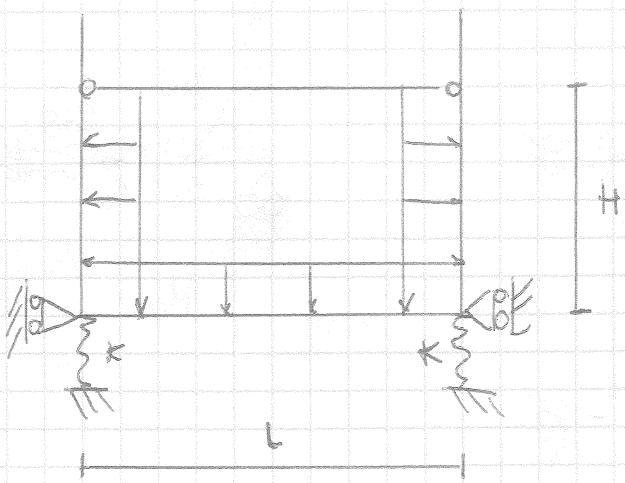
FILA A

16/06/2016

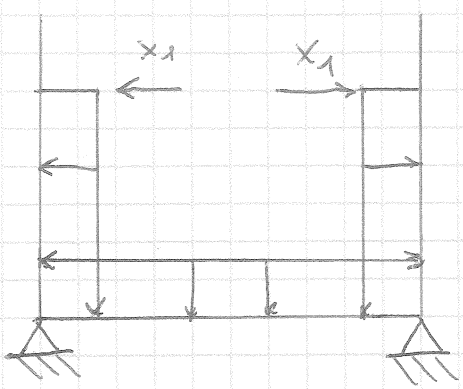


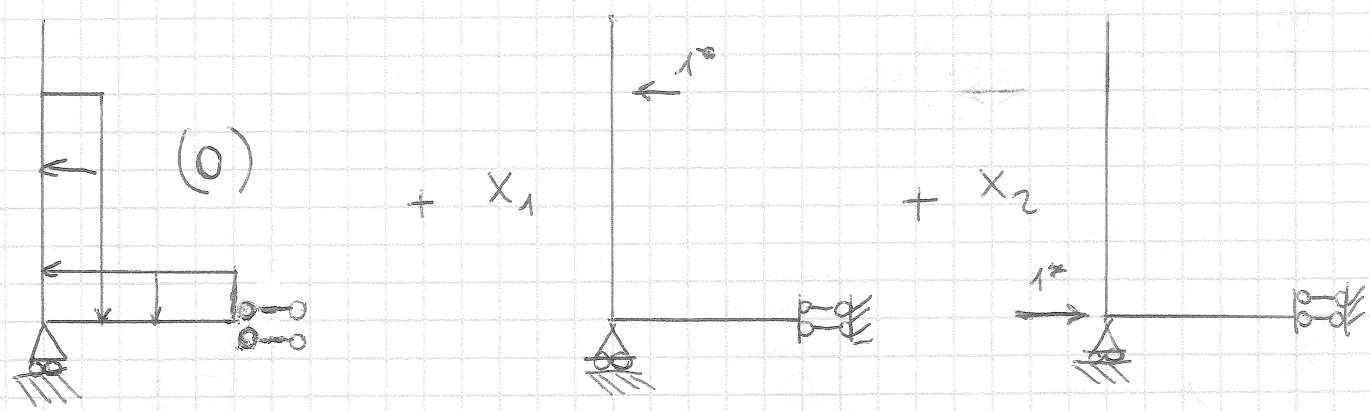
$q = 2000\ N/m$

$L = 5m$

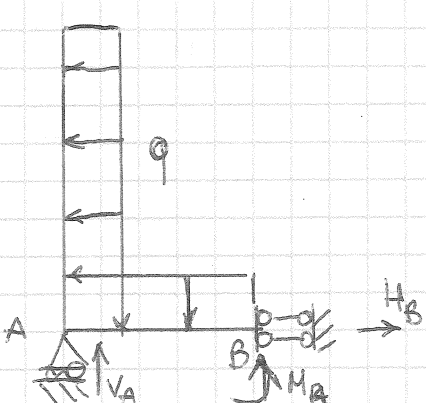
$H = 3\ m = \frac{3}{5}\ell$

1)





