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Building Coffered Ceilings

Three framing methods

Editor's note: The following three projects hardly look the same, but they share one detail: a coffered ceiling. A coffer is characterized by sunken panels (they're usually square or octagonal) that decorate a ceiling or a vault. Though the term is generally associated with multiple panels, a proper coffer can have a single panel. The technique is thought to derive from the visual effect created in buildings where heavy ceiling beams crossed one another, and it has been used structurally and decoratively for buildings as dissimilar as neoclassical churches and the Washington, D. C., subway system.

Don Dunkley frames coffers into custom homes, typically by creating one big recessed panel. Greg Lawrence used coffering to conceal glulam beams. And Jay Thomsen used crisscrossed 1x wood strips to create the effect of sunken panels over the surface of a vaulted ceiling. *—Mark Feirer, editor of* Fine Homebuilding.

One big coffer. **Soffits girdle this bedroom to support angled coffer framing. A single, recessed ceiling coffer is the result. Photo by Scot Zimmerman.**

Single Coffer

by Don Dunkley

Among the most common ceiling details I run into when framing custom homes is the coffered ceiling. Though the term coffer encompasses a range of ceiling treatments, around here we use it to refer to a ceiling with a perimeter soffit having a sloped inner face that rises to a flat ceiling (photo left). The detail is usually found in bedrooms and dens.

The first coffers I built were usually sloped to match the roof and fastened directly to the roof framing. There was no soffit; the sloped portion of the coffer simply died into the surrounding wall. I used this method routinely for a few years—until I realized its limitations. For one thing, linking the roof to the framing of the ceiling limited the angle of the coffering to that of the roof (unless a very steep pitch was used on the main roof). Also, there was a limit to the amount of insulation that could be put into the perimeter of the coffered ceiling. Adding a soffit to the coffering solves these problems.

The soffit encircles the room and is framed so that its underside is level with the top plate. The soffit usually extends 1 ft. to 2 ft. away from the walls and offers several advantages. Framing is simplified, the pitch of the coffer can be any angle, there's plenty of room for insulation, and the flat ceiling surrounding the room can be embellished with can lights and crown molding.

The layout and the pitch of the coffer are usually found on the floor plan or the electrical plan. But before I start framing, I usually confer with the builder or the home owner to finalize the actual size of the soffit, the pitch of the coffer and the height of both the main ceiling and the soffit. Once these dimensions have been confirmed, the framing can usually be completed in a few hours.

