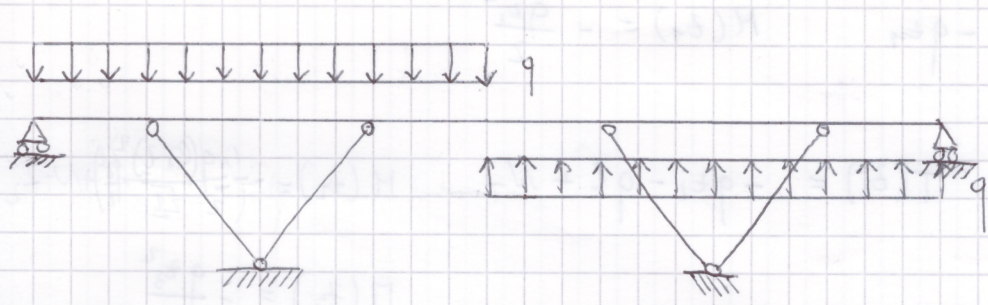
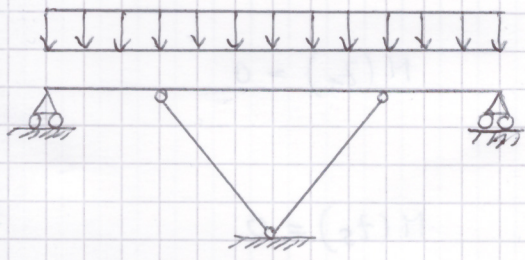


TOTALE 15/11/2021

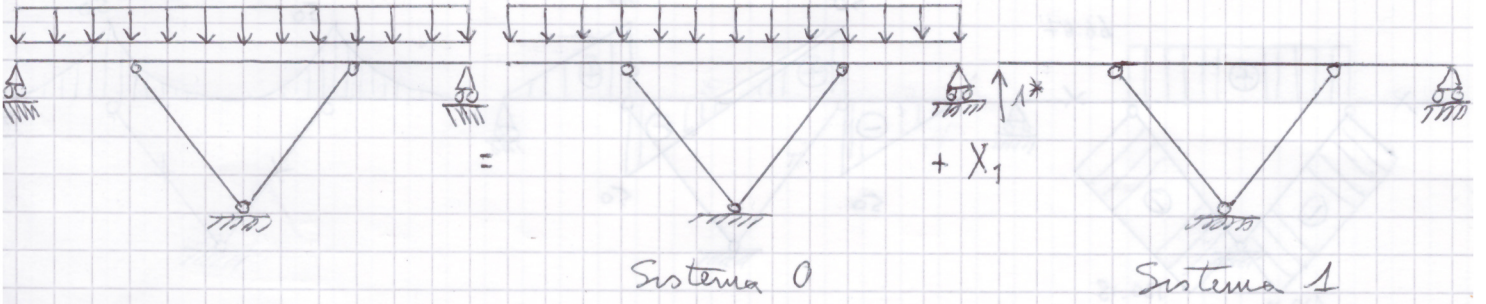


$h = 3\text{ m}$
 $l = 2\text{ m}$
 $q = 25\text{ kN/m}$
 $\tan \alpha = \frac{3}{2} \rightarrow \alpha = 56.31^\circ$