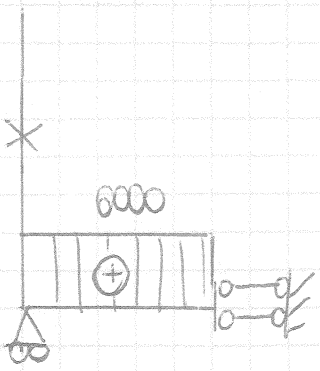
SISTEMA (0)



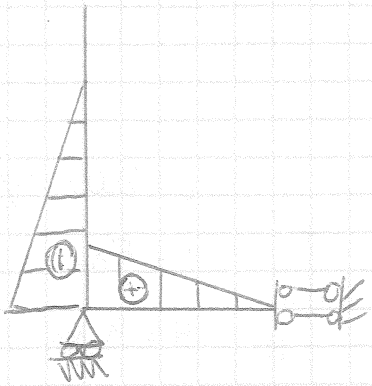
$\rightarrow) \quad H_B = q \cdot \frac{3}{5}\ell$

$\uparrow) \quad V_A = \frac{q\ell}{2}$

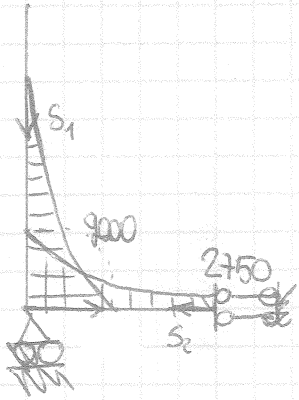
$A) \quad \frac{q}{2}\frac{9}{25}\ell^2 - \frac{q\ell^2}{8} + M_B = 0 \qquad M_B = -\frac{11}{200}q\ell^2$



N_0



T_0

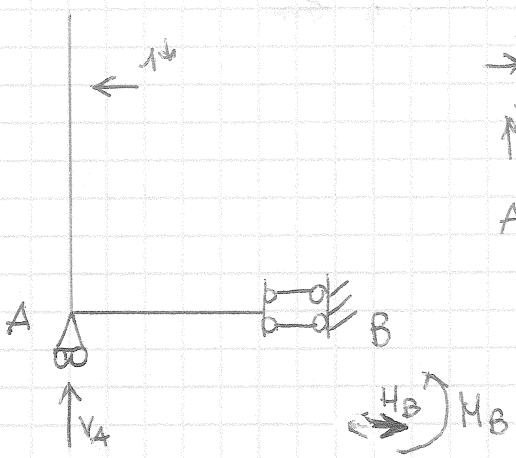


M_0

$M_0(S_1) = -\frac{qS^2}{2}$

$M_0(S_2) = -\frac{11}{200} ql^2 - \frac{qS^2}{2}$

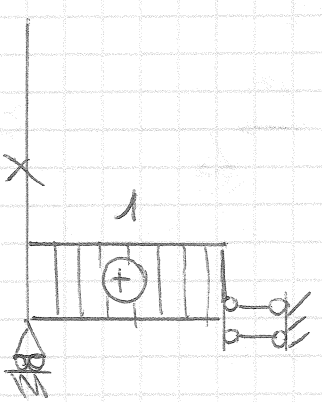
SISTEMA (1)



