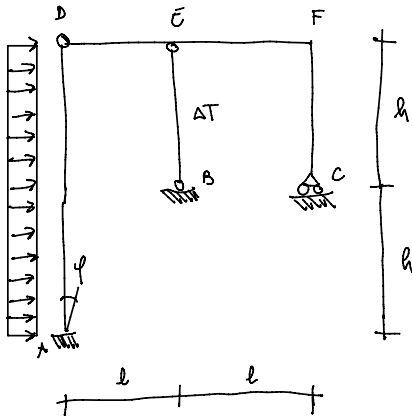




$$q = 2000 \text{ N/m}$$

$$l = 2 \text{ m}$$

$$h = 3 \text{ m}$$

$$\Delta T = +20^\circ \text{C}$$

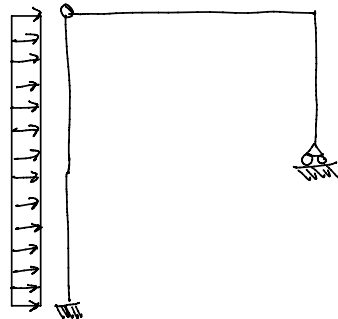
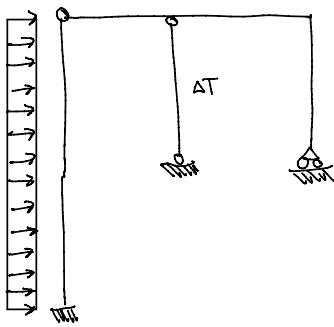
$$\alpha = 1.2 \cdot 10^{-5} \text{ }^\circ \text{C}^{-1}$$

Adotto un profilo IPE 200

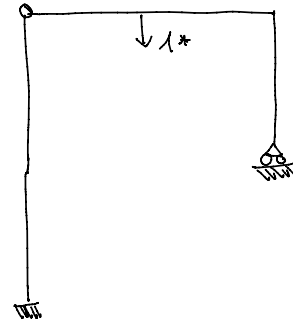
$$A = 28.5 \text{ cm}^2 \quad J = 1943 \text{ cm}^4$$

Struttura a vista approssimativa

$$1) \phi = 0$$



$$+ X_1$$

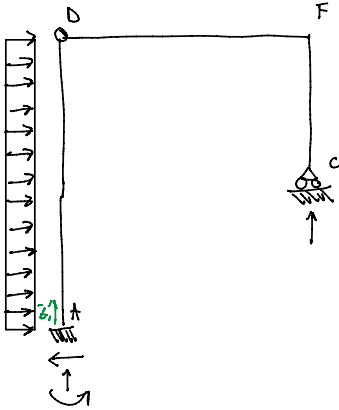


$$\begin{aligned} & \uparrow 1^* \\ & + \Delta T L v_e = - h \alpha \Delta T \\ & \downarrow 1^* \end{aligned}$$

System 0

System 1

System 0



$$\rightarrow H_A = 2qh = 12000 \text{ N}$$

$$\sum \mathcal{M}_x V_c 2l = 0 \Rightarrow V_A = 0$$

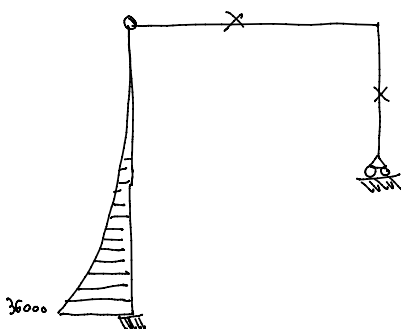
$$\sum \mathcal{M}_x - H_A 2h + 2qh^2 + M_A = 0$$

