Framing for Skylights

The trick is in laying out and building the splayed walls of the lightwell

Skylight frame in place. With the sash removed, the skylight frame can be set on the roof to check the rough opening. The author makes the opening in the roof slightly longer than necessary, then furs out the framing to the correct length. In the photo below, he uses a scrap of ½-in. plywood to determine the thickness of the furring he will nail to the headers at the bottom of the well.

by Doug Hopper

Winter days in the Pacific Northwest can be short and gray, which helps explain why many people rely on skylights to make the most of what little natural light there is. When I started building 20 years ago, "skylight" wasn't even in my construction vocabulary. But skylights are now standard in the houses I build and are one of the improvements homeowners ask for most frequently in remodeling projects.

Framing for a skylight isn't difficult, but it's more than just cutting a hole in the roof and dropping in a factory-made unit. Installation is a lot simpler in new construction because roof and ceiling framing are open and visible, and the skylight can be included in framing plans right from the start. In a retrofit, you'll have to grapple with obstructions like heating ducts, plumbing, wiring and insulation, and none of these obstacles may be apparent when you start. Whether you're installing a skylight in a new house or an old one, though, framing is essentially the same. There are two basic framing questions you'll have to settle: how to create the openings in the roof and in the ceiling, and how to build the light shaft, or lightwell, that connects the two.

The size of the skylight has a lot to do with how complicated the framing will be. Some skylights fit between rafters or trusses on standard 24-in. o. c. spacing. If you choose one of these units, no rafters or ceiling joists must be cut, and framing is fairly simple. Large skylights require more work and a slightly different framing technique to make the openings and to build the lightwell. I'll explain how I handle both situations.

Planning the skylight well—What makes framing for a skylight unique is the lightwell, which connects openings in the roof and the ceiling. Of course, if there is no ceiling, such as in an open-beam roof, there is no well, and the only required framing will be at the roof. I frame my skylight wells with 2x material so that they can be insulated like an exterior wall (for tips on making well walls from plywood, see sidebar p. 74).

The size of the roof opening is determined by the rough opening of the skylight, but the size of the ceiling opening, and consequently the design of the well, is variable. A simple approach, and the one I use when the well will not be very deep (less than 2 ft. high at the high end), is to bring all four sides of the well down 90° to the roof slope. More often, though, I run the high end of the well 90° to the roof slope, and the lower end of the well plumb. The ceiling opening then becomes longer than the roof opening but the same width as the skylight. The splayed shape allows for greater dispersion of light inside.

This approach works well unless the depth of the well is more than about 4 ft. at the high end. With very deep wells, the ceiling opening can get too long if the high end is run 90° to the roof. An obvious solution is to reduce the angle so that the opening is somewhat shorter or to bevel the high-end wall. A beveled wall starts perpendicular to the roof slope and then breaks about halfway down to continue plumb, or perpendicular, to the ceiling. But before I build that kind of well, I first try to adjust the angles of the well because I think the finished well looks nicer when the walls are each in a single plane.

Another option is to make the ceiling opening greater in width and length than the roof opening. This distributes the light more than the simple splayed-end well, but it's more complicated to build because of the compound angles involved. In addition, it usually means more structural work at the ceiling because you probably will have to cut more joists to make the opening. For those reasons, I don't use this approach very often. Yet it's worth considering, especially when using a small skylight because the distribution of light is increased greatly.

Locating the well inside—In new construction, I often start my skylight framing on the floor below the well, not on the roof. After all of the exterior and interior walls have been laid out on the floor deck, I lay out approximate dimensions for the well on the deck. It may sound backward, but starting the process on the floor lets me see how the skylight well will fit with other openings in the walls, the roof and the ceiling. Sometimes I know how big I want the well to be at the ceiling, but I'm not sure how big a skylight to order. If that's the case, I can use a simple formula to make the calculation (see sidebar this page).

