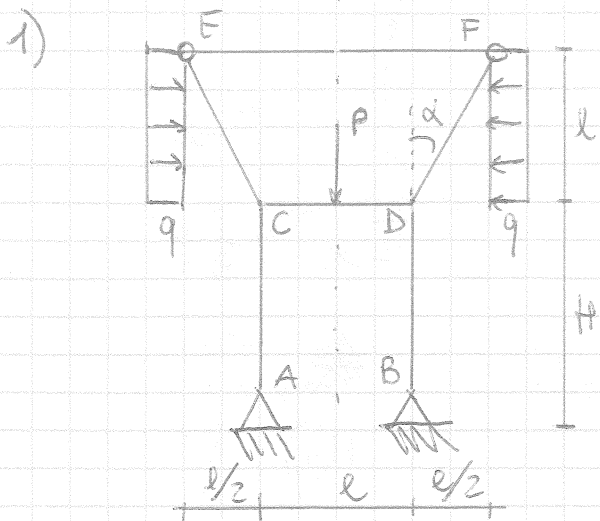




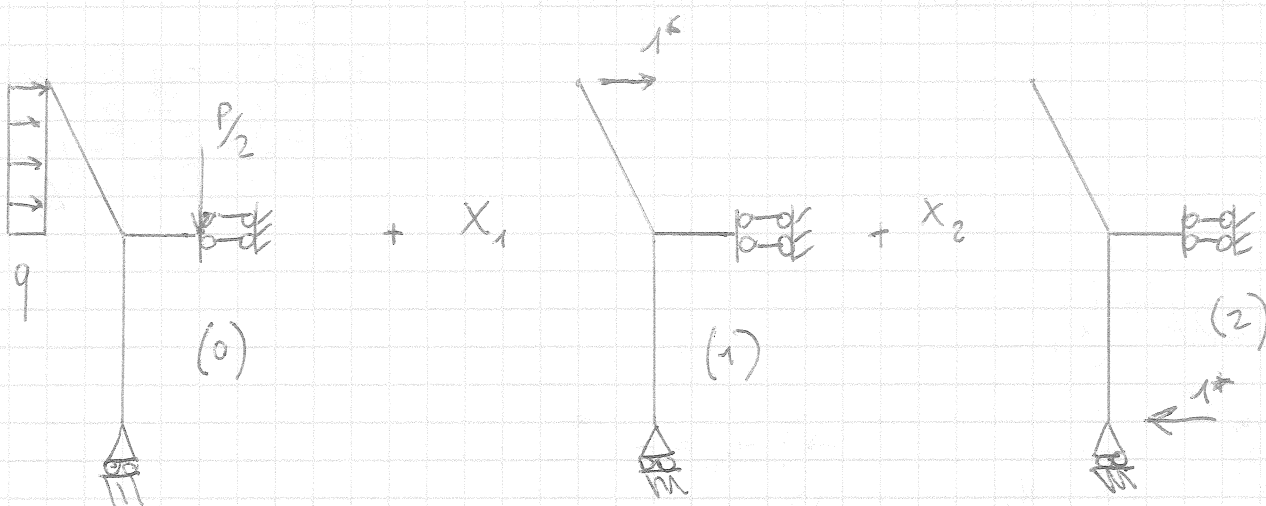
$$H = 3m = \frac{3}{2} l$$

$$l = 2m$$

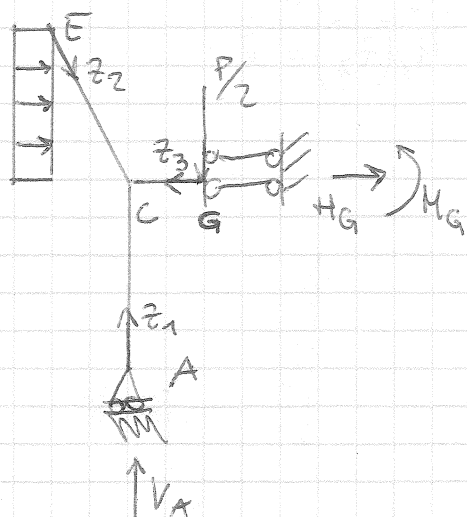
$$q = 2000 \text{ N/m}$$

$$P = \frac{ql}{2} = 2000 \text{ N}$$

$$\alpha = \arctan(1/2)$$



SISTEMA (0)

