

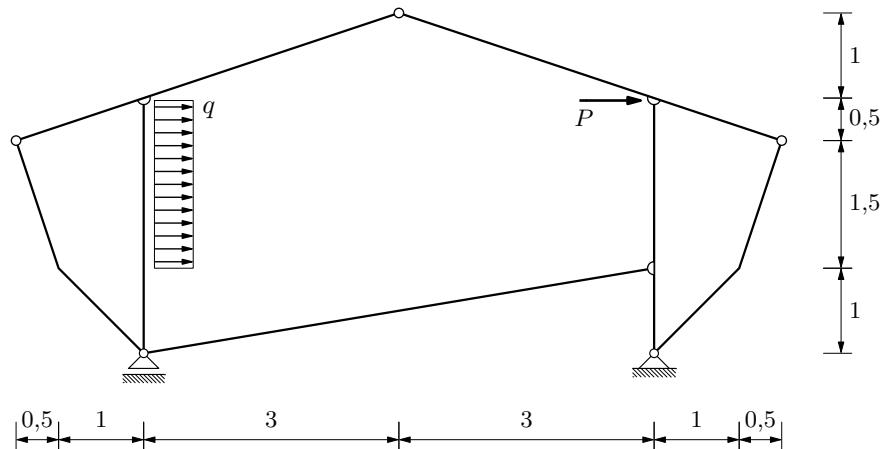
# GS 1. — 1. kolokvij (A) (2023./2024.)

## Zadatak 2.

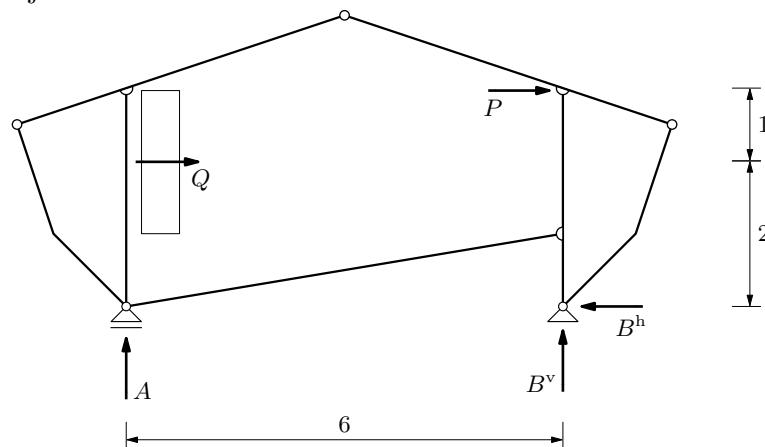
Izračunajte potrebne vrijednosti i nacrtajte dijagram momenata savijanja! Na temelju diferencijalnoga odnosa nacrtajte dijagram poprečnih sila!

$$q = 25 \text{ kN/m}$$

$$P = 75 \text{ kN}$$



vrijednosti reakcija:



$$Q = q \cdot 2 = 50 \text{ kN}$$

$$\sum_{\widehat{AB}} F_x = 0 : \quad Q + P - B^h = 0 \quad \Rightarrow \quad B^h = Q + P = 125 \text{ kN}$$

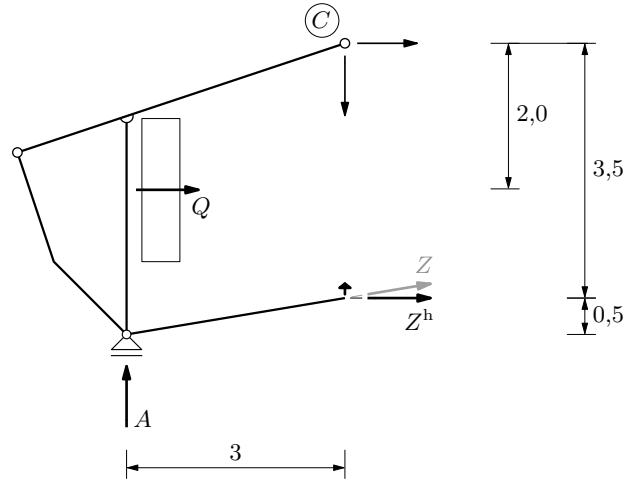
$$\sum_{\widehat{AB}} M_B = 0 : \quad -6 \cdot A - 2 \cdot Q - 3 \cdot P = 0$$

