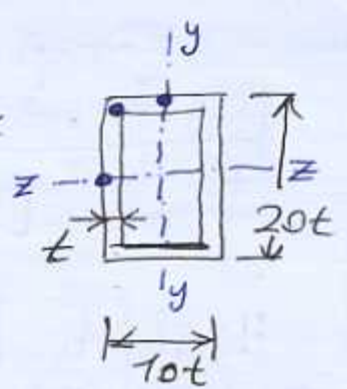


$$M_x = T =$$

$$M_y =$$

$$M_z =$$



$$Z = \frac{T}{2tA} = \frac{T}{2t \cdot 9t \cdot 19t} = T / 342 t^3$$

$$\sigma_{maks} = \frac{M_y}{I_{yy}} \cdot z_{maks} = \frac{M_y}{\frac{1}{12} [20t(10t)^3 - 18t(8t)^3]} \cdot 5t = 0,005563798 M_y / t^3$$

$$\sigma_{maks} = \frac{M_z}{I_{zz}} \cdot y_{maks} = \frac{M_z}{\frac{1}{12} [10t(20t)^3 - 8t(18t)^3]} \cdot 10t = 0,003598848 M_z / t^3$$

$$M_x = 4,5 \text{ kNm}$$

$$M_y = 2,5 \text{ kNm}$$

$$M_z = 3,5 \text{ kNm}$$

$$t = 4 \text{ mm}$$

$$b = 40 \text{ mm}$$

$$h = 80 \text{ mm}$$

$$I_z = 470666,6 \Rightarrow W_z = 17783 \text{ mm}^3$$

$$I_y = 426666,6 \Rightarrow W_y = 21333,3$$

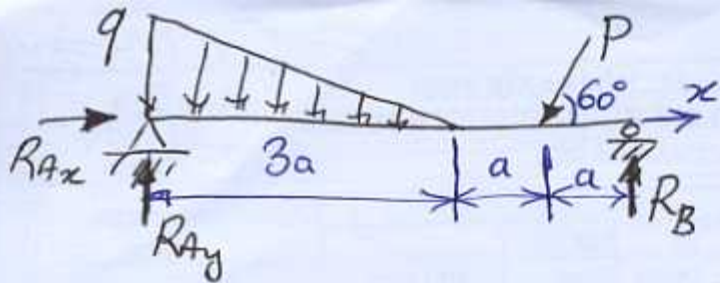
$$\sigma_y = \frac{M_y}{W_y} = 117,3 \text{ MPa} ; \sigma_z = \frac{M_z}{W_z} = 196,196 \text{ MPa} ; \tau = \frac{T}{2tA} = 205,6 \text{ MPa}$$

$$I_z = \frac{10t(20t)^3}{12} - \frac{8t(18t)^3}{12} = 2778,6 t^4$$

$$W_z = 277,86 t^3 \checkmark$$

$$I_y = \frac{20t(10t)^3}{12} - \frac{18t(8t)^3}{12} = 898,6 t^4$$

$$W_y = 179,73 t^3 \checkmark$$



$$R_{Ax} = 0,5 \cdot P$$

$$R_{By} = 0,69282 \cdot P + 0,3qa$$

$$R_{Ay} = 0,1732 \cdot P + 1,2qa$$

$$\sum F_x = 0 \Rightarrow R_{Ax} = P \cos 60^\circ = P/2$$

$$\sum F_y = 0 \Rightarrow R_{Ay} + R_B = \frac{1}{2} \cdot q \cdot 3a + 0,866P$$

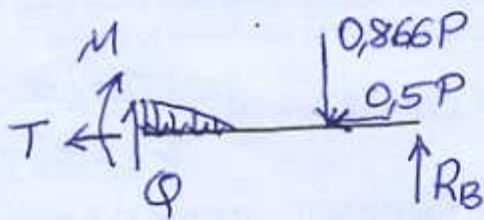
$$\sum M_A = 0 \Rightarrow \frac{1}{2} q 3a a + \frac{\sqrt{3}}{2} P 4a - R_B \cdot 5a = 0$$

