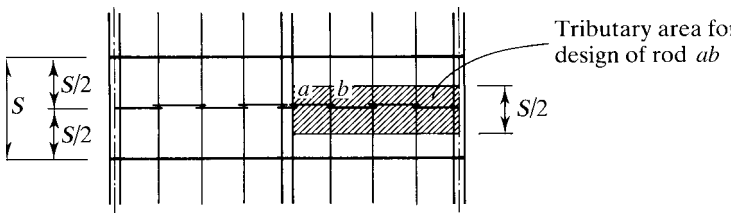
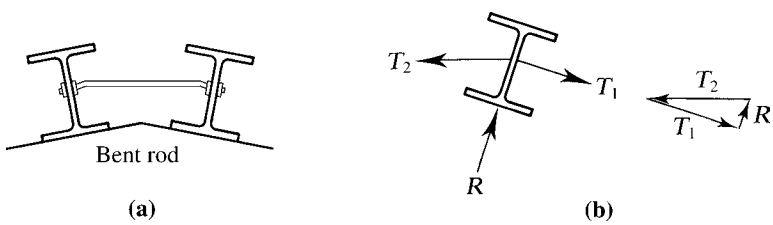
FIGURE 3.30



The extra amount of material in question is insignificant, and the use of the same size for each segment eliminates the possibility of a mix-up during construction.

A possible treatment at the peak or ridge is shown in Figure 3.31a. The tie rod between ridge purlins must resist the load from all of the sag rods on either side. The tensile force in this horizontal member has as one of its components the force in the upper sag-rod segment. A free-body diagram of one ridge purlin illustrates this effect, as shown in Figure 3.31b.

FIGURE 3.31



EXAMPLE 3.15

Fink trusses spaced at 20 feet on centers support W6 × 12 purlins, as shown in Figure 3.32a. The purlins are supported at their midpoints by sag rods. Use A36 steel and design the sag rods and the tie rod at the ridge for the following service loads.

Metal deck:	2 psf
Built-up roof:	5 psf
Snow:	18 psf of horizontal projection of the roof surface
Purlin weight:	12 pounds per foot (lb/ft) of length

SOLUTION Calculate loads.

Tributary width for each sag rod = 20/2 = 10 ft

Tributary area for deck and built-up roof = 10(46.6) = 466 ft^2

Dead load (deck and roof) = (2 + 5)(466) = 3262 lb

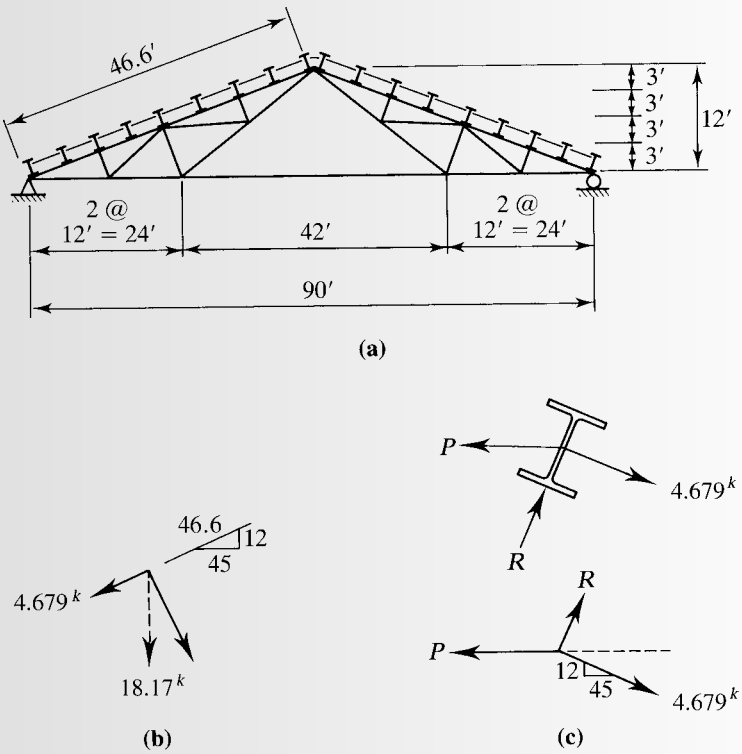
Total purlin weight = 12(10)(9) = 1080 lb

Total dead load = 3262 + 1080 = 4342 lb

Tributary area for snow load = 10(45) = 450 ft^2

Total snow load = 18(450) = 8100 lb

FIGURE 3.32



LRFD SOLUTION

Check load combinations.

Combination 2: $1.2D + 0.5S = 1.2(4342) + 0.5(8100) = 9260$ lb

Combination 3: $1.2D + 1.6S = 1.2(4342) + 1.6(8100) = 18{,}170$ lb

Combination 3 controls. (By inspection, the remaining combinations will not govern.)
For the component parallel to the roof (Figure 3.32b),

$$T = (18.17)\frac{12}{46.6} = 4.679 \text{ kips}$$

$$\text{Required } A_b = \frac{T}{\phi_t(0.75F_u)} = \frac{4.679}{0.75(0.75)(58)} = 0.1434 \text{ in.}^2$$

ANSWER

Use a ⅝-inch-diameter threaded rod ($A_b = 0.3068$ in.^{2}).
Tie rod at the ridge (Figure 3.32c):

$$P = (4.679)\frac{46.6}{45} = 4.845 \text{ kips}$$

$$\text{Required } A_b = \frac{4.845}{0.75(0.75)(58)} = 0.1485 \text{ in.}^2$$