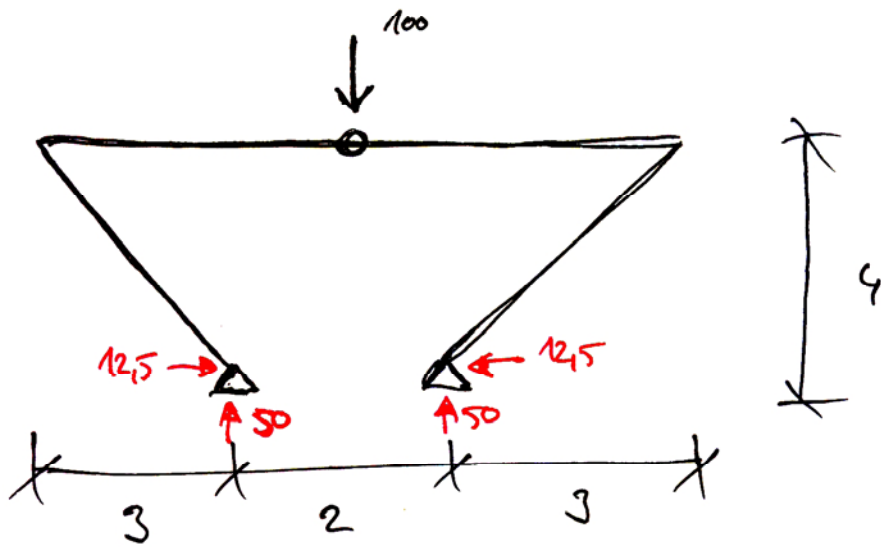
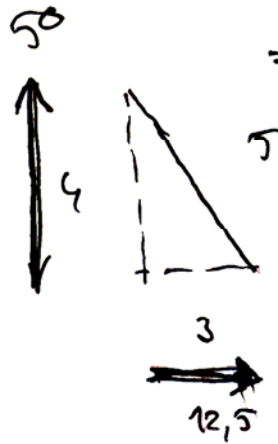
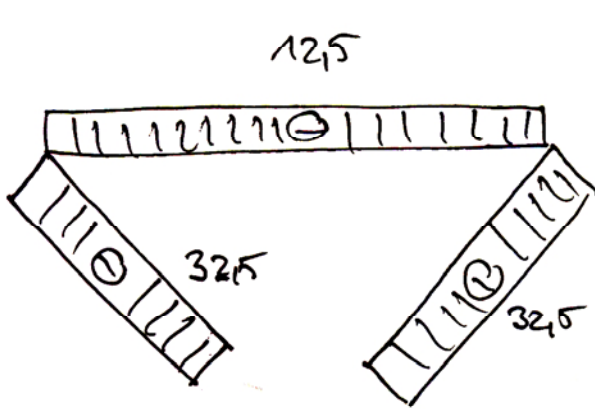


S73, w. 4

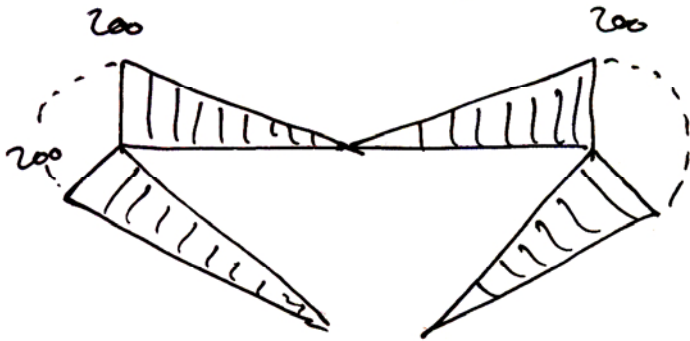


$$N = -\frac{50 \cdot 4}{5} + \frac{12,5 \cdot 3}{5} = -32,5 \text{ kN}$$

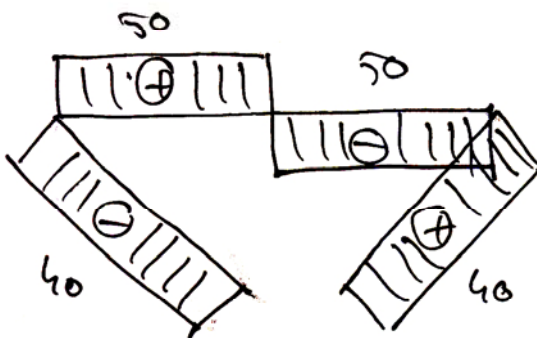
(N)
[kN]



