Beregningsrapport

Isdalstø kai

BruKon As

BruKon As
Org.nr. 914 386 381 MVA

Last 10 tonn

Q_k = 10 kN

Q_d = 1,35 = 100 kN = 135 kN

Egenlast Tverrdrager

Spennlengde 3700 mm

Bredde: 0,6m

Høyde: 0,6m

Egenvekt/m = 0,6 × 0,6 × 1 × 25 = 9 kN/m

$q_{k.egen.tv.b}$ = 9 kN/m

Egenlast Frontdrager

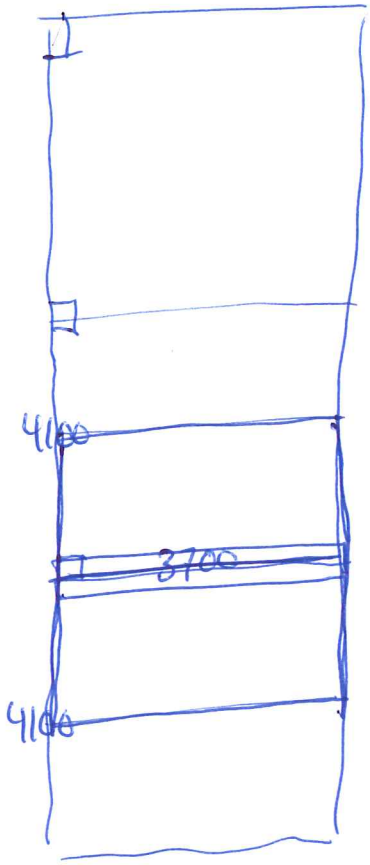
Spennlengde 4100 mm

Bredde: 0,6m

Høyde: 0,8m

Egenvekt/m = 0,6 × 0,8 × 1,0 × 25 = 12 kN/m

Egenlast Dekke



Tykkelse 0,3m

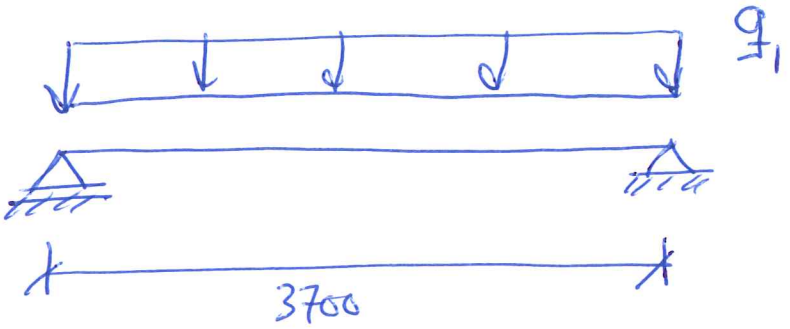
Faktisk tykkelse $1,25 \times 0,3 = 0,375m$

