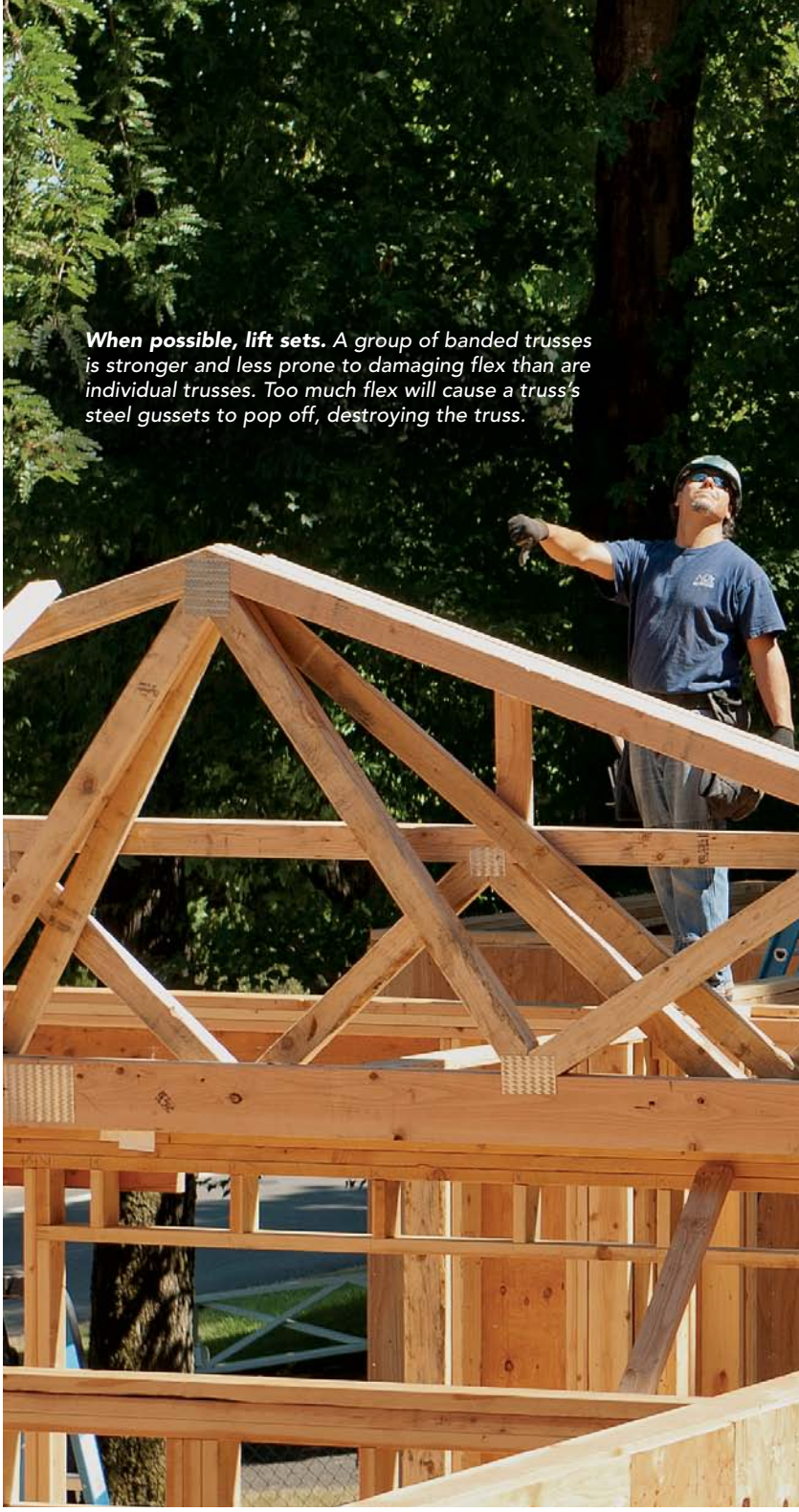
Perhaps the most important element in framing a truss roof is the plan provided by the truss manufacturer. It identifies every truss and truss location with a three- or four-digit code. A paper label attached to the truss corresponds with the coding on the plan. The plan is so important that Portland-area truss manufacturers laminate the drawing so that it can stand up to the area's notoriously wet weather. Plan in hand, the framer decides where to start and in what order he'll lift and set the trusses.

out the back by 10 ft., which meant that the truck was blocking a lane in the street. Further complicating matters, the truck driver, who was also the crane operator, had to navigate around trees to get the trusses off the truck, which prolonged the delivery process.

