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**TIMBER TRUSS
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Timber-Frame Roofs for Great Rooms

Classic mortise-and-tenon timber trusses add timeless appeal to open rooms without the expense of a whole-house frame

by **Anthony Zaya**

If it hasn't happened already, chances are good that one of these days a client will ask you to incorporate some timber framing into a new house or addition. Your reaction probably won't be neutral. Either you'll welcome the challenge of working with a timber framer or you'll feel the beginnings of a headache that you fear will bloom into a full-scale wall banger.

Relax. It's not that complicated. And

you may discover that timber framing adds an attractive element to the usual package you offer clients.

I've been involved in timber framing for nearly 20 years. Back in the '80s, when I was starting out, we mainly built barns and whole houses, like most other timber framers. Gradually that has

changed, though, and over the last 10 years we've been involved with hybrid frames — structures that are primarily stick framed but have timber-framed spaces included in the plan.

By far, our most popular job is the exposed timber-frame truss ceiling in a great room, in either new construction or an addition. These roofs are typically supported on standard 2x6 exterior walls, which are far simpler and less

costly to build than a timber-frame support wall, with its posts and girders.

Why Hybrids Are Popular

Timber framing is labor-intensive and specialized. Without question, it's more costly than stick construction. By limiting its application to one or two areas, the homeowners get the look and feel they're after at less cost. Also, reducing the amount of material makes it possible to upgrade the timber quality to kiln-dried or recycled old-growth stock, either of which is as dimensionally stable as wood can get.

Fewer complications. Compared with the hybrid approach, a whole-house timber frame can be especially challenging in areas like kitchens and baths where space is at a premium, and where

fixtures dictate room layout. Also, having posts in every room tends to dominate the interior design, complicating furniture placement and making it hard to locate plumbing and mechanical ducts and piping. The lead time for a hybrid project is also considerably less than for a whole-house frame.

More drama. Though we still do a dozen or more whole-house timber frames each year, we're encountering a growing number of architects and clients who prefer area-specific timber framing. There's a sense that limiting the timber framing in the overall design gives it greater impact — something about less being more.

Truss design can make a space feel contemporary and light, medieval and heavy, or just about anything in

between, depending on configuration, timber species, surface, and finish. Finished ceiling material also has an impact. White drywall or pickled tongue-and-groove boards can help a tight area feel larger, while painted drywall or natural-finish tongue-and-groove can visually lower a high ceiling and make a large room feel more inviting.

We also consider roof pitch and span. Steep pitches typically look best, but if a shallow pitch is needed, it's smart to avoid scissors, hammer-beam, and "tied rafter" systems, which, because of their structural geometry, are not stable at low pitches. Some types of trusses handle long spans more comfortably than others do — any of the trusses that



Depending on the details, timber trusses can evoke a traditional — even medieval — feeling or fit nicely in a contemporary space. At left are strutted king-post trusses with bracketed knee braces underneath; below, scissors trusses with horizontal purlins.



have a low bottom chord, for example. Scissors trusses, hammer-beam trusses, and tied-rafter trusses are more appropriate for shorter spans — say, 24 feet or less.

Working With the Timber Framer

We work with the builder, owner, or architect to explain the possible truss configurations for a given room, and the possible timber species. Once a decision is reached, we design the timber trusses and supply stamped engineered shop drawings. (When working with a timber framer, be sure to request that truss drawings are sealed by an engineer registered in your state.)

We also provide detailed drawings showing how the trusses interface with the stick-built walls. If the builder or architect seems anxious about the job, or the job is especially complex, we'll visit the site before delivery. On delivery, we handle installation of the trusses and sometimes of the built-up insulated roof, including either the drywall or T&G ceiling boards. Many builders will handle the roof with their own crews.

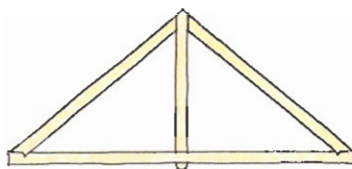
Framing the Walls

We've built trusses for rooms ranging from 16 by 20 feet all the way up to a 102-by-120-foot church sanctuary. Most of our jobs are closer to the small end; a 20-foot-wide by 30-foot-long room is typical.

Depending on budget, we may use fewer trusses spaced farther apart or more trusses closer together. Heavy trusses can generally be spaced up to 16 feet apart as long as they are joined with purlins at 4 feet on-center. In that case, the T&G ceiling boards would run parallel to the trusses, across the purlins. With closely spaced trusses, we run the ceiling boards perpendicular — rather than parallel — to the trusses.

