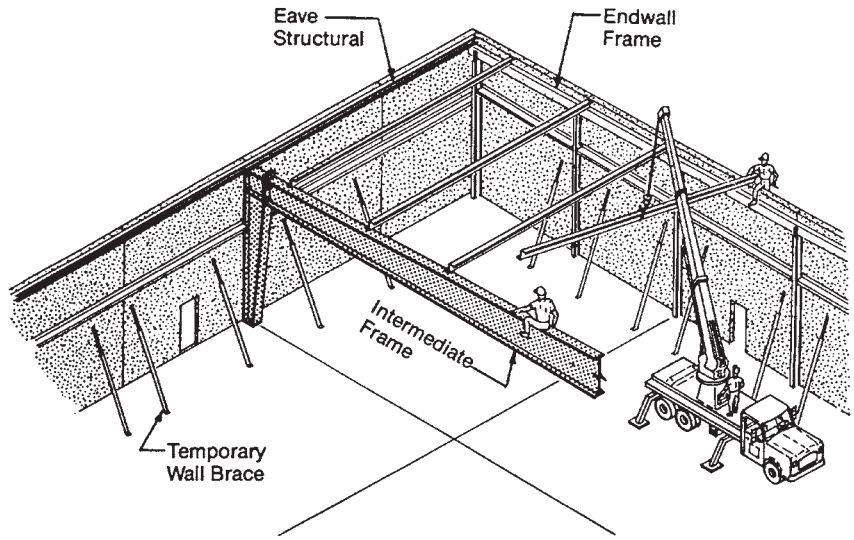

FIGURE 16.4 Steel erection in a tilt-up building. (*Star Building Systems.*)

roof bracing during a site visit and had mentioned it to the erectors as a courtesy. No corrective action was taken. The next day, as the third rigid frame was being put in place in a similar fashion, the entire structure collapsed (Fig. 16.5). It was later discovered that the erectors had in their possession neither the erection manual nor the erection drawings and had never before worked with a building of that size. The authors conclude: "Inadequate bracing during erection probably contributes to more metal building system collapses than all other factors combined."

16.4 INSTALLATION OF GIRTS AND PURLINS

As we have seen, some girts and purlins necessary for bracing are installed along with the main frames, and the remainder is put in place immediately thereafter. Girts and purlins may be bolted directly to the main framing steel or be attached to it by clips, as illustrated in Chap. 5 and in Figs. 16.2 and 16.6. The details of installation depend on whether girts and purlins are assumed to behave as simple-span or continuous members, on a degree of criticality of web crippling stresses, and on design span and loading.

It is often more cost-effective to raise the purlins onto the roof in bundles rather than one by one. The bundles are placed near the eaves, from where the erectors can move the individual purlins to their intended positions by hand.[5] Purlin bracing, the importance of which was demonstrated in Chap. 5, should be set in place as soon as possible, and definitely before the roofing is installed.

Slender cold-formed C and Z sections are easily distorted during construction. Sagging and twisted girts and purlins, a sad but common result of poor storage and installation practices, do not inspire confidence in the builder's work. Special care should be taken to avoid damaging those members by erection equipment and by careless people using them to support ladders, toolboxes, and similar gear. Many manufacturers keep purlins from rotation during erection by means of temporary wood blocks. These blocks function on the same principle as the permanent purlin bracing made of steel channels described in Chap. 5.

Installation of secondary framing around wall and roof openings completes the erection of secondary steel. Some issues in specifying this framing are addressed in Chap. 10.

FIGURE 16.5 Pre-engineered building collapsed during erection. (*Photo: Prof. Duane S. Ellifritt.*)

16.5 PLACEMENT OF INSULATION

Insulation is placed after the secondary steel is installed, but before the cladding. In buildings with fiberglass insulation under through-fastened roofing, the roofing is attached to purlins right through the insulation. The insulation placement usually begins with a 3-ft-wide starter roll being installed near an endwall. The subsequent rolls of normal width (4 to 6 ft) are then attached to purlins with self-drilling screws, which should be of proper length. The insulation blankets 6 in and thicker require longer screws ($1\frac{1}{2}$ or $1\frac{3}{4}$ in) than commonly used for roofing attachment, to avoid squeezing the insulation so tight that the panel gets dimpled.

Insulation placement at the eaves and at the edges of framed openings requires some finesse. Most manufacturers recommend letting the roof insulation overhang the framing edge, removing about 6 in of fiberglass from its facing, and then folding the facing back over the insulation to prevent wicking of moisture (Fig. 16.7). Wall insulation is hung from the eave strut, temporarily held by Vise Grip pliers or similar clamping devices (Fig. 16.8), pulled at the bottom to obtain a taut, smooth inside surface, and attached at the eave strut and at the base.

The attachment of roof blanket insulation is a hazardous job, because no roofing is yet installed to support the workers in case of a fall. Butler Manufacturing Company uses its proprietary Sky-Web* Fall Protection and Insulation Support System, essentially a coated $\frac{1}{2}$-in woven polyester mesh, to provide fall protection at the leading edge of the roof. The mesh has the additional benefits of providing protection from falling objects for the workers below and, in some cases, of supporting the roof insulation.

*Sky-Web is a registered trademark of Butler Manufacturing Company.