Traditional Coffer

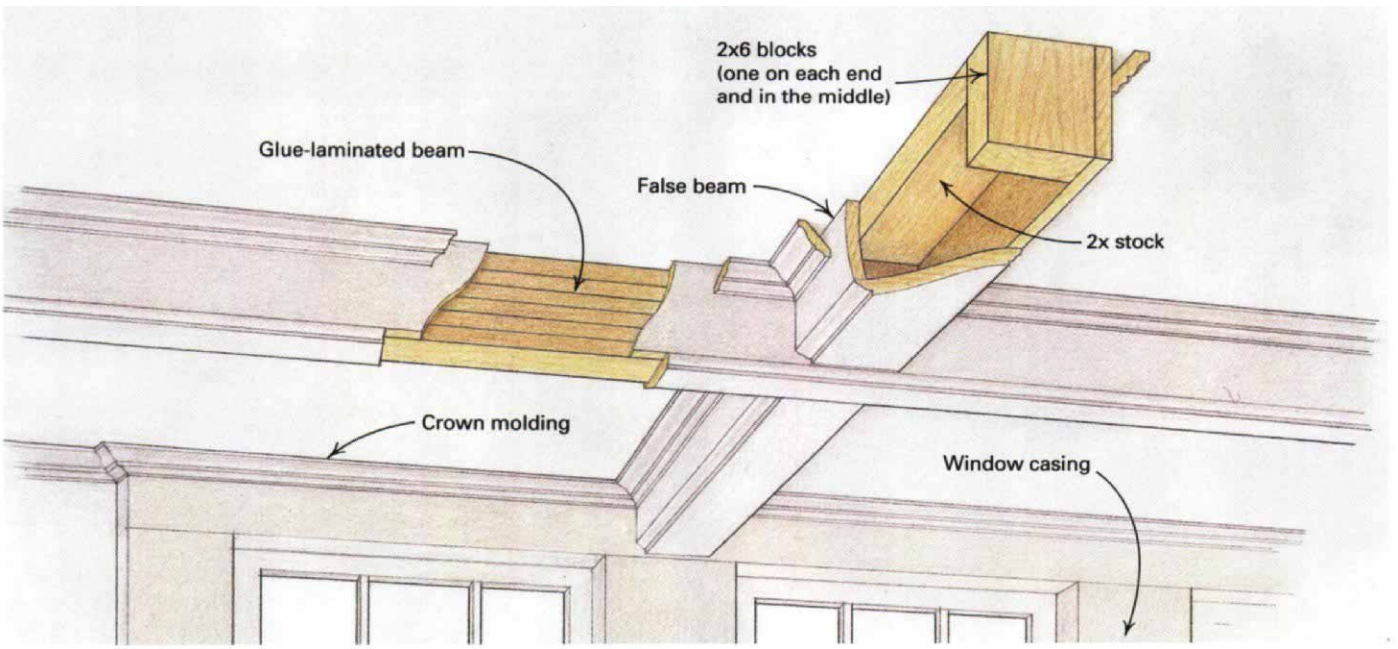
by Greg Lawrence

In the course of a recent remodeling project, we removed the roof from a 1,200sq. ft. house and built a second-story addition in its place. We had to demolish the vaulted ceiling of the existing living room to make space for the new rooms above. To support those new rooms, we installed several glulam beams parallel to the exterior wall; the photo at right and the drawing below show how we coffered the ceiling to conceal the glulams.

First we wrapped each glulam on three sides with 1x Douglas fir, detailing the edges with a roundover beading bit and a router. Then we built intersecting false beams with 2x6 blocks (ripped to match the width of the glulams) and more fir. Finally, we trimmed the ceiling with crown molding. Where the molding returned off the window head casing, a striking homed cornice was created.

The resulting coffered ceiling adds a stately look to the room and nicely complements the window muntins. □

Greg Lawrence is the owner of Green River Construction in Sebastopol, Calif. Photo by the author.

