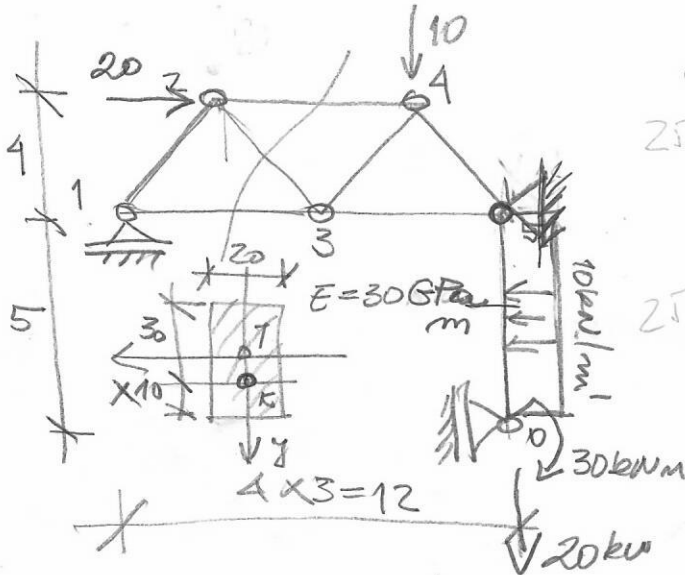


18.06.2021.

MEHANIKA I ODPORNOST MATERIJALA

ZA NOSAČ I OPTEREĆENJE NA SKICI TREBA:

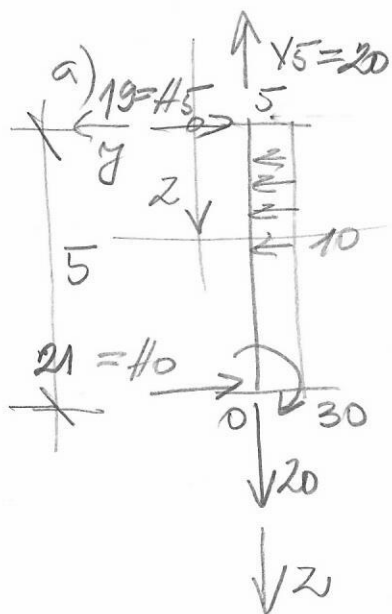


a) NACRTATI DIJAGRAME  
 25 PRESEČNIH SILA NA  
 GREDE 0-5 I ISPISATI  
 IZRAZE ZA  $M_x(z)$ ,  $T_y(z)$  I  
 25  $N(z)$

b) NACRTATI DIJAGRAME  
 KOMPONENTIČNIH  
 NAPONA U SREDINI  
 GREDE M

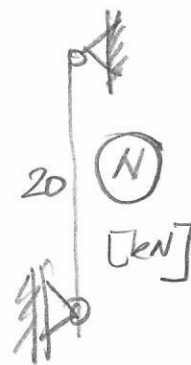
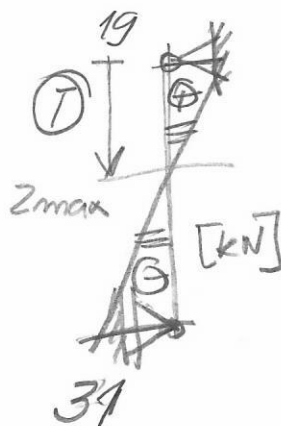
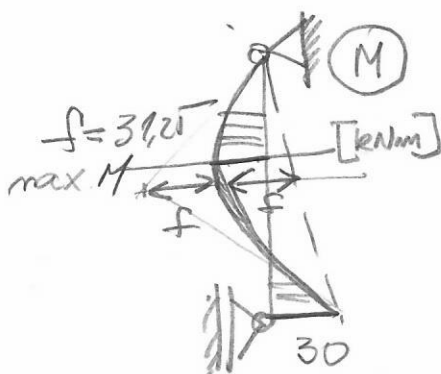
c) SILE U ŠTAPOVIMA  $S_{13}$ ,  $S_{23}$  I  $S_{24}$  ODREĐITI  
 25 METODAMA RITERA I KULNANA A  
 PROVERITI METODOM ÖVERDA

