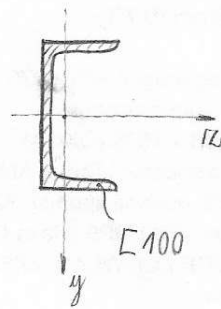
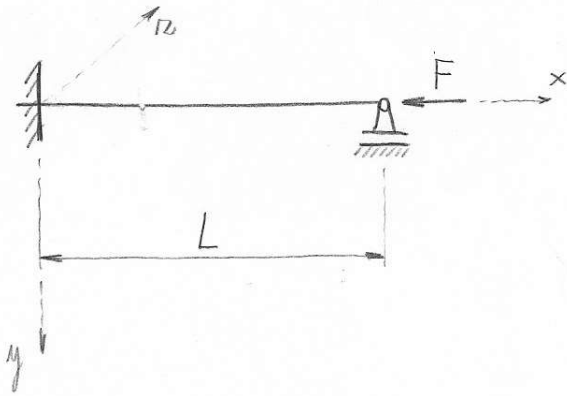


2.) Daljite silo F a katere lahko obremenimo nosilec. 2017/2018 - DN 13



$$G_M = 500 \text{ MPa}$$

$$G_{PL} = 300 \text{ MPa}$$

$$G_{PR} = 280 \text{ MPa}$$

$$m = 2,5 \text{ - namot}$$

$$L = 1,8 \text{ m}$$

$$E = 200 \text{ GPa}$$

$$F = ?$$

$$I 100 : J_{min} = J_y = 29,3 \cdot 10^4 \text{ mm}^4$$

$$A = 1350 \text{ mm}^2$$

$$i_{min} = \sqrt{\frac{J_{min}}{A}} = \sqrt{\frac{29,3 \cdot 10^4}{1350}} = 14,732 \text{ mm}$$

$$\lambda_{DEJ} = \frac{\beta \cdot L}{i_{min}} = \frac{0,7 \cdot 1800}{14,732} = 85,53$$

$$\lambda_{PR} = \pi \cdot \sqrt{\frac{E}{G_{PR}}} = \pi \cdot \sqrt{\frac{200000}{280}} = 83,96 < 85,53$$

⇓
velja EULER

EULER-jev uklon:

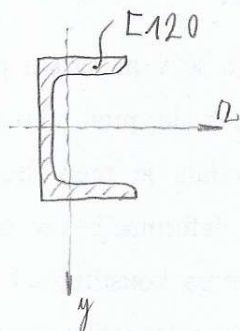
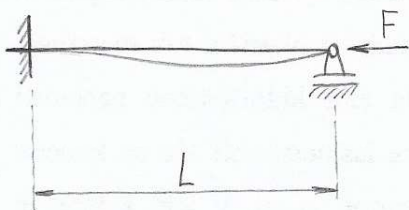
$$F_k = \frac{\pi^2 E J_{min}}{(nL)^2} = m \cdot F$$

$$F = \frac{\pi^2 E J_{min}}{m \cdot (nL)^2}$$

$$F = \frac{\pi^2 \cdot 200000 \cdot 29,3 \cdot 10^4}{2,5 \cdot (0,7 \cdot 1800)^2}$$

$$F = 145719 \text{ N} \approx 145,7 \text{ kN}$$

3.) Določite silo F s katero lahko obremenimo nosilec. 2016/2017 - DN 11



$$\sigma_H = 360 \text{ MPa}$$

$$\sigma_{PL} = 250 \text{ MPa}$$

$$\sigma_{PR} = 190 \text{ MPa}$$

$$m = 4 - \text{varnost}$$

$$L = 2,35 \text{ m}$$

$$E = 200 \text{ GPa}$$

$$F = ?$$

$$J_{\min} = 43,2 \cdot 10^4 \text{ mm}^4$$

$$A = 1700 \text{ mm}^2$$

$$i_{\min} = \sqrt{\frac{J_{\min}}{A}} = \sqrt{\frac{43,2 \cdot 10^4}{1700}} = 15,941 \text{ mm}$$

$$\beta = 0,7$$

$$\lambda_{DEJ} = \frac{\beta \cdot L}{i_{\min}} = \frac{0,7 \cdot 2350}{15,941} = 103,193$$

$$\lambda_{PR} = \pi \cdot \sqrt{\frac{E}{\sigma_{PR}}} = \pi \cdot \sqrt{\frac{200000}{190}} = 101,927 < \lambda_{DEJ}$$