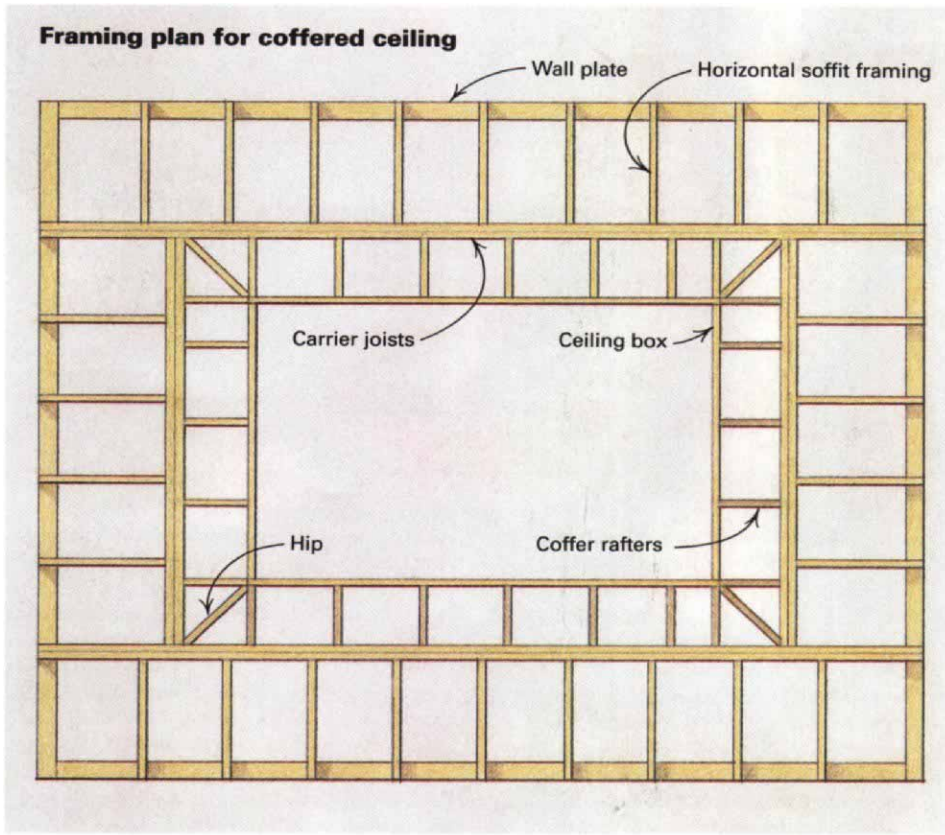


It starts with the soffit—One of the big advantages of the coffering technique I've adopted is that the coffer framing can be done before the roof is constructed. That gives us plenty of room in which to work. The first step is to lay out the location of the doubled joists, sometimes called carrier joists, that form the outer edge of the soffit (drawing p. 38). The locations are marked on the top plates of the surrounding wall. The carrier joists are oversized because they support both the coffer framing and the soffit framing—we usually use 2x10s or 2x12s, depending on the size of the room. It's important to build this part of the framing (we call it a carrier box) straight and square. Otherwise, the rest of the coffer will be a bear to build, not to mention what the finish carpenter will say about you when he hangs the crown molding. Nail off all the carrier joists very well because green lumber, while drying, will try to go places you don't want it to visit; three nails spread the width of the boards on 16-in. centers will suffice. Of course, in order to build a good, square carrier box, the surrounding wall framing had best be on the money—a square box in an out-of-square room will endow the soffit with a noticeable deviation in width.

To install the carrier box, start by spanning the room (usually, but not always, the shortest dimension) with doubled carrier joists. Once these have been cut and nailed in place, string a dry line across each pair and brace them straight with a temporary 2x4 "finger." Nail the finger to the carrier, push the carrier into line, then nail off the finger to the underside of the top plate. This will hold the carrier in place until the framing is complete (top right photo, p. 39). After

Drawings: Vince Babak

A topless hip. **Once the soffit is in place, framing for the coffer itself is like a hip roof with the top removed. Pressure blocks are nailed between framing members on either side of the doubled carrier box; the blocks prevent the framing from twisting as it dries.**



lining the first two pairs of carrier joists, measure and hang (we use joist hangers) the second two pairs between them. These carrier joists should be lined and braced as well.

With the carrier box in place, you're ready to lay out the locations of soffit joists on the top plate. We use 2x4s 16 in. o. c. for these joists, running them perpendicular to all four pairs of carrier joists (drawing left). The soffit joists should tie into the rafters at the exterior wall plates (a code requirement in these parts), so lay the rafters out ahead of time.

As we toenail the soffit joists to the plate with 8d nails, we secure pressure blocks in every other bay (photo above). A pressure block fits snugly between the ends of the joists to prevent them from twisting as the joists dry. Nail a 1x4 to the top of the joists that are toenailed to the plate, running it the length of the wall, and secure it with a pair of 8d nails at every joist. Called a catwalk around here, the 1x4 is required by code and helps to prevent twisting at the wall end. It should be located as close as possible to the intersection of rafters and joists.

One last check for clearance—With the soffit framing in place, you're ready for the angled coffer framing—but not before one last check of the specs. If the coffer is at a steeper pitch than the roof framing to follow, now's the time to make sure that the coffer framing won't interfere with the rafters. If someone changes the pitch of the

Framing the ceiling. **A ceiling box with mitered corners (photo above) forms the perimeter of the ceiling. A short hip rafter with beveled plumb cuts at top and bottom connects the corners of the ceiling box to the doubled carrier box.**

roof from what's on the plans, the angle and the height of the coffer should be recalculated—a quick double-check now can avoid major problems later when the roof gets framed.

To check this, measure the run from the inside of the exterior plate (in most cases, this is where the bottom edge of the rafter will start its incline) to the inside edge of the carrier box and add this figure to the run of the coffer rafter. This gives the overall run, and by plugging this into a calculator (I use a Construction Master II) and entering the pitch of the roof, you'll end up with the height of the roof rafter's bottom edge. When 6 in. is added to account for the thickness of the ceiling framing, you'll know if the coffer will collide with the rafters. If it will, lower the pitch of the coffer.

