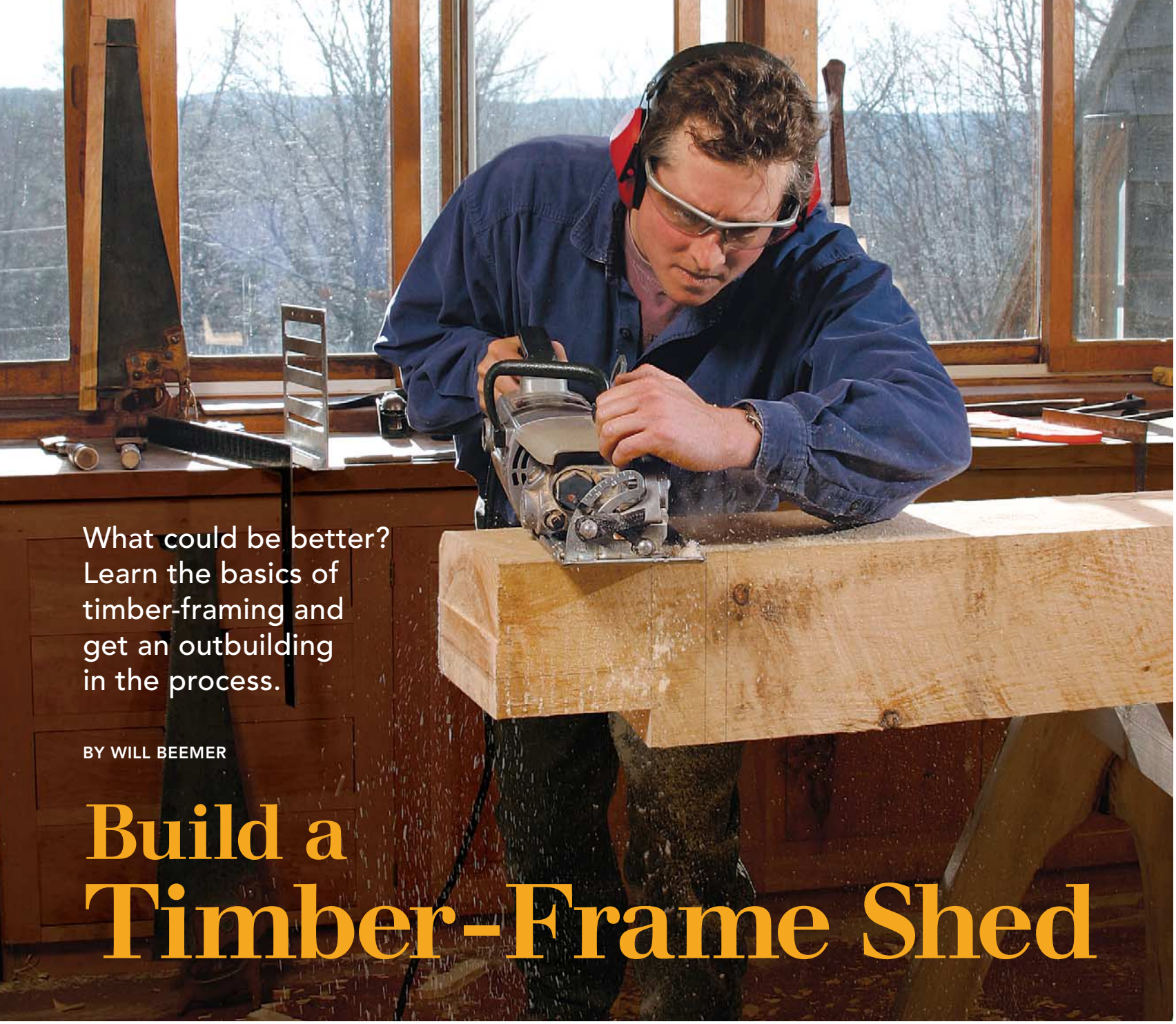


What could be better? Learn the basics of timber-framing and get an outbuilding in the process.

