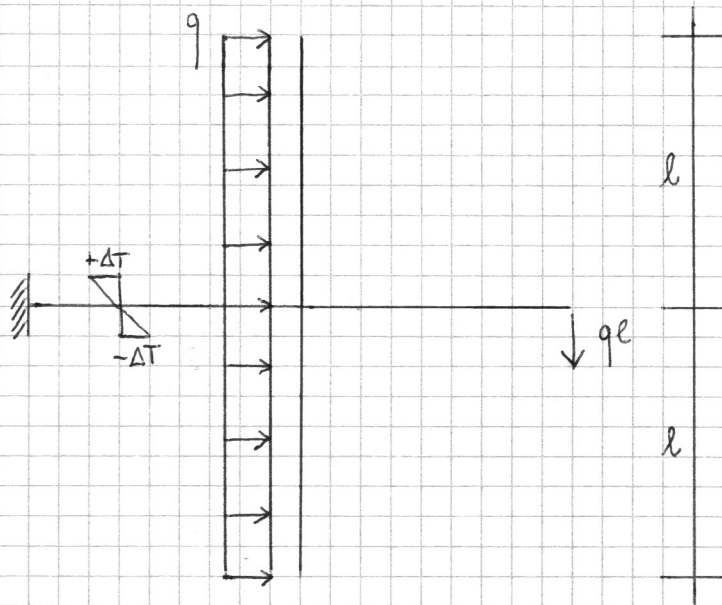




DATI:

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

$$q = 1000 \text{ N/m}$$

$$E = 210000 \text{ MPa}$$

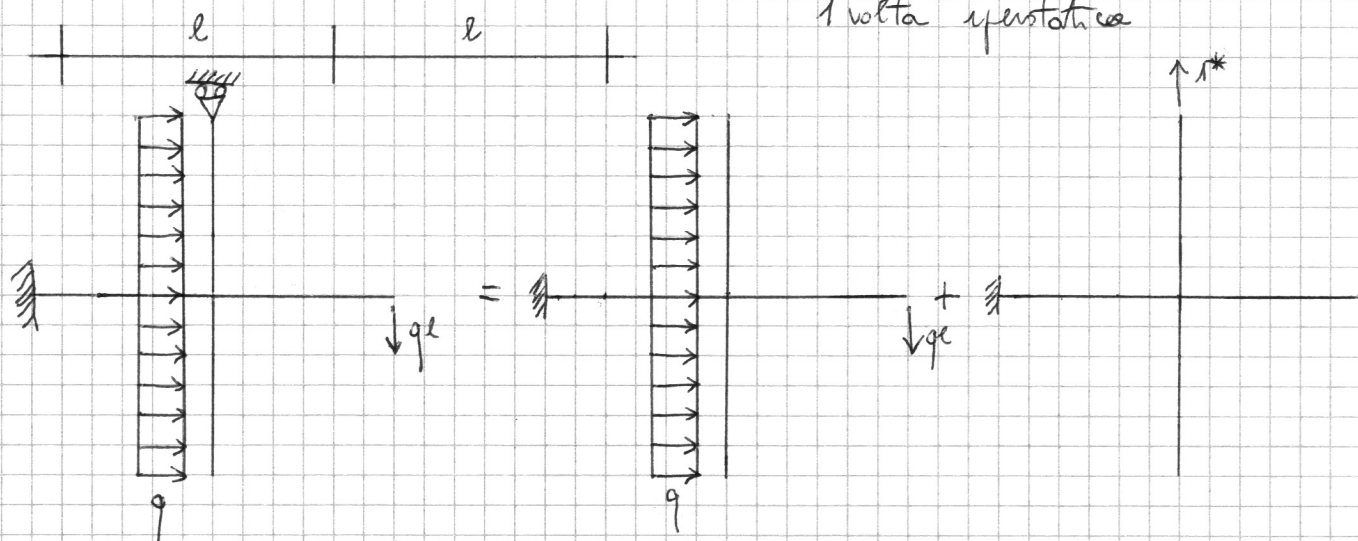
$$\sigma_{amm} = 190 \text{ MPa}$$

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

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

1 volta ipostatice

1)

