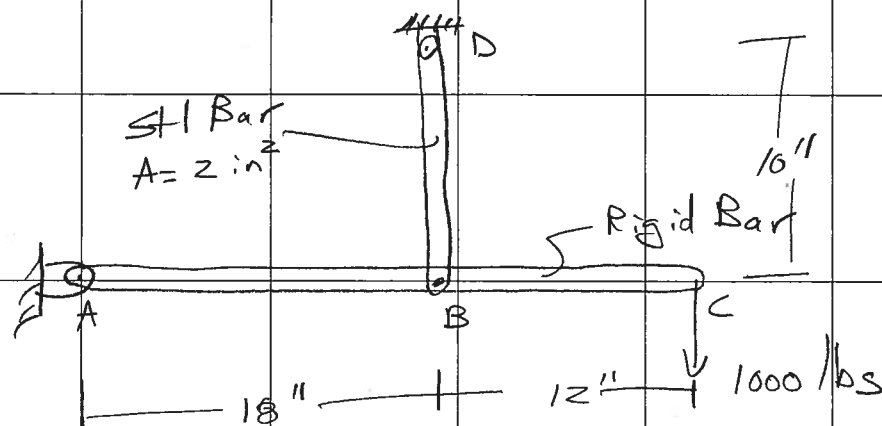
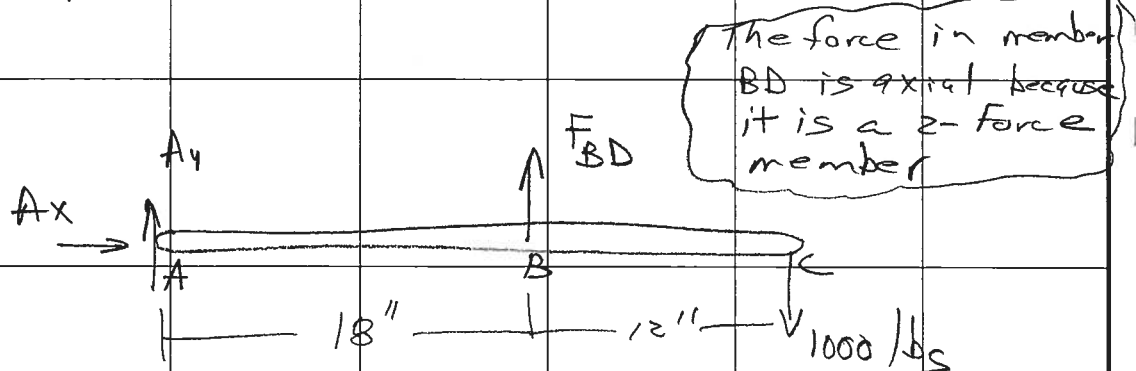


Rigid member ABC is pin supported at A as shown. Member BD is a steel member ($E = 30 \times 10^6 \frac{\text{lb}}{\text{in}^2}$) that is pin supported at D and attached to the rigid bar at B with a pin.

Calculate the reactions on member ABC, the nominal tensile stress in the middle area of member BD, and the vertical deflection of point C.



First draw a F.B.D. of member ABC



The force in member BD is axial because it is a 2-force member

$$\sum \curvearrowright M_A = 0$$

$$+ F_{BD} (18) - 1000 (30) = 0$$

$$\underline{F_{BD} = 1666.7 \text{ lbs}}$$

$$+\uparrow \sum F_y = 0$$

$$+ A_y$$

$$+ \cancel{F_{BD}}^{1666.7} - 1000 = 0$$

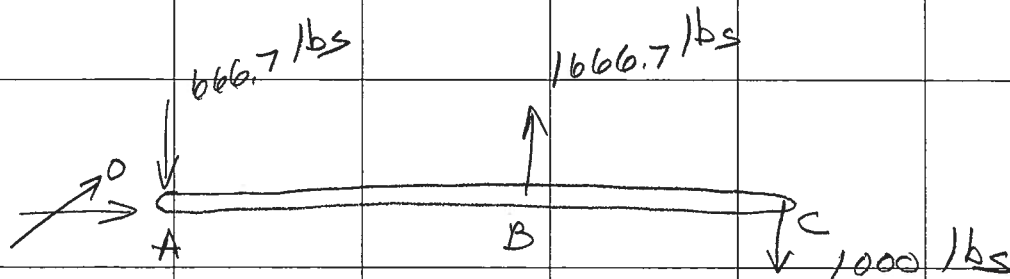
$$A_y = -666.7 \text{ lbs} \uparrow$$

or

$$\underline{666.7 \text{ lbs} \downarrow}$$

$$+\rightarrow \sum F_x = 0$$

$$+ A_x = 0$$



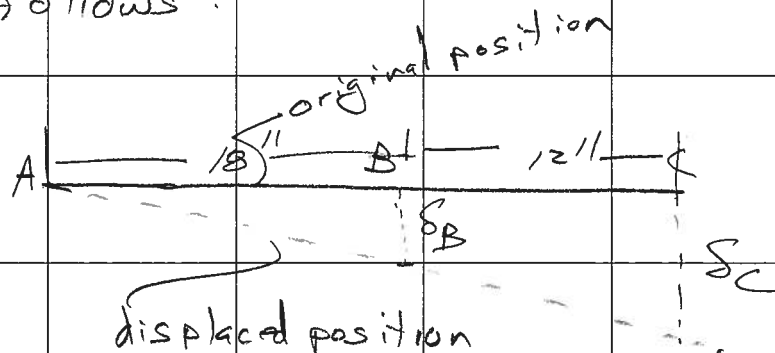
Summary of reactions
on member ABC

The nominal stress in member BD is given as follows

$$\sigma_{BD} = \frac{P_{BD}}{A_{BD}} = \frac{1666.7 \text{ lbs}}{2 \text{ in}^2}$$

$$\sigma_{BD} = 833.3 \frac{\text{lbs}}{\text{in}^2}$$

Member BD is in tension which means that it will lengthen. Since member ABC is rigid, the displacement can be visualized as follows:



Using similar triangles we can say

$$\frac{\delta_B}{18} = \frac{\delta_C}{30}$$

or

$$\delta_C = \frac{30}{18} \delta_B = 1.667 \delta_B$$

S_B is found as follows

$$S_B = \frac{P_{BD} L_{BD}}{A_{BD} E_{BD}}$$

$$S_B = \frac{(1666.7 \text{ lbs})(10 \text{ in})}{(2 \text{ in}^2)(30 \times 10^6 \frac{\text{lb}}{\text{in}^2})}$$

$$S_B = 2.778 \times 10^{-4} \text{ in}$$

$\therefore$ 2.778×10^{-4}

$$S_C = 1.667 S_B$$

$$S_C = 4.631 \times 10^{-4} \text{ in}$$