Raising an Eyebrow

Two methods used to frame wave-like dormers

by James Docker

Eyebrow dormers had their American heyday during the late 19th century, when they turned up on the elaborate roofs of Shingle-style Victorian and Richardsonian Romanesque houses. Tucked between the conical towers, spire-like chimneys and abundant gables that distinguish these buildings, the little eyebrows provided a secondary level of detail to the roof and some much needed daylight to upstairs rooms and attics.

The roof cutters of that era could probably lay out an eyebrow dormer during a coffee break, but for a contemporary West Coast carpenter such as myself (well-versed in shear walls, production framing and remodeling techniques), framing an eyebrow dormer presented an out-of-the-ordinary challenge.

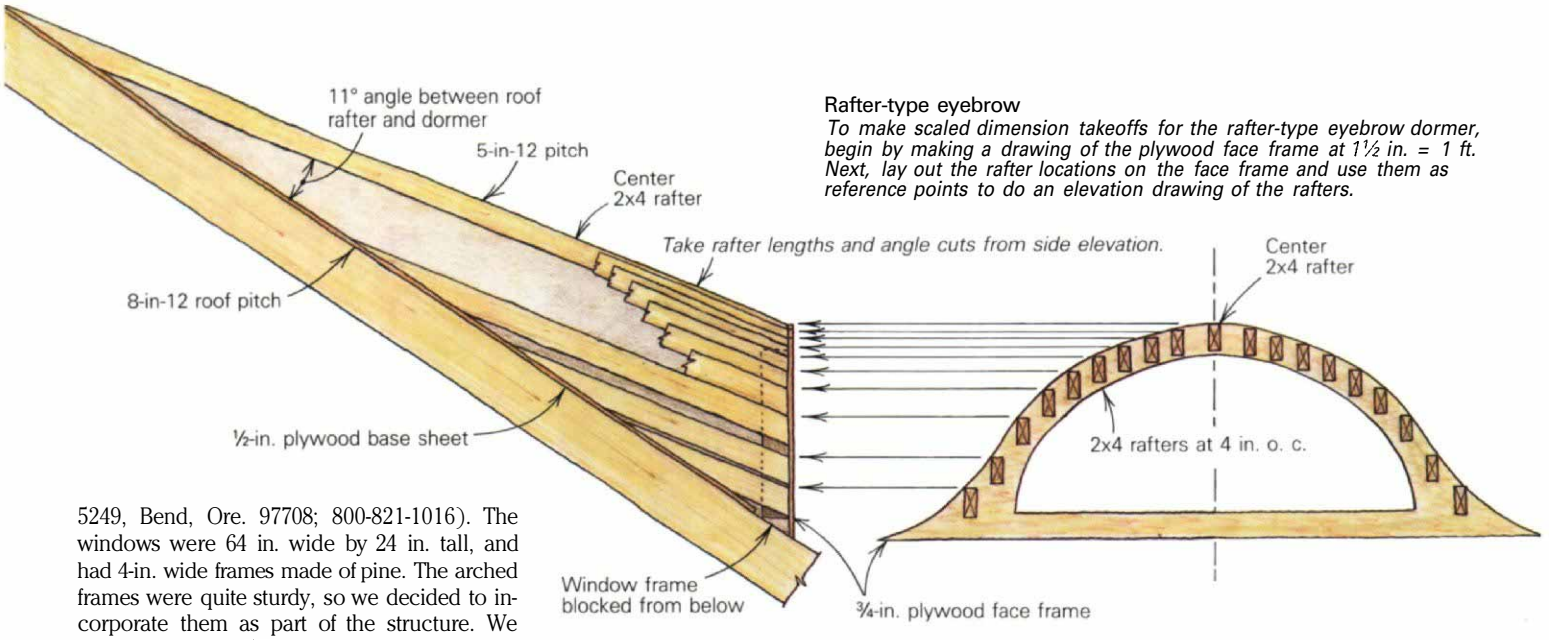
The setting for this dormer project was a rambling Tudor house in Atherton, California. The owners were adding a garage and remodeling several portions of the building, including a dilapidated barnlike recreation room next to the swimming pool. The roof of the house was covered with cedar shingles, and at the eaves and gable ends, curved shingles gave the roof a thatched look. Eyebrow dormers, rising by way of gentle curves from the plane of the 8-in-12 roofs, would look right at home on the house (photos right).