Laying out the well opening on the floor also gives me a chance to make minor adjustments in ceiling and roof framing before it goes up. For instance, a common location for a skylight is centered over the kitchen sink and window. In the case of a single-bay skylight, I may be able to shift roof and ceiling framing a few inches in either direction so that the framing won't encroach on

Sizing a skylight from below

Because I usually build skylight wells with a splayed wall at the high end, the opening in the ceiling will be larger than the rough opening at the roof. What if you know how big the well should be at the ceiling, but you're not sure what size skylight to order? A simple formula can help you solve this layout and framing problem.

Let's say your goal is to frame a 5-ft, long well opening in the middle of a 10-ft. wide ceiling, leaving 2 ft. 6 in. on both sides of the opening (drawing below). Your object is to figure out the rough opening on the roof, assuming the high end of the well is perpendicular to the roof plane, and the low end of the well is plumb. The rough opening will tell you what size skylight to order. The same formula could be used to work the other way, that is, starting with the rough opening and figuring out the size of the well opening in the ceiling.

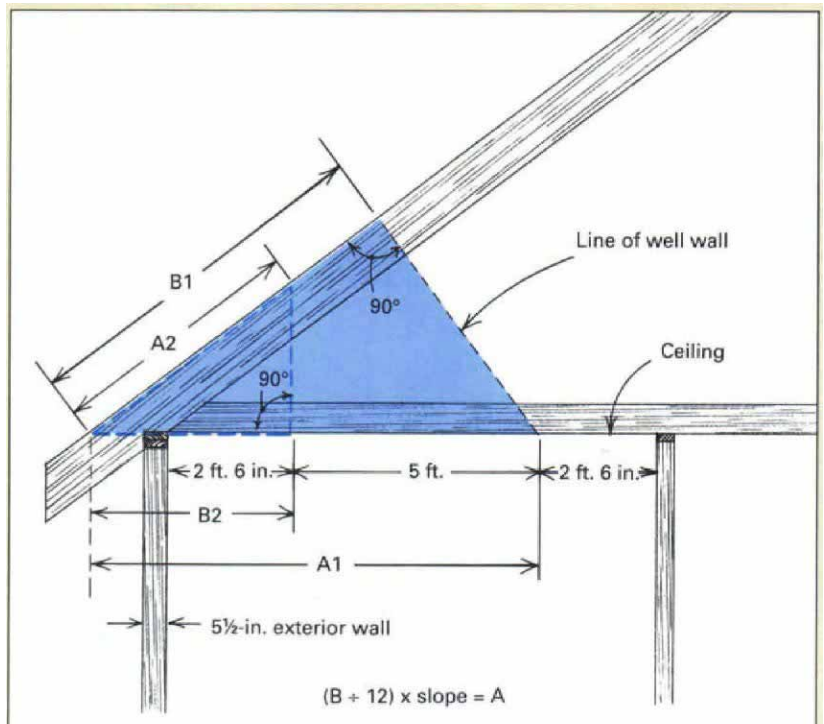
Here's the formula for figuring out the skylight problem:

(B÷12) x slope factor = A

A1 in the drawing is the horizontal distance from the outside edge of the rafter to the exterior wall (10½ in. in this example), the width of the 2x6 stud in the exterior wall (5½ in.) plus our desired well opening (60 in) plus the setback from the outside wall (30 in.) for a total of 106 in. B2 in the drawing is 46 in. We also need to know the slope factor, which is the hypotenuse of the triangle formed by the roof. This 9-in-12 roof has a slope factor of 15. (You can get this number right off your framing square in the line named "length of common rafters per foot run.")

It's not hard to plug these values into the formula and get the answers. To determine A2, you use the formula as shown: (46÷12) x 15 = 57½ in. To determine Bl, you have to invert the formula because the known quantity, Al, is the hypotenuse of the larger right triangle, not the long leg as in the smaller triangle. So, (A÷slope) x 12 = B or (106÷15) = 84$^{13}/_{16}$ in. The difference between Bl and A2, 27$^{5}/_{16}$ in, is the length of the rough opening. The width of the skylight can vary and doesn't really affect this layout.

