

BMC - Leistung 31 oktober 2007 - uibwerkingen

$q = 1,0 \text{ kN/m}^1$
 $f_{m,c} = 14 \text{ N/mm}^2 \text{ (bet)}$

$\sum M_{\text{tov. B}} = 0$
 $A_V \cdot 3 - 3,8 \cdot 1,1 = 0 \rightarrow A_V = 1,39 \text{ kN}$
 $\sum V = 0$
 $1,39 + B_V - 3,8 = 0 \rightarrow B_V = 2,41 \text{ kN}$

afstand x

$1,39 : x = 3 : 3$
 $x = 1,39 \text{ m}$

D-lijn
[kN]

$\sum M_{\text{tov. X}} = 0$
 $1,39 \times 1,39 - 1,39 \cdot \frac{1,39}{2} - M_x = 0$

$\rightarrow M_x = 0,97 \text{ kNm}$
 (✓)

$\sum M_{\text{tov. B}} = 0$
 $0,8 \times 0,4 - M_B = 0 \rightarrow M_B = 0,32 \text{ kNm}$
 (✓)

Controleer buigspanning

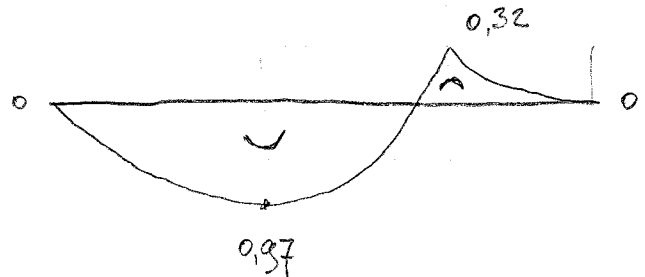
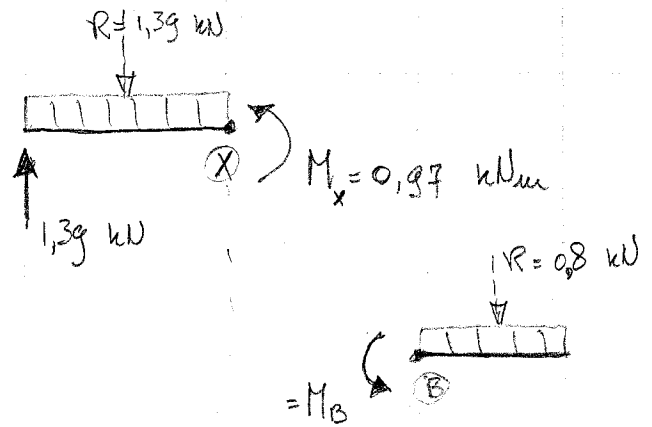
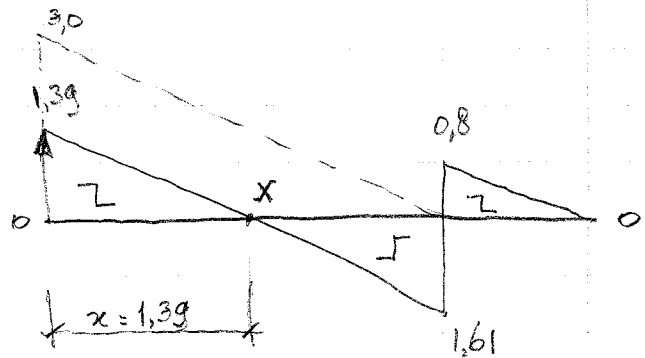
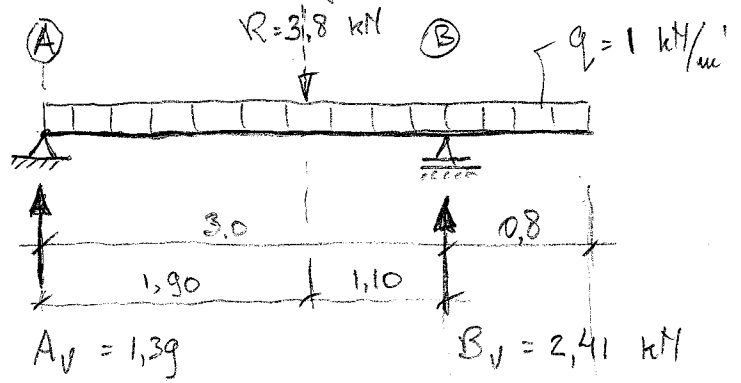
$W_{\text{ben}} = \frac{M}{\sigma} = \frac{M_{\text{max}}}{f_m} = \frac{0,97 \times 10^6}{14} \rightarrow$

