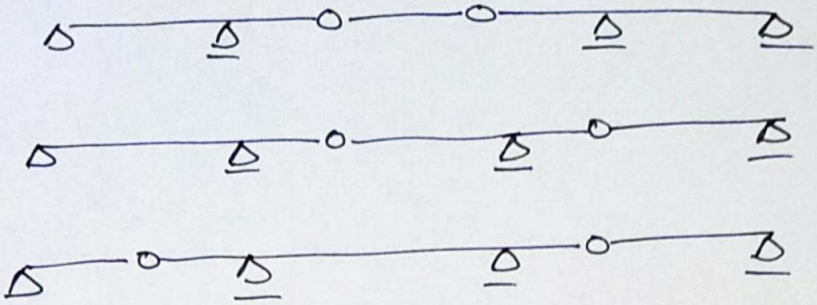
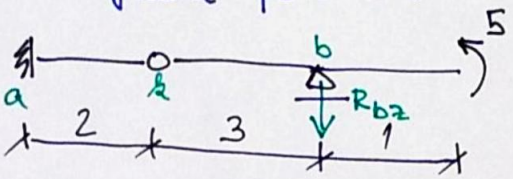
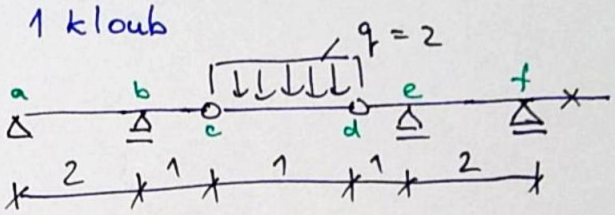
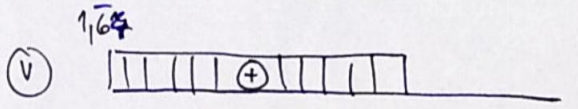
GERBERŮV NOSNÍK

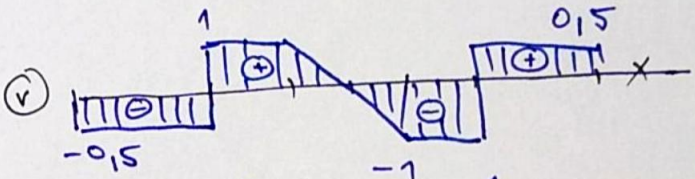


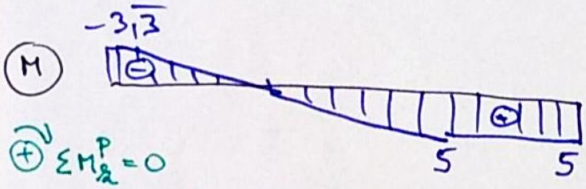
- nesmí vzniknout nestabilní část
- krajní pole zakončené △ ▲ - max 1 kloub
- ⊣ nebo ve vnitřním poli - max 2 kl.
- v krajním poli s ⊣ min 1 kloub