EULER VELJA

$$F_{KR} = \frac{\pi^2 E J_{\min}}{(\beta L)^2}$$

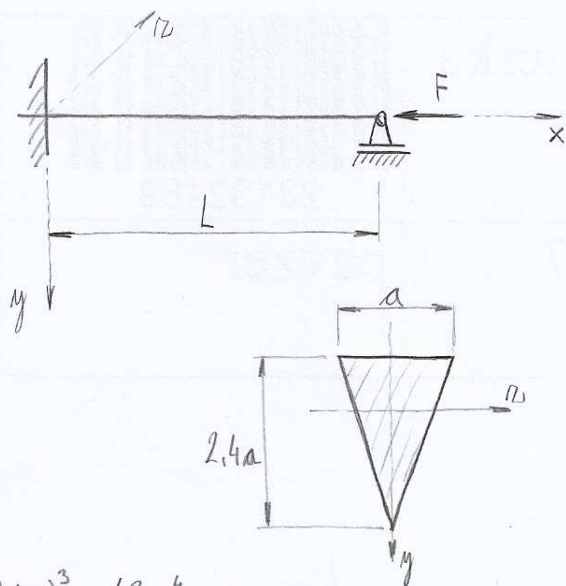
$$m \cdot F = \frac{\pi^2 E J_{\min}}{(\beta L)^2}$$

$$F = \frac{\pi^2 E J_{\min}}{m \cdot (\beta L)^2} = \frac{\pi^2 \cdot 200000 \cdot 43,2 \cdot 10^4}{4 \cdot (0,7 \cdot 2350)^2} = 78781,04 \text{ N}$$

$$\underline{\underline{F = 78,781 \text{ kN}}}$$

4.) Dimenzionirajte narisani stebel trikotnega prečnega prereza ($a = ?$).

2018/2019 - DN11



$$F = 5 \text{ kN}$$

$$L = 1 \text{ m}$$

$$E = 210 \text{ GPa}$$

$$m = 2,5 - \text{VARNOST}$$

$$G_M = 500 \text{ MPa}$$

$$G_{PL} = 300 \text{ MPa}$$

$$G_{PR} = 280 \text{ MPa}$$

$a = ?$

$$J_z = \frac{a \cdot (2.4a)^3}{36} = \frac{48 \cdot a^4}{125} \approx 0,384 \cdot a^4$$

$$J_y = \frac{2.4a \cdot a^3}{48} = \frac{a^4}{20} = 0,05 a^4 = J_{\min}$$

$$A = \frac{1}{2} \cdot a \cdot 2.4 \cdot a = 1,2 a^2$$

$$i_{\min} = \sqrt{\frac{J_{\min}}{A}} = \sqrt{\frac{0,05 a^4}{1,2 a^2}} = \frac{\sqrt{6}}{12} a \approx 0,2041 \cdot a$$

$$\lambda_{DEJ} = \frac{m \cdot L}{i_{\min}} = \frac{0,7 \cdot 1000 \cdot 12}{\sqrt{6} \cdot a} = \frac{3429,29}{a}$$

uzamemo: $a = 9,58935 \text{ mm}$

$$\lambda_{DEJ} = 357,614$$

$$G_{PL} = 335 - 0,62 \cdot \lambda_{PL}$$

$$\lambda_{PL} = \frac{335 - 300}{0,62} = 56,45$$

$$G_{PR} = 335 - 0,62 \cdot \lambda_{PR}$$

$$\lambda_{PR} = \frac{335 - 280}{0,62} = 88,71 \quad \text{ali} \quad \lambda_{PR} = \pi \sqrt{\frac{E}{G_{PR}}}$$

$$\lambda_{PR} = \pi \sqrt{\frac{210000}{280}}$$

$$\lambda_{PR} = 86,036$$

mimo N TETMAJER-jevom
obm. ampak mo N EULER-jevom obm.