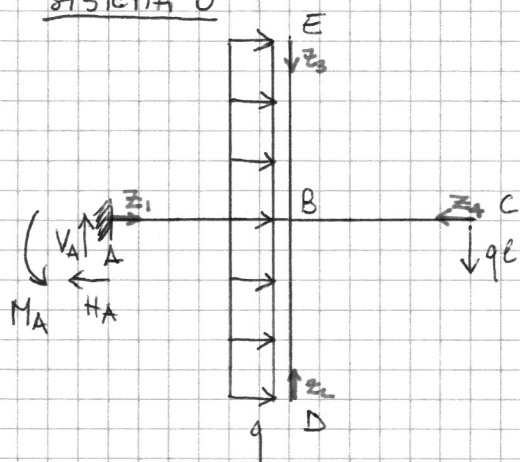


SISTEMA 0

SISTEMA 1

1) Si trascuri la deformabilità assiale  $\Delta T = 0^\circ \text{C}$

SISTEMA 0



$$H_A = 2ql = 6000 \text{ N}$$

$$V_A = ql = 3000 \text{ N}$$

$$M_A = ql \cdot 2l = 2ql^2 = 18000 \text{ N/m}$$

Tratto AB

$$N(z_1) = 2ql = 6000 \text{ N}$$

$$T(z_1) = ql = 3000 \text{ N}$$

$$M(z_1) = -2ql^2 + qlz$$

## Trade DB

$$N(z_2) = 0$$

$$T(z_2) = -9z$$

$$n(z_2) = -q \frac{z^L}{2}$$

Tratto EB

$$N(z_3) = 0$$

$$T(z_3) = \neq 9z$$

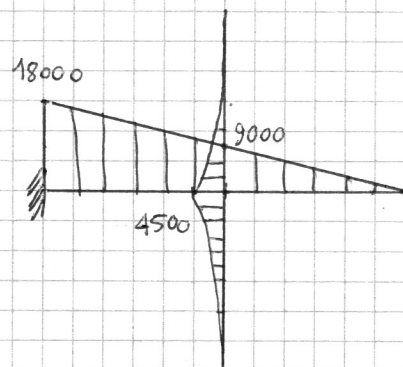
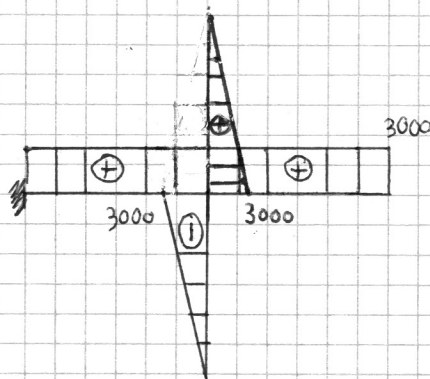
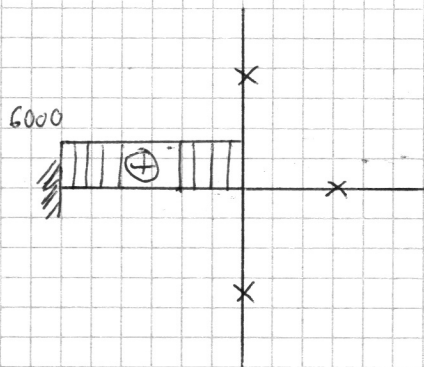
$$M(z_3) = -9 \frac{z^2}{2}$$

Thats CB

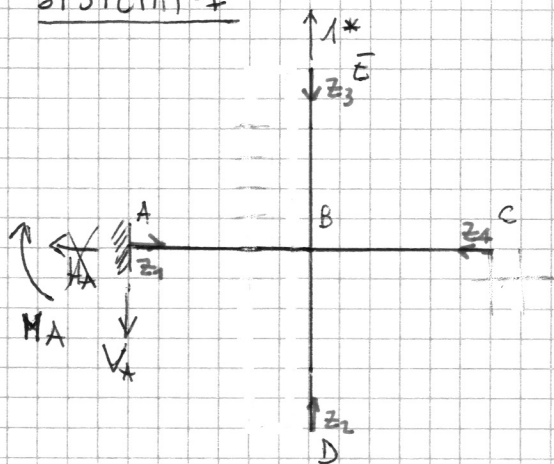
$$N(z_+) = 0$$

$$T(z_4) = 92$$

$$\Pi(z_A) = -q \ell z$$


$$N[N]$$
$$T[N]$$
$$M [Nm]$$

## SISTEMA 4



$$V_A = 1^*$$

$$H_A = 0$$

$$M_A = 1^* 2$$

Tratto AB

$$N(z_1) = 0$$

$$T(z_1) = -1$$

$$M(z_1) = 1^* l - 1^* z$$

Tratto DB

$$N(z_2) = 0$$

$$T(z_2) = 0$$

$$M(z_2) = 0$$

Tratto EB

$$N(z_3) = 1^*$$

$$T(z_3) = 0$$

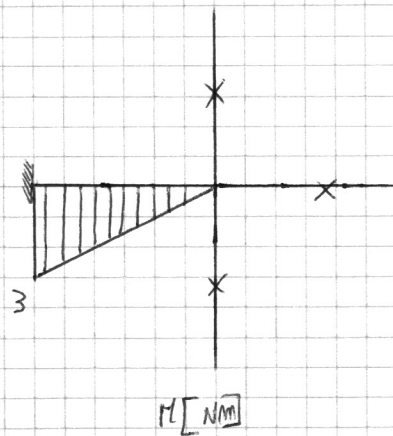
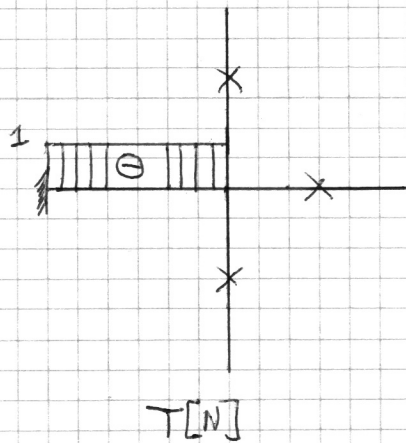
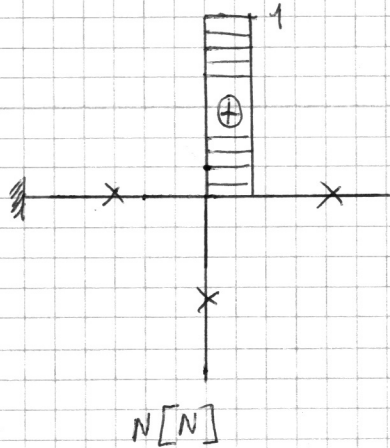
$$M(z_3) = 0$$

