Framing a Second-Story Addition

A quartet of gables is linked by California-style valleys

by Alexander Brennen

Almost every day the local refuse company parks a debris bin in front of some house in Albany, California. The bin usually means that a crowbar-wielding crew will soon arrive to tear the roof off the house, signaling the start of another second-story addition.

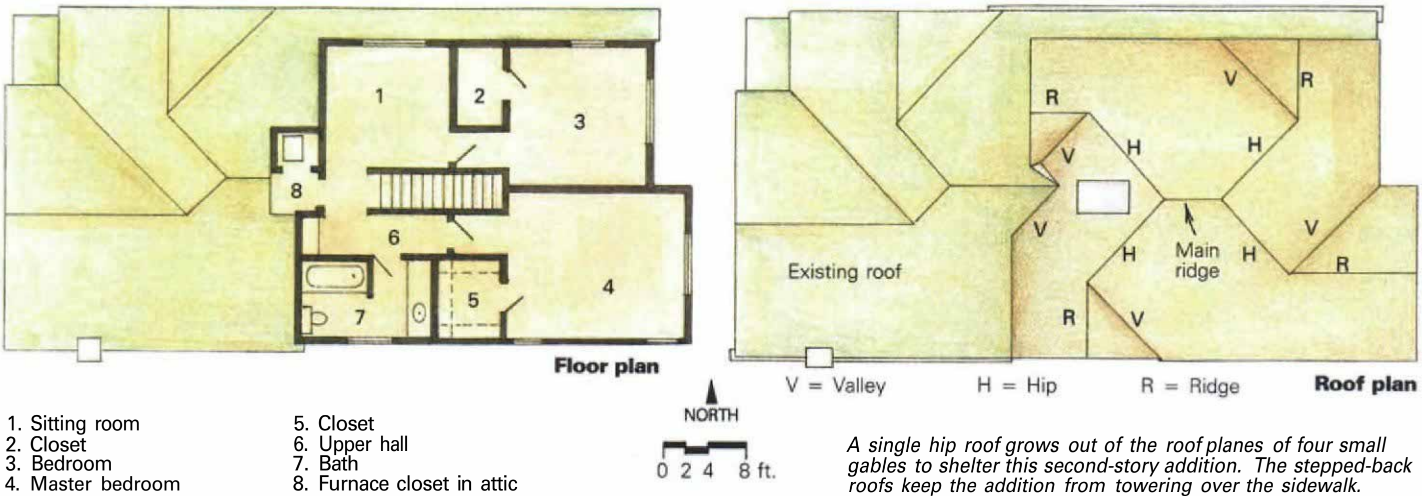
In this neighborhood of two-bedroom, wartime tract houses it's commonplace for families to add another level of living space atop their original house. Unfortunately, these additions often show little regard for the original shape of the building or the shadows cast across the neighbor's house and yard to the north. Recently, my partner Michael Keenan and I added a second story to a house in Albany that we think is in keeping with the style of the original structure. Our clients, Joe and Denise Lahr, felt that one of the reasons many second-story additions look out of place is that their height is out of proportion to the original house. To make sure their addition remained in scale with the rest of the building, the Lahrs wanted to keep the highest portion of the roof well back from the sidewalk, with the roofs stepping up as they moved toward the back of the house. The footprint of the original building was basically a rectangle, but it had an appealing roofline because its relatively steep 9-in-12 gable roofs intersected one another in a pleasing asymmetrical geometry of differing ridge heights.

The Lahrs' architect, H. M. Wu, met their needs with a second floor topped with an arrangement of four gables organized around a central hip roof. In plan, the configuration looks a little like a pinwheel (roof plan, facing page). Each gable shelters a distinct part of the addition—one for the sitting room, one for the bathroom, and one each for the two bedrooms. In the center of the plan, a skylit stairwell leads to the upstairs hallway (floor plan, facing page).

The architect kept the walls as low as possible by giving them a 6-ft. 6-in. plate height. Except for the hallway, each room has a cathedral ceiling, so the low plate doesn't make the rooms feel claustrophobic. The flat ceiling over the hallway is 7 ft. 6 in. high, which leaves enough room above it to run heater ducts for the upstairs rooms.

Hip rafters extending upward from the ridges of each gable meet at the main ridge, forming the tallest of the new roofs. This big hip roof links the four new gables, and repeats the form of the original hipped portion of the roof (photo above).