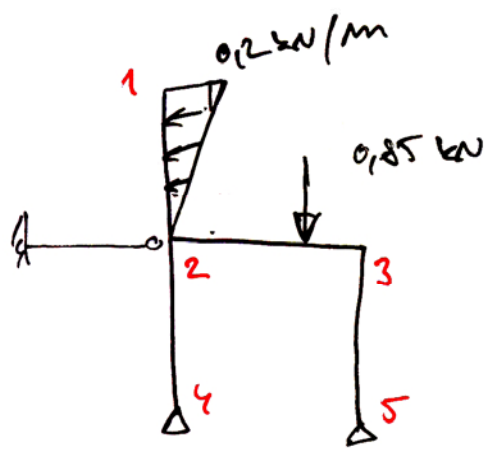
(M)
[kNm]



(Q)
[kN]

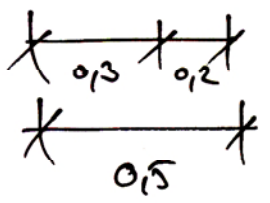


Pr. 1



Uřete přebíhy užitím
síť a maximální normál.
napětí v prave' noze

$E = 10 \text{ GPa}$

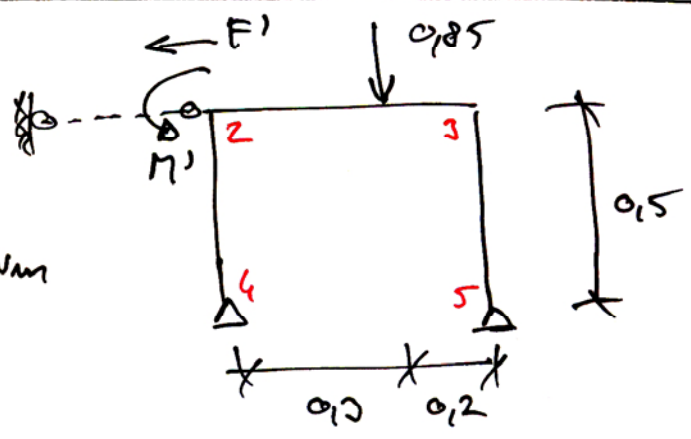


noha $0,04 \times 0,04 \quad I = 2,133 \cdot 10^{-7} \text{ m}^4$
 ředátka ~~0,04~~ $0,15 \times 0,04 \quad I = 2,667 \cdot 10^{-6} \text{ m}^4$

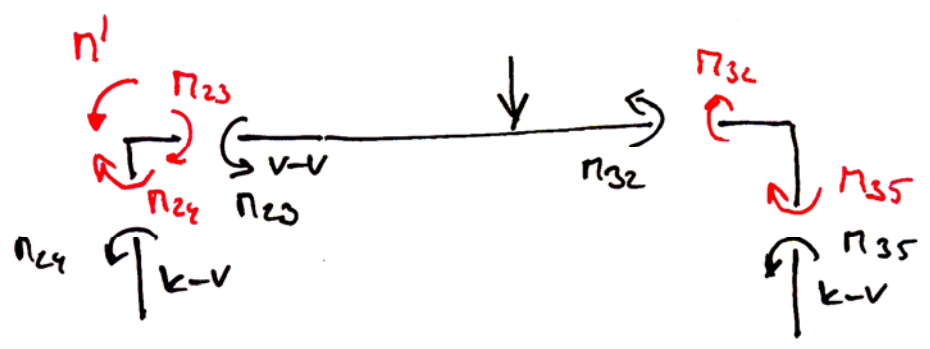
$EI_n = 0,002133 \text{ MN m}^2 \quad EI_s = 0,02667 \text{ MN m}^2$

