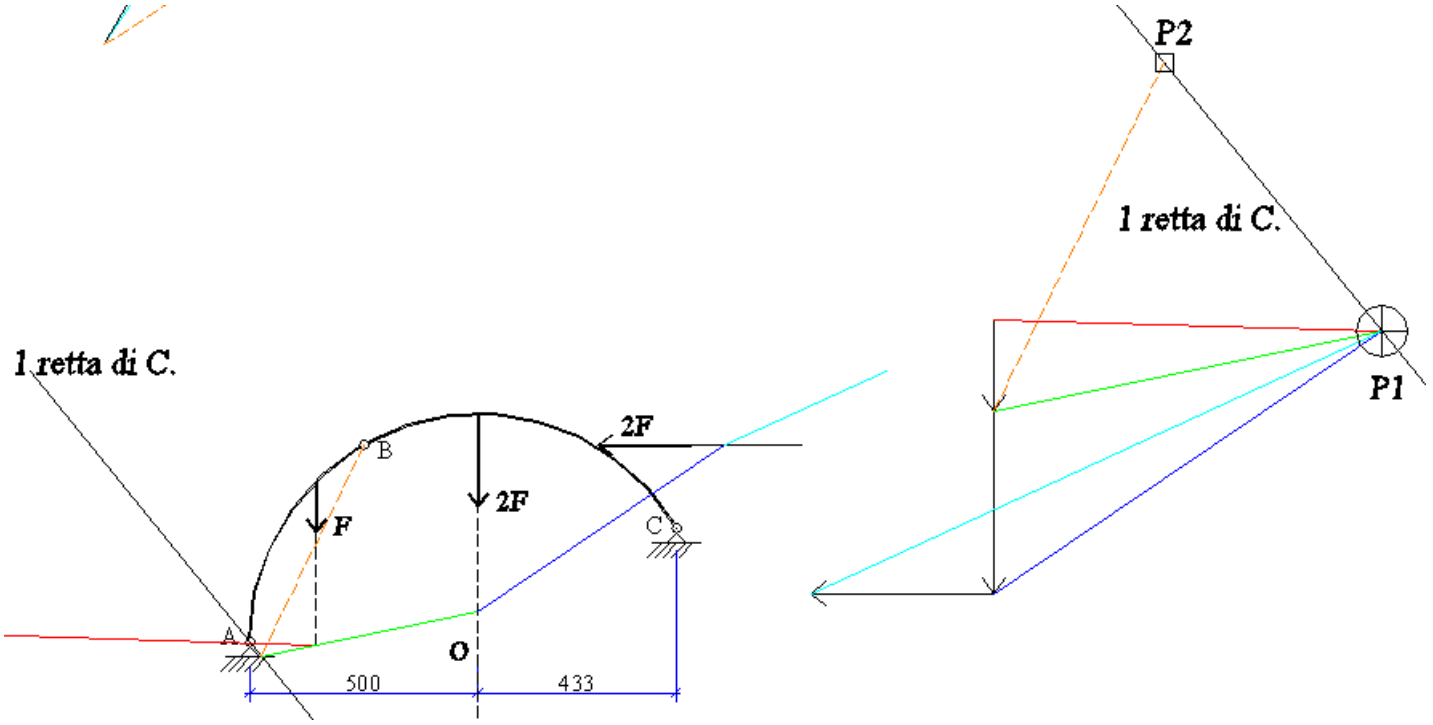
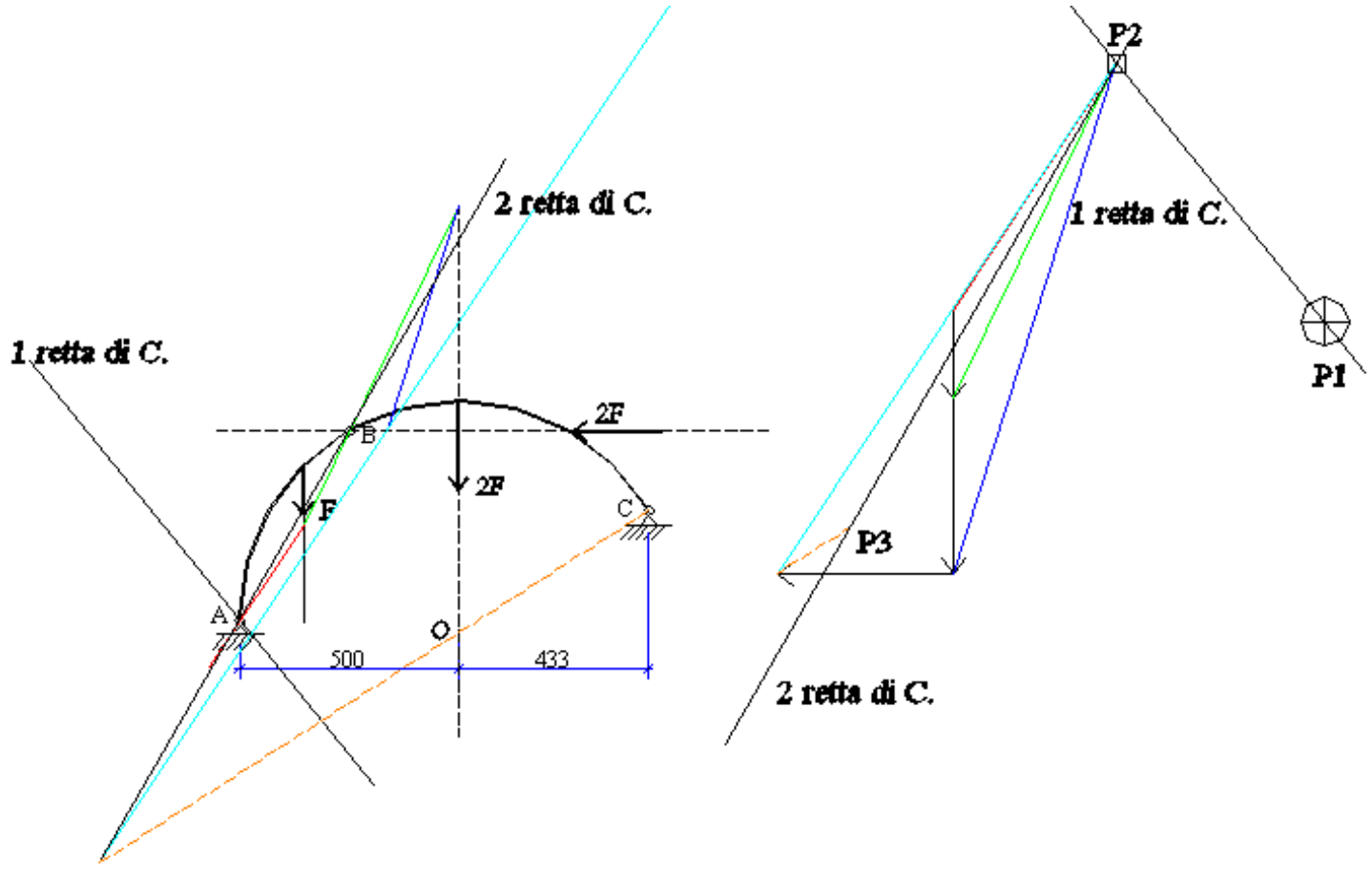
SCIENZA DELLE COSTRUZIONI II: TEORIA DELLE STRUTTURE TRASPARENTI