First, remove the roof—We started our work by stripping the shingles from the south side



1. Sitting room
2. Closet
3. Bedroom
4. Master bedroom
5. Closet
6. Upper hall
7. Bath
8. Furnace closet in attic

A single hip roof grows out of the roof planes of four small gables to shelter this second-story addition. The stepped-back roofs keep the addition from towering over the sidewalk.

of the old roof, letting them fall onto the driveway. Then we pulled out the 1x8 sheathing and the 2x4 rafters. The north side of the roof was very close to the property line, and we didn't want the neighbor's yard cluttered with roof debris. To prevent that, we cut the north side of the old roof into 3-ft. sq. chunks, using a worm-drive circular saw and a 24-tooth carbide blade with wide-set teeth. The wide-set teeth keep the blade from building up a thick layer of asphalt while cutting through the shingles, and the carbide stands up to the many nails that get cut during this kind of work. Since completing this job, we've started using the "negative-rake" carbide blades for this kind of demolition work.

New piers, new beam—The original footings of the house were sturdy enough to take the weight of the addition, but calculations revealed that raising the original wall would shade the neighbor's solar panels. To keep the sun shining on the panels, the Lahrs asked that the addition's north wall be placed 3 ft. south of the existing foundation line. For solid bearing, we needed a beam supported by two 3-ft. sq. by 18-in. deep piers under the house. We used army shovels to excavate the pier holes in the cramped crawl space.

Excavating footings in a crawl space is just plain disagreeable. Fortunately, it's pretty easy to get the concrete under the house with the variety of pumps available today. We used a grout pump with a 2-in. hose for this pour. The small-diameter hose is really maneuverable in a confined space, but it requires small aggregate—⅜-in. pea gravel—and six sacks of cement per yard of concrete (instead of the typical five) to reach a strength of 2,500 psi.

Piers in place, we turned our attention to the original south wall of the house. The second-floor joists of the new addition would bear on the wall's top plate, so we wanted to make sure that it was level. If it wasn't, subsequent construction would require tedious adjustments. Most of the houses around here have settled somewhat, and this one was no exception; we had to remedy the situation.

The existing ceiling joists (over which we were framing the new floor) were rough-sawn 2x4s varying in width from 3½ in. to 4 in. Between each ceiling joist we nailed a pair of 2x4 blocks, face down, using four 16d box nails in each block. The doubled blocks added 3⅛ in. to the height of the top plate. We then notched each ceiling joist to be slightly below the doubled blocks, and ran a continuous plate across all the blocks and joists as a base for the second-story floor joists.

Next we set up the transit on top of the old ceiling joists to check the plate for level. As an aside, I should mention the importance of setting up the transit over intersecting walls so that the tripod legs have solid bearing. If you set up mid-span over flexible joists, you may spend time wondering just when your transit went out of adjustment.

We checked the heights of all the surfaces we were going to build upon, and sure enough, the building was tilted. We were, however, surprised at the severity of the problem. One end of the wall was 2½ in. lower than the other end. We ripped 2x4s into long shims with a bandsaw to level things up. This is the kind of discrepancy that stucco is very good at hiding.

We positioned our new footings in the crawl space so that they fell directly below existing walls of the downstairs bedroom closets. That allowed us to insert the new posts into the walls from the closet sides of the walls, thereby preserving the finished wall surface in the adjoining bedroom and bathroom. The post on the east side of the house tucks into the exterior wall, and we installed it from the outside.

The beam that rides on the three posts is built up from three 2x12s, spiked every 8 in. with 20d nails. Because the beam is wider than the wall that it rests on it, we aligned its inboard edge with the inside of the new wall. The 2x8 joists of the new floor are supported by joist hangers and a ledger nailed to the side of the beam (drawing next page).

Framing the gables—Layout of the stairwell and joists was next, and to nobody's surprise the existing building was not square. After nailing down our plywood subfloor, we squared the new outside walls as best we could by dividing the error as we snapped our chalklines for the wall. At one end the wall plates project 3/16 in. beyond the edge of the subfloor, while they fall 3/16 in. inside the edge of the subfloor at the other end. Once again, the stucco would hide the discrepancies.

Before framing the rake walls at the end of each little gable, we snapped chalklines on the subfloor to mark their full scale dimensions, along with all stud and header locations. That allowed us to take direct measurements for the angled studs that intersect the top plates. We positioned the chalkline for the bottom plate to coincide with the plate's baseline so that we could frame the first wall, stand it up and nail it in place, and then use the same layout marks to frame the opposite wall.