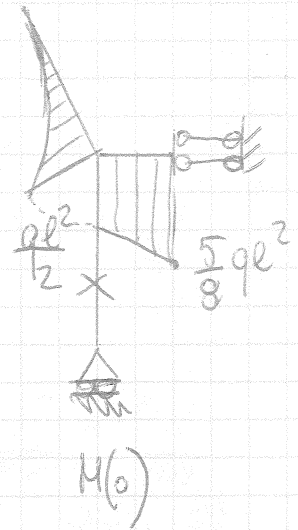
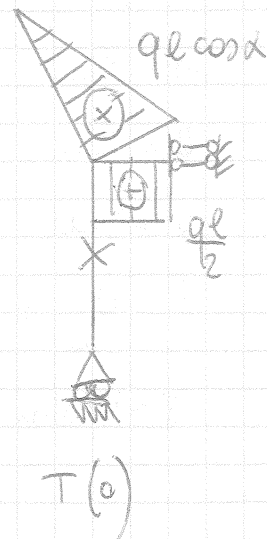
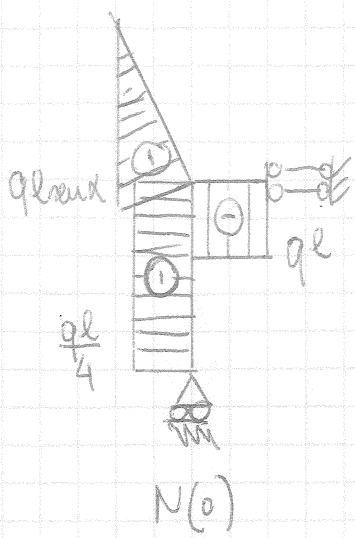


$$\uparrow) V_A = P/2 = \frac{ql}{4}$$

$$\rightarrow) H_G = -ql$$

$$\curvearrowright) -P/2 \cdot l/2 + M_G - \frac{ql^2}{2} = 0$$

$$M_G = \frac{ql^2}{8} + \frac{ql^2}{2} = \frac{5}{8} ql^2$$



$$N_0(z_2) = -q z_2 \cdot \sin \alpha \cos \alpha$$

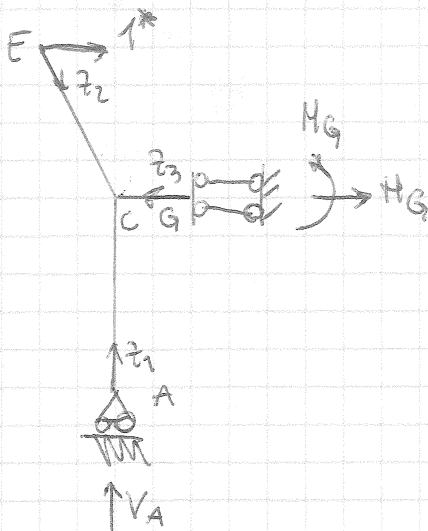
$$T_0(z_2) = q z_2 \cdot \cos^2 \alpha$$

$$M_0(z_1) = 0$$

$$M_0(z_2) = -\frac{q}{2} (z_2 \cdot \cos \alpha)^2$$

$$M_0(z_3) = \frac{5}{8} q l^2 - \frac{q l}{4} z_3$$

SISTEMA (1)



