A Timbered Ceiling

Combining stick-framed walls with a timber-framed ceiling

by George Nash

Exposed ceiling joists are among the most prominent and appealing features of a timber-frame home. As shown in the photo above, the system of joists, rim beams and summer beams is supported on conventionally framed walls in order to minimize cost and ease the placement of mechanical systems.

Traditional timber frames have an undeniable aesthetic appeal. And coupled with high-tech materials like stress-skin panels, they're energy-efficient. But modern milling and assembly systems notwithstanding, timber framing is still more labor-intensive than stick framing and imposes severe constraints on the layout of mechanical systems. Whatever the merits or disadvantages, no one can claim that timber framing is inexpensive. As a builder living and working in a relatively poor rural area, my typical clients are well educated, seriously underpaid urban refugees—people with timber-frame tastes and stick-frame budgets.

Probably because I enjoyed the sheer sensuality of timber joinery so much myself, I tried to find a satisfying compromise between the absurdity of appliqued wood-grain plastic beams and the expense of genuine mortise-and-tenon joinery. Some builders attempt to create a timber-frame effect by notching a center beam to receive one end of the joists while carrying the other end on standard exterior wall plates. With this construction, it's impossible to finish off the junction of the interior wall and the joist penetrations in a way that doesn't look clumsy or forced.

Ceiling treatment is also problematic with a timbered ceiling. Although V-grooved 2x6 decking installed over the joists has the advantage of providing finish ceiling and floor (or subfloor) simultaneously, it restricts mechanical systems to exterior walls, partitions, dropped ceilings and chases routed into beams. And even with sound-deadening board between the decking and a wood finish floor, people downstairs will experience the pitter patter of little feet as a jackboot fandango.

Grappling with these and other difficulties within the framework of tight budgets, I devised a framing system using heavy timber ceiling joists that combines the speed and flexibility of conventional stick framing with the aesthetic and structural benefits of timber framing (photo above).

Pine woodworking—I use native eastern white pine for all my timbers. Pine is more stable than hemlock and white spruce, the two other readily available timber species in our area. It shrinks, checks and twists much less as it dries in place. Also, pine works easily. It has a uniform grain, so there is less danger of splitting the wood when cutting joints.

Timbers are best worked when green, before they've had a chance to bow or warp. You can't force a crooked timber into true, at least not without a come-along and some means of permanently maintaining the pressure.

Some builders might wonder if pine is suitable for structural use. In general, timber framing has an inherently greater margin of safety than conventional framing. In particular, with the relatively light loads typical of residential construction, and with short spans and oversize timber cross-sections, timber strength has never been a problem. With this particular

Photo this page: Kevin Ireton

system, only the central girder, or summer beam (from the Old English term "sumpter," a pack mule bred for shouldering heavy loads) carries a significant load unassisted, and is therefore greatly oversized.

All my timbers are planed on four sides to match standard dimension lumber. This lets me combine timbers with standard framing, as the design may require. Planing also speeds joinery and ensures tight fits because all timbers have the same dimensions. I typically use 4x8s, 6x8s and 8x8s milled to 3½ in. by 7¼ in., 5½ in. by 7¼ in. and 7¼ in. by 7¼ in. respectively. The summer beams, nominally 8x10s or 8x12s, are an exception. The single-side planer at my local mill has a maximum capacity of 8 in., so these timbers come through planed two sides only. The top surface will not be exposed, so I leave that rough and plane the bottom smooth with a power plane. I prefer smooth, oiled wood to roughsawn. Most clients appreciate how much less dust planed timbers collect.

Rim beams—I frame exterior walls conventionally, using 2x4 stock at 16 in. o. c., except that I eliminate window and door headers. Here the framing is the same as a nonbearing interior partition, which saves time and trouble running wiring and allows for better insulation.

