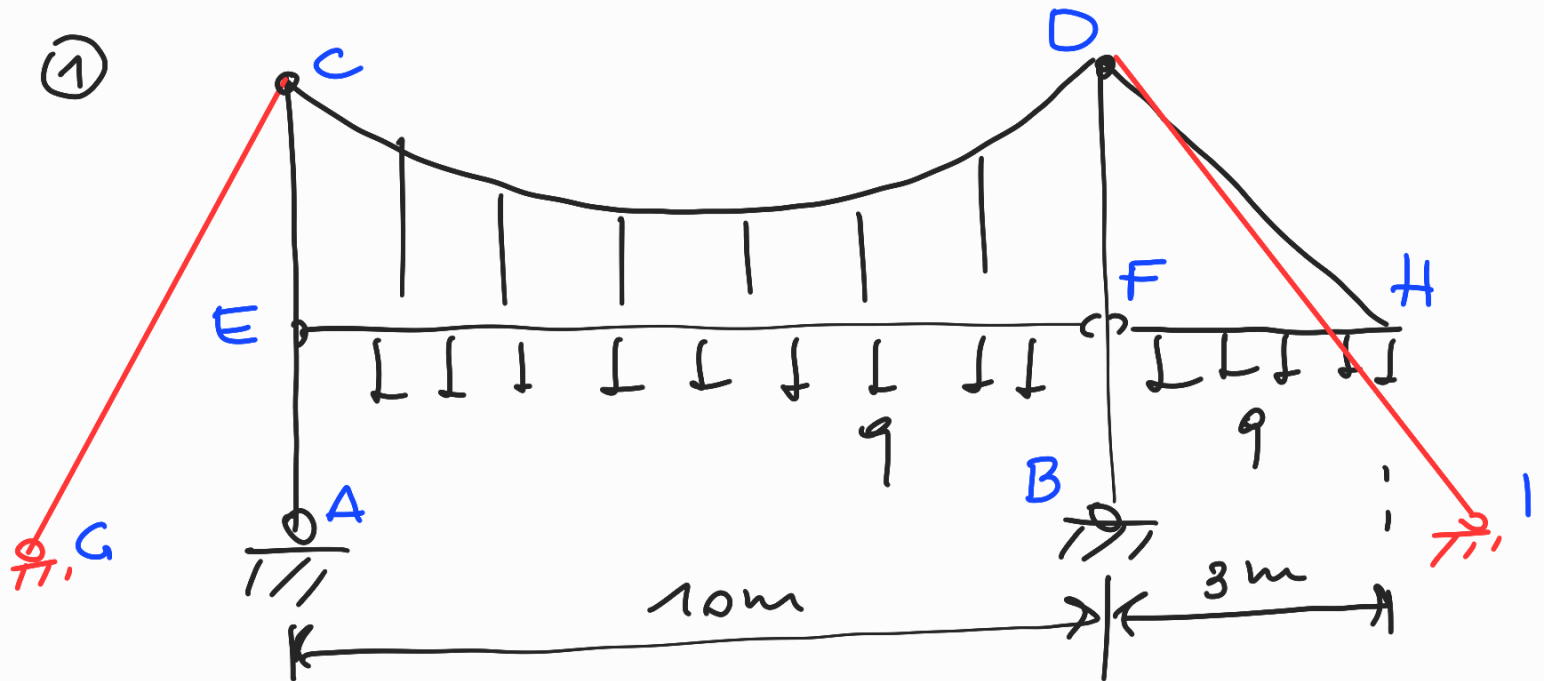


Es. 2



$$q = 3 \cdot 1,5 = 4,5 \text{ kN/m}$$

$$H = \frac{qL^2}{8f} = \frac{4,5 \cdot 10^2}{8 \cdot 1} = 56,25 \text{ kN}$$

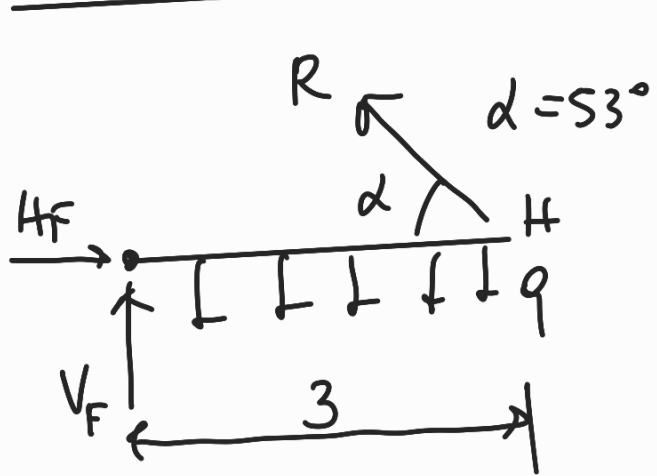
$$V = q \frac{L}{2} = 22,5 \text{ kN}$$

$$T_{\text{TOT}} = \sqrt{H^2 + V^2} = 60,58 \text{ kN}$$

$$A_{\text{sezioe min}} = \frac{60,58 \cdot 10^3}{400} = 151 \text{ mm}^2$$

$$1\phi 16 A = 201 \text{ mm}^2$$

Stato FH



$$\rightarrow: HF - R \cos \alpha = 0$$

$$\uparrow: VF + R \sin \alpha - 3q = 0$$

