UNIT II CONNECTIONS IN STEEL STRUCTURES

Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts –Prying forces and Hanger connection– Design of Slip critical connections with High strength Friction Grip bolts.- Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and but Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.

Introduction [Section-10 IS 800-2007]

The steel structures are constructed by properly connecting the available standard sections. The connections are an important part of steel structure and are designed more conventionally than any individual members. There is a discrepancy between the actual behavior and the analysis of steel structure is large, therefore the connections are complex to analyze and design. When the structural member fails in case of overloading then there is a general practice to prefer the individual member rather than the connections, therefore this kind of practice affects many structural members. The cost of structural steel consists of major portion of connections and that is the reason primary importance should be given to the design of connections for safety and economy of structure.

The connections are generally provided in the following cases:

- When there is the requirement to cater the heavy load and long span then the built-up sections are to be provided. In this case, this section should be connected together to get a good section.
- In case of longer span, the length of standard section needs to be connected with other section. In this case to connect the multiple sections proper design of connections are important.
- The different members need to be connected at the end (for example secondary beams to be connected to primary beam, column, footings, etc).

The classification in the connections provided in the steel structure is as follows:

- Riveted connections
- Bolted connections
- Welded connections
- Pinned connections

BOLTS PINS AND WELDS

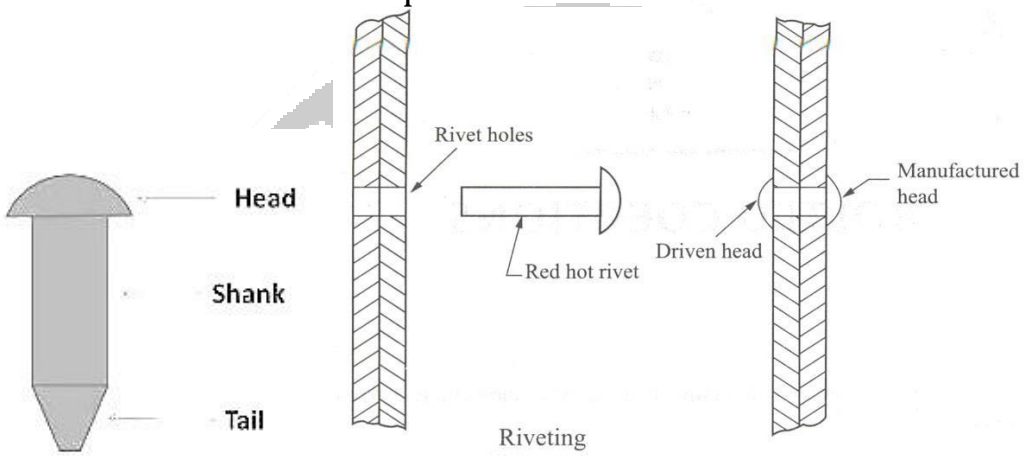
Riveted (Pin) Connections

A piece of round steel forged in place to connect two or more than two steel members together is known as a rivet.

The rivets for structural purposes are manufactured from mild steel and high tensile rivet bars. A rivet consists of a head and a body as shown in Fig. The body of rivet is termed as shank. The rivets are manufactured in different lengths to suit different purposes. The size of rivets is expressed by the

diameter of the shank.

- Riveted connections are used because rigid connection are establish since there was lot of disadvantages in riveted connection.
- Requirements of skilled labour Cost increased due to defective rivets, the connections are later preferred



RIVETED JOINT

The riveted joints are of two types:

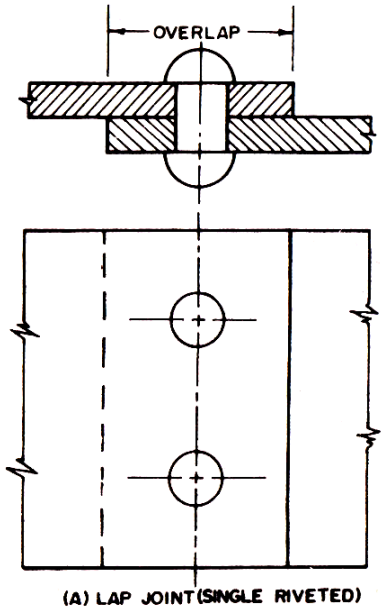
- **Lap joint**
- **Butt joint**

Lap joint:

When one member is placed above the other and the two are connected by means of rivets the joint is known as lap joint as shown in figure

These joints are further classified according to the number of rivets used and the arrangement of rivets adopted. Following are the different types of lap joints:

- Single riveted lap joint
- Chain riveted lap joint
- Double riveted lap joint
- Zig-zag riveted lap joint

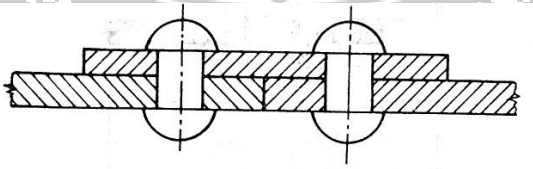


(A) LAP JOINT (SINGLE RIVETED)

