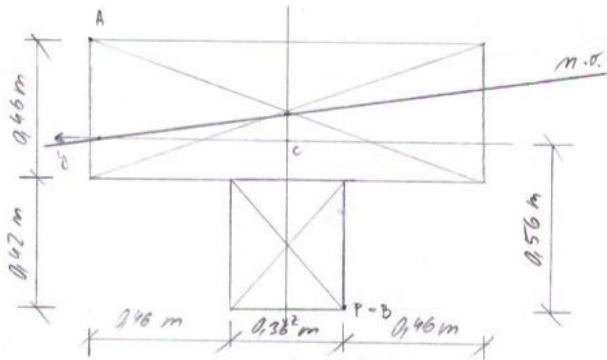


PRÍKLAD 1) STĽP S PRIEREZOM LP JE NATAŽENÝ TLAKOVOU OSOVOU SILOU F PÔSOBIACOU V BODE P. URČITE MAXIMÁLNU SILU F TAK, ABY NAPÄTIE V PRIEREZE NEPREKROČILO 6 NÁVRH $\sigma_{\text{tl}} = 20 \text{ MPa}$ A 6 NÁVRH $\tau_{\text{tl}} = 1,2 \text{ MPa}$. VYPOČÍTajte A VTKRESLITE POLOHU NEUTRÁLNEJ OSI A PRIEBEH NORMÁLOVÝCH NAPÄTÍ V PRIEREZE.



$$A = A_1 + A_2 = 0,146 \cdot 1,28 + 0,142 \cdot 0,36 = 0,18888 + 0,1512 = 0,34008 \text{ m}^2$$

$$z_c = \frac{\sum A_i \cdot z_i}{\sum A_i} = \frac{0,18888 \cdot 0,165 + 0,1512 \cdot 0,121}{0,34008} = 0,156 \text{ m}$$

$$I_y = \sum (I_{y_i} + A_i (z_i - z_c)^2) = \frac{1}{12} \cdot 1,28 \cdot 0,146^3 + 0,18888 \cdot 0,09^2 + \frac{1}{12} \cdot 0,36 \cdot 0,142^3 + 0,1512 \cdot (-0,075)^2 = 10,38 \cdot 10^{-3} + 4,769 \cdot 10^{-3} + 2,222 \cdot 10^{-3} + 18,522 \cdot 10^{-3} = 35,895 \cdot 10^{-3} \text{ m}^4$$

$$I_z = \sum (I_{z_i} + A_i (z_i - z_c)^2) = \frac{1}{12} \cdot 0,146 \cdot 1,28^3 + \frac{1}{12} \cdot 0,142 \cdot 0,36^3 = 80,39 \cdot 10^{-3} + 1,6329 \cdot 10^{-3} = 82,023 \cdot 10^{-3} \text{ m}^4$$

$$i_y = \sqrt{\frac{I_y}{A}} = \sqrt{\frac{35,895 \cdot 10^{-3}}{0,34008}} = 0,220 \text{ m}$$

$$i_z = \sqrt{\frac{I_z}{A}} = \sqrt{\frac{82,023 \cdot 10^{-3}}{0,34008}} = 0,333 \text{ m}$$

$$P [-0,18; 0,156]$$

$$r = -\frac{i_z^2}{z_p} = -\frac{0,333^2}{-0,18} = 0,616 \text{ m}$$

$$A [0,165; -0,132]$$

$$q = -\frac{i_y^2}{z_p} = -\frac{0,220^2}{0,156} = -0,086 \text{ m}$$

$$B [-0,18; 0,156]$$

$$\frac{F}{A} \cdot \left| \left(1 + \frac{z_p}{i_y^2} \cdot z + \frac{z_p}{i_z^2} \cdot y \right) \right| \leq 6 \text{ NÁVRH}$$

$$F^A = \frac{1,2 \cdot 10^3 \cdot 0,34008}{\left| \left(1 + \frac{0,156}{0,220^2} \cdot (-0,132) + \frac{(-0,18)}{0,333^2} \cdot (0,165) \right) \right|} = \frac{888}{1,3749} = 237,3 \text{ kN}$$

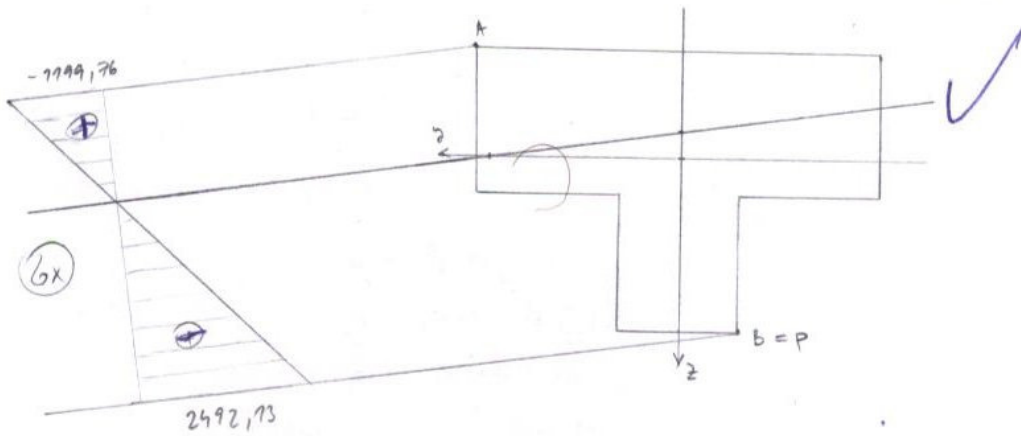
$$F^B = \frac{20 \cdot 10^3 \cdot 0,34008}{\left| \left(1 + \frac{0,156}{0,220^2} \cdot (0,156) + \frac{(-0,18)}{0,333^2} \cdot (-0,18) \right) \right|} = \frac{14800}{7,7715} = 1904,3 \text{ kN}$$