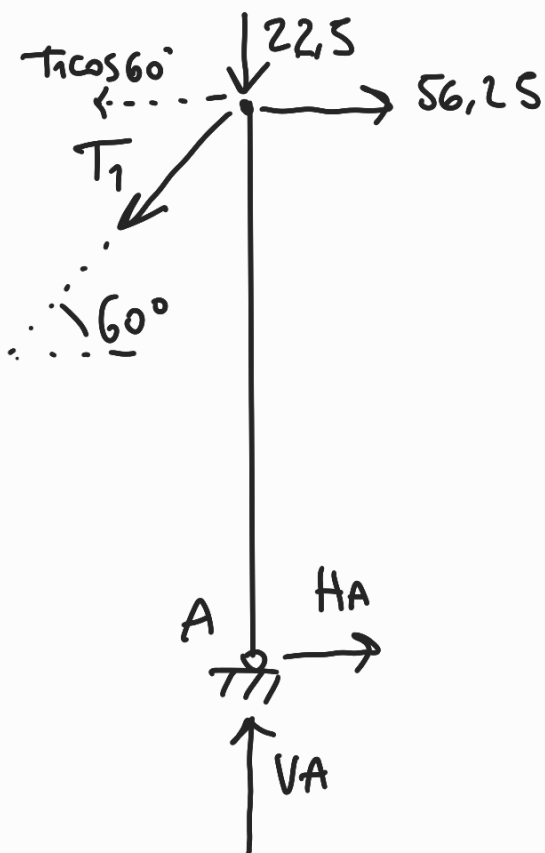
$$\curvearrow_H: -3q \cdot 1,5 + VF \cdot 3 = 0$$

$$VF = 6,75 \text{ kN}$$

$$R = \frac{3q - VF}{\sin \alpha} = 8,45 \text{ kN} \quad HF = 5,09 \text{ kN}$$

2-3) Azioni negli strobili e nelle colonne

Colonna AC



$$\sum MA = 0:$$

$$56,25 \cdot 7 - T_1 \cos 60^\circ \cdot 7 = 0$$

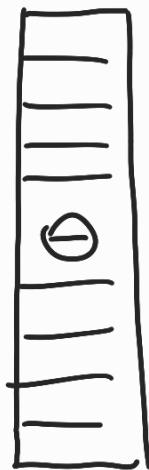
$$T_1 = 112,5 \text{ kN}$$

(N)

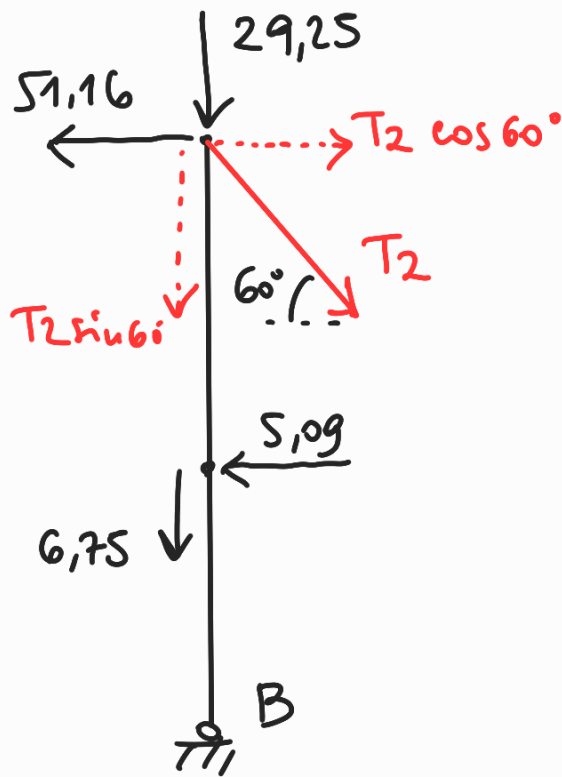
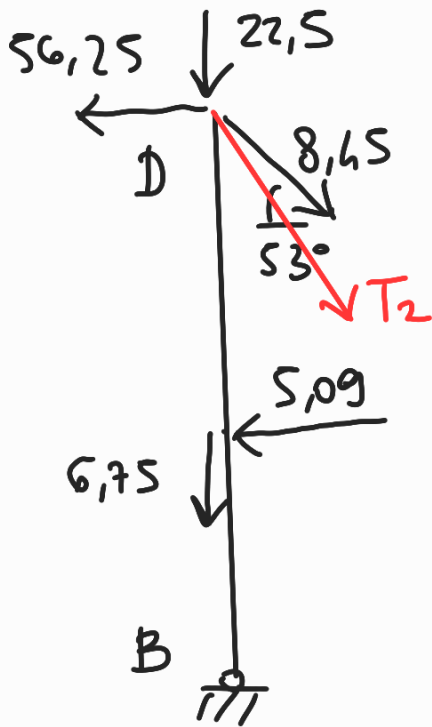
-135 kN