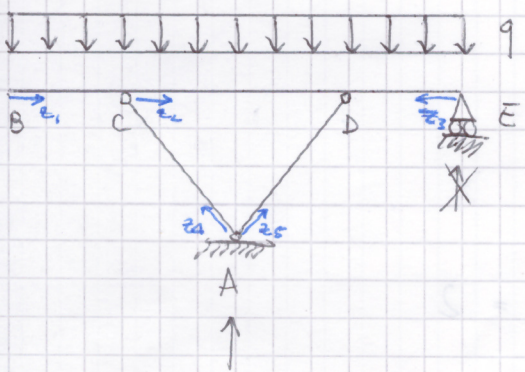
Struttura antisimmetrica



1 volta iperstatica

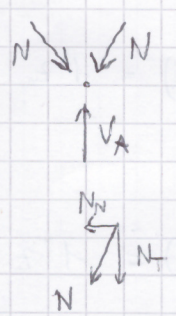


Sistema 0



$A) V_E = 0$
 $\uparrow) V_A = 4ql = 200\text{ kN}$
 $\rightarrow) H_A = 0$

Nodo A



$$2N \sin \alpha = 4ql \rightarrow N = \frac{2ql}{2 \sin \alpha} = 120.18\text{ kN}$$

$$N_v = N \cos \alpha = \frac{4ql}{3} = 66.67\text{ kN}$$

$$N_h = N \sin \alpha = 2ql = 100\text{ kN}$$

Asta BC

$$N(z_1) = 0 \quad T(z_1) = -qz_1 \quad M(z_1) = -\frac{qz_1^2}{2}$$

Asta CD

$$N(z_2) = N_N = 66.67 \text{ kN} \quad T(z_2) = -qz_2 - ql + N_T \quad M(z_2) = -\frac{q(l+z_2)^2}{2} + N_T z_2$$

Asta ED

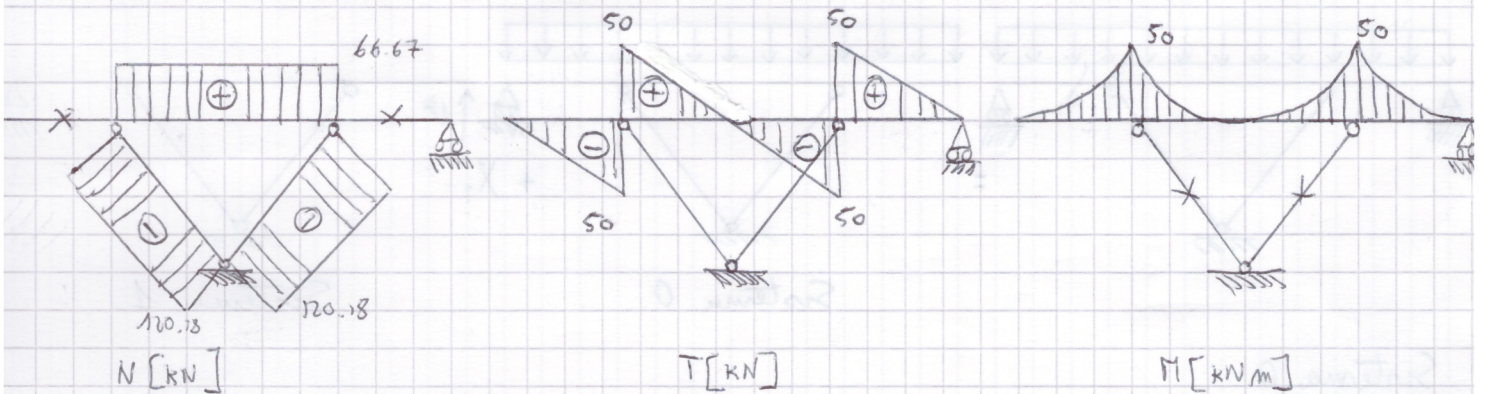
$$N(z_3) = 0 \quad T(z_3) = qz_3 \quad M(z_3) = -\frac{qz_3^2}{2}$$

Asta AC

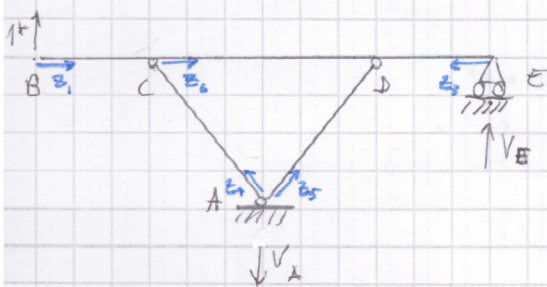
$$N(z_4) = 120.18 \text{ kN} \quad T(z_4) = 0 \quad M(z_4) = 0$$