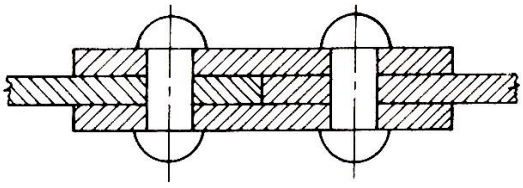
Butt joint:

When plates are placed end to end and flushed with each Other and are joined by means of cover plates, the joint is known as butt joint. The butt joints are of two types

- **Single cover butt joint**
- **Double cover butt joint**



SINGLE COVER PLATE BUTT-JOINT

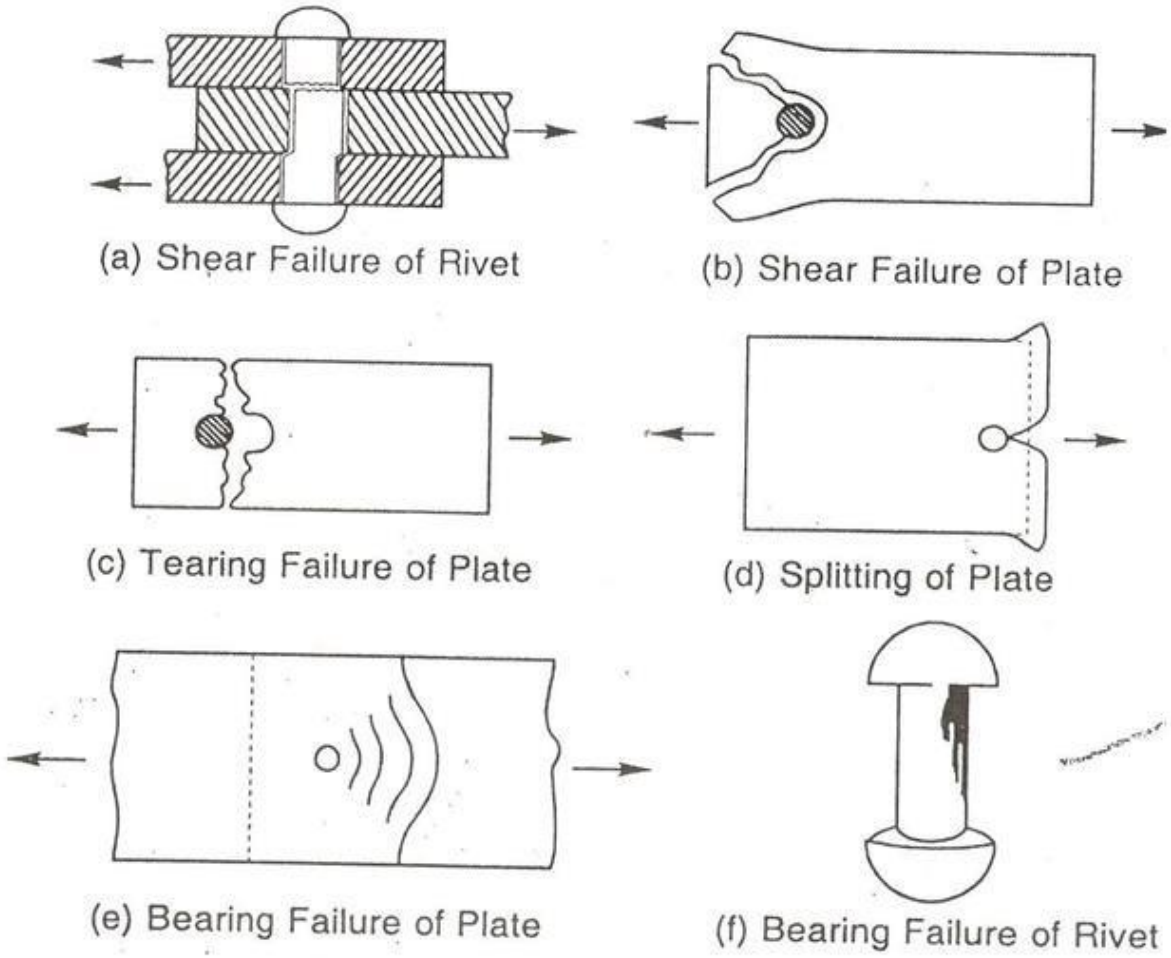


DOUBLE COVER SINGLE RIVETED BUTT JOINT

Failure of a Joints

The failure of a riveted joint may take place in any of the following ways:

- Shear failure of rivets.
- Shear failure of plates.
- Tearing failure of plates.
- Bearing failure of plates.
- Splitting failure of plates at the edges.
- Bearing failure of rivets.



Failure of Riveted Joints