$$\rightarrow H_G = -1^*$$

$$\uparrow V_A = 0$$

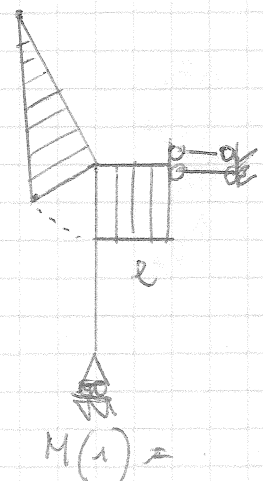
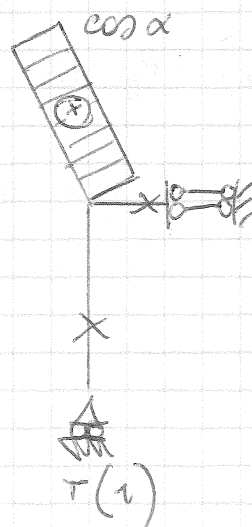
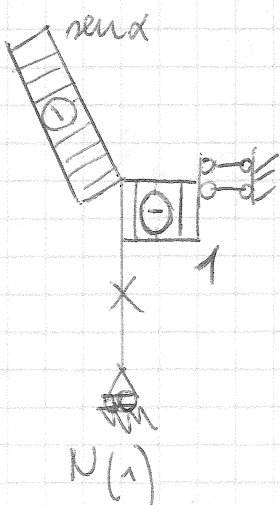
$$\curvearrowright -1^* \cdot l + M_G = 0$$

$$M_G = l$$

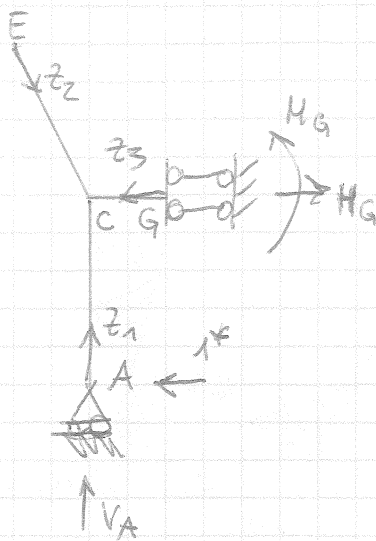
$$M_1(z_1) = 0$$

$$M_1(z_2) = -1 \cdot z \cos \alpha$$

$$M_1(z_3) = l$$



SISTEMA 2



$$\rightarrow) H_G = 1$$

$$\uparrow) V_A = 0$$

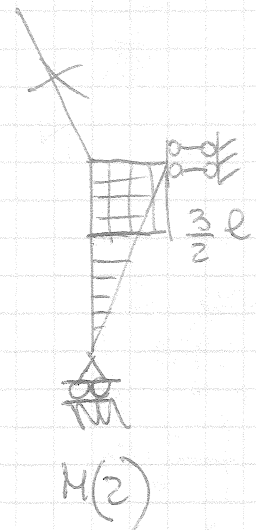
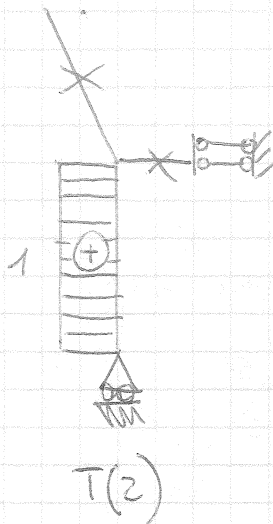
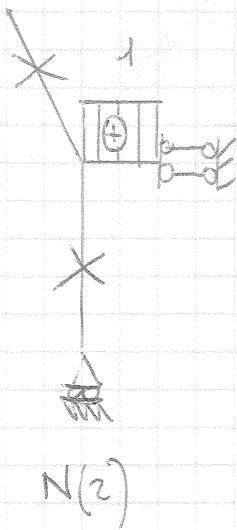
$$C) -1 \cdot \frac{3l}{2} + M_G = 0$$

$$M_G = \frac{3l}{2}$$

$$M_2(z_1) = z$$

$$M_2(z_2) = 0$$

$$M_2(z_3) = \frac{3l}{2}$$



$$M_{10} = \frac{1}{EJ} \int_0^{l/\cos\alpha} \left(-\frac{qz^2 \cos^2\alpha}{2} \right) (-z \cos\alpha) dz + \frac{1}{EJ} \int_0^{l/2} \left(\frac{5}{8} ql^2 - \frac{qlz}{4} \right) (l) dz = 0,421 \frac{ql^4}{EJ}$$

$$M_{20} = \frac{1}{EJ} \int_0^{l/2} \left(\frac{3l}{2} \right) \left(\frac{5}{8} ql^2 - \frac{qlz}{4} \right) dz = \frac{27}{64} \frac{ql^4}{EJ}$$

$$M_{11} = \frac{1}{EJ} \int_0^{l/\cos\alpha} z^2 \cos^2\alpha dz + \frac{1}{EJ} \int_0^{l/2} l^2 dz = \frac{0,873 l^3}{EJ}$$

