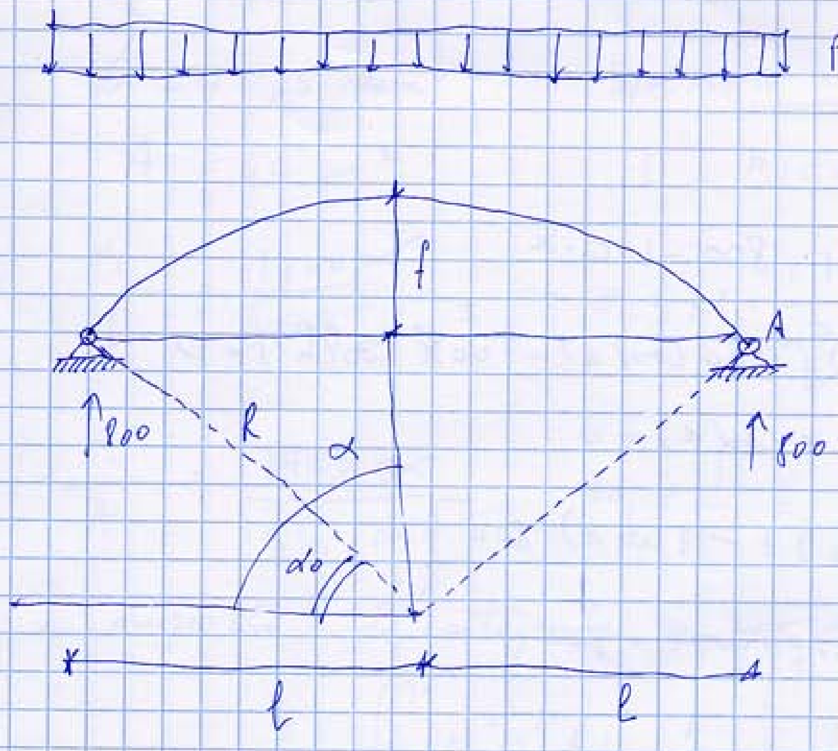
VALLICELLI



$p = 100 \, KN/m$

$l = 8$

$f = 2$

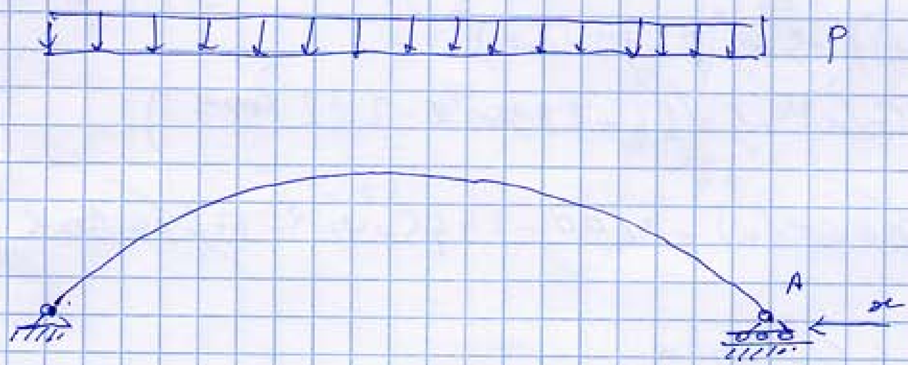
$\alpha_0 = \arcsin\left(\frac{R-f}{R}\right) =$

$= R = \frac{l^2+f^2}{2f} = \frac{64+4}{4}$

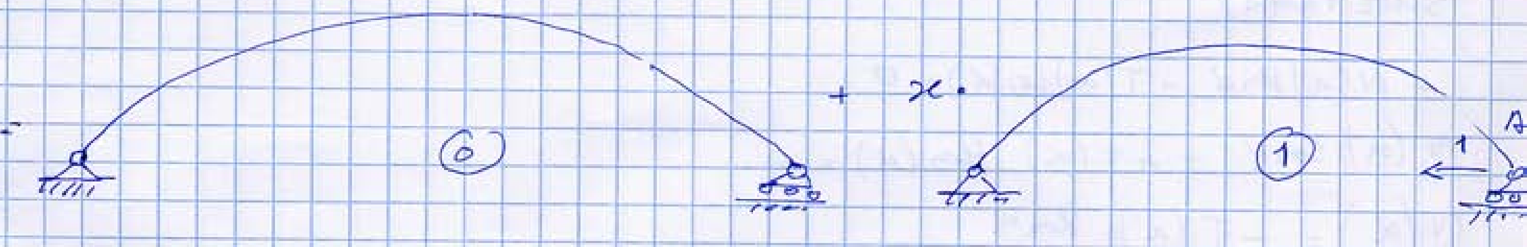
$\frac{68}{4} = 17$

$\alpha_0 = \arcsin\left(\frac{17-2}{17}\right)$

$\alpha_0 \cong 62^\circ$



$=$



SCHEMA 0

$- N(\alpha) \operatorname{sen}(\alpha) - T(\alpha) \cos(\alpha) = 0$

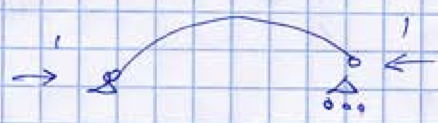
$- N(\alpha) \cos(\alpha) + T(\alpha) \operatorname{sen}(\alpha) + 800 - 100 \cdot x$

