

FRAMING A GABLE DORMER

by Richard Cooley

This technique leaves room for a vaulted ceiling and puts the load where it belongs



The extended valley rafter (top) provides a sturdy structure since it bears on the ridge and the wall top plate. The side view (bottom) shows the treatment at the eaves and gable end.



Builders facing the job of framing a gable dormer generally use one of two options. Most simply build a header between two doubled common rafters from the main roof, and use this to support the dormer's ridge beam. This method is especially common for dormers situated toward the middle of the roof elevation, which require a lower as well as an upper header.

Another method is to continue the dormer's ridge beam through its intersection with the main roof and hang it from a metal saddle or wood 2x2s hanging vertically from the main roof's ridge beam. But this method compromises strength and can't be used with vaulted ceilings.

To get around these limitations, and to put the load of the dormer where it belongs—on the main roof ridge and the house's exterior walls—I like to use a third method: I extend one of the dormer's valley rafters upward from the house's top plate until it intersects the main ridge beam. This works particularly well with vaulted ceilings. The method takes a bit of figuring and a little eighth-grade geometry, but the design versatility and structural rigidity it provides are worth it.

Mixing Trusses and Conventional Framing

For the job I'll describe here, I had a unique situation in that the dormer helped form a vaulted ceiling over the house's central hallway and stairwell, but standard 8-foot ceilings were used on either side of this. This let me simplify things by using trusses for the 8-foot ceiling areas, while using my extended-rafter approach over the vaulted area. The extended valley-rafter

saved me some truss expenses, for had I used the header method, I would have had to get specially engineered trusses to take the load off the header mid-truss.

Siting the Extended Rafter

The first step is siting the extended valley rafter. Our main roof had an 8/12 pitch with a 20-foot span (see Figure 1). Our dormer, which was to be 11 feet wide, was to have the same pitch, meaning the valley would form a 45° angle when viewed from above. Extending that angle to the main roof's ridge in a plan view, we find it meets the ridge 10 feet over from a line drawn up the roof from the eaves line of the dormer. This distance always equals the run of the roof because it is the leg of a 45° right triangle.

After making the start and finish points of the extended rafter on the ridge and top plate, I found the rafter's length by measuring with a tape between these two points. In this case it was 15 feet 6 1/4 inches from the ridge to the outside of the top plate of the exterior wall; this represents the length from the top long point of the rafter to the top of the birdsmouth (see Figure 2).

If you're uncomfortable measuring this length with a tape, you can find the rafter length by looking it up in a hip/valley rafter table or figuring it on your steel square. In either case, find the length for a valley rafter that makes the run and rise of the main roof rather than the dormer. Also, keep in mind that either of these methods will give you the theoretical length of the rafter—from the center of the ridge to the birdsmouth plumb cut, as measured along the rafter's top edge. For the actual length, you'll have to reduce the

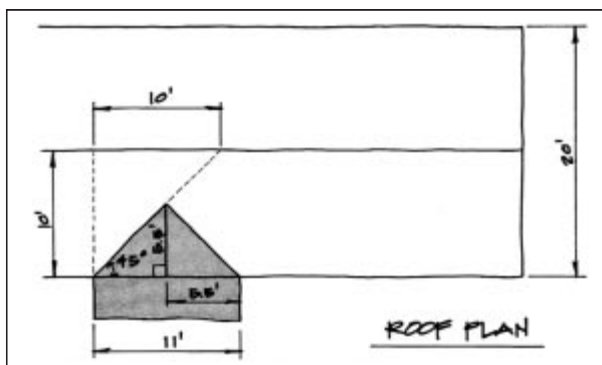


Figure 1. Roof plan for a gable dormer. Because both roofs have the same pitch, the extended valley rafter forms a 45° angle in plan. Lay out the extended valley rafter as if the dormer were extending all the way to the ridge of the main roof.

