UNIVERSITÀ DEGLI STUDI DI PARMA

DIPARTIMENTO DI INGEGNERIA CIVILE,
DELL'AMBIENTE, DEL TERRITORIO E ARCHITETTURA

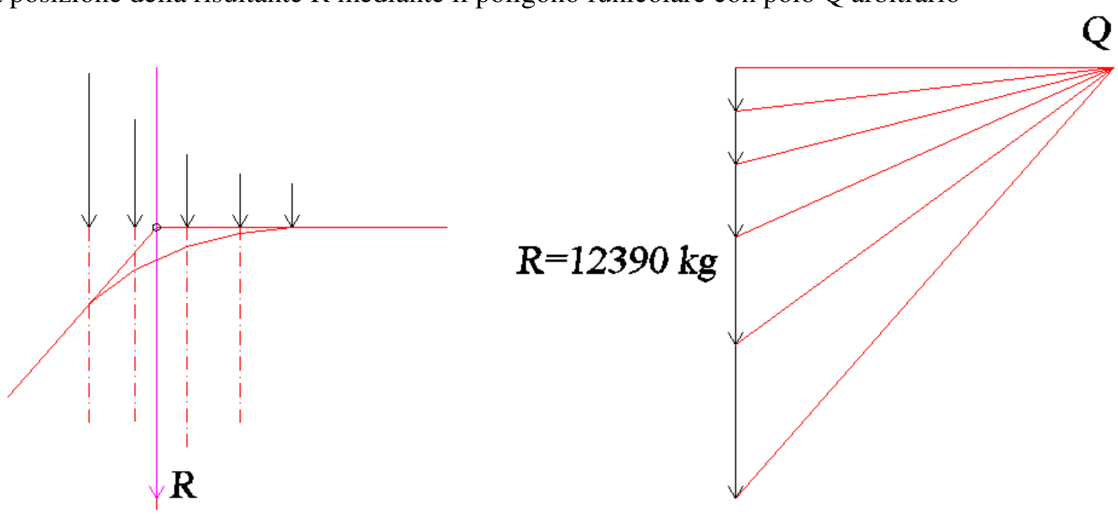
CORSO DI STUDI IN ARCHITETTURA - A.A. 2014/2015

SCIENZA DELLE COSTRUZIONI II: TEORIA DELLE STRUTTURE TRASPARENTI

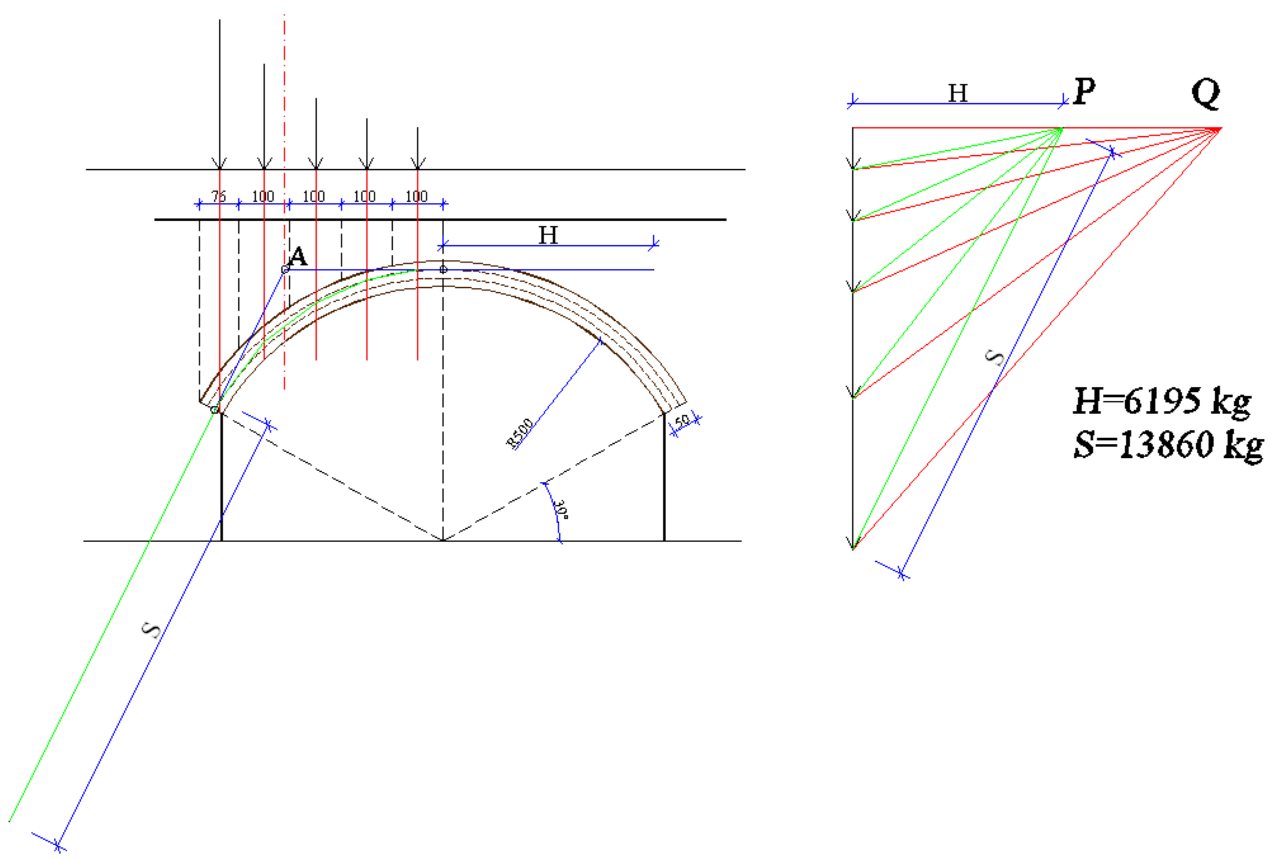
Prof. Brighenti - Prova scritta del **09/07/2015**