In place of the rim (or band) joist of conventional platform framing, I set a 6x8 rim beam on top of the exterior walls (bottom photo). Using continuous rim beams resolves the problem of detailing the interior finishes and eliminates the need for fake beams between the joists and at the gable-end walls.

A 6x8 rim beam used over a 2x4 wall exposes 2 in. of beam on the interior. With drywall or ¾-in. wood paneling, there is still a satisfying amount of reveal. I use 1-in. foam sheathing on the outside, which along with 3½-in. fiberglass batts, gives me R-19 walls. But if a client wished to increase the R-value of the walls by going to 2x6 framing, 8x8s would maintain the same or a slightly deeper interior reveal.

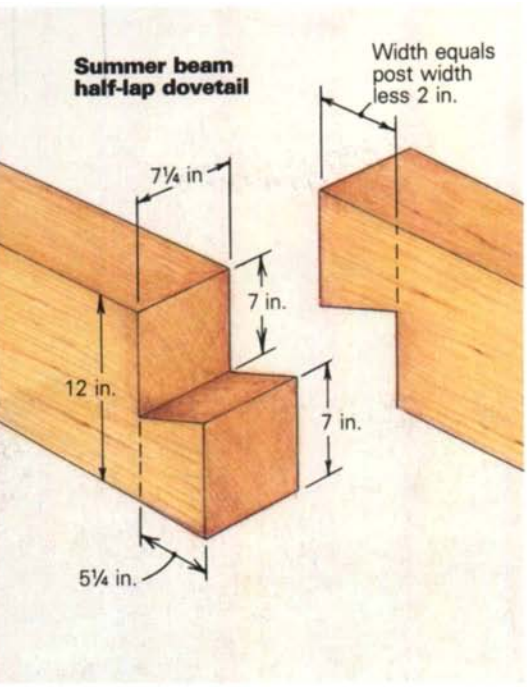
Simple notches—While my crew is framing and erecting the exterior walls, I lay out and cut notches in the summer beams and the rim beams. Because the notches themselves are quite simple, I can usually have all the beams finished by the time the walls are up, plumbed, lined and braced.

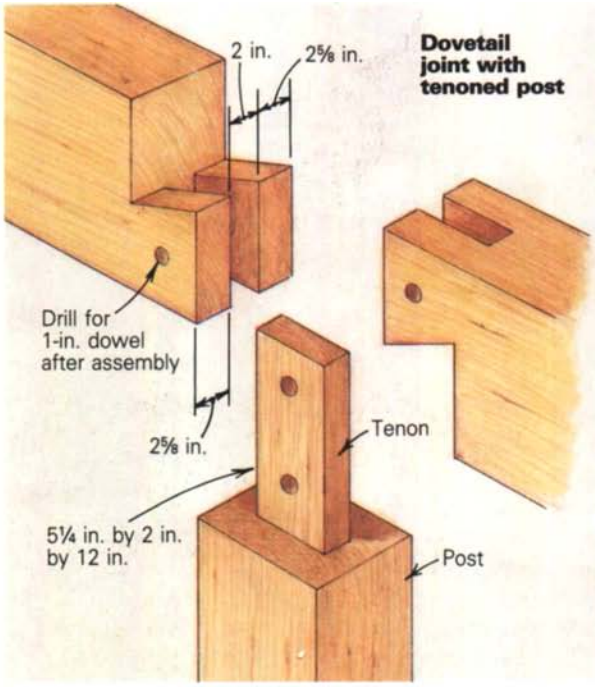
Notches are laid out from the same end of the building as all other framing measurements. I use 32-in. o. c. spacing, which I feel strikes the best balance between pleasing appearance, adequate structural strength (using 4x8 joists) and efficient use of standard-length flooring and lumber lengths. Four-ft. spacing can be used with 2x6 decking, but will result in a bouncier floor and fewer beams exposed.

