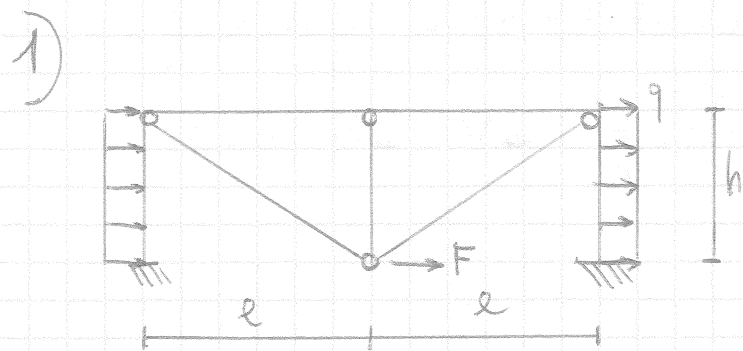


24/07/2017



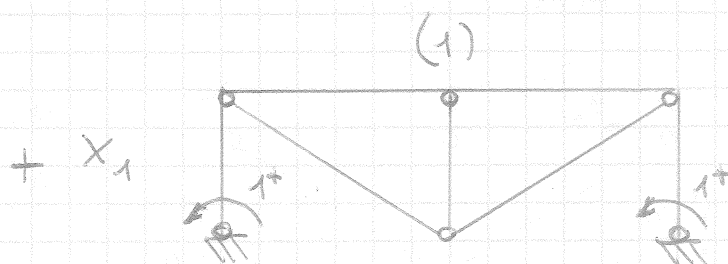
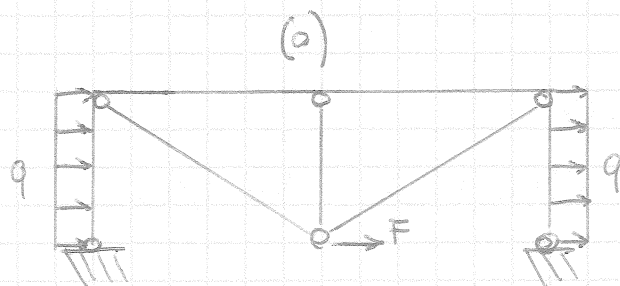
$$e = 3\text{m}$$

$$h = 2\text{m} = \frac{2}{3}e$$

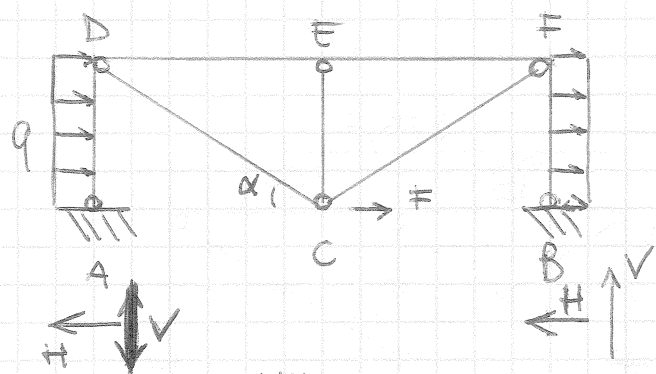
$$q = 1000\text{ N/m}$$

$$F = ql/2$$

$$\alpha = \arctan(2/3)$$



SISTEMA (o)

