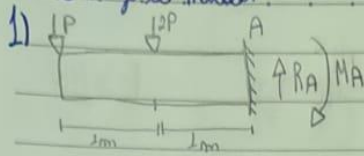


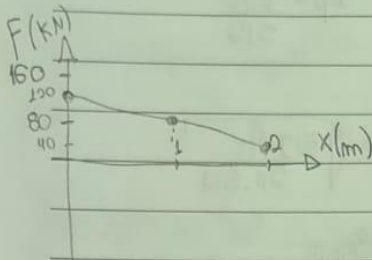
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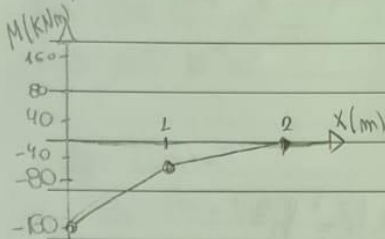


$$\begin{aligned}\sum F_x &= 0 \\ \sum F_y &= 0 & R_A - P - 2P &= 0 & R_A &= 3P = 120 \text{ kN} \\ \sum M &= 0 & M_A + 2P + P \cdot 2 &= 0 \\ & M_A &= -4P \\ & M_A &= 4P\end{aligned}$$

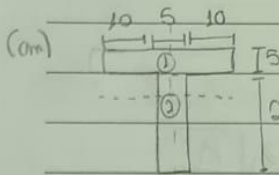
$$M_A = 160 \text{ kNm}$$



$$\begin{aligned}M + Px &= 0 \\ M &= -40x & Q &= -40 \\ x=0 & M=0 \\ x=1 & M=-40 \text{ kNm}\end{aligned}$$



$$\begin{aligned}M + 2Px + P(1+x) &= 0 \\ M &= -2Px - P - Px \\ M &= -3xP - P \\ Q &= -120 \text{ kN} \\ x=0 & M=-40 \text{ kNm} \\ x=1 & M=-160 \text{ kNm}\end{aligned}$$



$$\bar{I}_x = \frac{b \cdot h^3}{12}$$

	y	A	d _y	\bar{I}_x
1	12,5	125	7,5	260,42
2	27,5	125	7,5	6510,42

$$I_x = (\bar{I}_{x1} + A_1 \cdot d_{y1}^2) + (\bar{I}_{x2} + A_2 \cdot d_{y2}^2)$$

$$\begin{aligned}I_x &= 20833,34 \text{ cm}^4 \\ I_x &= 208,33 \cdot 10^{-6} \text{ m}^4\end{aligned}$$

$$\sigma = \frac{M \cdot c}{I_x}$$

$$\bar{y} = \frac{\sum A y}{\sum A} = 20 \text{ cm}$$

$$\sigma = \frac{M \cdot c}{I_x} = 153,6 \text{ MPa}$$

$$\bar{x} = 12,5 \text{ cm}$$

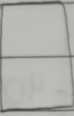
$$\sigma = \frac{M \cdot c}{I_x} = 76,8 \text{ MPa}$$

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2)

h = ?



12cm

$$M_{\max} = 6,625 \text{ kN.m} = 562500 \text{ Ncm}$$

$$Q_{\max} = 7 \text{ kN}$$

$$I_x = \frac{b \cdot h^3}{12} = \frac{12 \cdot h^3}{12} = h^3$$

$$\bar{\sigma} \geq \frac{M \cdot c}{I_x}$$

$$\bar{\sigma} = 0,4 \text{ kN/cm}^2$$

$$\bar{\sigma} \geq \frac{M \cdot \left(\frac{h}{2}\right)}{h^3} \Rightarrow \bar{\sigma} \geq \frac{M}{2h^2}$$