Egenvekt/m^2 $= 25 \times 0,375 \times 1 \times 1$

$g_{Egen.k} = 9,375 \approx 9,5 \ kN/m^2$

$g_{Egen.d} = 1,35 \times 9,5 = 12,8 \ kN/m^2$

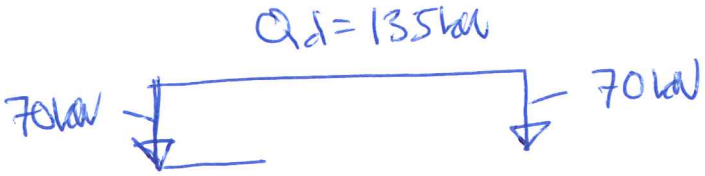
Statisk belastning tverrgelle

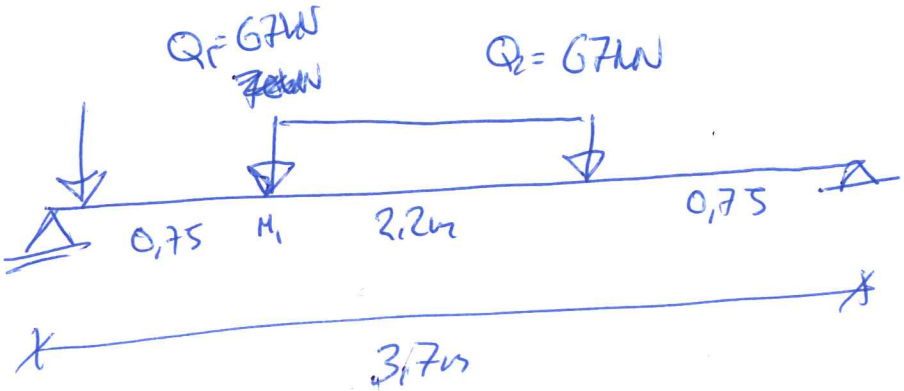


q_1 = 12,8 kN/m² × 4,1m = 52,5 kN/m

Q_{d1} = ~~13666 kN~~ 135 kN

Pkt. last

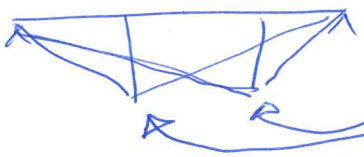




$$M_1 = \frac{Q \cdot a \cdot b}{L} = \frac{67\,kN \cdot 0{,}75 \cdot 2{,}95}{3{,}7\,m} = 40\,kNm$$

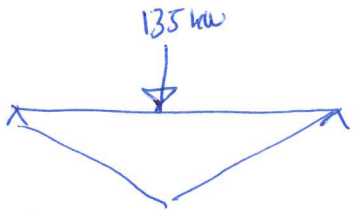
$$M_2 = \qquad = 40\,kNm$$

M_{TOT} =



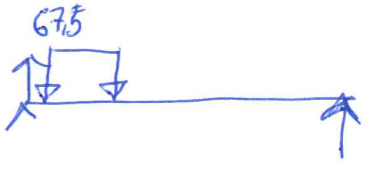
40 + 20 = 60 kNm.

$M_{TOT.FLY}$



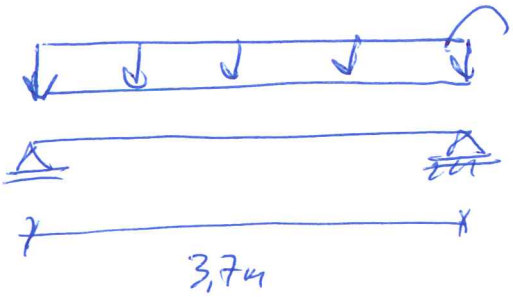
$= 12{,}5\,kNm$

V_d =



$= 67{,}5\,kN$

Egenlast



$$V_{Egen} = \frac{q \cdot L}{2} = \frac{52,5 \cdot 3,7}{2} = 97\ kN$$

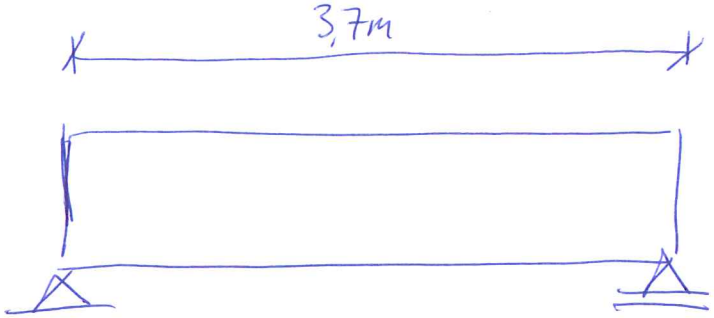
$$M_{Egen} = \frac{q \cdot L^2}{8} = \frac{52,5 \cdot 3,7^2}{8} = 89\ kNm$$