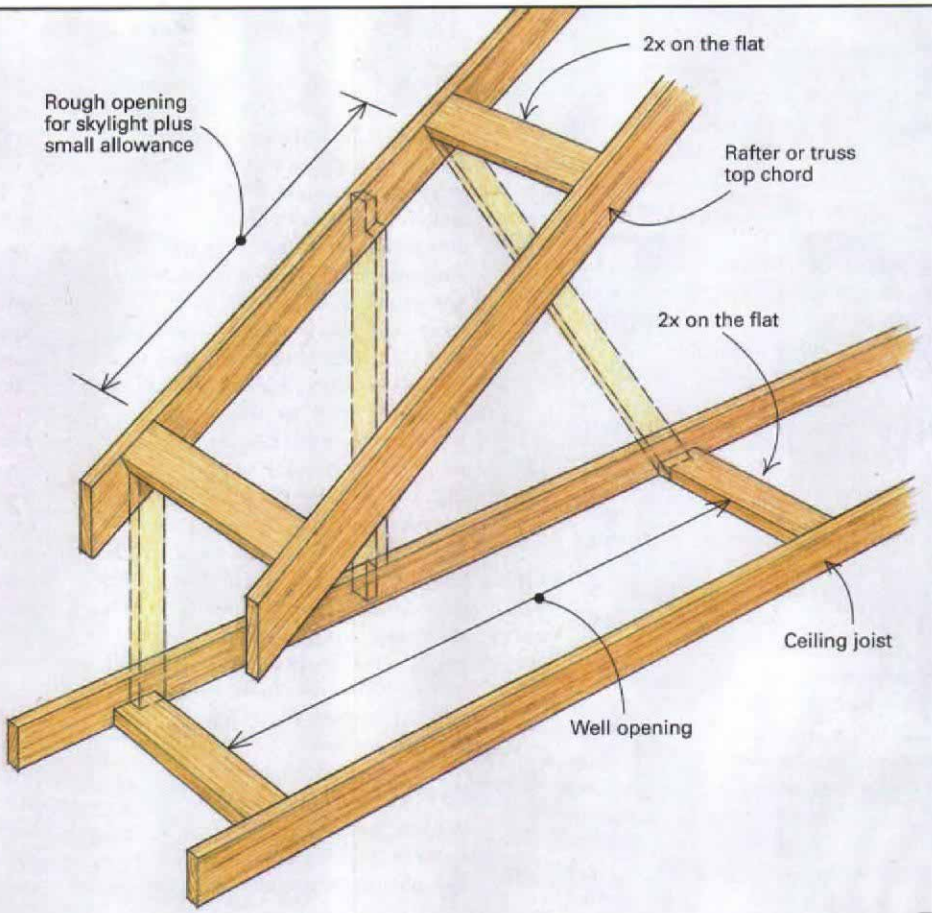
With these numbers in hand, I can order the skylight that comes closest to my design goals. I'd wait until I had the unit on the site before I framed the openings and built the well. ***—D, H.***



