INTERNATIONAL UNIVERSITY OF AFRICA

CIVIL ENGINEERING DEPARTMENT

ANALYSIS AND DESIGN OF STEEL WORKS II

Tutorial 1

Numerical examples on Connections by bolts

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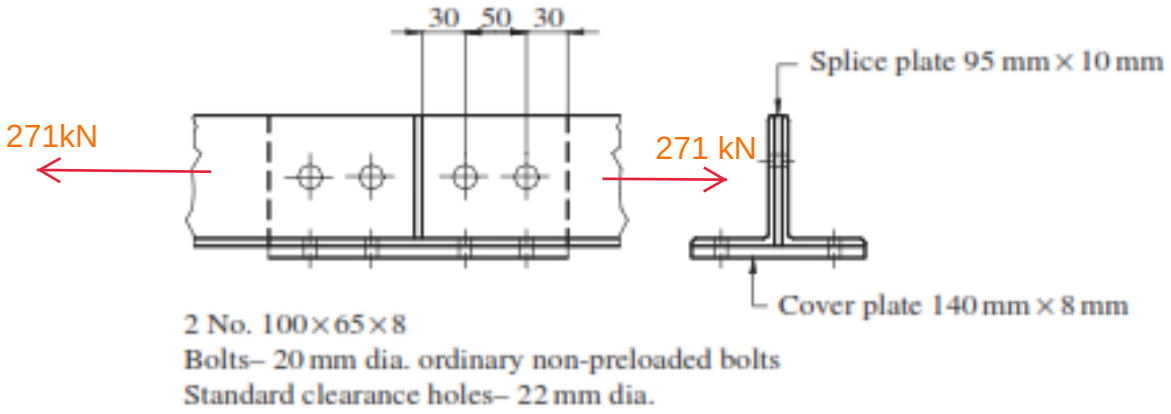
Examples of non-preloaded bolted connections

Example (1)

The joint shown in Figure is subjected to a tensile ultimate load
All data regarding the member and joint are shown in the figure. The steel is Grade S275 and the bolt Grade 4.6. Check that the joint is satisfactory. Gross area = 12.7cm2 per angle.
Factored load = 271 kN
Gross area = 12.7cm2 per angle.



Step 1 get the property of bolt from table

Table 10.1 Non-preloaded bolts in standard clearance holes (shear and bearing strengths of bolts and connected parts in N/mm^2)

Strength of bolts	*Bolt grade*					
	4.6	8.8	10.9	S275[a]	S355[a]	S460[a]
Shear strength p_s	160	375	400	–	–	–
Bearing strength p_{bb}	460	1000	1300	–	–	–
Bearing strength p_{bs}	–	–	–	460[b]	550[b]	670[b]

[a]Steel grade.
[b]Connected parts.

why 18mm not 20mm ? becuase i assumed the section is in the thread

Strength of bolts from Table 10.1 for 20-mm diameter bolts:
1-shear capacity
Single shear capacity on threads = 39.2kN $A_t x160=(18*18*3.14/4)*160$
Bearing capacity of bolts on 10-mm ply = 87.0Kn *18*10*460/1000*
*double shear capacity on threads = 39.2*2=78.4kN*
All group capacity in shear 2in double shear+ 4 single shear

Capacity of the bolt, $P_{bb} = dt_p p_{bb}$

=2 78.4+4*39.2=313 kN>217 kN* *OK for shear*

2-Bearing capacity bolts

Bearing capacity should be taken as lesser of:

Capacity of the bolt,

$$\text{Capacity of the bolt, } P_{bb} = dt_p p_{bb}$$

P_{bb} table 10.1=460 N/mm2 *t=10 mm d= nominal diameter of bolt=20 nn*

*Bearing capacity bolt =460*10*20/1000= 92 kN > 217/number of bolt (6 No)*

>36 kN OK for bearung

3-Capacity of the connected part:

- *Strength of the angles.*

Gross area = 12.7cm2 per angle.

Net area = 2(1270 - 2 × 22 × 8) = 1836 mm2

Design strength $p_y = 275\,\text{N/mm}^2$

Capacity $P_t = 275 \times 1836/10^3 = 504.9\,\text{kN}.$

Then Pt 504.9 kN.> 217 kN *OK*

in between plate multip by Ke= 1.2 since its S275

bottom cover

- *Strength of the connecting Plate*

Effective area $= 1.2[(95 - 22)10 + (140 - 44)8] = 1798\,\text{mm}^2$

Capacity $P_t = 275 \times 1798/10^3 = 494.3\,\text{kN}.$

Then Pt 494.3 kN.> 217 kN *OK*

K_e is a factor depending on the grade of steel, being 1.2 for S275 and 1.1 for grade S355.