$$\Rightarrow F_{\text{min}} = 237,3 \text{ kN}$$

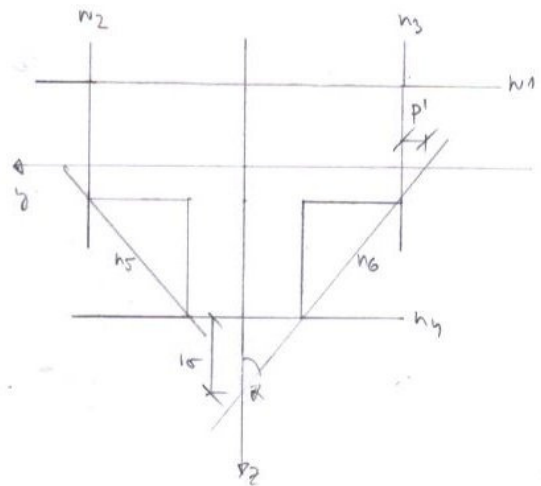
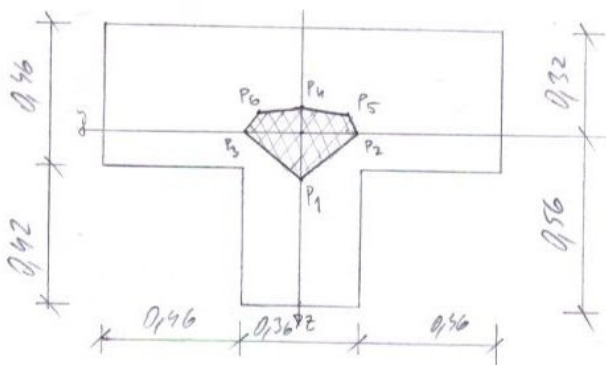
$$\sigma_x = \frac{F}{A} \left(1 + \frac{z_P}{i_y^2} \cdot z + \frac{y_P}{i_z^2} \cdot y \right)$$

$$\sigma_{xA} = \frac{257,3}{0,74} \left(1 + \frac{0,156}{0,220^2} \cdot (-0,32) + \frac{(-0,118)}{0,333^2} \cdot 0,64 \right) = \underline{\underline{-1199,76 \text{ tPa}}}$$

$$\sigma_{xB} = \frac{257,3}{0,74} \left(1 + \frac{0,156}{0,220^2} \cdot (0,156) + \frac{(-0,118)}{0,333^2} \cdot (-0,118) \right) = \underline{\underline{-2492,13 \text{ tPa}}}$$



PRÍKLAD 2) URČITE JADRO PRIEREZU PRE PRIEČNY REZ STŪPA



$$A = 0,74 \text{ m}^2$$

$$I_y = 35,895 \cdot 10^{-3} \text{ m}^4 \quad i_y = 0,220 \text{ m}$$

$$I_z = 82,023 \cdot 10^{-3} \text{ m}^4 \quad i_z = 0,333 \text{ m}$$

1) $P = \infty$; $q = -0,32 \text{ m}$

$$P = -\frac{i_z^2}{y_P} \Rightarrow y_P = -\frac{i_z^2}{P} = -\frac{0,333^2}{\infty} = 0 \text{ m}$$

$$q = -\frac{i_y^2}{z_P} \Rightarrow z_P = -\frac{i_y^2}{q} = -\frac{0,220^2}{-0,32} = 0,151 \text{ m}$$

$$P_1 [0,151; 0]$$

2) $P = 0,64 \text{ m}$; $q = \infty$

$$y_P = -\frac{0,333^2}{0,64} = -0,173 \text{ m}$$

$$z_P = -\frac{0,220^2}{\infty} = 0 \text{ m}$$

$$P_2 [-0,173; 0]$$

3) $P_3 [0,173; 0]$

$$4) p = \infty ; q = 0,56 \text{ m}$$

$$y_p = -\frac{0,333^2}{\infty} = 0 \text{ m}$$

$$P_4 [0 ; -0,086]$$

$$z_p = -\frac{0,220^2}{0,56} = -0,086 \text{ m}$$

$$5) \operatorname{tg} \alpha = \frac{0,46}{0,42}$$

$$\alpha = 47,602^\circ$$

$$\operatorname{tg} \alpha = \frac{\bar{q}}{0,18} \Rightarrow \bar{q} = 0,197 \text{ m}$$

$$\operatorname{tg} \alpha = \frac{0,113}{\bar{p}} \Rightarrow \bar{p} = 0,127 \text{ m}$$

$$q = 0,56 + \bar{q}$$

$$p = 0,64 + \bar{p}$$

$$q = 0,56 + 0,197$$

$$p = 0,64 + 0,127$$

$$q = 0,757 \text{ m}$$

$$p = 0,767 \text{ m}$$

$$y_p = -\frac{0,333^2}{0,767} = -0,145 \text{ m}$$

$$P_5 [-0,145 ; -0,065]$$

$$z_p = -\frac{0,220^2}{0,757} = -0,065 \text{ m}$$

$$6) P_6 [0,145 ; -0,065]$$