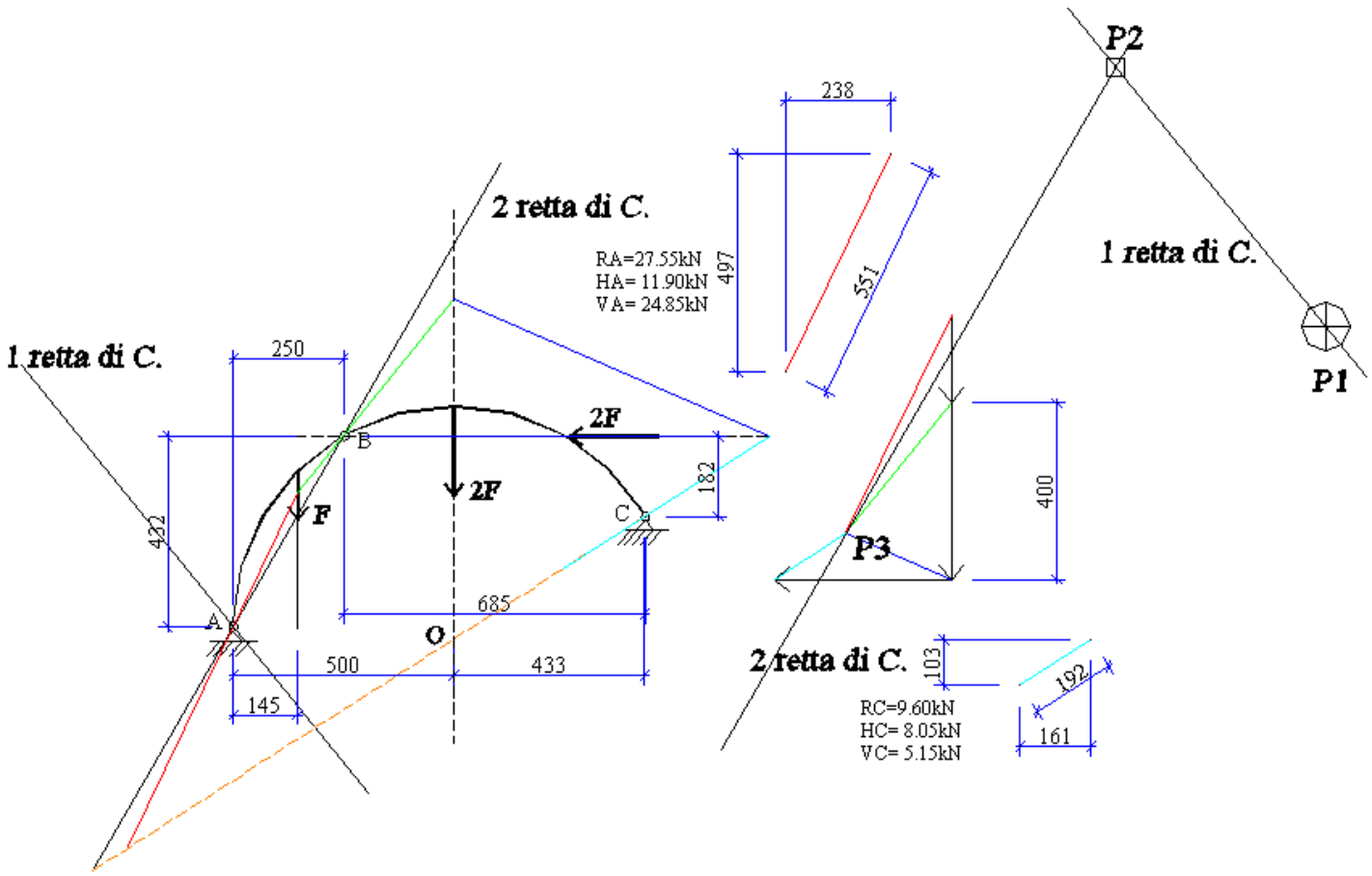
Prof. Brighenti - Prova scritta del **20/01/2015**

