

Introduction to Steel

Steel is basically an alloy of iron and carbon with a small percentage of other metals such as nickel, chromium, aluminium, cobalt, etc.

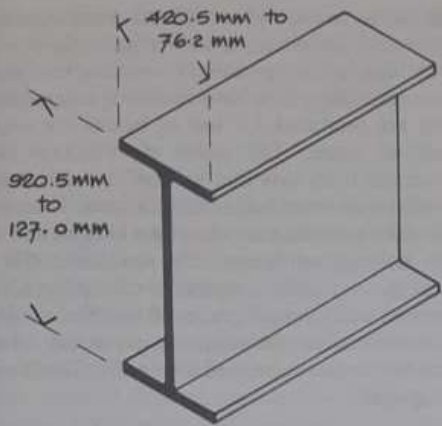
Structural steel is a category of steel used for making construction materials in a variety of shapes. Many structural steel shapes take the form of an elongated beam having a profile of a specific cross section.



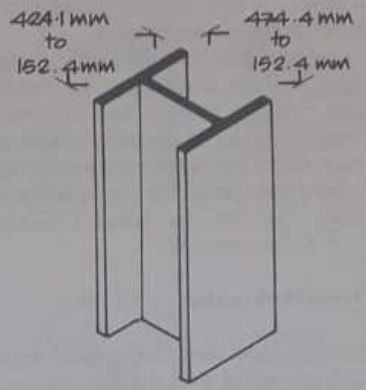
Steel frame

Steel frame is a building technique with a "skeleton frame" of vertical steel columns and horizontal I-beams, constructed in a rectangular grid to support the floors, roof and walls of a building which are all attached to the frame. The development of this technique made the construction of the skyscraper possible.

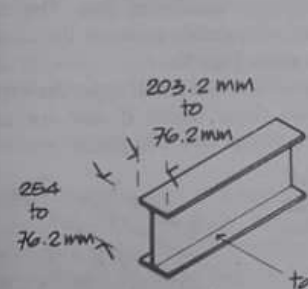




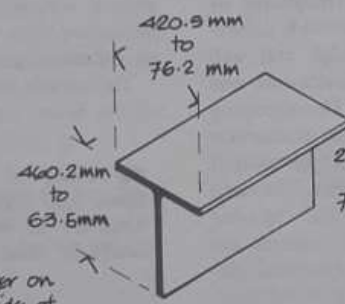
Universal beams



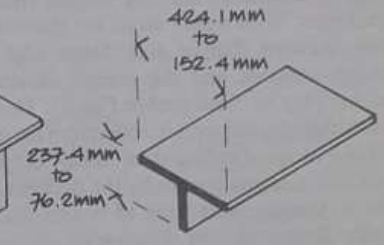
Universal columns



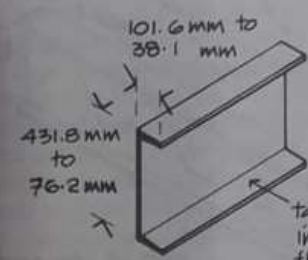
Joists



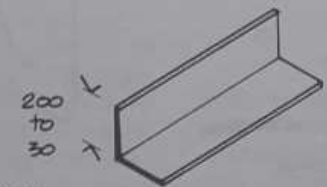
Structural tees cut from Universal beams



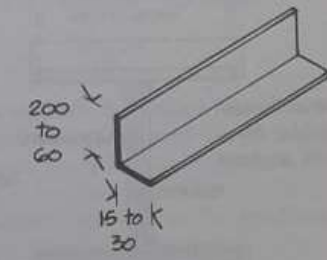
Structural tees cut from Universal columns