Framing the walls in preparation for the trusses is straightforward. In a typical job, the GC builds standard 2x6 exterior walls to the designated height

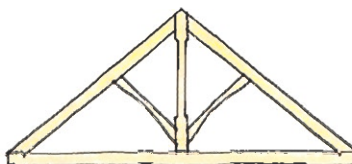
Truss Types



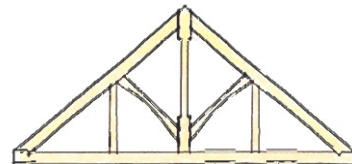
King Post Truss



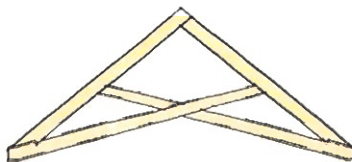
Queen Post Truss



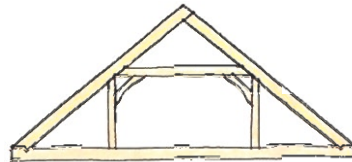
King Post Truss
with Struts



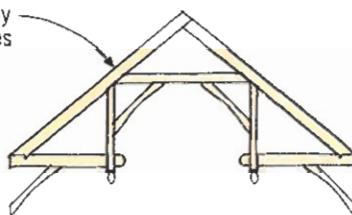
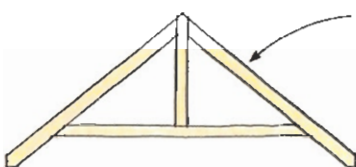
King Post Truss with Struts
and Queen Posts



Scissors Truss



Tied-Rafter System



Hammer-Beam System

Technically
not trusses

Timber trusses are made in a variety of configurations depending on structural needs and the look the customer is after. According to the author, the tied-rafter and hammer-beam types are not technically trusses because they lack the bottom chord; these styles work better at shorter spans.

for supporting the truss bottom chord. Under each truss layout location, a post of ganged 2x6s carries the point load to the foundation below. On a wood-framed floor, the joist cavity below the post must also be blocked solid.

The "mini wall" can be built either before or after the trusses are set. If it's

done before, the builder leaves a 1/16-inch gap on either side so the truss can easily slide into position. If the trusses are made from seasoned or kiln-dried wood, the angled top plate of the mini wall can be flush with the top surface of the upper chord (rafter). If the timbers are green, I advise setting the

angled plate about $\frac{3}{8}$ inch lower for hardwood trusses and $\frac{3}{16}$ inch lower for softwood.

We use Simpson ST6236 straps to tie the trusses to the sidewalls. After the trusses are in place, the purlins are dropped in place. If the purlin ends are dovetailed, they simply slide into their slots; if they have tenons on the ends, the trusses have to be spread slightly so that the purlins can be positioned. We use opposing come-alongs to spread the trusses. The purlins that die into

the gable walls are set last.

Once the purlins are positioned and racked square, we nail diagonal 2x4s across the top to hold things true. Then we set the knee braces, which fit between the truss bottom chords and the ganged 2x6 posts. Because we like to join the braces to the posts with a pegged tenon, we give the general contractor a measurement down from the top plate as a "no nail" zone. That way we can drill and chisel the mortise without trashing our tools.

Built-Up Vented Roof

It's always a good idea to get a roof over a timber frame as soon as possible. There are a number of options. Some projects use structural insulated panels for the roof, while others have a conventionally framed roof built over our truss system. A framed roof is typical when the client wants recessed lighting in the ceiling.

Our own recommendation is a built-up vented roof. We used to use panels, but found that adding strapping and another substrate for venting was both redundant and costly. Our built-up roof system, by contrast, is simple and economical. It doesn't require a crane to build, and it provides the code-required ventilation.



Trusses are prefabricated and bored in the shop (below left), then reassembled on site in preparation for lifting with the crane (below).



T&G ceilings. The most popular finished ceiling is tongue-and-groove boards. Most clients choose a lighter-colored wood species that contrasts with the timbers. For example, if the timbers are Doug fir, white pine, or spruce, T&G boards work well. If you use the same species for both, you lose some of the dramatic effect of the trusses.

There's no need to oil the T&G, although some clients request it. Whitewashing the boards brightens the ceiling and is an increasingly popular treatment.

