

When precast concrete units are used the erection sequence must ensure that they are placed alternately in adjacent bays. This prevents excessive torsion being applied to the beams. The specific benefits of options employing metal decking are discussed separately in Section 6.4.

### **3.4 Connections**

Basic materials account for approximately 40% of the cost of a steel frame. The remaining 60% is primarily related to joining and handling members; it may be further broken down into 30% for connections, 10% for general handling, and 20% for connections related handling. Connections therefore affect approximately 50% of the total frame cost<sup>(13)</sup>.

Considerable savings have been made in recent years in the UK, where standard connections are now widely adopted. Standard details are given in the 'Green Books' published by the SCI/BCSA Connections Group(14,15,16). Some examples of standard details are given below.

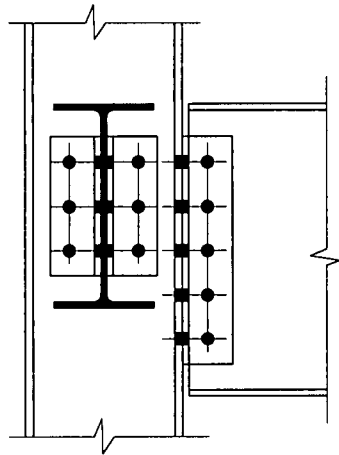
The following general points should be considered when designing and detailing the connections(7):

- the connection arrangement should allow safe and rapid erection
- where possible, use one connection type per principal joint type (for example beam to column) on a given project
- locate column splices in general at every alternate floor
- provide a hole 1 m above beam connections for the attachment of safety lines.

#### **3.4.1 Simple beam to column connections**

Details and design procedures for simple connections are given in *Joints in simple construction, volumes 1 and 2*, to which reference should be made for more details<sup>(14,15)</sup>. General information is given below.

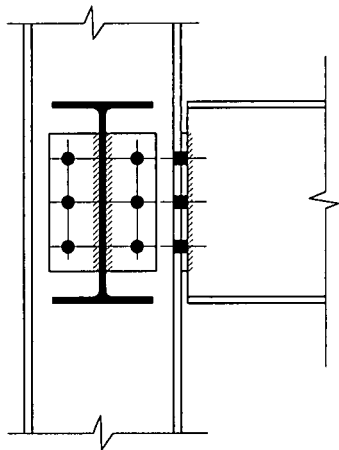
A typical standard double angle web cleat beam to column connection is shown in Figure 3.4. This type of connection enables considerable site adjustment. Both sets of bolts are placed in clearance holes to allow adjustment in two directions before the bolts are tightened. Packs can be used to provide further adjustment if required. Web cleats are not generally used for skew connections.



**Figure 3.4** *Double angle web cleat connection*

A typical standard flexible end plate connection is shown in Figure 3.5. This type of connection has less facility for site adjustment than web cleats. Care must be taken with long runs of beams, as the accumulation of cutting and rolling tolerances can lead to columns being pushed out of plumb. This problem can usually be overcome if the beams are accurately cut to length and a shorter beam with packs is detailed at regular intervals, for example every fifth beam.

Difficulties, and therefore time delays, can be encountered on site when a pair of beams either side of a column web share a common set of bolts. When such a detail is adopted for larger beams, it may be necessary to provide some form of support during erection, for example, a seating cleat.



**Figure 3.5** *Partial depth flexible end plate connection*

Fin plate connections are of the configuration shown in Figure 3.6. The simplicity of this type of connection offers considerable benefits both on site and during fabrication. Once the beam has been swung roughly into position it can be quickly aligned using a podger spanner (which has a tapered handle to facilitate this). As with other types of connection, the insertion of approximately one third of the total number of bolts is then usually sufficient to secure the beam and allow the crane hook to be released.