My job was to install five of them in the garage roof and a single larger eyebrow dormer in the roof of the recreation room. The garage ceiling would remain unfinished, so I didn't need to worry about providing backing for drywall or plaster. I would, however, have to solve that problem in the receation room. The garage dormers required a lower level of finish while presenting the same conceptual problems, so I decided to build them first.

Rafter-type eyebrow—By the time I got on the job, contractor Dave Tsukushi had already taken delivery of the windows for the garage roof. They were arched, single-glazed units available off-the-shelf from Pozzi Wood Windows (Bend Millworks Systems, P. O. Box

Undulating courses of cedar shingles wrap over the warped contours of these eyebrow dormers on a Tudor-style house in Atherton, California. The solo dormer (top photo) lets light into the recreation room, while the others illuminate the garage (bottom photo).

Photos this page: Charles Miller



Rafter-type eyebrow

To make scaled dimension takeoffs for the rafter-type eyebrow dormer, begin by making a drawing of the plywood face frame at 1½ in. = 1 ft. Next, lay out the rafter locations on the face frame and use them as reference points to do an elevation drawing of the rafters.

5249, Bend, Ore. 97708; 800-821-1016). The windows were 64 in. wide by 24 in. tall, and had 4-in. wide frames made of pine. The arched frames were quite sturdy, so we decided to incorporate them as part of the structure. We faced them with ¾-in. ACX plywood, which would serve as a vertical surface for attaching the rafters, as well as backing for a stucco finish (top photo, right). At the top of the arch, this plywood face frame is 3¾ in. wider than the window frame. This dimension accommodates the 22½° plumb cut of a 2x4 rafter on a 5-in-12 slope—the pitch of our dormer. I screwed the face frame to the first window; then I braced it firmly on the roof, exactly on its layout between the roof trusses.

An arched window 2 ft. high with a base about 5 ft. wide makes a pretty tight curve for the dormer roof sheathing to follow. To make sure the curves stayed smooth and to ensure plenty of backing for the plywood, I decided to put my 2x4 rafters on 4-in. centers. I laid out their centerlines on the base of the window, and then used a level held plumb to transfer them to the arched portion of the face frame. Next I got out the string.

The luxury of full scale—Normally I make detailed drawings of unusual framing assemblies to familiarize myself with the geometry involved while still sitting on terra firma. This first dormer proved to be an exception to that rule, as I had the luxury of mocking it up on the garage roof. Still, clambering around on an 8-in-12 roof deck isn't everybody's idea of fun, so I would recommend doing a detailed drawing of the dormer's essential components, and then using it to scale the lengths and angles (more on this in a minute).

The opening in the roof made by an eyebrow dormer is bell-shaped in plan (bottom photo, right), with the bottom of the bell corresponding to the base of the window. Finding the shape of the bell became the next task.

