Tillhör byggnadsnämndens
beslut d. 26/10 1943 § 266

GUNNAR FÄLLMAN
INGENIÖRSBYRÅ
SKEPPSBROHUSET
GÖTEBORG

Konstruktionsberäkningar

till

K.v. Abborren 1
i Mölndal

4.

Platta ö skyddsrum - pl. A_1

Belastn. av golv + fyllning 50
" bet. platta 12 cm 290
" mellanväggar 100
" nyttig last 200
640 kg/m²

$\frac{l_y}{l_x} = 1.50$ (3 × 4.5)

$q_x = 0.835 \cdot 640 = 0.53$ t/m
$q_y = 0.11$

$M_x = 0.53 \cdot \frac{3^2}{8} \cdot 0.691 = 0.42$ tm $h = 10$ cm

$M_y = 0.11 \cdot \frac{4.5^2}{8} \cdot 0.691 = 0.19$ tm

$f_{ex} = 0.94 \cdot \frac{0.42}{0.08} = 5$ cm² = φ10 c 15 cm

$f_{ey} = \frac{0.19}{0.07} = 2.6$ cm² = φ10 c 30 cm

Platta A_3

$\frac{l_y}{l_x} = 1$ $q_x = q_y = 0.35$ t/m; $v_x = v_y = 0.60$

$M_x = M_y = 0.60 \cdot 0.35 \cdot \frac{6.9^2}{8} = 0.9$ tm $h = 15$ cm

$f_{ex} = 0.94 \cdot \frac{0.9}{0.12} = 7.1$ cm² = φ14 c 20 cm

$f_{ey} = \frac{0.9}{0.13} = 6.5$ cm² = φ14 c 22

Platta A_4

$\frac{l_y}{l_x} = \frac{5.5}{3.3} = 1.65$ $q_x = 0.88 \cdot 0.54 = 0.47$; $q_y = 0.07$; $v_x = v_y = 0.73$

$M_x = 0.47 \cdot \frac{3.3^2}{8} \cdot 0.73 = 0.48$ tm

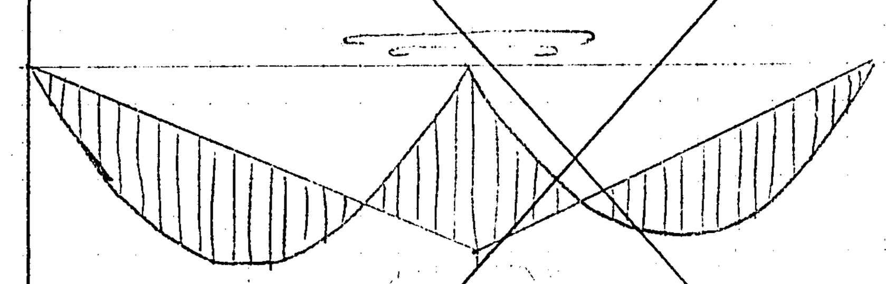
$M_y = 0.07 \cdot \frac{5.5^2}{8} \cdot 0.73 = 0.19$ tm $h = 11$ cm

$f_{ex} = 0.94 \cdot \frac{0.48}{0.09} = 5$ cm² = φ10 c 15 cm

$f_{ey} = \frac{0.19}{0.08} = 2.3$ cm² = φ10 c 30 cm

$M_{o_{AK}} = 0.62 \cdot \frac{5.4^2}{8} = 2.27$ tm

$M_{o_{KL}} = 0.62 \cdot \frac{5.8^2}{8} = 2.60$ tm



Trapplan

$M = 0.70 \cdot \frac{2.5^2}{8} = 0.55$ tm $h = 11$ cm

$f_e = 0.94 \cdot \frac{0.55}{0.09}$ = φ10 c 13 cm

Skyddsrum i källaren [illegible] kl. A_2

Belastn. av golv + fylln. = 50
" 26 cm bet. 620
" mellanväggar 100
" 1500 + 200 1700
2470 kg

Denna last reduc. 20% varvid räknas med normala påkänningar (q = 2 t/m)

$\frac{l_y}{l_x} = \frac{4.50}{6.8} = 0.66$ $q_x = 0.165 \cdot 2.00 = 0.33$; $q_y = 1.67$; $v_x = v_y = 0.69$

$M_x = 0.33 \cdot \frac{6.8^2}{8} \cdot 0.69 = 1.33$ tm

$M_y = 1.67 \cdot \frac{4.5^2}{8} \cdot 0.69 = 2.95$ tm $h = 25$ cm

$f_{ex} = 0.94 \cdot \frac{1.33}{0.215} = 5.8$ cm² = φ14 c 25 cm

$f_{ey} = \frac{2.95}{0.23} = 12.0$ cm² = φ14 c 12.5 cm

Platta ö skyddsrum 2 - pl.