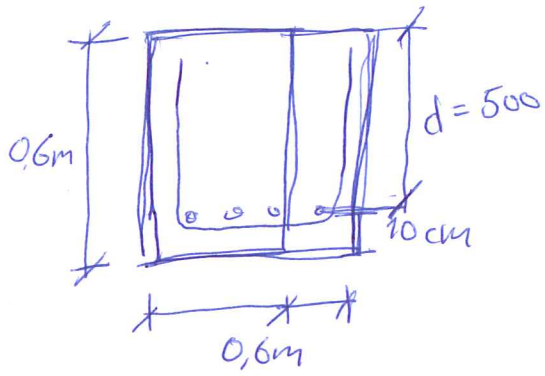
Dim.last

$$M_{TOT.alt} + M_{Egenlast} = 125 + 89 = \underline{214\ kNm}$$

$$V_{Tot} = V_{Egen} + V_d = 97\,kN + 67\,kN = \underline{164\ kN}$$

Tv. dvager





$M_{Ed} = 214\ kNm$

$V_{Ed} = 164\ kN$

$A_s = 4\phi 25 c150$ B30

B500NC

$A_{bygle} = \phi 16 c150$

$A_s = 1963 mm^2$

Dim. av Belle. Lengdearm

$$M_{Rd} = k \cdot f_{cd} \cdot b \cdot d^2$$

$$M_{Rd} = \left(0{,}275 \cdot \left(0{,}85 \cdot \frac{30}{1{,}5}\right) \cdot 600 \cdot 500^2\right) \cdot 10^{-6}$$

$M_{Rd} = 701\ kNm > 214\ kNm \Rightarrow$ OK

Trykksonen er delvis utnyttet.

Indre momentarm

$$z = \left(1 - c \cdot \frac{M_{Ed}}{M_{Rd}}\right) \cdot d$$

$$z = \left(1 - 0{,}17 \cdot \frac{214}{701}\right) \cdot 500 =$$

$$z = 0{,}948 \cdot 500 = 474 \text{ mm}$$

Nødvendig armering

$$A_s = \frac{M_{Ed}}{f_{yd} \cdot z}$$

$$A_s = \frac{214 \cdot 10^6}{434 \cdot 474} = 1040 \text{ mm}^2$$

Opptredende armering

$A_s = 1963 \text{ mm}^2 > 1040 \text{ mm}^2 \Rightarrow$ OK

Dim. av Bjelke. Skjær.anm

$V_{Ed} = 164\ kN$

$$V_{Rd.c} = C_{Rd.c} \cdot k \cdot (100\, \rho_L \cdot f_{ck})^{\frac{1}{3}} \cdot b \cdot d$$

$$C_{Rd.c} = \frac{0{,}18}{1{,}5} = 0{,}12$$

$$k = 1 + \sqrt{\frac{200}{d}} = 1 + \sqrt{\frac{200}{500}} = 1{,}6 < 2{,}0$$

$$\rho_L = \frac{1963}{600 \cdot 500} = 0{,}006 < 0{,}02 \Rightarrow \text{ok.}$$

$$V_{Rd.c} = 0{,}12 \cdot 1{,}6 \cdot (100 \cdot 0{,}06 \cdot 30)^{\frac{1}{3}} \cdot 600 \cdot 500$$

