The second approach recognizes a restraining action of the sag rods. The girts are considered laterally supported at each rod, and the sag rods are located as close together as needed for full efficiency of the girt section. This seemingly unconservative approach has been used for decades and has withstood the test of time.

For the unconvinced, here is one rationalization, as advanced by the author earlier.[27] In order for the interior flange to buckle laterally—the most probable mode of failure—it must rotate and move vertically. This movement is prevented both at the exterior flange by the siding fasteners and at the sag rod locations. The interior and exterior flanges are, of course, tied together by the web, which acts as a cantilevered beam in restraining the unbraced flange (Fig. 5.53). It is commonly assumed that the compression flange of a flexural member may be considered braced if the brace can resist some 2% of the compressive force in the flange. The bracing action of the web occurs, therefore, if the web is strong enough to resist this force by cross-bending. (For this model to work, the sag rods must be attached to the foundation.) The effective width of the web for this action is a matter of engineering judgment.

For girts deeper than 8 in, the web may be too thin for the cantilever action. In this case a few continuous lines of interior flange bracing, attached to the eave girt and to the foundations, may be needed to supplement the sag rods. Because the girts are hot-rolled, their bracing straps are usually hot-rolled as well, for example, 3 × 1/4 in. Unlike the light straps of Fig. 5.52, these should definitely be anchored to the concrete, not to the sheet-metal trim.

5.9 EAVE STRUTS

The third type of secondary structural members, after purlins and girts, is the eave strut. This unique structural element is located at the intersection of the roof and the exterior wall, so that it acts as both the first purlin and the last (highest) girt. The building's eave height is measured to the top of this member.

The term *strut* refers to another important function of this element: it typically serves as a compression member in the wall cross-bracing assembly and as a tie between such bracing assemblies located along the same wall. Accordingly, eave struts are often designed for the combined effects of flexure and axial compression. Because of their importance in metal building systems, eave struts have already been mentioned many times in this book.

The traditional shape of eave struts is a channel-like section of Fig. 5.1, which allows the roofing to be attached to the top flange of the member and siding to its web. Some manufacturers produce

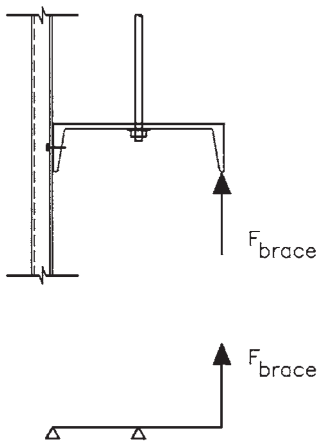

FIGURE 5.53 Web cross-bending.

unique shapes, such as the one shown in Fig. 5.54. Others manage not to have a structural member at the eave at all—the first purlin and the highest girt are separate members (Fig. 5.55)!

Depending on the magnitude of the web crippling stresses, the channel-like eave strut can be simply bolted to the top of the primary frame rafter (Fig. 5.56*a*) or be connected to it by purlin clips (Fig. 5.54). A reinforcing plate (Fig. 5.56*b*) can be added to facilitate transfer of axial forces from strut to strut.

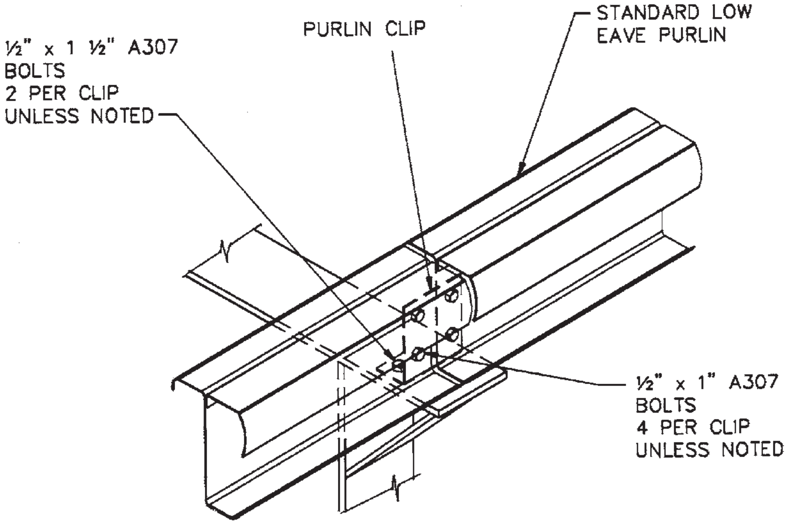

FIGURE 5.54 Proprietary eave purlin assembly. (*VP Buildings.*)

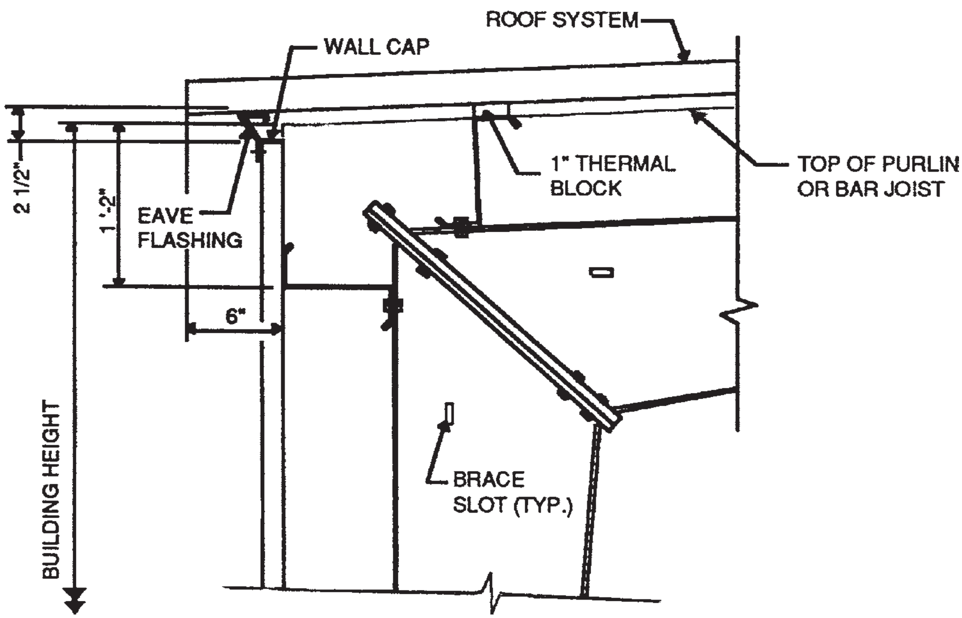

FIGURE 5.55 A system without eave struts. (*Steelox Systems, Inc.*)