Building an Arched Dormer

This unusual project took some concentrated thought about the framing and an interesting roofing material to top it off

by Bill Phelps

When architect Bob Gordon designed an arched dormer for a house I was scheduled to build, I was less than enthusiastic. What he had created in a few minutes with a compass and a pencil, I would have to convert into reality on a tight budget. Our clients liked the idea, though, and as it turned out, I enjoyed working on the project.

An arched dormer presents a difficult problem in on-site geometry. Picture its roof as a cylinder lying on its side and cut in half the long way. The main roof, a simple flat plane, intersects the cylinder at an angle, and the line formed where they intersect is half an ellipse. The dormer rafters meet the main roof on this half-ellipse, and the steeper the roof, the less elongated the elliptical curve.

The main roof had a 4-in-12 pitch and was framed with 2x10 rafters that defined the ceiling of the living room below. This meant that the half-ellipse would appear in the finished living-room ceiling. A 6¼-in. by 21-in. gluelam beam parallel to the ridge was the main header for the dormer, and I tripled up the rafters on each side of the rough opening (photo facing page, bottom left).

I didn't anticipate many problems in constructing the curved header for the window, but then I'd have to frame the curve inside the rectangular rough opening in the main roof before I could set the dormer rafters. It didn't take me a long time to realize that computing the required lengths and angles for this three-dimensional nightmare in solid geometry was out of the question. So I figured out a way to measure them directly off string lines.

The curved header—Since the arched window for the dormer was already on the job, we used it to trace the right arc on a piece of ¾-in. plywood, which became our template (photo facing page, top left). The header had to be deep enough to receive 2x6 rafters and sheathing, so we glued it up from seven layers of ¾-in. plywood, cut out with a jigsaw (photo top right). We installed joist hangers radially 12 in. o. c., so that the dormer's 2x6 rafters would sit flush with the top of the beam (photo center left). The top three rafters intersected the gluelam beam, and we used joist hangers there, too.

Stringing it up—The moment of truth had now arrived. The rest of the dormer rafters would intersect the main roof on the half-

ellipse that was still to be determined. Luckily, the plywood cutout from the curved header's plywood template was leaning against the wall right in front of me. Its shape duplicated the inside curve of the curved header, so I transferred the header's rafter layout onto it and tacked the cutout onto the gluelam at the opposite end of the rough opening, level with the header (photo center right). By running string lines between the two, I located the bottom of each dormer rafter and also the centerline of the arch over the entire length of the dormer. A straightedge extended across the bottoms of the 2x10 main roof rafters intersected each string line where the main living-room ceiling would meet the arched dormer ceiling. These points described the ellipse, and they also made it easy for me to figure the lengths of each of the dormer rafters.

Next, to approximate the ellipse, I cut two 2x10 headers for each side of the rough opening. As shown in the photo at bottom left, each intersected two of the points I'd just located on the rafter strings. I then nailed the dormer rafters to these headers to complete the framing. We blocked the inside corners to get closer to the curve of the ellipse.

Unlike the headers, which were in the plane of the main roof, the dormer rafters required a compound-angle cut at one end. The easiest angle to measure was the one between the header and the string that represented each rafter. We simply measured it with a protractor aligned to meet the header at the same angle as the rafter would. Each rafter was to lie on a line radiating from the centerline of the half-cylinder—much like the spokes of a wheel cut in half. We also needed to find the angle that each spoke or rafter would make with a plumb line, since the headers inserted to approximate the ellipse were plumb. One of my crew held a straightedge between the centerline string and the rafter intersection. I held one leg of the protractor against this straightedge and held a torpedo level against the other leg. I adjusted the protractor until the level read plumb, and I had my angle.

Roofing—After the arched roof was sheathed with two layers of ¼-in. plywood, glued and screwed to the dormer rafters, we covered it with a multi-ply copper-clad roofing system called Veral. Developed in France, this product is now manufactured in this country (Siplast, Arkadelphia, Ark. 71923). It consists of a copper foil bonded to a multi-layer glass-reinforced asphalt. You roll the material out, then use a torch to melt the asphalt at the overlap (photo bottom right). The result was a continuously sealed roofing membrane that easily conformed to the curved surface of the arch. We extended the Veral under the cedar shakes of the main roof for about 2 ft. on each side. This provided a near-typical valley flashing detail where the dormer joined the main roof. The installed cost was $300, not too bad when you consider that we didn't have to install the fascia, soffit, exterior siding and trim that a normal dormer requires.

Finishing touches—We insulated the arch by spraying polyurethane foam between the rafters. Then we sheathed the inside surface so that it could receive wire lath for the plaster finish. We used two layers of glued and screwed ⅛-in. Masonite, because ¼-in. plywood is tough to bend to that radius.

To plaster the ceiling of the arch, we used an acrylic compound called STO (STO Energy Conservation, Inc., Quality Lane, Box 219, Rutland, Vt. 05701), and finished right to the arched window frame so we wouldn't have to build a curved window casing. STO can be applied in fairly thick coats, and made the final shaping of the elongated ellipse easier.

It took longer to frame the arched dormer than it would have to frame a standard one, but there was less exterior and interior trim work to be done. The triple-glazed arched window unit was the major extra expense, but overall, the increase in cost was modest, and the owners are pleased with the result. □

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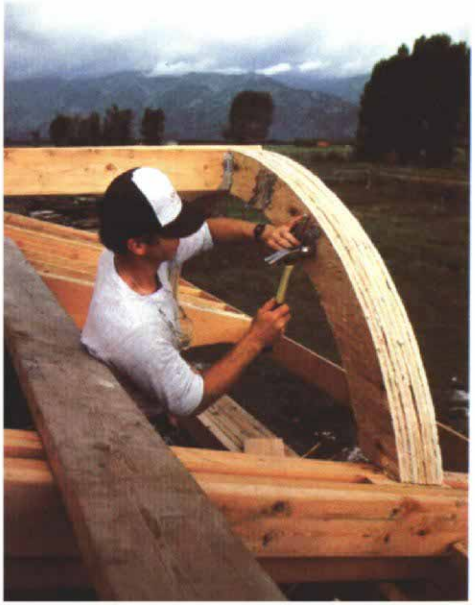
Photo this page: Bill Phelps; Photos facing page: Ron Wagar

Using the dormer's window as a pattern for the arched header, above, Phelps traced its shape onto a sheet of ¾-in. plywood. Once it was cut out, he used it as a template for six more plywood layers, which were all then glued and screwed together to form the header, right.



Once the curved header was installed, Phelps installed joist hangers radially every 12 in., left, to support the outside end of the dormer's 2x6 rafters. At the other end, above, he used strings and the cutout from the original plywood header template to lay out the locations of the joists' other ends.

To approximate the half-ellipse, Phelps installed two 2x10 headers on each side of the rough opening, below. The inside corners were blocked to produce the curve. The dormer is covered with Veral, a roofing system that consists of copper foil bonded to glass-reinforced asphalt. Workers roll the material out and join sections by melting the asphalt, right.