Channels



Equal angles

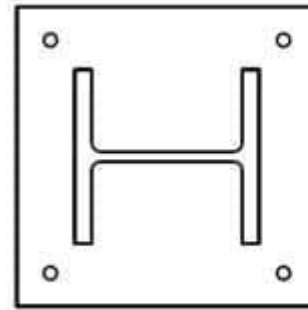


Unequal angles

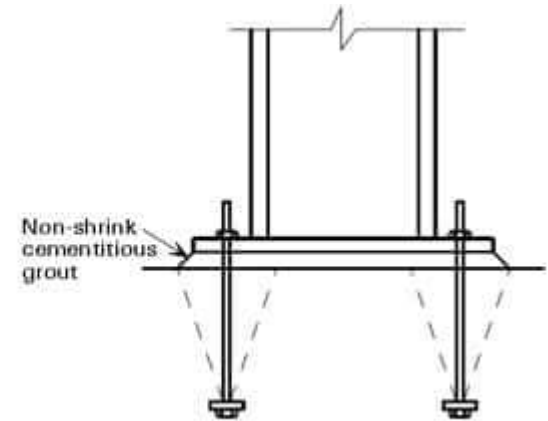
HOT ROLLED STRUCTURAL STEEL SECTIONS

STEEL COLUMNS

- foundation to column joints, base plates are welded to the end of columns. The most desired shape of base plate is square and rectangular shape, because such plates provide largest spacing between the bolts which is desirable.

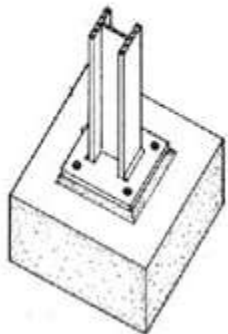


A

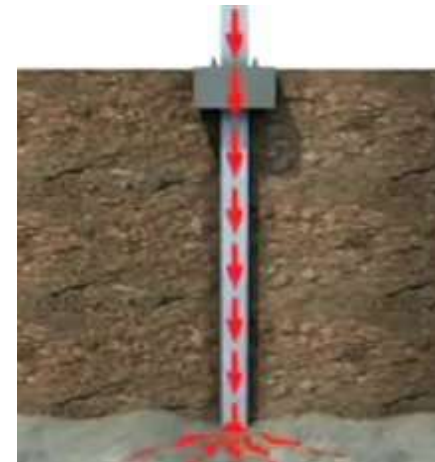


B

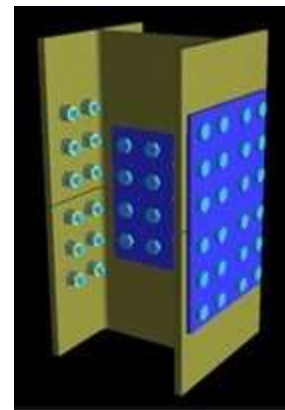
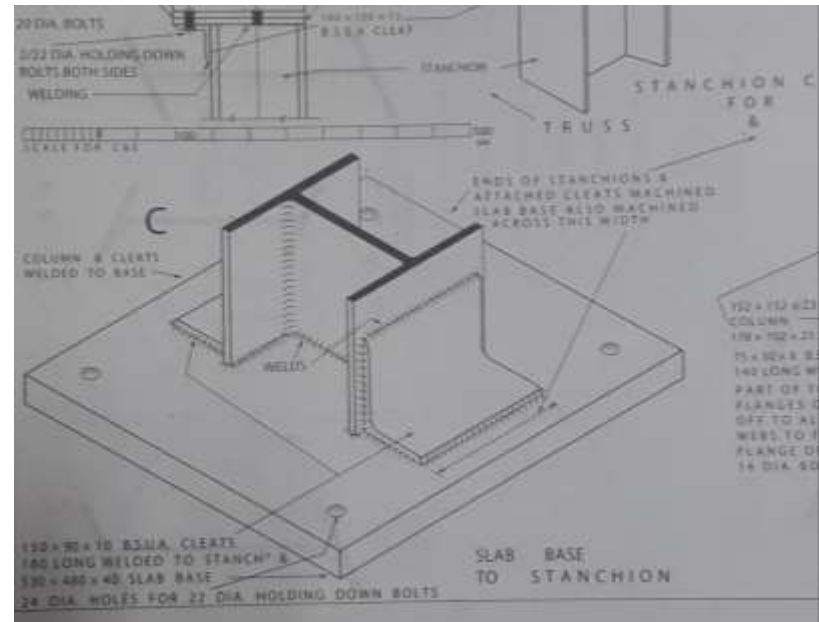
Steel Column to Foundation Details, (A) Top bolt places created in base plate, (B) Side view of column base to foundation



