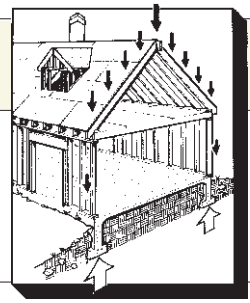

Framing With a Raised Rafter Plate

by Robert Randall, P.E.

The May *Practical Engineering* column looked at the issue of lateral thrust in roofs — the tendency for rafters to spread apart under load. Conventionally framed roofs (see Figure 1) are often strong enough to resist this lateral thrust as long as the carpenters use enough nails or bolts where the rafter laps the attic joist (though this can be a challenge in shallow-pitched roofs).

A problem with this framing detail, especially in cold climates, is that the attic insulation tends to get compressed above the wall plate. Even with ventilation chutes, the increased heat loss at the plates may contribute to ice dam troubles. So many energy-conscious builders use a "raised rafter plate" detail (Figure 2) which lifts the rafter end above the attic joist, allowing for more insulation over the wall plates. This helps to solve the heat loss problem, and also has other advantages: It creates more headroom and floor space in the attic, it allows more sunlight to come in below the roof overhang, and it gives a greater reveal outside for a wide frieze board above the windows.

Unfortunately, the structural requirements of this detail are often overlooked. The results can be disastrous, as the roof collapse cited in May's column illustrates. Toenailing the rafters to the raised plate — the most common job-site solution — will rarely provide a strong enough connection. A really industrious carpenter might get six or eight toenails into each rafter, but if the raised plate itself has been nailed off with one or two nails per joist, it won't matter.

Raised Plate Details That Work

Here are three simple details that work well (Figure 3). All rely on metal connectors available from Simpson Strong-Tie (1450 Doolittle Dr., San Leandro, CA 94577; 800/999-5099) and other manufacturers.

Detail A, the simplest, uses either the Simpson ST strap tie or the CS coil strap — galvanized steel straps

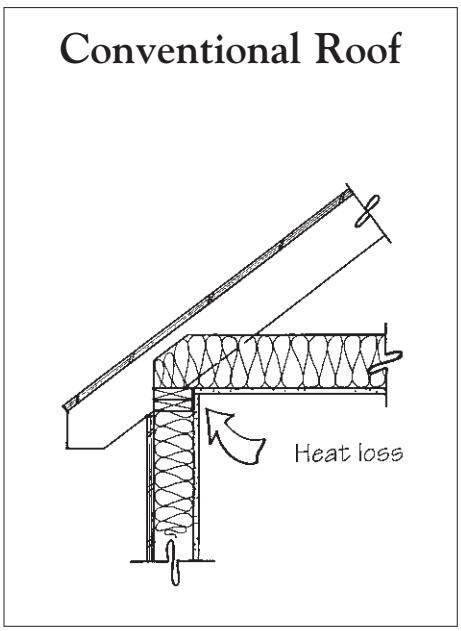

Figure 1. *Conventional attic framing provides a strong eaves tie connection where the rafter laps the joist, but it doesn't allow much space for insulation above the wall plates.*

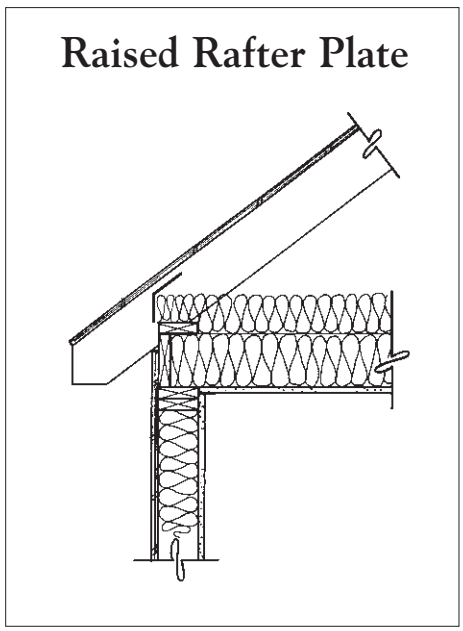

Figure 2. *The raised rafter plate allows room for insulation above the wall plate, but the lateral thrust of the roof must be accounted for in the design.*