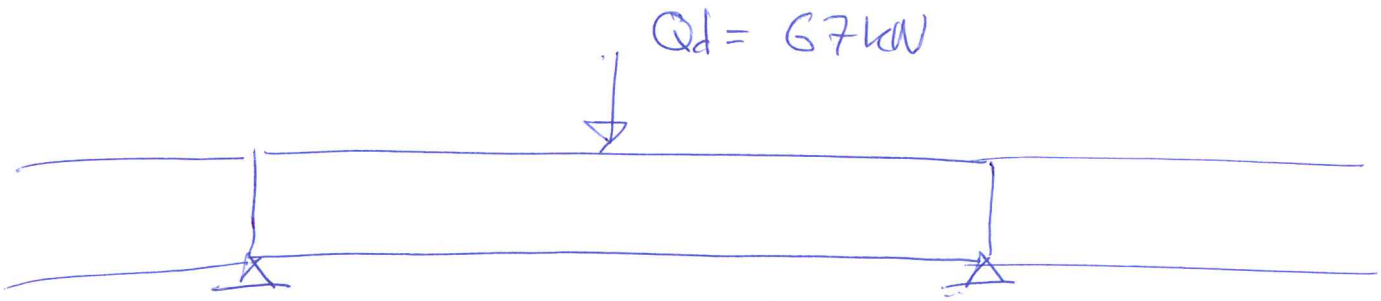
$$= 325\ kN$$

$V_{Rd.c} = 325\ kN$

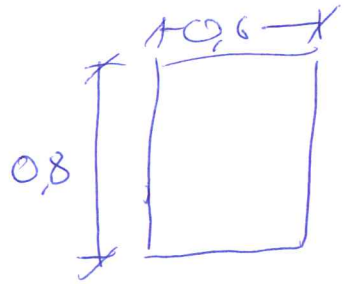
$V_{Ed} = 164\ kN$

$V_{Rd.c} > V_{Ed} \Rightarrow$ ok

Kantdrager



Egenvekt



$g_{Egen.k} = 25 \times 0,6 \times 0,8 \times 1.0$

$= 12 \text{ kN/m}$

$g_{Egen.d} = 1,35 = 16,2 \text{ kN/m}$

$$M_{egen} = \frac{g \cdot L^2}{24} = \frac{16,2 \cdot 5m^2}{24} = 17 \text{ kNm}$$

$$M_{Nytte} = 2 \cdot Q_d \cdot \frac{2,5^2 \cdot 2,3^2}{5^3} = 42 \text{ kNm}$$

$$V_{Egen} = \frac{g \cdot L}{2} = 40 \text{ kN}$$

$V_{Nytte} = 67 \text{ kN}$

$M_{Ed} = 17 + 42 = 59 \text{ kNm}$ $V_{Ed} = 67 + 40 = 107 \text{ kN}$

Dim au Belle. Longdeaum

$$M_{Rd} = \left(0{,}275 \cdot \left(0{,}85 \cdot \frac{30}{1{,}5}\right) \cdot 600 \cdot 700^2\right) \cdot 10^{-6}$$

$$M_{Rd} = 1374 \text{ kNm}$$

$$M_{Ed} = 59 \text{ kNm}$$

$$Z = 0{,}9 \cdot 700 = 630$$

$$A_s = \frac{M_{Ed}}{f_{yd} \cdot z}$$

$$A_s = \frac{59 \cdot 10^6}{434 \cdot 630} = 215 \text{ mm}^2$$

$$A_s = 2\phi 25 = 2 \cdot \pi \cdot 12{,}5^2 = 981 \text{ mm}^2$$

$$981 > 215 \Rightarrow \text{ok}$$

$$V_{Ed} = 107\ kN$$

$$V_{Rd,c} = C_{Rd,c} \cdot k \cdot (100\ \rho_l \cdot f_{ck})^{\frac{1}{3}} \cdot b \cdot d$$

$$k = 1 + \sqrt{\frac{200}{700}} = 1{,}53$$

$$\rho_l = \frac{981}{600 \cdot 630} = 0{,}0025 < \underline{0{,}02} \Rightarrow ok.$$

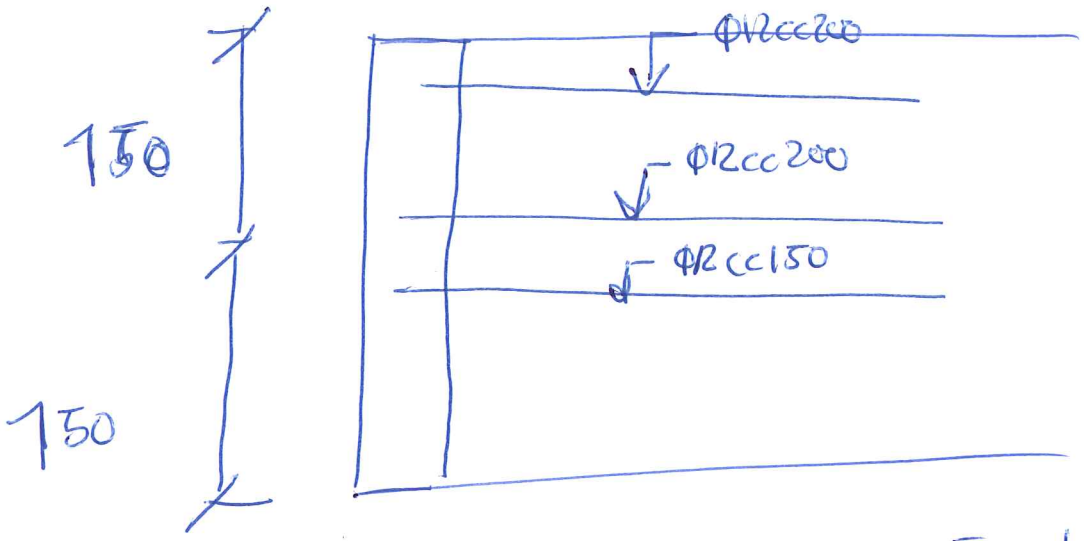
$$V_{Rd,c} = 0{,}12 \cdot 1{,}53 \cdot (100 \cdot 0{,}0025 \cdot 30)^{\frac{1}{3}} \cdot 600 \cdot 700$$