1. Esercizio

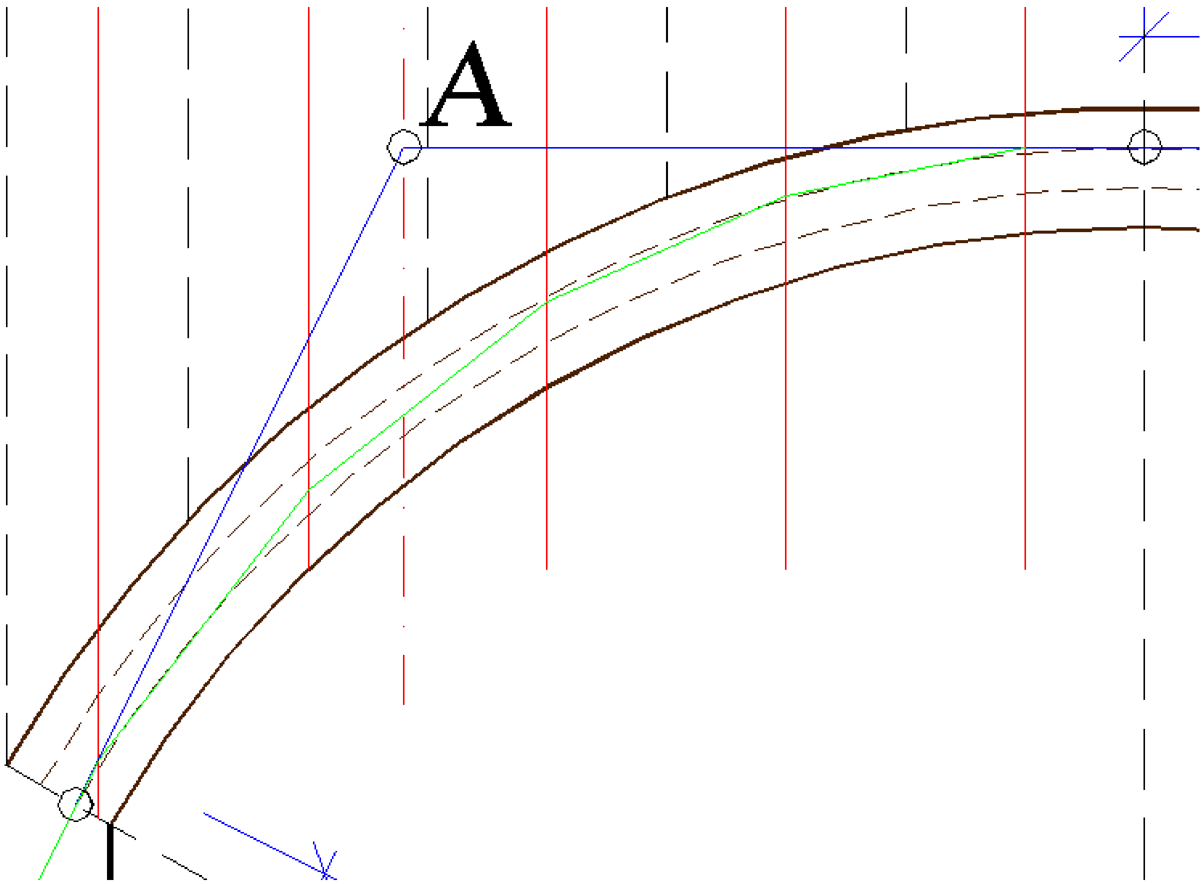
a) Calcolo la posizione della risultante R mediante il poligono funicolare con polo Q arbitrario



