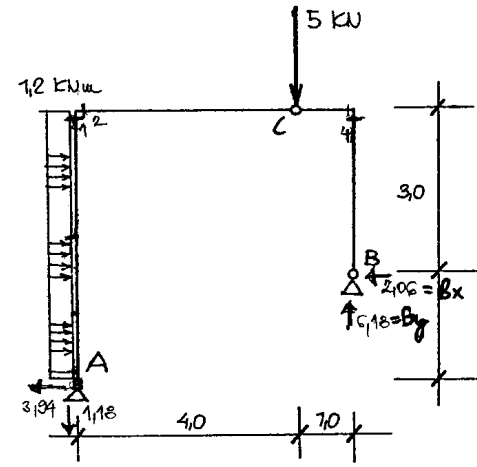


VI./1.

Háromcsuklós tartó



$$\sum M_A = 0 = 1.2 \cdot 5 \cdot 2.5 + 5 \cdot 4 - B_y \cdot 5 - B_x \cdot 2$$

$$\sum M_C = 0 = B_x \cdot 3 - B_y \cdot 1 = 0$$

$$B_x = \frac{B_y}{3}$$

Rajzolja meg az $M; N; T; \delta$ brát

$$\sum M_A; B_y = \frac{5 \cdot 1.2 \cdot \frac{5}{2} + 5 \cdot 4 - B_x \cdot 2}{5}$$

$$B_y = 7 - 0.4 B_x$$

$$B_x = \frac{1 \cdot B_y}{3} = \frac{B_y}{3}$$

$$B_y = 7 - \frac{0.4 \cdot B_y}{3}$$

$$B_y = \frac{21}{3.4} = 6.18 \text{ kN} \uparrow$$

$$B_x = 2.06 \text{ kN} \leftarrow$$

$$\Delta y = 5 - 6.18 = -1.18 \text{ kN} \downarrow$$

$$\Delta x = 6 - 2.06 - 3.94 \text{ kN} \leftarrow$$

$$x_0 = \frac{3.94}{1.2} = 3.28 \text{ m}$$

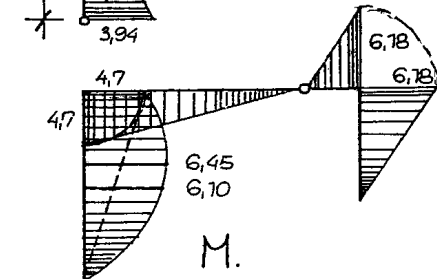
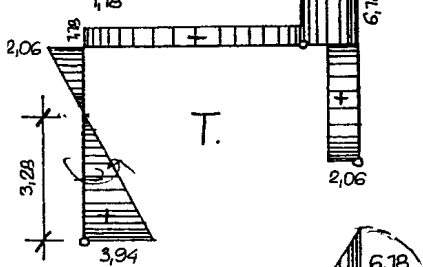
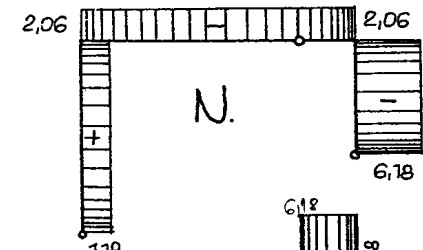
$$M_{bf} = 5 \cdot 3.94 - 5 \cdot 1.2 \cdot 2.5 = 4.7$$

$$M_{max}^{(+)} = \frac{4.7}{2} + \frac{1.2 \cdot 5^2}{8} = 6.70 \text{ kNm}$$

$$M_{max}^{(-)} = 3.94 \cdot 3.28 - \frac{1.2 \cdot 3.28^2}{2} = 6.45$$

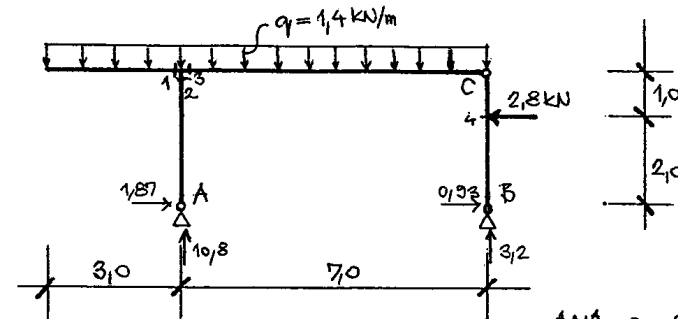
$$M_{max}^{(+)} = 6.45 \text{ kNm}$$

$$M_{2,4} = -2.06 \cdot 3 = -6.18 \text{ m} \cdot \text{m}$$



VI./2.

