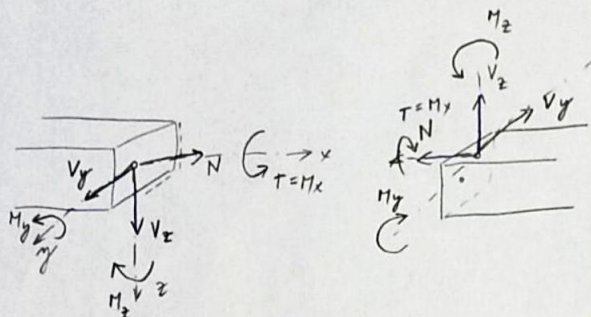


PROSTOROVĚ NAMÁHANÝ PRUT:

- 6 stupňů volnosti $\rightarrow$ 6 stat. podm. rovnováhy
 $3N + 3M$ $\Sigma F_{ix} = 0$ $\Sigma F_{iy} = 0$ $\Sigma F_{iz} = 0$
 (4M + 2F, 5M + 1F, 6M)
 $\Sigma M_{ix} = 0$ $\Sigma M_{iy} = 0$ $\Sigma M_{iz} = 0$

kladné smyčky:



N... normálová síla

V_y, V_z ... posuvné síly

$T = M_x$... krútiaci / točivý moment

M_y, M_z ... ohybové momenty

- prostoroové namáhaní lze rozdeliť na 4 druhů nuly:

a) osová namáhaní - tah, tlak $\rightarrow N$

b) ohyb ve smyčce v rovine xz $\rightarrow V_z, M_z$

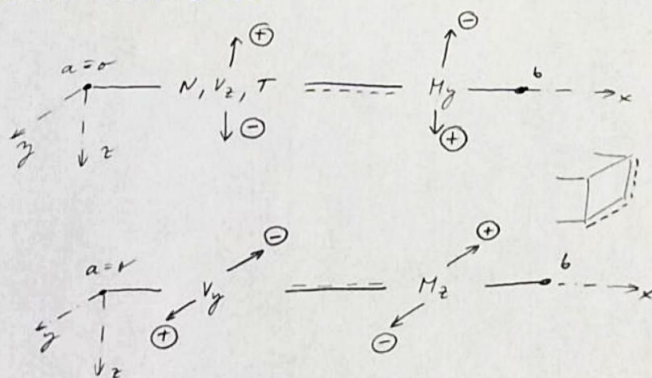
c) ohyb ve smyčce v rovine xy $\rightarrow V_y, M_y$

d) krúcení $\rightarrow T = M_x$

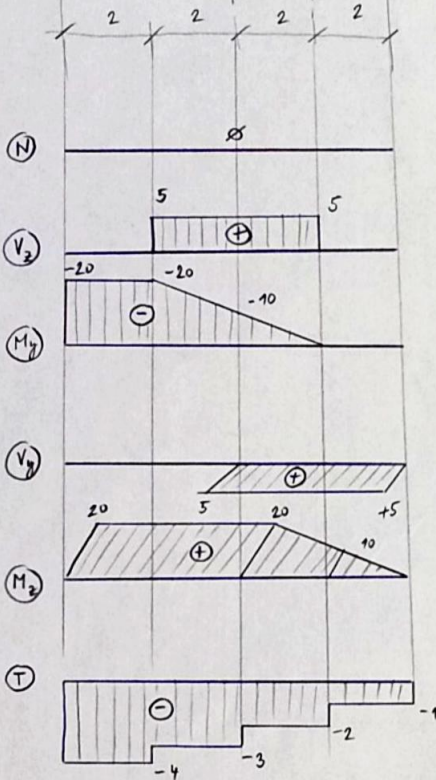
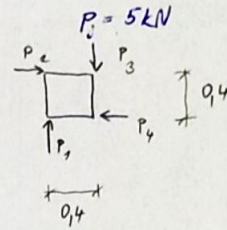
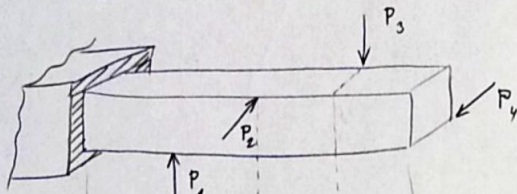
N, V_z, M_z, T vyhodnotíme ve rovine xz

