

Betonkors. Maj 17, 09g. 1

1/3

SPM 1

Moment om punkt A

$$M_A = (P/2) \cdot L \cdot L/2 + \frac{1}{2}(P/2) \cdot \frac{1}{2} \cdot \left(\frac{1}{2} + \frac{2}{3} \cdot \frac{1}{2}\right) + F \cdot \frac{3}{4}L - R_C \cdot L = 0 \Rightarrow$$

$$R_C = \frac{1}{4}PL + \frac{5}{72}PL + \frac{3}{4}F \\ = \frac{1}{4} \cdot 15 \cdot 8 + \frac{5}{72} \cdot 15 \cdot 8 + \frac{3}{4} \cdot 100 = 117,5 \text{ kN}$$

SPM 2

$$R_A = \frac{1}{2}PL + \frac{1}{2} \cdot \frac{P}{2} \cdot \frac{1}{2} + F - R_C \\ = \frac{1}{2} \cdot 15 \cdot 8 + \frac{1}{2} \cdot \frac{15}{2} \cdot \frac{8}{2} + 100 - 117,5 = 57,5 \text{ kN}$$

$$M_B = R_A \cdot L/2 - \frac{P}{2} \cdot \frac{1}{2} \cdot \frac{1}{4} \\ = 57,5 \cdot 8/2 - \frac{15}{2} \cdot \frac{8}{2} \cdot \frac{8}{4} = 170,0 \text{ kNm}$$

SPM 3

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

$$f_{yd} = 500/1,2 = 416,7 \text{ MPa}$$

$$\epsilon_{cu3} = 3,5\%, \quad \epsilon_{yd} = 416,7/2 \cdot 10^5 = 2,083 \cdot 10^{-3}$$

$$\epsilon_{cu4} = 5\%$$

Design ϵ (postern or i tabellin)

$$N = A_c f_{cd} - A_s f_{yd} = 0 \Rightarrow$$

$$y = \frac{A_c}{b \cdot \epsilon} = \frac{A_s f_{yd}}{b \cdot \epsilon \cdot f_{cd}} = \frac{37(2412)^2 \cdot 416,7}{1000 \cdot 24,1} = 23,4 \text{ mm}$$

$$x = y/\alpha = 23,4/0,8 = 29,3 \text{ mm} \quad (\epsilon_{fy} = 100 \text{ mm})$$

(Jeg antog rektangulært tværsnit (fyd))

$$\epsilon_s = \frac{\epsilon_{cu3}}{x} (d - x) = \frac{3,5 \cdot 10^{-3}}{29,3} (367 - 29,3) = 6,4 \cdot 10^{-2}$$

$$D_0 \quad E_{gd} = 2,083 \cdot 10^{-2} < E_s = 164 \cdot 10^{-2}$$

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

Design C er derfor underordnet

Case	1	2	3	4	5
Tværsnit	A (rekt)	B (T)	B (T)	C (omv T)	C (omv T)
h	600	600	600	500	500 mm
cover	15	15	15	15	15 mm
Øw	6	6	6	6	6 mm
d	569	567	567	465	465 mm
b	200	-	-	-	- mm
bf	-	1000	1000	600	600 mm
bw	-	300	300	300	300 mm
tf	-	100	100	200	200
Øs	20	24	24	28	28 mm
n	2	2	3	3	5
As	628,3	904,8	1357,2	1847,3	3078,8 mm ²
y	54,2	15,6	23,4	106,3	177,2 mm
x	67,8	19,5	29,3	132,9	221,4 mm
eps,s	2,588E-02	9,815E-02	6,427E-02	8,749E-03	3,850E-03
Armering ?	Normal	Underarmeret	Underarmeret	Normal	Normal
Svar	OK	Nej	Nej	OK	OK

Spørge 4

Design c) (Resten er i tabellen)

$$V_{rd,l} = 2 A_s f_{yd} \cot \theta$$

$$= 2 \cdot 271 (20/12)^2 \cdot 416,7/12 = \underline{261,8 \text{ kN}}$$

$$V_{rd,w} = A_{sw} f_{ywd} \cdot \frac{z \cot \theta}{s}$$

$$= 271 (6/12)^2 \cdot 416,7 \cdot 550 \cdot 2/150 = \underline{172,8 \text{ kN}}$$

$$V_{rd,c} = \frac{f_{ctd} \cdot z}{1 + \cot \theta} \cdot \cot \theta$$

$$V = \max \left\{ \begin{array}{l} 0,7 - \frac{f_{ctd}}{f_{ctd,200}} = 0,7 - 35/200 = 0,525 \\ 0,45 \end{array} \right.$$

$$= 0,525 \Rightarrow$$

$$V_{rd,c} = 200 \cdot 0,525 \cdot 271 \cdot 550 \cdot \frac{2}{12^2} = \underline{336,7 \text{ kN}}$$

$$V_{rd} = \min(V_{rd,l}; V_{rd,w}; V_{rd,c}) = \underline{172,8 \text{ kN}}$$

OK! $> V_{Ed} = 150 \text{ kN}$

Case	1	2	3	4	5	
z	550	550	550	550	550	mm
bf	600	600	600	600	600	mm
bw	200	200	200	200	200	mm
Øs	20	20	20	20	20	mm
n	2	2	2	2	2	
As	628,3	628,3	628,3	628,3	628,3	mm ²
Øw	6	6	6	6	6	mm ²
s	100	150	150	150	100	mm ²
Ny	0,525	0,525	0,525	0,525	0,525	
Cot(teta)	1	1,5	2	2,5	1,5	
VRd,l	523,6	349,1	261,8	209,4	349,1	kN
VRd,w	129,6	129,6	172,8	216,0	194,4	kN
VRd,c	697,0	643,4	557,6	480,7	643,4	kN
VRd	129,6	129,6	172,8	209,4	194,4	kN

Nej

Nej

OK

OK

OK