Háromcsuklós tartó



$$\sum M^A = 0 = 2 \cdot 10 \cdot 1.4 - 2 \cdot 2.8 - 7 B_y$$

$$B_y = \frac{22.4}{7} = 3.2 \text{ kN} (\uparrow)$$

$$\sum F_y = 0 = 10 \cdot 1.4 - 3.2 + A_y$$

$$A_y = 10.8 \text{ kN} (\uparrow)$$

$$\sum M_{jchh}^C = +1.2 \cdot 8 - 3 B_x = 0$$

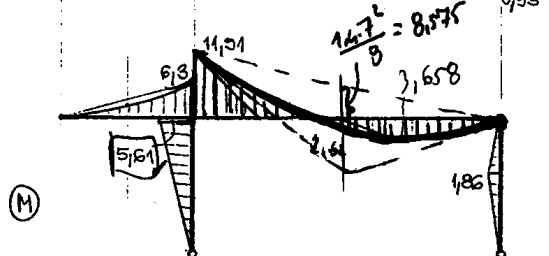
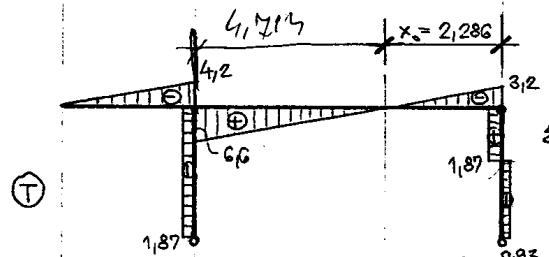
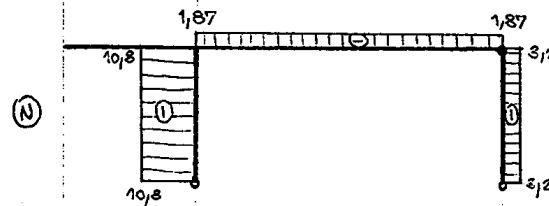
$$B_x = \frac{2.8}{3} = 0.93 \text{ kN} (\rightarrow)$$

$$\sum F_x = 0 = -2.8 + 0.93 + A_x$$

$$A_x = 1.87 \text{ kN} (\rightarrow)$$

Ellenőrzés:

$$\sum M_{bal}^C = -\frac{1.4^2}{2} \cdot 1.4 - 3 \cdot 1.87 + 7 \cdot 10.8 = 0$$



$$M_1 = \frac{3}{2} \cdot 1.4 = 6.3 \text{ kNm}$$

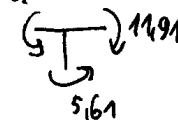
$$M_2 = 3 \cdot 1.87 = 5.61 \text{ kNm} \checkmark$$