Konstrukce zjednodušíme:

Náhradní moment a síla
 $M' = \frac{0,2 \cdot 0,5}{2} \cdot \frac{0,5 \cdot 2}{3} = 0,01667 \text{ kNm}$
 $F' = \frac{0,2 \cdot 0,5}{2} = 0,05 \text{ kN}$



• ZAVEDEME 2 NEZNÁMÉ - φ_2 a φ_3 A PRO TYTO STŘEMÍKY
 SESTAVÍME PŘÍKLADY ROVNOSTAT



(1) $M_{23} + M_{24} = M'$ (2) $M_{32} + M_{35} = 0$
 $M_{23} = \frac{0,85 \cdot 0,3 \cdot 0,12^2}{0,15^2} = 0,0408 \text{ kNm}$ $M_{32} = -\frac{0,85 \cdot 0,3^2 \cdot 0,12}{0,15^2} = -0,0612 \text{ kNm}$

$(a = 0,3 \quad b = 0,2 \quad L = 0,5)$

$$k_{23} = \frac{2EI_3}{L} = \frac{2 \cdot 0,02667}{0,5} = 0,10668 \text{ MNm}$$

$$k_{24} = k_{35} = \frac{2EI_4}{L} = \frac{2 \cdot 0,002133}{0,5} = 0,008532 \text{ MNm}$$

$$M_{23} = 0,0408 + 0,10668 (2\varphi_2 + \varphi_3) \quad M_{32} = -0,0612 + 0,10668 (\varphi_2 + 2\varphi_3)$$

$$M_{24} = \varphi + 0,008532 \cdot \frac{3}{2} \varphi_2$$

$$M_{35} = \varphi + 0,008532 \cdot 1,5 \cdot \varphi_3$$

→ Sestavíme rovnice

$$(1) \quad 0,21336 \varphi_2 + 0,10668 \varphi_3 + 0,0128 \varphi_2 = 0,01667 - 0,0408$$

$$0,2262 \varphi_2 + 0,10668 \varphi_3 = -0,02413$$

musi' platit

$$(2) \quad 0,10668 \varphi_2 + 0,21336 \varphi_3 + 0,0128 \varphi_3 = 0,0612$$

$$0,10668 \varphi_2 + 0,2262 \varphi_3 = 0,0612$$

"metoda" ale vždy > 0

$$\Rightarrow \varphi_2 = -0,3013 \text{ mrad}, \varphi_3 = 0,4127 \text{ mrad}$$

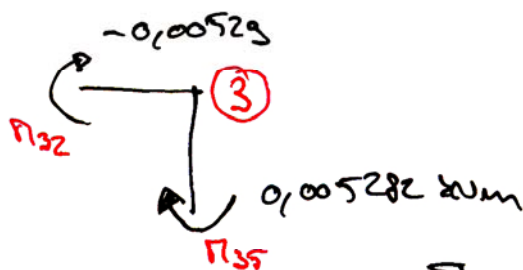
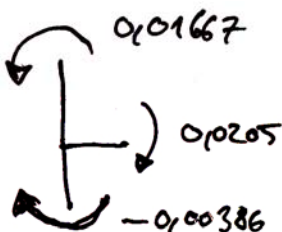
$$M_{23} = 0,0408 + 0,10668 (2 \cdot -0,3013 + 0,4127) = 0,0205 \text{ kNm}$$

