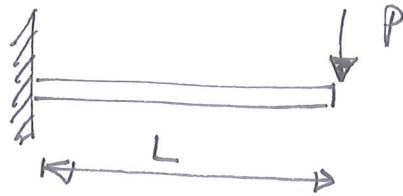


2.4.37

GIVET:



$$P = 1500 \text{ N}$$

$$L = 2 \text{ m}$$

SÖKT: Dimensionera:

A). - ϕ_{\min} om mat är trä som tål 20 MPa

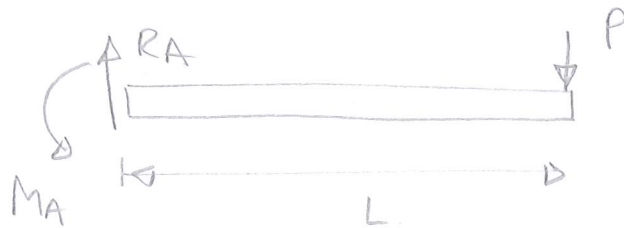
B). - $\rho_{\text{trä}} = 600 \text{ kg/m}^3$ med egentynghd \Rightarrow måste ϕ ökas?

C) med IPE balk stål $\sigma_{\text{till}} = 100 \text{ MPa}$
dim?

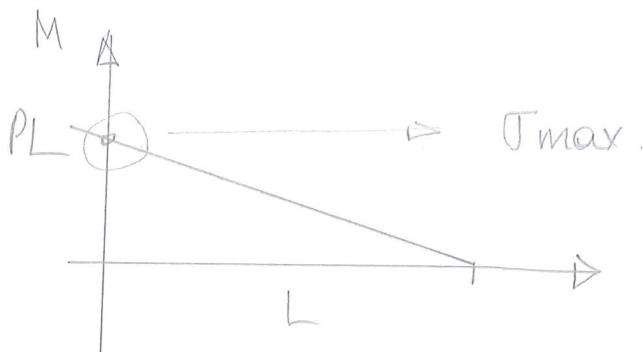
$$\rho_{\text{stål}} = 7840 \text{ kg/m}^3$$

LÖSNING:

1 - Global jmv.



$$\begin{cases} R_A = P \\ M_A = PL \end{cases}$$



$$A) - \quad \sigma_{\max} = \frac{M \cdot z}{I_y} = \frac{M}{w} \quad \begin{cases} M = PL \\ z = r (= \phi/2) \\ I_y = \frac{\pi r^4}{4} \end{cases}$$

$$\sigma_{\max} = \frac{PLr}{\pi r^4/4} = \frac{4PL}{\pi r^3} < \sigma_{\text{till}}$$

$$r > \sqrt[3]{4PL/\pi\sigma_{\text{till}}}$$

$$r > \sqrt[3]{\frac{4 \cdot (1500) \cdot (2000)}{\pi (20)}} \quad \underline{\underline{r \geq 57.6 \text{ mm}}}$$

$$\underline{\underline{\phi \geq 115.2 \text{ mm}}}$$

B).

$$\underline{\phi = 116 \text{ mm}}$$

$$Q = \rho A L g = 800 \frac{\text{kg}}{\text{m}^3} \frac{1 \text{ m}^3}{(1000) \text{ mm}^3} \cdot \pi \cdot \left(\frac{116}{2}\right)^2 \cdot (2000) \cdot 9.81 \frac{\text{m}}{\text{s}^2}$$

$$\underline{Q_{\text{TOT}} = 132 \text{ N}}$$

$$M_{\text{max}} = \frac{Q_{\text{TOT}} L}{2} + PL \Rightarrow \text{ökning} \quad \frac{\Delta M}{M} = \frac{Q_{\text{TOT}} L}{2}$$

$$\Delta \tau_{\text{max}} = \frac{2 Q_{\text{TOT}} L}{\pi r^3}$$

$$\frac{\Delta \tau_{\text{max}}}{\tau_{\text{max}}} = \frac{Q_{\text{TOT}}}{2P} = 0.044$$

$$\tau_{\text{max}} = \frac{4PL}{\pi r^3}$$

Spänningen har ökat 4% \Rightarrow

diametern måste ökas

$$c). \text{ IPE balk } \left\{ \begin{array}{l} \sigma_{till} = 100 \text{ MPa} \\ \rho_{st\ddot{a}l} = 7840 \text{ kg/m}^3 \end{array} \right.$$

[F.S. s. 339]

$$\sigma_{\max} = \sigma_{till} \geq \frac{|M|_{\max}}{W_y}$$

$$W_y \geq \frac{|M|_{\max}}{\sigma_{till}} = \frac{1500 \cdot (2000)}{100} = 30 \cdot 10^3 \text{ mm}^3$$

$$\underline{W_y \geq 30 \cdot 10^3 \text{ mm}^3}$$

$$\text{Tabell 31.5} \Rightarrow W_y \geq 30 \cdot 10^3 \text{ mm}^3 \Rightarrow \underline{\text{IPE 100}}$$

$$\text{IPE 100} \rightarrow \text{vikt } 8.1 \text{ kg/m}$$

$$\underline{Q} = 8.1 \text{ kg/m} \cdot 9.81 \text{ m/s}^2 \cdot 2 \text{ m} = \underline{\underline{158.92 \text{ N}}}$$

$$\sigma_{\max} = \frac{(1500 \cdot (2000) + 158.92 \cdot (1000))}{34.2 \cdot 10^3 \text{ mm}^3} \text{ N/mm}^2$$

$$\underline{\underline{\sigma_{\max} = 92.36 \text{ MPa} < \sigma_{till}}}$$