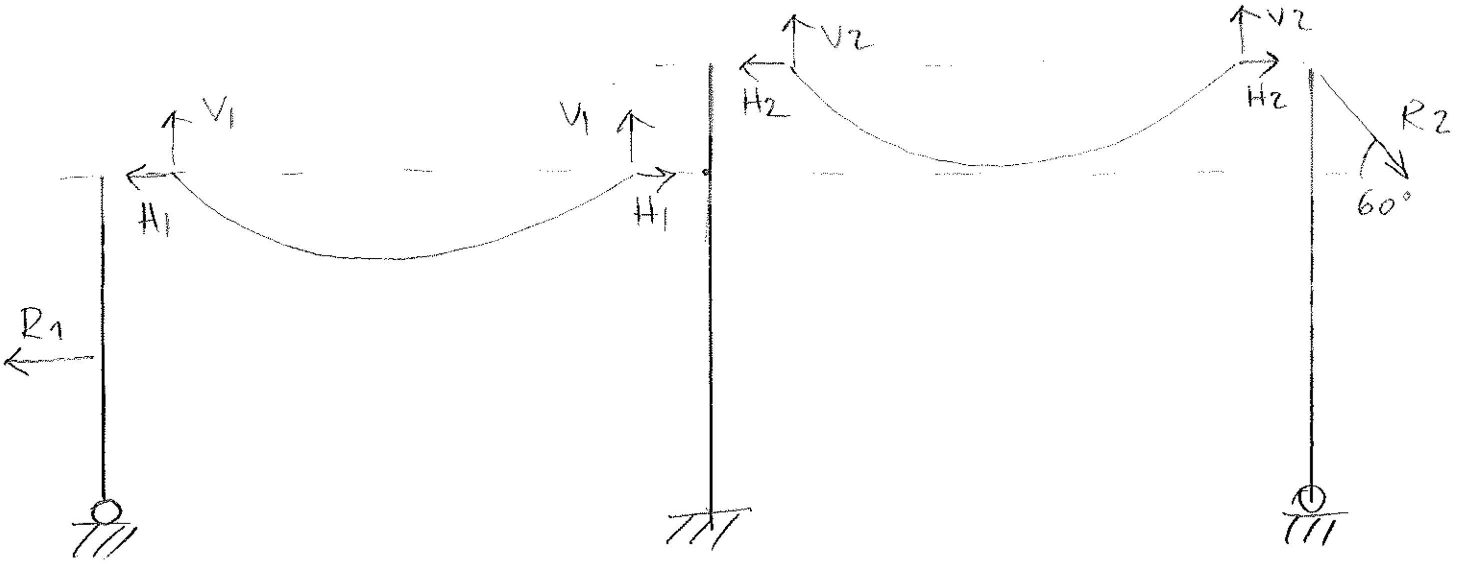
b) Determino la retta d'azione di S imponendo il passaggio per un punto noto A e per il terzo medio inferiore all'imposta → trovo il nuovo polo P con il quale costruire il poligono funicolare finale



c) Determino graficamente i valori di H ed S per le verifiche di resistenza e controllo se il poligono funicolare (linea verde) rientra nel terzo medio di tutti i conci dell'arco:



2)