$$M_3 = 6.3 + 5.61 = 11.91 \text{ kNm}$$

$$M_4 = 2 \cdot 0.93 = 1.86 \text{ kNm}$$

$$M_{max} = 3.2 \cdot \frac{2.286}{2} = 3.658 \text{ kNm}$$

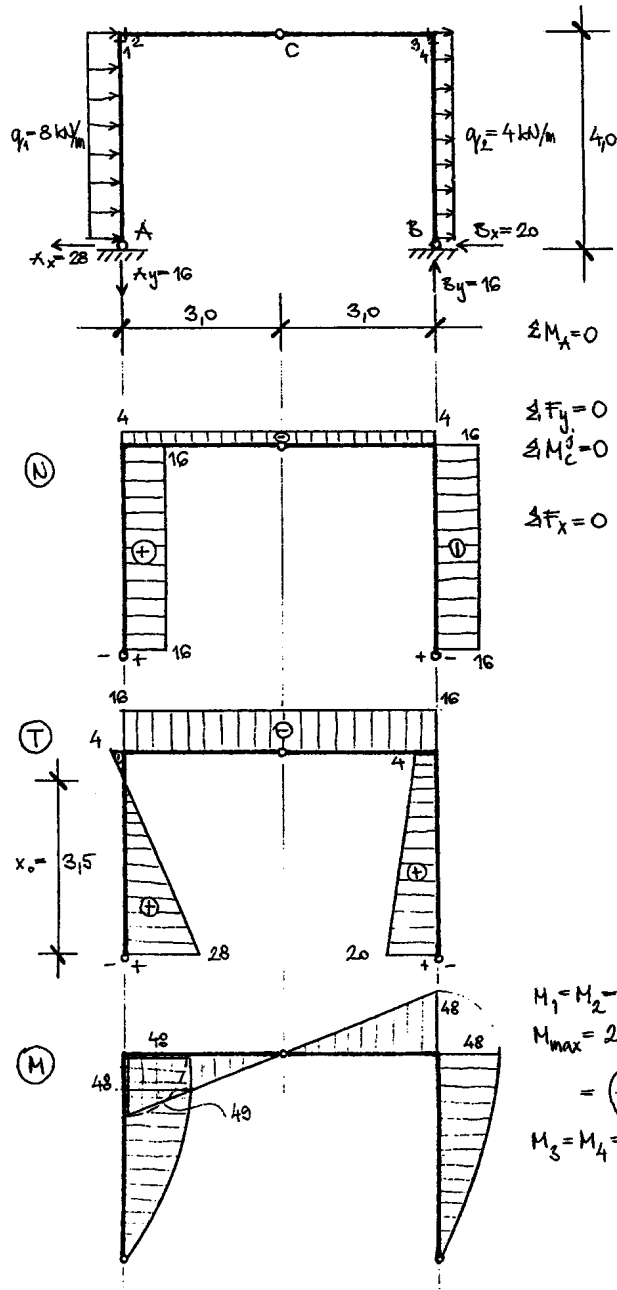
6.3



$$M_{max} = -1.4 \cdot \frac{7.744^2}{2} - 1.87 \cdot 3 + 10.8 \cdot 4.744 = 3.658 \text{ kNm}$$

VI./3.

