than electric cranes. Hand-geared cranes act with less impact on the structure than their faster-running electric cousins. The operator controlling an electrically powered crane can be either standing on the floor using a suspended pendant pushbutton station or sitting in a cab located on the moving bridge.

## 15.3 JIB CRANES

Jib cranes require relatively little planning from the pre-engineered building designer. Floor-mounted jib cranes (also known as pillar cranes) do not depend on the building superstructure for support and bear on their own foundations (Fig. 15.1). Column-mounted jib cranes, on the other hand, are either supported from or braced back to the metal building columns and thus impose certain requirements on strength and stiffness of the structure. For example, Ref. 5 recommends that building columns supporting jib cranes be rigid enough so that the relative vertical deflection at the end of the boom is limited to the boom length divided by 225. Floor-mounted jib cranes can rotate a full 360°, while column-mounted cranes are usually limited to a 200° boom rotation.

A jib crane picks up the load by a trolley that travels on the bottom flange of the boom and carries a chain hoist. The hoist can be either electric or manually operated. Upon lifting the load, the boom rotates around the crane's stationary column and lowers the object to the desired location. These two operations—travel of the trolley and rotation of the jib—are frequently performed manually.

The length of the jib crane's boom varies from 8 to 20 ft. The lifting capacity ranges from $^1/_4$ to 5 tons,[3] with $^1/_2$- and 1-ton jib cranes being the most popular.

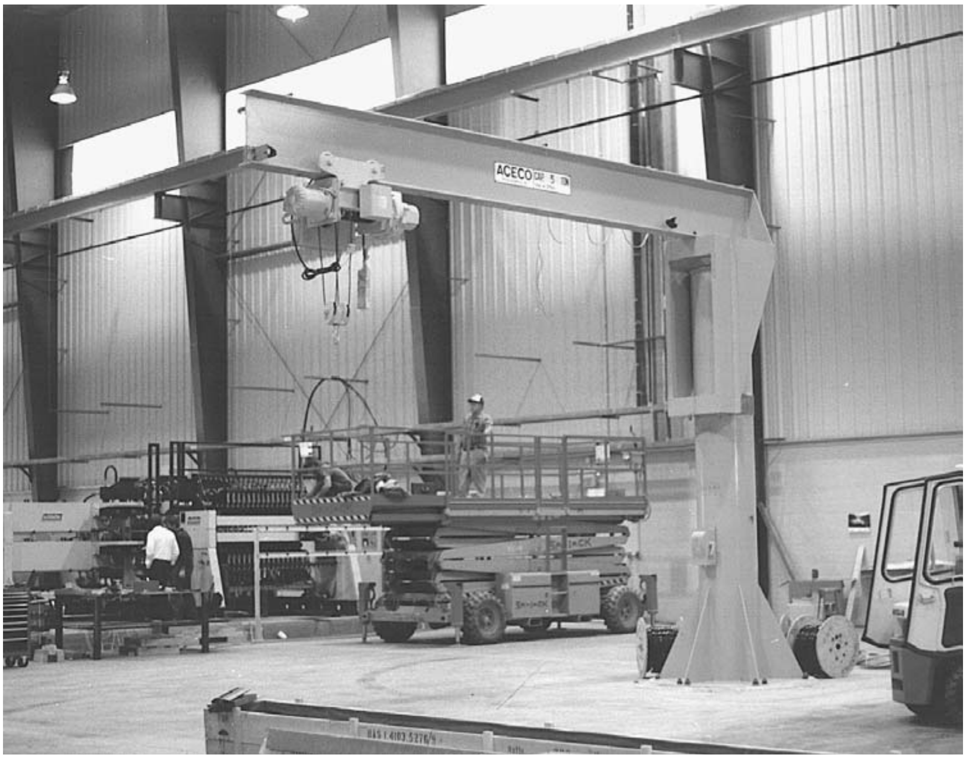


**FIGURE 15.1** Floor-mounted jib crane. (*American Crane and Equipment Corp.*)

Common applications of jib cranes include machinery servicing operations, assembly lines, steam hammers, and loading docks. Sometimes, a pair of jib cranes and a monorail in combination with forklifts is sufficient to transport cargo from a loading dock to the area serviced by overhead or stacker cranes. Inexpensive jib cranes can relieve main overhead cranes of much minor work that would tie them up for a long time.

Manufacturers of floor-mounted jib cranes normally supply the suggested foundation sizes for their equipment, but the foundation design is still the specifying engineer's responsibility.

Whenever floor-mounted jib crane foundations are added to an existing metal building, care should be taken not to interrupt any floor ties or hairpins which could be located in the slab. Otherwise the lateral-load-resisting system of the building could be damaged. Obviously, an addition of the column-mounted crane needs to be approached even more carefully, because the existing building columns will probably need strengthening to resist the newly imposed loads. The basic design concepts for jib cranes are discussed in Ref. 6.

## 15.4 MONORAILS

### 15.4.1 The Monorail System

The monorail crane is a familiar sight in many industrial plants, maintenance shops, and storage facilities. Monorails are cost-effective for applications requiring material transfer over predetermined routes without any side-to-side detours; their range of travel can be expanded with the help of switches and turntables. The monorail crane is essentially a hoist carried by trolley, the wheels of which ride on the bottom flange of a single runway beam. Monorails can be used to move the loads from 1 to 10 tons and can be either hand-geared or electric.

Monorail runway beams have been traditionally made of standard wide-flange sections that could accept straight-tread wheels or from I beams supporting tapered-tread wheels. (The straight-tread wheel is essentially a short cylinder; the tapered-tread one is a short truncated cone.) Today, these standard beam sections are being increasingly displaced by proprietary built-up runway beam products with unequal flange configuration. Figure 15.2 illustrates one of these hard-alloy-steel inverted T products offered by crane manufacturers; it also shows the loads exerted on the runway by the hoist.

Some advantages of the proprietary tracks over rolled beams include better wear resistance, easier rolling, longer service life, and weight savings. The tracks are specially engineered to overcome such common problems of the standard shapes as excessive local flange bending due to wheel loading. The advantages of the proprietary products make their use worthwhile for most monorail applications.

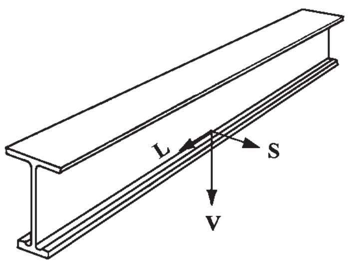


**FIGURE 15.2** Loads acting on monorail runway beam (proprietary track shown).

### 15.4.2 Loads Acting on Monorail Runway Beams

The vertical load *V* indicated in Fig. 15.2 includes the lifted weight and the weight of the hoist and trolley. It also includes impact that the AISC specification[7] prescribes to be taken as 10 percent of the maximum wheel load for pendant-operated cranes and 25 percent of the wheel load for cab-operated cranes. The side thrust *S* is specified as 20 percent of the lifted load including the crane trolley; this lateral force is equally divided among all the crane wheels. According to AISC, the longitudinal force *L* caused by trolley deceleration is to be taken as 10 percent of the maximum wheel loads.

Some building codes contain design provisions different from these, and the load percentages of the AISC specification apply only if not otherwise specified by other referenced standards. Also, some codes contain more detailed provisions for monorail cranes. The *International Building Code*[8]