that each structural member, including siding and roofing panels, be identified by the manufacturer—imprinted with the manufacturer's name or logo and the part number or name. Similar language is contained in the MBMA manual's *Common Industry Practices.*[2] Unfortunately, complaints about shipments lacking piece marks are quite common. Some manufacturers even resort to use of "universal" (one-size-fits-all) purlins and girts to eliminate the jobsite confusion.

For the erectors, the way delivery trucks are packed can make a difference. The most useful method of packing is in the reverse order of erection, so that the items needed first are removed from the truck first. This packing method is reserved for those dealers with the foresight to ask for it in their agreements (order documents) with the manufacturers. Otherwise, manufacturers are free to load flatbed trailers in any way they please.

Upon delivery, the builder inspects the shipment. If the inspection discovers that packaged or nested metal components have become wet in transit, the builder is expected to unpack and dry them out to prevent rusting. Then the builder arranges for material storage, however brief. Here is where care, or a lack thereof, will show. Careful builders follow proper procedures during lifting slender cold-formed members which twist and deform easily, keeping in mind that any damage from a rough handling of "iron" will be easily noticeable.

Building components must be stored in accordance with the manufacturer's instructions. Roofing and siding panels are normally kept in a slightly sloped position for drainage, while cold-formed girts and purlins may be stored flat, to eliminate hard points at the supports. Proper dunnage keeps the metal members off the ground rather than allowing them to sink into the mud.[3] Rolls of fiberglass insulation are best kept off the ground and covered.

Experienced builders store the building components in a logical way which helps, rather than hinders, future erection. They also plan the erection process beforehand and know when each building part is needed. The old adage—those who fail to plan, plan to fail—is very true in construction of metal building systems.

16.3 ERECTION OF MAIN FRAMES: THE BASICS

16.3.1 The Braced Bay

Now that the metal building package is in the builder's hands and the foundations are properly constructed, cured, and inspected, steel erection can begin. The erector can be the builder or a separate subcontractor. Normally, building manufacturers are not involved in the actual construction—unless, of course, they erect the building directly—and do not supervise or inspect the process of steel assembly. However, for critical projects or when the erector's expertise is in doubt, project specifications could require that a competent manufacturer's representative be present at the jobsite throughout the erection process to make certain that the building is put together properly. Whether an extra cost and perhaps contractual uncertainty of such representation are warranted should be decided carefully because it is the erector who is solely responsible for the means, methods, techniques, and sequences of construction. In any case, the manufacturer should provide erection manuals, erection drawings, and printed instructions. Some manufacturers do not furnish any erection manuals at all, citing the variability of the erection procedures, local conditions, and erector's expertise.

The most common method of assembly begins with construction of a braced bay, which consists of two parallel frames interconnected by girts, purlins, and wall and roof bracing. The braced bay is used as a stable element that the adjacent frames and endwalls can "lean on" during their installation. It is usually located in the second bay from an endwall.

The erection process starts when two adjacent columns are lifted into place by a crane or other equipment and temporarily stabilized by cross bracing. (For small rigid frames, the whole frame could be assembled on the ground and installed as described below.) Next, the columns are interconnected by one or two lines of wall girts which provide some stability and allow the columns to be plumbed (Fig. 16.1).

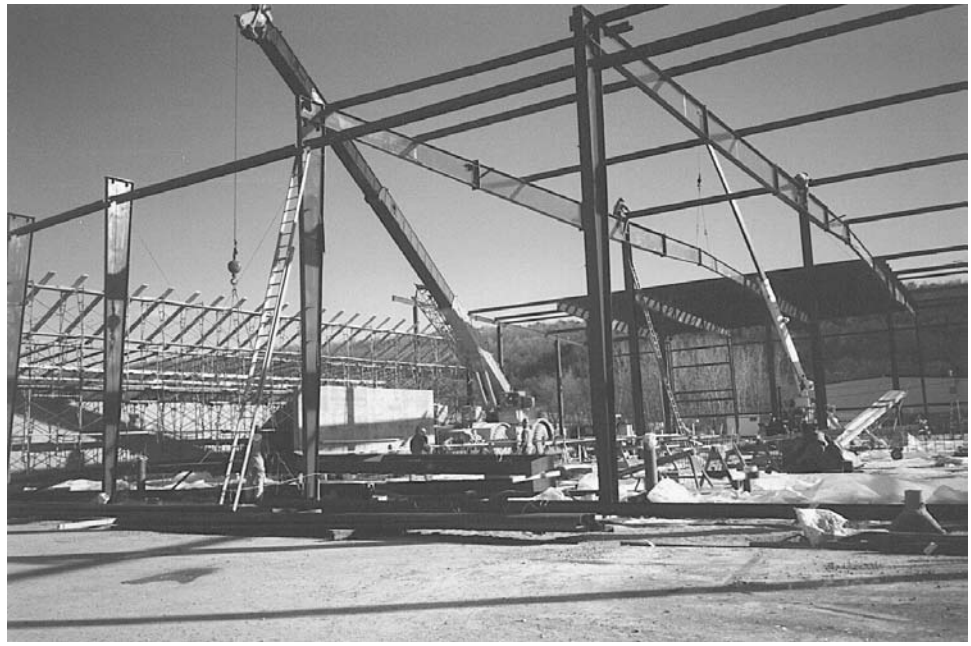

FIGURE 16.1 Assembly of multiple-span rigid frames. The columns at left are stabilized by diagonal bracing and wall girts. (*Photo: Maguire Group Inc.*)

After the columns are plumbed, the wall bracing is tightened and the two columns at the opposite sidewall are similarly erected. Then the frame rafters that have been preassembled on the ground, where connections are much easier done than in the air, are lifted into place by a crane and bolted to the columns. The bolts are tightened only after the crane boom is repositioned to produce some slack in the cables, allowing the rafters to slightly stretch under their own dead load.[4] The procedure is repeated for the second frame in the braced bay, and the roof bracing is secured.

Next, a few purlins, usually including the peak purlin, are installed at the points where the roof cross bracing is attached to the frames, to form a trusslike roof diaphragm. Installation of column and rafter flange braces at the inside flanges, as shown in Figs. 4.19 and 4.20, completes the braced-bay assembly. The flange braces safeguard against lateral buckling of the frames and should not be neglected at this stage. In fact, some erection manuals[5,6] recommend installation of column flange braces even before the rafters are in place.

The endwall framing is erected next. For spans under 60 ft, it can be preassembled on the ground, lifted in place as a unit, and braced by purlins and girts extending to the braced bay. For spans over 60 ft, the endwall framing may be erected similarly to the interior frames[4] or pre-assembled in alternating sections (because of common connections).[7] Typical assembly details for a post-and-beam endwall are shown in Fig. 16.2.

The assembly then moves to the adjacent frames, which are laterally supported by the girts and purlins attached to the braced bay. Finally, the opposite endwall framing is erected, followed by a final check and cleanup.

16.3.2 Other Frame Erection Methods

A slightly different method is used for erection of small fully assembled single-span rigid frames. In this method the first frame is installed by a crane, plumbed, and stabilized on both sides by tempo-