d) MOR-MARKVELDOVOM ANALIZOM ODREĐITI  
 25 UGIB  $v_m$ ,  $\varphi_m$  I  $\varphi_0$   
 I SKICIRATI DEFORMISANU OSU NOSAČA



$$\begin{aligned} \sum M_0 &= 30 + 5 \cdot 5 - 10 \cdot \frac{z^2}{2} = 0 & H_5 &= 19 \text{ kN} \\ \sum Y &= 15 - 20 = 0 & X_5 &= 20 \text{ kN} \\ \sum H &= 10 + 19 - 50 = 0 & H_0 &= 31 \text{ kN} \\ f &= 10 \cdot \frac{z^2}{2} = 31,25 \\ N(z) &= 20 \\ T_y(z) &= 19 - 10z \\ M_x(z) &= 19 \cdot z - 10 \frac{z^2}{2} \end{aligned}$$

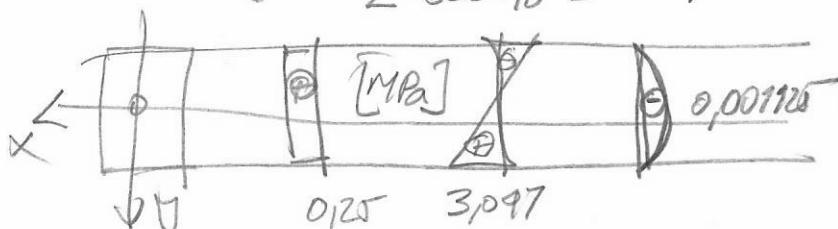
$$\begin{aligned} N(5) &= 20 \checkmark \\ T_y(5) &= -31 \checkmark \\ M_x(5) &= -30 \text{ kNm} \checkmark \end{aligned}$$

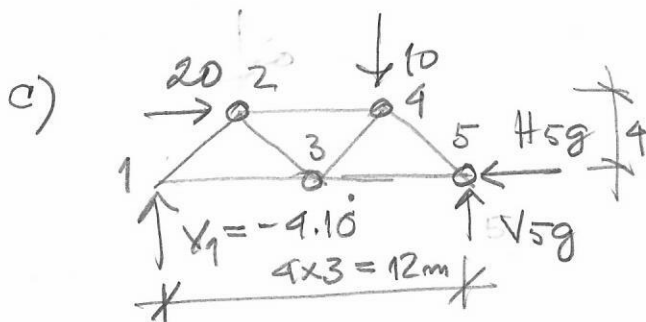


$$\begin{aligned} T_y(z_{max}) &= 19 - 10z_{max} = 0 & z_{max} &= 1,9 \text{ m} \\ \max M_x &= M_x(z_{max}) = 19 \cdot 1,9 - 10 \cdot \frac{1,9^2}{2} = 18,05 \text{ kNm} \end{aligned}$$

$$\begin{aligned} \text{b) } N(z, T) &= 20 \text{ kN} \\ T_y(z, T) &= 19 - 2,5 \cdot 10 = -6 \text{ kNm} \\ M_x(z, T) &= 19 \cdot 2,5 - 10 \cdot \frac{2,5^2}{2} = 16,25 \text{ kNm} \end{aligned}$$

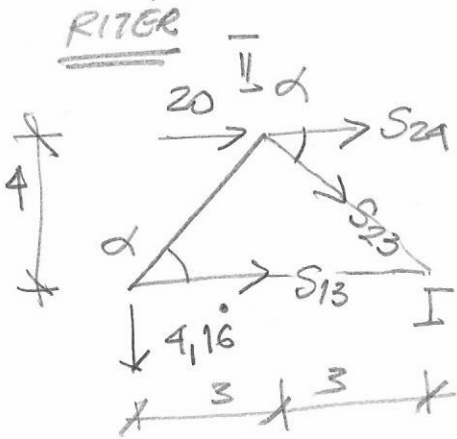
$$\begin{aligned} F &= 20 \times 40 = 800 \text{ cm}^2 \\ J_x &= \frac{20 \cdot 40^3}{12} = 106666,6 \text{ cm}^4 \\ \sigma_z(N) &= \frac{20 \cdot 10^{-3}}{800 \cdot 10^{-4}} = 0,25 \text{ MPa} \\ \sigma_z(M_x) &= \frac{16,25 \cdot 10^{-3} \cdot 20 \cdot 10^{-2}}{106666,6 \cdot 10^8} = 3,047 \text{ MPa} \\ \max \sigma_{zy} &= \frac{3 \cdot (-6) \cdot 10^{-3}}{2 \cdot 800 \cdot 10^{-2}} = -0,001125 \text{ MPa} \end{aligned}$$