$$V_{Rd,c} = 151\ kN$$

$$V_{Ed} = 107\ kN$$

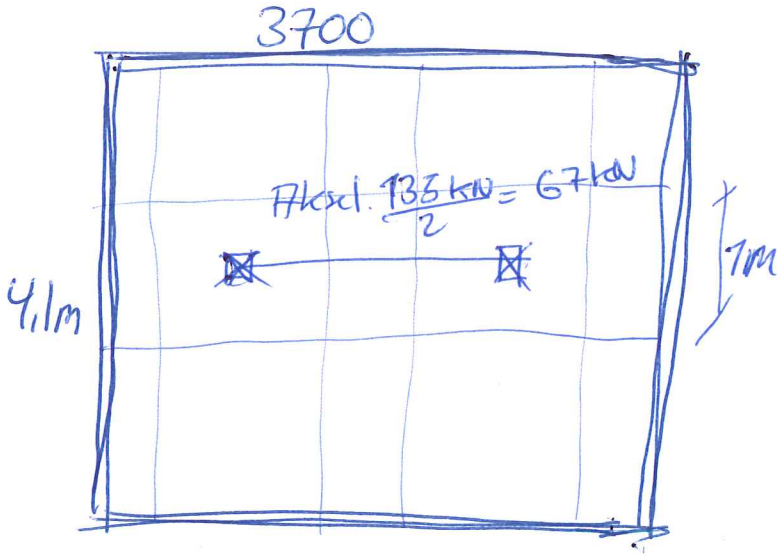
$$V_{Rd,c} > V_{Ed} \Rightarrow ok.$$

Berekening plate

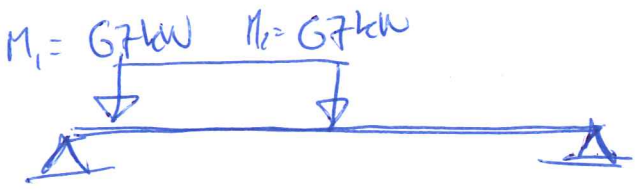


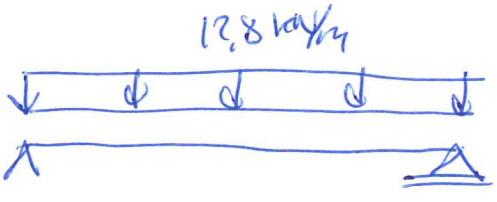
Eigenlast = 12

$q_{Eigenlast} = 12{,}8\ kN/m^2$



To-versplate $\frac{4100}{3700} = 1{,}11$

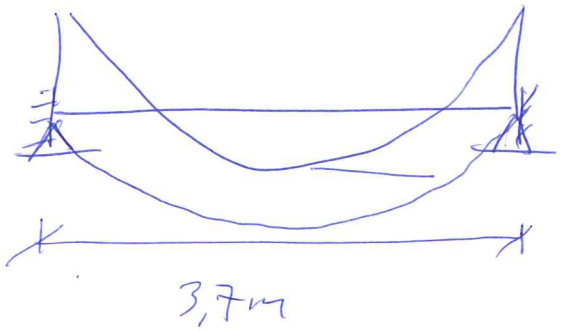




M: M_1 =
M_2 =

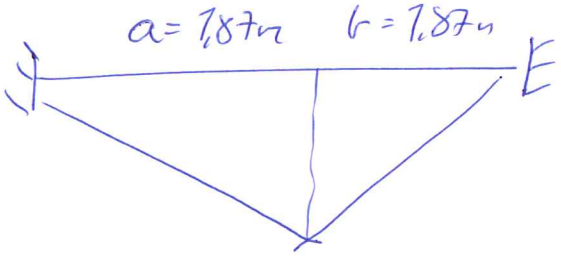
M_3 = 22 kNm

M_3



$$M_3 = \frac{12,8 \cdot 3,7^2}{8} = 22\,kNm$$

M_2



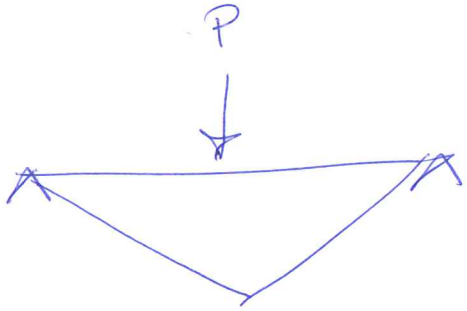
$P = 67\,kN$

$$2 \cdot P \cdot \frac{a^2 \cdot b^2}{L^3}$$

$$M_2 = 2 \cdot 67 \cdot \frac{7,87^2 \cdot 7,87}{3,7^2}$$

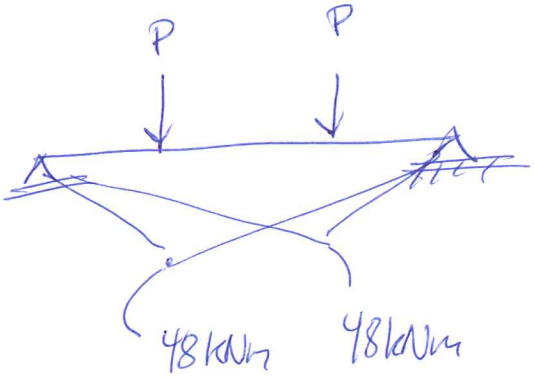
$M_2 = 82\,kNm$

M_3:



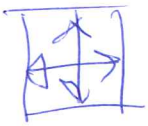
$$M_3 = \frac{P \cdot a \cdot b}{L} = \underline{63\,kNm}$$

$M_4 =$



Maks. Moment = 22 kNm + 63 kNm = 85 kNm
(om 1 akse)

Maks. Moment om 2-aksen. $0{,}5 \cdot 85\,kNm = 42{,}5$ (2 aksen)



$M_{Ed} = 85\,kNm$, om 1-aksen

$M_{Ed} = 42{,}5\,kNm$, om 2-aksen.