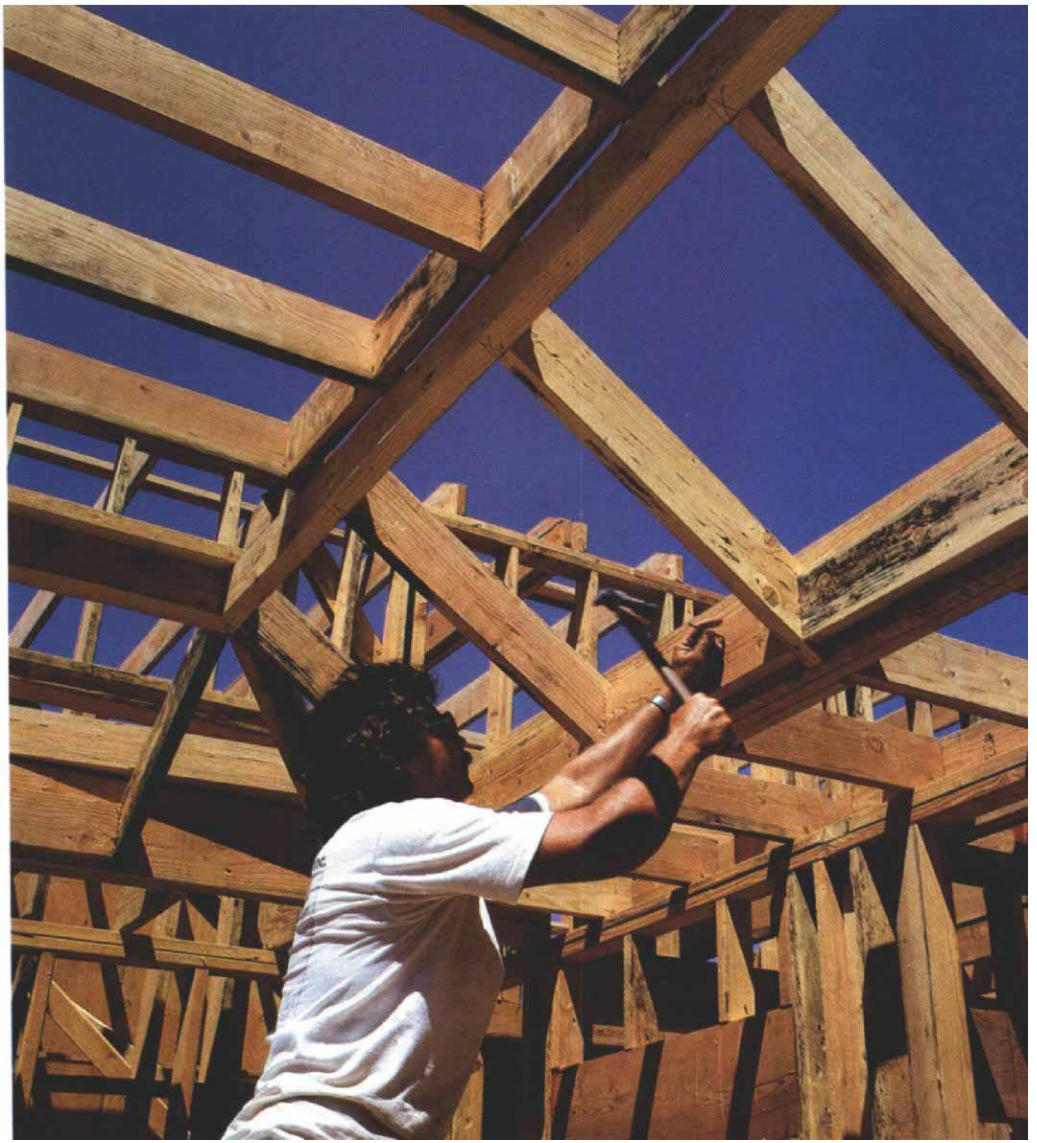
If the ceiling height hasn't been given on the framing plans, check a section detail (if there is one). A decent set of plans usually carries all this information, but not all plans are created equal. If the plans have left this information out, you'll have to calculate the height of the coffer based on the run and pitch of the coffer rafters.

The coffer layout—The coffer layout is no mystery; think of it simply as a hip roof with the top cut off (photo facing page). At each corner there will be two common rafters and a hip rafter; the areas between corners will be filled with common rafters. After laying out a common-rafter pattern, we cut as many rafters as we'll need. Mark the locations on the carrier joists of all eight commons that form the coffer corners, then pick one corner and work your way around the box, installing the fill rafters. These are usually 16 in. o.c., but 2 ft. o. c. is fine if the coffer is small. We use either 2x4 or 2x6 stock—in general, we use what we have most of. Of course, an unusually long span might call for larger stock.

Armed with the rise and run of the coffer rafters, you can figure them for length (for more on rafter framing, see *FHB* #10, pp. 62-69). There's no need to figure in a shortening allowance, though. When the length is known, we cut one pattern and then whack out the quantity needed. If we're building more than one coffer of

Helping fingers. **Pieces of scrap stock, called fingers, should be nailed between the carrier joists and the surrounding wall framing. They prevent the joists from bowing as the soffit framing is installed. Later on, the fingers will be removed.**

Blocking the rafters. **With the framing complete, Dunkley works his way around the ceiling to install any last pressure blocks that might be required.**



the same size, the second set of rafters can also be cut now.