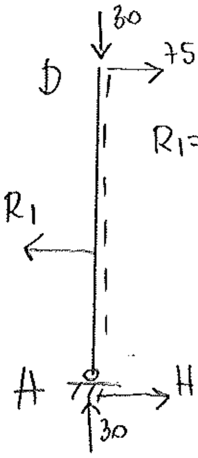
$$V_1 = \frac{q_1 \cdot 10}{2} = 30\,KN \qquad V_2 = \frac{q_2 \cdot 10}{2} = 40\,KN$$

$$H_1 = \frac{q_1 \cdot l_1^2}{8 \cdot 1} = 75\,kN \qquad H_2 = \frac{q_2 \cdot l_2^2}{8 \cdot 1{,}2} = 83\,kN$$

$$F_{TOT} = \sqrt{V_1^2 + H_1^2} = 80{,}77\,KN \qquad F_{TOT} = \sqrt{V_2^2 + H_2^2} = 92{,}13\,KN$$

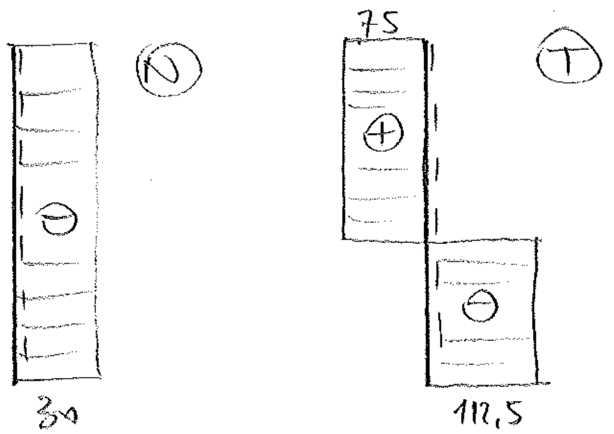
$$A_{1\phi 32} = 8{,}04\,cm^2$$

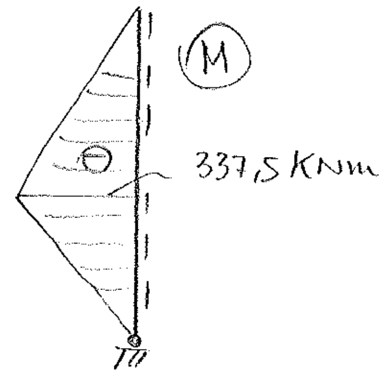
$$\sigma_{max} = \frac{80{,}77 \cdot 10^3}{804} = 100{,}46\,MPa \qquad \sigma_{max} = \frac{92{,}13 \cdot 10^3}{804} = 115\,MPa$$