It wasn't a problem on this job, but the parking area for the truck needs to be wide enough to accommodate the stabilizers for the crane. Because the truck is heavy, the truss company may require a damage waiver to protect it from lawsuits if the truck breaks a paved driveway. We often use scraps of LVLs under the stabilizers to help spread the load when the truck is on concrete or asphalt.

The truss company is responsible for getting the trusses to the job and will set the bundled trusses on the ground, or on the wall plates if they can reach, but they won't spend the time to set individual trusses. On most residential projects, this isn't a problem, but on commercial and large residential jobs with especially long or tall spans, it's

Layout comes first. *With a three-person crew, the lead carpenter lays out a section of roof and then gets the other two framers started on setting the trusses. Once things are moving along, he starts laying out the next section of roof. It's a good idea to figure out where you'll set the truss bundles so that you don't have to move them later.*



When possible, lift sets. *A group of banded trusses is stronger and less prone to damaging flex than are individual trusses. Too much flex will cause a truss's steel gussets to pop off, destroying the truss.*

worth the cost of hiring a crane to set individual trusses while the framers brace them. We've also been on jobs where the delivery truck can't get the trusses on the roof because of their size or because of poor access. In these situations, we bring in a smaller crane or an all-terrain forklift to lift trusses individually or in bundles.

Precise layout and understanding of the truss plan is the key to making a truss roof with hips and valleys that come together. A good truss manufacturer provides a detailed layout, bracing instructions, and all the necessary hardware. However, you'll need a basic understanding of roof framing for the plan to make sense. Fortunately, truss and stick-frame roofs share much of the same terminology.

Where do you start?

The first step is to look critically at the plan and decide which truss to place first. It usually makes sense to start with a girder truss in one of the hip or valley sections of the roof. As their name suggests, girder trusses support other trusses, and they're common on complex truss roofs. We start with a girder truss because once the girder truss is fastened to the other trusses that it helps to support, these assemblies are sturdy and largely self-bracing. We also find it easier to compensate for irregularities in the layout by adjusting common trusses rather than girder trusses and the hip and valley trusses that attach to them.

Once we decide where to start, we transfer the layout from the plan to the top plates. We don't do the entire layout at once; instead, we do it in sections. With a three-person crew, we find it's most efficient to have our lead carpenter start the other two crew members setting trusses in one section. Once things are under way, he continues on the next section of roof. Any of the crew members can direct the crane operator when he's setting the individual or bundled trusses that they're currently working on, but the lead guy is responsible for deciding where to place the bundled trusses that will be installed after the crane leaves.

Given the high loads imposed on them, girder trusses are often made from multiple truss layers called *plies*. Many times, the truss

Photo this page, right: Nina Johnson

Trusses are grouped by location and type. *Generally, trusses are grouped in sequential sets and are individually identified with paper labels. When possible, place the groups close to where they'll be installed.*

Start with the girders. *Girder trusses almost always have hangers that carry other trusses. It's easier and faster to install the hangers when the truss is lying flat.*

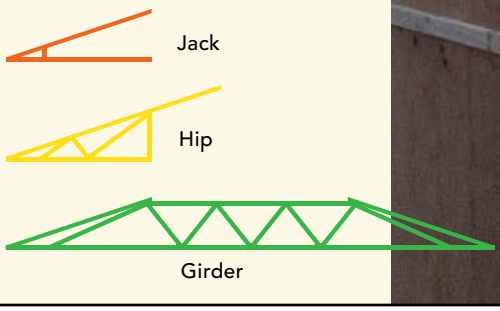
company assembles multi-ply trusses, which generally saves time and effort, but it makes sense to leave the plies separate when a multi-ply truss would be too heavy or awkward to set. If you field-assemble multi-ply trusses, follow the manufacturer's fastening schedule. Once a girder section is set and braced, we move on to a neighboring section of roof, then set those trusses and brace them to the girder section.