The coffer framing—After the rafters are cut (but before installing them), we build the ceiling box at the top of the coffer, which is similar to the carrier box that forms the soffit. The difference is that the ceiling box is smaller (by the run of the coffer rafters), and the framing is not doubled up. We usually frame it on the deck from 2x6 stock, then lift it into approximate position, using temporary legs to hold it up; these legs will rest on the floor. The frame should be square; carefully cut rafters will keep it straight.

Once the ceiling box is up, install a pair of common rafters at each corner to hold the box in place. Toenail the rafters top and bottom, then install the rest of the commons, adding pressure blocks to prevent the rafters from twisting later (bottom photo, p. 39). When installing the rafters, make sure that they're not bowing the ceiling box; trim them if necessary.

When the commons are in, cut the hips to finish off the corners (top left photo, p. 39). The hips will have double cheek cuts on both ends; the cuts can be measured in place or calculated. When installing the hips, fit them in so that the drywall will follow the plane of the rafters into the center of the hip. A 6-ft. length of 1x4 makes a good straightedge to guide the hip placement. Fill in any jack rafters, if needed.

The ceiling framing is simple: Just add joists inside the ceiling box and fill in between with pressure blocks (bottom photo, p. 39). We use 2x4s laid flat to provide backing for the ceiling drywall along the length of the ceiling box. A strongback can be run down the center of the joist span to prevent the joists from sagging.

Variations—There are several variations to our coffer-framing techniques. One way to install the ceiling box is to eliminate the temporary legs and install eight common rafters at the corners of the soffit. Then lift the ceiling box up past the commons until the bottom edge is flush with the bottom of the rafters. The pressure of the commons will hold it until everything's nailed off.

Another approach is to nail the ceiling frame to the commons one board at a time, eliminating the need for help in positioning the unit. This box is supported by the hip rafters. It can withstand quite a load as long as the lower ceiling box is well braced with the ceiling-joist fingers.

Crown molding—If crown molding is desired at the top of the coffer ceiling, the ceiling joists are placed on top of the ceiling box, allowing a 5½-in. recess for the molding. To blend the bottom of the coffer rafters into the inside edge of the recess, we rip the bottom edge of the ceiling box to match the rafter slope, providing a smooth transition. If the rip reduces the width of the stock too much, cut the commons with a notch to accommodate the ceiling box so that they will blend into the inside edge (the box will be oversized by 3 in. to make up for the notch). □

Don Dunkley is a framing contractor in Cool, Calif. Photos by Charles Miller except where noted.

Applied Coffer

by Jay Thomsen

Usually an addition is built to reflect the design of the main house. A recent project of ours, however, showed that the opposite can also be true: Eventually, the Mrachek's house will be remodeled to reflect the addition.

As vice-president of the Handel and Haydn Society in Boston, Massachusetts, Bobbi Mrachek wanted a room in which to entertain large numbers of guests, usually for live performances of classical music. The design delivered by local architect John McConnell called for a room 40 ft. by 15 ft. 16 in., topped with a barrel vault. The look of the ceiling had to be bold, but not dark and depressing, and the surfaces had to reduce the echo effect of such a large space. Coffering would soak up the echoes. To do this without further complicating an already involved ceiling structure, we created a coffered effect with strips of 1x stock (photo facing page).

Providing the structure—As builders, we had constructed barrel vaults before, but never one so big. Given the dimensions of the new room, we knew we had a serious project to contend with. Fortunately, articles by Gerry Copeland and Lamar Henderson ("Building Barrel Vaults," *FHB* #51, pp. 79-85) helped quite a bit.

We framed the main roof of the addition as a gable with 2x10 rafters. Flush-framed collar ties (photo top right) secured with metal gusset plates completed the basic shape of the room. Plywood gussets would form the exact curve of the vault and provide a nail base for the finish ceiling (photo bottom right).

Calculating the radius of the plywood strips was done simply by drawing a layout on the floor to exact scale using a string, a nail and a pencil. Sheets of ¾-in. CDX plywood were then laid out on top of the curve, and the radius was redrawn on top of the sheets. Three stacks of templates and several jigsaw blades later, we were ready to begin installation.