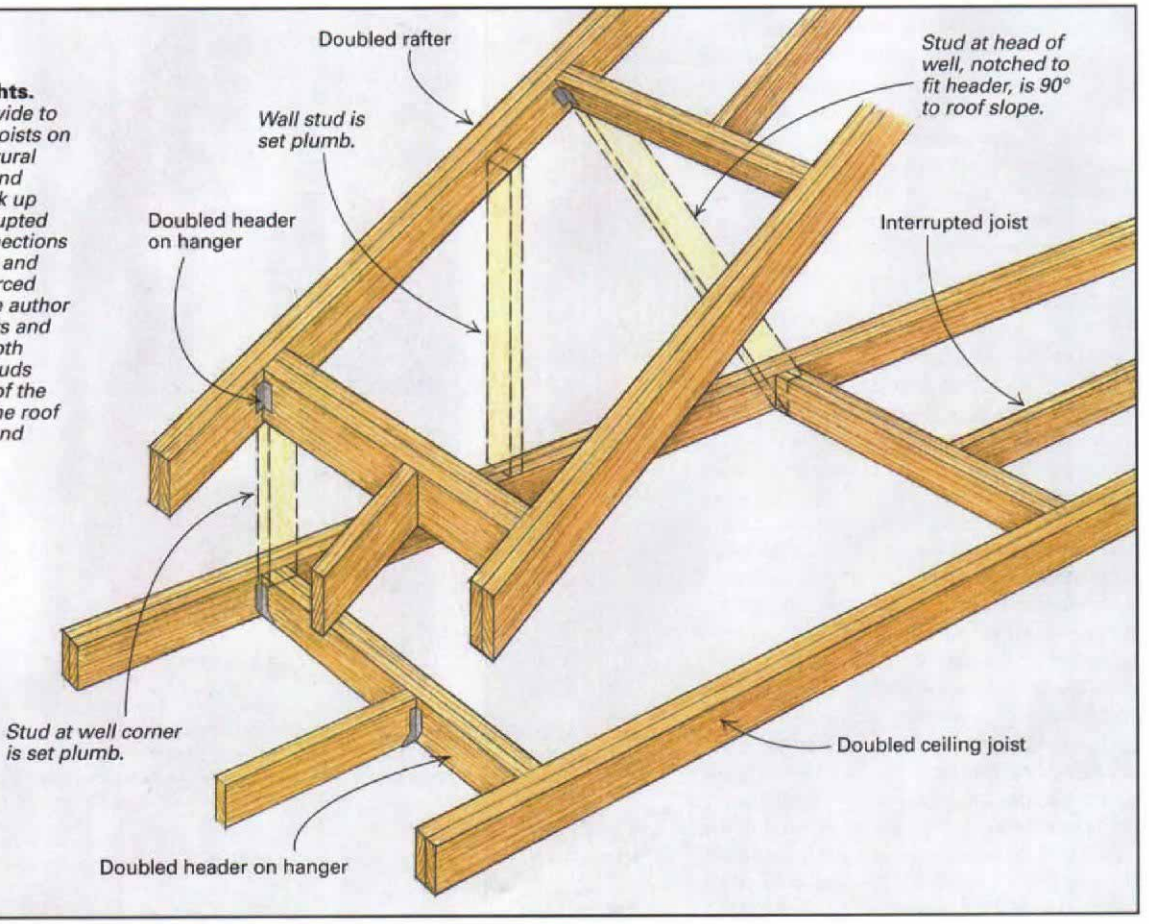
Laying out the well and roof opening. *Framing for a skylight usually requires two different size openings—one in the roof and one in the ceiling. You may start by knowing the size of one of them but not the other. If that's the case, a simple formula can help you calculate the size of the second opening and complete the layout for framing.*

Drawings: Vince Babak

Framing for single-bay skylights. *When a skylight will fit between rafters or roof trusses, the top and bottom plates of the well walls can be 2xs nailed on the flat. These 2xs won't carry any loads from interrupted roof or ceiling members and must support only the weight of the finish material inside the well. The openings in the roof and the ceiling are connected with studs the same width as the wall framing. That allows the well to be insulated just like exterior walls. The high-end wall of the well is 90° to the roof slope; the low end is plumb.*



Framing wider skylights. *When a skylight is too wide to fit between rafters and joists on standard spacing, structural members must be cut and headed off. Headers pick up the load from the interrupted rafters or joists, so connections between headers, joists and rafters should be reinforced with metal hangers. The author doubles up both headers and framing members on both sides of the opening. Studs that form the high end of the well, perpendicular to the roof plane, are notched around the header.*



the skylight well. This method is a lot faster than framing everything and then going back later to frame in the roof opening—especially when the roof opening wouldn't require headers if located properly. A potential drawback is when a shift in rafter or joist spacing means there will be too great a span for roof sheathing or material I'm going to use on the ceiling. If that's the case, I just drop in an extra rafter or joist to keep spans within allowable limits.