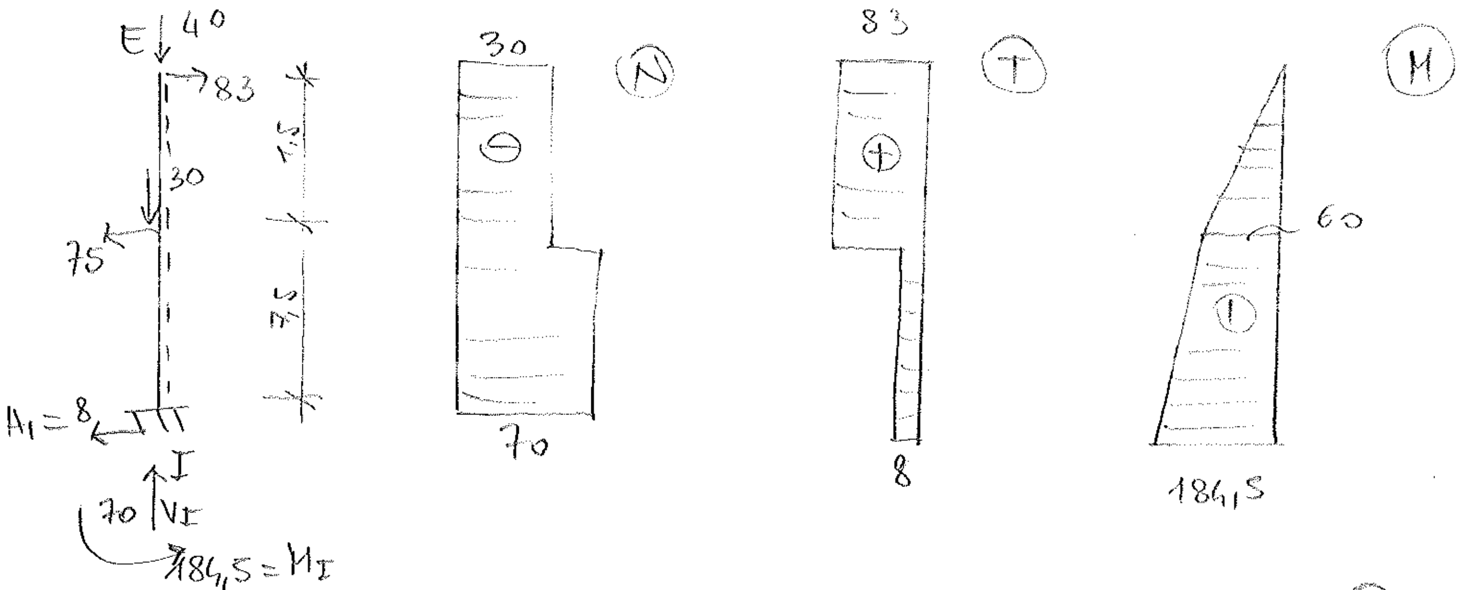


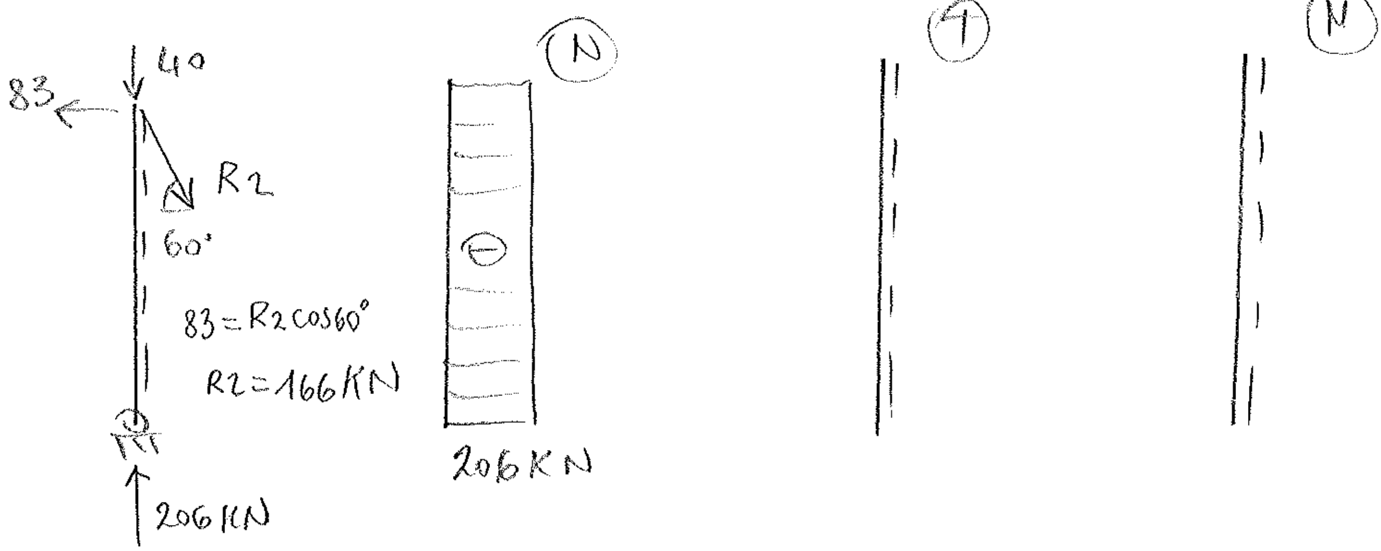
$$R_1 = \frac{75 \cdot 7{,}5}{3} = 187{,}5\,KN$$

$$H_H = 112{,}5\,KN$$

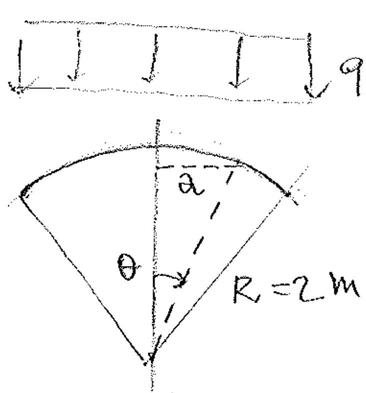








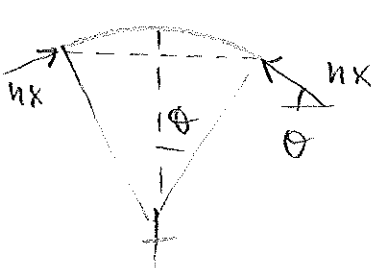
3)