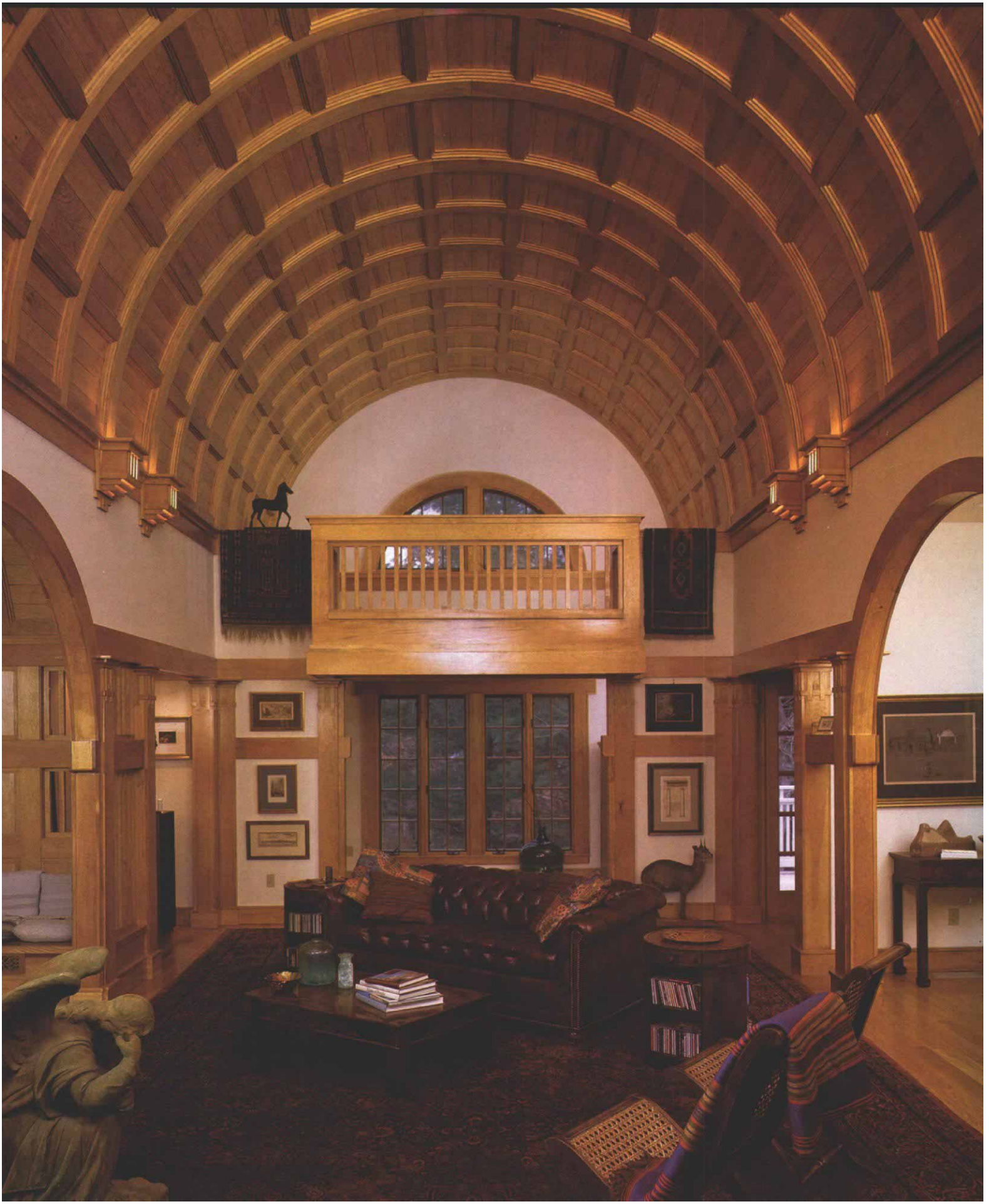
A working solution—The height of the ceiling (18 ft. 6 in.) became a factor in our planning at this point, not so much for safety reasons but for convenience: To hand each of the 1,350 pieces of the ceiling up a long ladder from below would have taken too much time. So we constructed a temporary second floor within the room to serve as a work platform—we'd need only a short stepladder to reach the highest point of the ceiling. A space 18 in. wide, running the length of the room, was left along each side of the platform to provide access for hoses, cords, passing up stock and even to dangle our legs through when working at the springline of the vault (the springline is the point of the ceiling where the curve first leaves the vertical plane of the wall).

The finish ceiling—After screwing the plywood gussets to the rafters and touching up the resulting curves with a belt sander, it was time to start nailing up the 1x6 finish ceiling. The Mracheks didn't want to see the V-groove that would characterize the seams of conventional T&G stock, so custom stock was milled from clear select pine. Every piece was prestained on both sides and both edges—twice—before installation and was sealed as soon as it went up.