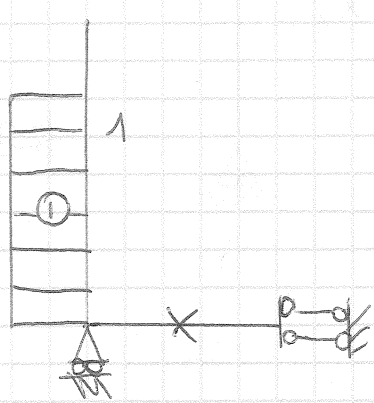
$\rightarrow) \; H_B = 1$

$\uparrow) \; V_A = 0$

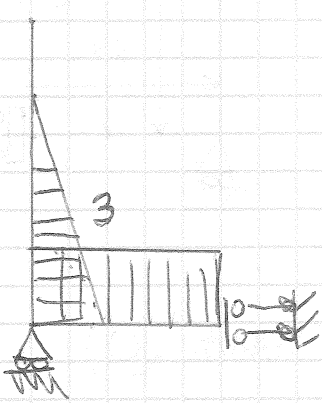
$A) \; M_B = -\frac{3}{5} l$



N_1



T_1

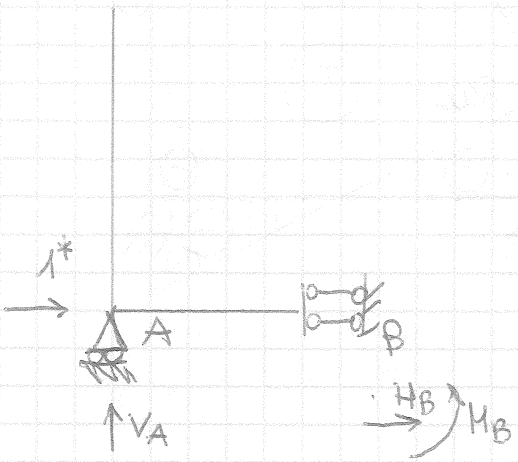


M_1

$M_1(S_1) = -S$

$M_1(S_2) = -\frac{3}{5} l$

SISTEMA (2)



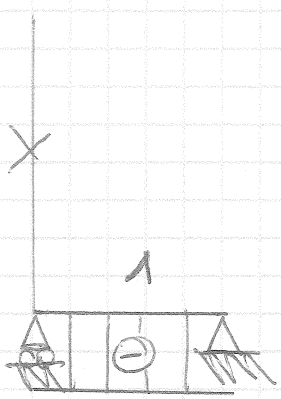
$\rightarrow) \; H_B = -1$

$\uparrow) \; V_A = 0$

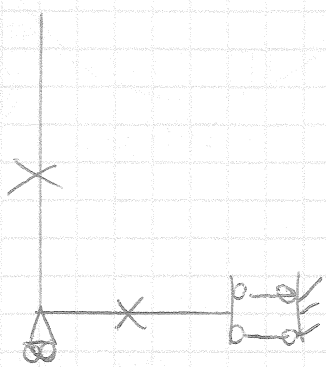
$A) \; M_B = 0$

$M_2(S_1) = 0$

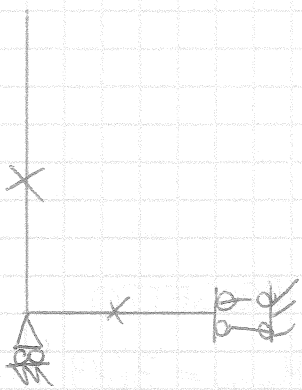
$M_2(S_2) = 0$



N_2



T_2



M_2

$$\eta_{10} = \frac{1}{EJ} \cdot \left\{ \int_0^{\frac{3}{5}\ell} \left(-\frac{qz^2}{12}\right)(-z)\,dz + \int_0^{\frac{\ell}{2}} \left(-\frac{11}{200}q\ell^2 - \frac{qz^2}{12}\right)\left(-\frac{3}{5}\ell\right) dz \right\}$$

$$= \frac{113}{2500}\frac{q\ell^4}{EJ}$$

$$\eta_{20} = 0$$

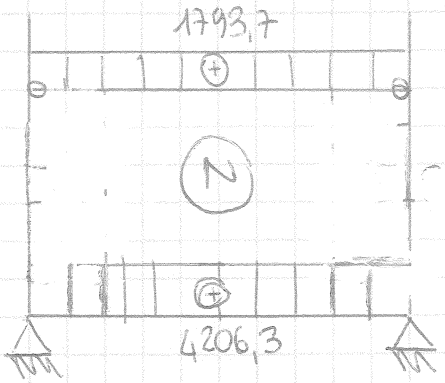
$$\eta_{11} = \frac{1}{EJ}\left\{ \int_0^{\frac{3}{5}\ell} (z^2)\,dz + \int_0^{\frac{\ell}{2}} \left(\frac{9}{25}\ell^2\right) dz \right\} = \frac{63}{250}\frac{\ell^3}{EJ}$$