Háromcsuklós tartó



$$\sum M_A = 0 \quad 12 \cdot 4 \cdot 2 - 6 B_y = 0$$

$$B_y = 16 \text{ kN} (\uparrow)$$

$$\sum F_y = 0 \quad A_y = 16 \text{ kN} (\downarrow)$$

$$\sum M_C^B = 0 \quad -4 \cdot 4 \cdot 2 - 16 \cdot 3 + B_x \cdot 4 = 0$$

$$B_x = 20 \text{ kN} (\leftarrow)$$

$$\sum F_x = 0 \quad 32 + 16 - 20 - A_x = 0$$

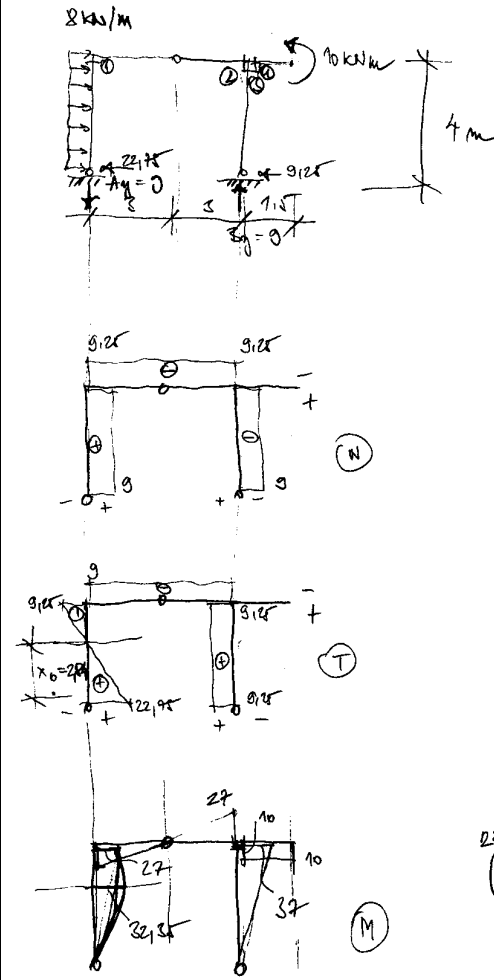
$$A_x = 28 \text{ kN} (\leftarrow)$$

$$M_1 = M_2 = 28 \cdot 4 - 8 \cdot 4 \cdot 2 = 48 \text{ kNm}$$

$$M_{max} = 28 \cdot 3.5 - \frac{8 \cdot 3.5^2}{2} = 49 \text{ kNm}$$

$$= \left(\frac{A_x^2}{2q} = \frac{28^2}{2 \cdot 8} = 49 \right)$$

$$M_3 = M_4 = 20 \cdot 4 - 4 \cdot 4 \cdot 2 = 48 \text{ kNm}$$



$$\sum M_A = 0 = 8 \cdot 4 \cdot 2 - 10 - 6 B_y$$

$$\frac{64 - 10}{6} = B_y = 9 \text{ kN}$$

$$A_y = 9 \text{ kN} (\uparrow)$$

$$\sum M_C^B = 0 = -10 - 9 \cdot 3 + 4 B_x$$

$$\frac{+10 + 27}{4} = B_x = 9.25$$

$$\sum M_C^A = 0 = -4 \cdot 8 \cdot 2 - 3 \cdot 9 + 4 A_x$$

$$\frac{-64 - 27}{4} = A_x$$

$$x_0 = \frac{22.95}{8} = 2.87 \text{ m}$$

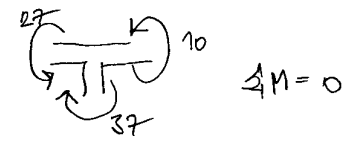
$$M_1 = 4 \cdot 22.95 - 4 \cdot 8 \cdot 2 = 27 \text{ kNm}$$

$$M_0 = 22.95 \cdot 2.87 - \frac{8 \cdot 2.87^2}{2} = 32.55$$

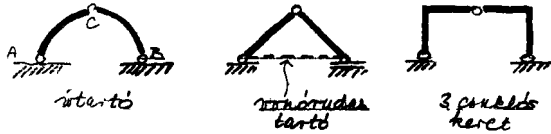
$$M_2 = -4 \cdot 8 \cdot 2 - 9 \cdot 3 + 4 \cdot 22.95 = 27$$

$$M_4 = 10 \text{ kNm}$$

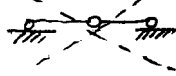
$$M_3 = 9.25 \cdot 4 = 37 \text{ kNm}$$



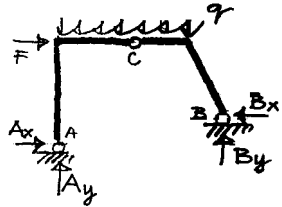
HÁROMCSUKLÓS TARTÓ



a 3 csukló nem helyezkedhet el egy egyenesen!



TÁMASZERŐK MEGHATÁROZÁSA ÁLTALÁNOS TERHELÉSRE



4 ismeretlen támaszerőkomponens

4 egyensúlyi egyenlet

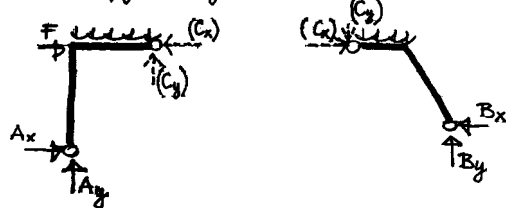
$$\begin{cases} \sum F_x = 0 \\ \sum F_y = 0 \\ \sum M = 0 \end{cases} \text{ az egész tartóra!}$$

$$\sum M_C = 0 \text{ (C től jobbra vagy balra)}$$

A "C" csukló nem támasz, itt csak belső erő íród! (T_c és N_c)

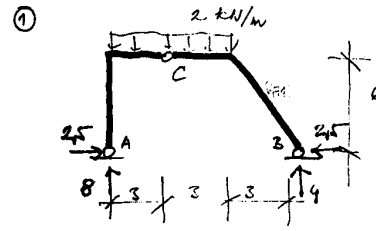
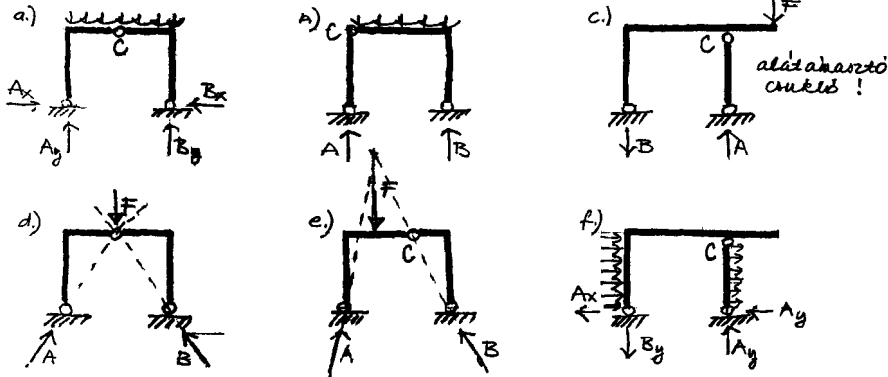
$M_c = 0!$

A "C" csuklóról a tartó gondolatlan szelvényható - a 2 rész egyensúlytalan van



C_x és C_y : belső erők!

KÜLÖNLEGES TERHELÉSI ESETEK



$$\sum M_A = 0 \quad 6 \cdot 2 \cdot 3 - B_y \cdot 9 = 0$$

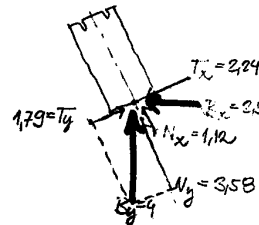
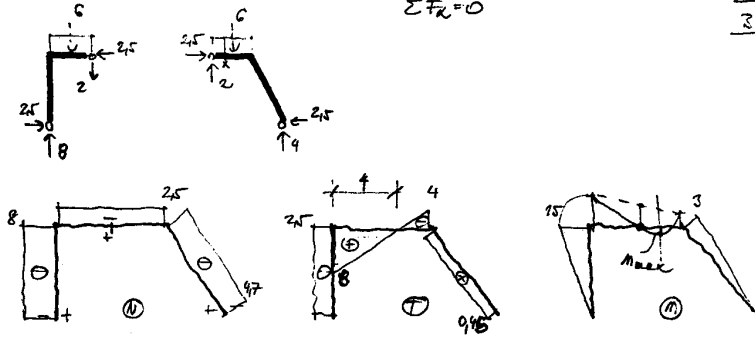
$$\sum F_y = 0 \quad B_y = 4 \text{ kN} \uparrow$$

$$\sum M_{C_{bal}} = 0 \quad -2 \cdot 3 \cdot 1.5 + 8 \cdot 3 - A_x \cdot 6 = 0$$

$$24 - 9 = 6A_x$$

$$\sum F_x = 0 \quad A_x = 2.5 \text{ kN} \leftarrow$$

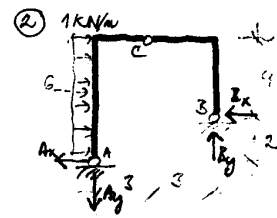
$$B_x = 2.5 \text{ kN} \leftarrow$$



$M_{max} = 2 \cdot 1 - 2 \cdot 1 \cdot 0.5 = 1 \text{ kNm}$

$M_1 = 2.5 \cdot 6 = 15 \text{ kNm}$

$M_2 = 2.5 \cdot 6 - 4 \cdot 3 = 3 \text{ kNm}$
(= 0.45 G, 7.1 ~ 3.0 kNm)



$$\sum M_A = 0 \quad 6 \cdot 3 - B_x \cdot 2 - B_y \cdot 6 = 0$$

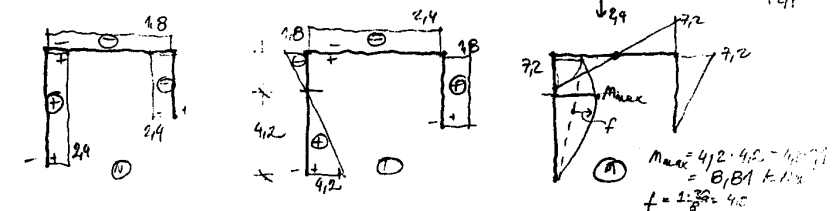
$$\sum M_B = 0 \quad -B_y \cdot 3 + B_x \cdot 4 = 0 \Rightarrow B_y = \frac{3}{4} B_x$$