Calotte sferice

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

Equilibrio verticale



$$2\cancel{\pi} R \cancel{\sin\theta}\, n_x \cancel{\sin\theta} = Q(\theta) = -\cancel{\pi} R^{\cancel{2}} \cancel{\sin^2\theta}\, q$$

$$n_x = \frac{Rq}{2} = \frac{2 \cdot 300}{2} = -300 \text{ KN/m}$$

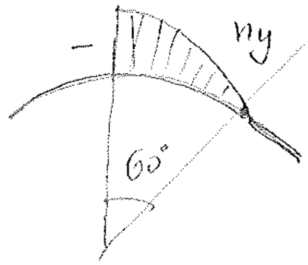
$$\sigma_x = \frac{n_x}{0{,}1} = \frac{-300 \cdot 10^3 \text{ N}}{1{,}0 \cdot 0{,}1} = -3 \cdot 10^6 \text{ Pa} \; (< 20 \cdot 10^6 \text{ Pa}) \text{ OK}$$

- Equilibrio secondo z:

$$\frac{n_x}{R_x} + \frac{n_y}{R_y} = -p_z \rightarrow \frac{n_x}{R} + \frac{n_y}{R} = q\cos\theta \rightarrow n_y = -qR\cos\theta - n_x$$
$$= -qR\left(\cos\theta - \frac{1}{2}\right) =$$

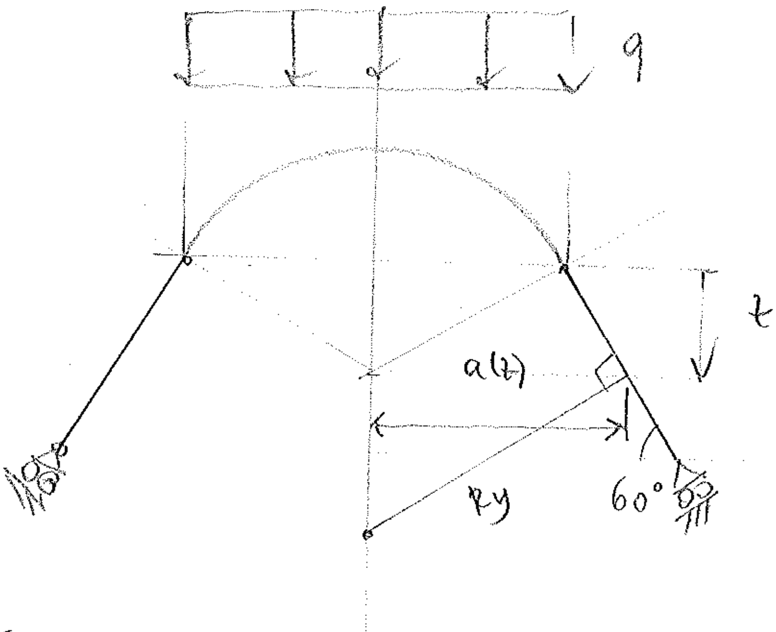
per $\theta = 60°$: $n_y = -300 \cdot 2 \left(\cos 60° - \frac{1}{2}\right) = 0$

$\theta = 0°$: $n_y = -300 \cdot 2 \left(1 - \frac{1}{2}\right) = 300$ KN/m



$\sigma_y = 3$ MPa

Zona conica



$a(z) = R \sin 60° + z/\tg 60°$

$Q(z) = -2827$ KN

Equilibrio verticale

$$n_x \cdot 2\pi \cdot \underset{\downarrow \atop 1{,}73 + 0{,}58 \cdot z}{a} \sin 60° = -2827 \rightarrow n_x = \frac{-2827}{2\pi \sin 60° \cdot (1{,}73 + 0{,}58\, z)} =$$

$z = 0$: $n_x = -\dfrac{2827}{2\pi \sin 60° \cdot 1{,}73} = -300{,}31$ KN/m $\qquad \sigma_x = -3$ MPa

$z = 1{,}5$ m : $n_x = \dfrac{-2827}{2\pi \sin 60° (1{,}73 + 0{,}58 \cdot 1{,}5)} = -199{,}8$ KN/m $\qquad \sigma_x = -1{,}99$ MPa

Equilibrio lungo z

$$\frac{n_x}{\cancel{\infty}} + \frac{n_y}{a/\sin 60°} = 0 \qquad n_y = 0$$