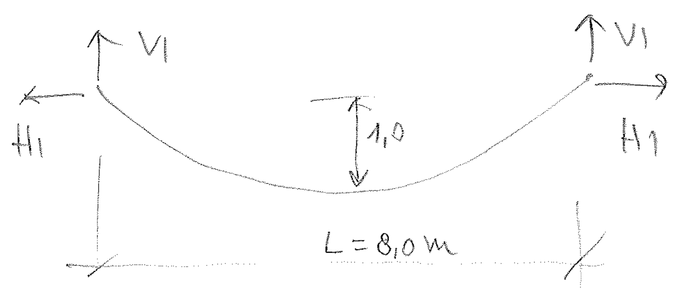
Sc. II : arch. dell'equilibrio — LM in Architett. - UNIV. DI PARMA

Prova scritta del 16/02/2016

1) Es. metodo Mery

2)

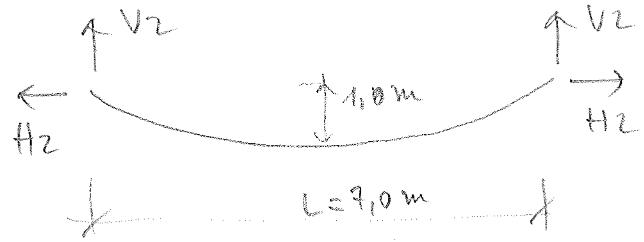



$$H_1 = \frac{qL^2}{8f_1} = \frac{8000 \cdot 8^2}{8 \cdot 1} = 64\,000\ N$$

$$V_1 = \frac{qL}{2} = \frac{8000 \cdot 8}{2} = 32\,000\ N$$

$$T_{1max} = \sqrt{H_1^2 + V_1^2} = 71554\ N$$

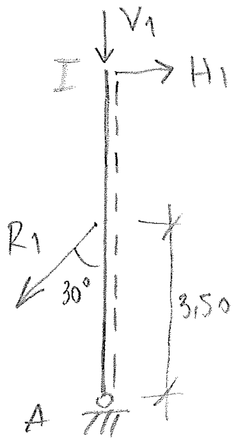
$$\sigma_{1max} = \frac{T_{1max}}{A_{1\phi30}} = 101\ MPa$$