$$\sum M_5 = 12 \cdot V_1 - 10 \cdot 3 + 20 \cdot 4 = 0$$

$$\underline{V_1 = -4.16 \text{ kN}}$$



$$\sum M_I = (S_{24} + 20) \cdot 4 - 6 \cdot 4.16 = 0$$

$$\underline{S_{24} = -13.75 \text{ kN}}$$

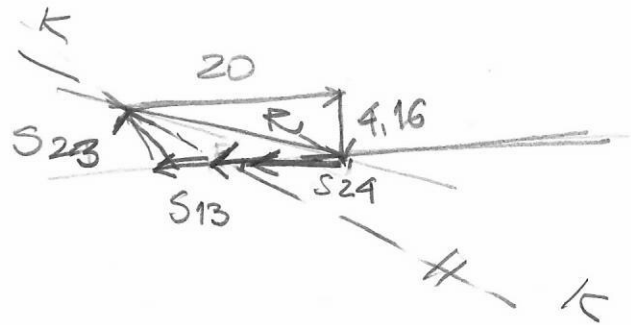
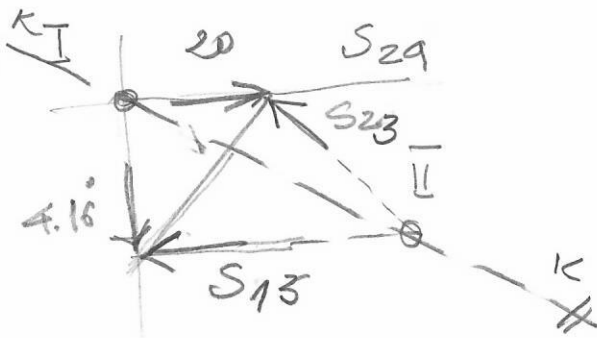
$$\sum M_{II} = 4 \cdot S_{13} + 4.16 \cdot 3 = 0$$

$$\underline{S_{13} = -3.125 \text{ kN}}$$

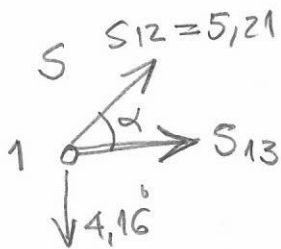
$$\sum V = 4.16 + 0.8 S_{23} = 0$$

$$\underline{S_{23} = -5.21 \text{ kN}}$$

KULMAN



ÖKORDVI



$$\sum V = S_{12} \cdot 0.8 - 4.16 = 0$$

$$\underline{S_{12} = 5.21}$$

$$\sum H = S_{13} + 5.21 \cdot 0.6 = 0$$

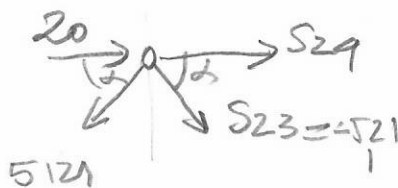
$$\underline{S_{13} = -3.125 \text{ kN}}$$

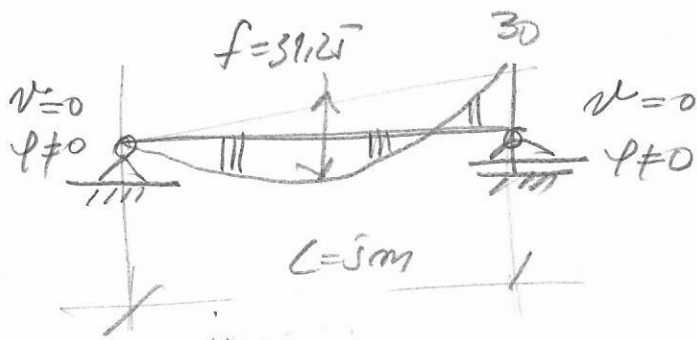
$$\sum V = (S_{23} + 5.21) \cdot 0.8 = 0$$