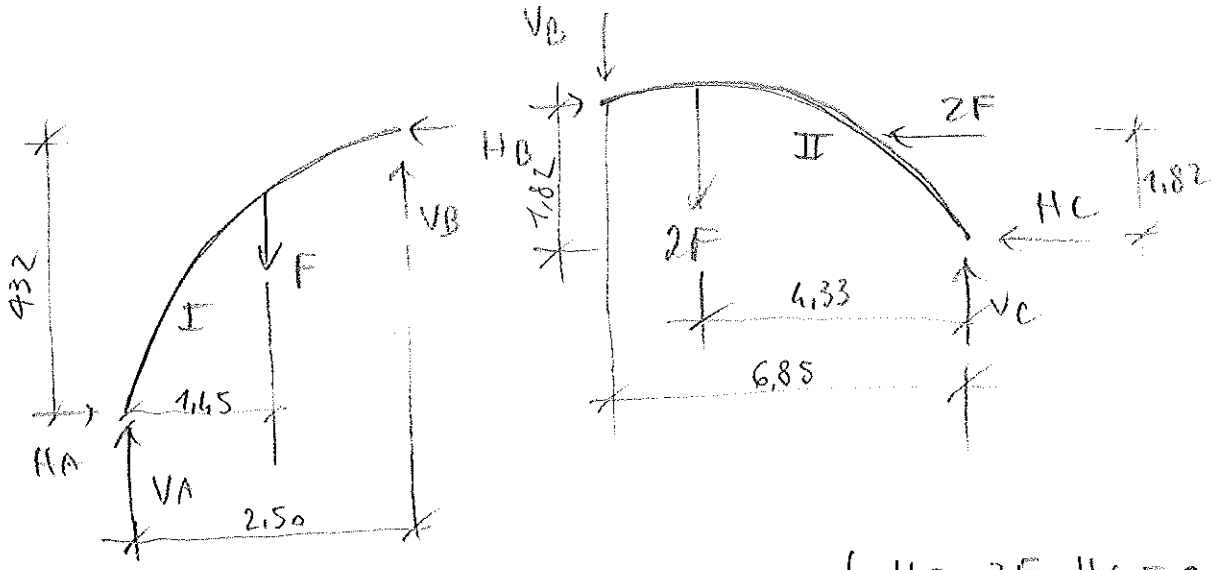
SOLUZIONE

1)