$\frac{l_y}{l_x} = \frac{5.50}{7.00} = 0.78$ $q_x = 0.27 \cdot 2 = 0.54$; $q_y = 1.46$; $v_x = v_y = 0.64$

$M_x = 0.64 \cdot 0.54 \cdot \frac{7^2}{8} = 2.12$ tm

$M_y = 1.46 \cdot 0.64 \cdot \frac{5.5^2}{8} = 3.55$ tm $h = 27$ cm

$f_{ex} = 0.94 \cdot \frac{2.12}{0.235} = 8.5$ cm² = φ14 c 17 cm

$f_{ey} = \frac{3.55}{0.25} = 13.4$ cm² = φ14 c 11 cm

Platta A_4

$\frac{l_y}{l_x} = \frac{5.5}{3.7} = 1.5$ $q_x = 0.835 \cdot 0.54 = 0.45$; $q_y = 0.09$; $v_x = 0.691 = v_y$

$M_x = 0.45 \cdot \frac{3.7^2}{8} \cdot 0.691 = 0.54$ tm $h = 12$ cm

$M_y = 0.09 \cdot \frac{5.5^2}{8} \cdot 0.691 = 0.24$ tm

$f_{ex} = 0.94 \cdot \frac{0.54}{0.10} = 5.1$ cm² = φ10 c 15 cm

$f_{ey} = \frac{0.24}{0.09} = 2.5$ cm² = φ10 c 30 cm

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Platta A8

$l_x = \frac{5.50}{7.30} = 0.755$

$q_x = 0.160$

$q_y = 0.481$

$\nu_x = \nu_y = 0.63$

$M_{vx} = 0.63 \frac{0.16 \cdot 7.30^2}{8} = 0.65$ tm

$M_{qy} = 0.63 \frac{0.481 \cdot 5.5^2}{8} = 1.14$ tm h = 16 cm

$A_{sx} = 3.9$ cm² ϕ10 c/c 20

$A_{sy} = 6.5$ cm² ϕ10 c/c 12

$R_x = 0.58$ tm/m

$R_y = 1.32$ "

Betongbalk i fältet A

$q = 11.32$ tm/m $s_{p.v} = 3.70$ m

$M = \frac{11.32 \cdot 3.70^2}{8} = 19.5$ tm

H = 95, B = 25, $\sigma = 80$ $A_s = 0.81 \frac{19.5}{0.90} = 17.5$ cm²

tex 5 ϕ 22

$R_{pel\ kant} = 1.85 \cdot 11.32 = 21.0$ tm

$\tau_1 = 1.15 \frac{21000}{90 \cdot 25} = 10.8$ kg/cm²

bygel. ϕ10 c/c 20 $A_{bygel.} = \frac{0.79 \cdot 2 \cdot 1400}{20 \cdot 25} = 4.7$ kg/cm²

erf. $A_{bygel.} = \frac{3.85 \cdot 110 \cdot 30}{\sqrt{2} \cdot 1400} = 6.5$ cm²

tex 3 ϕ 22

Bjälklag B

Last av 15 cm betong: 2400 · 0.15 = 360 kg/m².
-"- -"- fyllning + golv = 50 -"-
-"- -"- mellanväggar = 100 -"-
-"- -"- puts = 20 -"-

q = 530 kg/m².
p = 200 -"-
q = 730 kg/m²

Platta B1

5.6 / 9.6 $\frac{l_y}{l_x} = 0.60$;

$q_x = 0.049 \cdot 730 = 36$ kg/m²
$q_y = 0.951 \cdot 730 = 694$ -"- (505 kg/m²)
$\nu_x = 0.886$. $\nu_y = 0.839$.

Platta B2

5.75 / 5.60 $\frac{l_y}{l_x} = 1.00$;

$q_x = 0.5 \cdot 730 = 365$ kg/m² (265 kg/m²).
$q_y = 0.5 \cdot 730 = 365$ -"- (265 kg/m²)
$\nu_x = \nu_y = 0.766$.

Platta B3

5.75 / 5.60 $\frac{l_y}{l_x} = 1.00$;

$q_x = 0.286 \cdot 730 = 210$ kg/m²
$q_y = 0.714 \cdot 730 = 520$ -"- (380 kg/m²)
$\nu_x = 0.762$. $\nu_y = 0.665$

Platta B4.

5.25 / 3.60 $\frac{l_y}{l_x} = 1.45$;

$q_x = 0.8145 \cdot 730 = 595$ kg/m² (432 kg/m²)
$q_y = 0.1855 \cdot 730 = 135$ -"- (98 kg/m²)
$\nu_x = \nu_y = 0.818$

Platta B5 = B8

5.25 / 6.9 $\frac{l_y}{l_x} = 0.75$;

$q_x = 0.3875 \cdot 730 = 282$ kg/m² (205 kg/m²)
$q_y = 0.6125 \cdot 730 = 448$ " (325 kg/m²).
$\nu_x = 0.81$. $\nu_y = 0.841$.

Platta B6

5.25 / 3.60 $\frac{l_y}{l_x} = 1.45$;

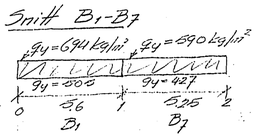
$q_x = 0.8862 \cdot 730 = 655$ kg/m². (475 kg/m²)
$q_y = 0.1030 \cdot 730 = 75$ -"- (55 kg/m²)
$\nu_x = 0.8815$. $\nu_y = 0.8995$

Platta B7

5.25 / 7.45 $\frac{l_y}{l_x} = 0.70$;

$q_x = 0.194 \cdot 730 = 140$ kg/m²
$q_y = 0.806 \cdot 730 = 590$ -"- (427 kg/m²)
$\nu_x = \nu_y = 0.815$.

