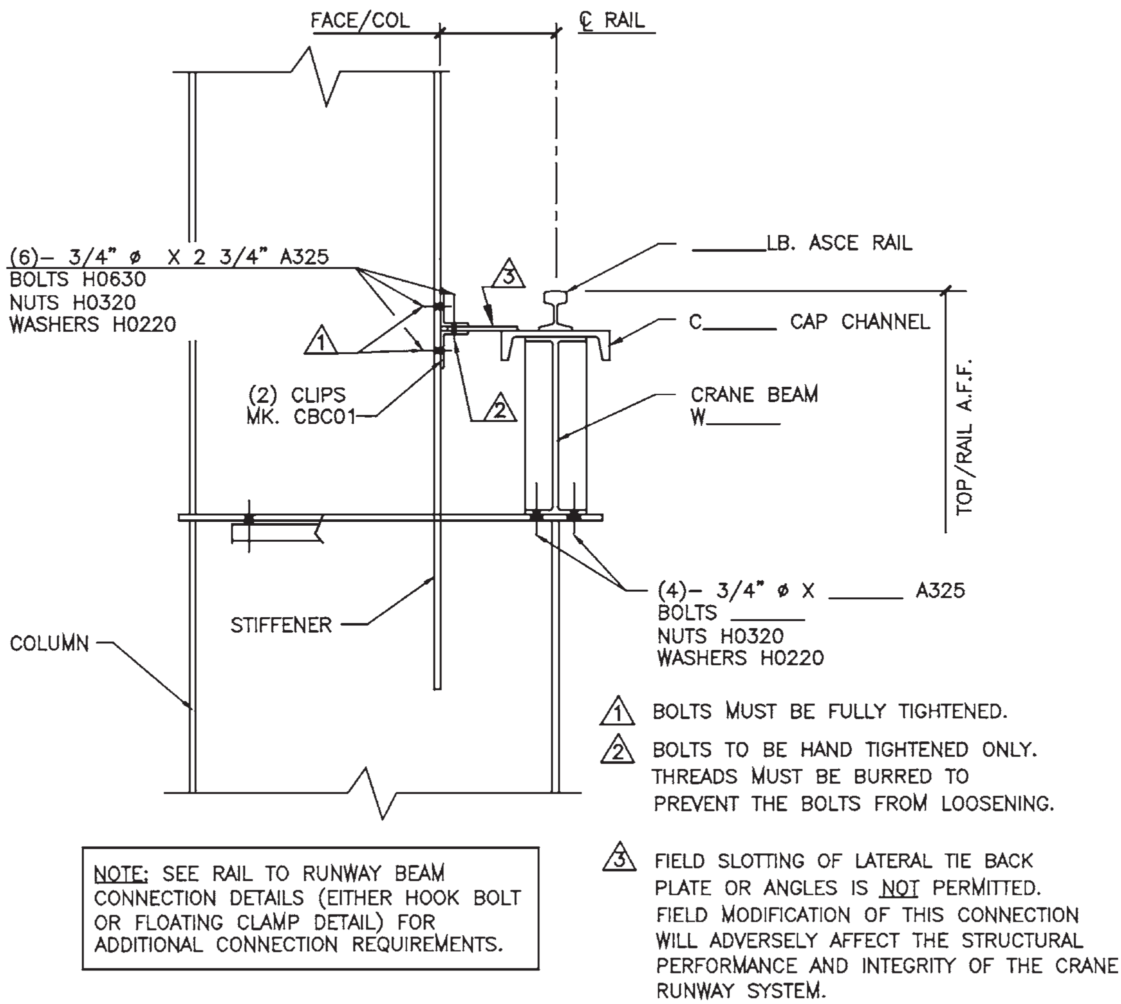

FIGURE 15.15 Detail of stepped building column supporting overhead crane. (*Nucor Building Systems.*)

flange and transferred into the building column via the top connection described above. For heavy cranes, a horizontal truss or a built-up member may be needed in lieu of the cap channel.

In order to design a bracing system to resist the side-thrust forces, one must make an assumption on whether or not to divide these forces between the runways at the opposite sides. The answer depends on a shape of the crane's wheels. Most medium-duty cranes have double-rimmed wheels which "grip" the rail well and ensure a good lateral guidance. Whenever these wheels are used, the side thrust can be equally divided between both runway girders. Some long-span bridge cranes have double-rimmed wheels only on one side, with rimless rollers on the other side. This design is intended to prevent wheel binding because of changes in the bridge length due to temperature fluctuations. Whenever such wheels are used, the entire side thrust should be resisted by only one runway girder.[14]

The longitudinal force L presents some difficulties. Caused mostly by the crane braking or accelerating, as well as by its impact on the runway stops, the longitudinal force subjects the building

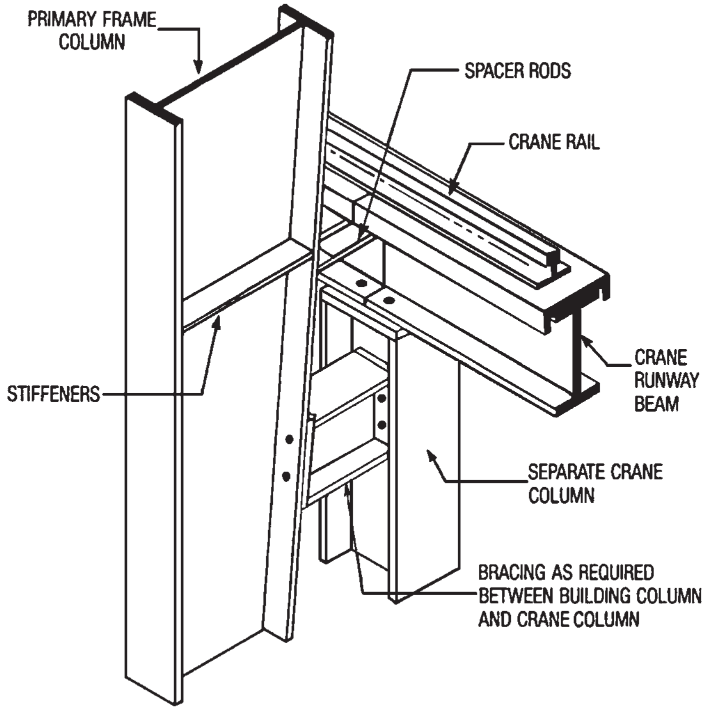

FIGURE 15.16 Crane runway beam supported by separate columns. (*Ceco Building Systems.*)

columns to a racking action. Unfortunately, most crane buildings are poorly braced in the runway direction. In fact, as Mueller[20] observes, "The most frequently heard complaint about steel mill buildings in the past has been too much sidesway, too much vibration, too much movement of the structure." This sentiment is echoed by many crane manufacturers supplying their products for metal building systems.

The best way to minimize longitudinal movement of the structure is to provide cross bracing made of structural steel sections under the runway beams to transfer the longitudinal forces from the runway beams to foundations. For multibay runways, Mueller (as well as the MBMA Manual) recommends that the bracing bents be located in the middle bay rather than at the ends of the runway. He strongly discourages the use of knee braces to stiffen the runway beams.

Proper splicing of runway girders is extremely important. As Mueller demonstrates, a simple splice utilizing web plates can lead to failure of the girder web, because the web plate restricts rotation of simply supported girder ends. Instead, he recommends that the girder's bottom flange be bolted to a cap plate of the crane column with the bolts designed to transfer the longitudinal forces from the runway to the cross bracing below.

As already noted in the previous section, the lateral tie-back connection is quite difficult to make. This connection must accommodate the in-plane movement of the runway beam's ends in horizontal and vertical directions (Fig. 15.14), yet provide for a load transfer normal to the plane of the beam. None of the many previously popular details completely addresses the problem. The rigid vertical diaphragm, the horizontal bent plate, the slotted holes of Fig. 15.13, even the thin rods of Fig. 15.16—none of those connections allows for an unrestricted end curling.

The design solution utilizing a rigid vertical plate diaphragm is perhaps the least effective in providing for the desired movement, and it has resulted in many failures involving cracking of the