(T)

(M)



Colonna BD



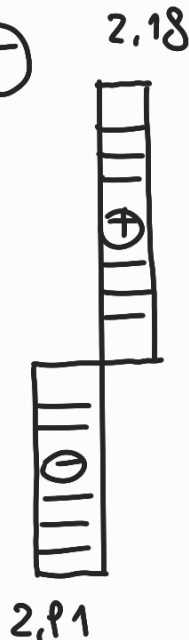
$$\sum M_B = 0; -51,16 \cdot 7 - 5,09 \cdot 3 + T_2 \cos 60^\circ \cdot 7 = 0$$

$$T_2 = 106,68 \text{ kN}$$

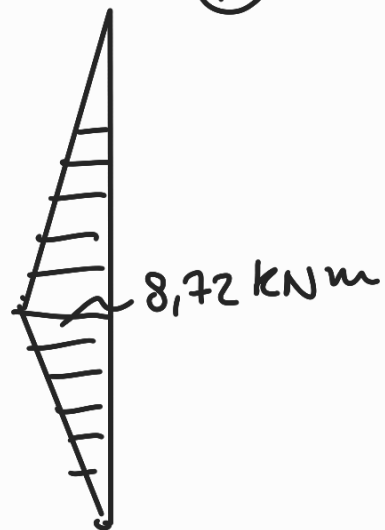
(N)



(T)



(M)



(4) Allungamento fune

Adottiamo sempre il seno = $H = 56,25 \text{ kN}$

length of cable: $L = l + \frac{8f^2}{3l} = 10 + \frac{8 \cdot 1^2}{3 \cdot 10} = 10,27 \text{ m}$

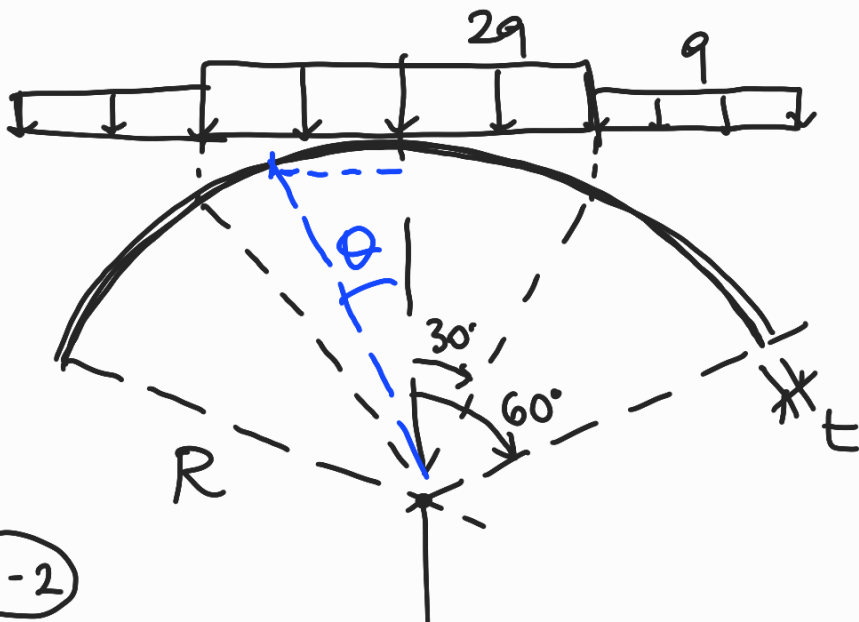
$$\Delta L = \frac{HL}{EA} = \frac{56,25 \cdot 10^3 \cdot 10,270}{2,1 \cdot 10^5 \cdot 201} = 13,68 \text{ mm}$$

$$A = 2,01 \text{ cm}^2$$

$$L_{\text{fin}} = L + \Delta L = 10,283 \text{ m}$$

$$f = \sqrt{(L_f - l) \cdot \frac{3l}{8}} = 1,03 \text{ m}$$

Es. 3



(1-2)

$$\theta \leq 30^\circ$$

$$Q_\theta = \pi (R \sin \theta)^2 \cdot 2q = 1527 \cdot \sin^2 \theta$$

$$Q_{\text{opp}} = S_\theta \cdot t \cdot \gamma_m = 2\pi R \cdot (R - R \cos \theta) \cdot 0,15 \cdot 18$$

