9.3.7 Design strength of bolts in tension

9.3.7.1 Tension capacity of bolts

The tension capacity P_t of a bolt should be taken as

$$P_t = A_s\ p_t \qquad (9.25)$$

where

A_s is the tensile stress area

p_t is tension strength obtained from Table 9.8.

Table 9.8 - Design tension strength of bolts

Bolt grade			Design tension strength p_t (N/mm²)
ISO	4.6		240
	8.8		560
	10.9		700
BS	General grade HSFG	≤ M24	590
		≥ M27	515
	Higher grade HSFG		700
ASTM	A307		310
	A325		620
	A490		780
GB50017	8.8		400
	10.9		500
Other grades ($U_b \leqslant$ 1000 N/mm²)			0.7 U_b but ≤Y_b
Note: U_b is the specified minimum tensile strength of the bolt.			
Y_b is the specified minimum yield strength of the bolt.			

9.3.7.2 Prying force

(a) Design against prying force is not required provided that all the following conditions are satisfied.

(i) Bolt tension capacity P_t is reduced to

$$P_{nom} = 0.8\ A_t\ p_t \qquad (9.26)$$

in which P_{nom} is the nominal tension capacity of the bolt.

(ii) The bolt gauge G on the flange of UB, UC and T sections does not exceed 0.55B, in which B is total width of the flange, see Figure 9.11.

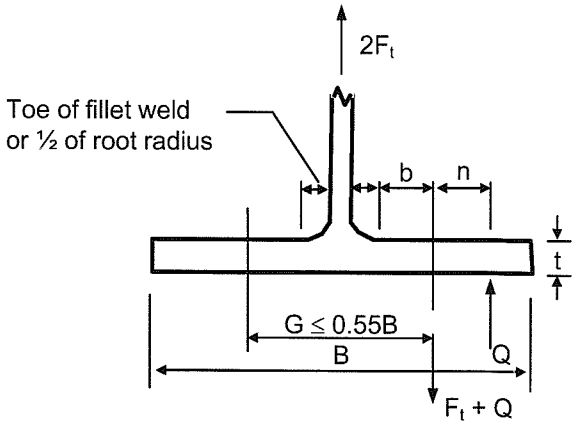

Figure 9.11 - Prying force

(b) If the conditions described in (a) above cannot be satisfied, the prying force Q should be calculated and taken into account and F_{tot} should be calculated as follows:

$$F_{tot} = F_t + Q < P_t \qquad (9.27)$$

F_{tot} is the total applied tension in the bolt including the prying force, and F_t is the tension force in the bolt.

The shear strength p_s should be reduced due to the effect of bolting conditions, see clauses 9.3.6.1.4 to 9.3.6.1.6 below.

Table 9.5 - Design shear strength of bolts

Bolt grade			Design shear strength p_s (N/mm²)
ISO	4.6		160
	8.8		375
	10.9		400
BS	General grade HSFG	≤ M24	400
		≥ M27	350
	Higher grade HSFG		400
ASTM	A307		124
	A325		248
	A490		311
GB50017	8.8		250
	10.9		310
Other grades (U_b ≤ 1000 N/mm²)			$0.4U_b$
Note: U_b is the specified minimum tensile strength of the bolt.			

9.3.6.1.2 Bearing capacity of bolts

The bearing capacity P_{bb} of a bolt bearing on connecting parts should be taken as

$$P_{bb} = d\ t_p\ p_{bb} \tag{9.16}$$

where d is the nominal diameter of the bolt

t_p is the thickness of the thinner connecting part

p_{bb} is the bearing strength of the bolt obtained from Table 9.6

Table 9.6 - Design bearing strength of bolts

Bolt grade			Design bearing strength p_{bb} (N/mm²)
ISO	4.6		460
	8.8		1000
	10.9		1300
BS	General grade HSFG	≤ M24	1000
		≥ M27	900
	Higher grade HSFG		1300
ASTM	A307		400
	A325		450
	A490		485
GB50017	8.8		720
	10.9		930
Other grades (U_b ≤1000 N/mm²)			$0.7(U_b + Y_b)$
Note: U_b is the specified minimum tensile strength of the bolt. Y_b is the specified minimum yield strength of the bolt.			

9.3.6.1.3 Bearing capacity of connected parts

The bearing capacity P_{bs} of the connected parts should be the least of the followings

$$P_{bs} = k_{bs}\ d\ t_p\ p_{bs} \tag{9.17}$$

$$P_{bs} = 0.5\ k_{bs}\ e\ t_p\ p_{bs} \tag{9.18}$$

and

$$P_{bs} = 1.5\ l_c\ t_p\ U_s \le 2.0\ d\ t_p\ U_b \tag{9.19}$$

in which