Treatto CB

$$N(z_4) = 0$$

$$T(z_4) = 0$$

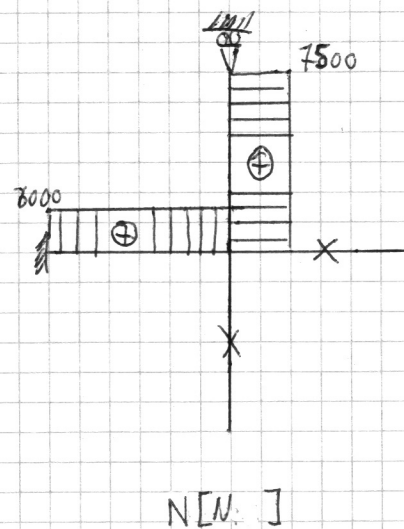
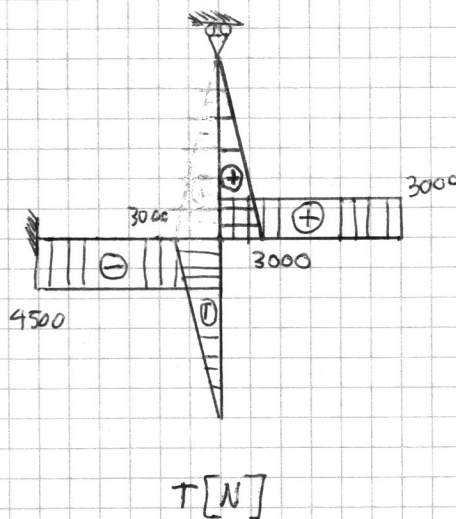
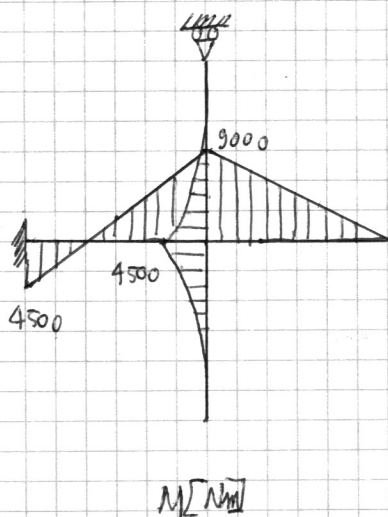
$$M(z_4) = 0$$



$$\eta_{10} = \frac{1}{EJ} \int_0^l (-2ql^2 + qlz)(1l - z) dz = -\frac{67500}{EJ}$$

$$\eta_{11} = \frac{1}{EJ} \int_0^l (1l - 1z)^2 dz = \frac{9}{EJ}$$

$$X_1 = -\frac{\eta_{10}}{\eta_{11}} = 7500 \text{ N}$$



2)  $M_{max} = 9000 \text{ N}\cdot\text{m}$        $N = 6000$        $\sigma_{am} = 190 \text{ MPa}$

semi progetto  $W_{min} = \frac{M}{\sigma_{am}} = 47.36 \text{ cm}^3$

ADOTTO IPE 120       $W_x = 53.0 \text{ cm}^3$        $A = 13.2 \text{ cm}^2$        $I_x = 318 \text{ cm}^4$

$$\sigma_{mm, max} = \frac{N}{A} \pm \frac{M}{W} = \frac{6000}{1320} \pm \frac{9000}{53.0} = \begin{cases} \sigma_{max} = 174 < 190 & \checkmark \\ \sigma_{min} = 165 < 190 & \checkmark \end{cases}$$

3)  $\Delta T = 20^\circ \text{C}$        $h_{IPE120} = 0.12 \text{ m}$

$$\Delta v_e = \Delta v_i \Rightarrow 0 = \eta_{10} + X \eta_{11} + \underbrace{\int_0^l \left( -\frac{2\alpha \Delta T}{h} \right) \cdot (3-z) dz}_{\eta_{10}^T}$$

$$\eta_{10}^T = \int_0^l \left( -\frac{2\alpha \Delta T}{h} \right) (3-z) dz = -\frac{9}{500}$$

$$X_1 = \frac{\eta_{10} + \eta_{10}^T}{\eta_{11}} = 8836 \text{ N}$$

