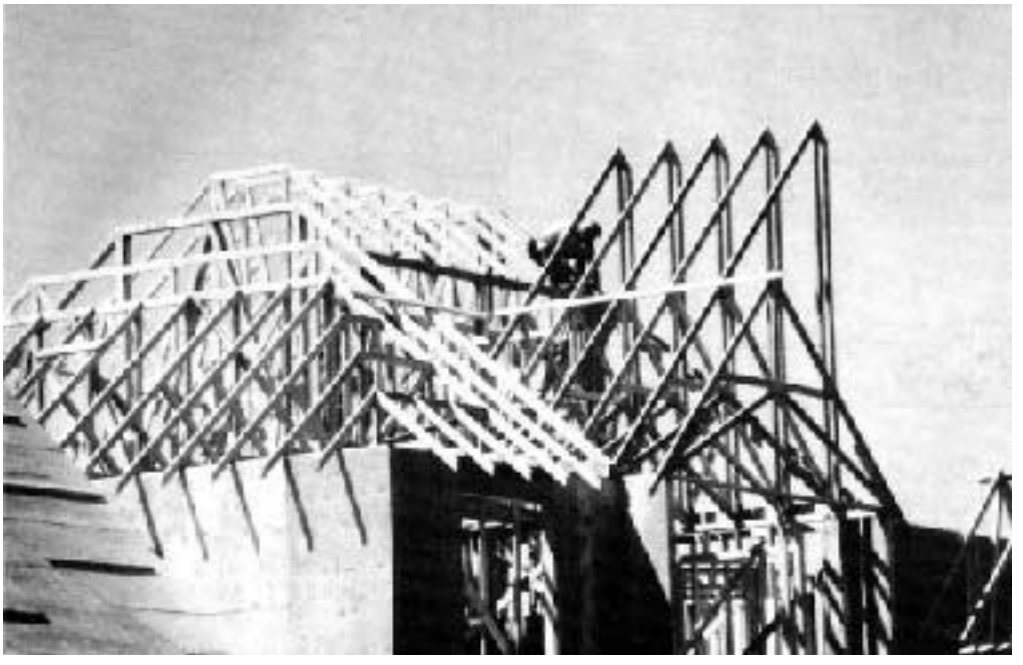
Shopping for Custom Trusses



Gary Carlson

Trusses can compete with conventional framing even on complex roofs, given advances in computer-aided design and manufacturing, and the growing scarcity of larger timbers and skilled labor.

By Frank Paul

If you haven't considered roof trusses recently, you'll be surprised at their versatility and economy

If you bought trusses 25 years ago, you were a pioneer. And you were probably a spec builder putting up simple houses with straight gables.

If you're buying trusses today, you are just as likely to be a small custom builder. And you're probably using truss types even *we* couldn't imagine back then: valley and hip systems, girder trusses, energy trusses that can be stuffed with insulation, and trusses that create vaulted ceilings, shed roofs, flat roofs, roofs with load-carrying attic space built in, and more.

Costs Dropping

Between standard truss design software and in-house designers, full-service truss companies can now create a system for almost any roof drawn. And they can do it with increasing economy. In fact, some of the trusses we sold five years ago for $150 now sell for $120.

One of the reasons our truss prices have dropped is automated assembly. The next step for us is computerized cutting; we estimate that it will triple the speed of that part of production.

Another factor reducing cost is increased design capability. What was once a challenge to this industry is now old hat to designers with 10 and 20 years experience. Aided by CADD systems and the increasing use of machine-stress-rated lumber, these professionals can even take on unusual, one-of-a-kind projects.

Truss Advantages

The best known advantage of wood trusses is their clear-spanning ability (for a glossary of truss terminology, see "Truss Talk," page 21). Truss manufacturers routinely produce 50- to 80-foot trusses for commercial and agricultural applications, but even in residential work, a clear span roof can eliminate expensive engineering, simplify foundations, and offer much greater freedom in floorplans.

Another advantage with trusses is reduced labor. Because they are spaced 24 inches on-center and are already cut and formed as units, trusses are much faster to install than standard rafters. They're also a lot harder to steal.