BY WILL BEEMER

Build a Timber-Frame Shed

There's something magical about timber-framing. It's difficult to describe or even identify the qualities that make it so. Maybe it's the result: a long-lasting, beautiful, strong structure. Or perhaps it's the process: teamwork, community, craftsmanship. I worked on my first timber frame back in 1980. Forty of us raised an entire house frame by hand in one day, and I was hooked for life.

Like any building discipline, timber-framing is a complex subject that can't be described adequately in a book, let alone a magazine article. At the building school that I run, students build a 12-ft. by 16-ft. frame that involves all the major elements of timber-framing. Building that simple frame inspires many students to dig deeper and try their own projects. In this article, I'll describe that same frame and try to inspire readers as well. Please remember that for any building project, it's a good idea to consult a structural engineer and the local building inspector.

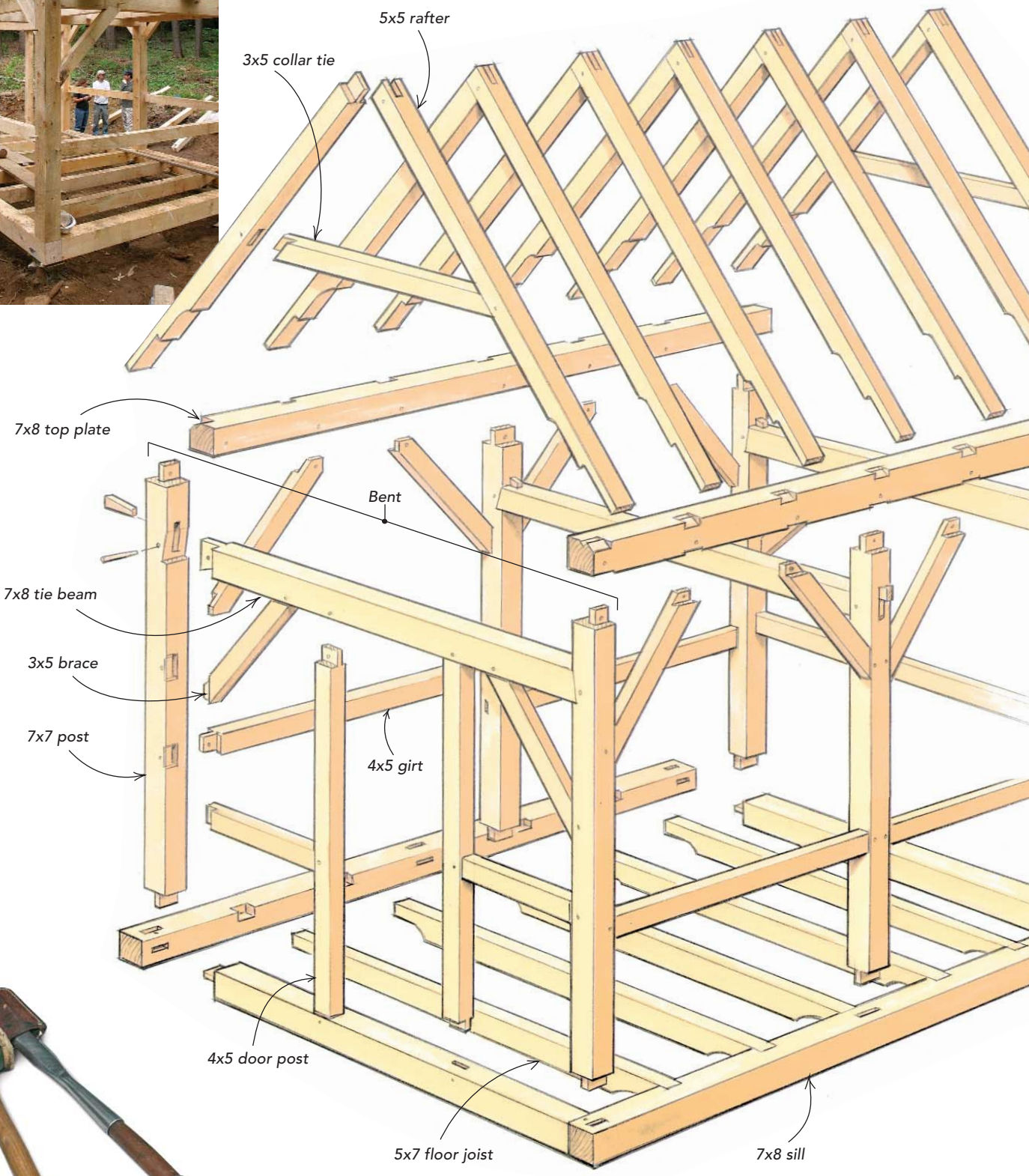
Select the right wood

Here in the Northeast, our favorite species for timber-framing is eastern white pine. It is lightweight, is easy to work with hand tools, and has one of the lowest shrinkage rates of all available woods. Red oak and Douglas fir also are popular woods valued for their strength and rich red color. Southern yellow pine is strong and a darker gold than white pine. White oak is also strong and stable, and it is highly resistant to rot, which makes it attractive for use in porches and outdoor structures. These five species account for the vast majority of timber frames that are built in the United States.

You can buy timber from a mill that will grade it or hire a grader to come in, but this step is not

LEARNING IN SMALL SCALE

