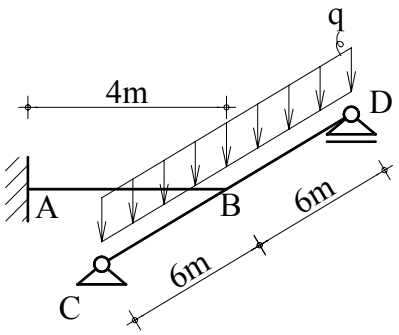
1.9. Treba odrediti intenzitet jednoliko raspodijeljenog opterećenja q koje djeluje na štapu CBD prikazane konstrukcije ako je zadano:

$$\sigma_{dop} = 16\frac{kN}{cm^2}$$

$$E = 20 \cdot 10^4 \frac{kN}{cm^2}$$



presjek na štapu AB

$$h/b = 60/20cm$$

$$I_1 = \frac{20 \cdot 60^3}{12} = 360000cm^4$$

$$W_1 = \frac{20 \cdot 60^2}{6} = 12000cm^3$$

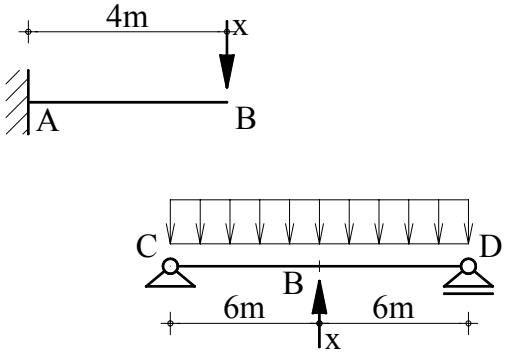
presjek na štapu CBD

$$h/b = 80/30cm$$

$$I_2 = \frac{30 \cdot 80^3}{12} = 1280000cm^4$$

$$W_2 = \frac{30 \cdot 80^2}{6} = 32000cm^3$$

Progib točke "B" na konzoli AB je isti kao i na prostoj gredi CD, a nepoznatu silu na spoju možemo označiti sa x.



$$v_B^{AB} = \frac{x \cdot (4m)^3}{3EI_1} \qquad v_B^{CBD} = \frac{5}{384} \cdot \frac{q \cdot (12m)^4}{EI_2} - \frac{x \cdot (12m)^3}{48EI_2}$$

$$v_B^{AB} = v_B^{CBD}$$

$$v_B^{AB} = v_B^{CBD}$$

$$\frac{x\cdot(4m)^3}{3EI_1} = \frac{5}{384}\cdot\frac{q\cdot(12m)^4}{EI_2} - \frac{x\cdot(12m)^3}{48EI_2}$$

$$\frac{x\cdot(4m)^3}{3EI_1} + \frac{x\cdot(12m)^3}{48EI_2} = \frac{5}{384}\cdot\frac{q\cdot(12m)^4}{EI_2}$$

$$x\left(\frac{(400cm)^3}{3I_1} + \frac{(1200cm)^3}{48I_2}\right) = \frac{5}{384}\cdot\frac{q\cdot(1200cm)^4}{I_2}$$

$$x\left(59.26\frac{1}{cm} + 28.125\frac{1}{cm}\right) = q\cdot 21093.75$$

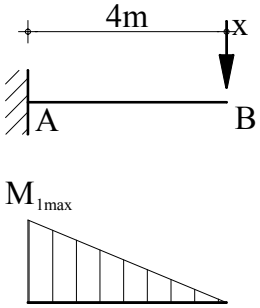
$$x\left(59.26\frac{1}{cm} + 28.125\frac{1}{cm}\right) = q\cdot 21093.75$$

$$x = 241.38cm\cdot q$$

$$x = q\cdot 2.4138m$$

Dimenzioniranje:

Konzola:



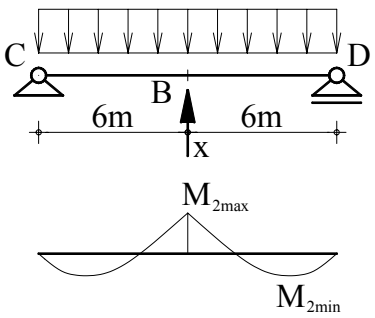
$$M_{1max} = x\cdot 4m = 2.413q\cdot 4m = 9.653m^2q$$

$$\frac{M_{1max}}{W_1} \le \sigma_{dop} \Rightarrow M_{1max} \le \sigma_{dop}\cdot W_1$$

$$9.653m^2q \le 16\frac{kN}{cm^2}\cdot 12000cm^3 = 1920kNm$$

$$q \le \frac{1920kNm}{9.653m^2} = 198.90kN/m$$

Greda:



$$M_{2max} = \frac{q \cdot L^2}{8} - \frac{x \cdot L}{4} = \frac{q \cdot (12m)^2}{8} - \frac{2.4138m \cdot q \cdot 12m}{4}$$

$$M_{2max} = 10.76m^2 \cdot q$$

$$\frac{M_{2max}}{W_2} \le \sigma_{dop} \Rightarrow M_{2min} \le \sigma_{dop} \cdot W_2$$

$$10.76m^2 \cdot q \le 16\frac{kN}{cm^2} \cdot 32000cm^3 = 5120kNm$$

$$q \le \frac{5120kNm}{10.76m^2} = 475.84kN/m$$

$$M_{2min} = R_C \cdot y - \frac{q \cdot y^2}{2}$$

$$M_{2min} = \frac{q \cdot L - x}{2} \cdot y - \frac{q \cdot y^2}{2}$$

$$\frac{q \cdot L - x}{2} = q \cdot y$$

$$\Rightarrow y = \frac{q \cdot L - x}{2q} = \frac{q \cdot L - 2.4138m \cdot q}{2q} = \frac{12m - 2.4138m}{2} = 4.79m$$

$$M_{2min} = \frac{q \cdot L - 2.4138m \cdot q}{2} \cdot 4.79m - \frac{q \cdot (4.79m)^2}{2}$$

$$M_{2min} = q(\frac{12m - 2.4138m}{2} \cdot 4.79m - \frac{(4.79m)^2}{2})$$

$$\frac{M_{2min}}{W_2} \le \sigma_{dop} \Rightarrow M_{2max} \le \sigma_{dop} \cdot W_2 = 5120kNm$$

$$q(\frac{12m - 2.4138m}{2} \cdot 4.79m - \frac{(4.79m)^2}{2}) \le 5120kNm$$

$$q \le \frac{5120kNm}{11.478m^2} = 445.725kN/m$$

Odabiremo najmanje kontinuirano opterećenje kao maksimalno djelujuće opterećenje za sustav.

$$q \le 198.90kN/m$$