Snitt B1-B7



$\frac{q \cdot l^3}{4} = \frac{694 \cdot 5.6^3}{4} = 30500$

$\frac{q \cdot l^3}{4} = \frac{590 \cdot 5.25^3}{4} = 21300$

$0 \cdot 5.6 + 2M_1(5.6+5.25) + 0 \cdot 5.25 = -30500 - 21300.$

$21.70\ M_1 = -51800.$ $\underline{M_1 = -2380 \text{ kgm.}}$

M_{1V}: $\frac{q \cdot l^3}{4} = 30500$; $\frac{q \cdot l^3}{4} = \frac{427 \cdot 5.25^3}{4} = 15500$;

$0 \cdot 5.6 + 2M_{1V}(5.6+5.25) + 0 \cdot 5.25 = -30500 - 15500$

$21.70\ M_{1V} = -46000.$ $\underline{M_{1V} = -2120 \text{ kgm.}}$

M_{1H}: $\frac{q \cdot l^3}{4} = 21300$; $\frac{q \cdot l^3}{4} = \frac{505 \cdot 5.6^3}{4} = 24200$;

$0 \cdot 5.6 + 2 \cdot M_{1H}(5.6+5.25) + 0 \cdot 5.25 = -21300 - 24200.$

$21.70\ M_{1H} = -45500.$ $\underline{M_{1H} = -2100 \text{ kgm.}}$

$R_{0max} = 0 + 2.8 \cdot 694 + 0 + \left(-\frac{2120}{5.6}\right) - 0 = \underline{1572 \text{ kg}}$

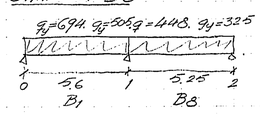
$R_{1max} = 2.8 \cdot 694 + 2.62 \cdot 590 + 0 + 0 - (-2380)\left(\frac{1}{5.6} + \frac{1}{5.25}\right) = \underline{\underline{3784 \text{ kg.}}}$

$R_{2max} = 2.62 \cdot 590 + 0 + \left(-\frac{2100}{5.25}\right) + 0 - 0 = \underline{1150 \text{ kg;}}$

$M_{0-1} = 0.839\ \frac{1572^2}{2 \cdot 694} = 1500 \text{ kgm.}$ ✓

$M_{1-2} = 0.815\ \frac{1150^2}{2 \cdot 590} = 915 \text{ kgm.}$ ✓

Snitt B1-B8



$\frac{q \cdot l^3}{4} = \frac{694 \cdot 5.6^3}{4} = 30500;$

$\frac{q \cdot l^3}{4} = \frac{448 \cdot 5.25^3}{4} = 16250;$

$0 + 2 \cdot M_1(5.6+5.25) + 0 = -30500 - 16250.$

$21.70\ M_1 = -116750.$ $M_1 = -2150 \text{ kgm.}$

M_{1V}: $\frac{q \cdot l^3}{4} = 30500$; $\frac{q \cdot l^3}{4} = \frac{325 \cdot 5.25^3}{4} = 11750;$

$0 + 2M_{1V}(5.6+5.25) + 0 = -30500 - 11750;$

$21.70\ M_1 = -42250;$ $M_{1V} = -1950 \text{ kgm.}$

M_{1H}: $\frac{q \cdot l^3}{4} = 16250$; $\frac{q \cdot l^3}{4} = \frac{505 \cdot 5.6^3}{4} = 22200;$

$0 + 2M_{1H}(5.6+5.25) + 0 = -16250 - 22200;$

$21.70\ M_{1H} = -38450;$ $M_{1H} = -1770 \text{ kgm.}$

$R_{0max} = 0 + 2.8 \cdot 694 + 0 + \left(-\frac{1950}{5.6}\right) - 0 = 1602 \text{ kg;}$

$R_{1max} = 2.8 \cdot 694 + 2.62 \cdot 448 + 0 + 0 - (-2150)\left(\frac{1}{5.6} + \frac{1}{5.25}\right);$

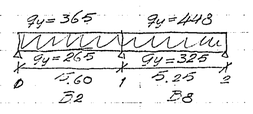
$R_{1max} = 3830 \text{ kg.}$

$R_{2max} = 2.62 \cdot 448 + 0 + \left(\frac{-1770}{5.25}\right) + 0 - 0 = 840 \text{ kg;}$

$M_{0-1} = 0.839 \cdot \frac{1602^2}{2 \cdot 694} = 1550 \text{ kgm;}$

$M_{1-2} = 0.84\ \frac{840^2}{2 \cdot 448} = 660 \text{ kgm;}$

Snitt B2-B8 = Snitt B2-B5



$\frac{q \cdot l^3}{4} = \frac{365 \cdot 5.60^3}{4} = 16000$

$\frac{q \cdot l^3}{4} = \frac{448 \cdot 5.25^3}{4} = 16200$

$0 + 2M_1(5.60+5.25) + 0 = -16000 - 16200;$

$21.70\ M_1 = -32200;$ $M_1 = -1485 \text{ kgm.}$

M_{1V}: $\frac{q \cdot l^3}{4} = 16000;$ $\frac{q \cdot l^3}{4} = \frac{325 \cdot 5.25^3}{4} = 11750;$

$0 + 2M_{1V}(5.60+5.25) + 0 = -16000 - 11750;$

$21.70\ M_{1V} = -27750;$ $M_{1V} = -1280 \text{ kgm.}$

M_{1H}: $\frac{q \cdot l^3}{4} = 16200;$ $\frac{q \cdot l^3}{4} = \frac{265 \cdot 5.60^3}{4} = 11620;$

$0 + 2M_{1H}(5.60+5.25) + 0 = -16200 - 11620;$

$21.70\ M_{1H} = -27820;$ $M_{1H} = -1280;$

$R_{0max} = 0 + 2.80 \cdot 365 + 0 + \left(-\frac{1280}{5.60}\right) - 0 = 791 \text{ kg;}$

$R_{1max} = 2.80 \cdot 365 + 2.62 \cdot 448 + 0 + 0 - (-1485)\left(\frac{1}{5.60} + \frac{1}{5.25}\right);$

$R_{1max} = 2748 \text{ kg.}$

$R_{2max} = 2.62 \cdot 448 + 0 + \left(-\frac{1280}{5.25}\right) + 0 - 0 = 938 \text{ kg;}$

$M_{0-1} = 0.766 - \frac{791^2}{2 \cdot 365} = 655 \text{ kgm;}$

$M_{1-2} = 0.84 - \frac{733^2}{2 \cdot 448} = 770 \text{ kgm;}$

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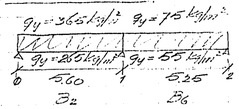
Snitt B2 - B6



$\frac{q \cdot l^3}{4} = \frac{365 \cdot 5.60^3}{4} = 16000;$

$\frac{q \cdot l^3}{4} = \frac{75 \cdot 5.25^2}{4} = 2720;$

$0 + 2M_1(5.60 + 5.25) + 0 = -16000 - 2720;$

$21.70\ M_1 = -18720; \quad M_1 = -865$ kgm.