$W_{\text{ben}} = 69286 \text{ mm}^3$

$W = \frac{1}{2} \cdot b \cdot h^2 \rightarrow$

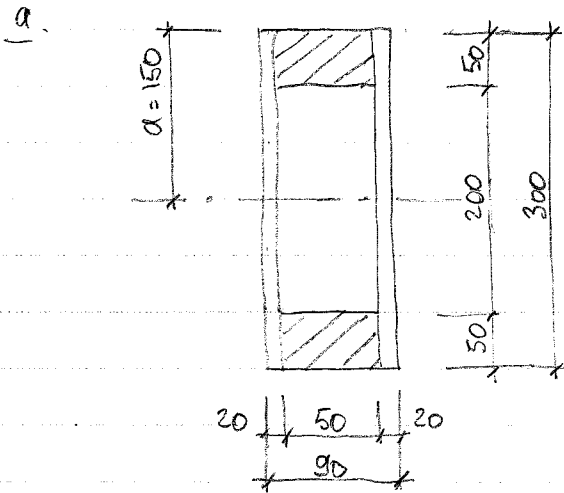
$h_{\text{min}} = \sqrt{\frac{W \cdot 6}{b}} = \sqrt{\frac{69286 \cdot 6}{50}}$

$h_{\text{min}} = 91 \text{ mm} ; \text{ kies: } \underline{50 \times 100 \text{ mm}^2}$



2

2] $q = 4,0 \text{ kN/m}^1$
 $f_{me} = 14 \text{ N/mm}^2$
 $E = 10000 \text{ N/mm}^2$



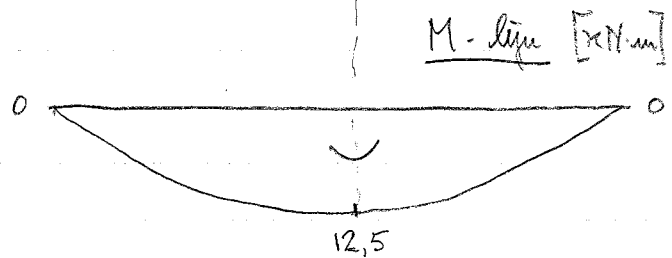
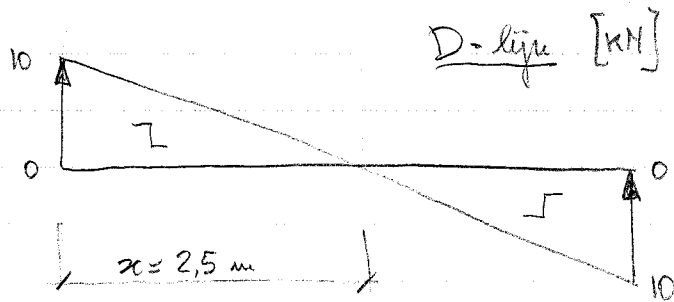
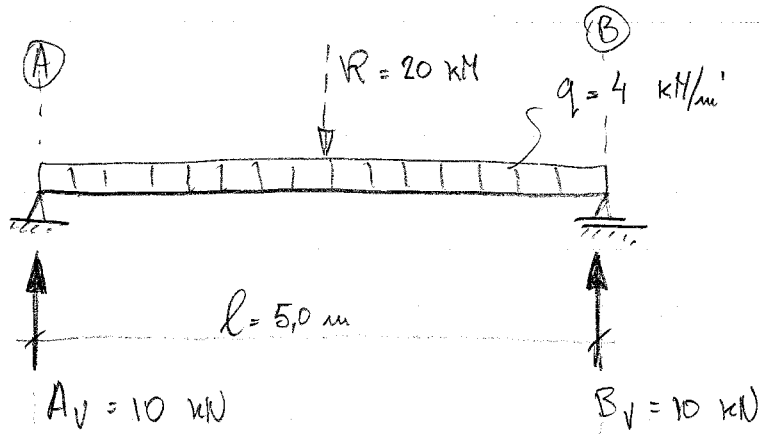
$a = \frac{300}{2} = 150 \text{ mm}$
 $A = 50 \times 50 = 2500 \text{ mm}^2$