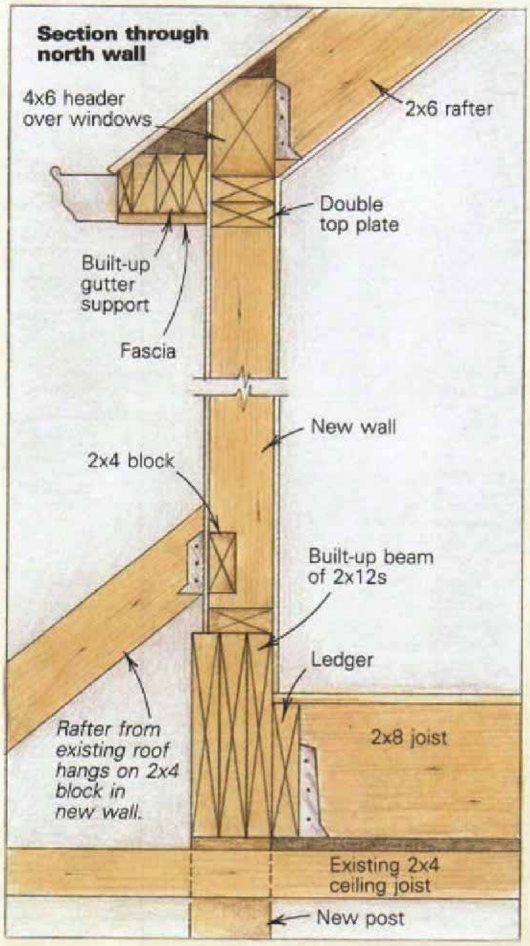
In order to keep the sidewalls low, we had to put the window headers on top of the wall plates and affix the rafters to them with joist hangers. The headers are 4x6s with a bevel along one edge to match the 9-in-12 roof pitch (drawing next page). Once the exterior walls were sheathed with ½-in. plywood, we placed our doubled 2x10 ridge beams and began installing the common rafters (bottom left photo, p. 79).

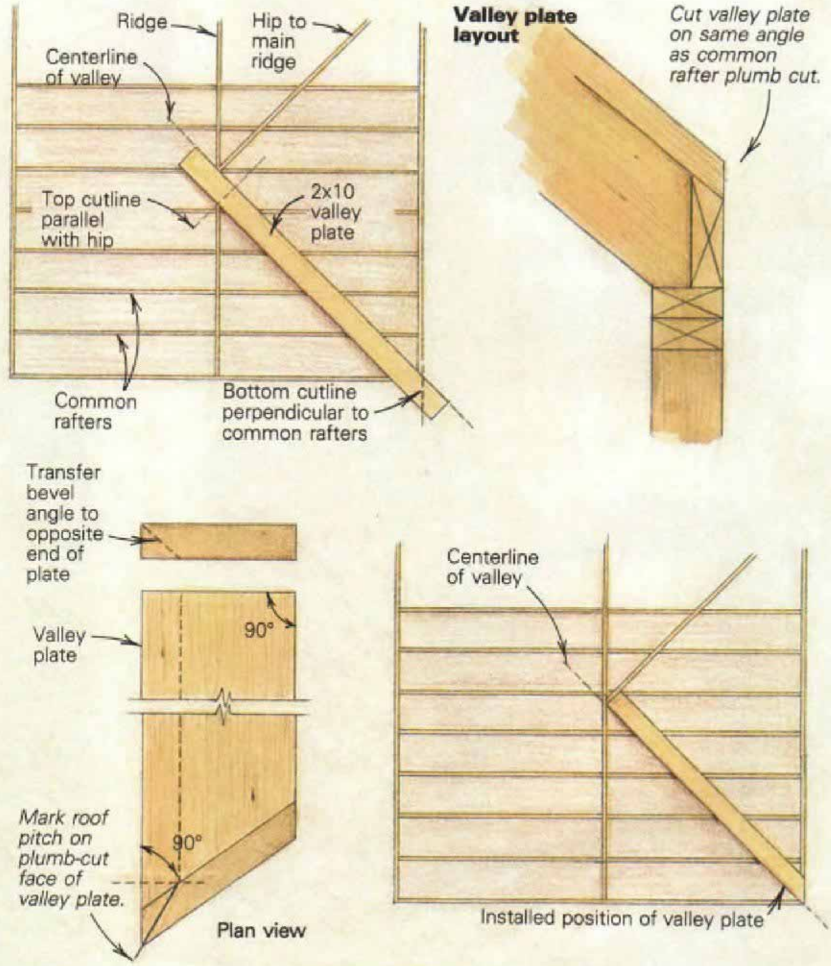
Three pairs of common rafters meet at the main ridge. To set this ridge, we first cut the common rafters that join it, and adjusted their length to accommodate the thickness of the ridge. Then we nailed the tails of the rafters to the wall plates, while aligning the ridge by hand between them. In this manner the height of the ridge was automatically set, and we could then bring a bearing wall from below to carry its load.

As anyone who has done any framing knows, it is especially gratifying to see the walls and rafters in place. All the drudge work in the crawl space starts to pay off when the bones of the building begin to give it shape. On this job, everything had been going well—too well.

