does not require any load increase due to impact for bridge cranes and monorail cranes with hand-geared bridge, trolley, and hoist, but for powered monorail cranes, the IBC specifies an impact load increase of 25 percent.

For overhead cranes, various design authorities impose higher minimum requirements for impact and lateral loads acting on runway beams. For example, ANSI MH 27.1[9] specifies the impact allowance for electric-powered hoists as 1/2 percent of the rated load for each foot per minute of hoisting speed, with a minimum allowance of 15 percent and a maximum of 50 percent. For bucket and magnet applications, it requires the impact allowance to be 50 percent of the rated load. Each of these forces must be resisted by suspension supports and lateral bracing.

15.4.3 Suspension and Bracing Systems

Monorails running perpendicular to the primary frames are ordinarily designed to span between the frames without any intermediate supports. When the monorails run parallel to the frames, additional support beams are needed. There are two basic suspension systems for attaching monorail beams to the frames or support beams: rigid and flexible.

In a rigid, or fixed, system, the beam is connected to the frame by relatively stiff steel support members. Depending on the available vertical clearance to the frame, the support member can consist of a simple bracket welded to the underside of the frame rafter or supporting beam (Fig. 15.3*a*), or a longer steel section (Fig. 15.3*b*). The short bracket is usually capable of resisting both vertical and side-thrust reactions, but longer sections may need to be supplemented by diagonal angles.

The suspended load applies a concentrated force on the supporting frame, and additional web stiffeners and welding are generally needed to reinforce the rafters at those locations. Some manufacturers provide a single stiffener (Fig. 15.3), others provide double stiffeners (Fig. 15.4). Regardless of the actual detail, the contract documents should indicate who is responsible for the various components of the suspension system. Figure 15.4 illustrates one manufacturer's approach, in which the frame stiffeners and a short shop-welded bracket are provided by the manufacturer, while the other components and bracing are provided by the crane supplier.

A flexible suspension uses hanger rods instead of brackets (Fig. 15.5). The rods are typically attached to hangers placed above the top flange of the frame, and the rod length can be easily adjusted. According to published data,[3,10] flexible suspension tends to result in lower crane loads

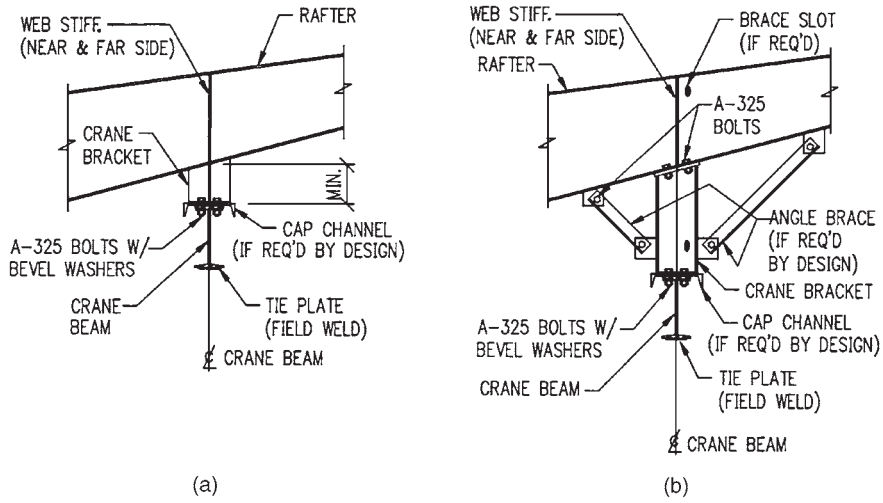

FIGURE 15.3 Monorail supports with rigid suspension: (*a*) minimum-length bracket; (*b*) long bracket. (*Metallic Building Systems.*)

