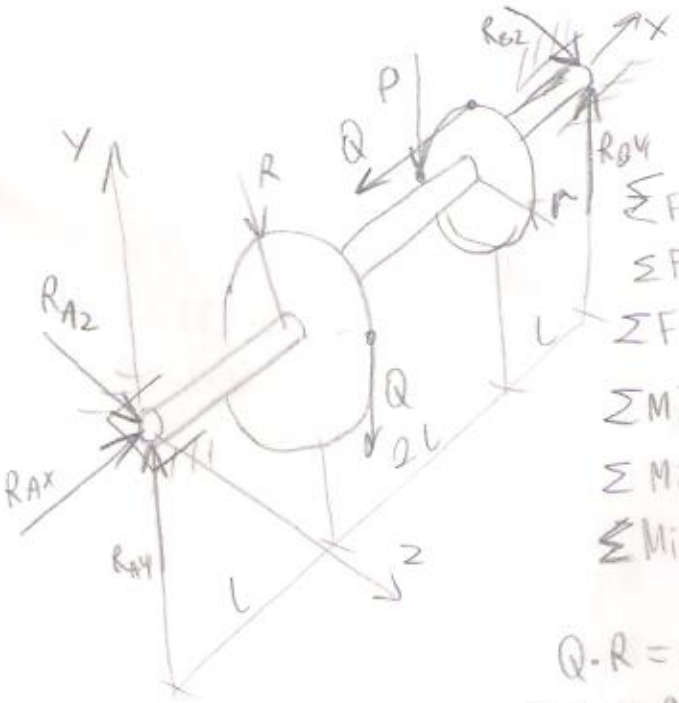


Dane. $Q = 4kN$ $l = 0{,}1\,m$ $r = 0{,}1m$

$R = 2r$

$\sum F_{ix} = 0 \quad R_{AX} - Q = 0 \rightarrow \underline{R_{AX} = Q}$

$\sum F_{iy} = 0 \quad R_{AY} - Q - P + R_{BY} = 0$

$\sum F_{iz} = 0 \quad R_{AZ} + R_{BZ} = 0 \Rightarrow R_{AZ} = 0$

$\sum M_{ix} = 0 \quad Q \cdot R - P \cdot r = 0$

$\sum M_{iy} = 0 \quad R_{BZ} \cdot 4l = 0 \Rightarrow R_{BZ} = 0$

$\sum M_{iz} = 0 \quad Q \cdot l - Q \cdot r + P \cdot 3l - R_{BY} \cdot 4l = 0$

$Q \cdot R = P \cdot r$

$Q \cdot 2r = P \cdot r \,/\, 2$

$2Q = P$

$\underline{P = 2Q}$

$Q - Q + 3P - 4R_{BY} = 0$

$4R_{BY} = 3P$

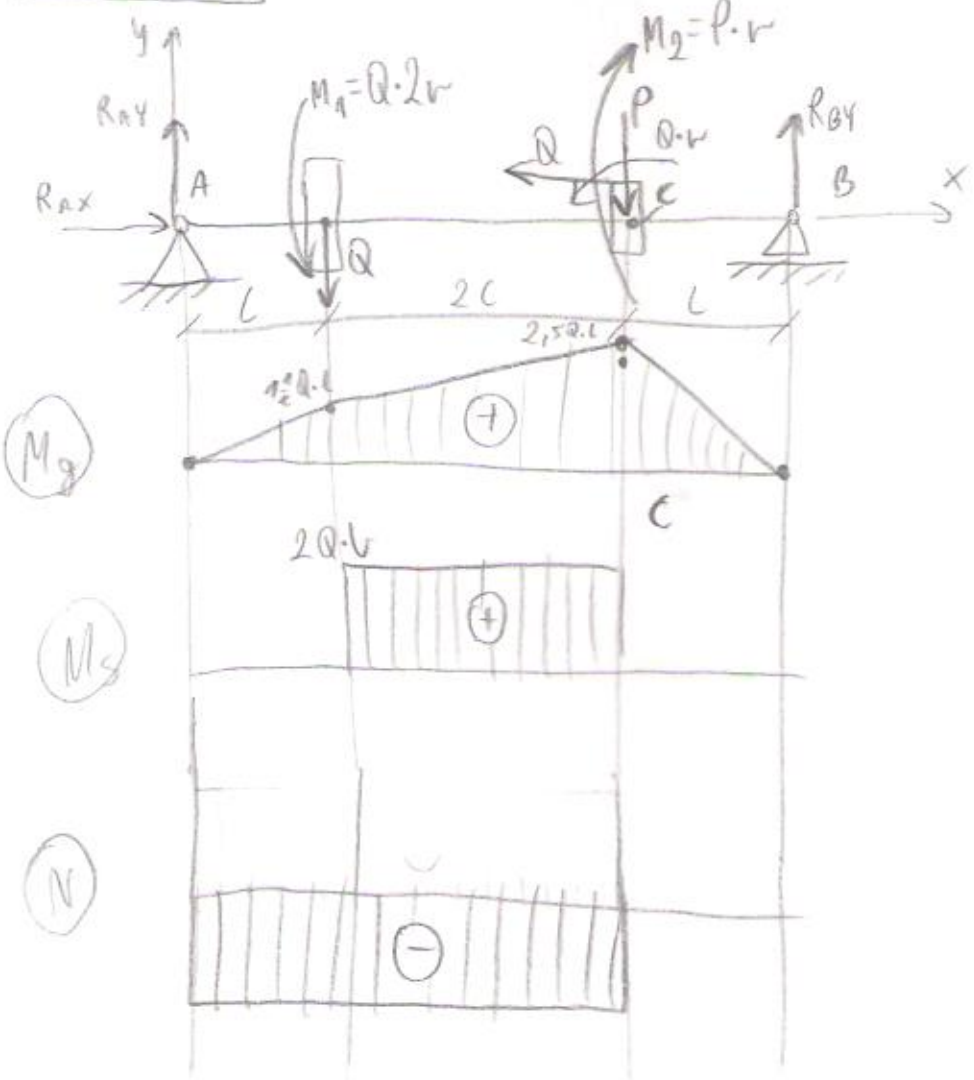
$4R_{BY} = 3 \cdot 2Q$

$\underline{R_{BY} = 1\frac{1}{2}Q}$

$R_{AY} - Q - 2Q + 1\frac{1}{2}Q = 0$

$R_{AY} = 3Q - 1\frac{1}{2}Q$

$\underline{R_{AY} = 1\frac{1}{2}Q}$



Hipoteza Hubera

$$\sigma_{zr} = \sqrt{(\sigma_g + \sigma_N)^2 + 3\tau^2}$$

$$\sigma_g = \frac{M_{gmax}}{J_x} \cdot y_{max}$$

$$\sigma_N = \frac{P}{A}$$

$$\tau = \frac{M_s}{J_0} \cdot \rho_{max}$$

$0 < x < l$

$M_g = R_{AY} \cdot x$

dla $x = 0$

$M_g = 0$

dla $x = l$

$M_g = R_{AY} \cdot l$

$M_g = 1\frac{1}{2} Q \cdot l$

$N = R_{AX}$

dla $\left.\begin{matrix} x=0 \\ x=l \end{matrix}\right\} N = -R_{AX}$, $N = -Q$

$M_S = 0$

$l < x < 3l$

$M_g = R_{AY} \cdot x - Q \cdot (x - l)$

$N = R_{AX}$

$M_S = M_1$

dla $x = l$

$M_g = 1\frac{1}{2} Q \cdot l$

dla $x = 3l$