In a retrofit, it may be easier to start the layout at the ceiling. This is especially true when you're trying to avoid an obstruction inside, like a wall, and the location of the skylight on the roof isn't critical. But be careful to avoid vents, roof valleys and other obstructions.

Framing on the roof–Once I know where the well is going, I plumb up from the floor to the ceiling joists and mark one end of the well wall. Those marks can then be transferred to the roof plane, and the roof opening marked on the rafters. I usually add a little bit to the length of the rough opening, 1 in. to 1½ in., and I'll tell you why a little later. The width of the opening should be exactly what the skylight manufacturer specifies. I'll complete the ceiling and well-wall framing from the inside a little later, but once I've marked the rough opening for the skylight on the rafters, I'm ready to frame the skylight opening at the roofline. This is the first step, whether it's new construction or a retrofit.

How I frame the opening depends on whether the skylight will fit between framing members on standard spacing. If the size of the skylight won't require that any rafters be cut, 1 use single framing members laid flat (parallel to the roof slope) between adjacent rafters to serve as the top plates for the end well walls that I'll build shortly (top drawing, facing page). If it's necessary to cut structural members and head off the framing (top left photo, this page), the standard practice is to double the adjacent framing members (rafters and ceiling joists) that are not cut, and double and set on edge the cross framing, or headers (bottom drawing, facing page).

You should use metal hangers on all connections because the headers are now carrying the load of the interrupted joists or rafters (top right photo, this page). If you have to head off an interrupted rafter, the opening may be too large for the skylight. If so, a single rafter between the headers will narrow the opening to the right size (bottom photo, this page). As a general rule, if I must head off more than one joist or rafter, I'll have the design checked by an engineer.

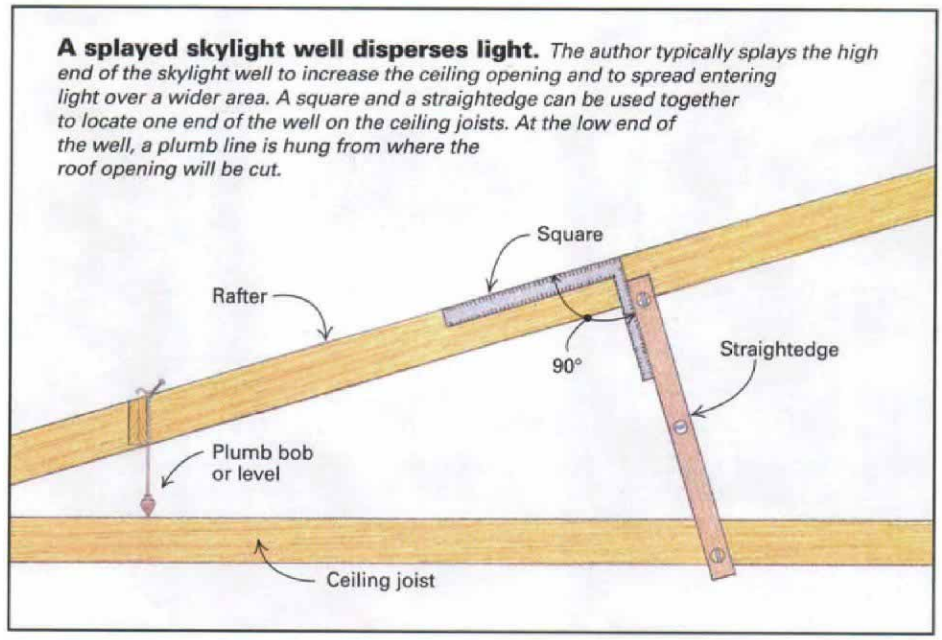
Finally, the roof sheathing goes on right across the opening. I don't cut the sheathing until I'm ready to install the skylight. That means the job site will be safer because there's one less hole on the roof to fall through, and the house will be less prone to weather damage.