- Pile foundation to transfer loads of steel frame structure though low soil bearing capacity of stiff soil with adequate bearing capacity



- column splices is provided in every two or three storey to ease erection process in addition to simplify steel column production and deliveries.
- The distance between floor and column splice is about 60cm. When circular steel columns are used, weld connection is used to join both steel columns above and below.



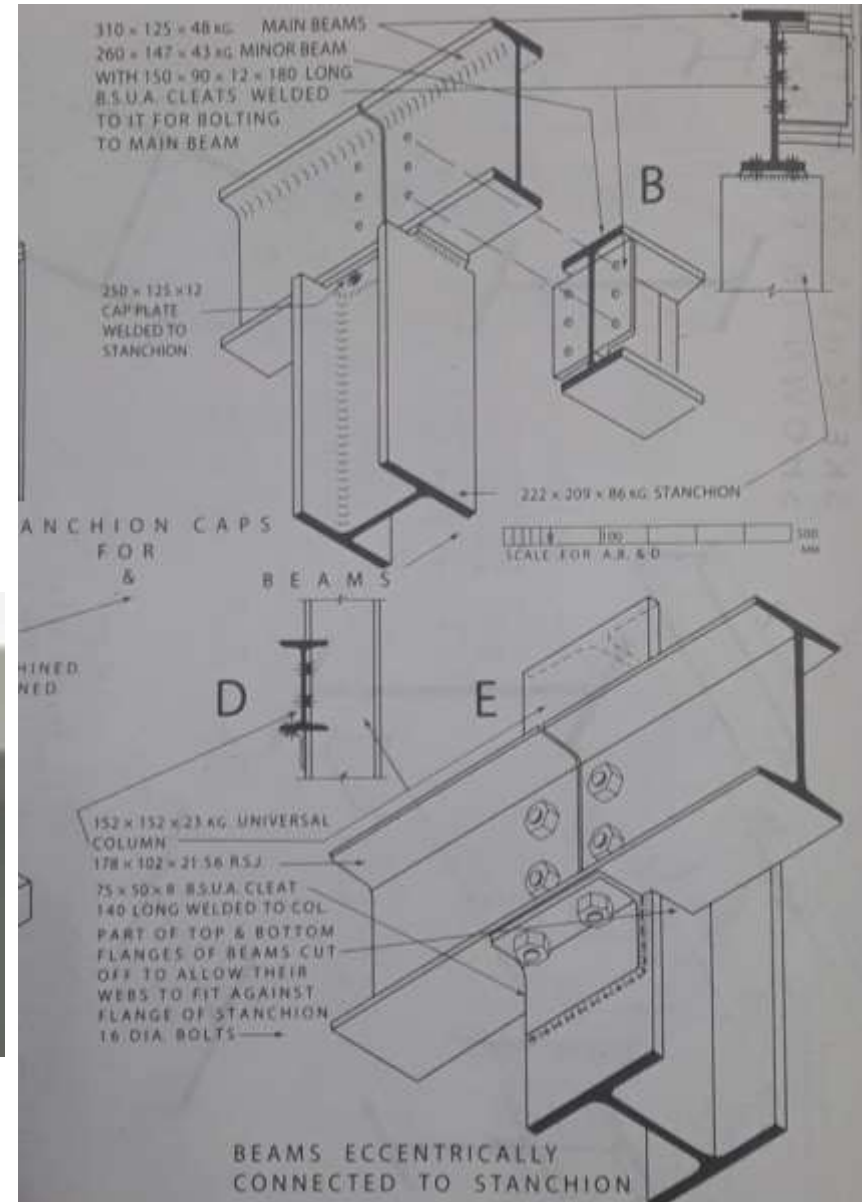
Column Splices

STEEL BEAMS

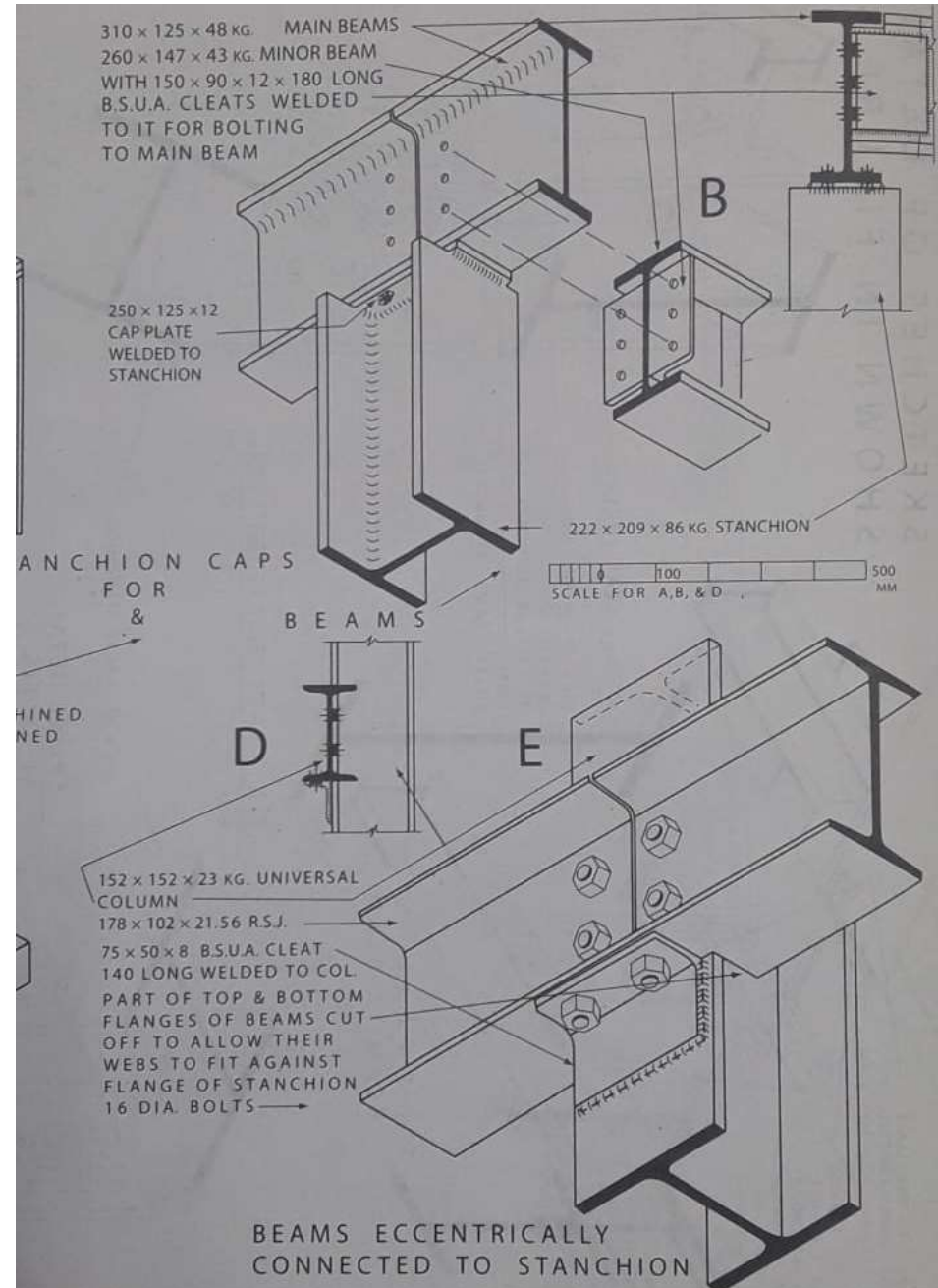
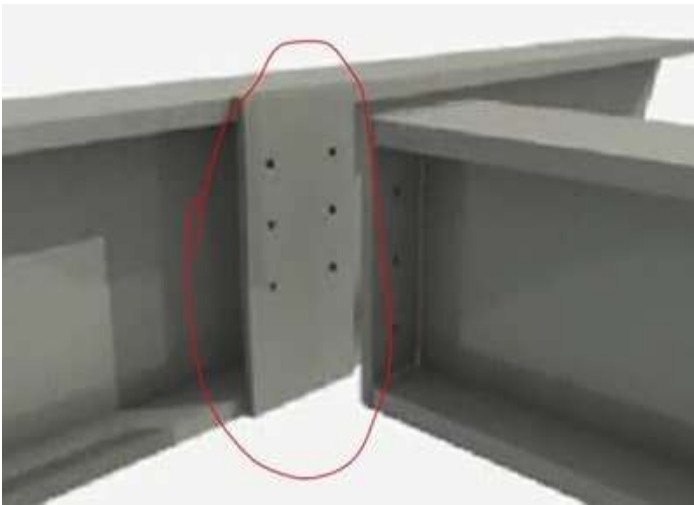
- end plate beam to beam connection is used to join secondary steel beams to primary steel beams.
- Since top flange of secondary beams support floor system, so it must be leveled with top flange of the primary beams. This can be obtained by notching the top flange of the secondary beam



