FIGURE 16.9 The roof of this pre-engineered building is installed before the walls. (*Photo: Maguire Group Inc.*)

boards should be secured to the roofing. If stepping on the panels is unavoidable, one should attempt to walk directly above the purlins where possible and to stay away from the middle of the flat panel part.

Wall panels are installed similarly to roofing. To minimize visibility of the vertical seams, the panels are best erected in a direction that allows their overlaps to face away from the main viewpoint of the building.

Field cutting of panels, especially of those with the state-of-the-art coatings on galvanized steel, weakens the panels' defense against corrosion by exposing unprotected metal, although galvanizing protects the cut edges to some degree. This reason alone makes factory precut panels preferable to those formed on-site. If unavoidable, panel cutting should be made on the ground, carefully and precisely. The edges should be touched up with a special compound supplied by the manufacturer; all the metal dust and shavings should be promptly removed lest, in humid climates, rust stains appear quickly.

16.7 SOME COMMON PROBLEMS DURING CONSTRUCTION

Disregard of good practices invariably leads to problems with the appearance, function, or longevity of a newly constructed metal building. Some of these mishaps occurring with a disheartening regularity are described below.

16.7.1 Problems with Slabs and Foundations

Anchor Bolts Missing or Out of Alignment. When not placed by a template, anchor bolts are likely to end up in a wrong position and to create a minicrisis involving frantic calls to the specifying engineer and the manufacturer. Some easy fixes such as making new holes in the column base plate and drilling-in new expansion or chemical anchors may solve the problem. Otherwise a new larger base plate or an extension of the existing one may be needed; truly critical cases might even require foundation replacement. All anchor bolts in oversized holes should be supplied with thick washers under the nuts. The washers are typically 5/16 to 1/2 in thick; this thickness must be accounted for when the bolt projection is detailed.[10]

The anchor bolts that do not protrude high enough to allow for a proper nut engagement are no less troublesome. The best solution to this common problem is to extend the bolts by welding short pieces of threaded rods; the welded end of each extension piece must be cut at 45° to allow for full-penetration welding. Alternatively, a special threaded coupler can be used for splicing, perhaps necessitating a removal of some base-plate metal and concrete. In any case, a few plate washers are needed to elevate the nut above the connection material into the thread area of the anchor.

The usual contractor's proposal of filling the void within the nut with weld will not provide a strong connection and deserves to be rejected, especially for bolts designed for tension loads. A classic example of a failure of anchor bolts plug-welded in this fashion occurred in a Louisiana school during high winds. When the welds and the minimal-length threads suddenly failed, a springlike action reportedly took place and the columns with attached beams were thrown into the air.[11]

Slab Cracking or Curling. Cracked slabs on grade are the perennial source of owners' complaints. Most of the many potential reasons for this cracking have to do with poor construction quality. Drying-shrinkage cracking, which occurs within days of the slab placement, is usually caused by a lack of proper control and construction joints. For example, a popular control-joint detail calls for every other wire of the welded wire fabric to be cut at the control joint locations. The detail will not work if the cutting of wires is not done—a frequent oversight—and the slab is not weakened enough at the joints to induce cracking there. As a result, the slab will crack elsewhere.

Major slab cracking accompanied by settlement indicates an improper subgrade preparation; most other cracks can be traced to inadequate slab curing.

A curling of slab edges usually results from improper detailing and execution of construction joints. It is known, for instance, that keyed construction joints are more likely to curl than doweled joints. The use of underslab vapor barriers without sand cushions has also been linked to slab curling. Chap. 12 provides some recommendations on building better slabs on grade and on avoiding both slab cracking and curling.

What to do about a cracked or curled slab? The corrective measures could range from doing nothing at all for minor cosmetic cracks and curling to filling the cracks with epoxy or a total slab replacement for critical superflat floor applications. The issues of repairing slabs on grade are discussed in detail by Newman.[12]

Improperly Placed or Missing Wall Dowels. Reinforcement dowels extending from foundation walls into a slab on grade may be specified for several reasons. Most commonly, the dowels are needed to support the slab by helping it span over the poorly compacted soil near the wall and to provide lateral support for the top of the wall. These dowels are supposed to be bent in the field, since subgrade compaction cannot take place with the dowels sticking out from the wall.

Unfortunately, regardless of what's shown on the design drawings, dowels are often supplied prebent and then bent in the field again—out of the way. Or dowels are omitted completely and require subsequent drilling and grouting in. Or dowels are too short to be of use. Because of their sheer number, improperly placed dowels can become a significant source of friction between the foundation contractor and the owner.