After setting the main ridge and some of its common rafters, we noticed that the inboard gable-end wall in the master bedroom had gone out of plumb where it met the exterior wall. When building this rake wall we had been unable to install a post directly under

Drawings: Michael Mandarano





its ridge because of plans to install a heating duct there. There were no horizontal top plates to stop the top of the wall from spreading as we added the weight of the rafters in that bedroom, as well as the rafters supporting the main ridge. When we spotted the problem the wall was out of plumb by ¾ in., and we had the uneasy feeling that the error was compounding at a slow but steady pace. We needed a quick and effective fix.

The interior east/west wall of the master bedroom was still plumb, so we braced it with angled studs nailed to the floor and tied a come-along to its top plate. Then we looped the come-along cable around the top plate of the exterior wall. Before winching the wall back toward the house, we placed floor jacks underneath the main ridge of the house and the ridge of the master bedroom. That allowed us to relieve the load on the exterior wall that was driving it outward while we winched the wall back a little past plumb. Then we sheathed the overloaded wall with ½-in. CDX plywood and linked the opposing rafters with 2x4 collar ties a couple of feet down from the ridge. The wall did spring back to about ⅛ in. out of plumb after we removed the jacks and the come-along. That's a discrepancy we can live with.

California framing—With the main ridge set and the frame bolstered against movement, we were ready to install the four hips and four valleys. As shown in the roof plan (previous page], the hips extend from the ridge beam of each gable to the main ridge beam. Because the hips meet their ridge at 45° in plan, we made the double cheek plumb cuts on their ends with the circular saw set at 45° (for more on the mechanics and theory of roof framing, see *FHB* #57, pp. 78-83).

Our crew uses the "California-style" valley for roofs. Instead of jack rafters from intersecting ridges meeting at a valley rafter, a California valley is built on a 2x plate that lies flat atop the common rafters of one of the gables (bottom right and top photos, facing page). We use this method because it takes less time to build than conventional valleys, and in this case, we wanted as many common rafters as possible in the individual gables because the drywall ceiling is affixed directly to their bottom edges.

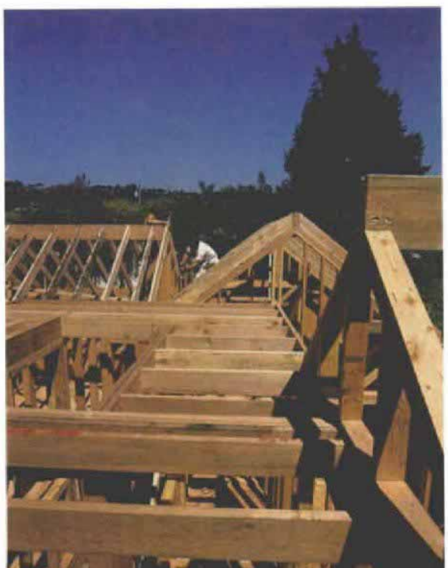
To make a California-style valley, we first snapped a line across the tops of the common rafters to mark the centerline of the valley where the two roofs would intersect. Then we laid a 2x10 next to the chalkline, as shown in the drawing above. Using a straightedge, we marked two cuts on the plate. The bottom cut is perpendicular to the common rafters, while the top cut is parallel with the hip rafter. The length is found by measuring in place.

We made the bottom cut with the circular saw set to the plumb cut for a 9-in-12 roof, which works out to 37°. This puts the face of the cut in plane with the sides of the intersecting rafters. On the face of the cut, we marked a 9-in-12 pitch line to represent the plane of the tops of the interesecting rafters. The leading edge of the valley plate should be beveled to this line. The plan view of the plate shows how the pitch line can be transferred to the opposite end of the plate, where you can make a direct degree reading. We typically bevel these plates on our 12-in. bandsaw before nailing them in place to the common rafters. Then we install blocks next to the plate, between each common rafter, as a nailing surface for the roof plywood.

We measured the jack rafters between the valley and the ridge in place. Their tops had the plumb cut angle of the common rafters, but with a 45° cheek cut to meet the hip rafters. Their bottom cuts were level, with the saw set at 37° to match the 9-in-12 pitch of the valley plate.

Before we sheathed the roof we laminated three 2x4s and a 1x4 directly to the walls for a gutter support that doubles as a narrow eave (section drawing above). We beveled the tops of the two outer laminations to be in line with the roof plane and finished the detail with a fascia board affixed to the bottom of the gutter support. □

Alexander Brennen is a partner in Zanderbuilt Construction in Berkeley, California.



Framing details. **Before the hip roof was erected, Brennen and his crew framed the four small gables that enclose the upstairs rooms (photo above). The joists in the foreground will carry the ceiling of the hallway. To the left is the skylight well. A California-framed valley relies on a valley plate for jack-rafter bearing rather than on a valley rafter (photo right). The plate is nailed to the common rafters, and its leading edge is aligned with the centerline of the valley. In the photo at the top of the page, the author aligns the lower end of the plate with the valley's centerline, while Michael Keenan snugs the upper end of the plate against a hip rafter leading to the main ridge.**