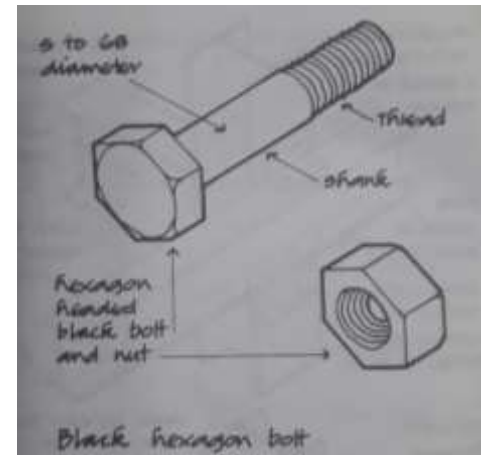
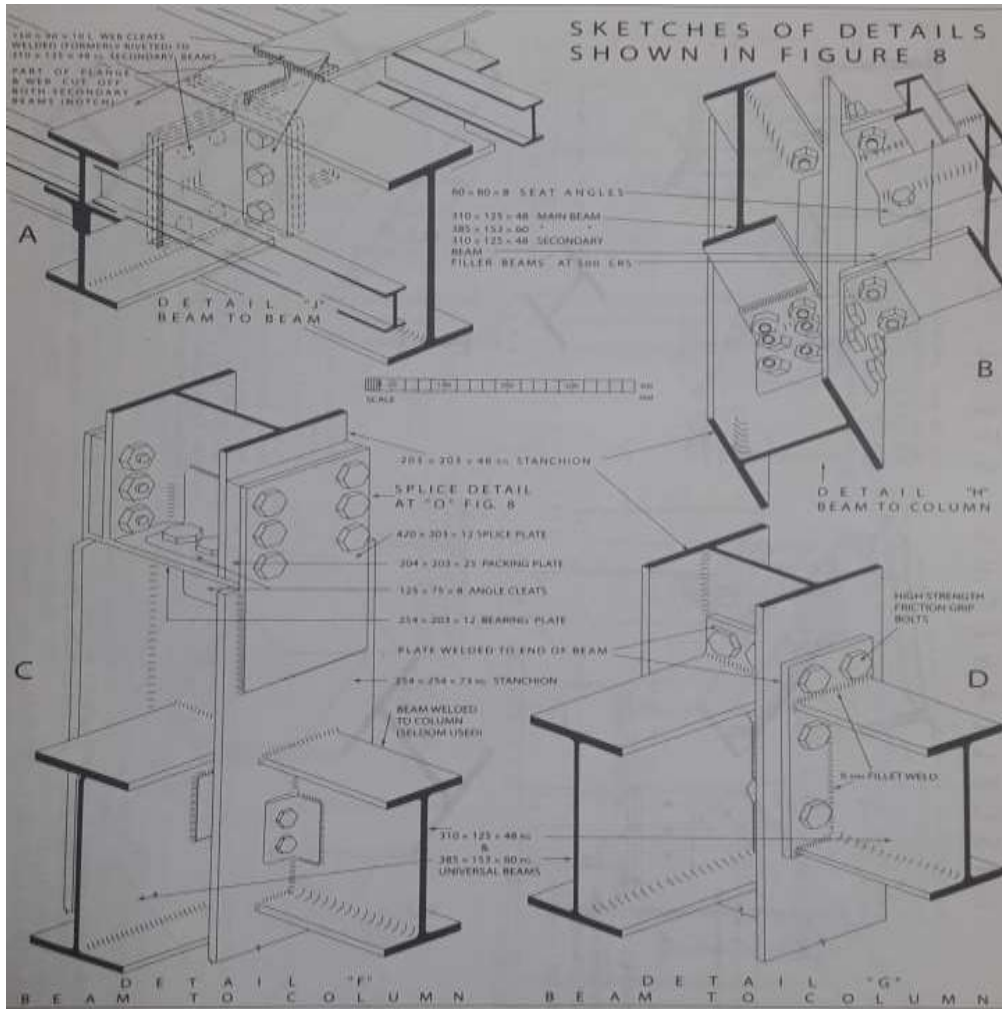
Notched Part of Secondary Beam