$- M(\alpha) - 800 \cdot x + 50 \, x^2$

$x = (R \cos\alpha_0 - R \cos\alpha)$

$x = (7{,}82 - 17 \cos\alpha)$

SCHEMA (1)



$y = (R \operatorname{sen}\alpha - R \operatorname{sen}\alpha_0)$

$y = (17 \operatorname{sen}\alpha - 14{,}96)$

$1 + N(\alpha) \operatorname{sen}(\alpha) - T(\alpha) \cos\alpha = 0$

$N(\alpha) \cos\alpha + T(\alpha) \operatorname{sen}\alpha = 0$

$M(\alpha) + 1 y = 0$

SCHEMA (0)

$$\boxed{T(\alpha)} = \frac{N(\alpha)\,\text{sen}(\alpha)}{\cos(\alpha)}$$

$$N(\alpha)\cos(\alpha) + \frac{N(\alpha)\,\text{sen}^2(\alpha)}{\cos(\alpha)} + 800 - 100\cdot x$$

$$N(\alpha)\cos^2(\alpha) + N(\alpha)\,\text{sen}^2(\alpha) + 800\cos(\alpha) - 100x\cos(\alpha) = 0$$

$$N(\alpha)\cdot 1 + 800\cos(\alpha) - 100x\cos(\alpha) = 0$$

$$N(\alpha) = \cos(\alpha)\left[100(7{,}97 - 17\cos\alpha) - 800\right]$$

$$N(\alpha) = \cos(\alpha)\left[\cancel{800} - 1700\cos\alpha - \cancel{800}\right] =$$

$$\boxed{N(\alpha)} = -1700\cos^2(\alpha)$$

$$M(\alpha) = 800(8 - 17\cos(\alpha)) - 50(8 - 17\cos\alpha)^2$$

$$M(\alpha) = 64000 - 13600\cos(\alpha) - 50(64 + 289\cos^2\alpha - 272\cos\alpha)$$

$$M(\alpha) = \cancel{64000} - \cancel{13600\cos(\alpha)} - 3200 - 14450\cos^2\alpha - \cancel{13600\cos\alpha}$$

$$\boxed{M(\alpha)} = 3200 - 14450\cos^2\alpha$$

SCHEMA (1)

$$1 + N(\alpha)\,\text{sen}\,\alpha - T(\alpha)\cos(\alpha) = 0$$

$$N(\alpha)\cos\alpha + 4T(\alpha)\,\text{sen}(\alpha) = 0$$

$$N(\alpha) = -T(\alpha)\frac{\text{sen}\,\alpha}{\cos\alpha}$$

$$1 - T(\alpha)\frac{\text{sen}^2\alpha}{\cos\alpha} - T(\alpha)\cos\alpha = 0$$

$$T(\alpha)\left(\frac{\text{sen}^2\alpha + \cos^2\alpha}{\cos\alpha}\right) = 1$$

$$T(\alpha)\left(\frac{\text{sen}^2\alpha + \cos^2\alpha}{\cos\alpha}\right) = 1$$

$$\boxed{T^1(\alpha)} = \cos\alpha =$$

$$\boxed{N(\alpha)} = -\text{sen}\,\alpha$$

$$\boxed{M(\alpha)} = (-17\,\text{sen}\,\alpha + 14{,}96)$$

SEZIONE TUBOLARE CAVO

ϕ 244,5 mm Spessore 6 mm

$A = 45\ cm^2$ $I = 3199\ cm^4$

$$\frac{R}{I} = \frac{1700\ \cancel{cm}}{3199\ cm^{\cancel{4}\,3}} = 0,531 \cdot \frac{1}{cm^3} = \frac{53100}{m^3} = a$$

$$\frac{R}{A} = \frac{1700\ \cancel{cm}}{55,1\ cm^{\cancel{2}}} = 30,8\,\frac{1}{cm} = \frac{30,8}{0,01} = \frac{3080}{m} = b$$

- imposto l'integrale in coordinate polari e lo molt. * 2 poiché è simmetrica

$$x = -2\,\frac{\frac{R}{I}\int_{62^\circ}^{90^\circ} M^0 M'\,d\alpha + \frac{R}{A}\int_{62^\circ}^{90^\circ} N^0 N'\,d\alpha}{\frac{R}{I}\int_{62^\circ}^{90^\circ} M'^2\,d\alpha + \frac{R}{A}\int_{62^\circ}^{90^\circ} N'^2\,d\alpha}$$

