

$$y_c = \frac{\sum x}{A}$$

$$A_{\text{TOTAL}} = 2(10) + 7(1) + 1(10) = 37 \text{ cm}^2$$

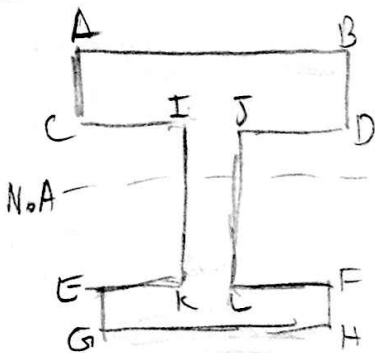
$$\sum x_{\text{TOTAL}} = 2(0) + 7(4.5) + 1(0.5) = 216.5 \text{ cm}$$

$$y_c = \frac{216.5}{37} = 5.85 \text{ cm}$$

$$\text{Centroid} = (0, 5.85)$$

$$\tau = \frac{VQ}{Ib} \quad I = \frac{1}{12}bh^3 + d^2A$$

$$\begin{aligned} I_{\text{TOTAL}} &= \frac{1}{12}(10)^2(2)^3 + (3.15)^2 \cdot 20 + \frac{1}{12}(1)(7)^3 + (1.35)^2(7) + \frac{1}{12}(10)(1)^3 + (5.35)^2 \cdot 10 \\ &= 205.117 + 41.34 + 287.06 = \underline{\underline{533.517 \text{ cm}^4}} \end{aligned}$$



$$\tau_{AB} = 0$$

$$\tau_{IJ} = \frac{VQ}{Ib}; \quad Q = 198.45 \text{ cm}^3, \quad b = 1 \text{ cm}, \quad V = 400 \text{ kN}$$

$$\tau_{IJ} = \frac{(400)(0.00019845)}{(0.000005335)(0.01)}$$

$$\therefore \tau_{IJ} = 1487910.028 \text{ kN/m}^2$$

$$\tau_{CD} = \frac{VQ}{Ib}, \quad Q = EAy$$

$$Q = 20(3.15)^2 = 198.45 \text{ cm}^3$$

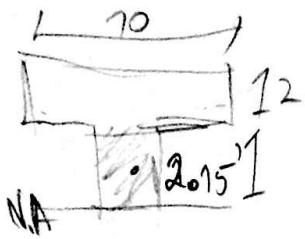
$$b = 10 \text{ cm}, \quad V = 400,000 \text{ N}$$

$$\therefore \tau_{CD} = \frac{(400,000)(0.00019845)}{(0.000005335)(0.1)}$$

$$\therefore \tau_{CD} = 148791 \text{ kN/m}^2$$

$$\tau_{N.A} = \frac{VQ}{Ib}, \quad V = 400 \text{ kN}, \quad I = 0.000005335 \text{ m}^4$$

$$b = 1 \text{ cm} = 0.01 \text{ m}$$



$$Q = (2.15)(1)(1.075)^2 + 20(3.15)^2 = 200.93 \text{ cm}^3$$

$$= 0.0002009 \text{ m}^3$$

$$\tau_{N.A} = \frac{400(0.0002009)}{(0.000005335)(0.01)} = 1506538.660 \text{ kN/m}^2$$