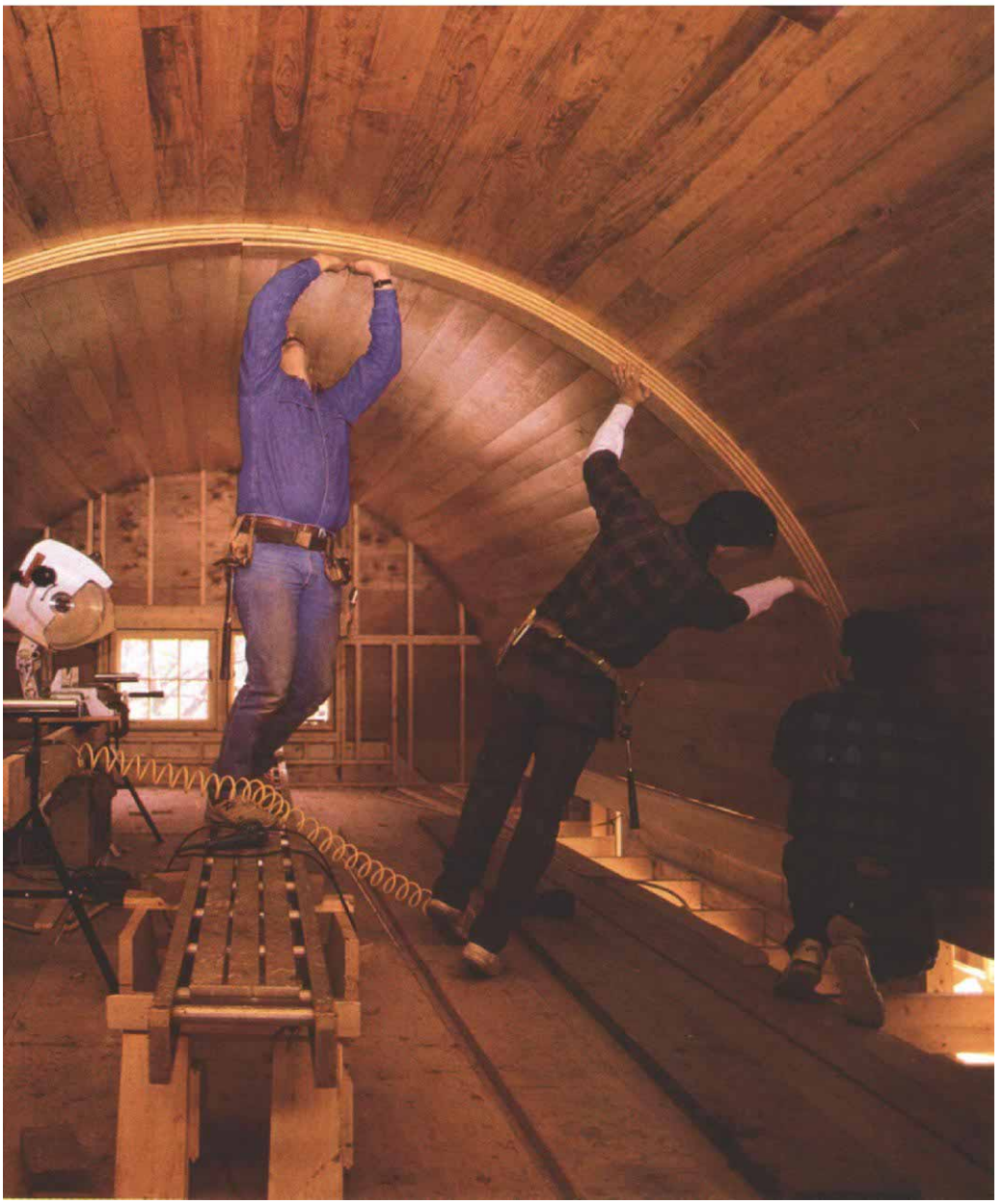
The shape revealed. **The project began with standard gable roof framing. Flush cross ties (photo above) secured with metal plates roughed out the shape of the barrel vault. Plywood gussets (photo below) provided the final shape. They were screwed to the rafters.**

We started the first piece of 1x6 at the centerline of the ceiling. Succeeding boards were then brought down either side toward the springlines. This allowed two crews of two men to work at the same time. We used nailers and 6d finish nails to secure the boards, toenailing most connections to avoid the incredible amount of time it would have taken to fill exposed nail holes with wood putty.