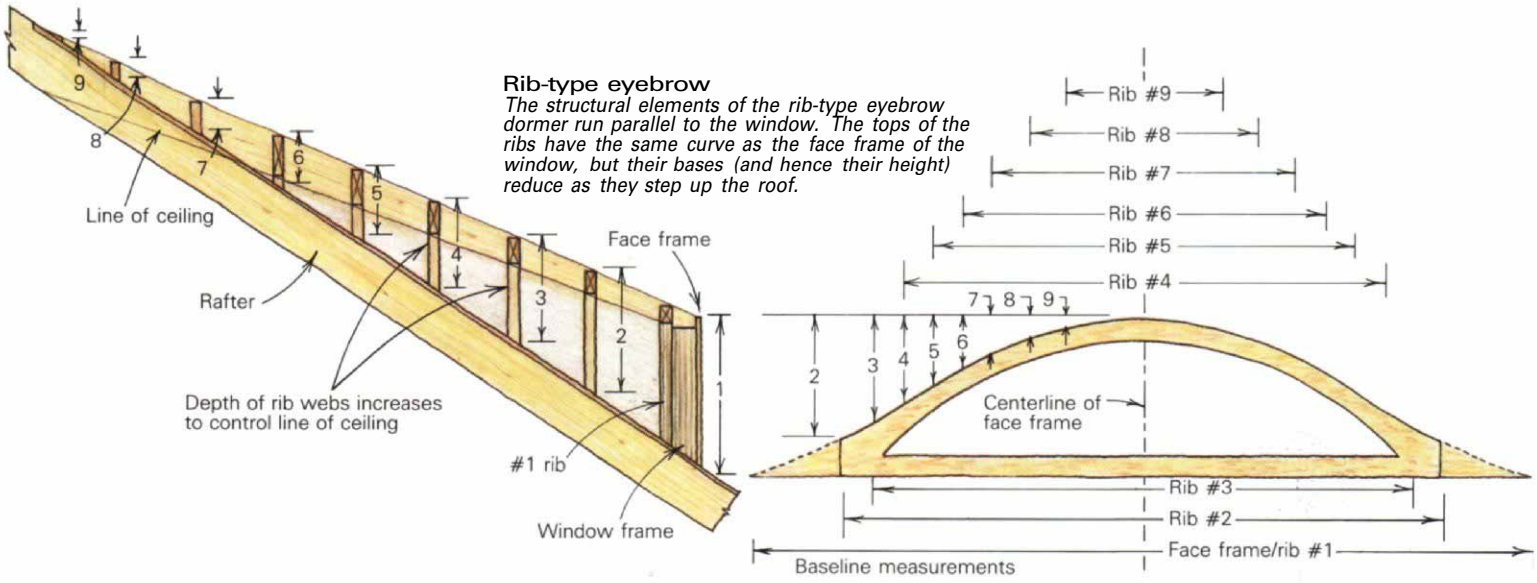
First I tacked a couple of sheets of ½-in. ACX plywood to the roof deck (one over the other) so that their right edges were aligned with the centerline of the dormer. I specified plywood with an A side for all the plywood parts of the dormers (except for the sheathing) because it's much easier to draw accurate layout lines on a smooth, knot-free expanse of plywood than it is on a bumpy C or D side.

Then I cut a 2-ft. length of 2x4 with a 5-in-12

Plywood face frames screwed to arched window frames support the ends of the 2x4 rafters. The rafters are on 4-in. centers, and are parallel to one another. Note the uphill ends of the rafters. Their outside and inside corners touch the base and determine its shape.

Before the window and the rafters are installed, a bell-shaped base sheet is affixed to the roof deck. The next step will be to cut away the decking inside the base.

Drawings: Christopher Clapp



Rather than adjust the ribs on the roof, the author brought the roof to the workspace. Temporarily tacked on this 8-in-12 worktable, the corners of the rib bases are noted on the plywood to generate the bell-shaped base. The paper pattern will be used to cut out the plywood sheathing.

plumb cut on one end to act as a dummy rafter and rested the cut end on the top of the window frame. I held a string flush to the top edge of the dummy rafter, using a helper to hold it at the uphill end. This Stringline represented the top of the center rafter, and its intersection at the roof was marked. Then the stringline-and-mark process was repeated for each rafter positioned to the left of center. By connecting the marks with a smooth curve, I had the outside line of the bell. To find the inside line of the bell, I measured the angle between the string and the roof deck. This angle (11°) represented the cut needed on the bottom of the dormer rafters where they intersect the garage roof. Because all the rafters are at the same pitch and parallel to one another, this cut is the same for all the rafters. By making a sample cut on a short length of 2x4, I simply placed the tapered end on each rafter layout line and marked the inside corners. Connecting the dots gave me the inside of the bell curve. Because the rafter layouts are symmetrical, the bell-shaped base for half of the dormer is the mirror image of the other half. Therefore, half of one base is all the layout template needed for one dormer. The same applies to the rafters. Once I had them measured and cut for half of the first dormer, I had templates for all the rest, allowing me to cut the parts quickly for all five dormers.

