INSTALLING Hip Roof Trusses

Accurate layout and preassembly on the ground speed installation

by Paul Bartholomew

Using trusses to frame a hip roof isn't difficult — it's just different. Yet for some reason, many builders have an irrational fear of hip trusses.

I've worked with hip roof trusses for 18 years. I currently run a truss installation company in Raleigh, N.C. In all that time, 90% of the problems I've seen were due to inaccurate placement of the trusses. But with good drawings and an understanding of how the pieces go together, a hip trussed roof offers the same cost advantages as a standard gable trussed roof.

Good Communication

Ordering the hip roof trusses is the most critical link in the entire process. Any mistakes made at this stage will most likely go unnoticed until the trusses arrive, so I'm careful that the information I give to the truss manufacturer is accurate and a delivery date is agreed on. I typically provide the manufacturer with detailed drawings, and answer any questions that come up.

If the truss manufacturer is working from an architect's or designer's set of drawings, it's important all three parties (the truss manufacturer, designer, and contractor) are on the same page. The Wood Truss Council of America (WTCA) has established a set of guidelines that describes who is responsible for

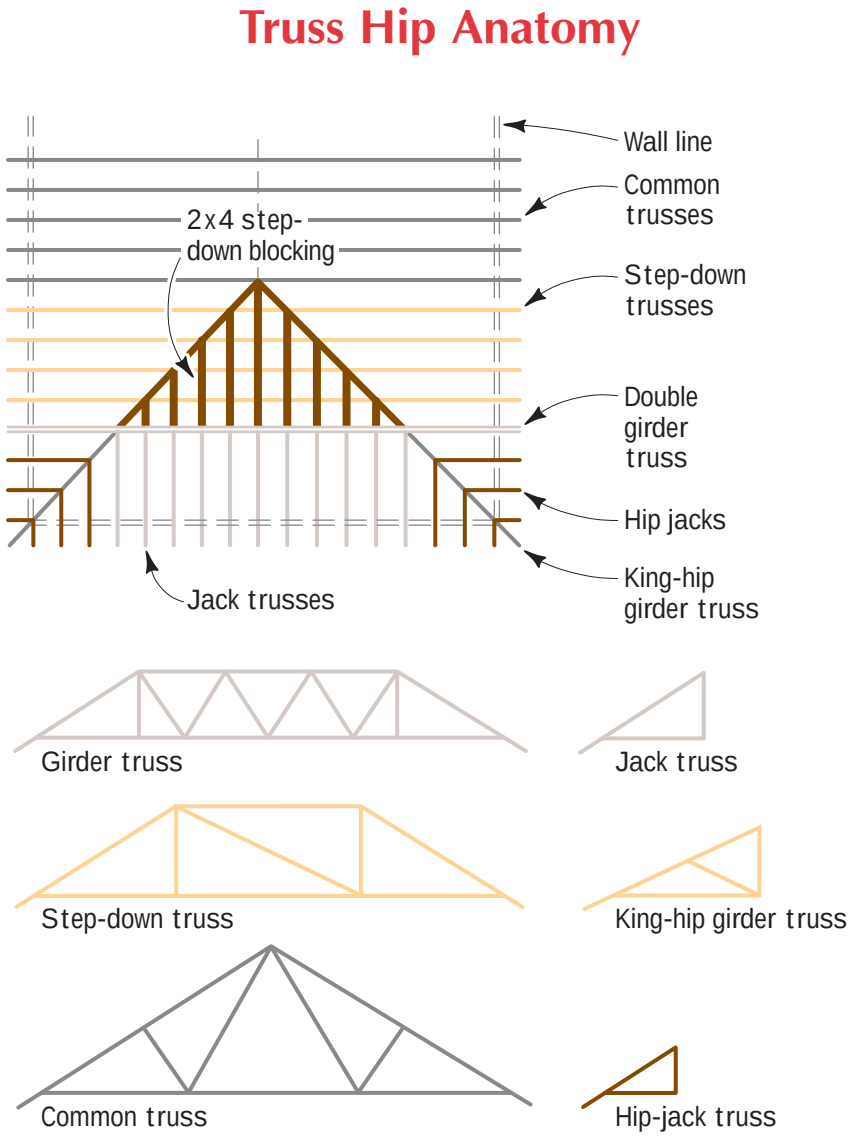

Figure 1. In a typical truss hip roof, the common trusses step down to a doubled girder truss. The hip is then completed with a pair of king hip girders and jack trusses.

