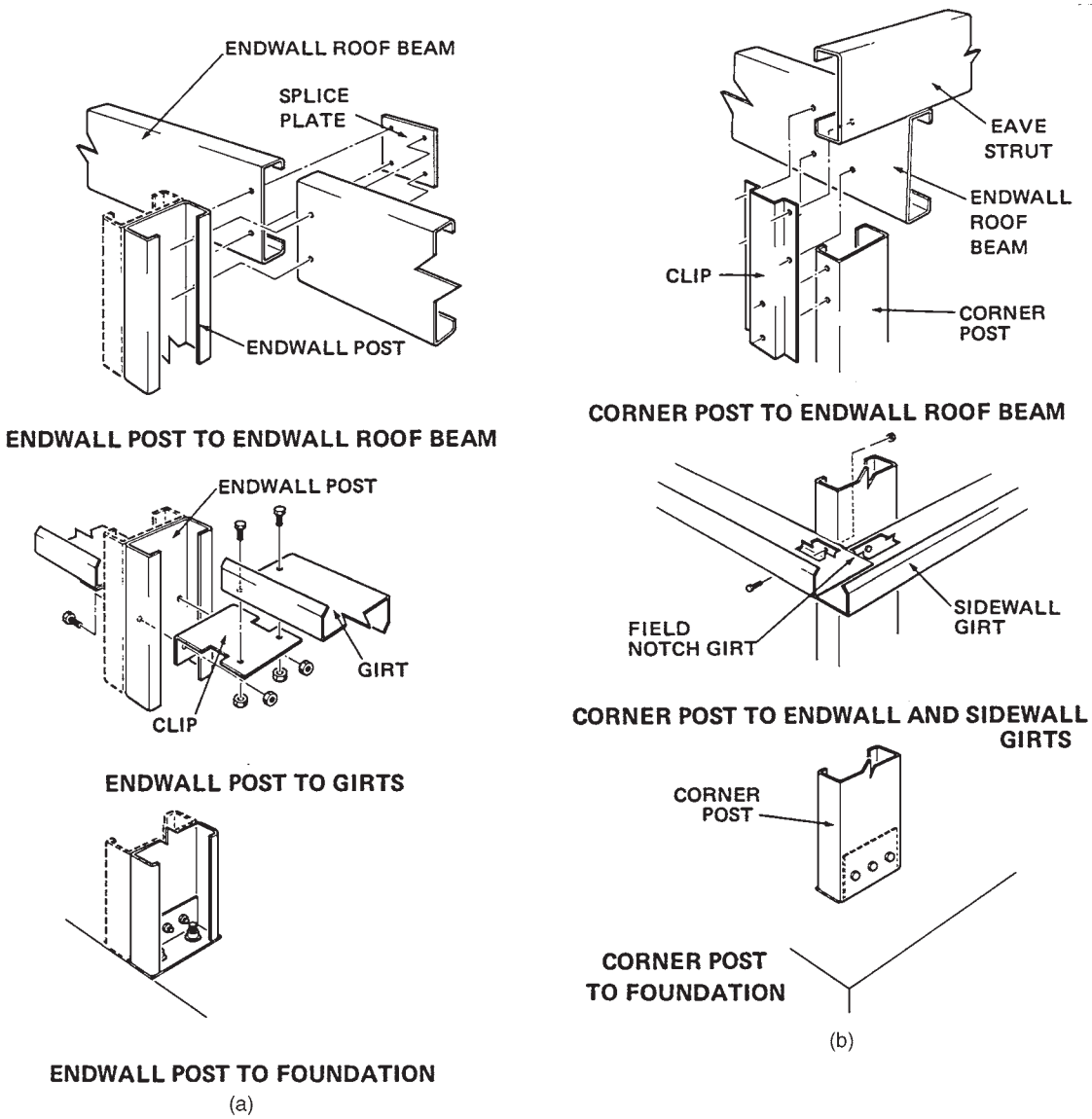

FIGURE 16.2 Details of post-and-beam endwall assembly: (*a*) intermediate post; (*b*) corner post. (*Butler Manufacturing Co.*)

rary guy wires. After the second frame is brought into place, girts and purlins are installed to brace it to the first frame (Fig. 16.3). The permanent wall and roof bracing is secured prior to removing the guy wires for the second frame.