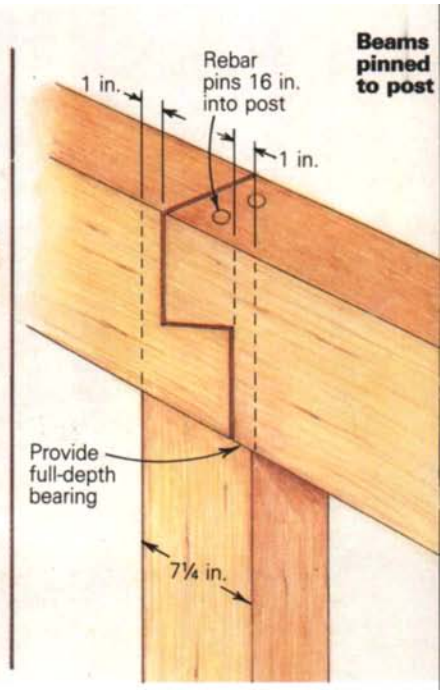
With a circular saw set to a depth of 3½ in., I cut 3½-in. wide notches for 4x8 joists all the way across the face of the rim joists (photo above). This depth is critical because it allows the joist to bear a full 1½ in. on the stud wall itself. The notches require only a series of circular-saw cuts and then a chisel to remove the

Notching the rim joist. **Because the joists will actually bear on the stud wall, they don't have to be mortise-and-tenoned into the rim joist, but can engage simple notches cut across the face of the timber. Here the notches are being cut with a 12-in. gas-powered circular saw that the author bought at a yard sale.**

Rim and summer beams. **In place of the rim joists of conventional platform framing, 6x8 rim beams are set on the exterior walls, with 8x10 summer beams supporting the joists at midspan.**







Joists in place. **Four-by-eight joists are set in their notches and secured with 12-in. spikes driven through the outside of the rim beams and with 20d nails toenailed down into the summer beams. The framing will also be tied together by a floor system above.**

scrap. The back of the notch need not be perfectly smooth or uniform because it will be completely hidden.

The other end of the joist is set into a notch cut 1½ in. deep by 7¼ in. high into the face of an 8x12 or 8x10 summer beam. (I use the deeper beam for unsupported spans over 14 ft. and the shallower beam for shorter spans.) These notches demand a bit more attention, but are hardly difficult. I begin by setting the beam on extra-heavy sawhorses (a 16-ft. 8x12 of green pine can weigh nearly 400 lb.). I carefully draw the notch on the face of the beam in pencil (keep a sharp point—16ths are important). Then, I use a 2-in. Forstner bit in a ½-in. drill and drill a series of holes along the bottom end of the notch. Forstner bits cut cleanly and leave a flat-bottomed hole. Next, I make saw cuts along the pencil lines, and several more in between them. I square up the bottom corners of the notch with a sharp 2-in. framing chisel and clean the notch itself.

I try to cut the notches just a hair under the actual joist width for a snug fit. If I've done it right, the joists must be pounded into their notches, but the fit should not be so tight that the joist crushes the edges of the notch. I undercut joist lengths ⅛ in. or so. Otherwise, the joists tend to push the rim beams out of line. Chamfering the edges of the joists will also ease initial fitting.

Big beams, big nails—At corners where the rim beams intersect each other I use a simple vertical half-lap joint, with one beam let into the other to make a cleaner joint (drawing facing page). The corners are pinned with ½-in. rebar. Because these rim beams are not entirely structural, rebar and nails can substitute for complicated mortises and tenons.