$$M_{32} = -0,0612 + 0,10668 (-0,3013 + 2 \cdot 0,4127) = -0,00529 \text{ kNm}$$

$$M_{24} = 0,008532 \cdot 1,5 \cdot (-0,3013) = -0,00386 \text{ kNm}$$

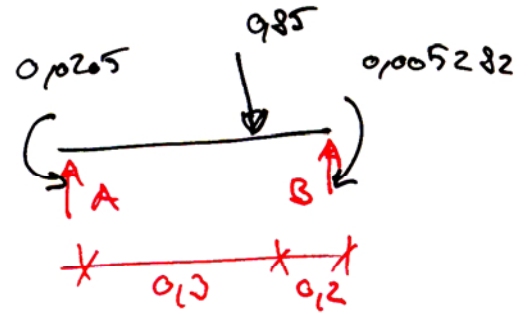
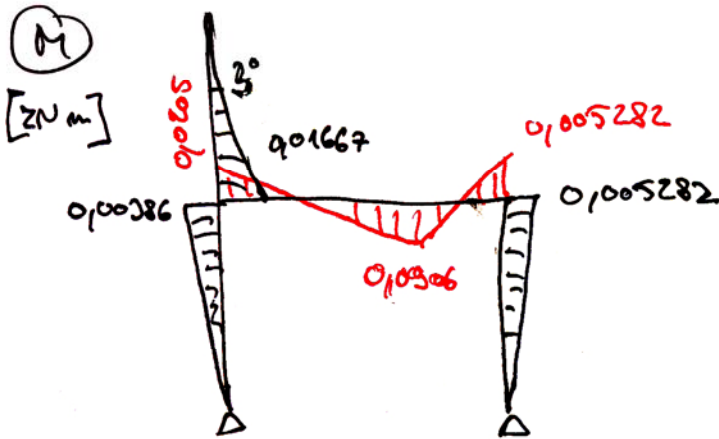
$$M_{35} = 0,008532 \cdot 1,5 \cdot 0,4127 = 0,005282 \text{ kNm}$$

ověřeni' rovností obj. úvah



$$\Sigma = 0 \dots \text{ok}$$

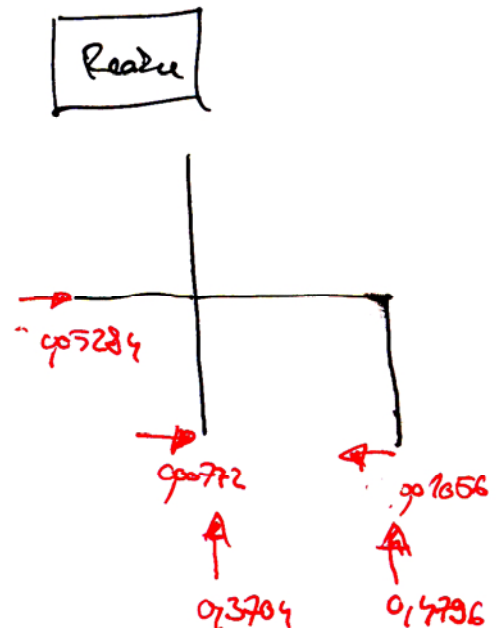
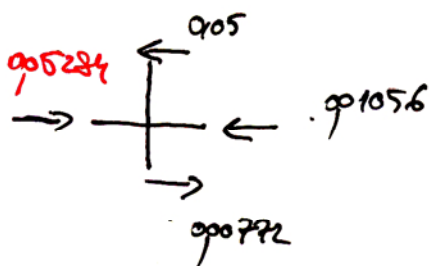
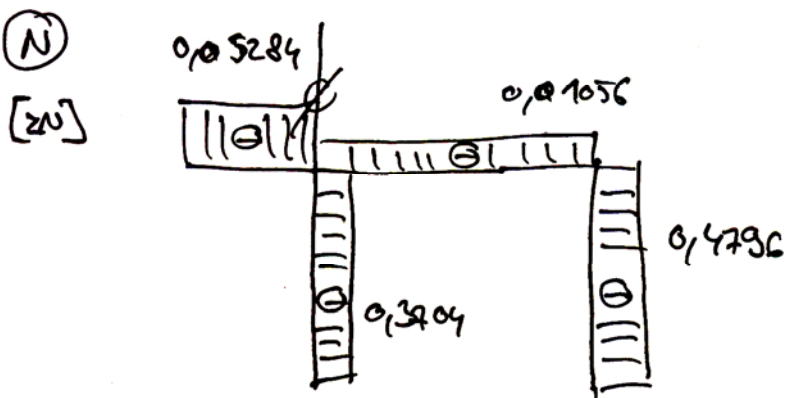
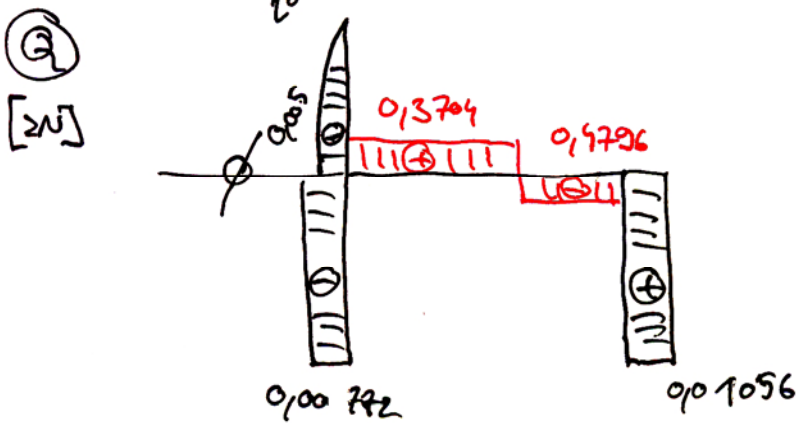
Vybrsleni' unitrich sil