The best way to investigate timber-framing is to attempt a small frame that incorporates the basics of joinery and design. The drawing below illustrates the frame's basic anatomy. Frame sections called bents are assembled first, followed by plates and rafters. For a materials list, go to www.finehomebuilding.com.



Cut a timber frame with a few specialized tools. *Most timber-framers begin with a circular saw, an electric drill, and a few hand tools.*

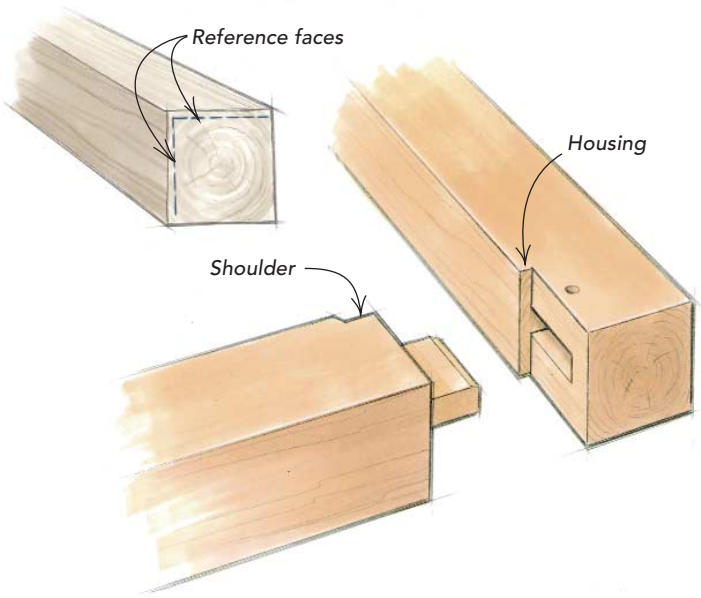
Drawings: Dan Thornton

CUTTING A TENON

The most common joint is the mortise and tenon. The shoulders of the tenons, which bear the load and ultimately determine the final dimensions of the frame, must be cut accurately. After laying out the tenon (1), set the circular saw to the depth of the shoulder; then make an accurate cut on the shoulder line. Kerf the rest of the shoulder to the end of the tenon (2). (Be aware that if the timber isn't square, the sawblade depth to the tenon could change from one side to the other.) Knock out the waste with a hammer before final paring. With a rabbet plane and/or timber-framing chisel, pare the tenon to its lines (3), then cut the tenon's opposite side. After cutting and beveling the shoulder (4), taper and chamfer the tenon's edges so that it won't bind in the mortise. Use a combination or framing square to check tenon thickness and distance from the reference surface.

SQUARE-RULE LAYOUT

Timbers usually arrive on site roughly square and nominally dimensioned. Square-rule layout compensates for these expected inconsistencies. On each timber, the straightest two adjacent sides that are most square to each other are marked as reference faces. All joinery measurements are made from these faces; any discrepancies in a timber's dimensions are canceled by cutting a housing or shoulder on the joint's mating surface.



always required. Our local inspector (and code) requires only that timber be produced by a state-registered mill, that the timber be stamped for species (but not grade), and that the timbers be structurally sized as if they were #2.