Engineered Solutions

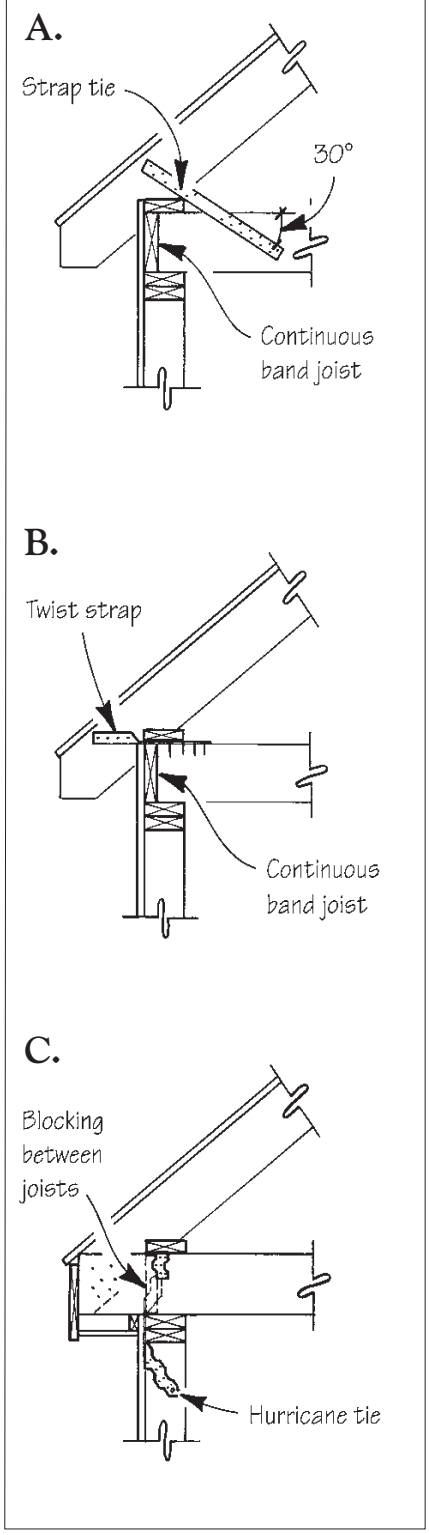

Figure 3. *When using a raised rafter plate, Simpson strap ties (A) are the easiest way to resist roof thrust, according to the author. When an attic floor is in the way, twist straps will work (B). Extending the attic joists beyond the walls (C) provides a strong rafter-joist connection, but may require additional hurricane ties to resist wind uplift.*

prepunched for the nails needed to carry a rated load. The Simpson catalog lists the capacity of each tie. Use the load calculation procedure from the May *Practical Engineering* article, increase the load by about 20% to allow for the slope of the strap tie, and just nail it in place with the nails specified in the catalog. For long spans, low roof pitches, or heavy snow loads, it may be easier to use two ties of lesser capacity rather than a single tie with 20 nails.

Note the placement of the exterior wall sheathing over the attic band joist, which provides a wind tie for the roof assembly. It also helps prevent ice dam leaks from getting into the wall framing.

Detail B allows for use of a plywood subfloor in the attic, which restricts the placement of the metal ties. In this case, you can use the Simpson TS series twist straps. Calculate the load as for Detail A, except there's no 20% increase because there's no angle involved. Because the twist straps are set perpendicular to the uplift force of the wind, Detail B has relatively poor wind lift resistance and may require supplementary wind ties in high-wind locations. By the way, remember to nail the twist straps to the joists before the plywood goes down.

Detail C provides excellent rafter thrust resistance because the joists extend past the wall plates and can be directly nailed or bolted to the rafters. The addition of a steel wind tie at alternate rafters, such as the Simpson H7 shown here, makes this a very dependable structural design. Note that the blocking above the plate is required by code to prevent the joists from rolling, but it also serves to prevent "wind washing" of the attic insulation. Dropping the soffit 2 inches helps prevent possible ice dam leaks. ■

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Curious about the forces that hold a building together — or cause it to fall apart? Address your questions to Practical Engineering, JLC, RR 2, Box 146, Richmond, VT 05477.