With the rough opening framed in the roof, I can plumb down to the ceiling joists at the low end of the well and mark the location for the wall there (drawing this page). The wall at the high end of the well is perpendicular to the roof, and I use a framing square and a straightedge from the roof to locate the inside of the well wall on

Make way for a skylight. If a skylight can't fit between framing members, a rafter will have to be cut back. Establish the cutline by holding a framing square to the inside of the adjacent rafter and marking the rafter to be cut.

Metal hangers for a strong connection. Because the header is supporting part of the roof load, the author uses a double 2x on edge and connects the header to adjacent rafters with metal hangers.

Establishing the well width. Using a short section of a 2x4, the author wedges a rafter in place and toenails it to the header. He'll add a metal hanger later to help carry the roof loads.



A splayed skylight well disperses light. *The author typically splays the high end of the skylight well to increase the ceiling opening and to spread entering light over a wider area. A square and a straightedge can be used together to locate one end of the well on the ceiling joists. At the low end of the well, a plumb line is hung from where the roof opening will be cut.*

the ceiling joists. The ceiling opening can then be framed in the same way the roof opening was.

Framing the well—I install the four corner studs of the well after the plates or headers have been nailed between the rafters and the joists. In my part of the country, energy codes require that skylight wells be insulated, so I use the same size framing members for the well as I do for the wall studs (usually 2x6s). For single-bay skylights, with top and bottom plates of the well walls made from 2xs on the flat, the easiest way to measure for the well corner pieces is to cut the top end of the studs at 90° or at the slope of the roof, depending on which end of the well I'm working on. I make the studs a couple of inches longer than their finished lengths. With locations for bottom plates marked on the ceiling joists, but the plates not yet installed, I hold the corner pieces in place and mark them at the bottom edge of the ceiling joist to get an exact measurement for length. Before cutting, I deduct 1½ in. for the thickness of the bottom plates.

Using the same same technique for determining length and angle, I fill in the side and end framing, spacing the studs just like those in the wall framing (for 2x6s, that would be 24 in. o. c.). On the well's sidewalls, I usually have only a single rafter or joist at top and bottom to which I nail the studs, so I notch the studs over the rafters and the joists to get better nailing,

Framing the well is a little different when structural members, either rafters or ceiling joists, are cut to accommodate the skylight. In that instance, the 2x headers will be on edge. At the high end of the well, the tops of the studs are cut square. The bottom of the studs are notched around the header so that the wall of the well will plane smoothly into the ceiling. The wall at the lower end is framed just the opposite way, with square cuts at the bottom and angle cuts at the top.

After the well has been framed, I drive nails up through the roof at the corners from the inside, mark the dimensions of the opening on the roof and then cut the opening.

Making final adjustments in the well—Here's why I usually allow a little extra room in the length of the well: The wall on the low end of the well is plumb and therefore intersects the roof plane at an angle. That makes it a little tricky to predict where the line of the wall will emerge through the roof sheathing. It's easier to make the finish opening a little smaller after it's framed than it is to enlarge it once all the framing is in place. So I shim the lower end of the wall out after I've put the skylight on the roof and can measure exactly how much space I have to take up.

I go through this trouble so that the finish material I use on the well lines up with the appropriate spot on the skylight frame. Some skylights have grooves cut in the bottom edges of the frame. These grooves accept the finish material on the sides of the well and make a clean finish. There isn't much room for error in the well framing. After the roof opening has been cut, I remove the sash from the skylight, put the frame on the roof and check the framing (top photo, p. 70). With a fixed unit, this step may require two people: one outside and one inside. If I'm using ½-in. drywall on the inside of the well, for instance, I'll use a scrap of ½-in. plywood as a gauge to align the well framing with the skylight frame (bottom photo, p. 70). At first glance this may not seem necessary, but because of the angle at the bottom of the well, it can be difficult to align the wall solely with a tape or by eye.

Framing in a truss roof—Framing in a skylight on a truss roof shouldn't be a problem as long as the skylight fits between the typical 24-in. o. c. spacing of the trusses. Because you can't modify trusses in the field without consulting an engineer, a skylight that's too big for this opening can be a problem.

