

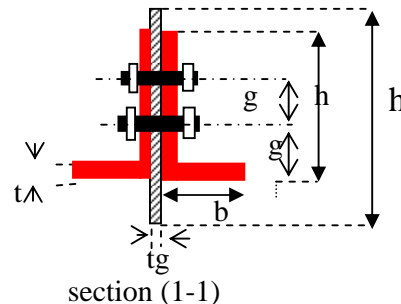
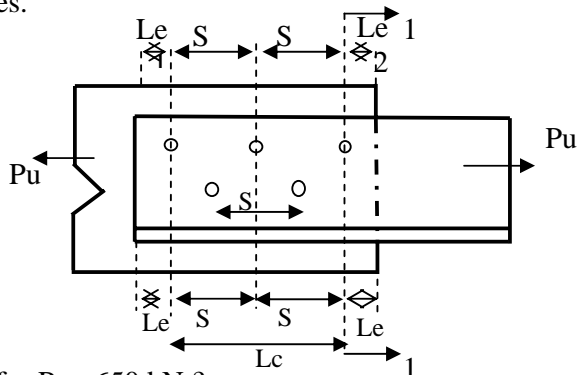
CE 473 : Steel Structures

Assignment: 3 -I - 28 Strength of Connections

Problem 1:

A tension member is composed of pair of angles 127 x 89 x 9.5 mm – A50 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 connection strength due to:

- 1- Slip-critical connection
- 2- bolt shear failure
- 3- Bearing failure of angles.
- 4- Gusset plate strength
 - a) Yielding on A_g
 - b) Fracture on A_e
 - c) Block shear



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) ,

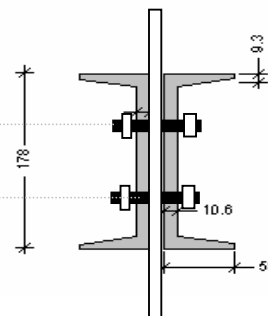
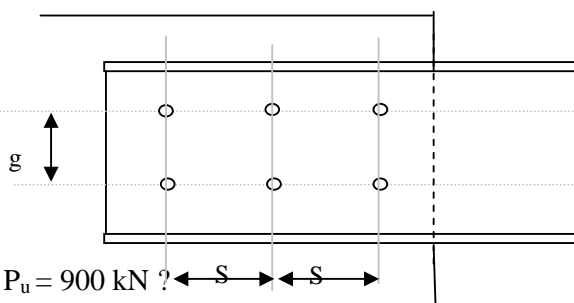
$y = 40.9$ mm (along long leg)

For bolts A325, $F_u = 620$ MPa, $F_v = 400$ MPa, and $\mu = 0.5$

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 connection strength due to:

- 1- Slip-critical connection
- 2- bolt shear failure
- 3- Bearing failure of angles.
- 4- Gusset plate strength
 - a) Yielding on A_g
 - b) Fracture on A_e
 - c) Block shear



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

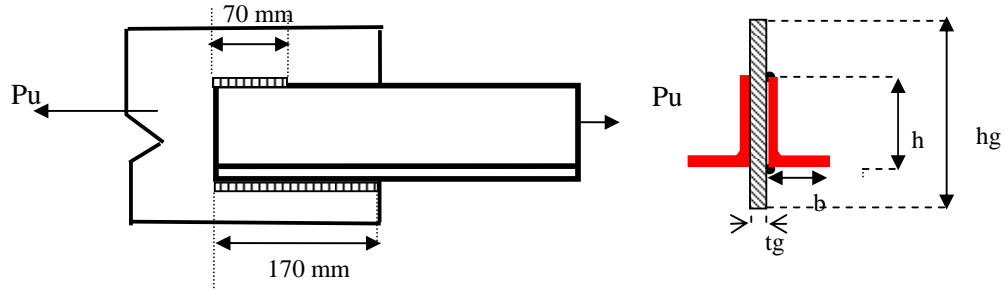
& position of its c.g , $x = 13.4$ mm

Problem 3:

If the same section given in problem (1) with long legs welded to 250x10 mm gusset plate as shown in figure with size of 6mm and $F_{Ex} = 500$ MPa. Compute the design connection strength due to:

- 1- Fracture of weld
- 2- Yielding of gusset plate on A_g
- 3- Fracture of guest plate on A_e
- 4- Block shear rupture of guest plate

Is the design satisfactory for $P_u = 1000$ kN ?

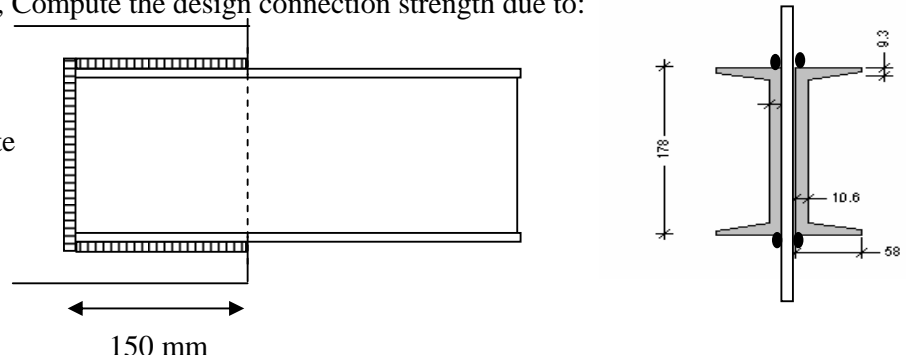


Problem 4:

If the same channels used in problem (2) welded to 250 x 10 mm plate with size of 6mm and $F_{Ex} = 500$ MPa, as shown in Figure, Compute the design connection strength due to:

- 1- Fracture of weld
- 2- Yielding of gusset plate on A_g
- 3- Fracture of guest plate on A_e
- 4- Block shear rupture of guest plate

Is the design satisfactory for $P_u = 1300$ kN ?



Problem 5:

For all above problems compare your results with those obtained from the member strength of assignment (2), to determine the maximum ultimate load to be applied on such connections.