$$\underline{S_{23} = -5.21 \text{ kN}}$$

$$\sum H = S_{24} + 20 - 2 \cdot 5.21 \cdot 0.6 = 0$$

$$\underline{S_{24} = -13.75 \text{ kN}}$$





$$EJ = 30 \cdot 10^3 \cdot 10666666 \cdot 6 \cdot 10^{-8}$$

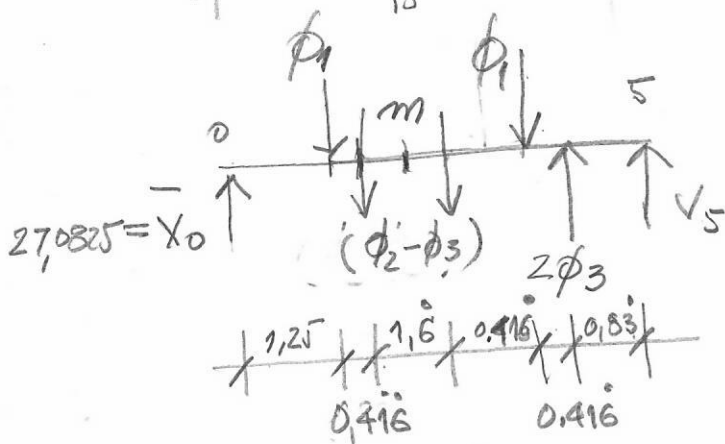
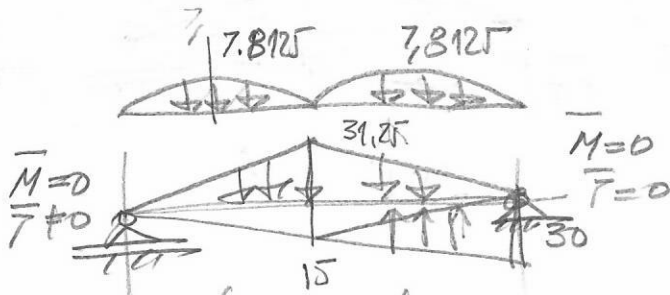
$$EJ = 32 \text{ MNm}^2$$

$$f_1 = \frac{f}{4} = \frac{39.25}{4} = 9.8125$$

$$\phi_1 = \frac{2}{3} \cdot 9.8125 \cdot 2.5 = 13.02$$

$$\phi_2 = \frac{39.25}{2} \cdot 2.5 = 49.0625$$

$$\phi_3 = -\frac{15 \cdot 2.5}{2} = -18.75$$



$$\sum M_5 = V_0 \cdot 5 - \phi_1 \left( \frac{3}{4} + \frac{1}{4} \right) \cdot 5 - (\phi_2 - \phi_3) \cdot \left( \frac{2}{3} + \frac{1}{3} \right) \cdot 5 + 2\phi_3 \cdot \frac{5}{6} = 0$$

$$= 5V_0 - 13.02 \cdot 5 - (39.0625 - 18.75) \cdot 5 + 18.75 \cdot \frac{5}{3} = 0$$

$$\underline{V_0 = 27.0825}$$

$$\phi_0 = \frac{V_0}{EJ} = \frac{27.0825 \cdot 10^{-3}}{32} = 0.846 \cdot 10^{-3} \text{ rad}$$

$$\phi_m = \frac{T_m}{EJ} = \frac{27.0825 - 13.02 - (39.0625 - 18.75)}{32 \cdot 10^3} = \frac{-6.25}{32 \cdot 10^3} = -0.195 \cdot 10^{-3} \text{ rad}$$

$$v_m = \frac{M_m}{EJ} = \frac{27.0825 \cdot 2.5 - 13.02 \cdot 0.625 - (39.0625 - 18.75) \cdot 0.833}{32 \cdot 10^3} = \frac{58.74}{32 \cdot 10^3}$$

$$v_m = 1.835 \cdot 10^{-3} \text{ m} = 1.835 \text{ mm}$$