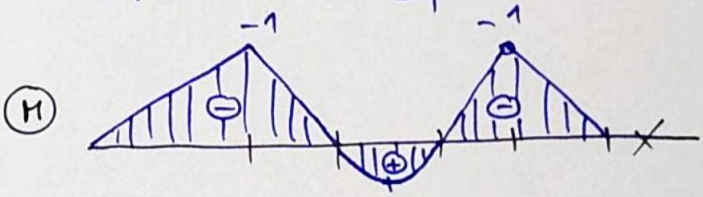








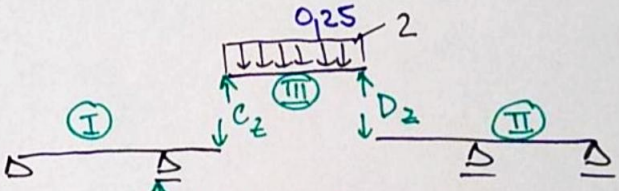




$\oplus \circlearrowright \Sigma M^P_{\dot{z}} = 0$

$R_{bz} \cdot 3 - 5 = 0$

$R_{bz} = \frac{5}{3} = 1,\bar{6}\ \text{kN}$



$R_{bz} = C_z = D_z = 1$

$\oplus \circlearrowleft \Sigma M^I_{ai} = 0$

$R_{bz} \cdot 2 - C_z \cdot 3 = 0$

$R_{bz} = 1,5\ \text{kN}$

* GERBERŮV NOSNÍK *

- spojitý nosník s vloženými vnitřními klouby

! ohybový moment ve vloženém kloubu má NULOVOU HODNOTU !

- vnitřní klouby NEumisťujeme zcela libovolně, ale vždy tak, aby na nosníku nevznikla nestabilní část:

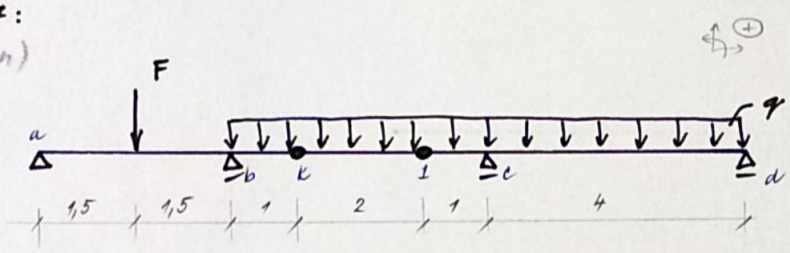
  * v krajním poli zakončeném △, ▲ max. 1 kloub
  * v krajním poli zakončeném ⊥ nebo ve vnitřním poli max. 2 klouby
  * v krajním poli ⊥ min. 1 kloub
  * jinak stat. neurčité podepření!

  stupeň stat. neurčitosti $n = a_1 + 2a_2 + 3a_3 - 3 = a - 3$

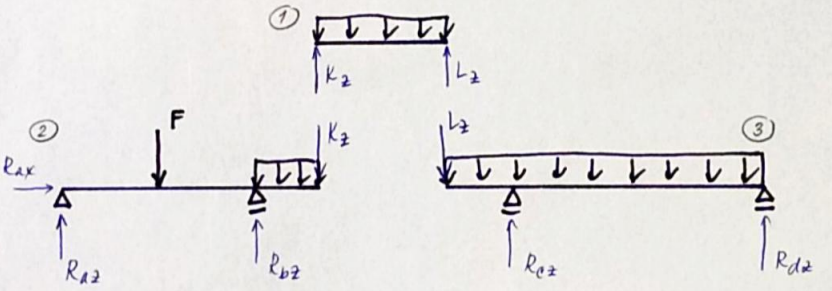
  → kolikrát je nosník stat. neurčitý, tolik kloubů vkládáme

Př. 37:
(30 min)

$F = 6\,kN$
$q = 2\,kN \cdot m^{-1}$



→ rozčleníme nosník na základní a vedlejší části
→ vypočítat probíkání od částí vedlejších k základním



① $\Sigma M_{ik} = 0$: $L_z \cdot 2 - q \cdot 2 = 0 \Rightarrow L_z = \frac{1}{2}(q \cdot 2) = \frac{1}{2}(2 \cdot 2) = \underline{2\,kN}$
$\Sigma M_{il} = 0$: $-K_z \cdot 2 + q \cdot 2 = 0 \Rightarrow K_z = \frac{1}{2}(q \cdot 2) = \frac{1}{2}(2 \cdot 2) = \underline{2\,kN}$
} zrumělnout: $K_z = L_z = \frac{1}{2} q \cdot 2$

