1.10. Dvije grede poprečnih presjeka 36/20cm spojene su sredini. Treba odrediti intenzitet jednoliko raspodijeljenog opterećenja q koje djeluje na štapu ACB prikazane konstrukcije ako je zadano:

$\sigma_{dop} = 1.0 \frac{kN}{cm^2}$

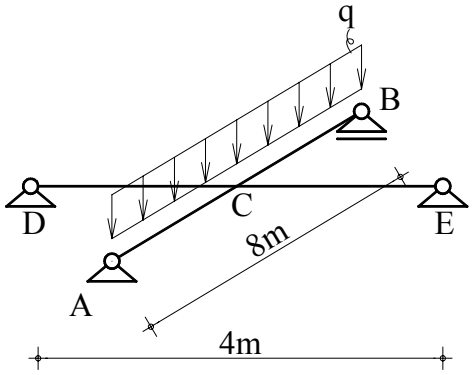
$\tau_{dop} = 0.1 \frac{kN}{cm^2}$

$E = 10^3 \frac{kN}{cm^2}$

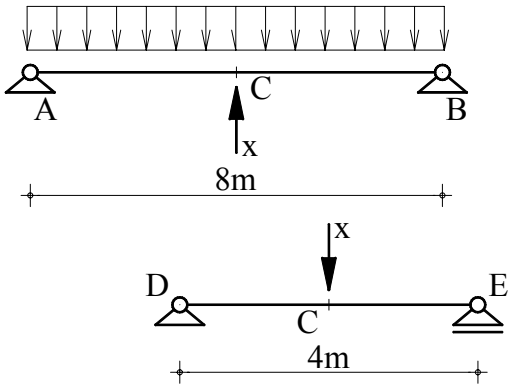
$I = 77760 cm^4$

$W = 4320 cm^3$

$S = 3240 cm^4$



Progib točke "C" na gredi AB je isti kao i na gredi DE, a nepoznatu silu na spoju možemo označiti sa x.



$$v_C^{AB} = \frac{5}{384} \cdot \frac{q \cdot (8m)^4}{EI} - \frac{x \cdot (8m)^3}{48EI} \qquad v_C^{DE} = \frac{x \cdot (4m)^3}{48EI}$$

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

$$v_C^{AB} = v_C^{DE}$$

$$\frac{5}{384}\cdot\frac{q\cdot(8\text{m})^4}{EI_2}-\frac{x\cdot(8\text{m})^3}{48EI_2}=\frac{x\cdot(4\text{m})^3}{48EI_2}$$

$$\frac{5}{384}\cdot\frac{q\cdot(8\text{m})^4}{EI}-\frac{x\cdot(8\text{m})^3}{48EI}=\frac{x\cdot(4\text{m})^3}{48EI}$$

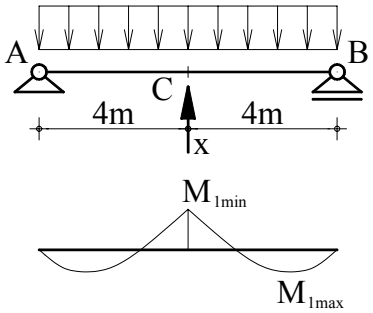
$$\frac{5}{384}\cdot\frac{q\cdot(8\text{m})^4}{1}=\frac{x\cdot(8\text{m})^3}{48}+\frac{x\cdot(4\text{m})^3}{48}$$

$$53.33\text{m}^4\cdot q = 12.00\text{m}^3\cdot x$$

$$x = 4.44\text{m}\cdot q$$

Dimenzioniranje prema maksimalnom momentu savijanja (normalno naprezanje):

Greda AB:



$$R_A = \frac{q\cdot 8\text{m}-x}{2}=\frac{q\cdot 8\text{m}-4.44\text{m}\cdot q}{2}=1.78\text{m}\cdot q$$

$$R_A - q\cdot y = 0 \Rightarrow y = \frac{R_A}{q} = 1.78\text{m}$$

$$M_{1max} = R_A\cdot y - \frac{q\cdot y^2}{2} = 1.5842\text{m}^2 q$$

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

$$q \le 27.269\,\text{kN/m}$$

$$M_{1min} = \frac{q\cdot L^2}{8}-\frac{x\cdot L}{4}=\frac{q\cdot(8\text{m})^2}{8}-\frac{4.44\text{m}\cdot q\cdot 8\text{m}}{4}$$

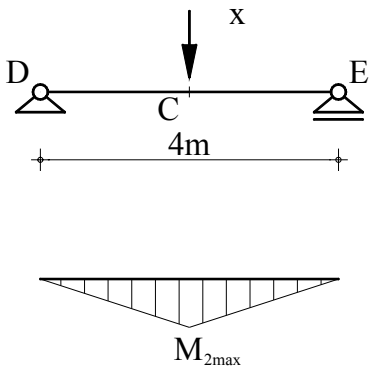
$$M_{1min} = -0.88\text{m}^2\cdot q$$

$$\frac{M_{1min}}{W_2}\le\sigma_{dop}\Rightarrow M_{1min}\le\sigma_{dop}\cdot W_2$$

$$0.88\text{m}^2\cdot q \le 1\frac{\text{kN}}{\text{cm}^2}\cdot 4320\text{cm}^3$$

$$q \le 49.09\text{kN/m}$$

Greda DE:



$$M_{2max} = \frac{x \cdot L}{4} = 4.44q$$

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

$$4.44q \le 1\frac{kN}{cm^2} \cdot 4320cm^3$$

$$q \le 9.73kN/m$$

Odabiremo najmanje kontinuirano opterećenje kao maksimalno djelujuće opterećenje za sustav.

$$q \le 9.73kN/m$$

Kontrola za poprečnu silu (posmično naprezanje):

$$\tau = \frac{T \cdot S}{I \cdot b} \le \tau_{dop}$$

$$\tau = \frac{R_A \cdot S}{I \cdot b} = \frac{1.78q \cdot 3240cm^3}{77760cm^4 \cdot 20cm} =$$

$$= \frac{1.78m \cdot 9.73\frac{kN}{m} \cdot 3240cm^3}{77760cm^4 \cdot 20cm} = 0.03608\frac{kN}{cm^2} \le \tau_{dop}$$