All this string-holding worked okay. But if I were to do this again, I'd do a drawing at a scale of 1½ in. to 1 ft. showing the elevation of the window from two vantage points (drawing previous page). At this scale, it would be easy to make dimension and angle takeoffs for the

lengths of the rafters and the angle at which they intersect the roof and the face frame. Then I'd use the rafters instead of the stringlines to figure out the bell shape of the plywood plate.

Assembly and sheathing—Once the plywood plates were cut out, we screwed them to the roof deck with galvanized drywall screws. Then we cut out the decking on the interior side of the base sheet, and screwed the eyebrow rafters to the plate and the face frame.

When one of the dormers had all its rafters, we draped 30-lb. felt over half of it and trimmed the felt along the valley formed by the intersection of the garage roof and the side of the dormer. This gave us the pattern we needed for marking cut lines on the ⅜-in. CDX plywood sheathing.

Bending a sheet of plywood over a radius this tight while holding it on the layout can be daunting—especially on a steep roof—so I wanted to prebend the largest pieces. Shallow kerfs on the underside of the plywood would have allowed it to bend more easily, but the structure of the dormers is visible from below so I wanted to avoid kerfs. Instead, I made a simple bending form out of a sheet of plywood with some 2x4 cleats nailed to the long edges. Then I stuffed several of ⅜-in. plywood sheets between the cleats, soaking each one liberally with the garden hose. Left in the form for a couple of days, the sheets took on a distinct curve, making them easier to bend over the rafters. Each dormer has one layer of ⅜-in. plywood affixed to the framing with 1-in. staples. We left the tops of the rafters unbeveled, but added beveled strips for better bearing where the sheets abut one another.

The garage roof had skip sheathing atop its decking to give the cedar shingles some breathing space. We carried the skip sheathing over each dormer by stapling a double layer of 6-in. wide redwood benderboard (5/16 in. thick) on top of the plywood. I had wondered what kind of valley flashing would be needed at the junction of dormer and roof. As it turned out, we didn't need any. The roofers wove layers of shingles together with very little exposure to form the valleys (bottom photo, p. 80).

After the rafters, the ribs—Unlike the multiple eyebrows on the garage roof, the single eyebrow atop the pool house had to have a finished ceiling underneath it. I decided that this extra wrinkle warranted another approach to the eyebrow's structure. Granted, you could hang blocking and furring strips from the bottom of a rafter-framed eyebrow to make a smooth transition from a flat ceiling plane to one with an arch, but why not make the bottom of the eyebrow structure conform as closely as possible to the shape of the arched portion of the ceiling? To that end, I worked up a full-scale drawing of the dormer (drawing facing page) on the recreation-room floor.

The window hadn't yet been ordered for this eyebrow, allowing me to design the arch from scratch. I made it long and low, taking the bulk of its face frame from a 10-ft. sheet of ¾-

The bell-shaped base of the rib dormer rests on rafters that will soon be headed off and trimmed back (top photo). In the bottom photo you can see how the two rafters at the top, now cantilevered over a new ridge beam, have been cut back at a taper to keep them out of the arched ceiling plane. To their right, an angled doubler picks up the weight of the ribs bearing on the base sheet. Benderboard strips backed by 2x blocking define the curve of the arched ceiling.

in. plywood. The short reverse-curve valley returns at each end were made of scabbed-on pieces of plywood (photo, p. 82).

