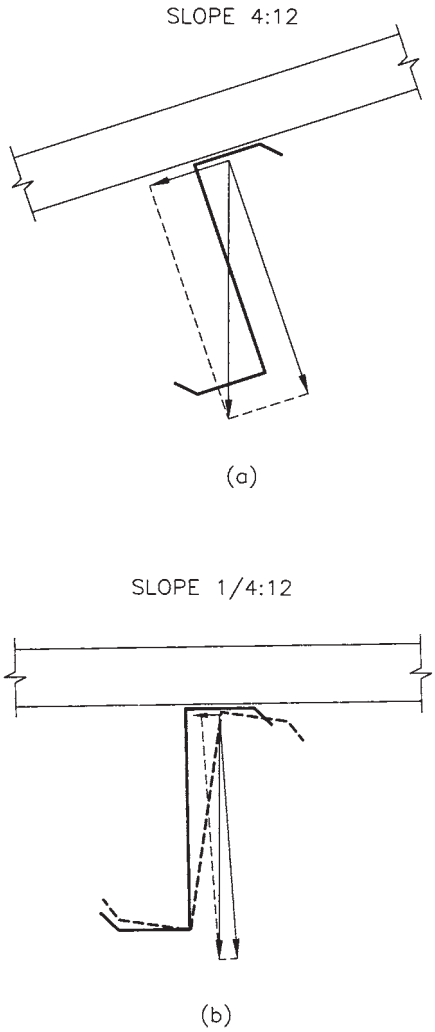

FIGURE 5.14 Gravity load applied at the top flange of Z purlin can be resolved into components parallel and perpendicular to the roof: (*a*) roof with a steep slope (4:12); (*b*) roof with a shallow slope (¼:12).

1. *To provide lateral flange bracing.* Depending on the load direction, either interior or exterior member flange can be in compression, and lateral bracing may be needed for both flanges. The closer the spacing of the braces, the smaller the unbraced length of the section in the weak direction.
2. *To restrain the purlin or girt from rotation and to relieve torsion.* Member rotation tends to occur under essentially any type of loading: gravity, wind, truly vertical or inclined, as should be evident from Fig. 5.14. In addition, as discussed in Chap. 3, pipes, ducts, conduits, and similar items are often suspended from roof purlins. Unfortunately, these are often attached to the bottom flanges of purlins with C clamps or eye bolts, exerting additional torsional loading on the purlins.

SECONDARY FRAMING: GIRTS AND PURLINS

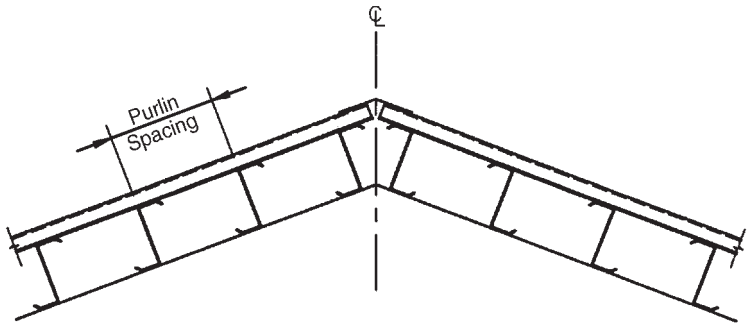

FIGURE 5.15 Typical purlin orientation in medium-sloped roofs.

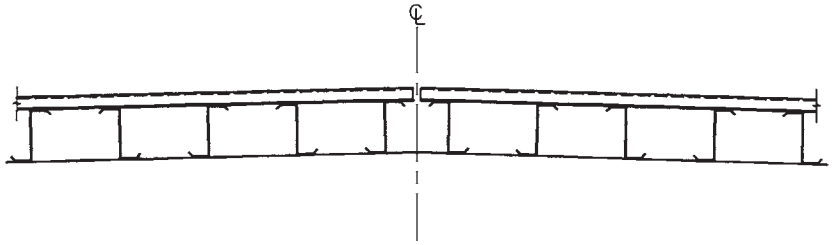

FIGURE 5.16 Possible purlin orientation at roofs with slopes less than 1:12.

Purlin bracing should help relieve this torsion. (Still, it is best to attach suspended items from the purlin web, rather than from the flanges. Another possibility is suspending them from a light-gage steel channel placed between two adjacent purlins. The channel would not only allow some flexibility of hanger location, but also provide some added bracing for both purlins.)

3. *To restrain the whole assembly of purlins and roofing from lateral translation.* Even if each member is properly braced laterally and torsionally, the whole single-slope roof assembly with purlins oriented in the same direction will tend to move upslope as a unit. The bracing system, therefore, must be anchored at the ends—and strong enough to extinguish the accumulated bracing forces. In double-slope roofs, this is typically accomplished by sturdy ridge channels or angles. Alternatively, an effective roof diaphragm may be provided to span between, and carry all the bracing forces to, the properly designed primary frames capable of resisting those forces.

Not every purlin bracing system used today is effective in meeting these three objectives.

5.4.2 Types of Purlin and Girt Bracing

What types of bracing are used for secondary members? First, continuous lateral bracing may be provided by some types of metal roofing, mainly of the through-fastened variety. To qualify, the panels must be of proper thickness and configuration, with attachments that provide a continuous load path. Standing-seam metal roofing can provide only a limited degree of purlin bracing, as discussed in Sec. 5.5.2. Many engineers consider this type of roofing totally devoid of any bracing ability.

Even through-fastened roofing can potentially meet only the first objective of purlin bracing—to provide lateral flange restraint. Roofing cannot provide torsional stability for purlins, and its diaphragm strength and rigidity might be insufficient to prevent the whole assembly of purlins and roofing from lateral movement. Therefore, metal roofing must be supplemented by some other purlin bracing to ensure that the remaining two objectives are met.