predpostavimo TETMAJER-jev uklon:

TRDO JEKLO

$$G_K = 335 - 0,62 \cdot \lambda$$

$$\frac{F_K}{A} = 335 - 0,62 \cdot \frac{3429,29}{a} ; F_K = m \cdot |N|$$

$$\frac{m \cdot F}{1,2 a^2} = 335 - 0,62 \cdot \frac{3429,29}{a}$$

$$\frac{2,5 \cdot 5000}{1,2 \cdot a^2} = 335 - \frac{2126,157}{a} \quad \left\{ \cdot a^2 \right.$$

$$\frac{31250}{3} = 335 \cdot a^2 - 2126,157 \cdot a$$

$$a^2 - 6,34674 a - 31,09453 = 0$$

$$a_1 = 9,58935 \text{ mm}$$

$$a_2 = -3,24261 \text{ mm}$$

EULER-jevom obm.:

$$F_K = \frac{\pi^2 E J_{\min}}{(mL)^2} ; F_K = m \cdot F$$

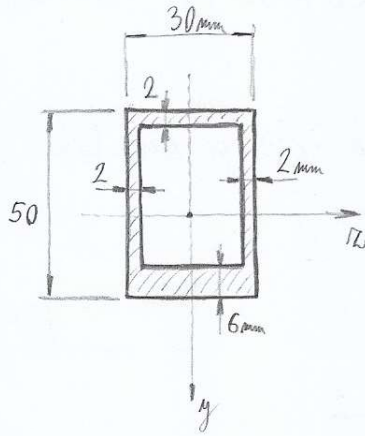
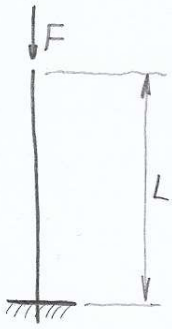
$$m \cdot F = \frac{\pi^2 E \cdot a^4}{20 \cdot 0,7^2 \cdot 1000^2}$$

$$2,5 \cdot 5000 = \frac{\pi^2 \cdot 210000 \cdot a^4}{20 \cdot (0,7 \cdot 1000)^2}$$

$$a = 15,592 \text{ mm}$$

$$\lambda_{DEJ} = \frac{3429,29}{15,592} = 219,939 > 86,036 \Rightarrow \text{EULER ner velja!}$$

5.) Dobite silo F s katero lahko obremenimo nosilec / palico.



$$G_M = 360 \text{ MPa}$$

$$G_{PL} = 250 \text{ MPa}$$

$$G_{PR} = 190 \text{ MPa}$$

$$E = 210 \text{ GPa}$$

$$L = 0,65 \text{ m}$$

$$M = 3 - \text{VARNOST}$$

$$\lambda_{DEJ} = \frac{\beta \cdot L}{i_{min}}$$

$$i_{min} = \sqrt{\frac{J_{min}}{A}}$$

$$J_{min} = J_y = \frac{50 \cdot 30^3}{12} - \frac{42 \cdot 26^3}{12} = 50984 \text{ mm}^4 \quad (14)$$

$$A = 50 \cdot 30 - 42 \cdot 26 = 408 \text{ mm}^2 \quad (2)$$

$$i_{min} = \sqrt{\frac{50984}{408}} = 11,1786 \text{ mm} \quad (2)$$

$$\beta = 2 \quad (2)$$

$$\lambda_{DEJ} = \frac{2 \cdot 650}{11,1786} = 116,294 \quad (2)$$

$$\lambda_{PR} = \pi \sqrt{\frac{E}{G_{PR}}} = \pi \sqrt{\frac{210000}{190}} = 104,444 < \lambda_{DEJ} \Rightarrow \text{EULER velja} \quad (2)$$

$$F_K = \frac{\pi^2 E J_{min}}{(\beta L)^2} = M \cdot F$$

$$F = \frac{\pi^2 E J_{min}}{M \cdot (\beta L)^2}$$

$$F = \frac{\pi^2 \cdot 210000 \cdot 50984}{3 \cdot (2 \cdot 650)^2} = 20842,26 \text{ N} \quad (9)$$

$F = ?$