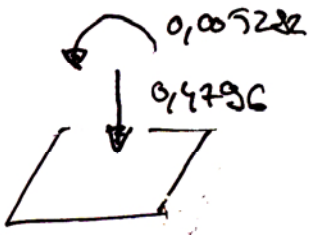
$$B = \frac{0.85 \cdot 0.3 + 0.005282 \cdot 0.5}{0.5}$$

$$= 0.4796 \text{ 2N}$$

$$A = 0.3704 \text{ 2N}$$



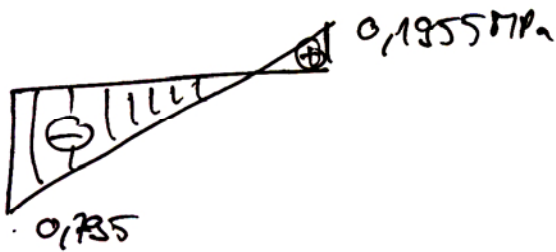
Maximalni (extremni) normalni napet!



$$I = \frac{1}{12} \cdot 0,4^4 = 2,133 \cdot 10^{-7} \text{ m}^4$$

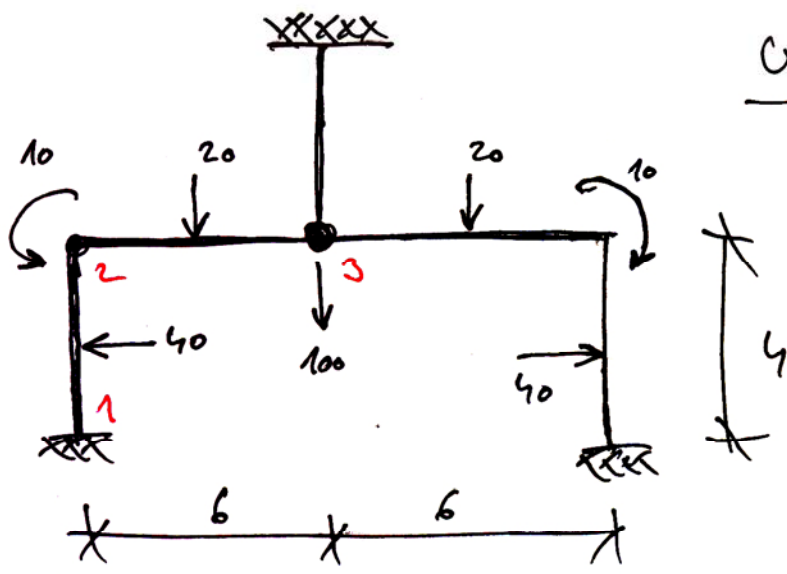
$$A = 0,04^2 = 0,0016 \text{ m}^2$$

$$\sigma = \frac{N}{A} + \frac{M}{I} \cdot z = -\frac{0,4796}{0,0016} + \frac{0,005282}{2,133 \cdot 10^{-7}} \begin{cases} \cdot (-0,02) = -795,052 \text{ Pa} = -0,795 \text{ MPa} \\ \cdot 0,02 = 795,052 \text{ Pa} = 0,795 \text{ MPa} \end{cases}$$