How a timber frame works

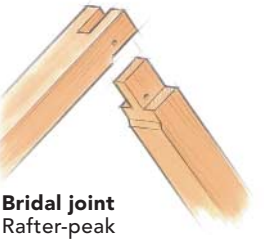
A typical timber frame consists of posts (vertical members), beams (or girts, horizontal spanning members), and braces (for racking resistance). Ideally, the timber frame should be designed to make all joints carry only compressive loads after the frame is raised. This way, the mating surfaces, or shoulders of the joints, can handle the weight efficiently, and the tenons and pegs aren't subject to tensile forces that try to pull them apart. The main function of the pegs (also called pins or trunnels) is to draw the joint up tight during assembly and hold the joint together during raising. Diagonal braces help to stiffen the frame and to reduce stresses in the joints.

Timbers often are cut in a shop and brought to the site for assembly prior to raising day. They can be assembled either as bents, which usually run across the short dimension of the building (perpendicular to the ridge), or as walls, longitudinal assemblies running parallel to the ridge. The method that you use depends on the raising method (crane or

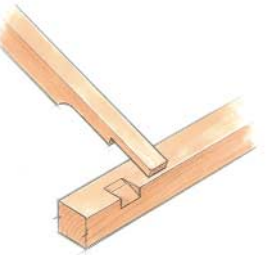
CUTTING A MORTISE

After drawing the layout lines, cut the edges with a chisel to keep tearout to a minimum. I use a 1½-in. auger bit in a heavy-duty ½-in. electric drill 1. (If auger bits are hard to find, you can use self-feeding Forstner-type bits, but you'll have to back out and clean the hole frequently to avoid getting stuck.) To make sure I'm drilling plumb and square to the timber surface, I bolted a plywood bracket and bull's-eye level to the drill motor housing. After roughing out the mortise with the drill, I go back with the proper-width chisel and clean it out 2. Use a 3-lb. mallet to drive the chisel down the ends of the mortise (thus severing the grain), and then use hand power and a little body weight to pare down the sides 3. Alternate between cutting the end grain and paring down the sides, and always keep the bevel of the chisel toward the inside of the mortise. Use a combination or framing square to check the width and squareness of the mortise 4. After the mortise is complete, cut the housing (if there is one) either by roughing it out with an ax or kerfing with a circular saw.

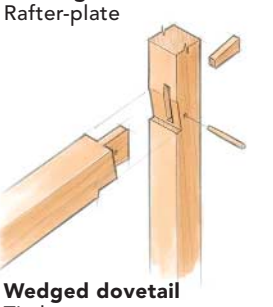
Common timber-frame joints
In addition to the mortise and tenon, the following joints also contribute to this frame.



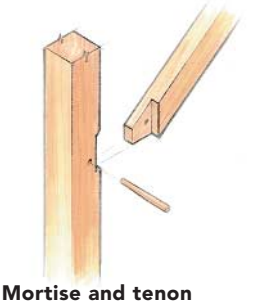
Bridal joint
Rafter-peak



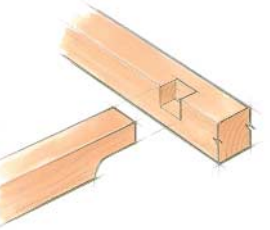
Housing
Rafter-plate



Wedged dovetail
Tie beam-post



Mortise and tenon
Brace-post



Drop-in housing
Joist-plate

RAISING THE FRAME

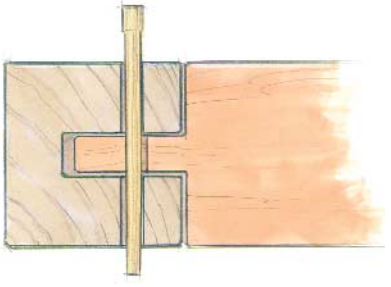
Safety comes first. Pay attention to the raising leader; keep focused on the job; and minimize tool use overhead. Even so, hard hats are a good idea. Before you start, it's wise to check the tenon sizes one more time.