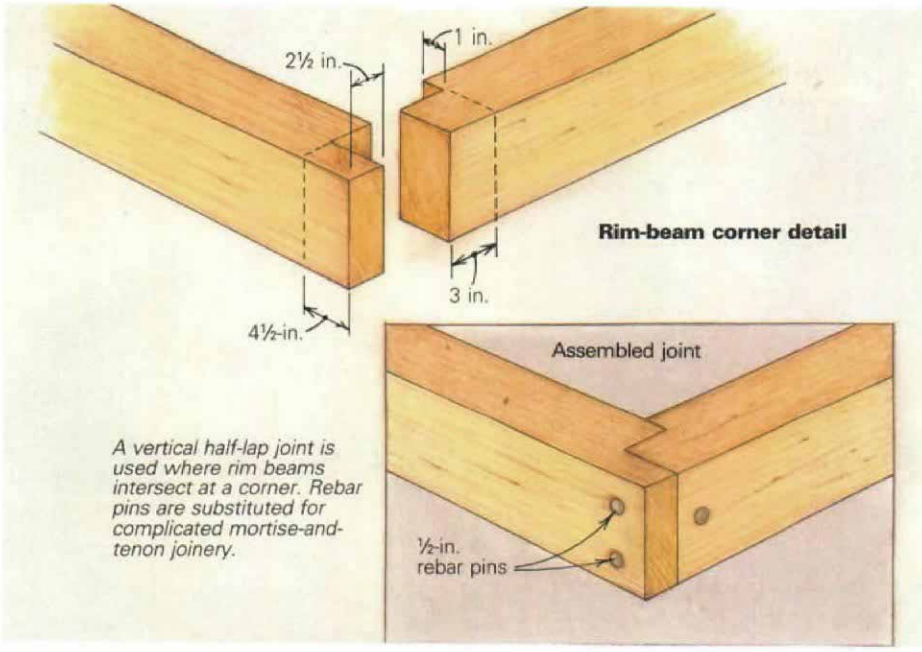
The rim beams are secured to the wall plates with toenailed 20d spikes every 2 ft. This corrects any slight bowing in the timbers. Sometimes a timber bows upward instead of outward or inward, causing a gap at the wall plate. Nails alone cannot close the gap, but pipe clamps will. In addition to the toenails, I drive 6-in. pole-barn nails up through the wall plate into the beams, spacing them about 6 ft. apart, with one about 3 ft. from each corner. It's a good thing that these ring-shank spikes hold so well—nailing more than a few upside down or over your head is definitely aerobic exercise.

The joists are fastened to the rim beams with two 12-in. log-cabin spikes driven through the outside face of the beam. (Around here, 80d to 100d spikes are called log-cabin spikes. I get these from the lumberyard.) I have also used 12-in. lengths of ½-in. rebar for this purpose. But cabin spikes do not require predrilling and seem even stronger than necessary. At the summer-beam notch, I toenail two 20d nails down through the top of the joist (photo left). There is little chance of the framing pulling apart because either solid decking or some other floor system will tie everything together from above.

Splicing and setting summer beams—In most cases, the summer beam has to run the entire length of the house, which often means two beams are required for the necessary length. They either terminate at opposite sides of a stairwell opening, or more likely, are spliced together over a post. This splice joint is literally the centerpoint of the ceiling frame and deserves special treatment.

I usually use a dovetailed half-lap for solid bearing on the post below (drawings above). This is fairly simple to cut and yet is pleasingly complex in appearance. An alternative would be to use a longer scarf joint or a bolster. These joints are pegged or bolted together (I countersink the bolts and plug the holes with dowels). The dovetailed joint can also be secured to the post with hardwood pegs driven through the beam and an internal tenon. Otherwise I simply pin the beams to the post with rebar.

Drawings: Michael Mandarano



Making room for pipes and wires. When the downstairs ceiling is the upstairs floor, it complicates the routing of wires, pipes and ducts. Nash solves the problem by installing 2x4s on edge across the tops of the timbered ceiling, leaving room for mechanicals, then covers the 2x4s with plywood.

I use a 12-in. gas-powered Homelite circular saw to make the 5-in. deep cut this joint calls for (with a maximum depth of 4⅝ in., only two cuts are needed to saw through an 8x8). Frankly, I'd prefer a 14-in. electric circular saw, for quieter working conditions, but I happened to buy the Homelite cheaply at a yard sale. Using a handsaw, I finish the cut to full depth, and then saw along the slope of the dovetail with an 8-in. circular saw and remove the waste with a chisel.