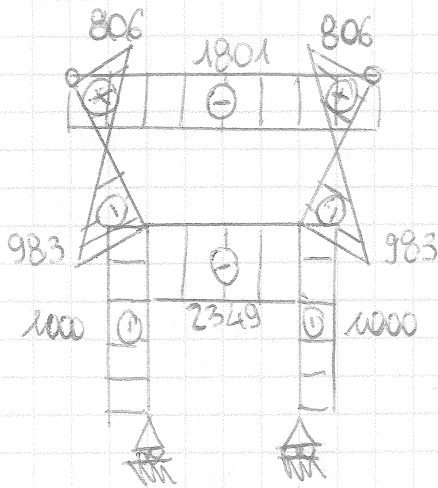
$$M_{22} = \frac{1}{EJ} \int_0^{\frac{3l}{2}} z^2 dz + \frac{1}{EJ} \int_0^{l/2} \frac{9l^2}{4} dz = \frac{9l^3}{4EJ}$$

$$M_{12} = \frac{1}{EJ} \int_0^{l/2} \left(\frac{3l}{2} \right) (l) dz = \frac{3l^3}{4EJ}$$

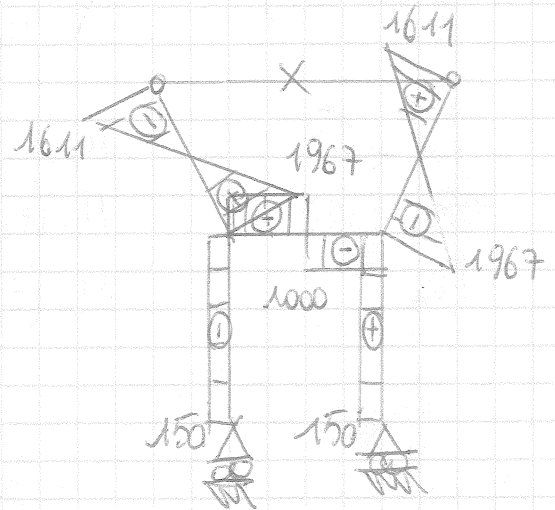
$$\begin{aligned} (1) & \rightarrow \begin{cases} M_{11} \cdot X_1 + M_{12} \cdot X_2 = -M_{10} \\ M_{12} \cdot X_1 + M_{22} \cdot X_2 = -M_{20} \end{cases} \\ (2) & \rightarrow \end{aligned}$$

$$X_1 = -1801,1 \text{ N}$$

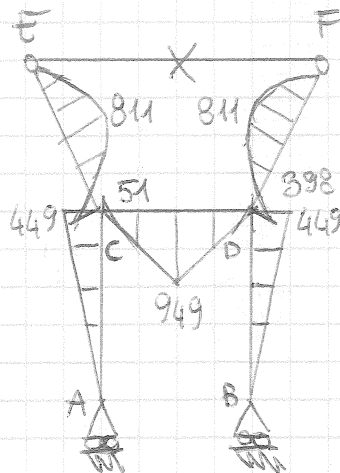
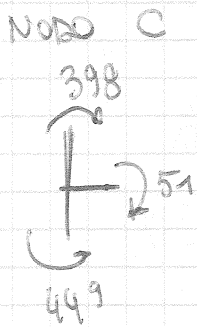
$$X_2 = -149,6 \text{ N}$$