$$R_B = (6,9282P + 3qa)/10$$

$$\sum M_B = 0 \Rightarrow R_{Ay} \cdot 5a - \frac{1}{2} q 3a 4a - \frac{\sqrt{3}}{2} P a = 0$$

$$R_{Ay} = (1,732P + 12qa)/10$$

Kirişin tam ortasında kesitler yöntemiyle



$$\frac{x/2}{q} = \frac{a/2}{3a}$$

$$x = q/6 \checkmark$$

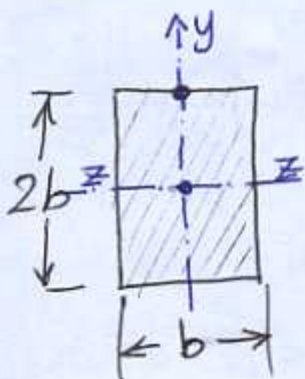
$$T = -0,5 \cdot P \checkmark$$

$$Q = 0,866P + \frac{1}{2} \frac{q}{6} \frac{a}{2} - 0,69282P - 0,3qa$$

$$Q = 0,1732 \cdot P - 0,2583 qa \checkmark$$

$$M = (0,69282 \cdot P + 0,3qa) \cdot \frac{5}{2} a - \frac{\sqrt{3}}{2} P \cdot \frac{3a}{2} - \frac{1}{2} \frac{q}{6} \frac{a}{2} \cdot \frac{1}{3} \frac{a}{2}$$