4

$$x = -2\,\frac{a\cdot\int_{62^\circ}^{90^\circ}(3200-14450\cos^2\alpha)(-17\,\text{sen}\,\alpha+14{,}892)\,d\alpha + b\cdot\int_{62^\circ}^{90^\circ}(-1700\cos^2(\alpha))(-\text{sen}(\alpha))\,d\alpha}{a\cdot\int_{62^\circ}^{90^\circ}(-17\,\text{sen}\,\alpha+14{,}892)^2\,d\alpha + b\cdot\int_{62^\circ}^{90^\circ}(-\text{sen}(\alpha))^2\,d\alpha}$$

$$x = -2\,\frac{a\int_{62^\circ}^{90^\circ}\left(-54400\,\text{sen}\,\alpha+47654{,}4+245650\cos^2\alpha\,\text{sen}\,\alpha-215189{,}4\cos^2\alpha\right)d\alpha + b\int_{62^\circ}^{90^\circ}\left(1700\cos^2(\alpha)\cdot\text{sen}(\alpha)\right)d\alpha}{a\int_{62^\circ}^{90^\circ}\left(289\,\text{sen}^2\alpha+221{,}7-2\cdot253\,\text{sen}\,\alpha\right)d\alpha + b\cdot\int_{62^\circ}^{90^\circ}+\text{sen}^2(\alpha)\,d\alpha}$$

- $\int \text{sen}\,\alpha\,d\alpha = -\cos\alpha$
- $\int \cos^2\alpha\,\text{sen}\,\alpha\,d\alpha = -\frac{1}{3}\cos(\alpha)^3$
- $\int \cos^2\alpha\,d\alpha = \frac{1}{2}(\alpha+\text{sen}\,\alpha\cos\alpha)$
- $\int \text{sen}^2\alpha\,d\alpha = \frac{1}{2}(\alpha-\text{sen}\,\alpha\cos\alpha)$

$$x = -2\,\frac{a\cdot\left[-54400(-\cos\alpha)\right]_{62^\circ}^{90^\circ} + a\cdot\left[47654{,}4(\alpha)\right]_{62^\circ}^{90^\circ} + a\cdot\left[245650\cdot\left(\frac{-\cos^3\alpha}{3}\right)\right]_{62^\circ}^{90^\circ} - a\left[215189{,}4\cdot\left(\frac{\alpha+\text{sen}\,\alpha\cos\alpha}{2}\right)\right]_{62^\circ}^{90^\circ} + b\cdot\left[1700\left(-\frac{\cos\alpha^3}{3}\right)\right]_{62^\circ}^{90^\circ}}{a\left[289\left(\frac{\alpha-\text{sen}\,\alpha\cos\alpha}{2}\right)\right]_{62^\circ}^{90^\circ} + a\left[221{,}7(\alpha)\right]_{62^\circ}^{90^\circ} + a\left[506(-\cos\alpha)\right]_{62^\circ}^{90^\circ} + b\cdot\left[\frac{\alpha-\text{sen}\,\alpha\cos\alpha}{2}\right]_{62^\circ}^{90^\circ}}$$

$$x = -2\,\frac{a\left\{\left[54400(\cos 90^\circ)-54400(-\cos 62^\circ)\right]+47654{,}4\left[\frac{\pi}{2}-\frac{\pi}{3}\right]+245650\left[\left(\frac{-\cos^3(90^\circ)}{3}\right)-\left(\frac{-\cos^3(62^\circ)}{3}\right)\right]-215189{,}4\left[\left(\frac{\frac{\pi}{2}+\text{sen}(90^\circ)\cos(90^\circ)}{2}\right)-\left(\frac{\frac{\pi}{3}+\text{sen}(62^\circ)\cos(62^\circ)}{2}\right)\right]\right\}+b\left\{1700\left[\left(\frac{-\cos^3(90^\circ)}{3}\right)-\left(\frac{-\cos^3(62^\circ)}{3}\right)\right]\right\}}{a\left\{289\left[\left(\frac{\frac{\pi}{2}-\text{sen}(90^\circ)\cos(90^\circ)}{2}\right)-\left(\frac{\frac{\pi}{3}-\text{sen}(62^\circ)\cos(62^\circ)}{2}\right)\right]+221{,}7\left[\frac{\pi}{2}-\frac{\pi}{3}\right]-506\left[(-\cos(90^\circ))-(-\cos(62^\circ))\right]\right\}+b\left\{\left[\left(\frac{\frac{\pi}{2}-\text{sen}(90^\circ)\cos(90^\circ)}{2}\right)-\left(\frac{\frac{\pi}{3}-\text{sen}(62^\circ)\cos(62^\circ)}{2}\right)\right]\right\}}$$

VALLICELLI

$$x = -2 \frac{a\left[-25513,6+26686,4+203889,5-1231,3\right]+b\left[51\right]}{a\left[17,34+124,1-237,3\right]+b\left[0,06\right]}$$

$$x = -2 \frac{a\left[192151\right]+b\left[51\right]}{a\left[-95,86\right]+b\left[0,06\right]}$$

$$\frac{\frac{53100}{m^3}\left[192151\right]+\frac{3080}{m}\left[51\right]}{\frac{53100}{m^3}\left[-95,86\right]+\frac{3080}{m}\left[0,06\right]}\cdot -2 = x$$

$x \simeq 4008\ KN$