$$H_2 = \frac{qL^2}{8f_2} = 49000\ N$$

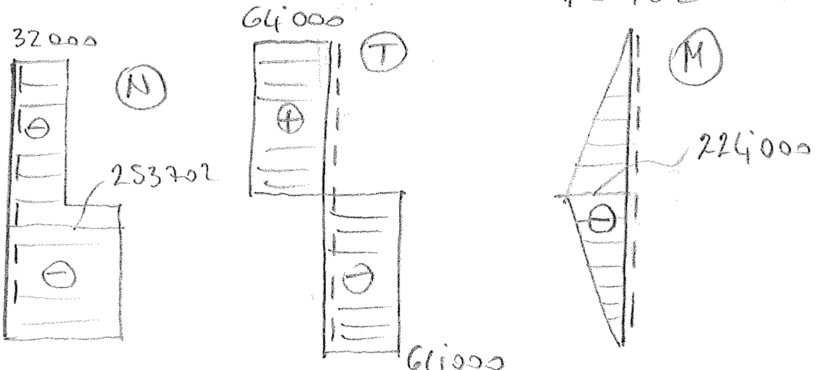
$$V_2 = \frac{qL}{2} = 28000\ N$$

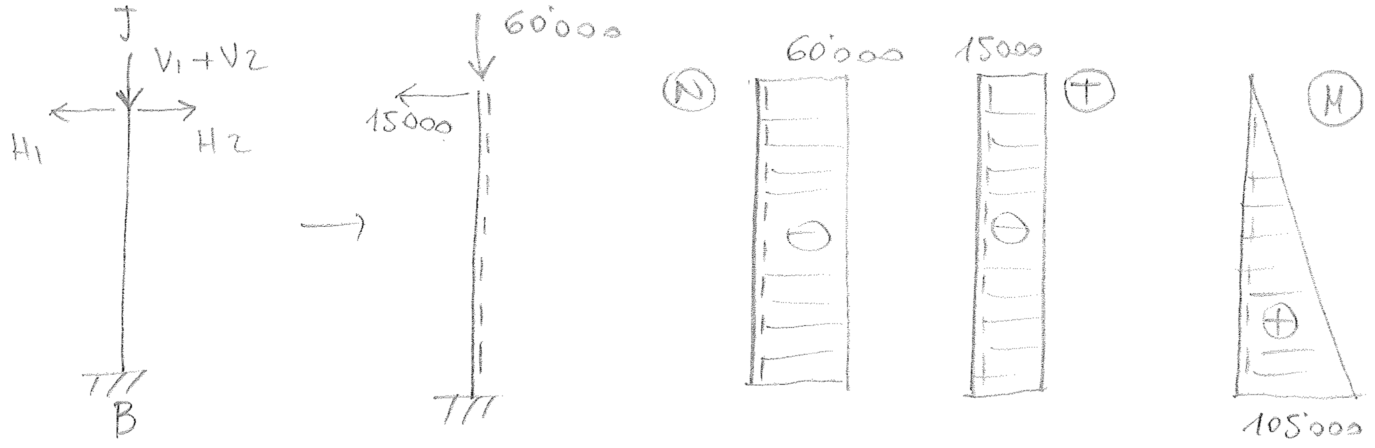
$$T_{2max} = 56436\ N\ ;\ \sigma_{2max} = 79{,}8\ MPa$$

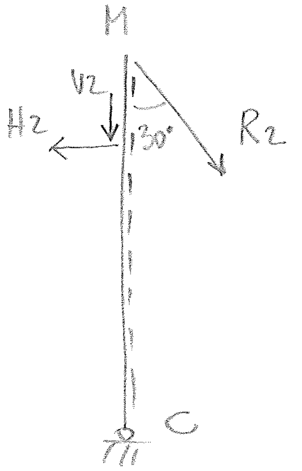



$$\Sigma M_A = 0 : \ H_1 \cdot 7 - R_1 \sin 30° \cdot 3{,}5 = 0 \rightarrow R_1 = 256\,000\ N$$

$$\sigma_1 = 482\ MPa$$

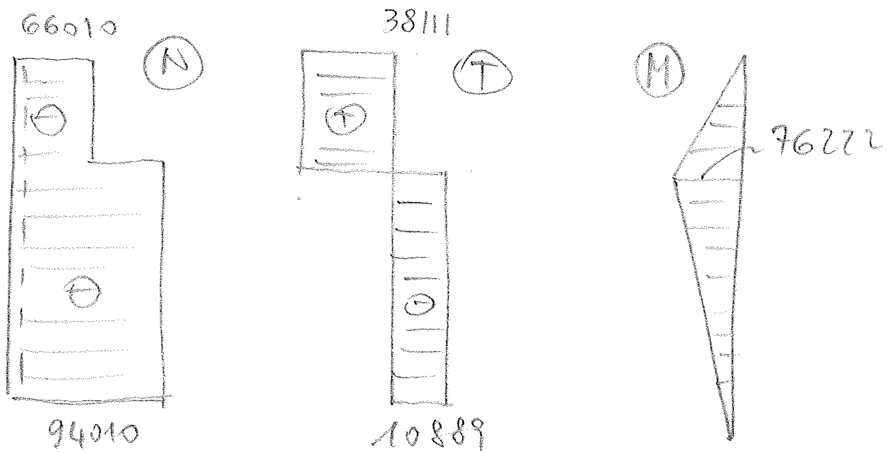




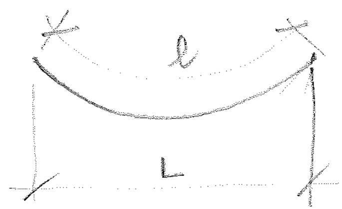




$\Sigma M_C = 0 \quad -H_2 \cdot 7 + R_2 \sin 30° \cdot 9 = 0 \rightarrow R_2 = 76'222\ N$

$\sigma_2 = 143{,}6\ MPa$




Allungamento funi:



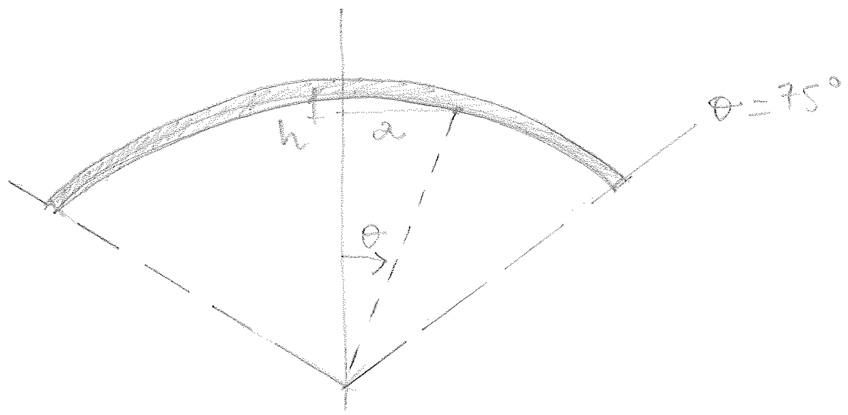

$l_1 = L_1 + \frac{8}{3}\frac{f_1^2}{L} = 8{,}0 + \frac{8}{3} \cdot \frac{1^2}{8} = 8{,}33\ m$

$\Delta l_1 \cong \frac{H_1 \cdot l_1}{E \cdot A} = \frac{64000 \cdot 8{,}33}{2{,}1 \cdot 10^{11} \cdot \underbrace{7{,}07 \cdot 10^{-4}}_{A\,1\phi 30}} = 3{,}60 \cdot 10^{-3}\ m \rightarrow f_1^{TOT} = \frac{\sqrt{L}}{4}\sqrt{6(l-L)} = 1{,}0004\ m$

$l_2 = L_2 + \frac{8}{3}\frac{f_2^2}{L} = 7{,}0 + \frac{8}{3} \cdot \frac{1^2}{7} = 7{,}38\ m$

$\Delta l_2 \cong \frac{H_2 \cdot l_2}{E \cdot A} = \frac{49000 \cdot 7{,}38}{2{,}1 \cdot 10^{11} \cdot 7{,}07 \cdot 10^{-4}} = 2{,}43 \cdot 10^{-3}\ m \rightarrow f_2^{TOT} = 1{,}002\ m$

3) Cupole a forma di calotta sferica




$a = R \sin\theta$

$Q(\theta) = \pi a^2 q = \pi R^2 \sin^2\theta \cdot q$

pp:

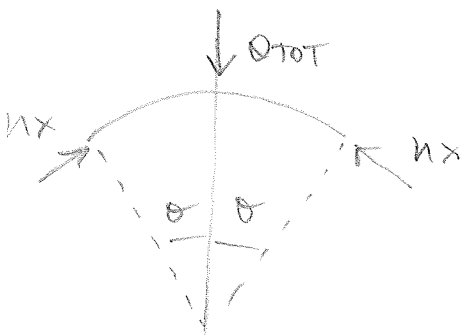
$S(\theta) = 2\pi R \underbrace{(R - R\cos\theta)}_{h}$

$Q_p(\theta) = 2\pi R^2 (1-\cos\theta)\gamma \cdot s$

$Q_{TOT}(\theta) = Q(\theta) + Q_p(\theta) = \pi R^2 \left[ q \sin^2\theta + 2\gamma(1-\cos\theta)s \right]$

$p_z = (q + \gamma s)\cos\theta$

Equilibrio verticale




$2\pi R \sin\theta \cdot n_x \sin\theta = Q_{TOT}(\theta)$

$$n_x(\theta) = \frac{\pi R^2 \left[ q \sin^2\theta + 2\gamma(1-\cos\theta) \cdot s \right]}{2\pi R \sin^2\theta}$$

$$n_x(\theta) = \frac{R \left[ q \sin^2\theta + 2\gamma(1-\cos\theta) s \right]}{2 \sin^2\theta}$$ (compressione)

Equilibrio trasversale

$$\frac{n_x}{R_x} + \frac{n_y}{R_y} = -p_z = -(q+\gamma s)\cos\theta$$

$$n_y = -R(q+\gamma s)\cos\theta - n_x = -R(q+\gamma s)\cos\theta - \frac{R\left[q\sin^2\theta + 2\gamma(1-\cos\theta)s\right]}{2\sin^2\theta}$$

$= -p_z \cdot R - n_x$

$n_x(\theta = 75°) = -73166$ N/m $\quad \sigma_x = |-0{,}61|$ MPa $< 2{,}0$ MPa, verificato

$n_y(\theta = 75°) = 40115$ N/m $\quad \sigma_y = 0{,}33$ MPa $> 0{,}05$ MPa, non verificato