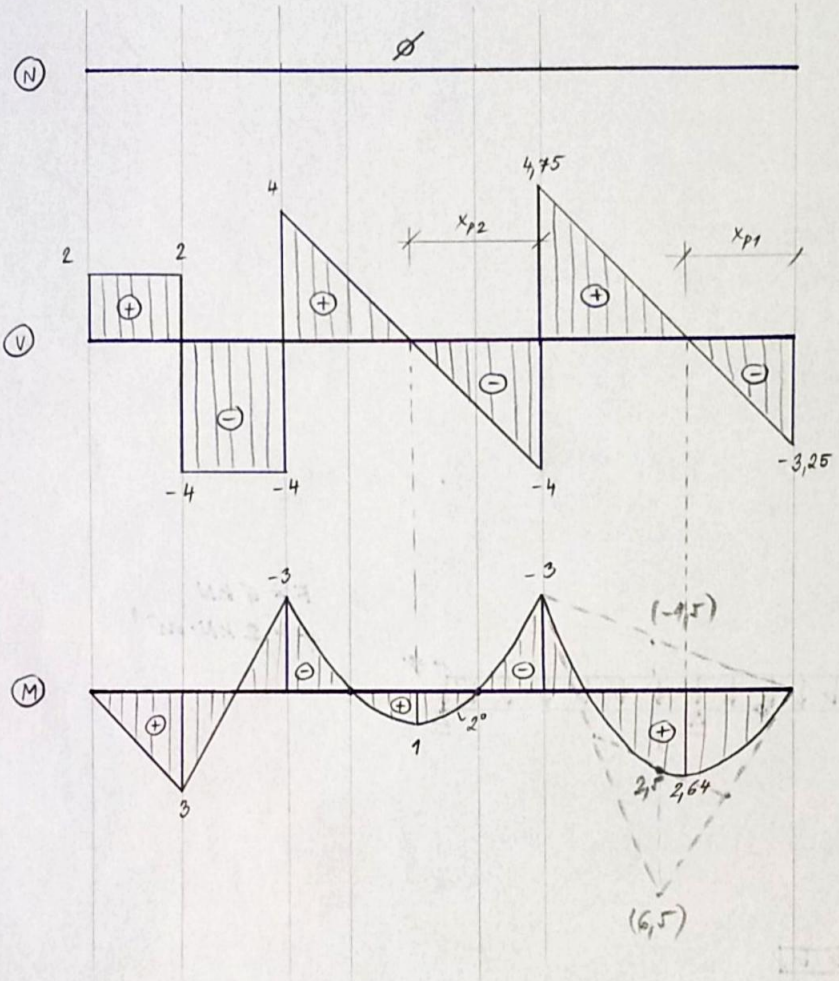
② $\Sigma F_{ix} = 0$: $\underline{R_{ax} = 0}$

$\Sigma M_{ia} = 0$: $-F \cdot 1{,}5 + R_{bz} \cdot 3 - q \cdot 1 \cdot 3{,}5 - K_z \cdot 4 = 0 \Rightarrow R_{bz} = \frac{1}{3}(F \cdot 1{,}5 + q \cdot 1 \cdot 3{,}5 + K_z \cdot 4)$
$= \frac{1}{3}(6 \cdot 1{,}5 + 2 \cdot 1 \cdot 3{,}5 + 2 \cdot 4) = \underline{8\,kN}$

$\Sigma M_{ib} = 0$: $-R_{az} \cdot 3 + F \cdot 1{,}5 - q \cdot 1 \cdot 0{,}5 - K_z \cdot 1 = 0 \Rightarrow R_{az} = \frac{1}{3}(F \cdot 1{,}5 - q \cdot 1 \cdot 0{,}5 - K_z \cdot 1) =$
$= \frac{1}{3}(6 \cdot 1{,}5 - 2 \cdot 1 \cdot 0{,}5 - 2 \cdot 1) = \underline{2\,kN}$

