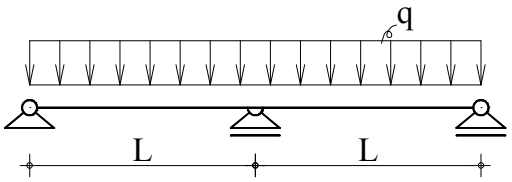
4.5 Potrebno je odrediti dopušteno kontinuirano opterećenje q, za sustav prikazan na crtežu, ako je poznato:

$L = 4\,\mathrm{m}$

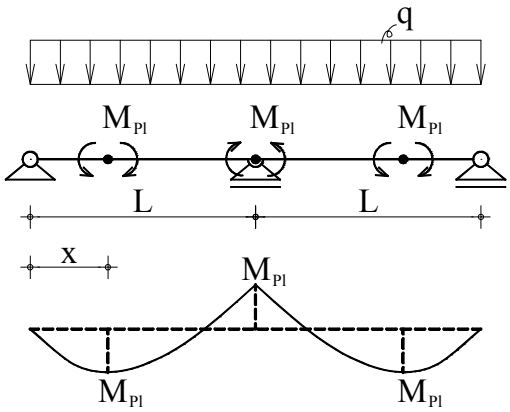
$S = 125\,\mathrm{cm}^3$

$\sigma_R = 24.0\,\frac{\mathrm{kN}}{\mathrm{cm}^2}$

$\nu = 1.7$



Plastična ravnoteža sustava



Uvjet za moment plastičnosti u polju

$$R_A \cdot x - \frac{q \cdot x^2}{2} = M_{Pl} \qquad (1)$$

Potrebno je odrediti udaljenost na kojoj se od ležaja javlja moment plastičnosti u polju

$$\sum V = 0$$

$$R_A - q \cdot x = 0 \Rightarrow x = \frac{R_A}{q}$$

$$R_A \cdot \frac{R_A}{q} - \frac{R_A^{\,2}}{2 \cdot q} = M_{Pl}$$

$$\frac{R_A^{\,2}}{2 \cdot q} = M_{Pl}$$

Uvjet za moment plastičnosti nad ležajem

$$R_A \cdot L - \frac{q \cdot L^2}{2} = -M_{Pl}$$

$$R_A \cdot L - \frac{q \cdot L^2}{2} = -\frac{R_A^{\,2}}{2 \cdot q} \qquad (2)$$

$$R_A \cdot L - \frac{q \cdot L^2}{2} + \frac{R_A^{\,2}}{2 \cdot q} = 0$$

$$R_A = q \cdot L(\sqrt{2} - 1)$$

$$M_{Pl} = \frac{q^2 \cdot L^2}{2q}(\sqrt{2}-1)^2 = \frac{q \cdot L^2}{2}(\sqrt{2}-1)^2$$

$$q = \frac{2M_{Pl}}{L^2 \cdot (\sqrt{2}-1)^2}$$

$$M_{Pl.dop} = \frac{\sigma_R \cdot W_{Pl}}{\nu} = \frac{24\frac{kN}{cm^2} \cdot 2 \cdot 125cm^3}{1.7} = 3529.41kNcm$$

$$q_{dop} = \frac{2M_{Pl.dop}}{L^2 \cdot (\sqrt{2}-1)^2} = \frac{2 \cdot 35.29kNm}{4^2 m^2 \cdot (\sqrt{2}-1)^2} = 25.71kN/m$$