Still another method of construction is used for buildings with tilt-up concrete walls. The tilt-up walls are installed and braced first, so as not to interfere with the frame erection. The best method of wall bracing is by temporary adjustable pipe braces anchored to the concrete slab or to the concrete deadmen cast into the ground for this purpose. Whenever job-built braces are used, a qualified engi-

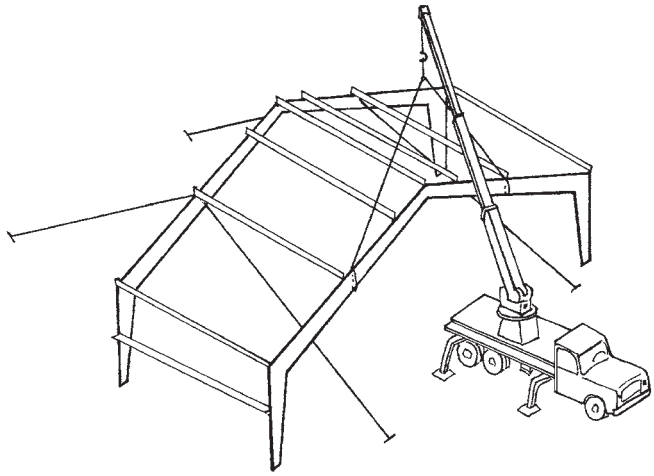

FIGURE 16.3 Erection of pre-assembled single-span rigid frames using guy wires.

neer should be retained by the contractor to design the braces and their connections. Poorly planned panel bracing may result in panels lying shattered on the ground.[8]

Once erected and braced, tilt-up walls provide lateral stability to endwalls and to sidewall frame columns. The first intermediate frame can now be connected to the endwall framing by purlins and girts (Fig. 16.4). A similar procedure follows for the other interior frames. Erection of the main steel continues until all permanent roof bracing is in place and all connections are completed.

Regardless of the installation method, fabrication and erection tolerances included in the MBMA manual's *Common Industry Practices* apply to most metal buildings. The crane buildings require especially tight tolerances, since sloppy erection may cause excessive forces in the crane runway system and may result in a host of performance and durability problems.

16.3.3 The Critical Nature of Erection Bracing

Whichever installation method is preferred by the erectors, it should incorporate proper erection bracing, which may be more substantial than the permanent bracing of the building. Notes the MBMA *Common Industry Practices:* "Bracing furnished by the Manufacturer for the Metal Building System cannot be assumed to be adequate during erection."[2] Indeed, the projected areas of all the exposed roof members might be larger than that of the enclosed building and thus receive more wind loading.

The owner or the engineer of record normally has no way of knowing what kind of bracing is adequate for erection and cannot detect whether a wrong kind is used. However, *some* sort of temporary wall and roof bracing is certainly needed. If there is none, or if only wall bracing is installed, trouble may be on a horizon: Inadequately braced pre-engineered buildings have been known to collapse during erection.

A case in point is documented by Sputo and Ellifritt,[9] who describe collapse of a rigid-frame building in Florida with the clear span of 206 ft. The erectors started installation with a post-and-beam endwall, not bothering to brace it with guy wires. They proceeded to erect the first rigid frame and installed cross bracing only in the sidewalls. The second rigid frame was erected next without any bracing; instead, the erectors seemed to rely on roof purlins that were installed between the two frames and the endwall. No roof cross bracing or frame flange braces were put in place, even though both were specified in the erection drawings. Curiously, a building inspector had noticed the lack of