Figure 2. Framing truss roofs on the ground reduces dangerous work on the roof. The hip end shown here, part of a large commercial job, was completely framed on the ground (left), then craned into place (right). On residential work, the author usually installs the king hip girder and hip jacks on the roof.

what (see "Avoiding the Blame Game").

I make a point to review and approve the truss design drawings and placement plan before the trusses are built. This reduces the chance of the trusses being incorrectly manufactured, and helps me become familiar with the truss plan.

It's Hip to Be Square

It's essential that the dimensions of the building's walls match those called out in the drawing, and that all walls are square, plumb, and level. If I arrive at the site and the wall plates are out of square or dimensioned incorrectly, I take the time to establish where an accurately framed roof system will rest on the plates.

Minor inaccuracies of an inch or less can generally be absorbed in the soffit, but major inaccuracies may require a meeting with the general contractor before work begins. In either case, the truss roof must be assembled accurately, or the roof sheathing and ceiling drywall will not break properly on the trusses.

Accurate Layout

Before the trusses arrive, I carefully lay out the truss locations on the wall plates, using the placement plan supplied by the truss manufacturer. These plans typically include a layout drawing that clearly indicates the location of each truss, and a drawing of each type of truss used in the roof assembly.

Ask your supplier to show you a sample layout drawing. Drawings that can't be deciphered won't do you much good the day the trusses arrive.

Starting on the Ground

In a hip roof truss system, the girder truss is set first, followed by the jack trusses (see Figure 1). To save time, I like to preassemble the girder and jack trusses on the ground, and lift them into place as a unit (Figure 2). This eliminates the temporary bracing needed when assembling these trusses on the wall plates.

Using temporary sleepers to provide a flat assembly area on uneven ground,

my crew of three men can assemble the trusses in less than 30 minutes. I don't worry too much about how the ends of the jack trusses line up while I'm assembling the trusses on the ground: I can adjust this after the assembly is set on the walls.

To crane the assembly over to the wall plates, I cinch two nylon straps around the top chord of the girder truss at quarter points. The entire assembly will be out of balance, with the ends of the jack rafters hanging much lower than the girder truss. To prevent the trusses from bending or distorting during the lift, I carefully brace the preassembled trusses while they're on the ground, and use the lift locations recommended by the manufacturer. I have the crane operator gently position the ends of the jack trusses at the layout marks on the plates, then slowly lower the girder truss into place.

After the preassembled unit is set in place on the walls, I check the positioning of the girder and jack trusses, nail them off, and install diagonal bracing (Figure 3, page 36). Bracing requirements for truss roofs will vary depending on the span, roof pitch, and other factors. I refer to the Truss Plate Institute's publication HIB-91 when deciding on bracing strategies ($7 from the Truss Plate Institute, 583 D'Onofrio Dr., Suite 200, Madison, WI 53719; 608/833-5900).

Step-Down and King Hip Trusses

After nailing and bracing the girder truss and jack truss assembly so it will stay rigid and straight, I install the step-down trusses, any common trusses, and the king hip girder. When I install the king hip girder, I fasten it securely to the girder truss (following the truss designer's specifications), but only tack it in place at the wall plate. This way, I can make adjustments later, when all the trusses are in place.

Before setting the hip jacks, I string a line from the ends of the common trusses to the end of the king hip girder, continuing around the corner to the ends of the jack trusses. Theoretically, this string line should run parallel to the

Avoiding the Blame Game

When a truss roof is specified for a new home or addition, there are typically three parties who will share responsibility: the building designer, the truss manufacturer, and the builder. To prevent problems, it's important that all three parties understand and agree on who is responsible for the various phases of the truss process.

