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الشالوخ عام

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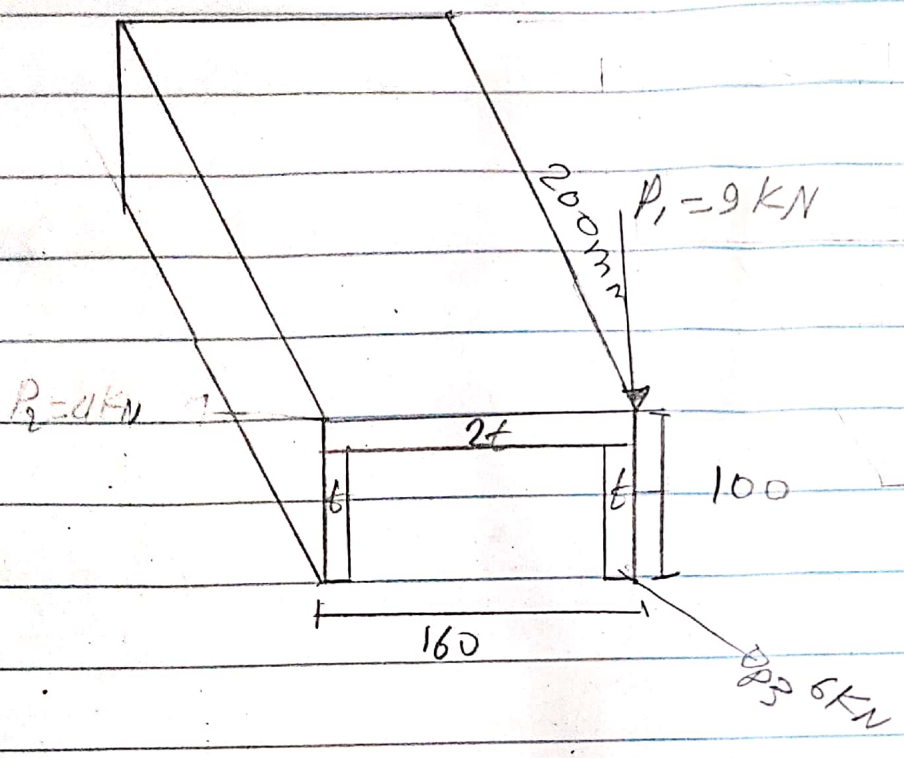
$S_{ubt} = 300\ MPa$

$S.F = 1.5$

Find thickness (t)



Sol

$$\bar{y} = \frac{\Sigma M_a (a-a)}{\Sigma A}$$

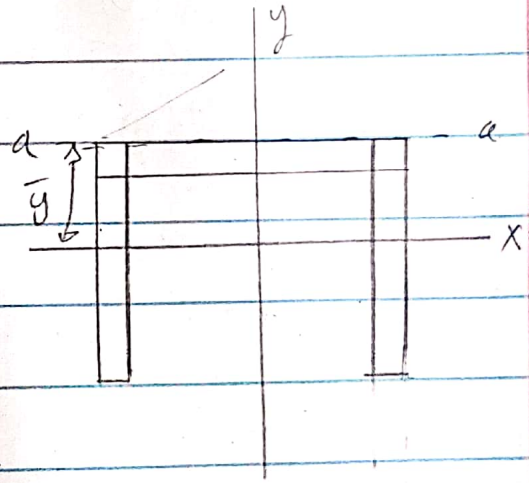
$$\bar{y} = \frac{(160 \times 2t)(0) + 2(100 * t)\,50}{(160 \times 2t) + 2(100 \times t)}$$

$$\bar{y} = 19.23\ mm$$

$$y_{bolo} = 100 - 19.23 = 80.77\ mm$$

$$\Sigma A = 160 \times 2t + 2(100t) = 520t$$

$$I = t$$



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$$I_x = \frac{bh^3}{12} + Ad^2$$

