

Betonkonstr. Aug 18, opg 2

1/1

$$f_{cd} = 35 / 1,45 = 24,1 \text{ MPa}$$

$$f_{yd} = 500 / 1,12 = 446,7 \text{ MPa}$$

$$E_{cd} = 2,08 \cdot 10^{-3}$$

$$E_{uh} = 5 \cdot 10^{-2}$$

$$E_{c03} = 3,5 \cdot 10^{-3}$$

$$d = 400 - 15 - 6 - 24/2 = 367 \text{ mm}$$

$$\begin{aligned} M_{IV} &= p \cdot L \cdot 4/2 + \frac{1}{2} p_1 \cdot \frac{L}{2} \cdot \frac{5}{6} L \\ &= 2 \cdot 6 \cdot 6/2 + \frac{1}{2} \cdot 4 \cdot 6/2 \cdot \frac{5}{6} \cdot 6 = \underline{66,0 \text{ kNm}} \end{aligned}$$

$$\begin{aligned} M_{Ecd} &= M_{IV} + N_{Ed}(e_0 + e_1) \\ &= 66,0 + 125(0,005 + 0,05) = \underline{72,88 \text{ kNm}} \end{aligned}$$

$$\begin{aligned} v &= \frac{1}{10} \cdot \frac{E_{c03} + E_{cd}}{d} \cdot L^2 \\ &= \frac{1}{10} \cdot \frac{2,08 \cdot 10^{-3} + 3,5 \cdot 10^{-3}}{367} (2 \cdot 6000)^2 = \underline{218,9 \text{ mm}} \end{aligned}$$

$$\begin{aligned} M_{Ed} &= M_{Ecd} + N_{Ed} \cdot v \\ &= 72,88 + 125 \cdot 0,218 = \underline{100,2 \text{ kNm}} \end{aligned}$$

Vi antager flydning i traktionsarm og 19 mm for trykarmningen

$$\Rightarrow \eta = \frac{A_s f_{yd} + N_{Ed}}{b \cdot f_{cd}} = \frac{27(24/2)^2 + 446,7 + 125 \cdot 10^3}{400 \cdot 24,1} = \underline{52,08 \text{ mm}}$$

$$\Rightarrow x = 52,08 / 0,8 = \underline{65,10 \text{ mm}}$$

$$\Rightarrow \epsilon_s = \frac{E_{c03}}{x} (d - x) = \frac{3,5 \cdot 10^{-3}}{65,10} (367 - 65,10) = 1,62 \cdot 10^{-2}$$

$E_{cd} < \epsilon_s < E_{uh} \Rightarrow$ Flydning betst

$$\begin{aligned} M_{red} &= A_s f_{yd} (d - \frac{x}{2}) + b \eta f_{cd} (\frac{b}{2} - \frac{x}{2}) \\ &= 27(24/2)^2 + 446,7(367 - 400/2) \\ &\quad + 400 \cdot 52,08 \cdot 24,1(400/2 - 52,08/2) \\ &= 150,3 \cdot 10^6 \text{ Nmm} = \underline{150,3 \text{ kNm}} > M_{Ed} (\text{OK}) \end{aligned}$$