I check the face of the joint against a template, then smooth it flat with a slick. This tool is used like a plane, not like a chisel: one hand holds the flat of the blade against the work, the other hand pushes against the butt of the handle. If it's sharp, the slick puts a mirror-smooth finish on the face of a joint. It is especially useful working across the grain and should be part of every timber joiner's toolkit.

Despite the care I take to make accurate cuts, the joint seldom fits perfectly the first time. Sometimes the face is open on one side and tight on the other. With the pieces together, I can saw down the vertical face of the joint with a handsaw and remove enough stock to allow the joint to pull or slide tightly together. I'm satisfied if the finished joint barely admits a matchbook cover (a matchbook = 1/32 in.).

I've learned to test fit this critical joint *before* lifting the beams into place. I set them on the floor deck, resting them on doubled 2x blocking (so their ends can protrude over the sole plates at the exterior walls) and make any necessary corrections. Because this often requires several tries, the advantages of working at floor level are obvious.

The summer beams are supported at the end walls on a built-up 2x4 post. Five 2x4s nailed together make a 7½-in. wide post. I like to nail a 2x4 block flat across all the ends of the post members for better bearing. A full-length stud nailed to each side of the post forms a beam pocket and nailing surface. Because the summer beam is usually planed to 7¼ in., the ¼-in. gap allows easy placement (and removal if needed). Before the beam is secured, I fill the space with cedar shims.

A string stretched across the run of the beam determines center-post height and lines the beams after they are in place. The summer beams should be diagonally braced to the outside walls or to convenient interior partitions until after the joists are installed. Otherwise, an excessively tight-fitting joist could push the beam off line.

While beams and joists are structural timbers, they are also finish lumber. Use the same care storing and handling beams as you would your casing stock. Keep them out of the mud and don't slide them across gritty floor decks. Wash your hands and clean your tools before working on them (a dirty beam cannot be spot-sanded; the entire face must be cleaned). Never pound a joint together without protective blocking; pine is soft and easily dented, and heavy summer beams are especially awkward and prone to denting when handled. It takes four of us, two at each end, to carry a summer beam, cradled on hardwood 2x4s. I use rollers cut from 1½-in. PVC drain pipe to move beams about on the deck.

Fake posts—When the walls are ready for interior finish, I screw 2x8 pine stock to the built-up posts and 2x2 stock under each corner to imitate structural posts. The finish wall material butts against these false posts, so the reveal and the look is exactly the same as that of a true post. I sometimes add 2x4 knee braces if the client desires. Unlike a true timber frame, these are not structural and fit over the wall studding. Four-by-four knee braces can also be installed at the summer-beam posts. The faces of the rim beams, false posts, etc., would have to be notched to accept these braces when cutting the other notches. So far, most clients have preferred the simplicity of unbraced corners.

Room for mechanicals—Until recently, I used V-groove 2x6 spruce decking over the beams for flooring. Considerable time was spent designing wiring and other mechanical runs, because unlike an ordinary joisted ceiling, there were no bays between the beams to conceal utilities. My solution is to nail 2x4s on edge, 16 in. o. c. across the joists (photo above). I glue and nail T&G ¾-in. plywood on top of the 2x4s. This subfloor reduces noise transmission, finish-floor problems, fear of water damage to the ceiling before close-in and provides a virtually unobstructed space in which to run wires, pipes and hot-air ducts. So long as floor loads are ultimately carried by the joists and summer beam, greater latitude is possible when cutting and framing for penetrations than with standard joisted ceilings. The finish ceiling, whether drywall or boards, is hung between the beams from the underside of the 2x4s. □

George Nash builds in Burlington, Vermont. Photos by author except where noted.