V_y, M_y ve vodorovné rovine xy

ZNAMĚNKOVÁ KONVENCE:



* Pr.: Procturung konzolig' normat:



[m]

(P3, P1)

(P4, P2)

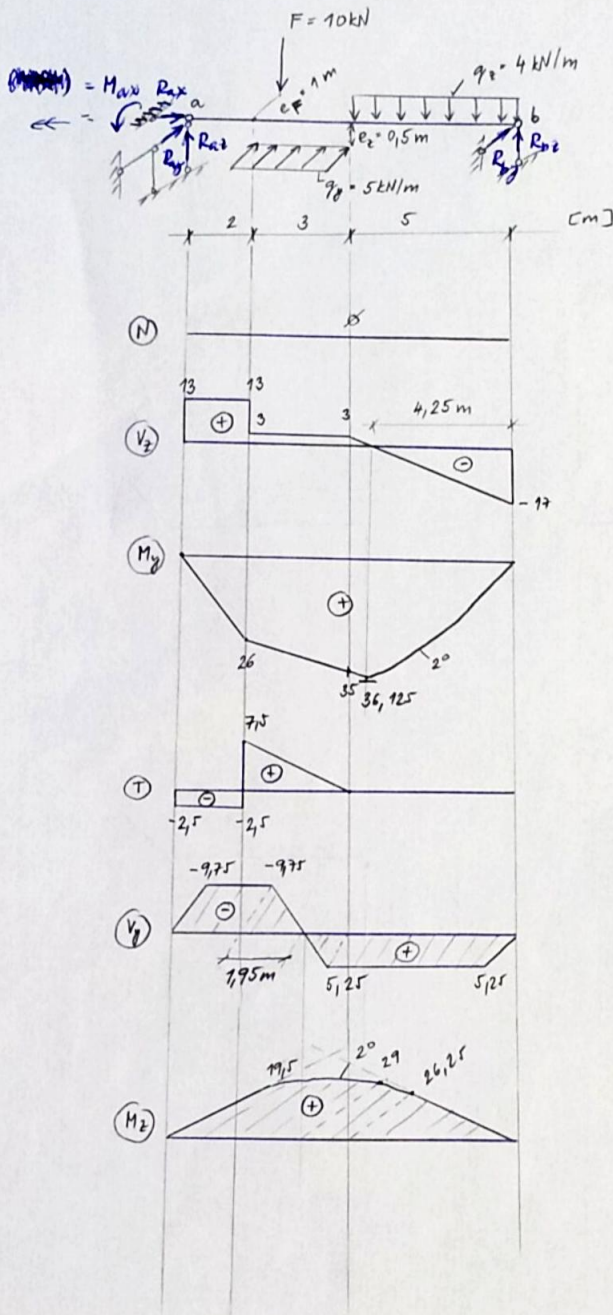
$$T_0 = -P_4 \cdot \frac{1}{2} = -5 \cdot 0.2 = -1 \text{ kNm}$$

$$T_1 = -P_4 \cdot \frac{1}{2} - P_3 \cdot \frac{1}{2} = -2 \text{ kNm}$$

$$T_2 = -P_4 \cdot \frac{1}{2} - P_2 \cdot \frac{1}{2} = -3 \text{ kNm}$$

$$T_3 = -P_4 \cdot \frac{1}{2} - P_1 \cdot \frac{1}{2} = -4 \text{ kNm}$$

* Pr: Procty norml:



$$\oplus \sum M_{1,2,b} = 0 :$$

$$-R_{bz} \cdot 10 + F \cdot 8 + q_z \cdot 5 \cdot 2,5 = 0$$

$$-R_{bz} \cdot 10 + 10 \cdot 8 + 4 \cdot 5 \cdot 2,5 = 0$$

$$R_{bz} = 13 \text{ kN } (\uparrow)$$

$$\oplus \sum M_{1,2,a} = 0 :$$

$$-F \cdot 2 - q_z \cdot 5 \cdot 7,5 + R_{bz} \cdot 10 = 0$$

$$-10 \cdot 2 - 4 \cdot 5 \cdot 7,5 + R_{bz} \cdot 10 = 0$$

$$R_{bz} = 17 \text{ kN } (\uparrow)$$

$$\sum F_{ix} = 0 :$$

$$R_{ax} = 0$$

$$\oplus \sum M_{1,2,b} = 0 :$$

$$-R_{ay} \cdot 10 - q_y \cdot 3 \cdot 6,5 = 0$$

$$-R_{ay} \cdot 10 - 5 \cdot 3 \cdot 6,5 = 0$$

$$R_{ay} = -9,75 \text{ kN } (\downarrow)$$

$$\oplus \sum M_{1,2,a} = 0 :$$

$$q_y \cdot 3 \cdot 3,5 + R_{by} \cdot 10 = 0$$

$$5 \cdot 3 \cdot 3,5 + R_{by} \cdot 10 = 0$$

$$R_{by} = -5,25 \text{ kN } (\downarrow)$$

$$\oplus \sum M_{1,2,a} = 0 :$$

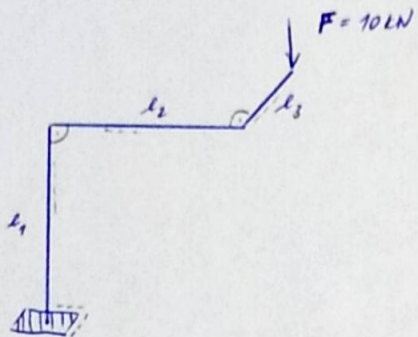
$$M_{ax} - F \cdot 8 + q_y \cdot 3 \cdot 0,5 = 0$$

$$M_{ax} - 10 \cdot 8 + 5 \cdot 3 \cdot 0,5 = 0$$

$$M_{ax} = 2,5 \text{ kNm } (\rightarrow)$$

PROSTOROVĚ NATAHANÁ PRAVOUHLÉ LOMENÁ KONVOLA :
 NODNÍK :

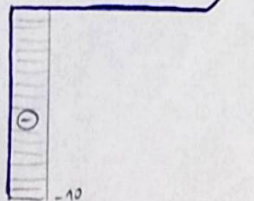
2. PR. :



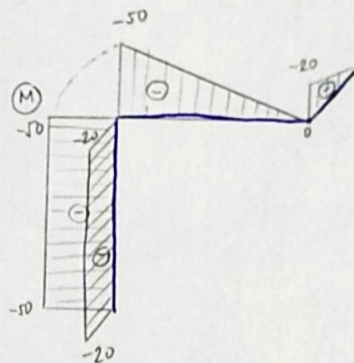
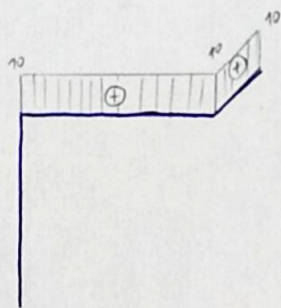
$$l_1 = l_2 = 5 \text{ m}$$

$$l_3 = 2 \text{ m}$$

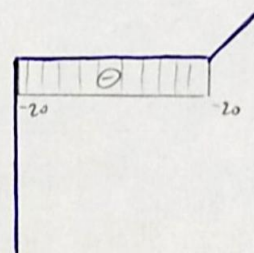
(N)



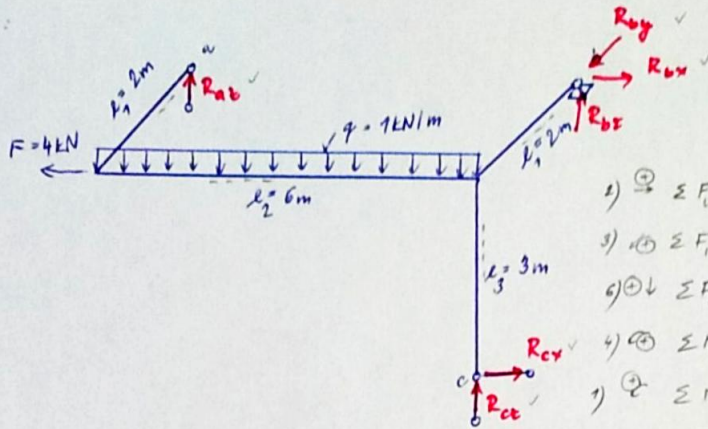
(V)