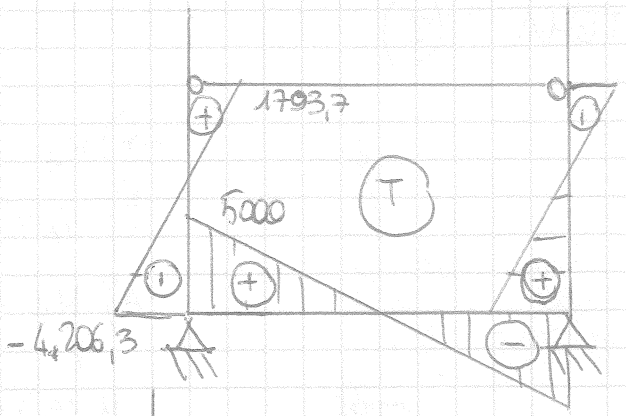
$$\eta_{22} = 0$$

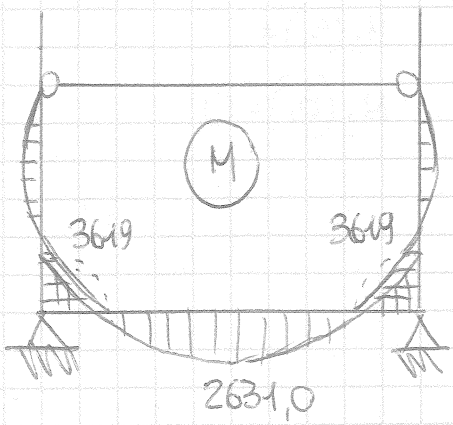
$$\eta_{12} = 0$$

$$X_2 = 0$$

$$X_1 = -\frac{\eta_{10}}{\eta_{11}} = 1793{,}7\ N$$







2) PROGETTO

$M_{max} = 3619\ Nm$ $\quad \sigma_{am} = 390\ MPa$

$W_{min} = \frac{M_{max}}{\sigma_{am}} > \frac{3619 \cdot 10^3}{390} = 9279,5\ mm^3 \rightarrow 9,3\ cm^3$

ADOTTO IPE 100

$W_x = 34,20\ cm^3$

$J_x = 171,0\ cm^3$

$A = 10,32\ cm^2$

VERIFICA (solo tensioni normali)

$\sigma_{max} = \frac{N}{A} + \frac{M}{W_{min}} = \frac{5000}{10,32 \cdot 100} + \frac{3619 \cdot 1000}{34,20 \cdot 10^3} = 110,66\ MPa < \sigma_{am}$

3) $\mu_{10}^N = \frac{1}{EA} \int_0^{\frac{l}{2}} \left(\frac{3}{5} ql\right)(1)\, dz = \frac{3ql^2}{10EA}$

$\mu_{20}^N = \frac{1}{EA} \int_0^{\frac{l}{2}} \left(\frac{3}{5} ql\right)(-1)\, dz = -\frac{3ql^2}{10EA}$

$$\eta_{11}^{N} = \frac{1}{EA}\int_0^{\ell/2} 1^2\,dz + \frac{1}{EA}\int_0^{\ell/2} (-1)^2\,dz = \frac{\ell}{EA}$$

$$\eta_{22}^{N} = \frac{1}{EA}\int_0^{\ell/2} 1^2\,dz = \frac{\ell}{2EA}$$

$$\eta_{12}^{N} = \frac{1}{EA}\int_0^{\ell/2} (-1)(1)\,dz = -\frac{\ell}{2EA}$$

$$\eta_{ik}^{TOT} = \eta_{ik} + \eta_{ik}^{N}$$

(1) $L_{VE} = L_{Vi} = X_1 \cdot \eta_{11}^{TOT} + X_2 \cdot \eta_{12}^{TOT} + \eta_{10} + V_A^{1*} \cdot \frac{V_A}{K} = 0$