M_{I_V}: $\frac{q \cdot l^3}{4} = 16000; \quad \frac{q \cdot l^3}{4} = \frac{55 \cdot 5.25^3}{4} = 1990;$

$0 + 2M_{I_V}(5.60 + 5.25) + 0 = -16000 - 1990;$

$21.70\ M_{I_V} = -17990; \quad M_{I_V} = -850$ kgm;

M_{II_B}: $\frac{q \cdot l^3}{4} = 2720; \quad \frac{q \cdot l^3}{4} = \frac{265 \cdot 5.60^3}{4} = 11600;$

$0 + 2M_{II_B}(5.60 + 5.25) + 0 = -2720 - 11600;$

$21.70\ M_{II_B} = -14320; \quad M_{II_B} = -660$ kgm;

$R_{0\,max} = 0 + 2.80 \cdot 365 + 0 + \left(-\frac{830}{5.60}\right) - 0 = 872$ kg;

$R_{1\,max} = 2.80 \cdot 365 + 2.62 \cdot 75 + 0 + 0 - \left(-865\right)\left(\frac{1}{5.60} + \frac{1}{5.25}\right);$

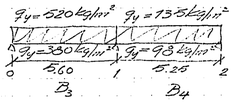
$R_{1\,max} = 1537$ kg.

$R_{2\,max} = 2.62 \cdot 75 + 0 + \left(-\frac{660}{5.25}\right) + 0 - 0 = 71$ kg

$M_{0-1} = 0.766 \cdot \frac{875^2}{2 \cdot 365} = 800$ kgm;

$M_{1-2} = 0.8995 \cdot \frac{71^2}{2 \cdot 75} = 30.2$ kgm;

Snitt B3 - B4



$\frac{q \cdot l^3}{4} = \frac{520 \cdot 5.60^3}{4} = 23000;$

$\frac{q \cdot l^3}{4} = \frac{135 \cdot 5.25^3}{4} = 4900;$

$0 + 2M_1(5.60 + 5.25) + 0 = -23000 - 4900$

$21.70\ M_1 = -27900; \quad M_1 = -1290$ kgm;

M_{I_V}: $\frac{q \cdot l^3}{4} = 23000; \quad \frac{q \cdot l^3}{4} = \frac{93 \cdot 5.25^3}{4} = 3550;$

$0 + 2M_{I_V}(5.60 + 5.25) + 0 = -23000 - 3550;$

$21.70\ M_{I_V} = -26550; \quad M_{I_V} = -1230$ kgm.

M_{II_B}: $\frac{q \cdot l^3}{4} = 4900; \quad \frac{q \cdot l^3}{4} = \frac{380 \cdot 5.60^3}{4} = 16700;$

$0 + 2M_{II_B}(5.60 + 5.25) + 0 = -16700 - 4900;$

$21.70\ M_{II_B} = -21600; \quad M_{II_B} = -995$ kgm;

$R_{0\,max} = 0 + 2.80 \cdot 520 + 0 + \left(-\frac{1230}{5.60}\right) - 0 = 1240$ kg;

$R_{1\,max} = 2.80 \cdot 520 + 2.62 \cdot 135 + 0 + 0 - \left(-1290\right)\left(\frac{1}{5.60} + \frac{1}{5.25}\right);$

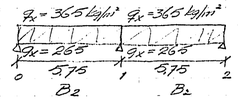
$R_{1\,max} = 2290$ kg.

$R_{2\,max} = 2.62 \cdot 135 + 0 + \left(-\frac{995}{5.25}\right) + 0 - 0 = 164$ kg;

$M_{0-1} = 0.665 \cdot \frac{1240^2}{2 \cdot 520} = 985$ kgm;

$M_{1-2} = 0.818 \cdot \frac{164^2}{2 \cdot 135} = 81.5$ kgm;

Snitt B2 - B2



$\frac{q \cdot l^3}{4} = \frac{365 \cdot 5.75^3}{4} = 17300;$

$0 + 2M_1(5.75 + 5.75) + 0 = -17300 - 17300;$

$23\ M_1 = -34600; \quad M_1 = -1500$ kgm;

$M_{I_V} = M_{II_B}$: $\frac{q \cdot l^3}{4} = 17300; \quad \frac{q \cdot l^3}{4} = \frac{265 \cdot 5.75^3}{4} = 12600;$

$0 + 2M_{I_V}(5.75 + 5.75) + 0 = -17300 - 12600;$

$23\ M_{I_V} = -29900; \quad M_{I_V} = M_{II_B} = -1300$ kgm;

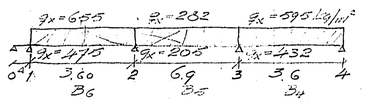
$R_{0\,max} = R_{2\,max} = 0 + 2.88 \cdot 365 + 0 + \left(-\frac{1300}{5.75}\right) - 0 = 824$ kg;

$R_{1\,max} = 2.88 \cdot 365 + 2.88 \cdot 365 + 0 + 0 - \left(-1300\right)\left(\frac{1}{5.75} + \frac{1}{5.75}\right);$

$R_{1\,max} = 2622$ kg.