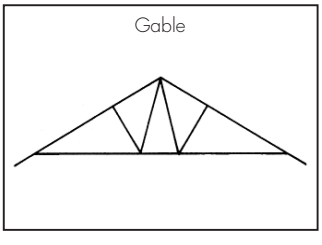
The greatest savings using roof trusses is still with a simple gable roof. Take a 26- x 40-foot ranch as an example. Our truss package for this house runs about $800 delivered. The material for conventional framing, figuring 2x8 rafters and 2x6 joists, would run nearly that much before cutting and installation. Also, the conventional framing would require nailing rafters and joists, as well as sheathing and ceiling finish, at 16 inches on-center rather than 24 inches.

At the other end of the spectrum is a 40-truss roof with 15 different truss types. Like all manufacturing processes, small quantities drive up unit costs significantly because of setup expenses. However, even in this case, it would be worth pricing out trusses (for more, see "Pricing and Ordering Trusses," page 20). If two-thirds of the 40 trusses were stock gables, there would probably be significant savings in using them. You could still conventionally frame the portions of the roof where that is more economical.

Truss Types

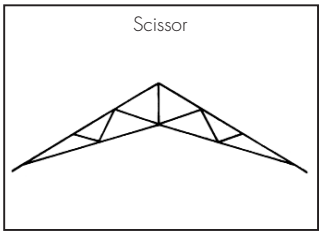
If you haven't considered trusses in the past few years, you're probably not aware of the many standard types now being produced. Here are the most popular, with some notes on price and sizing.

Gable. The most common truss type, we produce them from 16 feet

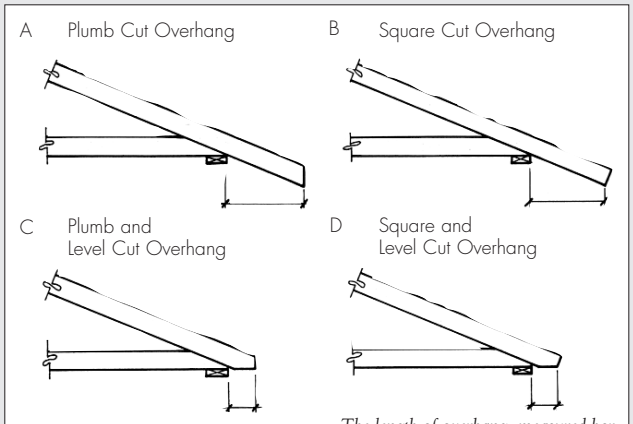


to 80 feet long in slopes from 3/12 to 12/12. Stock sizes run from 16 feet to 40 feet at a 5/12 slope.

Scissor. Scissor trusses, used to create cathedral ceilings, run only 10% to 20% more than gable trusses in lengths up to 30 feet. Stock sizes at our company run from 24 to 30 feet in a 5/12 slope. The bottom chord of these trusses runs at 2½ in 12. In most of our scissor truss designs, the bottom chord slope cannot exceed half the slope of the top chord.



Pricing and Ordering Trusses



The length of overhang, measured horizontally as shown, has to be specified in ordering trusses, but is not considered part of the truss length. You will also need to call out whether the top chord is to be plumb cut (A), square cut (B), plumb and level cut (C), or square and level cut (D). Cantilevers (E) are figured as part of the truss length. Overhangs on cantilevered trusses are specified plumb or square cut.

Getting a price quote and ordering trusses doesn't require a lot of knowledge or experience; it's the manufacturer that has to do most of the thinking.

Look For Experience

The first step is to find a truss manufacturer in your area with a lot of experience. Most manufacturers now use a computerized design program, but to make full use of this requires an experienced designer on staff.

You should make sure they carry sufficient product liability insurance. Not all companies do.

You should also look for good service, whether you are dealing with a wholesale manufacturer that sells through a network of retail lumberyards, or a retail manufacturer that will take orders directly. Either arrangement is fine, as long as the manufacturer will work with you before you place the order and after if you need it. Ask around to see how other contractors have been treated, particularly if things didn't go smoothly for some reason.

Reliability is also vitally important. Look for a company that guarantees delivery dates, since late delivery can really mess up the schedule. Also find out whether the delivery is to "plate line" (up on the walls) or "ground," in which case the builder needs to provide a crane.