N



T



M

$$\begin{aligned} 2) \quad M_{\max} &= 949 \text{ Nm} = M_G \\ N_{\max} &= 2349 \text{ N} = N_G \end{aligned}$$

$$W_{\min} = \frac{949 \cdot 10^3}{390} = 2433,33 \text{ mm}^3 \rightarrow W_{\min} = 24,3 \text{ cm}^3$$

$$\text{Adatto IPE 100} \quad W_x = 34,26 \text{ cm}^3 \quad I_x = 80,14 \text{ cm}^4 \quad A = 10,32 \text{ cm}^2$$

$$\sigma_{\max} = \frac{N}{A} + \frac{M}{W} = \frac{2349}{10,32 \cdot 10^2} + \frac{2433,33 \cdot 10^3}{34,26 \cdot 10^3} = 29,9 < 390 \text{ OK}$$

$$3) M_{10}^N = \frac{1}{EA} \int_0^{l/\cos\alpha} (-qz \sin\alpha \cos\alpha) (\sin\alpha) dz + \frac{1}{EA} \int_0^{l/2} qz dz = 0,387 \frac{ql^2}{EA}$$

$$M_{20}^N = \frac{1}{EA} \int_0^{l/2} (-ql) dz = -\frac{ql^2}{2EA}$$

$$M_{11}^N = \frac{1}{EA} \int_0^{l/\cos\alpha} \sin^2\alpha dz + \frac{1}{EA} \int_0^{l/2} 1 dz = \frac{l \sin^2\alpha}{\cos\alpha EA} + \frac{l}{2EA}$$

$$M_{22}^N = \frac{1}{EA} \int_0^{l/2} 1 dz = \frac{l}{2EA}$$

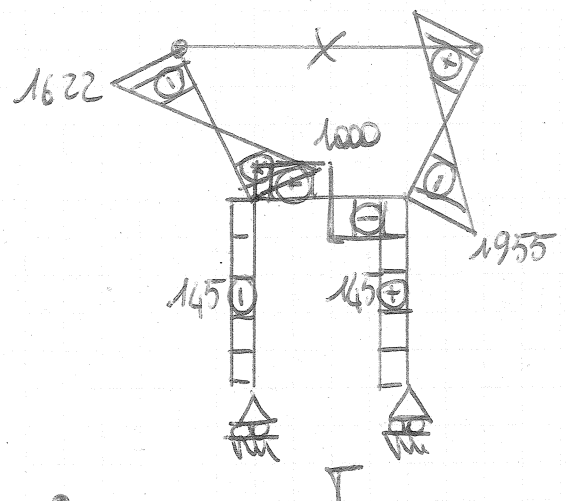
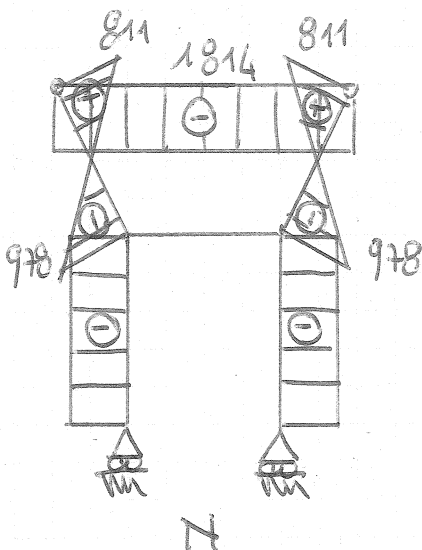
$$M_{12}^N = \frac{1}{EA} \int_0^{l/2} (-1) dz = -\frac{l}{2EA}$$

$$M_{ij}^{TOT} = M_{ij} + M_{ij}^N$$

$$X_1 = -1814 \text{ N}$$

$$X_2 = -145,1 \text{ N}$$

$$(1) \rightarrow \begin{cases} M_{11}^{TOT} \cdot X_1 + M_{12}^{TOT} \cdot X_2 = -M_{10}^{TOT} \\ M_{12}^{TOT} \cdot X_1 + M_{22}^{TOT} \cdot X_2 = -M_{20}^{TOT} - \int_0^l (-1) \cdot \alpha \Delta t dz \end{cases}$$



NOBO C