$M_{0-1} = M_{1-2} = 0.766 \cdot \frac{824^2}{2 \cdot 365} = 715$ kgm;

Snitt B6 - B5 - B4



$\frac{q \cdot l^3}{4} = \frac{655 \cdot 3.60^3}{4} = 7650; \quad \frac{q \cdot l^3}{4} = \frac{282 \cdot 6.9^3}{4} = 23100;$

$\frac{q \cdot l^3}{4} = \frac{595 \cdot 3.6^3}{4} = 6950;$

$0 + 2M_1(0 + 3.60) + M_2 \cdot 3.60 = -7650 - 0;$

$7.20\ M_1 + 3.60\ M_2 = -7650;$

$M_1 \cdot 3.60 + 2M_2(3.60 + 6.90) + M_3 \cdot 6.90 = -7650 - 23100;$

$3.60\ M_1 + 21\ M_2 + 6.90\ M_3 = -30750;$

$M_2 \cdot 6.90 + 2M_3(6.9 + 3.60) + 0 = -23100 - 6950;$

$6.90\ M_2 + 21\ M_3 = -30050;$

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Snitt B_6-B_5-B_4 (forts.)

$7.20\,M_1 + 3.60\,M_2 = -7650;$

$3.60\,M_1 + 21\,M_2 + 6.90\,M_3 = -30750;$

$-7.20\,M_1 \ominus 3.60\,M_2 = \overset{+}{(-)}\,7650;$

$7.20\,M_1 + 42\,M_2 + 13.8\,M_3 = -61500;$

$38.40\,M_2 + 13.8\,M_3 = -53850;$

$6.90\,M_2 + 21\,M_3 = -30050;$

$38.40\,M_2 + 13.8\,M_3 = -53850;$

$-6.90\,M_2 \ominus 21\,M_3 = \overset{+}{(-)}\,30050;$

$58.5\,M_2 + 21\,M_3 = -82000;$

$51.60\,M_2 = -51950;$ $\quad M_2 = -1010$ kgm;

$7.20\,M_1 + 3.60(-1010) = -7650;$ $\quad M_1 = -555$ kgm;

$6.90(-1010) + 21\,M_3 = -30050;$ $\quad M_3 = -1100$ kgm

$R_{1h} = 0 + 1.8 \cdot 655 + 0 + \left(-\frac{1010}{3.60}\right) - \left(-526\right)\left(\frac{1}{0} + \frac{1}{3.60}\right) = 1046$ kg;

$R_{2v} = 1.80 \cdot 655 + \left(-\frac{526}{3.60}\right) + 0 - (-1010)\left(\frac{1}{3.60} + \frac{1}{0}\right) = 1314$ kg;

$R_{2h} = 3.45 \cdot 282 + 0 + \left(-\frac{1100}{6.9}\right) - (-1010)\left(\frac{1}{0} + \frac{1}{6.9}\right) = 960$ kg;

$R_{3v} = 3.45 \cdot 282 + 0 + \left(-\frac{1010}{6.9}\right) + 0 - (-1100)\left(\frac{1}{6.9} + \frac{1}{0}\right) = 986$ kg;

$R_{3h} = 0 + 1.8 \cdot 595 + 0 + 0 - (-1100)\left(\frac{1}{0} + \frac{1}{3.6}\right) = 1376$ kg;

$R_{4v} = 1.8 \cdot 595 + 0 + \left(-\frac{1100}{3.6}\right) + 0 - 0 = 764$ kg;

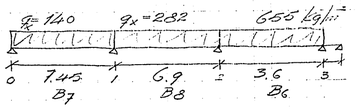
Fältmoment där $v = 0$ på 10,5.

$M_{1-2} = 1.10 \cdot 0.8815\left(\frac{1046^2}{2 \cdot 655} - 526\right) = 294$ kgm,

$M_{2-3} = 1.10 \cdot 0.81\left(\frac{960^2}{2 \cdot 282} - 1010\right) = 560$ kgm;

$M_{3-4} = 1.10 \cdot 0.818 \cdot \frac{764^2}{2 \cdot 595} = 445$ kgm;

Snitt B_7-B_8-B_6



$\frac{q \cdot l^3}{4} = \frac{140 \cdot 7.45^3}{4} = 14500;$ $\frac{q \cdot l^3}{4} = \frac{282 \cdot 6.9^3}{4} = 23200;$

$\frac{q \cdot l^3}{4} = \frac{655 \cdot 3.6^3}{4} = 7650;$

$0 + 2M_1(7.45 + 6.9) + M_2 \cdot 6.9 = -14500 - 23200;$

$28.7\,M_1 + 6.9\,M_2 = -37700;$

$M_1 \cdot 6.9 + 2M_2(6.9 + 3.6) + M_3 \cdot 3.6 = -23200 - 7650;$

$6.9\,M_1 + 21\,M_2 + 3.6\,M_3 = -30850;$

$M_2 \cdot 3.6 + 2M_3(3.6 + 0) + 0 = -7650 - 0;$

$3.6\,M_2 + 7.2\,M_3 = -7650;$

$6.9\,M_1 + 21\,M_2 + 3.6\,M_3 = -30850;$

$28.7\,M_1 + 6.9\,M_2 = -37700;$

$28.7\,M_1 + 87\,M_2 + 14.9\,M_3 = -128000;$

$-28.7\,M_1 \ominus 6.9\,M_2 = \overset{+}{(-)}\,37700;$

$80.1\,M_2 = -90300;$ $\quad M_2 = -1130$ kgm;