I first would use two or more smaller units that would fit within standard framing. The skylights can be ganged together, either side by side or top and bottom, with manufactured flashing designed to span typical framing-member widths. If you place the units side by side, you will build two identical wells separated by a truss.

In new construction, another option is to plan the truss design to allow for a larger opening. This typically means leaving out one truss to create a nominal 4-ft. opening. Be sure to notify the truss manufacturer so that appropriate adjustments can be made to the design (for more on roof trusses, *see FHB* #89, pp. 4045)

If I'm leaving out a long-span truss for a skylight (and the plan has been okayed by an engineer or the architect), I'll fill the area between full trusses with what I call ladder framing. This consists of 2xs nailed on edge with hangers at each end laid out to align with my sheathing courses. □

Doug Hopper is a builder in Tacoma, Wash. Photos by Scott Gibson.

Making a skylight well with plywood

by Larry Haun

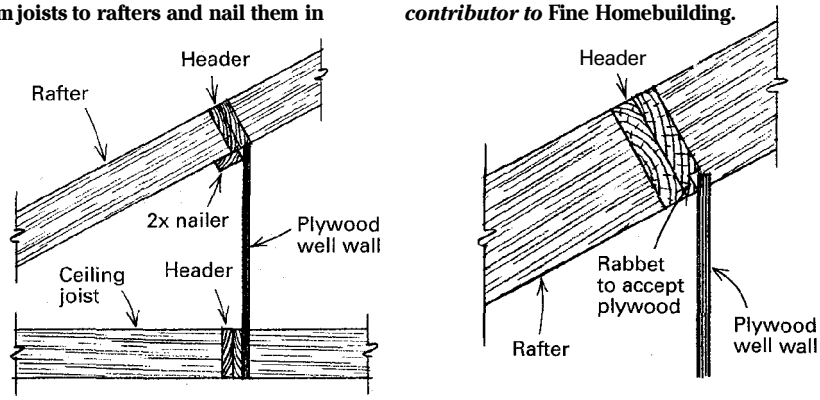
Sloped lightwells are open to many variations. They can be sloped on four sides, sloped on one or two sides only, or even sloped more on one side than on another. I've found the easiest way to build the well, especially when it is irregular, is to use sheets of ¾-in. plywood (drawing below) rather than make a 2x frame.

I frame the rough opening in the ceiling ¾ in. larger all the way around. Then, on the underside of the rafter opening, I nail a 2x back from the edge of the end headers and side rafters by at least ¾ in. When the shaft angle is steep, I nail the 2x farther back from the edge so that the plywood sheets will line up with the edge of the roof opening. The steeper the angle of the well, the more setback will be required in the 2x nailer.

Next I cut sheets of plywood that fit from joists to rafters and nail them in place. This is a good place to use scraps. If the shaft is long, more than 3 ft. or 4 ft., I nail a 2x4 band around the outside of the well to stiffen the plywood structure. Drywall can be nailed or screwed directly to the plywood on the inside, and insulation stapled to the back.

An easy alternative to using 2x nailers is to cut a simple rabbet in the bottom of the rafters and the headers before they are installed. Plywood used for the walls of the well fit into the rabbet. I cut the rabbet with a circular saw and make it at least ¾ in. deep by about 1 in. wide. Make sure the wood is supported and held firmly in place. Once the rabbeted members are in place, the edges of the ¾-in. sheets can be nailed snugly into place.

***—Larry Haun is a carpenter in Los Angeles, Calif., and a frequent contributor to* Fine Homebuilding.**



A plywood well minimizes framing. *Another method of making the well is to use plywood instead of 2x framing members. At the bottom of the well, the plywood is nailed to the inside of the headers and joists. At the top of the well, the plywood can be attached to a 2x nailer (drawing on left) set back from the edge of the header or set into a rabbet (drawing on right). Rabbets also can be cut into rafters and joists to accept the plywood walls on the side of the well.*