$I = 2 \cdot a^2 \cdot A = 112,5 \times 10^6 \text{ mm}^4$
 $W = \frac{I}{a} = 2 \cdot a \cdot A = 2 \cdot 150 \cdot 2500$
 $W = 750000 \text{ mm}^3$

$\sigma_{max} = \frac{M_{max}}{W} = \frac{12,5 \times 10^6}{750000} =$

$\sigma_{max} = 16,7 \text{ N/mm}^2 > f_{me} = 14 \text{ N/mm}^2$

conclusie: profiel voldoet niet op buigsterkte



$M_{max} = \frac{1}{8} q \cdot l^2 = \frac{1}{8} \cdot 4 \cdot 5^2 = 12,5 \text{ kNm (v)}$
 of
 $M_{max} = \frac{1}{2} \cdot 10 \cdot 2,5 = 12,5 \text{ kNm (v)}$

b. $u_{max} \leq 0,004 \cdot l = 0,004 \cdot 5000 \text{ mm} \rightarrow u_{max} \leq 20 \text{ mm}$

$u = 0,1 \times \frac{M_{max} \cdot l^2}{E \cdot I} = 0,1 \times \frac{12,5 \times 10^6 \times 5000^2}{10000 \times 112,5 \times 10^6}$

$u = 27,8 \text{ mm} > u_{max} = 20 \text{ mm}$

conclusie: profiel voldoet niet aan eis voor doorbuiging

$$3) \begin{cases} f_m = 235 \text{ N/mm}^2 \\ f_v = 136 \text{ N/mm}^2 \\ E = 210\,000 \text{ N/mm}^2 \end{cases}$$

Staalprofiel kiezen op sterkte en stijfheid:

sterkte; buigspanning $\sigma = \frac{M}{W} \rightarrow W_{\min} = \frac{M_{\max}}{f_m} = \frac{12,5 \times 10^6 \text{ Nmm}}{235 \text{ N/mm}^2}$

$$W_{\min} = 53\,191 \text{ mm}^3 \rightarrow \underline{\text{IPE 140}}$$

schuifspanning $\tau = \frac{D}{A_{\text{eff}}} \rightarrow A_{\text{eff}} = \frac{D_{\max}}{f_v} = \frac{10\,000 \text{ N}}{136 \text{ N/mm}^2}$

$$A_{\text{eff}} = 74 \text{ mm}^2 \rightarrow \underline{\text{IPE 80}}$$

$$(A_{\text{eff}} = 280 \text{ mm}^2)$$

stijfheid; $u_{\max} = 20 \text{ mm}$ (zie 2)

$$u = 0,1 \times \frac{M_{\max} \times l^2}{E \times I} \rightarrow I_{\min} = 0,1 \times \frac{M_{\max} \times l^2}{E \times u_{\max}}$$

$$I_{\min} = 0,1 \times \frac{12,5 \times 10^6 \times 5000^2}{2,1 \times 10^5 \times 20}$$

$$I_{\min} = 7\,440\,476 \text{ mm}^4$$

$$\rightarrow \underline{\text{IPE 160}}$$

KIES: IPE 160