• $\theta = 5^\circ$: $Q_\theta = 11,6 \text{ kN}$, $Q_{\text{opp}} = 5,23 \text{ kN}$

$$u_x(5^\circ) = \frac{-Q_{TOT}}{2\pi R \sin^2 \theta} = -\frac{11,6 + 5,23}{2\pi \cdot 9 \cdot \sin^2 5^\circ} = -39,18 \text{ kN/m}$$

$$\sigma_x(5^\circ) = \frac{u_x}{t} = \frac{-39,18}{150} = -0,26 \text{ MPa} (< 1,3 \text{ MPa, verificato})$$

$$u_y(5^\circ) = -p_t \cdot R - u_x$$

$$p_{t,IP} = \gamma_m \cdot t \cdot \cos \theta = 18 \cdot 0,15 \cdot \cos 5^\circ = 2,69 \text{ kN/m}^2$$

$$p_{t,q} = 29 \cos^2 \theta = 5,95 \text{ kN/m}^2$$

$$p_t = p_{t1} + p_{t,pp} = 8,64 \text{ kN/m}^2$$

$$u_y(5^\circ) = -8,64 \cdot 9 + 39,18 = -38,67 \text{ kN/m}$$

$\theta > 30^\circ$

$$\bullet \underline{\theta = 45^\circ} \quad Q_\theta = 381,7 + \left[(R \sin 45^\circ)^2 \pi - (R \sin 30^\circ)^2 \pi \right] \cdot q =$$

$$= 381,7 + 190,8 = 572,54 \text{ kN}$$

$$Q_{\theta,pp} = S_\theta \cdot t \cdot \gamma_m = 2\pi R (R - R \cos \theta) \cdot 0,15 \cdot 18 =$$

$$= 402 \text{ kN}$$

$$u_x(45^\circ) = \frac{-Q_{\theta,TOT}}{2\pi R \sin^2 \theta} = -34,46 \text{ kN/m}$$

$$\sigma_x(45^\circ) = \frac{u_x}{t} = \frac{-34,46}{150} = -0,23 \text{ MPa} (< 1,3 \text{ MPa verificato})$$

$$h_y(45^\circ) = -p_z \cdot R - h_x$$

$$\left. \begin{aligned} p_{zpp} &= 1,91 \text{ kN/m}^2 \\ p_{zq} &= q \cos^2 45^\circ = 1,5 \text{ kN/m}^2 \end{aligned} \right\} p_z = 3,41 \text{ kN/m}^2$$

$$h_y(45^\circ) = -3,41 \cdot 9 + 34,46 = +3,77 \text{ kN/m}$$

$$\sigma_y(45^\circ) = \frac{h_y}{t} = 0,025 \text{ MPa} (< 0,12 \text{ MPa verificato})$$

• $\theta = 60^\circ$

$$Q_{\theta pp} = 2\pi R(R - R \cos \theta) \gamma_m \cdot t = 687 \text{ kN}$$

$$Q_{\theta} (60^\circ) = 381,7 + 381,7 = 763,4 \text{ kN}$$

$$h_x(60^\circ) = - \frac{Q_{TOT}}{2\pi R \sin^2 60^\circ} = - \frac{1450,4}{2\pi \cdot R \sin^2 60^\circ} = -34,19 \frac{\text{kN}}{\text{m}}$$

$$\sigma_x(60^\circ) = \frac{h_x}{t} = -0,23 \text{ MPa verificato}$$

$$h_y(60^\circ) = -p_z(60^\circ) \cdot R - h_x$$

$$\left. \begin{aligned} p_{zpp} &= \gamma_m \cdot t \cdot \cos 60^\circ = 1,35 \text{ kN/m}^2 \\ p_{zq} &= q \cos^2 60^\circ = 0,75 \text{ kN/m}^2 \end{aligned} \right\} p_z = 2,1 \frac{\text{kN}}{\text{m}^2}$$

$$h_y(60^\circ) = -p_z \cdot R - h_x = -2,1 \cdot 9 + 34,19 = 15,29 \text{ kN/m}$$

$$\sigma_y = \frac{h_y}{t} = 0,102 \text{ MPa} (< 0,12 \text{ MPa, verificato})$$