③ $\Sigma M_{ic} = 0$: $L_z \cdot 1 + q \cdot 1 \cdot 0{,}5 - q \cdot 4 \cdot 2 + R_{dz} \cdot 4 = 0 \Rightarrow R_{dz} = \frac{1}{4}(-L_z \cdot 1 - q \cdot 1 \cdot 0{,}5 + q \cdot 4 \cdot 2)$
$= \frac{1}{4}(-2 \cdot 1 - 2 \cdot 1 \cdot 0{,}5 + 2 \cdot 4 \cdot 2) = \underline{3{,}25\,kN}$

$\Sigma M_{id} = 0$: $L_z \cdot 5 - R_{cz} \cdot 4 + q \cdot 5 \cdot 2{,}5 = 0 \Rightarrow R_{cz} = \frac{1}{4}(L_z \cdot 5 + q \cdot 5 \cdot 2{,}5) =$
$= \frac{1}{4}(2 \cdot 5 + 2 \cdot 5 \cdot 2{,}5) = \underline{8{,}75\,kN}$



x_{p1}: $V^P + q \cdot x_{p1} = \emptyset$

$-3,25 + q \cdot x_{p1} = \emptyset$

$x_{p1} = \frac{3,25}{q} = \frac{3,25}{2}$

$\underline{x_{p1} = 1,625\ m}$

x_{p2}: $V^P + q \cdot x_{p2} = \emptyset$

$-4 + q \cdot x_{p2} = \emptyset$

$\underline{x_{p2} = \frac{4}{q} = \frac{4}{2} = 2m}$

$\underline{M^P_{max\,x_2}} = R_{dz} \cdot (4 + x_{p2}) + R_{dz} \cdot x_p -$

$- q \cdot (4 + x_{p2})^2 \cdot 0,5 =$

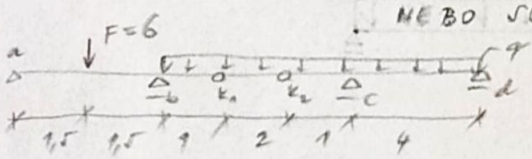
$= 3,25 \cdot 6 + 8,75 \cdot 2 -$

$- 2 (4+2)^2 \cdot 0,5 = \underline{1\ kNm}$

$\underline{M^P_{max\,x_1}} = R_{dz} \cdot x_{p1} - q \cdot x_{p1}^2 \cdot 0,5 =$

$= 3,25 \cdot 1,625 - 2 \cdot 1,625^2 \cdot 0,5 =$

$= \underline{2,64\ kNm}$



MEBO SOUSTAVA

⊕ $\Sigma M_{iK_1}^L = 0$:

$R_a \cdot 4 + R_b \cdot 1 - F \cdot 2,5 - 2 \cdot 1 \cdot 0,5 = 0$

⊕ $\Sigma M_{iK_2}^L = 0$:

$R_a \cdot 6 + R_b \cdot 3 - F \cdot 4,5 - 2 \cdot 3 \cdot 1,5 = 0$

$6R_a + 3(-4R_a + 2,5F + 2 \cdot 1 \cdot 0,5) -$

$- 4,5F - 2 \cdot 3 \cdot 1,5 = 0$

$\underline{R_a = 2kN}$

$\underline{R_b = 8kN}$

⊕ $\Sigma M_{iF2}^P = 0$

$R_c \cdot 1 + R_d \cdot 5 - 2 \cdot 5 \cdot 2,5 = 0$

⊕ $\Sigma M_{iK_1}^P = 0$

$R_c \cdot 3 + R_d \cdot 7 - 2 \cdot 7 \cdot 3,5 = 0$

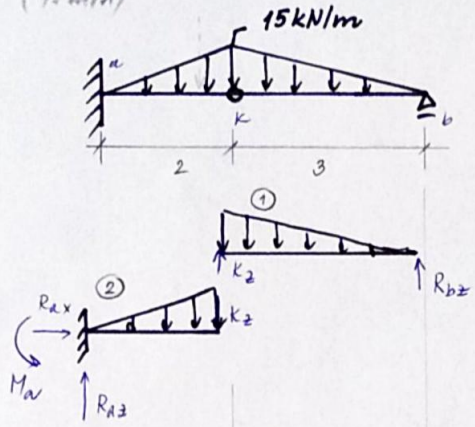
$3(-5R_d + 2,5 \cdot 2,5) + 7R_d - 2 \cdot 7 \cdot 3,5 = 0$