$$M_A = 2qh^2 = 36000 \text{ N}\cdot\text{m}$$

$$z_1: N(z_1) = -2qh^2 + 2qh^2 - q\frac{z^2}{2}$$

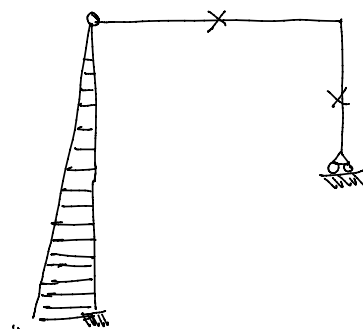
$$T(z_1) = 2qh - qz$$

$$N(z_1) = 0$$



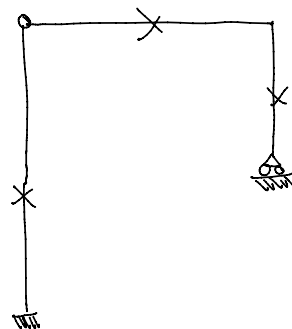
$$36000$$

$$M [\text{N}\cdot\text{m}]$$



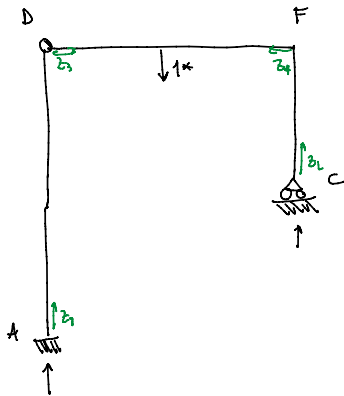
$$12000$$

$$T [\text{N}]$$



$$N [\text{N}]$$

Sistema 1



$$H_A = 0$$

$$M_A = 0 \quad \Rightarrow \quad -l + 2l \cdot \frac{1}{l} + M_A = 0$$

$$V_A + V_C = 1$$

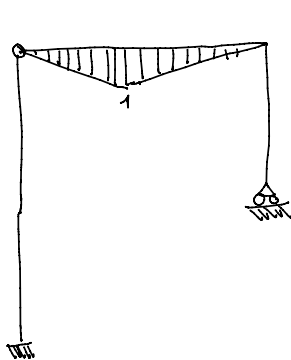
$$V_C \cdot 2l - 1l = 0 \quad \Rightarrow \quad V_C = \frac{1}{2} \rightarrow V_A = \frac{1}{2}$$

$$z_1: M(z_1) = 0 \quad T(z_1) = 0 \quad N(z_1) = -\frac{1}{2}$$

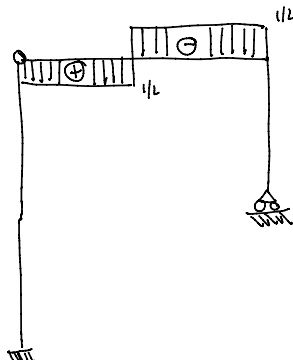
$$z_2: M(z_2) = 0 \quad T(z_2) = 0 \quad N(z_2) = -\frac{1}{2}$$

$$z_3: M(z_3) = \frac{1}{2}l \quad T(z_3) = \frac{1}{2} \quad N(z_3) = 0$$

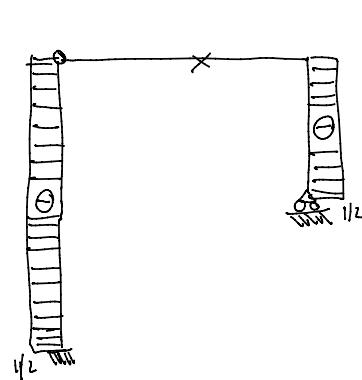
$$z_4: M(z_4) = \frac{1}{2}l \quad T(z_4) = -\frac{1}{2} \quad N(z_4) = 0$$



