ANSWER   Use a ⅝-inch-diameter threaded rod ($A_b = 0.3068$ in.²).

ASD SOLUTION   By inspection, load combination 3 will control.

$$D + S = 4342 + 8100 = 12{,}440 \text{ lb}$$

The component parallel to the roof is

$$T = 12.44\left(\frac{12}{46.6}\right) = 3.203 \text{ kips}$$

The allowable tensile stress is $F_t = 0.375F_u = 0.375(58) = 21.75$ ksi.

$$\text{Required } A_b = \frac{T}{F_t} = \frac{3.203}{21.75} = 0.1473 \text{ in.}^2$$

ANSWER   Use a ⅝-inch-diameter threaded rod ($A_b = 0.3068$ in.²) for the sag rods. Tie rod at the ridge:

$$P = 3.203\left(\frac{46.6}{45}\right) = 3.317 \text{ kips}$$

$$\text{Required } A_b = \frac{3.317}{21.75} = 0.1525 \text{ in.}^2$$

ANSWER   Use a ⅝-inch-diameter threaded rod ($A_b = 0.3068$ in.²) for the tie rod at the ridge.

For the usual truss geometry and loading, the bottom chord will be in tension and the top chord will be in compression. Some web members will be in tension and others will be in compression. When wind effects are included and consideration is given to different wind directions, the force in some web members may alternate between tension and compression. In this case, the affected member must be designed to function as both a tension member and a compression member.

In bolted trusses, double-angle sections are frequently used for both chord and web members. This design facilitates the connection of members meeting at a joint by permitting the use of a single gusset plate, as illustrated in Figure 3.33. When structural tee-shapes are used as chord members in welded trusses, the web angles can usually be welded to the stem of the tee. If the force in a web member is small, single angles can be used, although doing so eliminates the plane of symmetry from the truss and causes the web member to be eccentrically loaded. Chord members are usually fabricated as continuous pieces and spliced if necessary.

FIGURE 3.33
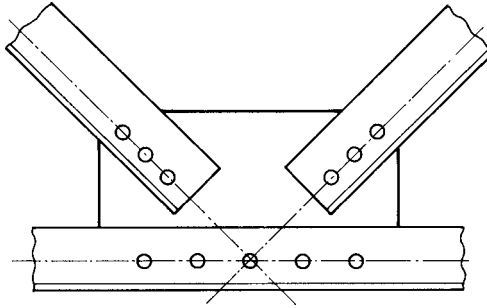
The fact that chord members are continuous and joints are bolted or welded would seem to invalidate the usual assumption that the truss is pin-connected. Joint rigidity does introduce some bending moment into the members, but it is usually small and considered to be a secondary effect. The usual practice is to ignore it. Bending caused by loads directly applied to members between the joints, however, must be taken into account. We consider this condition in Chapter 6, "Beam–Columns."

The *working lines* of the members in a properly detailed truss intersect at the *working point* at each joint. For a bolted truss, the bolt lines are the working lines, and in welded trusses the centroidal axes of the welds are the working lines. For truss analysis, member lengths are measured from working point to working point.

E X A M P L E   3 . 1 6

Select a structural tee for the bottom chord of the Warren roof truss shown in Figure 3.34. The trusses are welded and spaced at 20 feet. Assume that the bottom chord connection is made with 9-inch-long longitudinal welds at the flange. Use A992 steel and the following load data (wind is not considered in this example):

Purlins:	$M8 \times 6.5$
Snow:	20 psf of horizontal projection
Metal deck:	2 psf
Roofing:	4 psf
Insulation:	3 psf

FIGURE 3.34

8 @ 5'-0" = 40'-0"