You should also ask about lead time, which can vary from a few days to several weeks. And you might consider getting a price from more than one manufacturer, particularly if you're dealing with an unusual roof design. Not all manufacturers carry the same lumber and connectors, so their approach — and price — for a given job may be different than the next guy's. Also check to be sure that the quote includes delivery.

Simple to Order

The requirements for ordering trusses are quite simple. You'll need to know what the loading requirements are for wood trusses in your local jurisdiction, and you'll need the building dimensions, the slope of the roof, the size of the bearing walls (2x4, 2x6, etc.), and the length and type of overhang and cantilever you want.

Often the easiest way to present all this is to submit your plans for a takeoff. But if the framing plan isn't too complicated, you can typically get a price over the phone. At the other extreme, if you're dealing with a complex roof, you might want to sit down with the manufacturer. Large truss makers will send a rep to visit your office or the site.

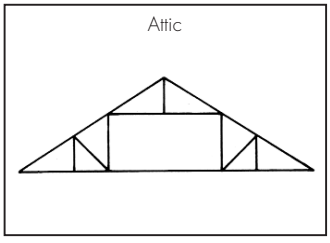
Most truss manufacturers will get back to you promptly with a price. If the manufacturer can't be competitive with conventional framing, some will include any options that will help the builder keep the price down.

If the job is complex or you request it, the truss manufacturer will draw up the job to confirm the loading requirements, dimensions, etc. Then they'll set a delivery date. The only requirement after that is to make a date for a crane if required, and to make sure the top plates match the dimensions on the plans.

— *F.P.*

One concern with scissor trusses, particularly in spans over 40 feet, is *horizontal deflection*. As scissor trusses deflect vertically with loading, they move horizontally where the heel of the truss rests on the bearing surface. Allowance for this movement — we limit it to 3/4 inch with our scissor trusses — should be made at one bearing wall.

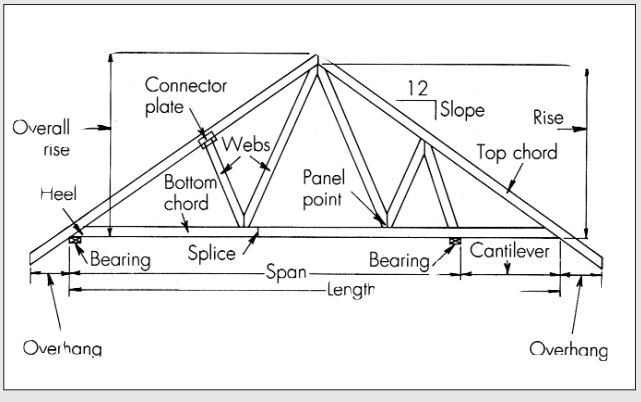
There are several variations on the scissor truss. One is the *modified scissor*, which uses a horizontal bottom chord on one part of the span with a scissor on the remainder. This produces a flat ceiling in rooms on one side of the house with a cathedral ceiling on the other. *Vaulted ceiling* trusses are similar to scissor trusses except that they include a horizontal section of bottom chord in the center.



Attic frame. This is a highly flexible design for creating living or storage space within the truss framework. Attic trusses do require a considerable slope: At 26 feet you'll need to be up around 8/12 to get usable living space at minimum ceiling heights.

The cost of attic trusses also tends to be high because of their construction. The strength of trusses is based on a system of triangles, or *panels*.

Truss Talk



Many of the engineering terms used to describe trusses are also used in conventional framing. Others are unique to truss construction. Here are the common ones that are worth reviewing if you haven't dealt with trusses in the past.

Bottom chord: The horizontal or inclined (on a scissor truss) member at the bottom of a truss. In a conventional system, the ceiling joist.

Butt cut (heel cut): Slight vertical cut at the ends of the truss bottom chord made to ensure uniform span and to provide clearance for sheathing.

Camber: An upward crown built into a truss bottom chord to compensate for deflection caused by the dead load.

Cantilever: Extension of the bottom chord beyond its support, exclusive of overhang.

Clear span: The ability of a truss to span the distance between the exterior walls of a building without requiring any interior support.

Connector plate: Pre-punched, metal-toothed connectors used to join two or more members in a truss. They are mechanically embedded in the wood.

Heel: Point where the top and bottom chords intersect.

Length: Overall measurement of the bottom chord.

Overall rise: Vertical distance from the bottom edge of the bottom chord to the uppermost point of the truss.

