larger stiffness, so it could be preferred if a lot of suspended items, which tend to locally distort the purlins, are anticipated.

The notes for the referenced tables state that in order to carry the design loading, both purlin sections must be laterally braced at a maximum distance L_y = 75 in, or 6.25 ft, and that purlin bearing clips are required at supports. The contract drawings should therefore specify:

- The design loads and load combinations
- The maximum spacing of lateral purlin bracing at 6.25 ft on centers (at one-quarter points of the span)
- Antiroll clips (or at least very sturdy purlin bearing clips) at each support
- The vertical deflection criteria (in this example *L*/150, but see discussion in Chap. 11 for other cases)

The contract drawings could include a suggested bracing scheme similar to Fig. 5.23.

5.6 OTHER TYPES OF PURLINS FOR METAL BUILDING SYSTEMS

5.6.1 Hot-Rolled Steel Beams

Hot-rolled steel purlins predate modern metal building systems by decades. A multitude of industrial buildings constructed since the beginning of the twentieth century utilized hot-rolled channel and I-beam purlins spanning the distance between roof trusses, a then-dominant type of primary roof framing. The beams are still popular among many engineers for heavy-duty industrial applications and can be used in pre-engineered metal buildings as well. The main advantage of hot-rolled steel beams lies is their higher load-carrying capacities as compared with light-gage sections. The beams may be useful for spans longer than 30 ft, an upper limit for economical use of cold-formed framing. Also, hot-rolled purlins are quite appropriate for heavy suspended or concentrated loads. Their chief disadvantage is a relatively high cost.

Hot-rolled shapes used as roof purlins include channels and wide flanges. Both can either bear on top of primary-frame rafters or be framed flush. The top-bearing design is usually more economical, since it avoids expensive flange coping. Hot-rolled purlins are frequently used in combination with steel decking, which can span longer distances than through-fastened roofing and makes better bracing. Purlin spacing is governed by the deck's load-carrying capacity.

Hot-rolled purlins at sloped roofs do not escape the parallel-to-roof component of gravity loads (Fig. 5.37*a*). This component can be resisted either by a properly attached and continuous roof-deck diaphragm (Fig. 5.37*b*), or by sag rods (Fig. 5.37*c*), the spacing of which is determined by analysis. A typical sag rod bracing assembly is shown in Fig. 5.38.

The closer to the ridge, the greater the tension in the sag rods, since the upper rods collect the loads from all the purlins below them. In fact, the rod loaded the most is the tie rod over the ridge. Because of its critical function, the tie rod is often made of plates or structural shapes, rather than round bars.

When sag rods are used for bracing the purlin's top flange, it is advantageous to locate them 2–3 in below the top of steel. This reduces the torsional moment M_z relative to the sag rod position at mid-depth shown in Fig. 5.37*c,* but still allows for a practical installation.

Unlike cold-formed C and Z framing, hot-rolled steel purlins can be readily designed for uplift, whether braced or unbraced between supports.

5.6.2 Open-Web Steel Joists

Open-web steel joists, also known as bar joists, can span longer distances than both cold-formed and hot-rolled purlins. Open-web joists are discussed in Chap. 3 (Sec. 3.4.1) as one of the most economical

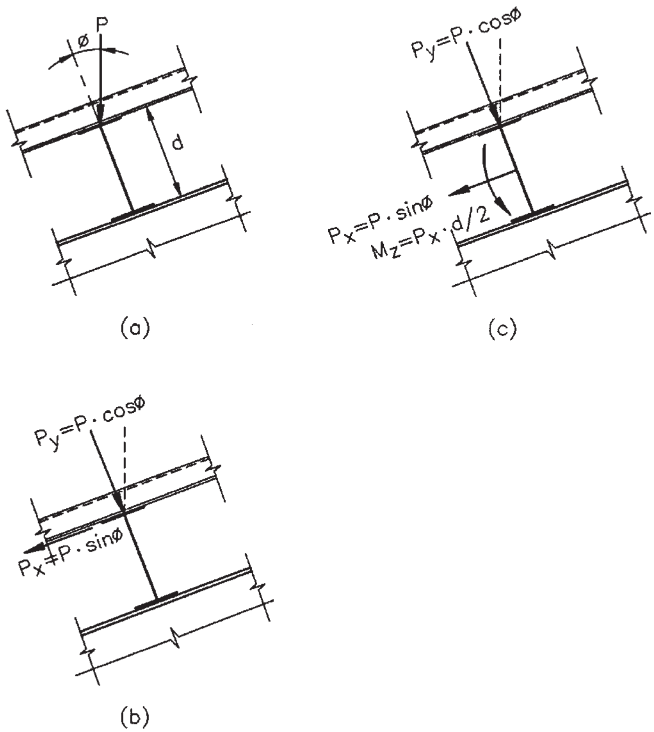

FIGURE 5.37 Forces acting on wide-flange purlins (the channel-type purlins are subjected to an additional twisting component due to asymmetry): (*a*) original force; (*b*) force resolution if roofing provides support for top flange, force P_x resisted by deck diaphragm; (*c*) force resolution if roofing provides no support, force P_x resisted by sag rods.

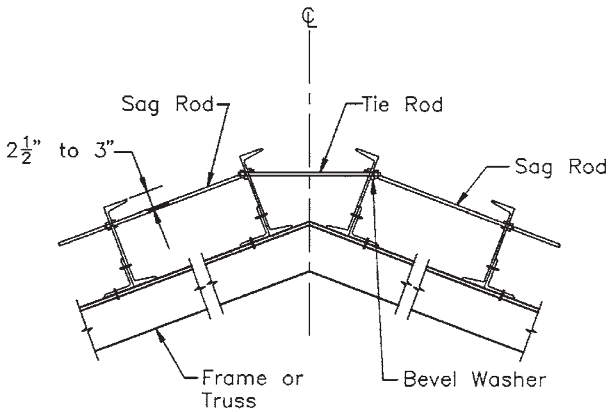

FIGURE 5.38 Typical sag rod details for hot-rolled purlins.