Asta AD

$$N(z_5) = 120.18 \text{ kN} \quad T(z_5) = 0 \quad M(z_5) = 0$$



Sistema 1



$$\begin{aligned} \rightarrow H_A &= 0 \\ \uparrow V_B &= 1 \\ \uparrow V_A &= V_B + 1^* = 2 \end{aligned}$$

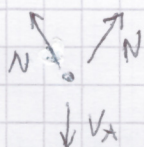
Asta BC

$$N(z_1) = 0 \quad T(z_1) = 1^* \quad M(z_1) = 1^* z$$

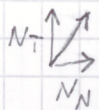
Asta DE

$$N(z_3) = 0 \quad T(z_3) = -1^* \quad M(z_3) = 1^* z$$

Nodo A



$$2N \sin \alpha = 2 \rightarrow N = \frac{1}{\sin \alpha} = 1.20 \text{ kN}$$



$$N_N = N \cos \alpha = 2/3$$

$$N_T = N \sin \alpha = 1^*$$

Aktion AC

$$N(z_4) = 1.20 \text{ kN}$$

$$T(z_4) = 0$$

$$M(z_4) = 0$$

Aktion AD

$$N(z_5) = 1.20 \text{ kN}$$

$$T(z_4) = 0$$

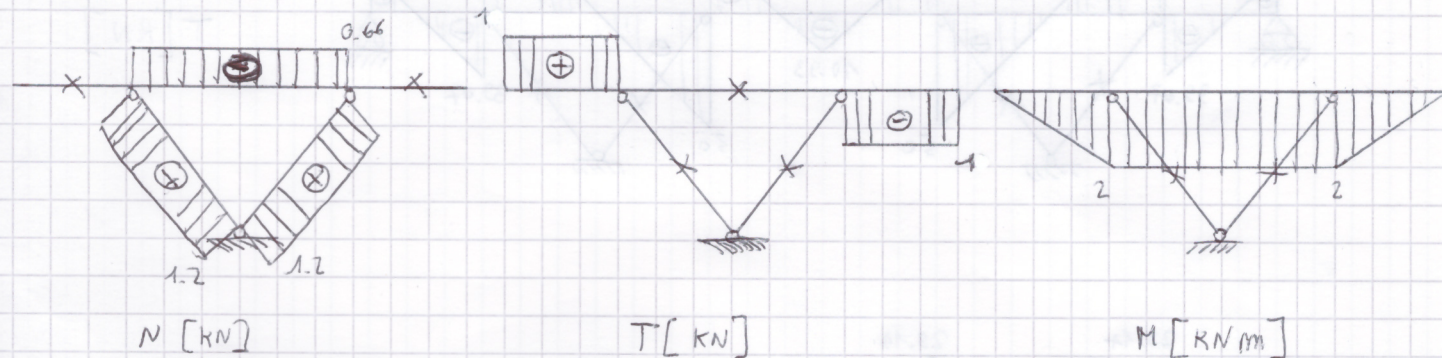
$$M(z_5) = 0$$

Aktion CD

$$N(z_2) = -0.67 \text{ kN}$$

$$T(z_2) = 0$$

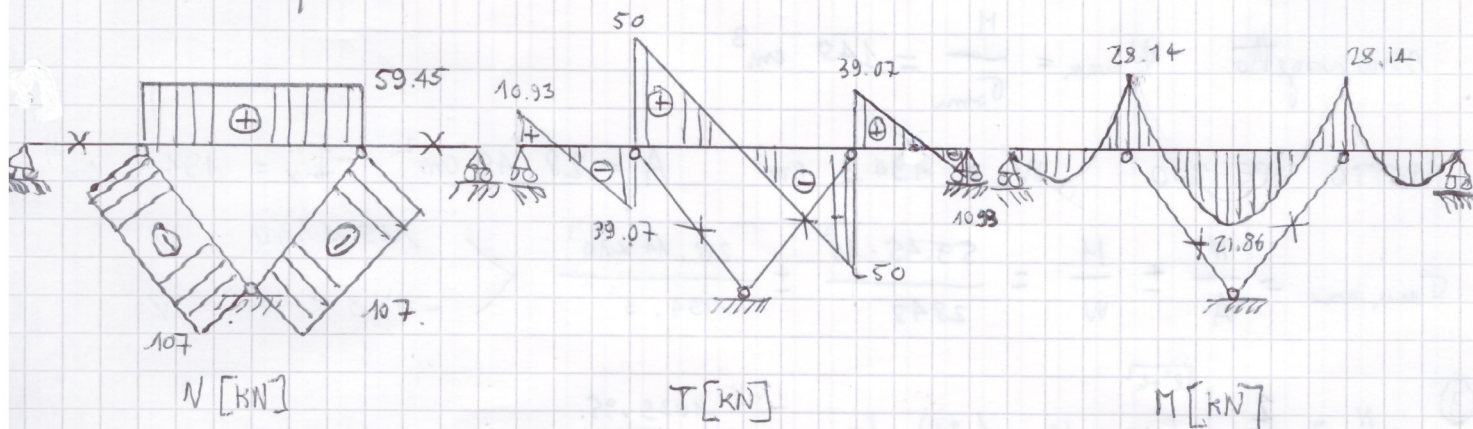
$$M(z_2) = 2$$

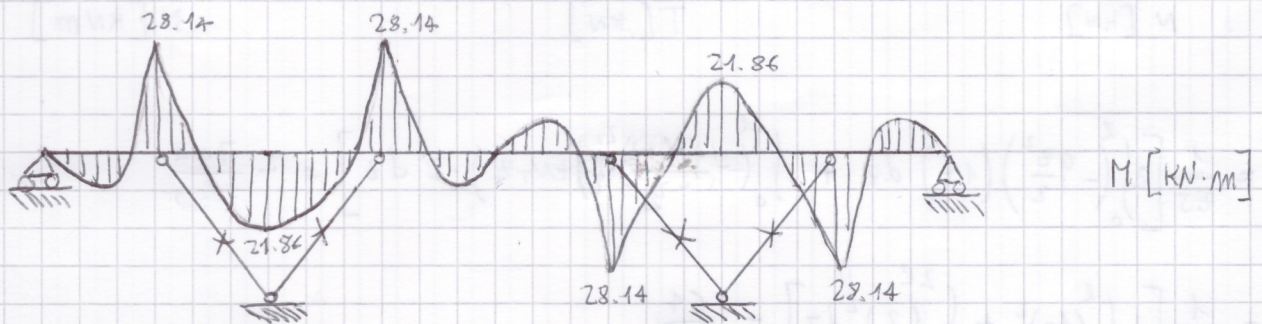
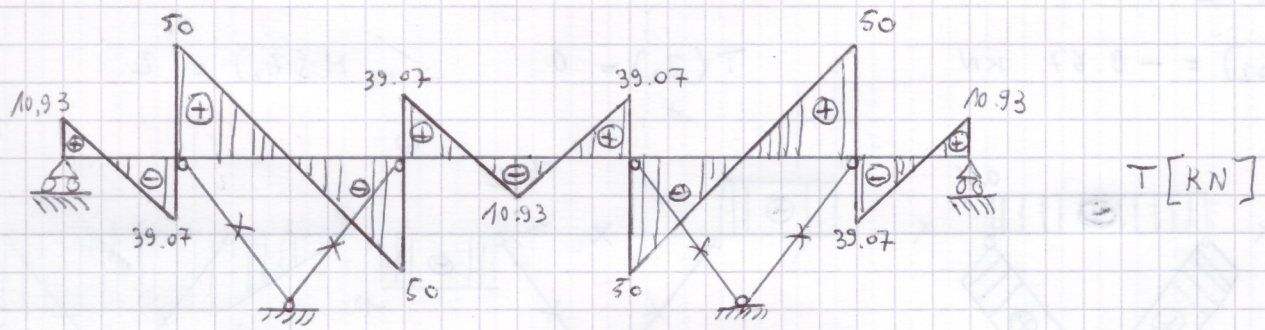
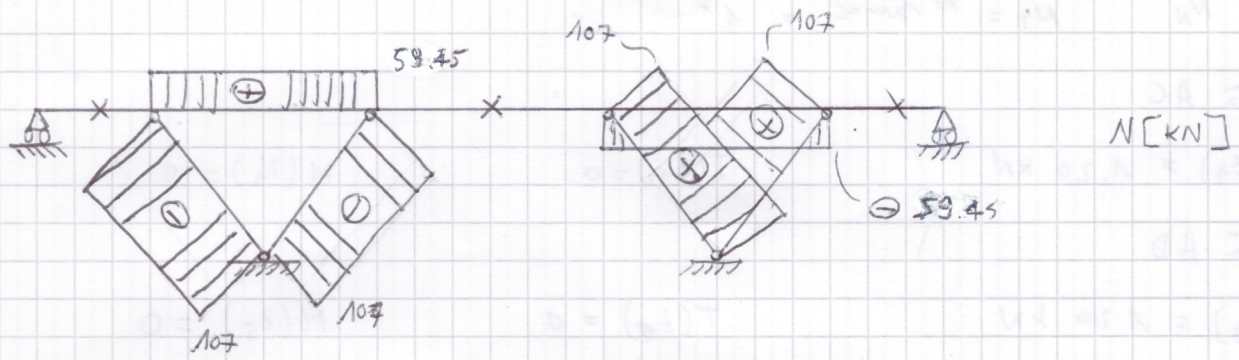