Overhang: The extension of the top chord of a truss beyond the heel, measured horizontally.

Panel: A chord segment between two panel points.

Panel point: Point where a web (or webs) intersect a chord.

Plies: Refers to the number of identical trusses joined together to form a girder, as in "2-ply."

Span: Horizontal distance between the outside edges of support (bearing).

Splice: Point at which two chord members are joined together to form a single member.

Symmetrical truss: Truss with the same configuration of members and design loading occurring on each side of the truss centerline.

Top chord: The inclined or horizontal (on a flat truss) member that establishes the upper edge of the truss; rafter in conventional framing.

Webs: Members that join at the top and bottom chords to form the triangular patterns that give a truss its inherent strength.

— *F.P*

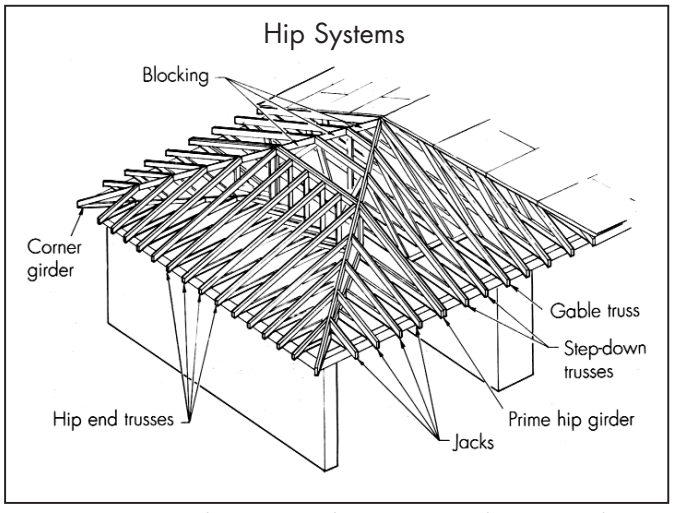


Figure 1. ***Hip systems.*** *The most common hip system uses step-down trusses and a prime hip girder that extend the length of the roof.*

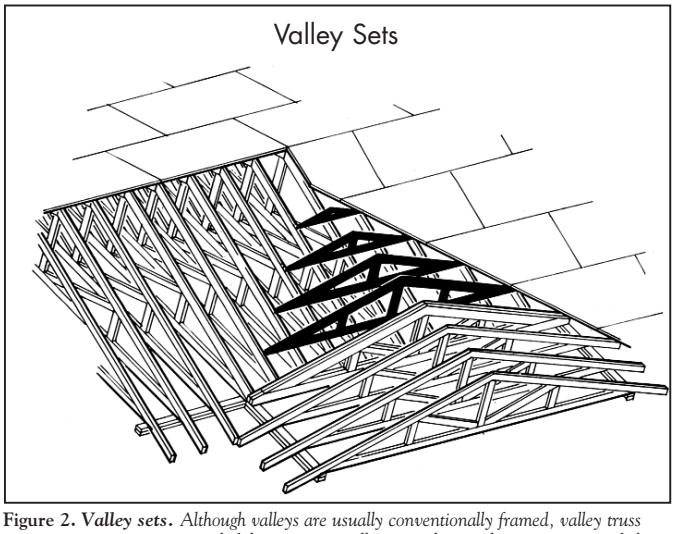


Figure 2. ***Valley sets.*** *Although valleys are usually conventionally framed, valley truss systems may prove economical if the same size valley is used more than once in a roof plan.*

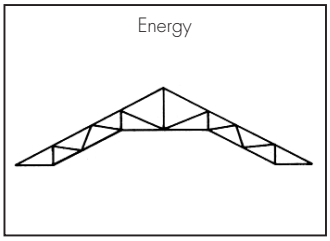
Because of the open space within an attic truss, a simple 24-foot span that would normally use 2x4 top and bottom chords requires 2x8s or even 2x10s, depending on the slope, room size, and loads.

Most of our attic trusses are used in residential work and are designed for a 40-pound live load. The typical application is garages, where a clear span is vital. In other areas of the house, the high cost usually has the builder looking for ways to provide intermediate bearing. If the area is just for storage, we often suggest less expensive Fink-type trusses with a center panel designed for light live loads.

