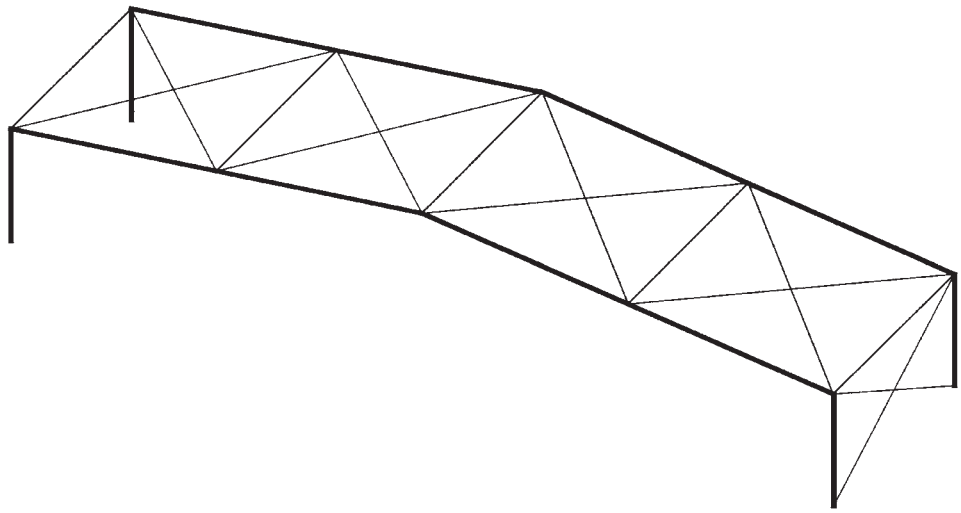

FIGURE 3.25 Wall bracing provided only at one sidewall. One manufacturer recommends that this "torsional braced bay" design be used only if *all* of the following conditions are met: The eave height ≤20 ft; the width ≤70 ft; the roof slope ≤1:12; no cranes are present; seismic load does not control the design. (*Nucor Building Systems.*)

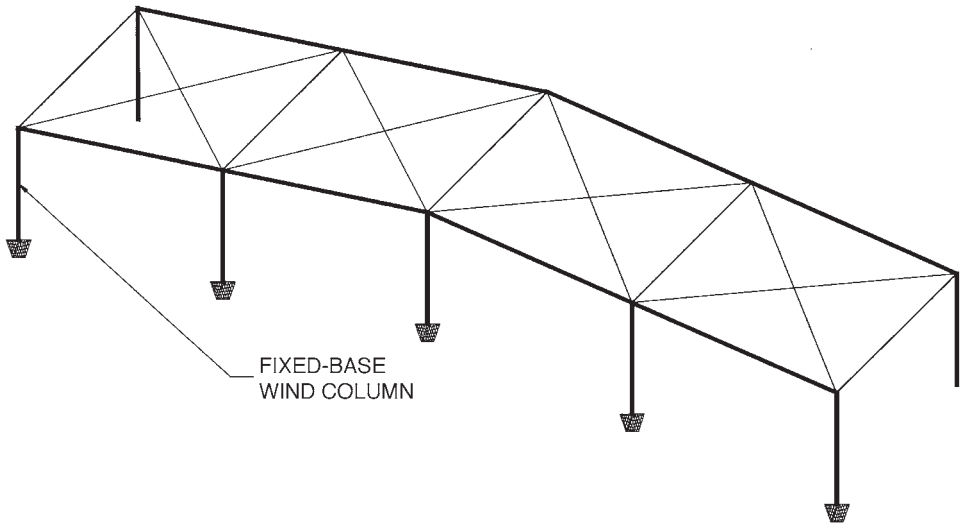

FIGURE 3.26 Fixed-based endwall columns. One manufacturer recommends that this bracing option be used only if all of the following conditions are met: The eave height ≤18 ft; the width ≤160 ft; the roof slope ≤1:12. (*Nucor Building Systems.*)

in advance. (The whole topic of designing foundations before the metal building manufacturer is selected is discussed in Chap. 12.)

