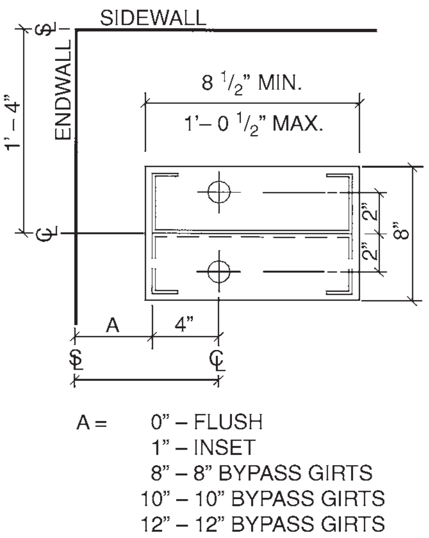

FIGURE 12.30 Detail of base plate and anchor bolts at corner endwall columns. (Note that more than two anchor bolts may be needed.) (*Nucor Building Systems.*)

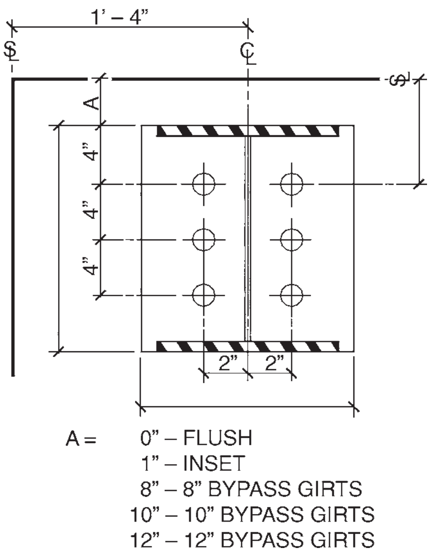

FIGURE 12.31 Base plate and anchor bolts for corner column of endwall rigid frame. (The number of anchor bolts is determined by design, but most likely is four.) (*Nucor Building Systems.*)

An often-overlooked detail involves enlarged piers at wall bracing clips (Fig. 12.34). As discussed in Chap. 3, these clips are used to avoid anchoring wall bracing directly to the thin frame web. The clips may be subjected to significant uplift and lateral forces without the benefit of any offsetting column dead load. To resist these loads, each clip must be attached to an enlarged foundation pier that carries the column (Fig. 12.35).

How big should those piers be? At least big enough to be able to receive the column base plate, the clips, and to provide an adequate edge distance to their anchor bolts. Unfortunately, the manufacturers details for this condition are not uniform; Fig. 12.36 shows one solution. A very similar situation occurs when portal frames are used. Figure 12.37 shows one manufacturer's layout for that condition.

Similar considerations apply to endwall columns that bear directly on foundation walls. An unfortunate situation of Fig. 12.38 could have been avoided with a proper coordination between the designer and the manufacturer.

12.7 DESIGN OF SLABS ON GRADE

A discussion of foundations for pre-engineered buildings would not be complete without at least a brief mention of some slab-on-grade design issues. A good deal of information required to design a slab on grade can be found in ACI *Guide for Concrete Floor and Slab Construction*[18] and the PCA's *Concrete Floors on Ground.*[19] We focus on only a few critical points.

A typical slab on grade consists of compacted subgrade; gravel or crushed stone subbase, usually 6 to 12 in thick; vapor barrier (if needed) covered with sand layer; and the slab itself with joints, reinforcing, and finish (Fig. 12.39).

Proper subgrade preparation is critical to a slab performance, since even a most carefully constructed slab will ultimately fail if placed on a poorly compacted or unsuitable soil. It is quite common to encounter several feet of poor soil, or even loose fill, near the surface underlain by a better material. In such situations, geotechnical engineering guidance is indispensable: the soils reports would state whether on-site materials could be compacted or should be removed and replaced with engineered fill, in which case deep foundations in combination with structural floor slab might become an economical alternative.

A subbase helps the slab to span over any poorly compacted spots by spreading concentrated loads over large areas and by providing drainage under the slab. The thicker the subbase, the more effective it is. A subbase may not be required at all if the subgrade consists of easily compactable free-draining granular material.

The pros and cons of vapor barriers have been debated for years. The proponents cite a need to interrupt capillary action of soil and to keep floor finishes dry. The opponents point out that common 6-mil polyethylene vapor barriers may disintegrate within a few years and note that the real-life vapor barriers are rarely effective in preventing moisture problems. The polyethylene, however, unintentionally prevents dissipation of water during curing: While surface water evaporates from the top of the slab, water stays trapped at the bottom,

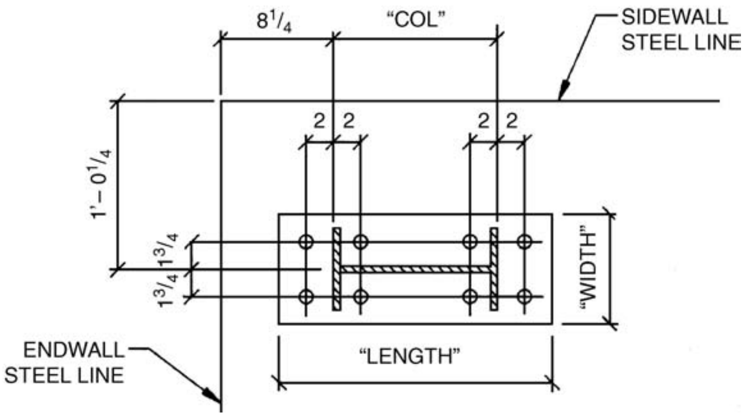

FIGURE 12.32 Anchor bolt layout for a fixed-base column. (*Metallic Building Systems.*)

FIGURE 12.33 Closely spaced anchor bolts are acceptable for pin-base but not for fixed-base columns.

resulting in uneven curing rates and, frequently, slab curling. A sand layer on top of the vapor barrier is intended to mitigate the curling problem. Still, many engineers believe that a slab on grade located on a proper subbase does not need a vapor barrier unless covered with a moisture-sensitive finish.

Structural design of slabs on grade is relatively straightforward, even for concentrated loads. Selection of slab thickness, amount of shrinkage reinforcement, and design approach for