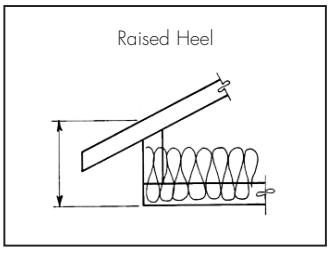
Hip system. Although a fully hipped roof framed with trusses has a high initial cost, a properly designed system can make up for much of this in labor savings.

The most common hip system uses step-down trusses and a prime hip girder that extend the length of the roof (see Figure 1). The hip package is completed with trussed hip end framing and hardware (see "New Members, New Connectors," 4/89, for a discussion of structural hardware for trusses), or the builder can choose to finish the framing conventionally. Field labor costs are the ultimate consideration here.

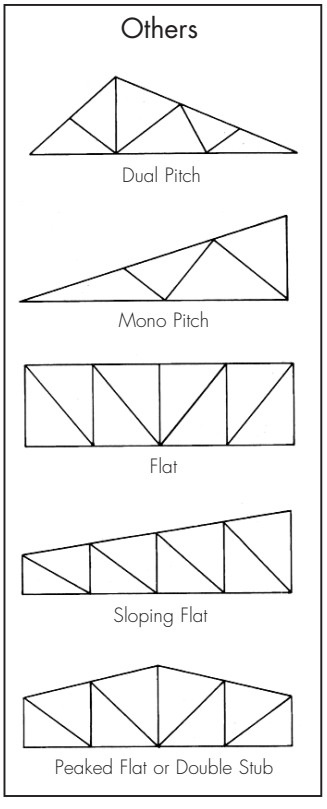
Valley sets. The costs of valley systems (see Figure 2) are high because there is usually only one of any given size in a roof plan. Smaller valleys in the 12-foot to 30-foot range are typically framed with conventional rafters even when trusses are used elsewhere on the roof.



"Energy" truss. Sometimes called a "super" truss, this is part of a truss system developed in the late 1970s by Roger Beaulieu of Roki Associates, and is used primarily by builders of superinsulated homes. It can accommodate roof R-values up to 60. It is relatively expensive compared to gable trusses, but is particularly useful with two popular regional styles: capes and salt boxes.



Raised heel. For most other architectural styles, a raised-heel truss will accommodate increased levels of insulation and still provide good airflow between soffit and ridge vents. Essentially a gable truss with an added riser at the heel, this feature adds about 10% to the cost. The height of the riser should be specified based on the amount and type of insulation being used.



Others. There are many other common types of trusses whose uses are relatively obvious from their shape. A so-called *mono* creates a shed roof, while a *dual pitch* is a gable with two different slopes. A *flat* is just what it sounds like, and a *sloping flat* is a single slope with both ends truncated. A *stub* is a gable truss with one truncated end. A *peaked flat* (*double stub*) creates a pitched roof with two vertical ends.

