

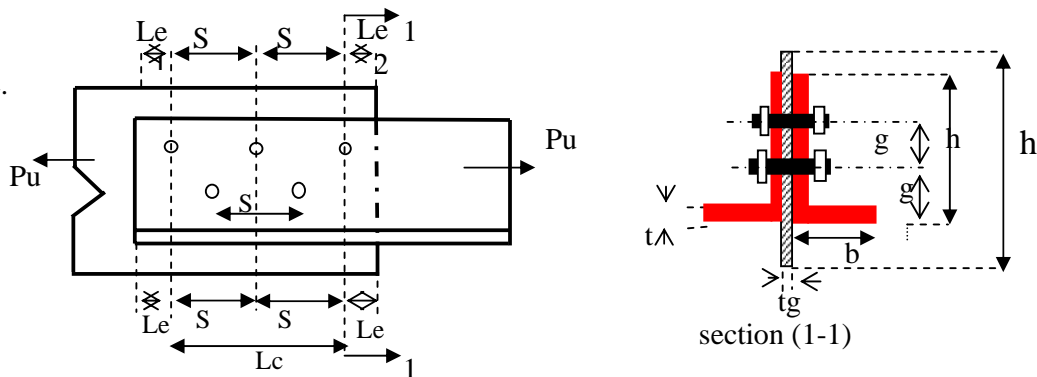
CE 473 : Steel Structures

Assignment: 2 -I - 28 Strength of Tension Members

Problem 1:

A tension member is composed of pair of angles 127 x 89 x 9.5 mm – A52 steel, with the long legs bolted to 250x10 mm gusset plate by 5 bolts of diameter 22 mm as shown in Figure. Compute the design tensile strength due to:

- 1- Yielding on A_g
- 2- Fracture on A_e
- 3- Block shear rupture.



Is the design satisfactory for $P_u = 650$ kN ?

Given that: $S = 70$ mm,

$L_e = 35$ mm,

$g_1 = g_2 = 45$ mm,

Area of one angle = 1960 mm²,

& position of its c.g , $x = 21.9$ mm (along short leg) ,

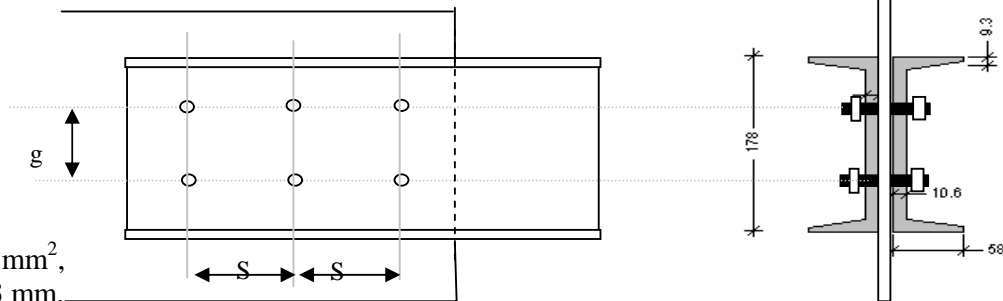
$y = 40.9$ mm (along long leg)

Problem 2:

A tension member is composed of 2 channels 180 x 22– A 36 steel, bolted to a 350 x 10 mm gusset plate by 6 bolts of diameter 20 mm, as shown in Figure. Compute the design tensile strength due to:

- 1- Yielding on A_g
- 2- Fracture on A_e
- 3- Block shear rupture.

Is the design satisfactory for $P_u = 900$ kN ?



Given that: $S = 70$ mm,

$L_e = 45$ mm,

$g = 80$ mm,

Area of channel = 2790 mm²,

Flange thickness $t_f = 9.3$ mm,

flange width = 58.0 mm

Web thickness $t_w = 10.6$ mm

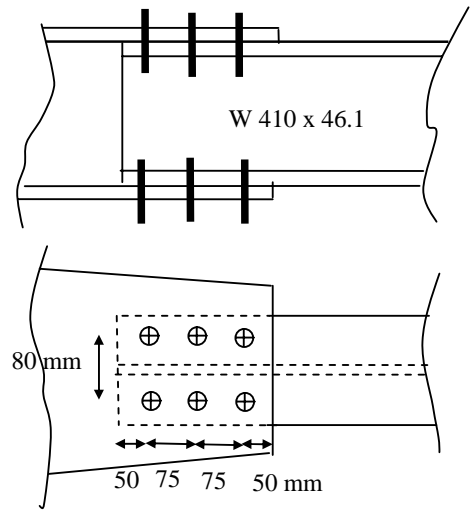
& position of its c.g , $x = 13.4$ mm

Problem 3:

A W 410 x 46.1 is connected at its ends with 12.5 mm plates at both flanges with 6 M 22 bolts at each flange, as shown in figure. If the member is made of steel A36, determine its factored tensile resistance based on;

- 1- Yielding on A_g
- 2- Fracture on A_e
- 3- Block shear rupture.

Given that for W 410 x 46.1
 $A_g = 5890 \text{ mm}^2$, $t_f = 11.2 \text{ mm}$, $b_f = 140 \text{ mm}$
 $d = 403 \text{ mm}$, $t_w = 7.0 \text{ mm}$

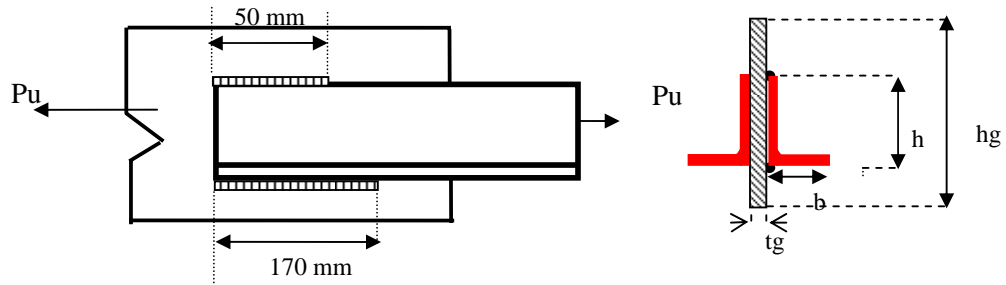


Problem 4:

If the same section given in problem (1) with long legs welded to 10 mm gusset plate as shown in figure with a length, . Compute the design tensile strength due to:

- 1- Yielding on A_g
- 2- Fracture on A_e
- 3- Block shear rupture.

Is the design satisfactory for $P_u = 1000 \text{ kN}$?



Problem 5:

If the same channels used in problem (2) welded to 250 x 10 mm plate, as shown in Figure, Compute the design tensile strength due to:

- 1- Yielding on A_g
- 2- Fracture on A_e
- 3- Block shear rupture.

Is the design satisfactory for $P_u = 1300 \text{ kN}$?