$$M_{Rd} = 0{,}275 \cdot \left(0{,}85 \cdot \frac{30}{75}\right) \cdot 1000 \cdot 110^2$$

$$M_{Rd_1} = 0{,}275 \cdot 17 \cdot 1000 \cdot 110^2 = 56\,kNm$$

$$M_{Rd} = 0{,}275 \cdot 17 \cdot 1000 \cdot 200^2 = 187\,kNm$$

Tryklssonekap $187 > 85$ kNm $\Rightarrow$ ok.

Delvis oplagret.

$$z = \left(1 - 0{,}17 \cdot \frac{85}{187}\right) \cdot 150 = 139\,mm$$

$$A_{s_1} = \frac{85 \cdot 10^6}{434 \cdot 139} = 1409\,mm^2/m$$

$$A_{s2} = \frac{42{,}5 \cdot 10^6}{434 \cdot 139} = 705\,mm^2/m$$

Opptredende armering i dekke.

ϕRc200, 5 stk/m

ϕ12c150, 6 stk/m

$5 \times \pi \cdot 6^2 = 565\ mm^2/m$

$6 \times \pi \cdot 6^2 = 678\ mm^2/m$

$\Sigma\ 1243\ mm^2/m$

Opptredende armering i dekke.

Begge akser

Det er god skjær-kap i plate, da skjær-tv.snitt er større enn tidligere bjelke tv.snitt.

V_{Rd} = ok.

Konklusjon Toveisplate.

Dim. Moment 47,5 kNm/m

Armeringsbehov 705 mm^2/m per akse.

Opptredende armering per akse

1243 mm^2/m

Konklusjon:

Plate og Hoved- og Sekundærbjelker

tåler BK70.

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mvh

Trondheim
03.04.2018