Chapter 23

STEEL CONNECTIONS

23.1 Bolted Connections

1 Bolted connections, Fig. 23.1 are increasingly used instead of rivets (too labor intensive) and more often than welds (may cause secondary cracks if not properly performed).

23.1.1 Types of Bolts

2 Most common high strength bolts are the A325 and A490.

3 A325 is made from heat-treated medium carbon steel, min. $F_y^b \approx 81 - 92$ ksi, $F_u^b = 120$ ksi

4 A490 is a higher strength manufactured from an alloy of steel, min. $F_y^b \approx 115 - 130$ ksi, and $F_u^b = 150$ ksi

5 Most common diameters are 3/4", 7/8" for building constructions; 7/8" and 1" for bridges, Table 23.1.

Bolt Diameter (in.)	Nominal Area (in^2)
5/8	0.3068
3/4	0.4418
7/8	0.6013
1	0.7854
1 1/8	0.9940
1 1/4	1.2272

Table 23.1: Nominal Areas of Standard Bolts

23.1.2 Types of Bolted Connections

6 There are two types of bolted connections:

Bearing type which transmits the load by a combination of shear and bearing on the bolt, Fig. 23.2.

Slip-critical transmits load by friction, Fig. 23.3. In addition of providing adequate at ultimate load, it must not slip during service loads.

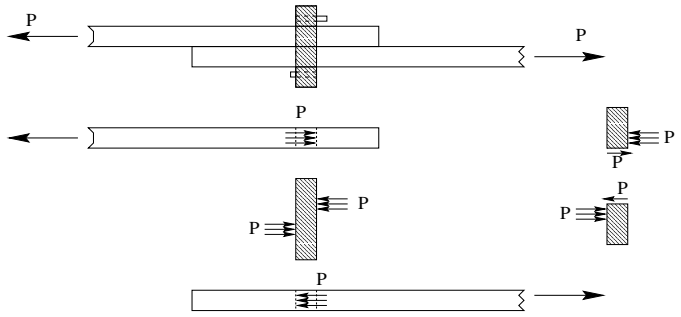

Figure 23.2: Stress Transfer by Shear and Bearing in a Bolted Connection

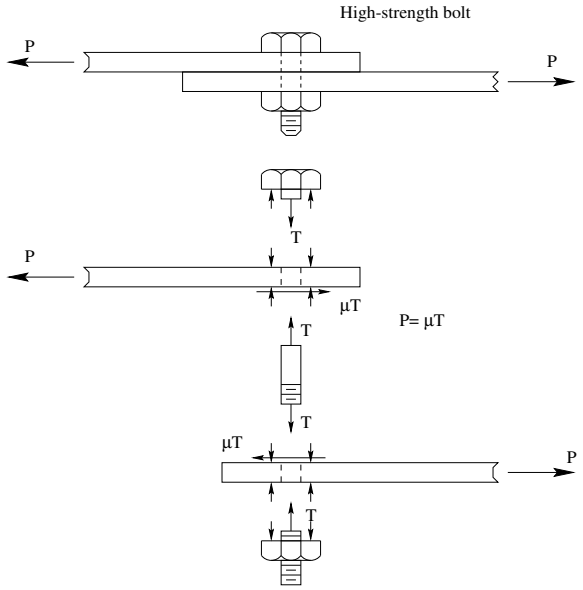

Figure 23.3: Stress Transfer in a Friction Type Bolted Connection

7 Possible failure modes (or "limit states") which may control the strength of a bolted connection are shown in Fig. 23.4.

23.1.3 Nominal Strength of Individual Bolts

Tensile Strength The nominal strength R_n of one fastener in tension is

$$R_n = F_u^b A_n \tag{23.1}$$

where F_u^b is the tensile strength of the bolt, and A_n the area through the threaded portion, also known as "tensile stress area". The ratio of the tensile stress area to the gross area A_g ranges from 0.75 to 0.79.