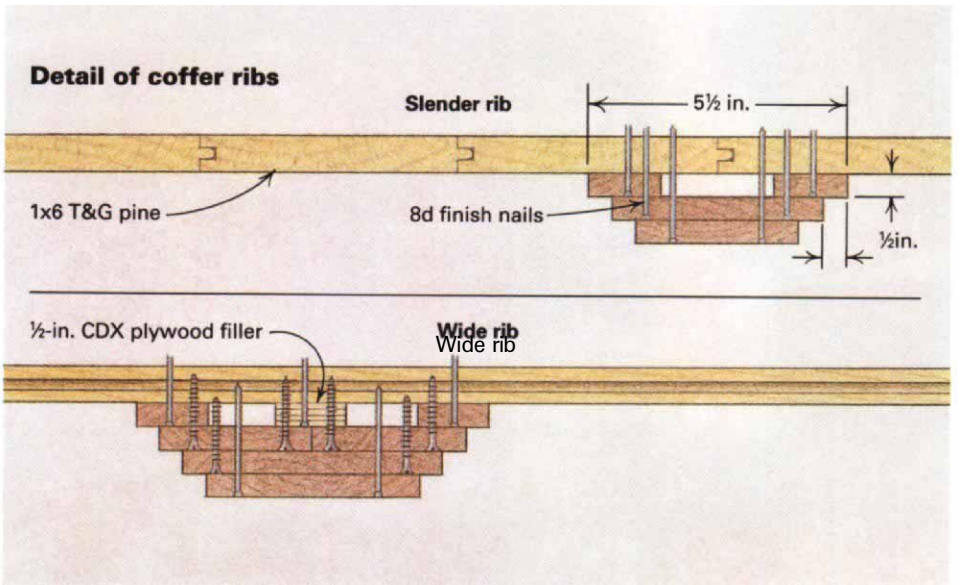
The coffer emerges—The main ribs of the coffering were to be layers of ½-in. pine applied in descending order of width (drawing p. 42). Intersecting ribs would overlap each other. Our hopes were that the layering of each member



A vault of considerable size. **This room addition was designed to house live performances of classical music. The lofty, coffered ceiling was created with built-up layers of 1x stock that were painstakingly screwed and nailed into place. Photo by James Shanley.**



Three against one. **The pliable nature of pine 1x stock allowed each layer of the ribbing to follow the vault of the ceiling. Nevertheless, it took a lot of work to press each strip into place.**



Adding up the ribs. **Stepped layers of 1x stock in various widths form the ribs of the coffer. Transverse ribs are slightly wider and one layer thicker than lengthwise ribs.**

would create enough shadow lines to stand out from the background 1x6s and make the ribs seem deeper than they were (photo above). The heavier ribs that line up with the columns in the wall below are 7½ in. wide and one layer thicker than the smaller, intersecting ribs, which are 5½ in. wide. The larger ribs helped to break the ceiling into sections that were easily subdivided into smaller, coffered squares.

Fortunately, ½-in. pine conformed to the radius of the ceiling, although it took three carpenters to bend and fasten each member in place (photo left). Each layer, except the final one, was screwed in place with 1⅝-in. drywall screws; subsequent layers hid the screw heads. The final layer of each rib was secured with 8d finish nails. In some cases, especially near joints, we needed better holding power, so we used 1⅝-in. trim screws instead of nails. All pieces were installed with butt joints; we were afraid that the beveled ends of scarf joints might slide past each other as the layers were fastened into place.

Given the repetitive but very precise nature of the coffering, it was important to come up with an accurate, easy method for laying out the location of each member. Ribs were kept parallel to one another by constantly checking measurements off the end walls and by our consistent use of spacer sticks cut to the desired distance between ribs.

The layout of the ribs running perpendicular to the main ribs (parallel with the springline) was kept in line with a 10 ft. long (and very flexible) layout stick, marked with the desired rib locations. As long as the end of the layout stick was butted to the springline, and the length of the stick was snug along the ceiling curve, the layout stayed very consistent. The spacing for all ribs is approximately 2 ft. o. c.

All in all, the vaulted ceiling consumed approximately 640 man hours. If we had a similar ceiling to do again, we could probably cut about 50 man hours from the process.

All carpentry work on this job was done by carpenters Charles Desserres (lead), Brian McCune, Don Baker, Steve Harris and Mark Roberto of I. M. Hamrin Builders, Milton, Massachusetts. □

Jay Thomsen is a remodeling contractor in Milton, Mass. Photos by Charles Desserres except where noted.