$28.7\,M_1 + 6.9(-1130) = -37700;$ $\quad M_1 = -1040$ kgm;

$3.6 \cdot (-1130) + 7.2\,M_3 = -7650;$ $\quad M_3 = -497$ kgm;

$R_{0h} = 0 + 3.73 \cdot 140 + 0 + \left(-\frac{1040}{7.45}\right) - 0 = 382$ kg;

$R_{1v} = 3.75 \cdot 140 + 0 + 0 + 0 - (-1040)\left(\frac{1}{7.45} + \frac{1}{0}\right) = 662$ kg;

$R_{1h} = 0 + 3.45 \cdot 282 + 0 + \left(-\frac{1130}{6.9}\right) - (-1040)\left(\frac{1}{0} + \frac{1}{6.9}\right) = 962$ kg

$R_{2v} = 3.45 \cdot 282 + 0 + \left(-\frac{1040}{6.9}\right) + 0 - (-1130)\left(\frac{1}{6.9} + \frac{1}{0}\right) = 988$ kg;

$R_{2h} = 0 + 1.8 \cdot 655 + 0 + \left(-\frac{526}{3.6}\right) - (-1130)\left(\frac{1}{0} + \frac{1}{3.6}\right) = 1349$ kg;

$R_{3v} = 1.8 \cdot 655 + 0 + \left(-\frac{1130}{3.6}\right) + 0 - \left(-526\right)\left(\frac{1}{3.6} + \frac{1}{0}\right) = 1011$ kg;

Snitt B_7-B_8-B_6 (forts.)

$M_{0-1} = 1.10 \cdot 0.815\ \frac{382^2}{2 \cdot 140} = 467$ kgm;

$M_{1-2} = 1.10 \cdot 0.81\left(\frac{962^2}{2 \cdot 282} - 1040\right) = 535$ kgm;

$M_{2-3} = 1.10 \cdot 0.8815\left(\frac{1349^2}{2 \cdot 655} - 1130\right) = 261$ kgm;

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Dimensionering
Anm. St. 44.

Fl. B1

$M_x = 0{,}886 \quad \frac{36 \cdot 9{,}6^3}{8} = 370$ kgm.

$H = 16$. $h' = 13$ cm.

$\sigma_b = 23{,}5$ kg/cm². $f_e = 2{,}2$ cm².

$\phi 8$ c/c 22 (2,27)

$M_y = 1500$ kgm.

$H = 16$ $h' = 14$

$\sigma_b = 50$ kg/cm² $f_e = 9{,}7$ cm²

$\phi 14$ c/c 17 (9)

Fl. B2

$M_x = 800$ kgm.

$H = 15$ cm. $h' = 13$ cm.

$\sigma_b = 37$ kg/cm². $f_e = 4{,}85$ cm²

$\phi 10$ c/c 16 (4,95)

$M_y = 715$ kgm.

$H = 15$ cm. $h' = 12$ cm.

$\sigma_b = 38{,}5$ kg/cm² $f_e = 4{,}8$ cm²

$\phi 10$ c/c 16 (5,3)

Fl. B3.

$M_x = 0{,}762 \quad \frac{210 \cdot 5{,}75^2}{8} = 660$ kgm

$H = 15$ cm. $h' = 12$ cm.

$\sigma_b = 36$ kg/cm². $f_e = 4{,}3$ cm²

$\phi 10$ c/c 18 (4,95)

$M_y = 985$ kgm.

$H = 15$ cm. $h' = 13$ cm.

$\sigma_b = 42$ kg/cm². $f_e = 6{,}1$ cm²

$\phi 10$ c/c 13 (5,1)

Fl. B4.

$M_x = 445$ kgm.

$H = 15$ cm. $h' = 13$ cm

$\sigma_b = 26$ kg/cm². $f_e = 2{,}65$ cm².

$\phi 10$ c/c 30 (2,65)

$M_y = 81{,}5$ kgm.

$H = 15$. $h' = 12$.

$\phi 8$ c/c 30

Fl. B5

$M_x = 560$ kgm.

$H = 15$. $h' = 12$ cm.

$\sigma_b = 32{,}8$ kg/cm². $f_e = 3{,}65$ cm²

$\phi 8$ c/c 13 (4,15)

$M_y = 1800$ kgm;

$H = 15$ cm. $h' = 13$ cm.

$\sigma_b = 150$ kg/cm² $f_e = 2{,}1$ cm²

$\phi 14$ c/c 19 (2,1)

$M_y = 0{,}84 \left(\frac{448 \cdot 2{,}62}{2 \cdot 442}\right)^2 = 1800$ kgm;

Fl. B6. $M_x = 294$ kgm.

$H = 15$ cm. $h' = 13$ cm.

$\sigma_b = 20{,}7$ kg/cm². $f_e = 1{,}72$ cm².

$\phi 8$ c/c 29 (1,73)

Fl. B7. $M_x = 467$ kgm.

$H = 15$ cm. $h' = 12$ cm.

$\sigma_b = 29{,}2$ kg/cm². $f_e = 3$ cm².

$\phi 8$ c/c 16 (3,1)

Fl. B8 $M_x = 535$ kgm.

$H = 15$ cm. $h' = 12$ cm.

$\sigma_b = 32$ kg/cm². $f_e = 3{,}5$ cm²

$\phi 10$ c/c 22 (3,6)

$M_y = 30{,}2$ kgm.