Building the roof. On a typical roof with purlins, we first install the T&G boards perpendicular to the purlins, good face down. We then apply a double layer of 3-inch-thick 4-by-8-foot

sheets of high-density extruded polystyrene, for a total of 6 full inches of insulation. (In extreme climates, we'll go thicker, depending on local energy codes.) If it's available, we might use three layers of 2-inch EPS instead.

We stagger the second layer 2 feet in both directions so the seams don't line up. Then we run 2x4s on the flat from the eaves to the ridge at 2 feet on-center. Since we know the spacing of the purlins, we predrill the 2x4s with holes at each purlin and the ridge, then drive ring-shank pole-barn nails or screws through the 2x4s, foam, and tongue-and-groove into the purlins. We let the 2x4s fly wild off the eaves, snap a line to mark the overhang, and install 5/8-inch plywood sheathing over the

2x4s. Either we or the GC will come back and finish up the soffit details.

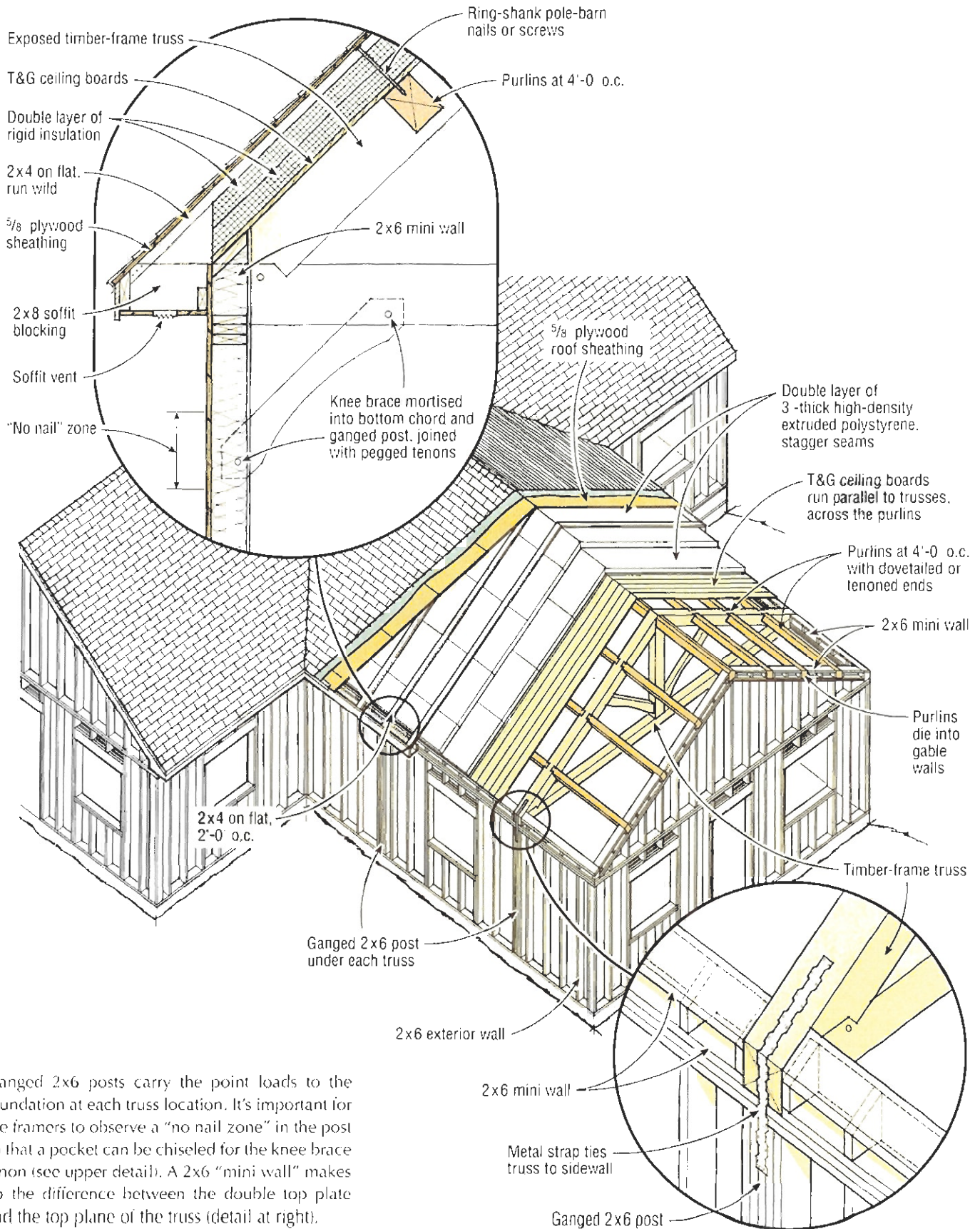
Drywall ceilings. Some clients prefer gypsum-board ceilings. In those cases, we use moisture-resistant GWB, laid out so the seams occur over the purlins and rafters. Next comes the tricky part: laying out and fastening 3/4-inch T&G plywood on top of the GWB, and screwing it to the purlins and top chords of the trusses. Once this is accomplished, we fasten the gypsum board to the plywood with drywall screws from the underside. The two layers of foam and the rest of the installation are the same as if T&G boards had been used.