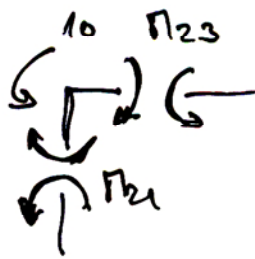
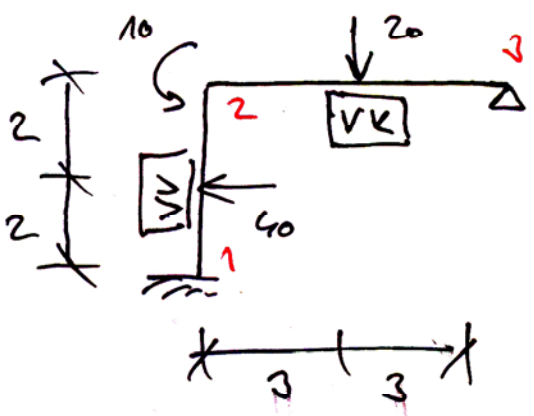
Pr. 2

Určete průběhy vnitř. sil!



$EI = 10 \text{ MNm}^2$

Konstrukce je symetricky zatížena, proto se objeví 3 vodorovné nepatrné. Proto můžeme čí. tento zjednodušit:



$M_{21} + M_{23} = 10$

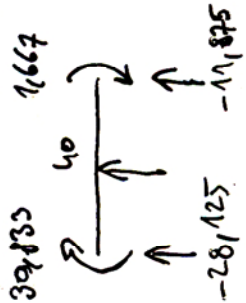
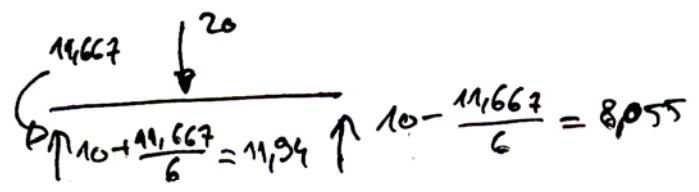
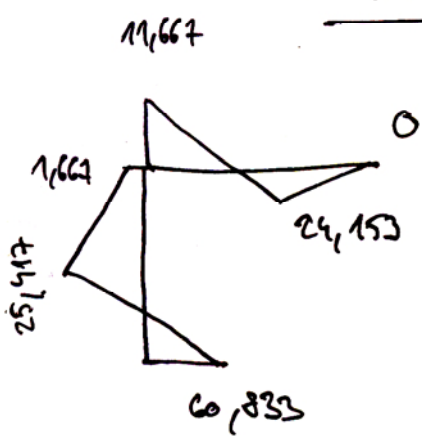
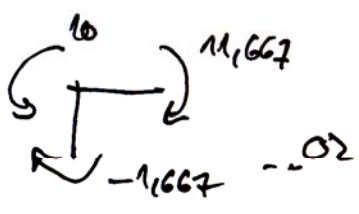
$M_{21} = \frac{40 \cdot 4}{8} + \frac{4 \cdot 10}{4} \varphi_2 = 20 + 10\varphi_2 = -1,667 \text{ MNm}$

$M_{23} = \frac{3 \cdot 20 \cdot 6}{16} + \frac{3 \cdot 10}{6} \varphi_2 = 22,5 + 5\varphi_2 = 11,667 \text{ MNm}$

$20 + 10\varphi_2 + 22,5 + 5\varphi_2 = 10$

$15\varphi_2 = -32,5$

$\varphi_2 = -2,1667 \text{ mrad}$



$M_{12} = -20 + 5\varphi_2 = -30,8333 \text{ MNm}$