$$h \geq \sqrt{\frac{M}{2\bar{\sigma}}}$$

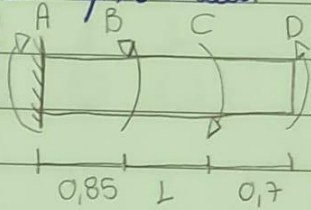
$$h \geq 26,5 \text{ cm}$$

$$h = 30 \text{ cm}$$

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3)



$$d_{AB} = 36 \text{ mm}$$

$$d_{BC} = 30 \text{ mm}$$

$$d_{CD} = 25 \text{ mm}$$

$$\sum M = 0 \quad 900 + 250 - 600 - R_A = 0$$

$$R_A = 550 \text{ Nm}$$

$$\tau = \frac{T \cdot r}{\left(\frac{\pi}{2} \cdot r^4\right)} = \frac{8 \cdot T \cdot r}{\pi \cdot d^4} = \frac{8T}{\pi d^3}$$

$$\tau_{AB} = \frac{8 \cdot 550}{\pi (36 \cdot 10^{-3})^3} = 30 \text{ MPa}$$

$$\tau_{CD} = \frac{8 \cdot 250}{\pi (25 \cdot 10^{-3})^3} = 40,74 \text{ MPa}$$

$$\tau_{BC} = \frac{8 \cdot 350}{\pi (30 \cdot 10^{-3})^3} = 33 \text{ MPa}$$

$$\phi = \frac{M_T \cdot l}{I_p \cdot G}$$

$$\phi_{CD} = \frac{250 \cdot 0,7}{\left(\frac{\pi (0,025)^4}{32}\right) \cdot 80 \cdot 10^9} = 0,057 \text{ rad}$$

$$\phi_{AB} = \frac{550 \cdot 0,85}{\left(\frac{\pi (0,036)^4}{32}\right) \cdot 80 \cdot 10^9} = 0,035 \text{ rad}$$

$$\phi_T = 0,037 \text{ rad}$$

$$\phi_{BC} = \frac{-350 \cdot L}{\left(\frac{\pi (0,03)^4}{32}\right) \cdot 80 \cdot 10^9} = -0,055 \text{ rad}$$

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4)

$$P = 5,5 \text{ kW}$$

$$\tau = \frac{M_T \cdot R}{I_p}$$

$$I_p = \frac{\pi r^4}{32}$$

$$P = 2\pi R M_T$$

$$f = 650 \text{ rpm} = 10,83 \text{ Hz}$$

$$I_p = \frac{\pi d^4}{32}$$

$$\tau = 60 \text{ MPa}$$

$$I_p = \frac{\pi d^4}{32}$$

$$M_T = \frac{P}{2\pi f} = 80,83 \text{ Nmm}$$

$$I_p = \frac{\pi d^4}{32}$$

$$\tau \geq \tau_{\text{adm}}$$

$$60 \geq \frac{M_T \cdot \left(\frac{d}{2}\right)}{\left(\frac{\pi d^4}{32}\right)} \Rightarrow 60 \geq \frac{512 M_T \cdot d}{\pi d^4} \Rightarrow d \geq \sqrt[3]{\frac{512 M_T}{\pi \cdot 60}}$$

$$d \geq 4,78 \text{ mm}$$

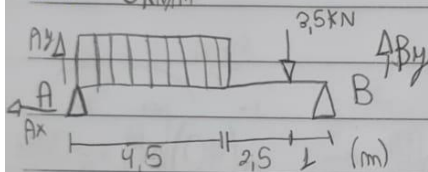
$$d = 5 \text{ mm}$$

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5)

8 kN/m



$$\sum F_x = 0$$

$$A_x = 0$$

$$\sum F_y = 0$$

$$A_y - 8 \cdot 4,5 - 3,5 + B_y = 0$$

$$A_y + B_y = 39,5 \text{ kN}$$

$$\sum M_A = 0$$

$$-(8)(4,5)(2,25) - (3,5)(7,0) + B_y \cdot 8 = 0$$

$$B_y = 13,18 \text{ kN}$$

$$A_y = 26,32 \text{ kN}$$