Putting Them Together

A recently built single-family home we supplied in Thomaston, Conn., is a

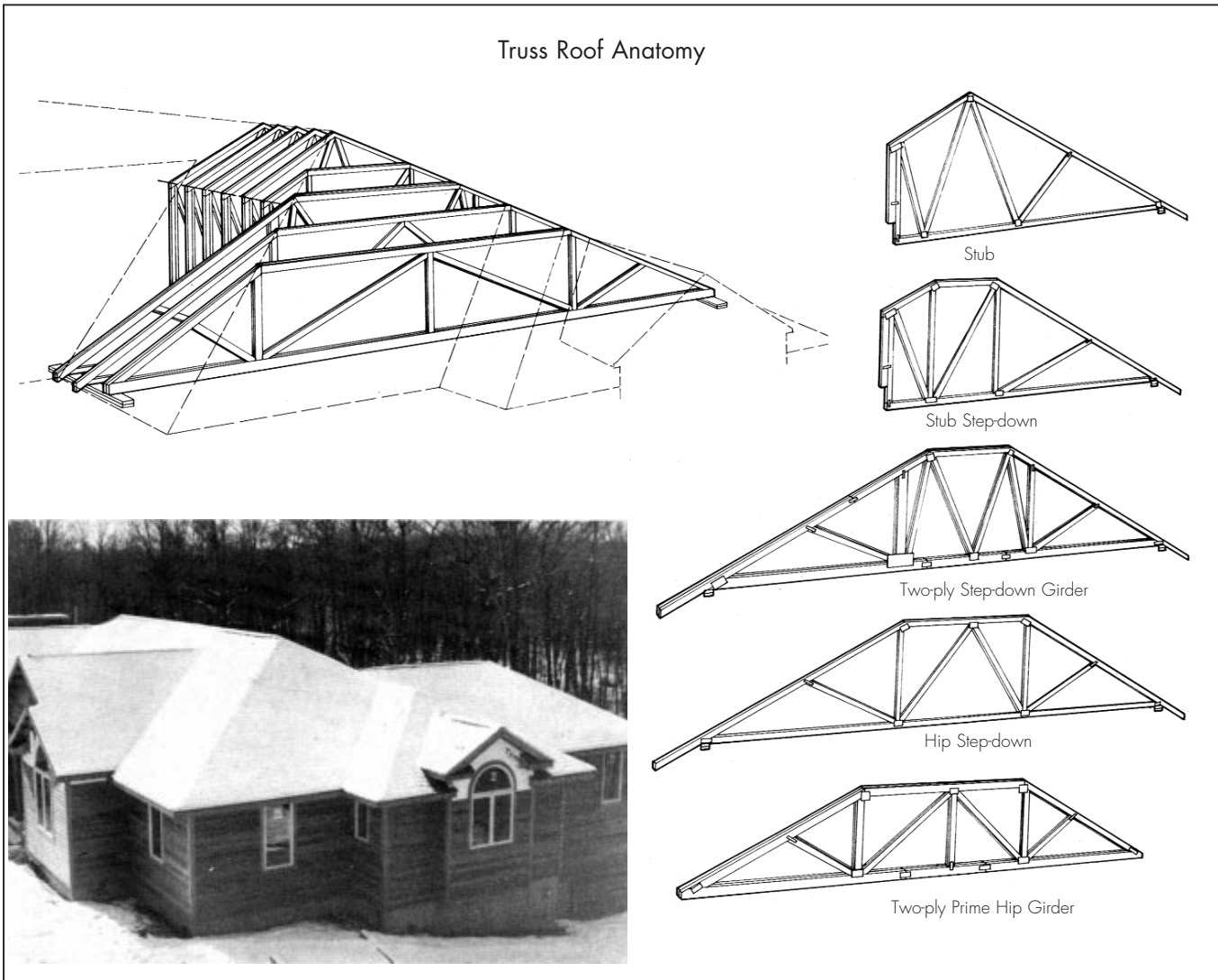


Figure 3. *Connecticut contractor Henry Osowiecki framed the roof of this open-plan, 3,500- square-foot house with 15 different kinds of trusses. They are predominantly gable, scissor, and hip (step-down and girder) trusses at 7/12. Osowiecki opted for trusses because they eliminated the expense of engineering and kept the floorplan free of bearing walls. He was able to save substantially on the overall price of the trusses by conventionally framing valleys and hip ends.*

good example of how a variety of truss types combined with some conventional framing can make sense for a small, quality-conscious builder.

When Henry Osowiecki started considering the roof on the 3,500-square-foot house he was building (see Figure 3), he wasn't worried about his crew's ability to frame it. Although the 7/12 roof has a vaulted section and a number of hips, valleys, and other complications, there was nothing that unusual. However, the open floor plan made no accommodation for bearing walls or beams. The time and cost that would go into engineering and building the necessary bearing prompted Osowiecki to get a price on trusses.

Using conventional framing instead of trusses on roof planes such as valleys and hip ends produced a savings of 30% to 40%

Working with a field rep, he identified the roof planes that would be easy enough to frame conventionally and that would be expensive to cover with trusses. These included valleys and hip areas below the prime hip girders. This produced a savings of between 30% and 40% over using trusses exclusively.

He ended up with a roof composed of 58 trusses of 15 different kinds, and six different areas that required conventional framing. He didn't have to alter his plans to accommodate bearing walls or beams, and finished the framing phase of the house ahead of schedule. The cost of the trusses delivered to the site was $7,800. ■

Frank Paul is a vice president at Wood Structures Inc. of Biddeford, Maine, a leading supplier of trusses to the New England area.