1. Assemble the sills on the foundation (drawing p. 95). Square up the assembly, shim level, and add remaining joists. Add temporary planking or a plywood floor.
2. Assemble the first bent, aligning the post tenons over the sill mortises, then work the posts onto the tie beam while inserting braces and girts. Raise the bent and brace plumb.
3. Assemble and raise the second and third bents as before.
4. Erect staging or planking across tie beams, then lift plates to that level. Insert the plate braces into each post, snug up the pegs, then place the plates onto the post and brace tenons. Secure with pegs.
5. Raise planking to the plate level, then assemble the first rafter and collar tie on the ground, raise it, and secure the tails to the plate's rafter seat with 20d nails.
6. The next five rafter sets are passed up individually and pegged together at the peak.

Pegs are available in ¾-in. and 1-in. diameters.

DRAW-BORE METHOD MAKES A SNUG JOINT

When joints are drilled for pegs, the hole through the mortise is drilled first. The tenon is inserted into the mortise, marked, then offset by ⅛ in. When the tapered peg is driven into the hole, it will draw the mortise and tenon tight and keep them that way.



hand), the sizes of the timbers, and the layout of the posts in the floor plan.

The square-rule method of layout compensates for irregular timber

Accurate layout is critical for a building to end up plumb, level, and square. Much of the skill in timber-framing lies in accounting for variations in the timber as it comes from the sawmill and as it goes from a green to a dry state. (Anyone who wants to simplify layout can pay extra for dry lumber milled to exact dimensions in a four-sided planer.) For the frame shown here, we used green timbers that were slightly irregular in dimension and square, so we used the square-rule layout to overcome these irregularities. This system ensures that the outside faces of perimeter posts and the tops of rafters, joists, and beams all will be flush and will match the building's critical dimensions. Nonreference faces will vary to suit the joinery.

After checking a timber for crown, twist, and big knots that can complicate joinery, we select two layout faces that are adjacent and square to each other. All the joinery is laid out parallel or square to these two layout faces; housings cut into nonlayout faces allow us to bring the mating timbers into the face of a smaller, imaginary "perfect" timber within a larger irregular timber. All mortises and tenons in this frame are laid out with their outside edge 1½ in. from a layout face and are 1½ in. wide. Larger sectioned timbers would use a 2-in. setback and 2-in. width. This rule of thumb allows you to use the 1½-in.-wide tongue or 2-in.-wide blade on a framing square as a basic layout tool.

Timber-framing joinery is based on the mortise and tenon

One of the major appeals of timber-framing is that you can see the timbers in a completed building and also appreciate the joinery that connects them. Most joints are variations of the mortise and tenon, and are secured with pegs or wedges. Simple tenons that aren't required to do much work after raising (such as post tops or girt/brace ends) are cut 3 in. to 4 in. long. Longer tenons are a requirement if the tenon and its peg are going to be subjected to some tensile stresses in service, as in tie-beam ends. The tenon width is usually the full dimension of the timber, unless that width comprises the mortise. Tenons always should be laid out with their length parallel to the grain of the tenoned members, thus ensuring continuous fibers to the end. Tenons also are tapered and chamfered to make assembly easier.

A mortise is laid out so that the length (which corresponds to tenon width) runs parallel to the grain of the mortised member. Mortises are cut ⅛ in. to ¼ in. deeper than the tenon so that the tenon doesn't bottom out before the shoulders meet; you can cut the tenon a bit shorter, too. □

Will Beemer is co-executive director of the Timber Framers Guild and the director of the Heartwood School (www.heartwoodschool.com) in Washington, Mass. He has been timber-framing for 25 years. Photos by Charles Bickford, except where noted.

A frame for all seasons. *A small timber frame like this one offers a great deal of design flexibility. Its uses have ranged from a guest cabin to a garden shed to an artist's studio.*

FOR MORE INFORMATION

For resources on tools, books, and training, a good place to start is the Timber Framers Guild, a nonprofit educational organization dedicated to the craft. Contact them at www.tfguild.org or at P.O. Box 60, Becket, MA 01223; 888-453-0879.

ONLINE CONNECTION

For more information about building this timber-frame shed, go to www.finehomebuilding.com.

Top photo this page: Will Beemer