Rissviddeberegning over søyle:

- Maks moment fra Robot-modell med lasthombinasjon i SLS og 30% permanent nyttelast over støtte: i felt 2 og 3.

$m_{ed} = 35{,}3$ kNm/m

NA. 7.3.1 tabell NA. 7.1. gir $w_{max} = k_c \cdot 0{,}30$ for XC1.

$k_c = c_{nom} / c_{min,dur} \leq 1{,}3$

$25/15 > 1{,}3$

Moment fordeles ikke over bredden!

$\Rightarrow k_c = 0{,}30 \text{ mm} \cdot 1{,}3 = 0{,}39 \text{ mm}$

- Armeringsspenning σ_s:

$$\sigma_s = E_s \cdot \frac{M \cdot (1-\alpha) \cdot d}{(EI)_{II}}$$

Må beregne ny α og $(EI)_{II}$ for armeringen i overkant:

Minste lengdearmering: $A_{sx,ms} = \phi 12 s 270 = 419 \text{ mm}^2/\text{m}$

$$\rho = \frac{A_{sx,ms}}{b \cdot d} = \frac{419}{10^3 \cdot 249} = 1{,}68 \cdot 10^{-3}, \quad n = 18{,}2$$

$$\alpha = \sqrt{(n\rho)^2 + 2n\rho} - n\rho = 0{,}219$$

$$I_c' = \frac{1}{2}\alpha^2 \cdot (1 - \alpha/3) \cdot b \cdot d^3 = \frac{1}{2} \cdot 0{,}219^2 \cdot (1 - 0{,}219/3) \cdot 10^3 \cdot 249^3$$

$$= 3{,}43 \cdot 10^8 \text{ mm}^4/\text{m}$$

$$(EI)_{II} = E_{c,middel} \cdot I_c' = 11{,}0 \cdot 10^3 \cdot 3{,}43 \cdot 10^8$$

$$= 3{,}77 \cdot 10^{12} \text{ Nmm}^2/\text{m}$$

$$\Rightarrow \sigma_s = 2{,}0 \cdot 10^5 \cdot \frac{35{,}3 \cdot 10^6 \cdot (1 - 0{,}219) \cdot 249}{3{,}77 \cdot 10^{12}} = 364 \text{ MPa}$$

• Rissvidden er gitt ved $w_k = s_{r,max} \cdot (\varepsilon_{sm} - \varepsilon_{cm})$.

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \cdot \frac{f_{ct,eff}}{\rho_{p,eff}} \cdot (1 + \alpha_e \cdot \rho_{p,eff})}{E_s}$$

$k_t = 0{,}4$ for langvarig belastning

$\rho_{p,eff} = A_{s,ins} / A_{c,eff}$

$A_{c,eff} = b \cdot h_{c,eff}$

$h_{c,eff} = \min\{2{,}5(h-d) ; \frac{1}{3}(h - \alpha d) ; \frac{1}{2}h\}$

$= \min\{2{,}5(280-249) ; \frac{1}{3}(280 - 0{,}22 \cdot 249) ; \frac{1}{2} \cdot 280\}$

$= \min\{77{,}5 ; 75{,}1 ; 140\} =$

$= 75{,}1$ mm

$A_{c,eff} = 10^3 \cdot 75{,}1 \text{ mm}^2 = 7{,}51 \cdot 10^4 \text{ mm}^2$

$\rho_{p,eff} = 419 / 7{,}51 \cdot 10^4 = 5{,}58 \cdot 10^{-3} / \text{m}$

$f_{ct,eff} = f_{ctm} = 3{,}2$ MPa for B35.

$\alpha_e = E_s / E_{cm} = 2{,}0 \cdot 10^5 / 34000 = 5{,}88$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{364 - 0{,}4 \cdot \frac{3{,}2}{5{,}58 \cdot 10^{-3}} \cdot (1 + 5{,}88 \cdot 5{,}58 \cdot 10^{-3})}{2{,}0 \cdot 10^5}$$

$= 6{,}35 \cdot 10^{-4}$ $\quad \geq 0{,}6 \cdot \frac{\sigma_s}{E_s} = 0{,}6 \cdot \frac{364}{2{,}0 \cdot 10^5} = 1{,}09 \cdot 10^{-3}$

NB!

$\therefore \underline{\varepsilon_{sm} - \varepsilon_{cm} = 1{,}09 \cdot 10^{-3}}$

Senteravstand mellom armeringsstenger er 270 mm.

$5(c + \phi/2) = 5 \cdot (25 + 12/2) = 155 \text{ mm} < 270$ mm

c - overdekning

$\Rightarrow \underline{s_{r,max} = 1{,}3(h - \alpha d) = 1{,}3 \cdot (280 - 0{,}219 \cdot 249) = 293 \text{ mm}}$

Dermed får vi rissvidden

$w_k = 293 \text{ mm} \cdot 1{,}09 \cdot 10^{-3} = 0{,}32 \text{ mm} < w_{max} = 0{,}39$ mm

$\therefore$ Rissvidden er tilstrekkelig liten!