P2
238
2 retta di C.
1 retta di C.
RA=27.55kN
HA= 11.90kN
VA= 24.85kN
497
551
1 retta di C.
P1
250
2F
B
2F
F
182
C
432
400
P3
685
A
O
500
433
2 retta di C.
103
192
145
RC=9.60kN
HC= 8.05kN
VC= 5.15kN
161



I) $\begin{cases} H_A - H_B = 0 \\ V_A - F + V_B = 0 \\ \circlearrowright_A : F \cdot 1{,}65 - V_B \cdot 2{,}50 - H_B \cdot 4{,}32 = 0 \end{cases}$

$$H_B = \frac{1{,}65 - V_B \cdot 2{,}50}{4{,}32} = 3{,}36 - 0{,}578\, V_B$$

$$\underline{V_A = F - V_B = 24{,}79\ KN}$$

$$\underline{H_B = 11{,}91\ KN}$$

$$\underline{H_A = 11{,}91\ KN}$$

II $\begin{cases} H_B - 2F - H_C = 0 \\ -V_B - 2F + V_C = 0 \\ \circlearrowright_C : -2F \cdot 4{,}33 + H_B \cdot 1{,}82 - V_B \cdot 6{,}85 = 0 \\ \quad -2F \cdot 1{,}82 \end{cases}$

$$-173 + 1{,}82\,(3{,}36 - 0{,}578\, V_B) - 6{,}85\, V_B = 0$$

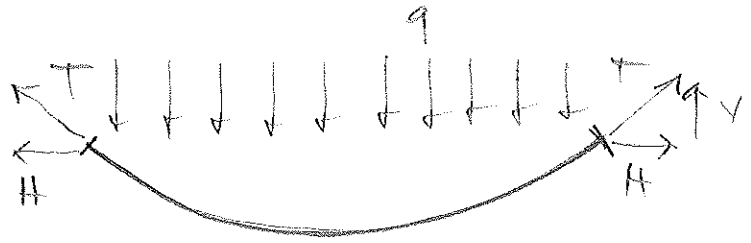
$$7{,}902\, V_B = -116{,}88\ KN$$

$$\underline{V_B = -14{,}79\ KN}$$

$$\underline{V_C = 2F + V_B = 5{,}21\ KN}$$

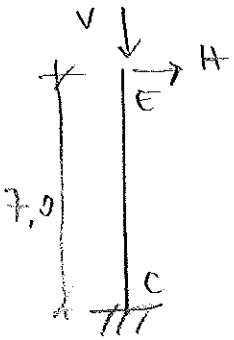
$$\underline{H_C = H_B - 2F = -8{,}09\ KN}$$

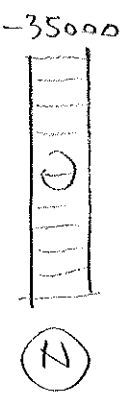
2)

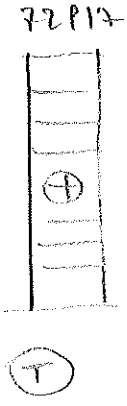


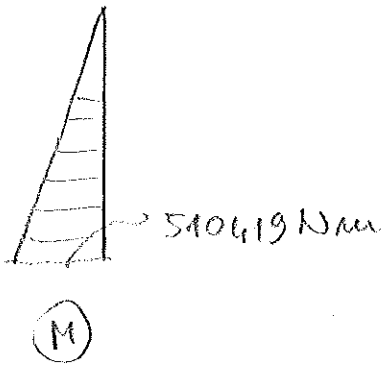
$$H = \frac{q\ell^2}{8f} = \frac{7000 \cdot 10^2}{8 \cdot 1{,}20} = 72\,917\ N$$

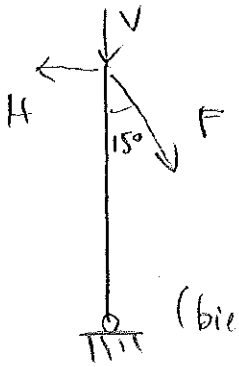
$$V = \frac{q\ell}{2} = 35\,000\ N \qquad T = \sqrt{H^2 + V^2} = 80\,882\ N$$