$$\Rightarrow \quad A = -\frac{1}{3} \cdot Q - \frac{1}{2} \cdot P = -54,1667 \text{ kN}$$

$$\sum_{\widehat{AB}} M_A = 0 : \quad -2 \cdot Q - 3 \cdot P + 6 \cdot B^v = 0$$

$$\Rightarrow \quad B^v = \frac{1}{3} \cdot Q + \frac{1}{2} \cdot P = 54,1667 \text{ kN}$$

vrijednost sile u zategi:

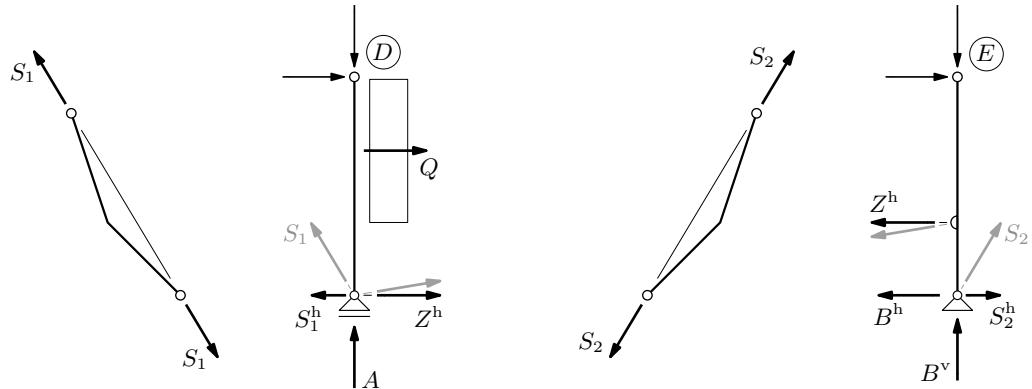


$$\sum_{AC} M_C = 0 : -3 \cdot A + 2 \cdot Q + 3,5 \cdot Z^h = 0$$

$$\Rightarrow Z^h = \frac{6}{7} \cdot A - \frac{4}{7} \cdot Q = \frac{6}{7} \cdot (-54,1667) - \frac{4}{7} \cdot 50 = -75 \text{ kN}$$

$$\frac{Z}{Z^h} = \frac{\sqrt{37}}{6} \Rightarrow Z = \frac{\sqrt{37}}{6} \cdot Z^h = -76,0345 \text{ kN}$$

vrijednosti sila u „slomljenim” zategama:



$$\sum_{AD} M_D = 0 : -3 \cdot S_1^h + 3 \cdot Z^h + 1 \cdot Q = 0$$

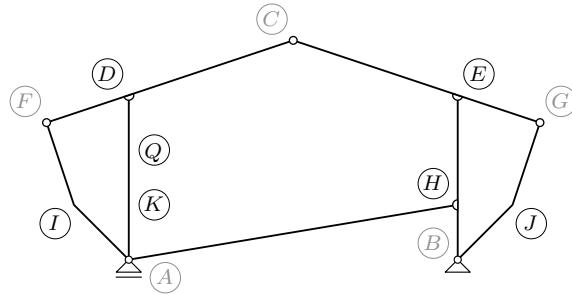
$$\Rightarrow S_1^h = Z^h + \frac{1}{3} \cdot Q = -75 + \frac{1}{3} \cdot 50 = -58,3333 \text{ kN}$$

$$\frac{S_1^v}{S_1^h} = \frac{2,5}{1,5} \Rightarrow S_1^v = \frac{5}{3} \cdot S_1^h = -97,2222 \text{ kN}$$