$H = 15$. $h' = 12$.

$\phi 8$ c/c 30

$M_y = 915$ kgm.

$H = 15$ cm. $h' = 13$ cm.

$\sigma_b = 40$ kg/cm². $f_e = 5{,}6$ cm².

$\phi 10$ c/c 14 (5,62)

$M_y = 0{,}84 \left(\frac{448 \cdot 2{,}62}{2 \cdot 442}\right)^2 = 1300$ kgm

$H = 15$ cm. $h' = 13$ cm.

$\sigma_b = 50$ kg/cm². $f_e = 8{,}1$ cm².

$\phi 14$ c/c 19 (8,1)

Stöd B1-B1 $M_y = -2380$ kgm

$H = 17$ cm. $h' = 15$ cm. $\sigma_b = 61$ kg/cm².

$f_e = 13$ cm². $\phi 14$ c/c 34 (4,5); $\phi 10$ c/c 28 (2,8); $\phi 10$ c/c 14 (5,7) } o.k.

Stöd B2-B6 $M_y = -865$ kgm.

$H = 15$ cm. $h' = 12$ cm. $\sigma_b = 38{,}8$ kg/cm². $f_e = 5{,}3$ cm²

$\phi 10$ c/c 32 (2,47); $\phi 10$ c/c 28 (2,8) } o.k.

Stöd B3-B4 $M_y = -1290$ kgm.

$H = 15$ cm. $h' = 13$ cm. $\sigma_b = 50$ kg/cm². $f_e = 8{,}1$ cm²

$\phi 10$ c/c 26 (3,05); $\phi 10$ c/c 15 (5,05) } o.k.

Stöd B2-B2 $M_x = -1500$ kgm.

$H = 15$ cm. $h' = 13$ cm. $\sigma_b = 55$ kg/cm². $f_e = 9{,}5$ cm².

$\phi 10$ c/c 32 (2,47); $\phi 10$ c/c 32 (2,47); $\phi 10$ c/c 17 (4,65) } o.k.

Stöd B7-B8. $M_x = -1040$ kgm.

$H = 15$ cm. $h' = 13$ cm. $\sigma_b = 43{,}5$ kg/cm². $f_e = 6{,}45$ cm².

$\phi 8$ c/c 32 (1,46); $\phi 10$ c/c 44 (1,8); $\phi 10$ c/c 27 (3,28) } o.k.

Stöd B8-B6. $M_x = -1130$;

$H = 15$ cm. $h' = 13$ cm. $\sigma_b = 46$ kg/cm². $f_e = 7{,}05$ cm².

$\phi 10$ c/c 44 (1,8); $\phi 10$ c/c 15 (5,05) } o.k.

Stöd B6-B6 $M_x = -526$ kgm.

$H = 15$ cm. $h' = 13$ cm. $\sigma_b = 28{,}8$ kg/cm². $f_e = 3{,}15$ cm².

$\phi 10$ c/c 25 (3,15)

Stöd B6-B4 $M_x = -1100$ kgm.

$H = 15$ cm. $h' = 13$ cm. $\sigma_b = 45$ kg/cm². $f_e = 6{,}8$ cm².

$\phi 8$ c/c 26 (1,92); $\phi 10$ c/c 60 (1,32); $\phi 10$ c/c 22 (3,58) } o.k.

11.45
2.72
14.17

Beräkning av mest ansträngd fönsterpelare

Last från:

ytterta[k] = 4.75 × 0.13 × 4.5 × $\frac{1}{6}$ (0.53) + 1.75 × 0.15 (0.26) =	0.79	ton/m
bj.l E = 0.55 × 2.8 × 0.951 =	1.47	"
" B, C, D = 0.585 × 2.8 × 0.951 × 3 =	4.67	"
	6.93	"

gasbetongvägg:

puts =	50	kg/m²
25 cm gasbtg	200	"
	250	"

Belastning vid:

bj.l. C	14.17 ton	σ ~ 5.65
" B	20.35 "	σ ~ 8.15
" A	26.80 "	σ ~ 8.85

16.15
4.20
20.35

360
80
50
490

muras i kalkcementbruk

Betongbalkar över fönster

Vid pl. B1   sp.v = 3 m

q = 1.56 + 0.50 = 2.06 t/m
0.95 × 0.25 = 0.24 "
2.30 "

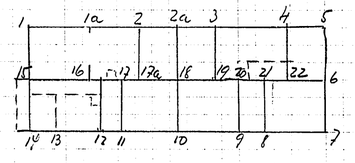
M = 2.6 tm   H ≈ 60 cm
B = 15 cm

$f_e = 0.82 \frac{2.6}{0.55} = 3.9$ 2 φ 16 uk
2 φ 12 ök

$\tau_0 = 1.15 \frac{3450}{55 \times 15} \approx 4.8$ bygl. φ 8 % 20

uppl. längd = $\frac{3450}{15 \times 6}$ = 40 cm

Grundcea



Sträcka 1-1a

Belästning från:

Bjälkl. = H. 0.8 · 1.15 =		3.70
" A = 0.8 · 1.32 =		1.06
garbtg	0.20 · 3.0 · 0.25 =	0.67
	0.25 · 10.0 · 0.25 =	1.90
Grunden 2.90 · 0.20 · 2.4 =		2.10
	H.67 =	

7.5 · 9.43 = 70.6 ton
antal pålar 6 st.

under 1a

21 ton " " 2 st.

Sträcka 1a-2

samma som 1-1a " " 6 st.

Sträcka 2-3

Bjälkl. = H · 0.8 · 0.07 =		0.22
" A = 0.8 · 5.5/2 · 0.09 =		0.16
garbtg + grunden		H.67

7.8 · 5.05 = 39.4 ton
antal pålar H st.