$$18 - 1.5 B_y - 6 B_y = 0 \Rightarrow B_y = 2.4 \text{ kN}$$

$$B_x = 1.8 \text{ kN}$$

$$A_y = 2.4 \text{ kN} \downarrow$$

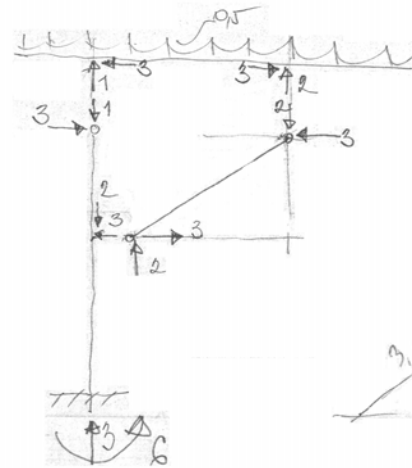
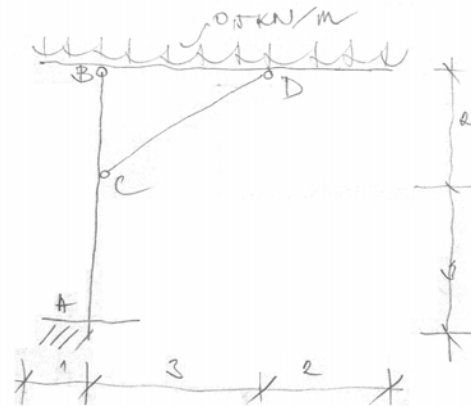
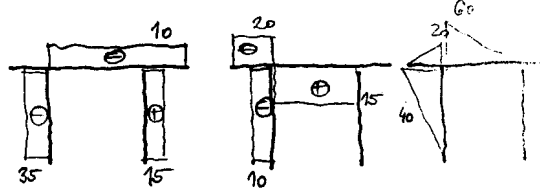
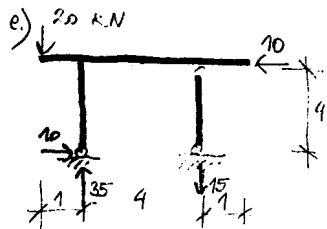
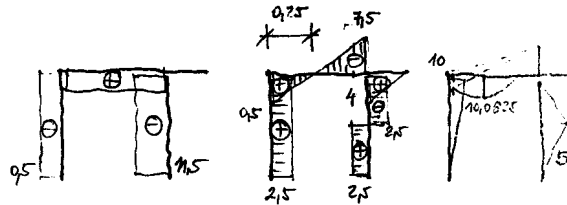
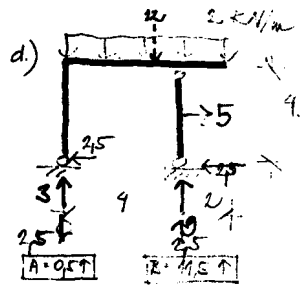
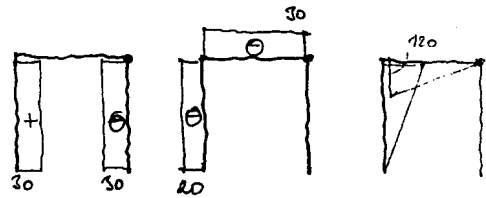
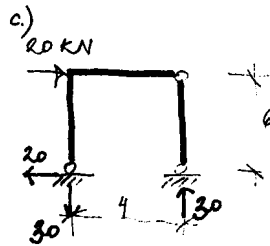
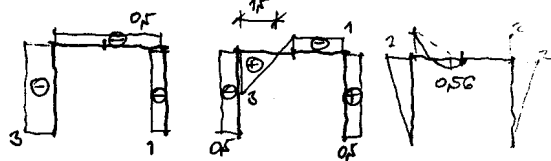
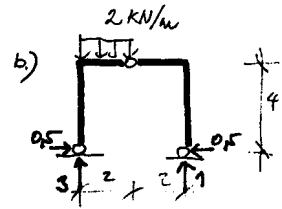
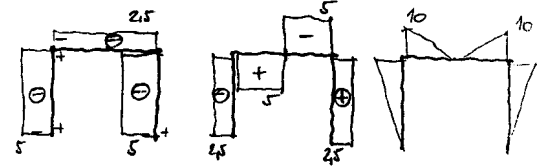
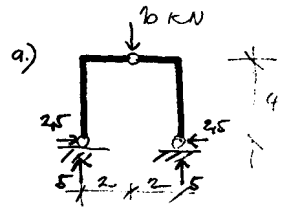
$$A_x = 6 - 1.8 = 4.2 \text{ kN} (\leftarrow)$$