$$S_1 = -\sqrt{S_1^h + S_1^v} = -113,380 \text{ kN}$$

$$\begin{aligned} \sum_{BE} M_{/E} &= 0 : -3 \cdot B^h + 3 \cdot S_2^h - 2 \cdot Z^h = 0 \\ \Rightarrow S_2^h &= B^h + \frac{2}{3} \cdot Z^h = 125 + \frac{2}{3} \cdot (-75) = 75 \text{ kN} \\ \frac{S_2^v}{S_2^h} &= \frac{2,5}{1,5} \Rightarrow S_2^v = \frac{5}{3} \cdot S_2^h = 125 \text{ kN} \\ S_2 &= \sqrt{S_2^h + S_2^v} = 145,774 \text{ kN} \end{aligned}$$

vrijednosti momenata u karakterističnim točkama:



$$M_D = 1,5 \cdot S_1^v + 0,5 \cdot S_1^h = 1,5 \cdot (-97,222\bar{2}) + 0,5 \cdot (-58,333\bar{3}) = -175 \text{ kNm}$$

$$M_E = 1,5 \cdot S_2^v + 0,5 \cdot S_2^h = 1,5 \cdot 125 + 0,5 \cdot 75 = 225 \text{ kNm}$$

$$M_H = 1 \cdot B^v - 1 \cdot S_2^h = 1 \cdot 125 + 1 \cdot 75 = 50 \text{ kNm}$$

$$M_I = -1 \cdot S_1^v + 1 \cdot S_1^h = -1 \cdot (-97,222\bar{2}) + 1 \cdot (-58,333\bar{3}) = 38,888\bar{9} \text{ kNm}$$

$$M_J = -1 \cdot S_2^v + 1 \cdot S_2^h = -125 + 75 = -50 \text{ kNm}$$

$$M_K = 1 \cdot S_1^h - 1 \cdot Z^h = 1 \cdot (-58,333\bar{3}) - 1 \cdot (-75) = 16,666\bar{7} \text{ kNm}$$

$$\begin{aligned} M_Q &= 2 \cdot S_1^h - 2 \cdot Z^h - 0,5 \cdot (q \cdot 1) \\ &= 2 \cdot (-58,333\bar{3}) - 2 \cdot (-75) - 0,5 \cdot 25 = 20,833\bar{4} \text{ kNm} \end{aligned}$$

$$\begin{aligned} \overline{M}_Q &= 2 \cdot S_1^h - 2 \cdot Z^h = 2 \cdot (-58,333\bar{3}) - 2 \cdot (-75) = 33,333\bar{4} \text{ kNm} \\ (\overline{M}_Q &\text{ --- apscisa sjecišta tangenata}) \end{aligned}$$

vrijednosti poprečnih sila:

$$\begin{aligned} T_{FD} &= \frac{0 + 175}{\sqrt{1,5^2 + 0,5^2}} = 110,680 \text{ kN} & T_{DC} &= -\frac{175 + 0}{\sqrt{3^2 + 0,1^2}} = -55,339\bar{9} \text{ kN} \\ T_{CE} &= -\frac{0 + 225}{\sqrt{3^2 + 0,1^2}} = -71,151\bar{2} \text{ kN} & T_{EG} &= \frac{225 + 0}{\sqrt{1,5^2 + 0,5^2}} = 142,302 \text{ kN} \end{aligned}$$

$$T_{FI} = \frac{0 + 38,8889}{\sqrt{0.5^2 + 1,5^2}} = 24,5955 \text{ kN}$$

$$T_{IA} = -\frac{38,8889 + 0}{\sqrt{1^2 + 1^2}} = -27,4986 \text{ kN}$$

$$T_{BJ} = -\frac{0 + 50}{\sqrt{1^2 + 1^2}} = -35,3553 \text{ kN}$$

$$T_{JG} = \frac{50 + 0}{\sqrt{0.5^2 + 1,5^2}} = 31,6228 \text{ kN}$$

$$T_{BH} = \frac{0 + 50}{1} = 50 \text{ kN}$$

$$T_{HE} = -\frac{50 + 0}{2} = -25 \text{ kN}$$

$$T_{AK} = \frac{0 + 33,3334}{2} = 16,6667 \text{ kN}$$

$$T_{KD}^g = -\frac{33,3334 + 0}{1} = -33,3334 \text{ kN}$$

dijagrami:

