

Strengthening an Old Roof

by Gary Morrison



New LVL framing straightens and stiffens an underbuilt timber frame

As a remodeler on Boston's North Shore, I work on my share of older homes. But few are as old as one of my recent projects, which involved extensive structural repairs to a farmhouse originally built in 1723, with a "new" wing off the back dating to the early 1800s (see Figure 1, next page).

One fairly minor but challenging part of the job called for beefing up the roof framing in the original attic. It consisted of hand-hewn 6x6 rafters on about 8-foot centers, with unevenly sized but much

smaller purlins running the width of each bay and mortised into the rafters on either side. The original pine roof boards ran vertically from the ridge to the eaves, and were fastened to the purlins with wrought-iron nails.

Sistered Rafters for Strong Connections

There was little sign of rot or insect damage, and the rafters were straight and in good condition. The purlins, though, were another story: Too widely spaced

and obviously undersized for the span, they were sagging by an inch and a half or more at their midpoints. After a little head-scratching, I worked out a method of adding some new LVL purlins without disturbing the relatively new architectural shingle roof or tearing out any of the historic original framing or boards.

Rather than trying to fasten the new purlins directly to the uneven hand-hewn framing, we sistered the existing rafters with 2-inch by 7¹/₄-inch LVLs so we could easily tie everything together with joist

Strengthening an Old Roof



Figure 1. Though still intact after nearly 300 years, the framing of the gable roof needed reinforcement to eliminate a long-term sag of the roof deck between the widely spaced rafters.



Figure 2. The original undersized purlins were small-dimensioned pieces of timber hewn flat on two sides, with some of the bark left on. Their ends were carefully cut free of the rafters, creating space to insert LVL sisters.

hangers. Fitting the sisters was fairly slow going, because we had to cut both ends of each of the original purlins free of the rafters, using a short LVL offcut as a Sawzall blade guide (**Figure 2**).

Once we'd chopped out the narrow pieces of waste between the cut ends and the rafter, we slid the LVL into position, with its upper edge just touching the underside of the roof sheathing and the lower edge extending an inch or so below the bottom of the rafter. We fastened it to the rafter with 6-inch LedgerLok screws placed about 12 inches apart in a staggered pattern. Now that they were disconnected from the rafters, the original purlins no longer carried any of the roof loads, but merely functioned as battens to hold the roof boards in the same plane. I had worried that this might worsen the sag in the boards — at least until we could get the new purlins in place — but a few quick measurements put this fear to rest. (Fortunately it was mid-summer, so there were no unexpected snow loads to worry about.)

New Purlins and a Straighter Roof

After sistering each side-by-side rafter pair, we fitted new LVL purlins between them on approximately 2-foot centers, adjusting the placement as needed to avoid the original purlins. Space in the blazing hot attic was tight, making this an awkward task. Once each new purlin was in place, we used a pair of bottle jacks to drive it home just tightly enough to overcome the sag in the original boards (**Figure 3**). We tacked the purlins in position with a couple of nails before fastening them permanently with joist hangers. (Although conventional framing lumber would likely have been strong enough and would certainly have saved some money, at this point I was glad I'd chosen to play it safe with LVLs: Their uniform size and absence of crown made it much easier to judge when things were flat and straight.)



Figure 3. Bottle jacks and scraps of blocking were used to press the new LVL purlins against the roof boards (above left). A level cut at the base of each LVL sister sits flat against the existing timber plate. Working down the roof one rafter bay at a time, the crew temporarily secured each new purlin with a single nail at each end (above) before fastening the assembly permanently with joist hangers (left).



Since there was no way to gain access to the roof deck from above without tearing off the existing roof, we couldn't drive fasteners down through the roof boards and into the new purlins. I knew future snow loads would tend to push the boards more tightly against the framing, so I considered going without any fasteners at all in this area. In the end, though, caution won out. I came up with an indirect fastening method that involved screwing 1½-inch by 1½-inch lumber strips to the side of each LVL, with additional screws — sized to stop short of the roofing underlayment when driven home — passing through them from below and into the roof boards (Figure 4).

Gary Morrison is a residential remodeler in Beverly, Mass.



Figure 4. A 1½-inch by 1½-inch nailer fastened alternately to the purlins and the roof boards stiffens the assembly against racking without penetrating the existing roof shingles.