To help clarify this issue, the Wood Truss Council of America (WTCA) has published guidelines that spell out the specific responsibilities of the parties. This document (WTCA 1-1995) is an excellent reference, although it tends to read somewhat like a tax form. Here's a summary:

Building Designer

Construction drawings are the starting point for any truss roof; therefore, the building designer should

- specify the location and direction of the trusses, and provide all the information needed to arrive at the final profile of the truss.
- provide a clear description of all the loads that will act on the truss system, define acceptable deflection values, and detail truss attachment at the wall plates.
- account for any "downstream" loads that the truss system will transmit to the structure.
- review and approve all drawings provided by the truss manufacturer.

Truss Manufacturer

The truss manufacturer is, for the most part, at the mercy of the construction drawings, and should

- prepare a detailed truss placement plan (when required) that includes layout information that can be used to accurately locate each individual truss.
- detail connection requirements when trusses are being ganged together, attached to one another, or field spliced.
- specify the location of permanent truss-member bracing.

Contractor

The building contractor is essentially (and not surprisingly) caught in the middle of the truss process, and should

- provide the truss manufacturer with a copy of the construction drawings, and any revisions that take place as the project progresses.
- review and approve all drawings provided by the truss manufacturer.
- provide the building designer with copies of the truss manufacturer's drawings, and coordinate the review, approval, and return of these drawings to the truss manufacturer.
- point out any potential problems that the truss layout will present to the subtrades.
- supervise the delivery, storage, handling, and installation (including temporary and permanent bracing) of the trusses.

Many smaller builders and remodelers act as both the contractor and designer, and provide the truss manufacturer with design information. In these cases the issue of design liability is an important one, and both parties should agree on who is responsible for providing the design loads.

If you have any concerns about the design loads, or "downstream" structural support for the truss system, spend a few dollars and have a structural engineer prepare the design information for the truss manufacturer.

Copies of the WTCA 1-1995 guidelines are available through your local truss manufacturer. For additional information, contact the WTCA at 5937 Meadowood Dr., Suite 14, Madison, WI 53711; 608/274-4849.