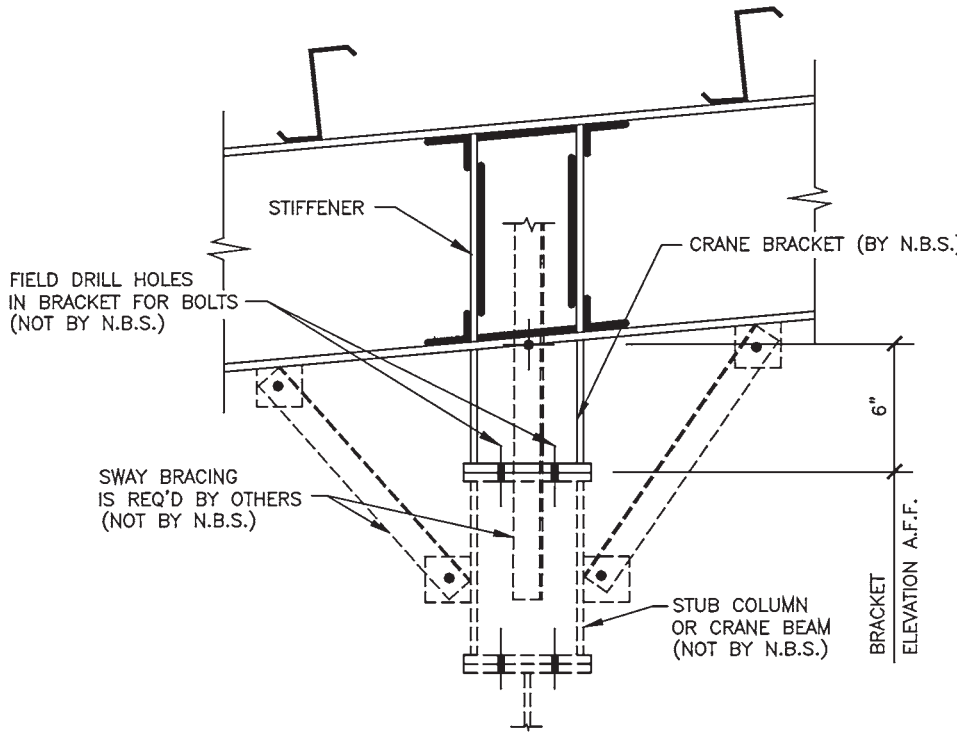

FIGURE 15.4 Details of fixed suspension and stiffener welding. The manufacturer typically excludes the dashed items from its scope of work. (*Nucor Building Systems.*)

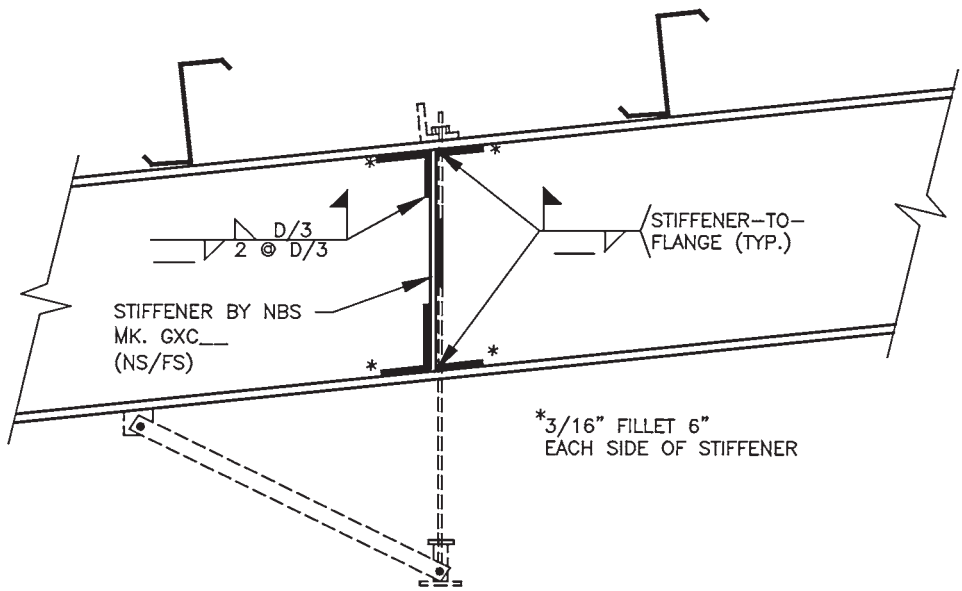

FIGURE 15.5 Web stiffener welding detail for flexible suspension. The manufacturer typically excludes the dashed items from its scope of work. (*Nucor Building Systems.*)