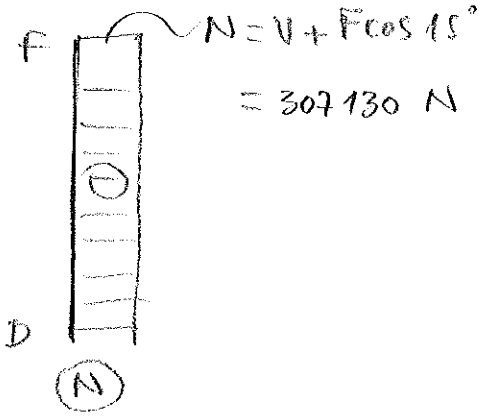




$\rightarrow$:

$-H + F \sin 15° = 0$

$$F = \frac{H}{\sin 15°} = 281730\ N$$

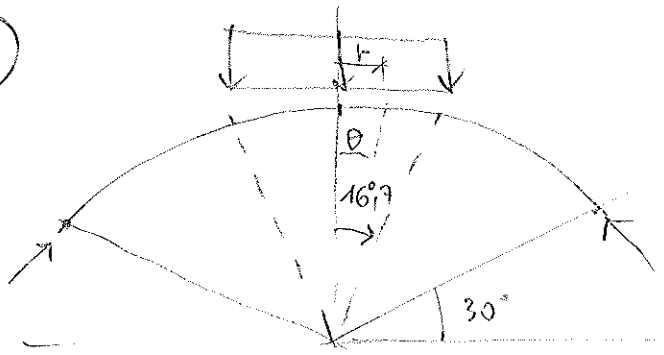


tensione nella fune FH:

$A_{\phi 20} = 3{,}14\ cm^2$

$$\sigma = \frac{F}{A_{\phi 20}} = \frac{281730}{3{,}14} = 897\ MPa\ (\text{eccessivo})$$

3)



Peso proprio:

$S(\theta) = 2\pi R(R - R\cos\theta)$

$Q_1(\theta) = 2\pi R^2(1-\cos\theta)\cdot s\cdot\gamma$

$Q_1(\theta) = 200\pi(1-\cos\theta)\cdot 0{,}1\cdot 18000$

$= 1130973(1-\cos\theta)$

Carico q:

$Q_2(\theta) = q\cdot\pi r^2 = q\cdot\pi(\overbrace{R\,tg\theta}^{r})^2$

$Q_2 = 5000\cdot\pi\cdot 100\cdot tg^2\theta \qquad 0 \le \theta \le 16{,}7°$

$$n_x(\theta) = -\frac{Q(\theta)}{2\pi R\sin^2\theta} = -\frac{\overbrace{1130973(1-\cos\theta)}^{Q_1} + \overbrace{15707{,}96\,tg^2\theta}^{Q_2}}{62{,}83\cdot\sin^2\theta}$$

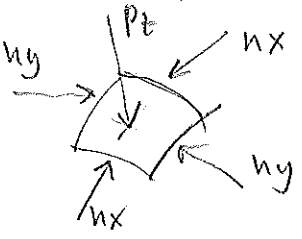
$n_x(16{,}7) = \frac{-47702 - 141385}{18{,}05} = 10473$ N/m $\qquad \sigma_x = -0{,}104$ MPa verificato ($<1{,}5$)

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

$= \left(-18000\cdot 0{,}1 - \frac{5000}{\cos\theta}\right)10\cdot\cos\theta - n_x$

$R_x = R_y = R$

$n_y(\theta = 16{,}7) = 63112 + 10473 = 73585$ N/m $\qquad \sigma_y = 0{,}074$ MPa non verificato



$\theta > 16{,}7°$

$$n_x = -\frac{\pi a^2 q + 2\pi R^2(1-\cos\theta)s\gamma}{2\pi R\sin^2\theta}$$

$n_x(\theta = 60°) = -\frac{141372 + 565487}{47{,}12} = -15001$ N/m $\qquad \sigma_x = -0{,}375$ MPa ($<1{,}5$) OK

$n_y(\theta = 60°) = -p_z\cdot R - n_x = +\gamma s\cos\theta\cdot R - n_x = 9000 + 15001 = 24001$ N/m

$\sigma_y = 0{,}24$ MPa $> 0{,}06$ non verificato