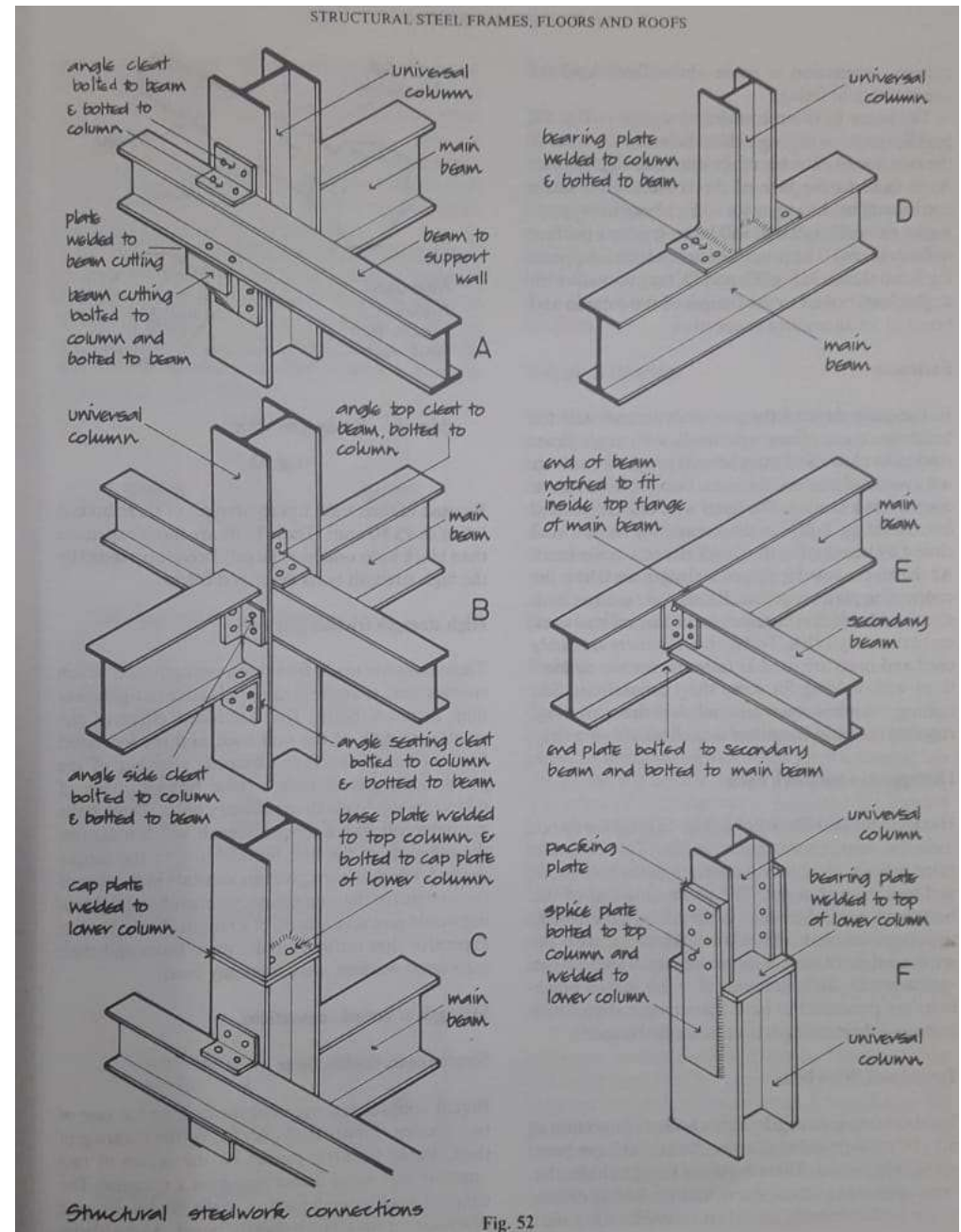
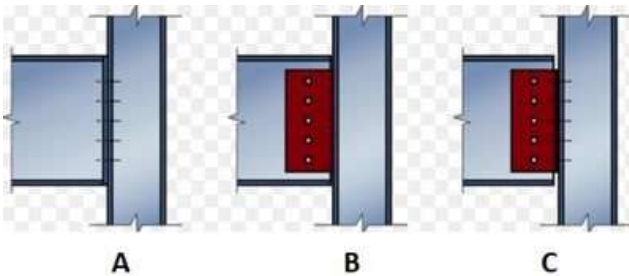
- projected bracket is welded to the primary beam and then secondary beam is attached without the need for notching secondary steel beams