$$I_x = \frac{160(2t)^3}{12} + 160(2t)(19.23)^2$$

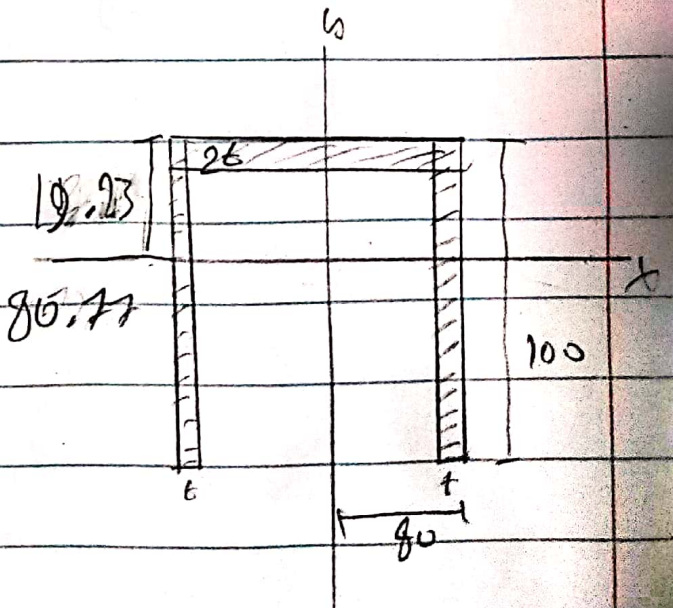
$$+ 2\left[\frac{t(100)^3}{12} + 100t\,(80.77-50)^2\right]$$

$$I_x = 2159.2.11 \cdot t \text{ mm}^4$$

$$I_y = \left[\frac{2t(160)^3}{12} + 2t(160)(0)^2\right]$$

$$+ 2\left[\frac{100t^3}{12} + 100t(80)^2\right]$$

$$I_y = 1696266.67t \text{ mm}^4$$



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$P_1 \rightarrow \delta x , I_1 , I_3$

$Pe \rightarrow \delta_{xy} , \delta x , \delta y$

$$\sigma x) t = \frac{\Sigma m . c}{I x} \mp \frac{P}{A}$$

$$\sigma x) t = \frac{\Sigma m . c}{Ix} \mp \frac{P}{A}$$

$$\sigma x) t = \frac{(9 \times 10^3 * 800) - (6 * 10^3 * 80.77)(19.23)}{2141519 2.11 t} + \frac{6 \times 10^3}{520 t}$$

$$\delta x t = \frac{12913675 7.4}{1415192.11 t} + \frac{6 \times 10^3}{520 t}$$

$$\delta y) t = \frac{1}{t} \left[\frac{12913675 7.4}{1415192.11} + \frac{6 \times 10^3}{520} \right]$$

$$\delta x) t = \frac{7908}{t}$$

$$\delta x) c = \frac{(9 \times 10^3) * 800) - (6 * 10^3 * 80.77) 80.77}{1415192.11 t}$$

$$- \frac{6 \times 10^3}{520 t}$$

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$$\delta x)_C = \frac{1}{E}\left[\frac{542012426}{1415192.11\,t} - \frac{6*10^3}{520}\right]$$

$$\delta x)_C = \frac{32.21}{t}$$

$$\delta y)_t = \frac{(6*10^3*80)80}{1962666.67\,t} + \frac{6*10^3}{520t}$$

$$\delta y) = \frac{1}{t}\left[19,5652 + 11,5385\right]$$

$$\delta y)_t = \frac{31.10366154}{t}$$

$$\delta y)_C = \frac{6*10^3*80*80}{1962666.67t} - \frac{6\times10^3}{520t}$$

$$\delta y_C = \left[19.5652 - 11.5385\right]\frac{1}{E}$$

$$\delta y_C = \frac{8}{t}$$

$$\frac{\delta x)_C + \delta y)_C}{\delta x)_t + \delta y)_t}$$

$$\frac{\frac{32.21}{E} + \frac{8}{E}}{\frac{7008}{t} + \frac{31.103}{t}} = 5.065\times10^{-3} < 1$$

