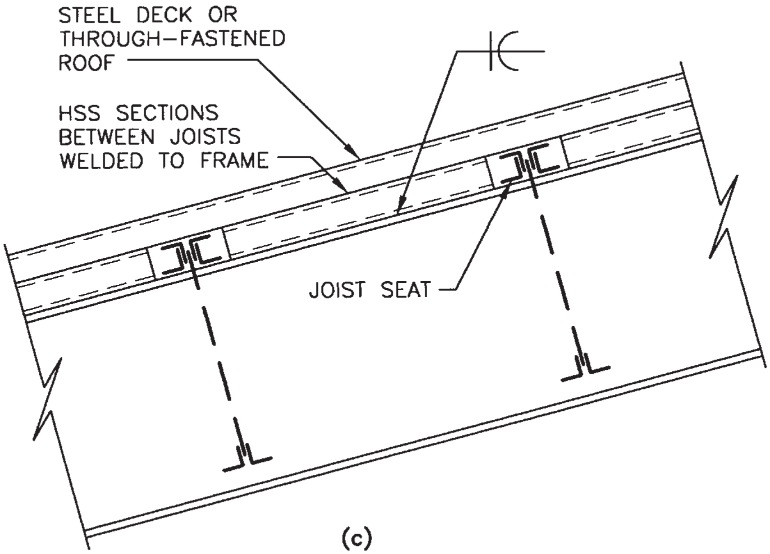
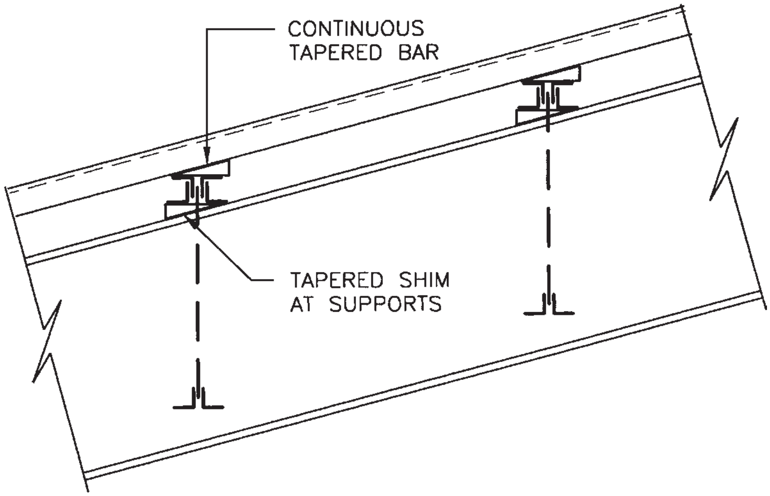


(c)



(d)

FIGURE 5.40 (*Continued*) (*c*) providing HSS collector elements at supports; (*d*) using tapered shims to avoid joist tilt.

The second approach is to avoid metal deck altogether and to provide closely spaced cross bridging instead, as in Fig. 5.40*b*. The bridging stabilizes the joists at close intervals, with the top chord angles—rather than the whole joist section—resisting the parallel-to-roof force component between the bridging. The criteria for joist design in this situation are given by SJI Specification[25] Section 5.8(g), which also states that some standing-seam roof systems "cannot be counted on to provide lateral stability to the joists." The specifiers need not get deeply involved in the joist design, other than to alert the joist manufacturer that standing-seam metal roofing will be present. It might be wise to add a note to the contract documents warning against relying on standing-seam roofing to laterally brace bar joists.

Another metal deck-related item to consider: The deck diaphragm is attached to the joists, not to the frame rafters, and lateral reactions accumulate at the joist seats before passing to the frame. The joist seats must be specifically designed to resist these significant lateral reactions trying to overturn them. To make the joist designer aware of this important issue, a note to that effect should be added to the contract documents. Alternatively, small tubular collector sections, with the height equal to the depth of the joist seats, can be welded between the seats (Fig. 5.40*c*) to relieve them from the overturning forces. The collector elements are routinely used in stick-built construction.

Very infrequently, a joist manufacturer may simply refuse to stand behind the tilted joist design and may insist on using the joists with vertically oriented webs. Then, it is possible to add to the regular joists (without a tilt) continuous tapered bars at the top chord and tapered shims at the supports (Fig. 5.40*d*). This design is obviously expensive, but it might be appropriate when heavy suspended items are attached to the bottom chords of the joists. One look at Fig. 5.40 should make clear that tilted joists are ill-equipped for that, except at the cross-bridging locations.

In this case, the design choices boil down to stipulating that all hanging loads occur at the cross-bridging locations, which requires an uncommon degree of coordination among several contractors; using the joists with extra heavy chords, an expensive proposition; or using the joists with vertical webs. The joists with vertically oriented webs can readily support hanging loads placed at the panel points—and even some loading between the panel points, if the joist webs are modified by the added angle pieces extending from the top-chord panel points to the hangers.

What happens to the joists and, more important, to the joist bridging at the ridge and the eaves? The ridge joists are spaced apart at the manufacturer-standard distance (Fig. 5.41), and they can be interconnected by cross-bridging. At the eaves, the bridging is attached to the eave struts; one such detail is shown on Fig. 5.42.

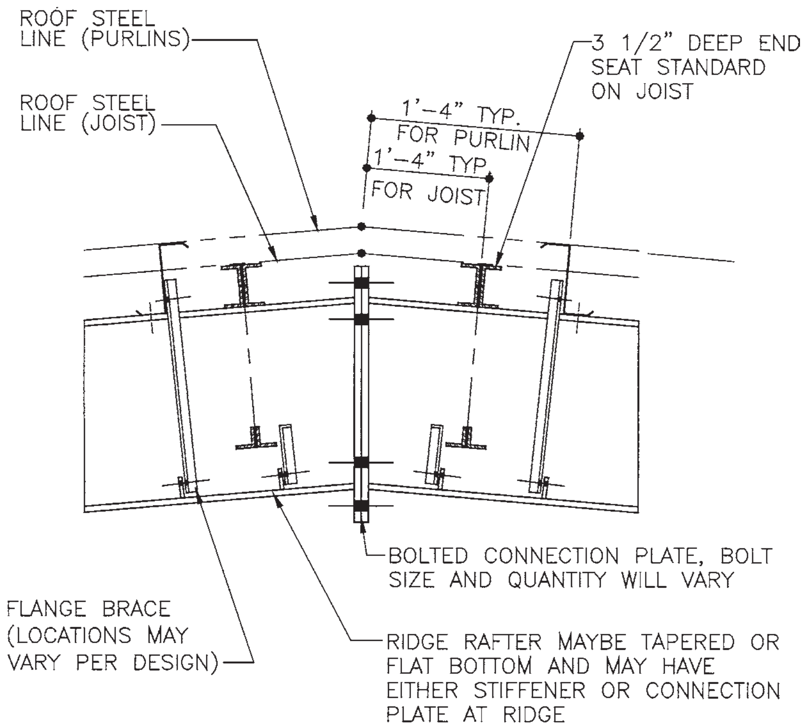


FIGURE 5.41 Composite detail at the ridge of a rigid frame, with standard offset distances shown for both Z purlins and open-web joists. Note the custom (3½ in) depth of the open-web joist seats supplied by this manufacturer. (*Nucor Building Systems.*)