Sträcka 3-4

Bjälkl. = H.0 · 0.8 · 1.15 =		3.70
" A = 0.73 · 0.62 · 5.5/2 =		1.25
garbtg + gr. mur =		H.67

7.2 · 9.13 = 69 ton
antal pålar = 6 st.

Sträcka 4-5

Bjälkl. = H · 0.8 · 0.16 =		0.53
" A =		0.17
garbtg + grund =		H.67

H.0 · 5.37 = 21.0 ton
antal pålar 2 st.

Sträcka 5-6

Bjälkl. H · 0.8 · 0.76 =		2.42
0.45 · 0.8 · 1.8 =		0.65
garbtg + grunden =		H.67

6.0 · 7.74 = H6.5 ton
antal pålar = H st.

Sträcka 6-7

Bjälkl. H · 0.8 · 0.21 · 5.75/2 =		1.91
" A = 0.35 · 0.8 · 3 =		0.84
garbtg + gr. =		H.67

6.2 · 7.42 = H6.0 ton
antal pålar = H st.

Sträcka 7-8

Bjälkl. = H · 0.8 · 1.24 =		H.0
" A =		0.84
garbtg + grund =		H.67

6.5 · 9.51 = 62.0 ton
antal pålar = 5 st.

Sträcka 8-9

räj + gr. mur = H.67 · 3 = 14.0 ton
antal pålar = 2 st.

Sträcka 9-10

Bjälklag H · 0.8 · 0.87 =		2.80
" A		0.84
		H.67

6.0 · 8.31 = 50.0 ton
antal pålar H st.

Sträcka 10-11 " " 5 st.

-"- 11-12 = 8-9 2 st.

-"- 12-13

Bjälkl. = H · 0.8 · 1.57 =		5.0 ton
" A = 0.585 · 2.35 · 0.62 =		1.16 "
		H.67 "

7.0 · 10.83 = 76
antal pålar 6 st.

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Sträcka 13-14

Bjälkl.	4 · 0.8 · 1.57 =	5.0
" A	0.19 · 3 =	0.57
		11.67

34 × 10.24 = 35 ton
antal pålar 3 st.

Sträcka 14-15

Bjälkl.	4 · 0.8 · 0.036 · 5 =	0.58
" A	0.53 · 1.5 =	0.77
		11.67

6.0 × 6.02 = 36 ton
antal pålar = 4 st.

Sträcka 15-1

Bjälkl.	4 · 0.8 · 0.28 =	1.20
" A		0.58
		5.00

5.8 × 6.78 = 39.5 ton
antal pålar = 4 st.

Sträcka 15-16

Bjälkl.	4 · 0.8 · 4.35 =	14.0
" A		1.32
tegel		3.40
grund		1.50
		6.90

8.0 × 23.28 = 186 ton
antal pålar = 16 st.

Sträcka 16-17a

Bjälkl.	4 · 0.8 · 3.83 =	12.25
" A		1.06
"		1.06
tegel + grund		6.90

21 × 21.27 = 151.0 ton
antal pålar = 13 st.

Sträcka 17a-19

Bjälkl.	4 · 0.8 · 1.54 =	4.95
" A	0.35 · 2.25 · 0.8 =	0.63
"		0.16
		6.90

8.0 × 12.64 = 101 ton
antal pålar = 9 st.

Sträcka 19-22

Bjälkl.	4 · 0.8 · 2.75 =	8.80
" A		1.25
		0.84
		6.90

7 · 17.79 = 125 ton
antal pålar = 11 st.

Sträcka 22-6

Bjälklag	4 · 0.8 · 2.27 =	7.20
" A		0.17
		0.84
		6.90

4 · 15.21 = 60 ton
antal pålar 5 st.

Bunkt 16

R = 21.0 + $\frac{1.25}{2}$ · 11.32 = 31 ton

Gr. mur = 0.6 · 3.0 · 1.25 = 3.2 ton

35 ton

antal pålar = 3 st.

Sträcka 2-17a

Bjälkl.	4 · 0.8 · 2.34 =	7.50
" A	0.8 · 0.58	0.47
	0.8 · 0.42 · 2 =	0.72
		6.90

5.7 × 15.59 = 89 ton
antal pålar 8 st.

Sträcka 2a-18

Bjälklag	4 · 0.8 · 2.57 =	8.20
" A	2 · 0.45 · 2 · 0.8 =	1.44
		6.90

5.7 · 16.64 = 95 ton
antal pålar = 8 st.

Sträcka 3-19

Bjälklag	4 · 0.8 · 3.27 =	10.50
" A		0.72
"	0.54 · 0.6 · 3.5 =	1.13
		6.90

5.7 × 19.25 110 ton

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Sträcka 4-22

Stjälklag	4 · 0.8 · 2.30 ·	7.60	
" A	= 0.45 · 0.8 · 2 ·	0.72	
" "		1.13	
		6.90	
		5.7 · 16.35 =	93 ton
		antal påkar	8 st.

Sträcka 12-16 a

11 - 17

9 - 20

8 - 21

Stjälklag	4/5 · 15 =	12.0	
" A	1 · 0.80 ·	0.80	
		0.20	
		6.90	
	2 · 3.70 ·	19.90	= 146 ton
	antal påkar	= 15 st.	

Sträcka 10-18

Stjälklag	4 · 0.8 · 2.6 ·	8.30	
" A	0.35 · 0.80 · 6 ·	1.68	
		6.90	
		5.8 · 16.58 =	98 ton
		antal påkar	8 st.

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