tension

COPHONE

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$$T_1 = \frac{P}{A} = \frac{9 \times 10^3}{5204} = \frac{17.30}{t}$$

$$T_2 = \frac{\sum T \times r}{J}$$

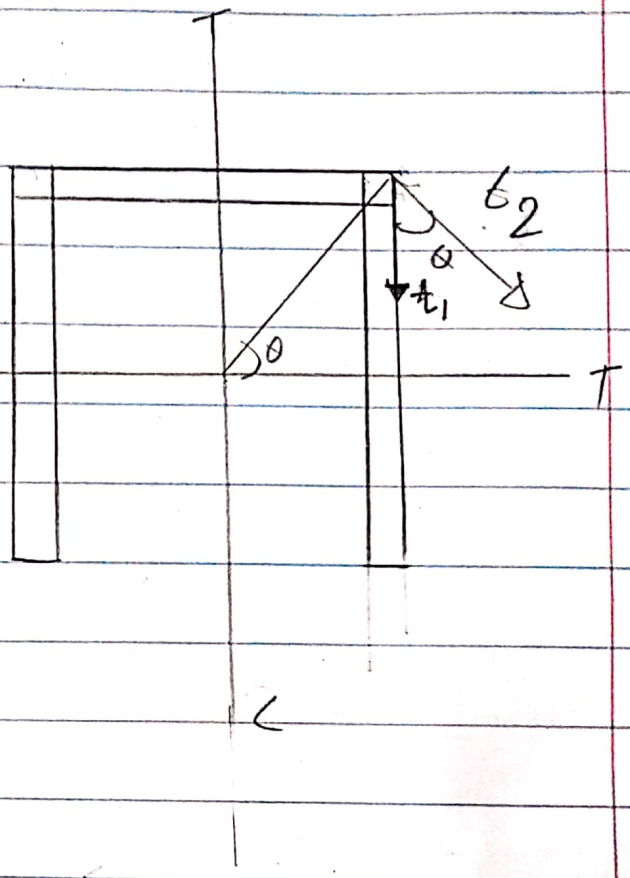
$$T_2 = \frac{[9 \times 10^3 \times 80]\, 82.21}{4\,15192.11 + 196266.66}$$

$$T_2 = \frac{22.24}{t}$$

$$r = \sqrt{(19.23)^2 + (80)^2} = 82.21$$

$$\theta = \tan^{-1}\left(\frac{19.23}{80}\right)$$

$$\theta = 13.5$$



$$R_x = T_2 \sin\theta = \frac{22.24}{t} \sin 13.5 = \frac{5.198}{t}$$

$$R_y = T_1 + T_2 \cos\theta$$

$$= \frac{17.30}{t} + \frac{22.24}{t} \cos 13.5 = \frac{38.92}{t}$$

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$$\tau_{xy} = \sqrt{R_x^2 + R_y^2}$$

$$\tau_{xy} = \sqrt{\left(\frac{5.198}{t}\right)^2 + \left(\frac{38.92}{t}\right)^2}$$

$$\tau_{xy} = \sqrt{\frac{27.019}{t^2} + \frac{1514.76}{t^2}}$$

$$\tau_{xy} = \frac{\sqrt{1541.7}}{t2} = \frac{39.265}{t}$$

$$\frac{\delta_{w.l}}{S.f} = \frac{\delta_x + \delta_y}{2} + \sqrt{\left(\frac{\delta_x - \delta_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\frac{300}{1.5} = \frac{\frac{7908}{t} + \frac{31.103}{t}}{2} + \sqrt{\left(\frac{\frac{7908 + 31.103}{t}}{2}\right)^2 + \left(\frac{39.265}{t}\right)^2}$$

$$200 = \frac{3969.5}{t} + \sqrt{\frac{15511376.59}{t^2} + \frac{1541.74}{t2}}$$

$$200 = \frac{3969.5}{t} + \sqrt{\frac{3938.644225}{t}}$$

$$200 = \frac{7908.145}{t} \quad t = 39.54072 \text{ min}$$

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