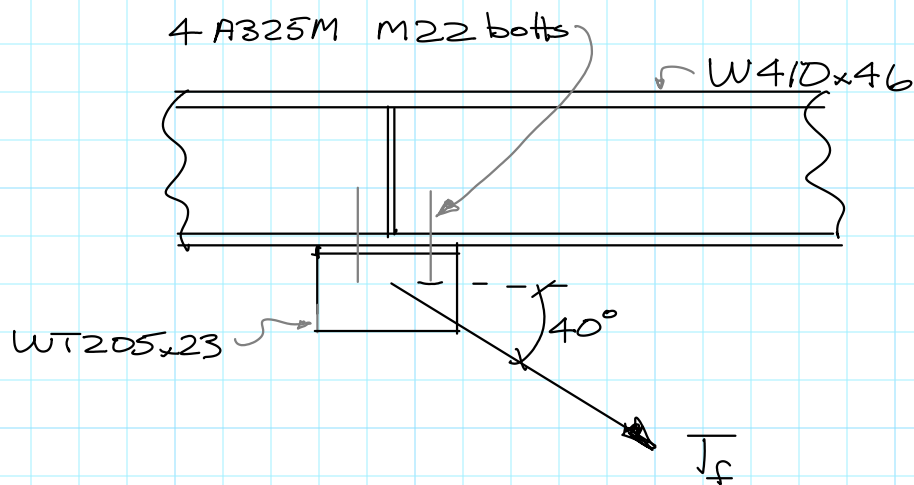


CIVE 3205

Bolt-5

Combined Shear  
&  
Tension in Bolts



Compute max  
factored value of  
 $T$

horizontal component, shear

$$V_f = \cos 40^\circ T_f = 0.766 T_f$$

vertical component, tension

$$T_f = \cos 50^\circ T_f = 0.643 T_f$$

Resistances

Shear, threads intercepted

$$V_r = 0.8 \times 0.6 \times 4 \times 1 \times \frac{\pi \times 22^2}{4} \times 0.830 \times 0.7$$

$$= 424 \text{ kN} \leftarrow \text{governs.}$$

Bearing

$$B_r = 3 \times 0.7 \times 4 \times 11.2 \times 22 \times 0.450$$

$$= 931 \text{ kN}$$

Tension

$$T_r = 0.75 \times 0.8 \times \frac{\pi \times 22^2}{4} \times 0.830 \times 4$$

$$= 757 \text{ kN}$$

Combined

$$\left( \frac{V_f}{V_r} \right)^2 + \left( \frac{T_f}{T_r} \right)^2 \leq 1$$

$$\left(\frac{0.766 T_f}{424}\right)^2 + \left(\frac{0.643 T_f}{757}\right)^2 \leq 1$$

$$3.26 \times 10^{-6} T_f^2 + 0.721 \times 10^{-6} T_f^2 \leq 1$$

$$T_f^2 \leq 251000$$

$$T_f \leq 501 \text{ kN}$$