The ribs are on 16-in. centers, and their bottoms are cut at an 8-in-12 pitch to match the roof slope (drawing, p. 82). As the individual ribs step up the roof, their overall depth decreases along with their width. Meanwhile, their arc at the top remains the same as that of the face frame. By taking direct measurements off the full-scale drawing, I got the overall depth of each rib. Then I measured down on the centerline of the window face frame to find the perpendicular baseline to read the width of each rib. To add a little extra complexity to the project, I had to increase the depth of the web of each rib in a sequential manner. This allowed the arched portion of the ceiling to make its transition into the cathedral ceiling without crowding the ridge (photo below).

I made all the parts for the rib-type dormer out of ¾-in. plywood. The face frame is a single layer, the built-up window frame has 5 layers and each rib has 3 layers. Rib number 1 is screwed to the back of the window frame.

Working with a full-scale drawing made for accurate and speedy work. But the pieces were large and cumbersome, and temporarily tacking them to the roof to figure out the shape of the base didn't sound like any fun at all. I probably could have used the full-scale elevation drawing to extrapolate its shape, but whenever I have to deal with unusual concepts, like sections of cones on inclined planes, I take comfort in three-dimensional models.

While regarding the cavernous interior of the recreation room, a solution occurred to me. Why not build a mockup of the roof, with one end of the rafters firmly planted on the recreation-room floor? Within an hour, I had a fake roof in place. I used the plywood that would eventually become the base sheet for its sheathing.

A plaster finish on the arched ceiling flows into the drywall covering the plane of the rafters.

As each rib was cut out according to direct measurement takeoffs, I tacked its base to the fake roof and braced it plumb with a temporary alignment spine (photo, p. 82). Once I had all the ribs tacked to the mockup, I marked the inside and outside points where their bases engaged the plywood. These points gave me the reference marks I needed to make the bell-shaped base for the ribs. After taking the ribs down, I drove 8d nails at each mark, leaving enough of the nails exposed to act as stops. Then I used a ¼-in. by 1½-in. strip of straight-grained redwood benderboard held against the protruding nails to generate the curve for the base sheet.

The base sheet tucks into a bay between a pair of new timber-framed trusses (top photo, previous page). Unlike the installation of the rafter-type dormers, this one went into a roof that hadn't been planned with an eyebrow dormer in mind. This meant that some rafters had to be removed, and their loads picked up and transferred to new structural members.

Blocking and benderboard—Before I took apart the mocked-up structure of the dormer, I made a rosin-paper pattern to guide the cutting of the plywood sheathing. Like the pattern for the dormers on the garage, this one could be flopped to be the pattern for the other side of the dormer.

Assembling the ribs began from the bottom up. With the face frame and its accompanying arches firmly attached to the base sheet and diagonally braced plumb, all the succeeding ribs were quickly placed on their layout marks. They were then decked with a single layer of ½-in. plywood. As before, I built up skip sheathing over the top of the eyebrow with two layers of 5/16-in. by 6-in. benderboard.

Picking up the loads of the removed rafters and carrying the curves of the ribs into the plane of the ceiling was the next task. Our engineer recommended a couple of doubled 2x8s as support for the legs of the base sheet. These doublers run diagonally from the ridge beam to the top chords of the new timber-framed trusses (bottom photo, previous page). This photo also shows the finicky blocking that it took to pick up the unsupported edges of plywood sheathing and to carry the arc of the eyebrow into plane with the rafters. Benderboard was also useful for this task. In places, I was able to extend the curve from a rib to the rafters with a strip of benderboard and then fill in the remaining gaps with solid pieces of blocking shaped to fit.

The ends of the benderboard abut the edges of the drywall that cover the flat parts of the ceiling. At the transition to the curve, expanded metal lath was stapled over the benderboard, and the junction between the flat ceiling and the eyebrow's arch feathered with plaster to make an invisible seam. □

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