$M_g = 1\frac{1}{2} Q \cdot 3l - Q \cdot (3l - l)$

$M_g = 4{,}5\, Q \cdot l - 2Q \cdot l$

$M_g = 2{,}5\, Q \cdot l$

dla $\left.\begin{matrix} x=l \\ x=3l \end{matrix}\right\} N = -R_{AX}$, $N = -Q$

dla $\left.\begin{matrix} x=l \\ x=3l \end{matrix}\right\} M_S = M_1$, $M_S = 2 \cdot Q \cdot r$

$3l < x < 4l$

$M_g = R_{AY} \cdot x - Q \cdot (x - l) - P \cdot (x - 3l) - Q \cdot r$

$N = R_{AX} - Q$

$M_S = M_1 - M_2$

dla $x = 3l$

$M_g = \frac{1}{2} Q \cdot l \cdot 3l - Q \cdot (3l - l) - Q \cdot r$

$M_g = 4{,}5\, Q \cdot l - 2\, Q \cdot l - Q \cdot l$

$M_g = 1{,}5\, Q \cdot l$

dla $x = 4l$

$M_g = 1\frac{1}{2} Q \cdot 4l - Q \cdot (4l - l) - P \cdot (4l - 3l) - Q \cdot l$

$M_g = 6 \cdot Q \cdot l - 3Q \cdot l - P \cdot l - Q \cdot l$

$M_g = 6 \cdot Q \cdot l - 3Q \cdot l - 2\, Q \cdot l - Q \cdot l$

$M_g = 6 \cdot Q \cdot l - 6 \cdot Q \cdot l$

$M_g = 0$

dla $\left.\begin{matrix} x=3l \\ x=4l \end{matrix}\right\} N = -R_{AX} + Q$, $N = Q - Q$, $N = 0$

dla $\left.\begin{matrix} x=3l \\ x=4l \end{matrix}\right\} M_S = M_1 - M_2$, $M_S = 2Q \cdot r - P \cdot r$, $M_S = 2Q \cdot r - 2Q \cdot r$, $M_S = 0$

$$\sigma_g = \frac{M_{g\,max}}{J_{zc}} \cdot y_{max}$$

$$\sigma_g = \frac{2{,}5\, Q \cdot l}{\frac{\pi \cdot d^4}{64}} \cdot \frac{d}{2}$$

$$\sigma_N = \frac{Q}{\frac{\pi d^2}{4}}$$

$$\tau = \frac{2Q \cdot l}{\frac{\pi d^4}{32}} \cdot \frac{d}{2}$$

$2r = d$

$\pi r^2 = \frac{\pi d^2}{4}$