$M_{max} = 4.2 \cdot 4.5 - 4.5^2 = 8.01 \text{ kNm}$

$f = 1.5 \cdot 4.5 = 6.75$

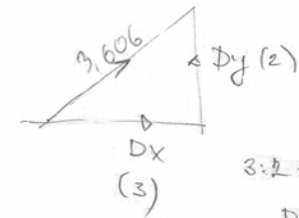
③



$$\sum M_B = 0$$

$$\frac{0.5 \cdot 6 \cdot 2}{3} = D_y \cdot 2 = 2$$

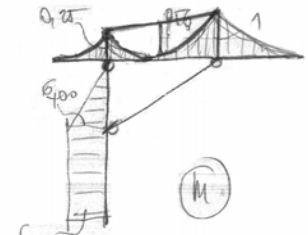
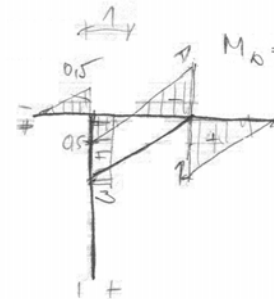
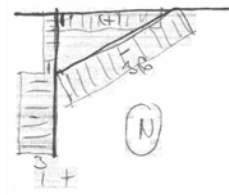
$$\sum F_y = 0$$



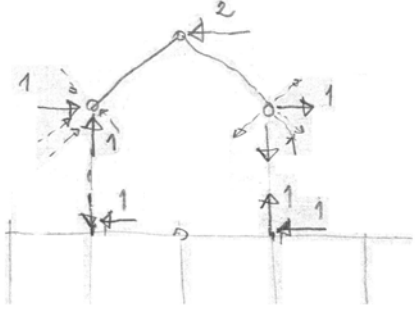
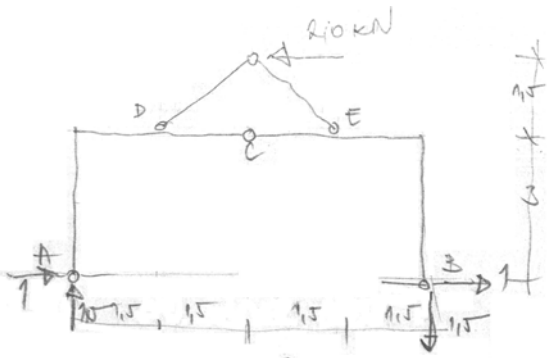
$$3 \cdot 2 = D_x \cdot 2$$

$$D_x = \frac{6}{2} = 3$$

$$M_B = 3 \cdot 5 - 3 \cdot 3 = 6 \text{ kNm}$$



$$\frac{0.5 \cdot 3^2}{8} = 0.56$$



$$+3 - 2 \cdot 3 + B_y \cdot 6 = 0$$

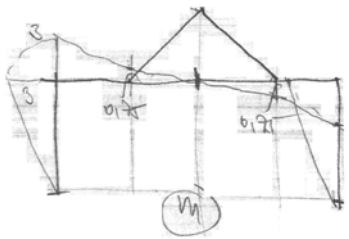
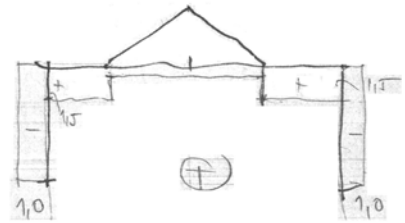
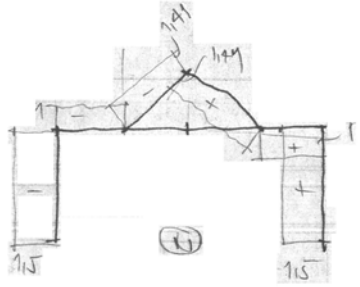
$$B_y = 1.5$$



$$-1 \cdot 1.5 + 1.5 \cdot 3 - B_x \cdot 3 = 0$$

$$B_x = 1$$

$$A_x = 1$$



$$M_b = 1.5 \cdot 1.5 - 1 \cdot 3 = 0.75$$