AISC Speed Connection Challenge – Column Splices

Current Situation

A typical structural steel frame consists of a floor system composed of steel beams that transfer gravity forces to the columns. When a frame is tall, such as columns in a multi-story building, the columns need to be brought to the building site in several pieces. These pieces are stacked on top of one another and joined together using a column splice. As shown in Figure 1, column splices will attach two column shafts together allowing framing to continue vertically.

Column splices are typically designed to transfer compressive and/or tensile forces between column shafts. Depending on the framing configuration and loading on the building, column splices will occasionally be designed to transfer moment and shear between the column shafts.

Shown in Figure 2, the two most common types of column splices are either bolted or welded. The bolted option transfers the forces through plates attached to the column flanges, or simply through the upper shaft bearing on the lower shaft with the flange plates holding the two pieces together. It is common for these plates to be the bolted to the lower column shaft in the fabrication shop. In the field the top shaft is lowered onto the bottom shaft and bolted to the flange plates. There are variations of this configuration where the flange plates are joined to the lower shaft in the fabrication shop using fillet welds instead of bolts. The other common type of splice connection is to weld the top and bottom column shafts together in the field. Usually, the top column shaft flanges (and possibly the web) are beveled to accept a groove weld. In the field the top shaft is lowered onto the bottom shaft and held in place with an erection aid. The column shafts are then welded together.

Note that the upper shaft is typically smaller than the lower shaft (see Figure 3). As illustrated in Figure 3, for the shapes most commonly used as columns, the distance between the inner faces of the flanges is constant throughout any given nominal depth. When flange plates are used, filler plates and shims are used to fill in the gap resulting from the difference in flange thicknesses.

Problem

While the currently used column splices can be configured to easily transfer the required loads, they can be time consuming to erect in the field. This is particularly true for the welded splice option where multiple passes of weld metal are required to groove weld the column flanges together. Since the welding is performed in the field, this can add a great deal of time and expense to the erection of the steel frame.

Solution

The optimal column splice connection will be quick and easy to erect in the field while still providing sufficient strength to transfer the required loads.