$$\eta_{10} = \frac{1}{EJ} \left[2 \int_0^l \left(-\frac{qz^2}{2} \right) (1z) dz + \int_0^{2l} \left(-\frac{q(l+z)^2}{2} + N_T z \right) \cdot 2 dz \right] = -\frac{700}{3EJ}$$

$$\eta_{11} = \frac{1}{EJ} \left[2 \int_0^l (1z)^2 dz + \int_0^{2l} (2z)^2 dz \right] = \frac{64}{3EJ}$$

$$X_1 = -\frac{\eta_{10}}{\eta_{11}} = +10.93 \text{ kN}$$





$M = 28.14 \text{ kN}\cdot\text{m}$ $\sigma_{amm} = 190 \text{ MPa}$
 $N = 59.45 \text{ kN}$

semiprogetto $W_{min} = \frac{M}{\sigma_{amm}} = 148 \text{ cm}^3$

ADOTTO IPE 200 $W_x = 194.3 \text{ cm}^3$ $A = 28.48 \text{ cm}^2$ $I_x = 194^3 \text{ cm}^4$

$\sigma_{amm} = \frac{N}{A} \pm \frac{M}{W} = \frac{59.45 \cdot 10^3}{2848} \pm \frac{28.14 \cdot 10^3}{194.3} < \begin{matrix} 165 < 190 & \checkmark \\ -123 < 190 & \checkmark \end{matrix}$

③ $\eta_{10}^N = \frac{2}{EA} \int_0^{\sqrt{2} \cdot 1.20} (-120.19 - 1.20) dz \Rightarrow -\frac{1039.95}{EA}$

$\eta_{11}^N = \frac{2}{EA} \int_0^{\sqrt{2} \cdot 1.20} (1.20)^2 dz \Rightarrow \frac{5.19}{EA}$

$(\eta_{11} + \eta_{11}^N) X_1 + \eta_{10} = 0$

$$X_1 = 11.25 \text{ kN}$$