What if there are no purlins? In a truss roof without purlins, we provide



Here, with the assistance of the crane, the gable truss is held in position while the tenoned purlins are dropped into place, stabilizing the roof structure.

A Hybrid Frame



Ganged 2x6 posts carry the point loads to the foundation at each truss location. It's important for the framers to observe a "no nail zone" in the post so that a pocket can be chiseled for the knee brace tenon (see upper detail). A 2x6 "mini wall" makes up the difference between the double top plate and the top plane of the truss (detail at right).

nailing for the built-up roof in one of two ways: We either add an extra layer of 2x3 strapping across the rafters, then a crisscross layer of strapping on top of that, or we use a stout nominal 3-inch-thick T&G product called Lock-Deck (Disdero Lumber Co., 800/547-4209, www.lockdeck.com) for the ceiling.

Lock-Deck is a great product because it comes with engineered design values that allow your designer to take into account wind-loading on the roof. It's also available in thicker sizes if you're in a heavy snow or high-wind area and need the extra strength or

greater nail penetration. And, because this material is tongue-and-groove on all four edges, there's minimal waste.

Cost

How much is this going to cost? The short answer is that it will be noticeably more costly than a simple drywall cathedral ceiling. The upside is that you'll have a dramatic exposed timber ceiling that is also well insulated. Exact cost depends on several factors, including timber species and grade, how big and complex the job is, and the level of craftsmanship the customer wants. Any timber-frame company, once you've

provided your floor plans and elevations, can walk you through the variables and present a number of options.

As an example, take a great room 16 feet wide and 24 feet long, with a 10/12 pitch. Let's say we go with two strutted king-post trusses and three bays of purlins and ridges, two of which die into stick-framed gable ends. The species is Douglas fir and the grade select structural. Let's further assume that the joinery is fully housed, the edges stop-chamfered, the timber dead smooth and finished, and the frame itself sealed by an engineer.

The cost for all that, FOB, might



Working on the "no nail zone," a carpenter prepares the knee-brace mortise in a 2x6 support post (above). The knee brace is then persuaded into place (above right). On this job, the top-sloped "mini wall" was added after the trusses (right).




range from \$9,000 to \$13,000. Crane time on a job that size would run about four to six hours. As for the built-up roof, we figure about \$1.20 per square foot for the 3-inch-thick extruded polystyrene, and around \$1.10 to \$1.70 per square foot for the 1-by T&G, depending on species and grade. Lock-Deck runs between \$3.50 and \$5 per square foot.

In Answer to the Purists

So, is the hybrid approach true timber framing? Of course it is. The same joinery is involved, members are larger than 4x4, pegs are used, and the timbers provide structural support. The only difference is that by selectively limiting the areas where you want the timber framing, you maximize impact and minimize costs.

A good number of years back, I encountered the first of my clients to request that only a few areas of her house be timber framed — and not because of budget limitations, but because that was what she wanted. At the time, being somewhat of a purist myself, I reacted badly. I felt that she was misguided, and pushed for a whole-house frame. She stood fast. Later into the job, she insisted on whitewashing the Douglas fir timbers, rather than going with my preference, tung oil. Again she stood fast.

As time passed and the project came to a close, I came to realize that her taste and perspective were, in many ways, superior to mine. We've since married. Now, when we find ourselves at an impasse, she takes charge. And I've stopped reacting badly. 

Anthony Zaya is the president of Lancaster County Timber Frames, Inc., in Lititz, Pa.



The author's built-up roof method provides both ventilation and insulation. First, T&G ceiling boards are installed face-down over the trusses and purlins (A). Next come two staggered layers of 3-inch-thick polystyrene insulation (B) followed by flatwise 2x4s, which get nailed to the timbers with ring-shank pole-barn nails (C). A layer of 5/8-inch sheathing completes the buildup (D).