(T)



* $\vec{R}$:



$$1) \sum F_{ix} = 0 : R_{bx} + R_{cx} - F = 0 \rightarrow \underline{R_{bx} = 0}$$

$$3) \sum F_{iy} = 0 : \underline{R_{by} = 0}$$

$$6) \sum F_{it} = 0 : -R_{bx} + q \cdot 6 - R_{by} - R_{cy} = 0 \rightarrow R_{by} = -5kN (\downarrow)$$

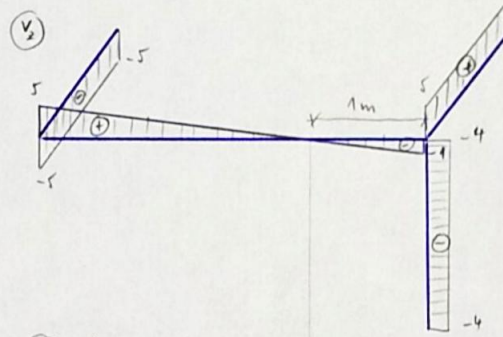
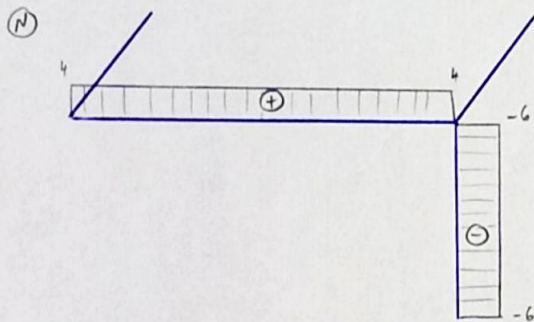
$$4) \sum M_{iy,b} = 0 : -R_{bx} \cdot 6 + q \cdot 6 \cdot 3 + R_{cx} \cdot 3 = 0 \rightarrow \underline{R_{cx} = 5kN (\uparrow)}$$

$$1) \sum M_{it,b} = 0 : -F \cdot 2 + R_{cx} \cdot 2 = 0$$

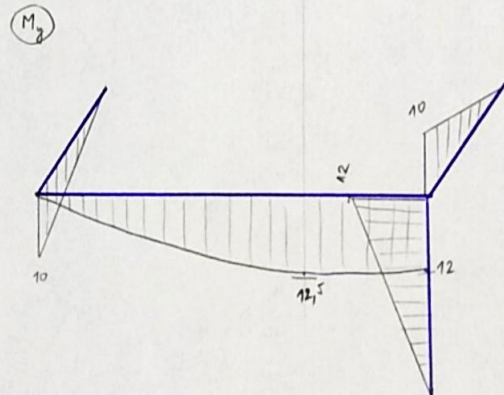
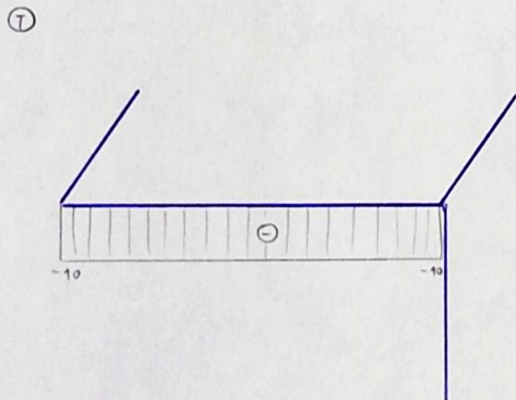
$$\underline{R_{cx} = 4kN (\rightarrow)}$$

$$5) \sum M_{ix,b} = 0 : -q \cdot 6 \cdot 2 + R_{cy} \cdot 2 = 0$$

$$\underline{R_{cy} = 6kN (\uparrow)}$$



(V₀) $\emptyset$



(M₂) $\emptyset$