LØSNINGSFORSLAG EKSAMEN KT 2 - OPPGAVE 2 STÅL

Løsningsforslag oppgave stål - forbindelse

Vertikal sveis:

$$\sigma_\perp = \tau_\perp = \frac{N_{Ed}}{\sqrt{2}\cdot A_s} = \frac{N_{Ed}}{\sqrt{2}\cdot a\cdot L}$$

$$\sqrt{\sigma_\perp^2 + 3\tau^2} \leq \frac{f_u}{\beta_w\cdot\gamma_{M2}} \Rightarrow 2\cdot\frac{N_{Ed}}{\sqrt{2}\cdot a\cdot L} \leq \frac{f_u}{\beta_w\cdot\gamma_{M2}}$$

$$N_{Ed} \leq \frac{f_u\cdot\sqrt{2}\cdot a\cdot L}{2\cdot\beta_w\cdot\gamma_{M2}} = \frac{490\cdot\sqrt{2}\cdot 4\cdot 2\cdot 300}{2\cdot 0{,}9\cdot 1{,}25}\cdot 10^{-3}$$

$$N_{Ed} \leq 739\ kN$$

Horisontal sveis:

$$\tau_{\parallel} = \frac{N_{Ed}}{A_s} = \frac{N_{Ed}}{a\cdot L}$$

$$\sqrt{3\tau_{\parallel}^2} \leq \frac{f_u}{\beta_w\cdot\gamma_{M2}} \Rightarrow \sqrt{3}\cdot\frac{N_{Ed}}{a\cdot L} \leq \frac{f_u}{\beta_w\cdot\gamma_{M2}}$$

$$N_{Ed} \leq \frac{f_u\cdot a\cdot L}{\sqrt{3}\cdot\beta_w\cdot\gamma_{M2}} = \frac{490\cdot 4\cdot 2\cdot 100}{\sqrt{3}\cdot 0{,}9\cdot 1{,}25}\cdot 10^{-3}$$

$$N_{Ed} \leq 201\ kN$$

Forbindelsens kapasitet:

$$N_{Rd} = 201\ kN$$

Løsningsforsalg oppgave stål søyle

Søylen er fri til å knekke om begge akser

HEA 400

S355			h=	390	mm
fy=	355	MPa	b=	300	mm
E=	210000	MPa	A=	15900	mm
γM1 =	1,05		Iy=	4,51E+08	mm4
			Iz =	85600000	mm4
Lk = 2*L			iy=	168	mm
Lk,y =	7000	mm	iz =	73,4	mm
Lk,z =	7000	mm			

a) Knekking om sterk akse: $N_{cr,y} = \frac{\pi^2 E I_y}{L_{k,y}^2} =$ 19 063 846 N

Punkt 6.3.1.1

$$N_{b,Rd} = \frac{N_{Ed}}{N_{b,Rd}} \leq 1 \quad \text{og} \quad N_{b,Rd} = \frac{\chi A f_y}{\gamma_{M1}}$$

Punkt 6.3.1.2 $\bar{\lambda} = \sqrt{\frac{A f_y}{N_{cr}}}$ = 0,54

Tabell 6.2 - Valset I profil knekking om y aksen

h/b= 1,30 < 1,2 tf < 100 mm dvs kurve b

Tabell 6.1 α = 0,34

$\Phi = 0{,}5\left[1+\alpha\left(\bar{\lambda}-0{,}2\right)+\bar{\lambda}^2\right]$ = 0,71

$\chi = \frac{1}{\Phi+\sqrt{\Phi^2-\bar{\lambda}^2}}$ = 0,86 ev fra kurve figur 6.4

$N_{b,yRd} = \frac{\chi A f_y}{\gamma_{M1}} =$ **4 645** kN

b) Knekking om svak akse: $N_{cr,z} = \frac{\pi^2 E I_z}{L_{k,z}^2} =$ 3620735 N

Punkt 6.3.1.1

$$N_{b,Rd} = \frac{N_{Ed}}{N_{b,Rd}} \leq 1 \quad \text{og} \quad N_{b,Rd} = \frac{\chi A f_y}{\gamma_{M1}}$$

Punkt 6.3.1.2 $\bar{\lambda} = \sqrt{\frac{A f_y}{N_{cr}}}$ = 1,25

Tabell 6.2 - Valset I profil knekking om z aksen

h/b= 1,30 < 1,2 tf < 100 mm dvs kurve c

Tabell 6.1 α = 0,49

$\Phi = 0{,}5\left[1+\alpha\left(\bar{\lambda}-0{,}2\right)+\bar{\lambda}^2\right]$ = 1,54

$\chi = \frac{1}{\Phi+\sqrt{\Phi^2-\bar{\lambda}^2}}$ = 0,41 ev fra kurve figur 6.4

$N_{b,zRd} = \frac{\chi A f_y}{\gamma_{M1}} =$ **2 211** kN