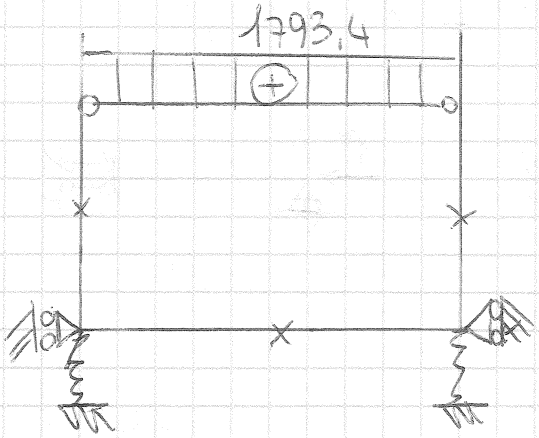
$= X_1 \cdot \eta_{11}^{TOT} + X_2 \cdot \eta_{12}^{TOT} + 0 \cdot \frac{V_A}{K} + \eta_{10} = 0$

(2) $L_{Ve} = L_{Vi} = X_1 \cdot \eta_{12}^{TOT} + X_2 \cdot \eta_{22}^{TOT} + \eta_{20} + V_A^{2*} \cdot \frac{V_A}{K} = 0$

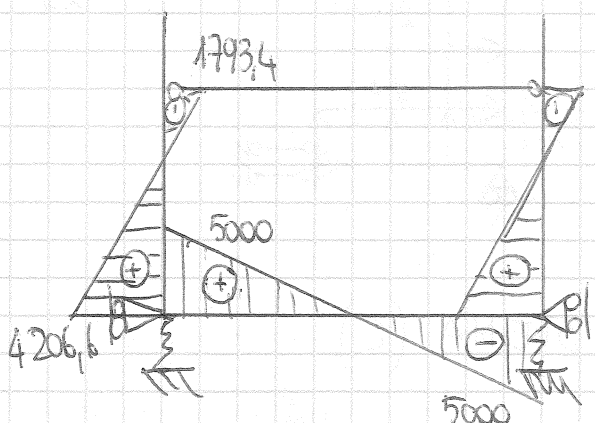
$= X_1 \cdot \eta_{12}^{TOT} + X_2 \cdot \eta_{22}^{TOT} + \eta_{20} + 0 \cdot \frac{V_A}{K} = 0$

$$\begin{cases} (1) \\ (2) \end{cases} \Rightarrow \begin{cases} X_1 \cdot \eta_{11}^{TOT} + X_2 \cdot \eta_{12}^{TOT} = -\eta_{10}^{TOT} \\ X_1 \cdot \eta_{12}^{TOT} + X_2 \cdot \eta_{22}^{TOT} = -\eta_{20}^{TOT} \end{cases}$$

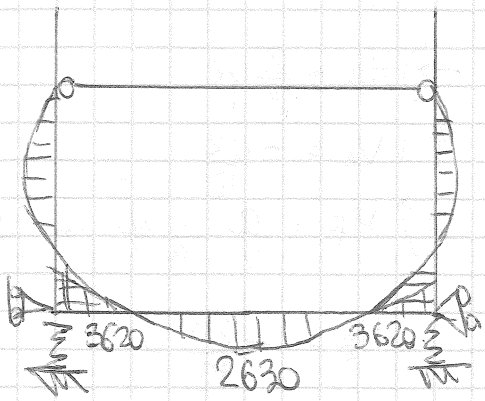
$X_1 = -1793{,}4\ N$ $\qquad X_2 = 4206{,}60\ N$



N



T



M