CONNECTIONS BETWEEN COLUMNS AND BEAMS



- Different types of column to beam connection suitable for the case where vertical loads are applied solely: (A) Flexible end plate, (B) fin plate, (C) Double angle cleat



METAL HARDWARE



Angle
Brackets



Plates
& Cleats



General Purpose Bracket



Purlin Cleat



Flanged Purlin
Nut & Bolt

Advantages

- Steel is tensile and has a high strength to weight ratio which means it has high strength per unit mass. So no matter how large the overall structure is, the steel sections will be small and lightweight, unlike other building materials.
- Steel can be easily fabricated and produced massively. Steel sections can be produced off-site at shop floors and then assembled onsite. This saves time and increases the efficiency of the overall construction process.
- Structural steel is very flexible. You can mould it into any shape, without changing its properties. You can convert it into sheets or turn it into wires as per the design.
- Structural steel is relatively cheap compared to other building materials.
- It is very durable. Structural steel structures can withstand external pressures such as earthquakes, thunderstorms, and cyclones. A well-built steel structure can last up to 30 years if maintained well.

Disadvantages

- Steel is an alloy of iron. This makes it susceptible to corrosion. This problem can be solved to some extent using anti-corrosion applications.
- It has high maintenance costs as it has to be painted to make it corrosion-resistant.
- There are extensive fireproofing costs involved as steel is not fireproof. In high temperatures, steel loses its properties.
- Buckling is an issue with steel structures. As the length of the steel column increases the chances of buckling also increases.
- Steel has a high expansion rate with changing temperatures. This can be detrimental to the overall structure.

CONCLUSION

Today, practically all industries have major applications of structural steel. From industry equipment to finished products, structural steel is used everywhere. Buildings, bridges, high-rise buildings and warehouses are made using structural steel sections. Industry experts prefer the use of structural steel over any other building material for construction. This is mainly because of the innumerable benefits structural steel provides. But as everything else in the world, there are certain downsides of using structural steel in building structures.