$M[N \cdot m]$



$T[N]$



$N[N]$

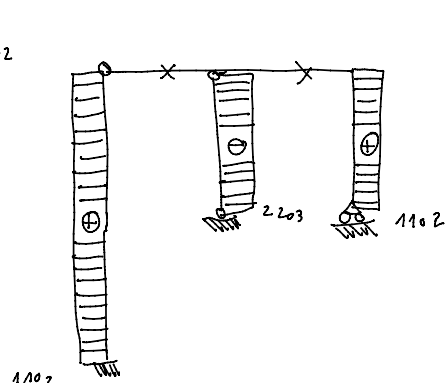
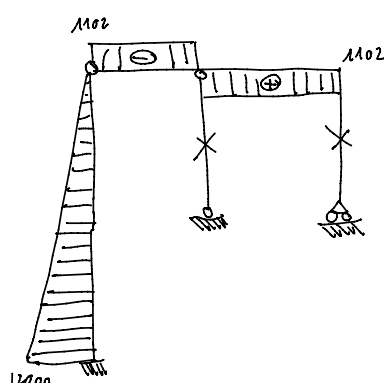
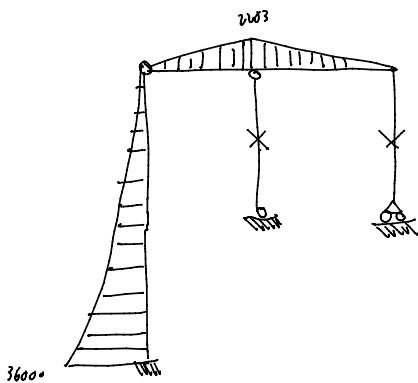
$$\eta^T = -k \alpha \Delta T = -7.20 \cdot 10^{-4}$$

$$\eta_{10} = 0$$

$$\eta_{11} = \frac{2}{ES} \int_0^l \left(\frac{1}{2} z \right)^2 dz = \frac{4}{3ES}$$

$$\eta_{10} + \eta_{11} X_1 = \eta^T$$

$$X_1 = -2203 \text{ N}$$



2) $\varphi = 1^\circ$ rotazione applicata nel punto A

$$\Delta u = 5 \text{ cm}$$

$$L u_e = \eta^D + \eta^C$$

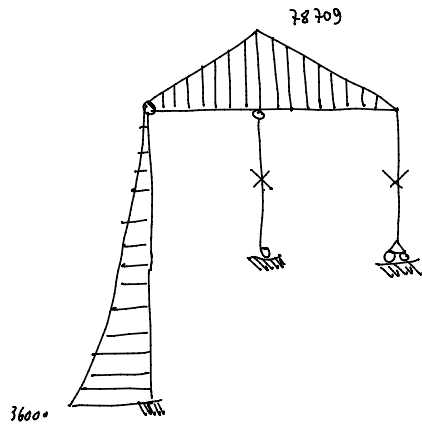
$$\eta^T = -k \alpha \Delta T = -7.20 \cdot 10^{-4}$$

$$\eta^D = M_A^L \varphi = 0 \cdot 2^\circ = 0 \quad \text{distorsione m A}$$

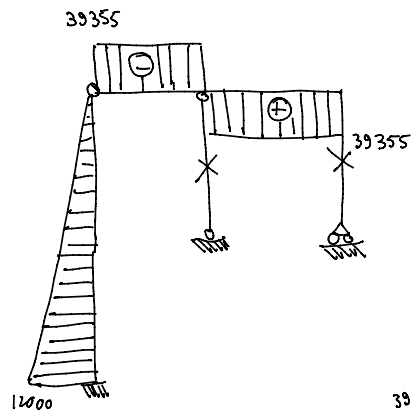
$$\eta^C = -V_A^L \Delta u = -\frac{1}{L} \cdot 0.05 = -\frac{1}{40} \quad \text{allungamento m A}$$

$$\eta_{10} + \eta_{11} x_1 = \eta^T + \eta^D + \eta^C$$

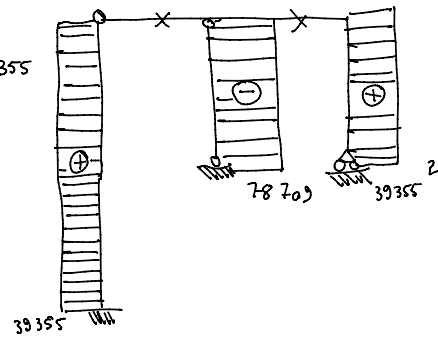
$$x_1 = \frac{\eta^T + \eta^C}{\eta_{11}} = -78709 \text{ N}$$



M [N.m]



T [N]



N [N]