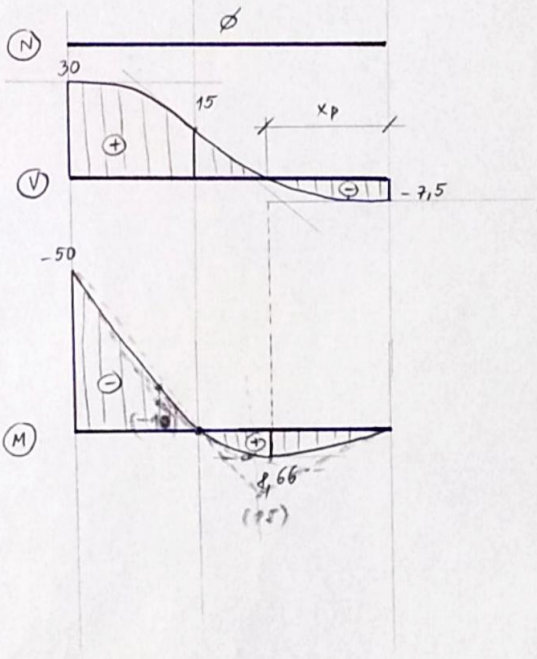
$\underline{R_d = 3,25\ kN}$

$\underline{R_c = 8,75\ kN}$

Př. 38:

(15 min)





① $\sum M_{iK} = \emptyset$: $-\frac{1}{2} \cdot 15 \cdot 3 \cdot 1 + R_{bz} \cdot 3 = \emptyset$

$R_{bz} = 7{,}5\,kN$

($\sum M_{ib} = \emptyset$: $-K_z \cdot 3 + \frac{1}{2} \cdot 15 \cdot 3 \cdot 2 = \emptyset$

$K_z = 15\,kN$)

② $\sum M_{ia} = \emptyset$: $M_a - \frac{1}{2} \cdot 15 \cdot 2 \cdot \frac{2}{3} 2 - K_z \cdot 2 = \emptyset$

$M_a = 50\,kNm$

$M_a - \frac{1}{2} \cdot 15 \cdot 2 \cdot \frac{2}{3} 2 - \frac{1}{2} \cdot 15 \cdot 3 \cdot 3 + R_{bz} \cdot 5 = 0$

$M_a = 50\,kNm$

$\sum F_{ix} = \emptyset$: $R_{ax} = \emptyset$

$\sum F_{iz} = \emptyset$: $R_{az} - \frac{1}{2} \cdot 15 \cdot 2 - K_z = \emptyset$

$R_{az} = 30\,kN$

$R_{az} + R_{bz} - \frac{1}{2} \cdot 15 \cdot 2 - \frac{1}{2} \cdot 15 \cdot 3 = 0$

$R_{az} = 30\,kN$

x_p: $V^p + \frac{1}{2} \cdot \left(\frac{15}{3} x_p\right) \cdot x_p = \emptyset$

$x_p^2 = 7{,}5 \cdot \frac{6}{15} = 3$

$x_p = \pm\sqrt{3} = 1{,}732\,m$

$M_{max} = R_{bz} \cdot x_p - \frac{1}{2} \cdot \left(\frac{15}{3} x_p\right) \cdot x_p \cdot \frac{1}{3} x_p =$

$= 7{,}5 \cdot \sqrt{3} - \frac{1}{2} \cdot 5 \cdot \frac{1}{3} \cdot (\sqrt{3})^3 = 8{,}66\,kNm$