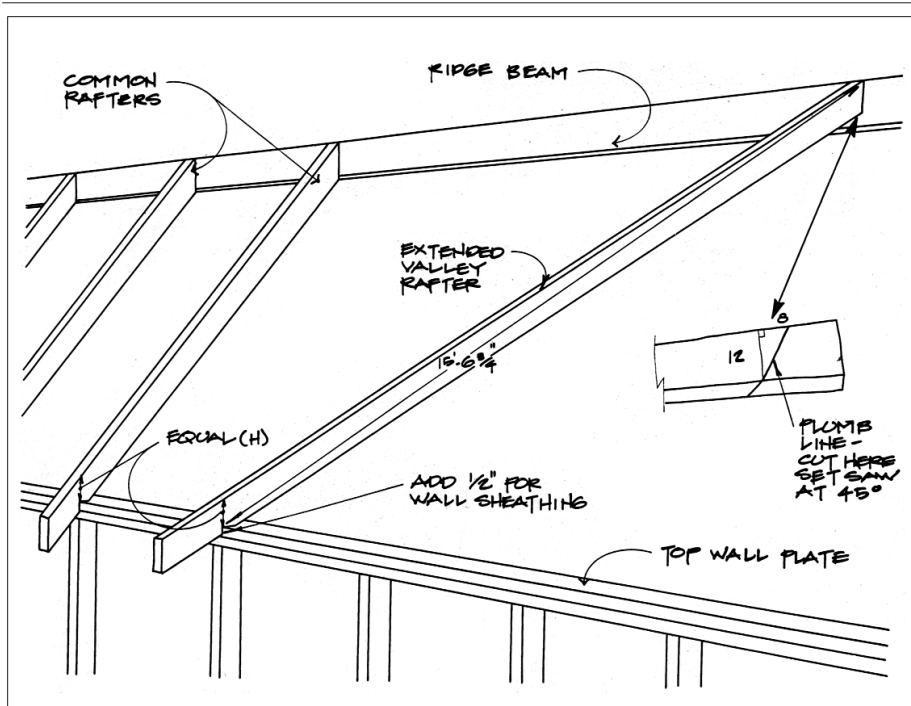


Figure 2. To measure the extended valley rafter with a tape: run your tape from the top long point where it meets the ridge to the outside edge of the top plate (at the top of the birdsmouth). Here, it's 15 feet 6 3/4 inches. For the top cut, mark the side of the rafter at 8/12 and cut with your saw blade set at 45°. The plumb cut at the birdsmouth is located so that the height above the cut (H) equals the corresponding height on the common rafters.

theoretical length by half the 45° width of the ridge—about 1 inch for 2x lumber.

We cut the rafter from a piece of 2x12 Douglas fir. The top cut is a compound cut, but not difficult if you look at each component. Looking at it from an elevation view, the cut is the same as any 8/12 rafter—a plumb cut, marked as usual with a framing square. The angle from the plan view is 45°, so you simply make the cut along the plumb cut line with your saw set at 45° (see Figure 2).

Once you've made the top cut, you can measure along the rafter to find and mark the spot for the bottom cut, which is a birdsmouth plumb cut into the bottom edge of the rafter.

Pythagoras Makes His Play

With the extended valley rafter in, it's time to locate and cut the other dormer valley rafter. This is where the geometry comes in—namely, the Pythagorean theorem ($A^2 + B^2 = C^2$), which enables you to find the length of a right triangle's third side if you know the other two.

The length of the second valley rafter forms the hypotenuse (longest side) of the right triangle whose other legs are defined by the ridge (length A in Figure 3) and the first full-length dormer common rafter (length B in Figure 3).

Length A will be half the dormer's total span as long as the dormer's roof pitch is the same as the main roof's. Looking at the roof in Figure 1, we find that dimension A is 5 feet 6 inches, or 5.5 feet.

We already know the dormer roof's run—5.5 feet—so we can derive dimension B (the length of the dormer's common rafters) from our roof framing charts. For an 8/12 roof, the length is 8 feet 3 inches, or 8.25 feet.

Whipping out the calculator, we figure $A^2 + B^2$:

$$(5.5 \times 5.5) + (8.25 \times 8.25) = (30.25) + (68.06) = 98.32 \text{ feet.}$$

Pushing the square-root button on our calculator, we find that the square root of 98.32 is 9.92 feet, or 9 feet 10 inches. That will be the length of our second valley rafter.

We measure this length along the main valley rafter and mark the point of intersection. This is also the length of the dormer valley rafter we need to cut. The intersection of the extended valley rafter and the second valley rafter is 90° as shown in Figure 1. This is not a compound angle, but a simple cut laid out with a framing square for an 8/12 pitch. The bottom cut is the same as for the extended rafter.

line cut on the rafter will be for an 8/12 pitch. The dormer ridge will fasten into the crotch of the valley rafters, with dormer jack-rafters and common rafters filled in last.

As always, when measuring actual rafter lengths, pay close attention to whether you're measuring the long points or the short points of the angles you're preparing to cut. Also, be sure to allow for the thicknesses of ridge beams and outside sheathing when converting the theoretical lengths to actual cuts. And for any rafter that will help support a roof overhang, be sure to include the overhang length.

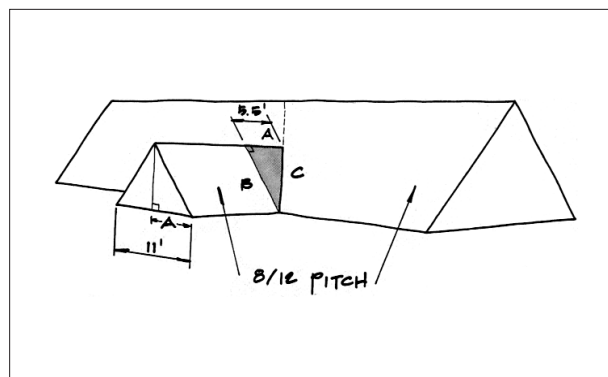


Figure 3. The dormer valley length C is the hypotenuse of the shaded triangle. In any dormer in which the dormer pitch equals the roof pitch, length A will equal the run of the dormer rafters, or half the dormer's width.

Back to Banging Nails

This completes the valley skeleton of the gable dormer—everything else is routine fill-in, and our job as mathematicians is done.

The main roof jack-rafters will be compound cuts similar to the cut made at the top of the extended valley rafter—the saw will be at 45°, and the

Last comes the fascia board and roof sheathing to complete the job. This leaves an open, vaulted ceiling inside for the drywallers—and the load resting on the exterior wall and the ridge, right where they belong. ■

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