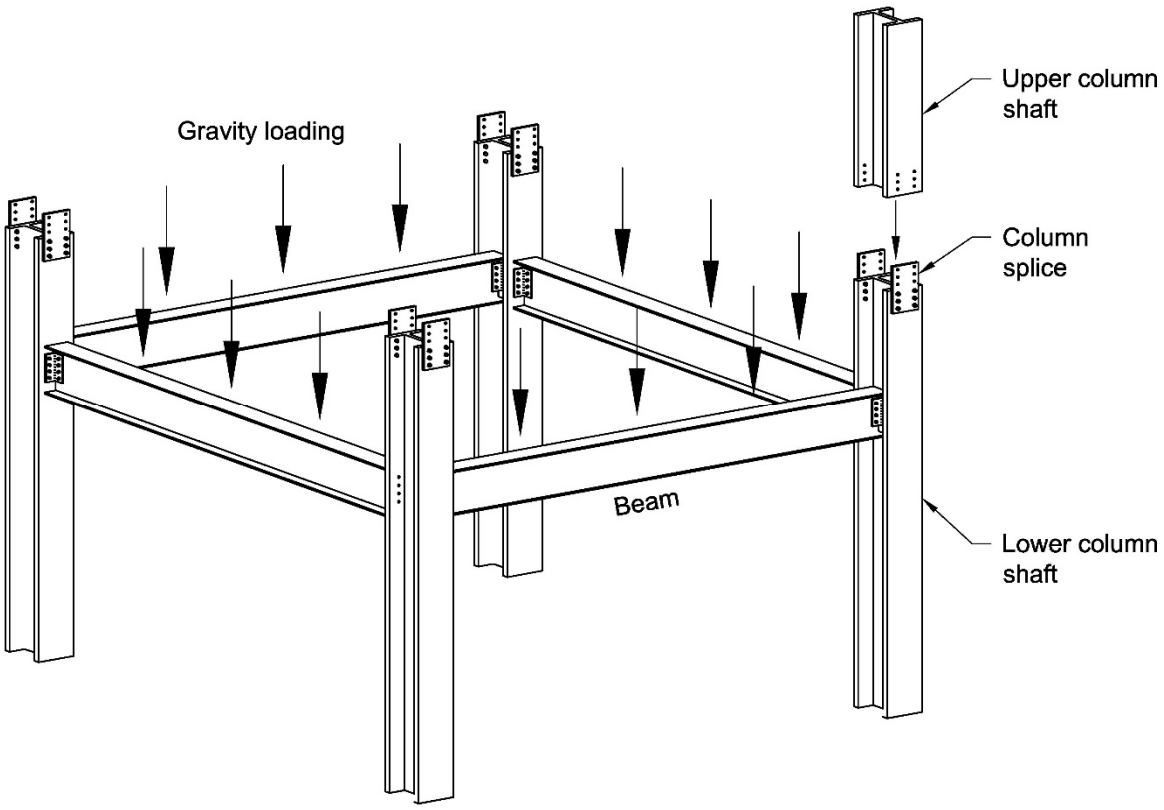

Figure 1. Column splice location in structural steel frame.

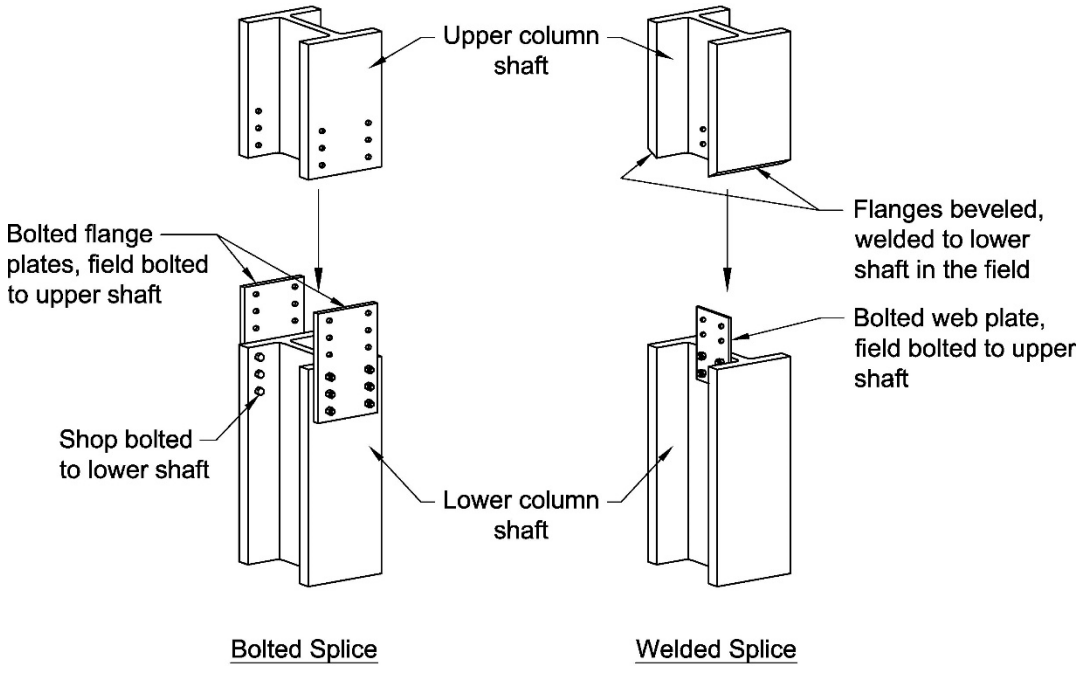

Figure 2. Erection of column splices.

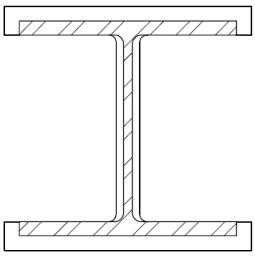

Figure 3. Upper to Lower Shaft Cross-Section Comparison