The disadvantage of not extending the portal frame column all the way down is that the bottom part of the primary building column would now have to provide the level of strength and stiffness comparable to that of the portal frame. This goal may be difficult to achieve, given that the primary

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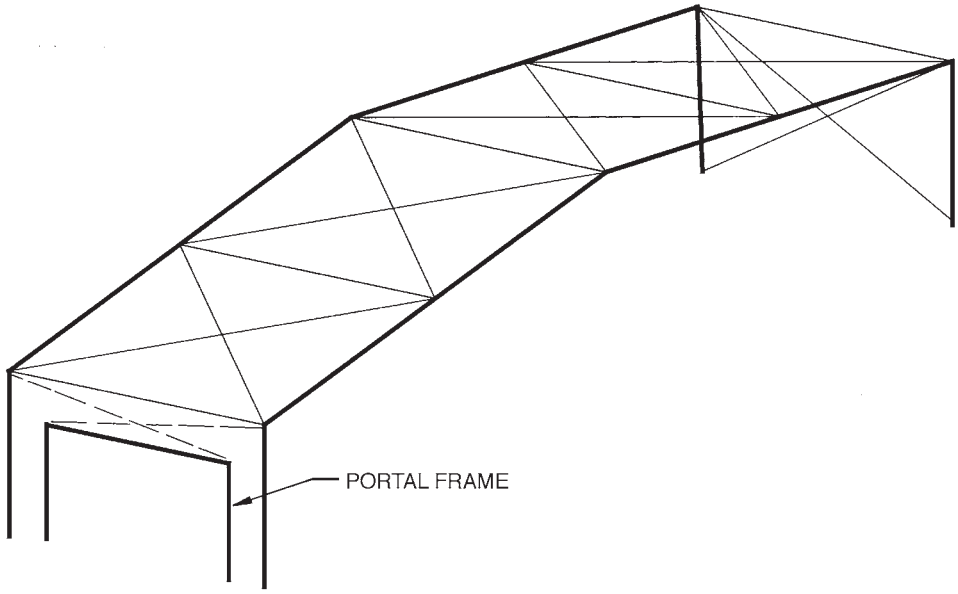

FIGURE 3.27 Sidewall portal frame. One manufacturer recommends that it be used only if *all* of the following conditions are met: The eave height ≤30 ft; the width ≤240 ft. (*Nucor Building Systems.*)

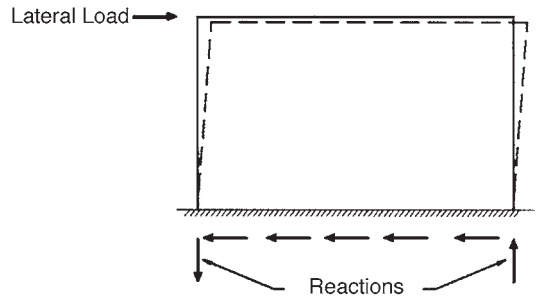

FIGURE 3.28 Shear wall.

column is oriented in the weak direction relative to the portal frame. The manufacturers tend to dislike this detail and prefer the first one.

The easiest portal frame attachment to the primary frame column can be made by a single angle bracket, as in Fig. 3.30. Unfortunately, this detail suffers from two shortcomings. The first one: An angle piece located eccentrically to the plane of the portal frame will likely introduce torsion into it. A better detail is to align the bracket with the plane of the portal frame, or at least to use a stiffened angle bracket, as in Fig. 3.31. The second problem is that the portal frame column is unrestrained against rotation under load. The solution is again shown in Fig. 3.31: The interior flange of the portal frame can be braced either by a pair of full-depth horizontal stiffeners or a flange brace.

For buildings with low eave heights, adequate space above the top of the opening must be provided to fit a portal frame. Conversely, in tall buildings there will be some space left between the top of the portal frame and the eave strut. If that space is substantial, a partial-height X-brace can be provided above the portal frame (Fig. 3.32). The X-brace allows for transfer of lateral forces from the

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