$$M = 0,433 \cdot P \cdot a + 0,743 qa^2 \checkmark$$



$$Z_{ort} = T/A$$

$$Z_{ort} = \frac{0,5P}{2b \cdot b}$$

$$Z_{ort} = P/4b^2$$

$$Z_{maks} = \frac{3}{2} Z_{ort}$$

$$Z_{maks} = 3P/8b^2$$

$$\sigma = \frac{\sqrt{3}P}{2A}$$

$$\sigma = \sqrt{3}P/2 \cdot 2 \cdot b^2$$

$$\sigma = 0,433 \cdot P/b^2$$

$$\sigma = \frac{M}{I_{TE}} \cdot y_{maks}$$

$$\sigma = \frac{M}{\frac{b(2b)^3}{12}} \cdot b$$

$$\sigma = 3M/2b^3$$

$$\sigma_N = \frac{-1,25 \times 100}{50 \times 100} = -0,25 \text{ MPa}$$

$$Z_{ort} = \frac{Q}{A} = \frac{-0,2}{5000} = -0,04 \text{ MPa}$$

$$Z_{maks} = \frac{3}{2} Z_{ort} = -0,06 \text{ MPa}$$

$$\sigma = \frac{M}{I} y_{maks} = 24,38 \text{ MPa}$$

$$T = -1,25 \text{ kN}$$

$$Q = -0,2 \text{ kN}$$

$$M = 2,032 \text{ kN.m}$$

$$q = 3,5 \text{ kN/m}$$

$$P = 2,5 \text{ kN}$$

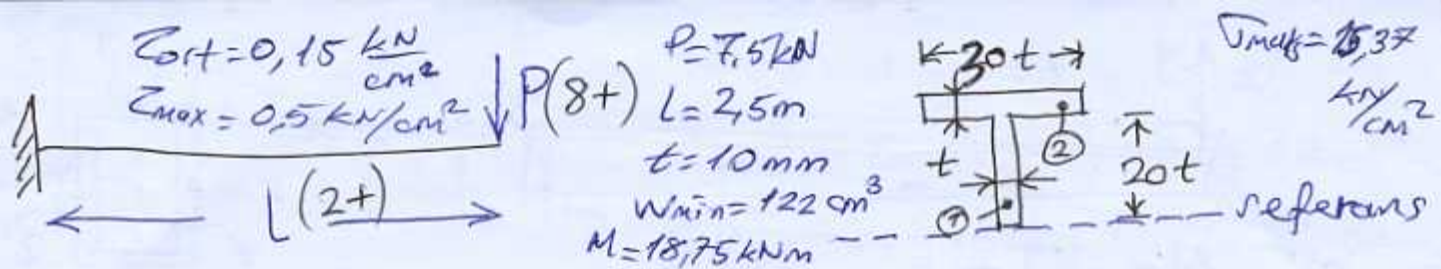
$$L = 3,5 \text{ m}$$

$$b = 50 \text{ mm}$$

$$R_{By} = 2,467 \text{ kN} \checkmark$$

$$R_{Ay} = 3,373 \checkmark$$

$$R_{Ax} = 1,25 \text{ kN}$$



	birim	A_i	y_i	$A_i \times y_i$	I_i	d_i	d_i^2	$A_i \times d_i^2$
①	$t \times 20t$	$20t^2$	$10t$	$200t^3$	$666,6t^4$	$16,3t - 10t$	$39,69t^2$	$793,8t^4$
②	$30t \times t$	$30t^2$	$20,5t$	$615t^3$	$2,5t^4$	$16,3t - 20,5t$	$17,64t^2$	$529,2t^4$
		$\Sigma_1 = 50t^2$	$\Sigma_2 = 815t^3$	$\Sigma_3 = 669,2t^4$	$\Sigma_4 = 1323t^4$			

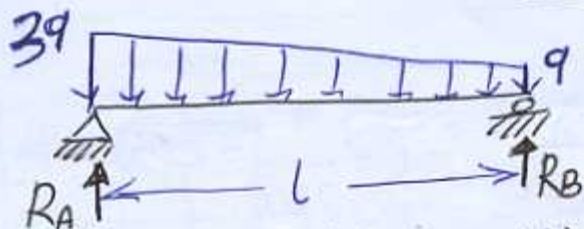
$$y_{TE} = y_{maks} = \Sigma_2 / \Sigma_1 = 16,3 \cdot t \quad \parallel \quad I_{TE} = \Sigma_3 + \Sigma_4 = 1992,2 t^4$$

$$M_{maks} = P \cdot L \Rightarrow \sigma_{maks} = \frac{M_{maks}}{I_{TE}} \cdot y_{maks} = \frac{P \cdot L}{122,22 t^3}$$

$$Q_{maks} = P \Rightarrow Z_{maks} = \frac{Q_{maks} \cdot S}{I_{TE} \cdot t}$$

$$S = \bar{A} \cdot \bar{y} = (t \times 16,3t) \times \left(\frac{16,3t}{2} \right) = 132,845 t^3$$

$$Z_{maks} = \frac{P \cdot 132,845 t^3}{1992,2 t^4 \cdot t} = 0,0668 P / t^2$$



$$\Sigma M_A = 0 \Rightarrow R_B = \left(\frac{q \cdot l \cdot l}{2} + \frac{1}{2} \cdot 2q \left(\frac{l}{3} \right) \right) / l = \frac{5}{6} q l$$

$$\Sigma M_B = 0 \Rightarrow R_A = \left(\frac{q \cdot l \cdot l}{2} + \frac{1}{2} \cdot 2q \left(\frac{2l}{3} \right) \right) / l = \frac{7}{6} q l$$

$$Q(x) = 0 = \frac{q}{l} x^2 + q x - \frac{5}{6} q l$$

$$D = b^2 - 4ac \Rightarrow D = q^2 + \frac{10}{3} q^2 = \frac{13}{3} q^2$$

$$x_{1,2} = \frac{-b \pm \sqrt{D}}{2a} \parallel x_{1/2} = \frac{-q \pm 2,089}{2(q/l)}$$

$$x_1 = 0,54083 \cdot l \quad \checkmark$$

Kesit alma yöntemiyle



$$Q = qx + \frac{1}{2} \cdot \frac{2qx}{l} \cdot x - \frac{5}{6} ql$$

$$M = -qx \frac{x}{2} + \frac{1}{2} \cdot \frac{2qx}{l} \cdot x \frac{x}{3} + \frac{5}{6} qlx$$

$$N(x) = -\frac{1}{3} \frac{q}{l} x^3 - \frac{1}{2} qx^2 + \frac{5}{6} qlx$$

$$M(0,54083 \cdot l) = 0,105462 \cdot q \cdot l^2$$

$$M_{maks} = 0,2517127 \cdot q \cdot l^2 \quad \checkmark$$