Go with the recommended bracing

Even though the bracing specified on the truss manufacturer's installation guide can seem like overkill, it's always best to go with it

Hip trusses

Hip trusses can take several regional forms. In their area, the authors most often see California hips (shown in yellow), which have sloping top chords that extend toward the ridge. In other areas, step-down or Midwest hips may be more common. Hip trusses are often combined with girder trusses (shown in green). Girders equipped with hangers help to support jack trusses (shown in orange).



Ensure that trusses are in the same plane. *Check the height from the top chord to the top plate often. Assuming equal overhangs and a consistent roof pitch, this measurement should be consistent.*

Check for plumb. *To achieve their designed strength, trusses should be vertical. Use a spirit level to check for plumb.*

in case something goes wrong. High winds and mishaps can cause trusses to fall like dominoes, and there's seldom anything left to salvage afterward.

That said, on residential projects where smaller trusses have greater structural integrity, the most important thing is solid bracing to keep the first truss upright. The rest of the trusses then can be braced to this truss and braced laterally to each other. We also install diagonal bracing every 12 ft. to 16 ft. to add vertical stability. For this project, we set a major girder truss, braced it, and then installed the perpendicular mono (single-slope) trusses that hang from it. This created a strong, self-bracing assembly that subsequent trusses could be safely braced against.

Once the trusses have been set, we often have additional framing to do in the valleys and blocking to install. Our truss supplier provides blocking as part of the package and even cuts holes and covers them with screening for eave blocking on vented roofs. We usually install the blocking as part of the sheathing process. Truss suppliers can make what are called *valley sets*, which are trusses that decrease in size to match the roof pitch as they ascend the valley, but we generally find that it's easier to stick-frame these small areas rather than to use trusses.

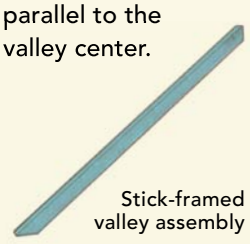
The biggest problem occurs in sections with California valleys, where the valley trusses are nailed on top of the sheathing. Manufacturers never seem to compensate for the underlying sheathing, which throws off the layout, so after several attempts, we've decided it's easier to stick-frame these sections ourselves.

Top photo: Nina Johnson

Sheathe as soon as possible. *Truss roofs are much stronger once sheathed. Leave a ⅛-in. gap between panels, and space the nails 6 in. on edges and 8 in. in the field.*

Valley trusses

Valleys are usually built with increasingly smaller trusses as they go up the intersecting slope. The authors often find it easier and less expensive to stick-frame these areas after all the trusses are set and the roof is mostly sheathed. The 2x6 site-cut rafters (shown in blue) bear on a 2x8 site-cut "lay board" that runs parallel to the valley center.



Stick-framed valley assembly

We generally use a stringline to locate the ridge board that will receive the rafters. Then, using a construction calculator to find the rafter lengths, we fill in the valley sections with 2x4 or 2x6 rafters nailed to a 2x8 bottom plate that we call a lay board. The calculated rafters are generally close enough that we can scribe them to deal with any inconsistencies. On this complex roof, filling in the valleys took about a day for a skilled framer and one helper.

We start sheathing at the eaves, and then we work up toward the ridge. It's easier to start on large, uninterrupted parts of the roof and then use offcuts for smaller sections. We generally use an all-terrain forklift to get the plywood up to the roof, which is a huge time- and muscle-saver.

Shopping for a truss supplier

The truss package for this 1950-sq.-ft. house with 2-ft. overhangs cost about $6500. This included the hip roof for the 450-sq.-ft. garage.

When you're shopping for a truss supplier, ask about the moisture content of the lumber and the truss company's tolerance for wane and crooked stock. When some of the trusses on this job arrived warped and required additional framing to correct, the truss company claimed that 1 in. of deflection is within their standards. We don't think we'll be using them again. □

Paul Johnson and Nathan D. Young are building contractors based in Portland, Ore. Photos by Patrick McCombe, except where noted.

MODIFYING TRUSSES?

Everything you read says not to modify trusses in any way, and for good reason (see "How It Works," pp. 18-19). The truth is, though, that truss companies make mistakes. When this hip truss simply wouldn't fit, it became clear that a worker at the truss company forgot to trim the top chord. After the authors triple-checked that they had the right truss, they decided to cut it themselves. Always inspect carefully what's going on, and discuss anything you're not totally sure about with the truss designer. When a truss is damaged, ask for a repair solution from the truss company. Most things can be fixed with lumber splices or plywood gussets.