— Carl Hagstrom

Stacking a Hip, Step-by-Step

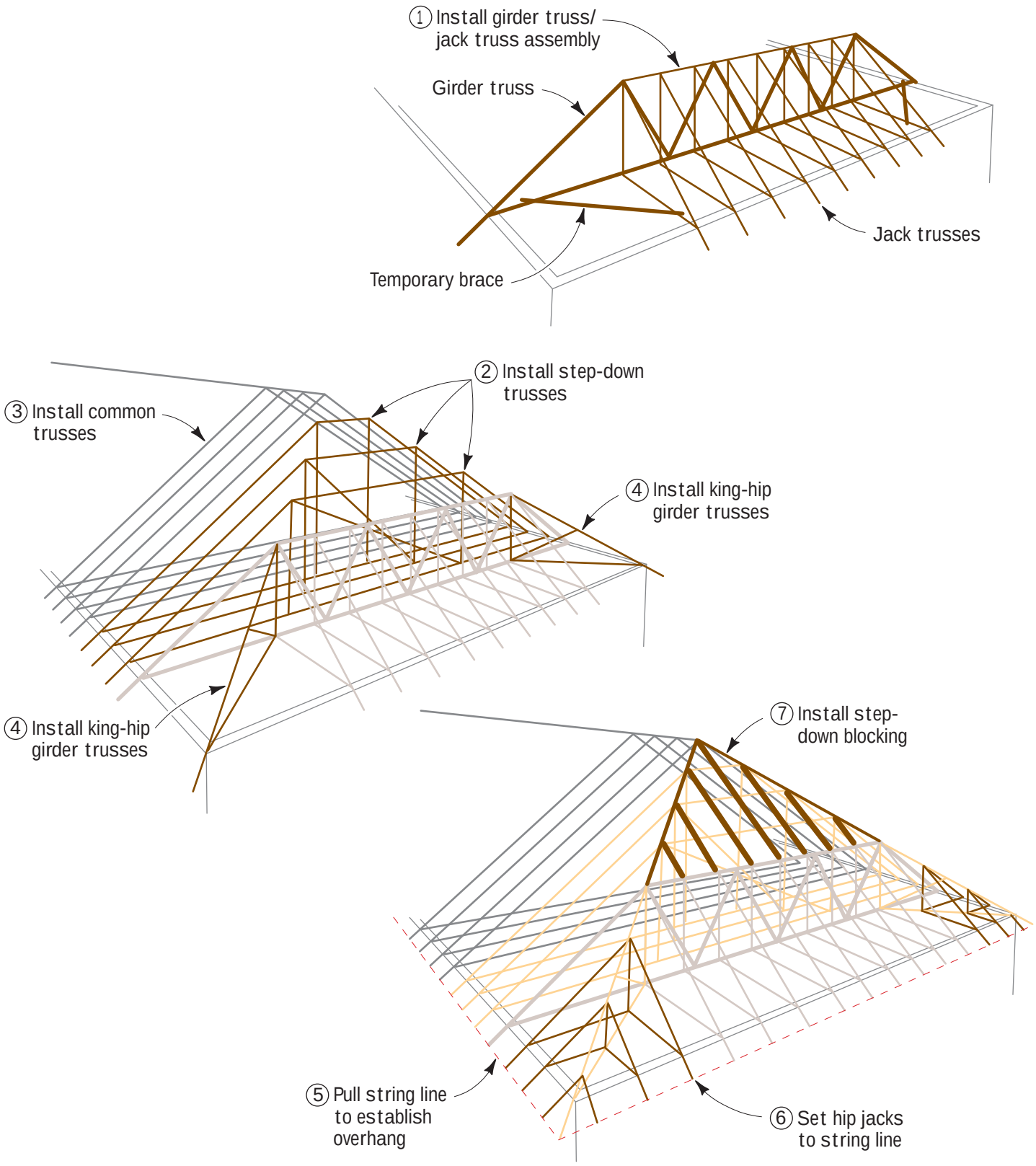

Figure 3. Working on level blocks on the ground, the author's crew fastens the hip jacks to the girder truss, then stiffens the whole assembly with temporary braces. The assembly is then crane-lifted and carefully set on the top plates (top). Next, the step-down trusses are assembled on the ground and lifted into place, followed by the common trusses (middle). The king hip girders are then installed, but fastened only to the girder truss, not at the plate. Finally, a string is pulled around the ends of the jacks and step-down trusses to establish the proper overhang (above). The king hip is adjusted as needed and the hip jacks set to the string.

Step-Down Blocking Options

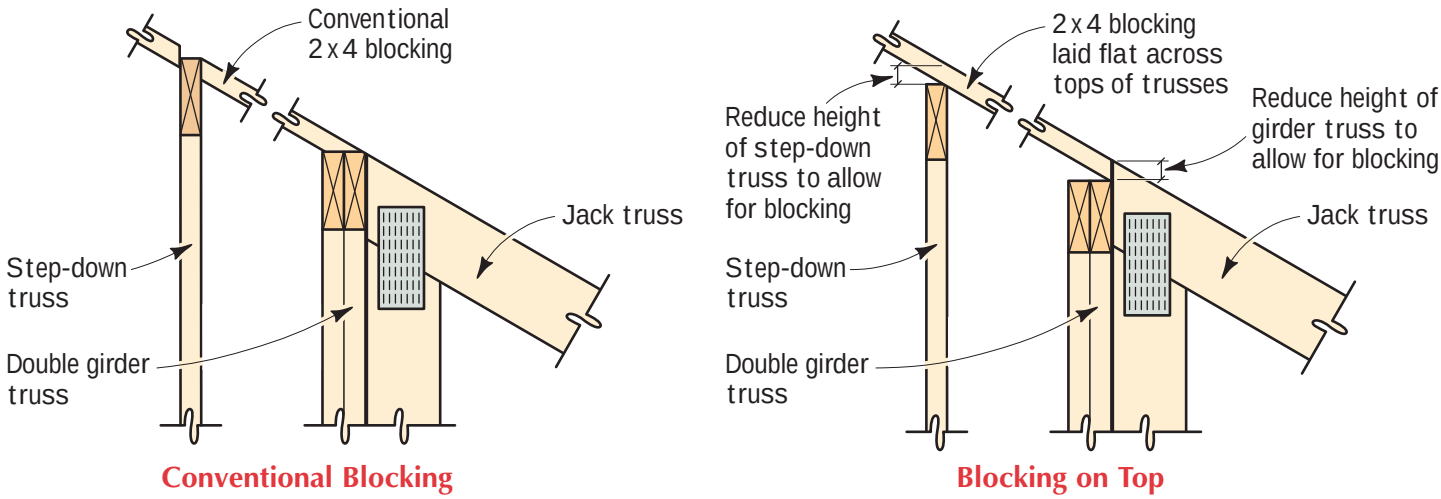

Figure 4. Conventional step-down blocking requires two bevel cuts and a lot of installation time (left). Instead, at the design stage, the author reduces the height of the girder truss step-down trusses to allow 2x4 blocking to be laid flat across the tops (right). An alternative to individual 2x4s is to have the truss factory make a "blocking truss" (see photo, page 33), which can be dropped into place with a crane.

walls, but in reality, I often have to adjust the end of the king hip girder to establish a parallel line. An improperly sized king hip girder can create a ripple effect that will cause problems when installing the roof sheathing, fascia, and soffit. If the king hip is long, I'll trim the end, and check to make sure that the top chord isn't above the roof plane. If the top chord crowds the roof plane, I use a skill saw to rip the top chord. If the king hip is short, I'll fasten a shim to the end.

It's important to remember that trusses are engineered products; unauthorized field modifications may reduce their strength or performance. If you're not certain what effect a field modification will have on a truss, check with the truss manufacturer before proceeding.

When I'm sure that my string line is parallel to the walls, I nail off the king hip girder at the wall plate.

Filling In the Corners

Using the string line as a guide, I set the remaining hip jacks. I position each hip jack over its layout mark (making sure that the truss is square to the wall plate) and check the end against the string line. If the hip jack is short, I slide it slightly off the layout mark toward the wall corner. If the hip jack is long, I slide it towards the main roof. By sliding the truss, I don't have to spend valuable time trimming it to fit. If a plywood edge will miss the relocated truss, I nail a scab to the side of the top chord.

When nailing the hip jacks to the king hip girder, I prefer to keep the bottom chords flush. If there is any difference in height where the two trusses join, I've found it easier to hide the discrepancy at the roof plane rather than at the ceiling plane.

I'm careful to keep an eye on the king hip girder as I nail off the hip jacks: It's easy to push the king hip girder out of line as you drive the nails home.

Step-Down Blocking

Typically, step-down trusses are designed so the roof sheathing is fastened directly to the top level chord of the truss. To provide a nail base along the hip, step-down blocking is installed from the end of the common roof's ridge down to the king hip girder. This type of step-down blocking requires a compound angle at both ends, and is very tedious to install. Intermediate step-down blocking is also installed between the step-down trusses to extend the nail base of the jack trusses all the way to the hip line.

To streamline the step-down blocking process, I have the truss manufacturer lower the top chord of the step-down trusses $1\frac{1}{2}$ inches perpendicular to the hip plane (Figure 4). This way, instead of fitting the blocking between the trusses, I can run continuous lengths of flat 2x4s on top. This technique cuts my blocking labor by 80%.

Another option, which we tried for the first time on a recent large job, is to have the truss manufacturer build a "blocking truss." All the step-down blocking is ganged together into one unit at the truss plant, and we set it in place with the crane. Since it's non-structural, we can fine-tune the fit once the truss is set in place.

After all the trusses are set, I pull a string line from the end of the king hip girder to the ridge intersection of the hips and back down to the end of the other king hip girder. This string line defines the hip of the roof, and I use it as a guide as I install the 2-by on top of the step-down trusses.

Paul Bartholomew *owns and operates PFB Company Inc., a truss installation company in Raleigh, N.C.* *Thanks to Jim Vogt, P.E., of the Wood Truss Council of America, for his help with this article.*