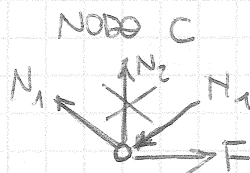


$$\rightarrow -2H + 2q \cdot \frac{2}{3}e + \frac{ql}{2} = 0$$

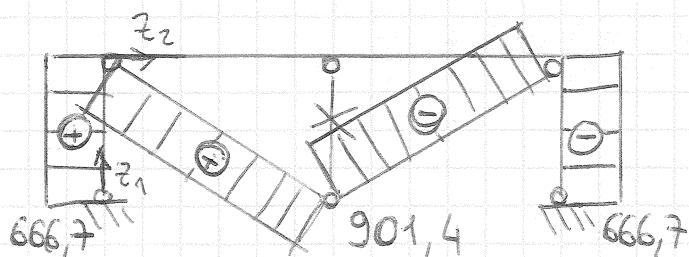
$$H = \frac{11}{12}ql$$

$$\uparrow - \frac{2q}{2} \left(\frac{2}{3}e \right)^2 + 2Ve = 0$$

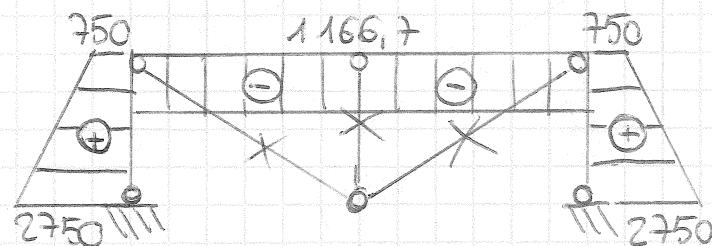
$$2Ve = \frac{2}{9}ql^2$$



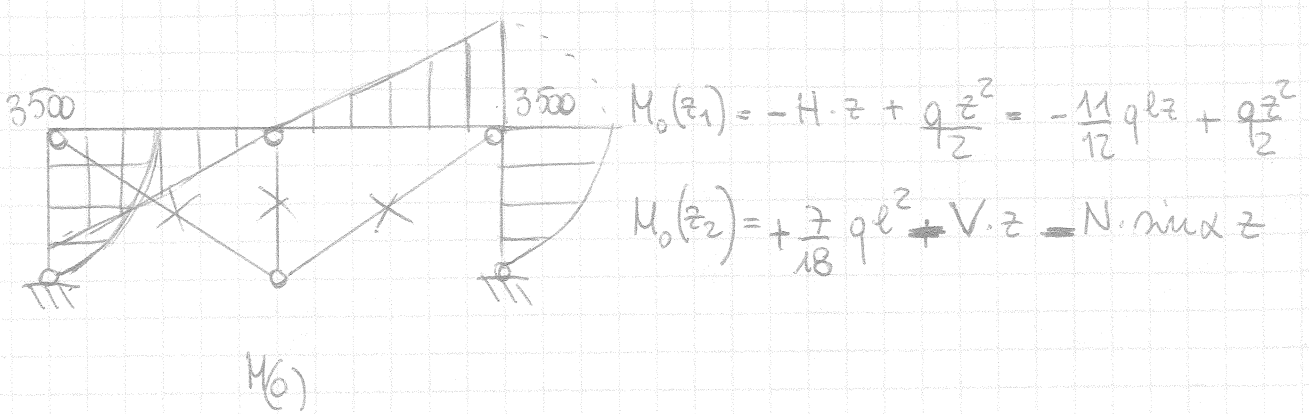
$$\rightarrow F - 2N \cdot \cos \alpha = 0 \quad N = F / (2 \cos \alpha)$$



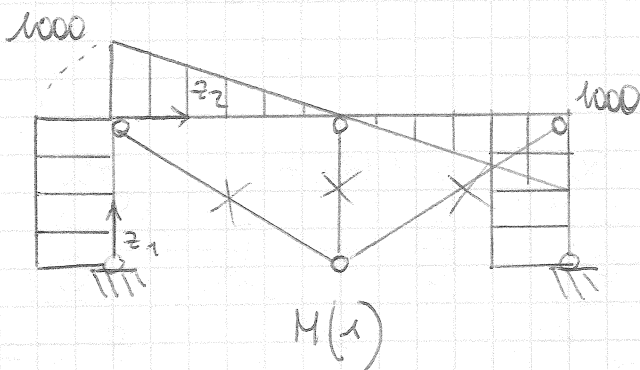
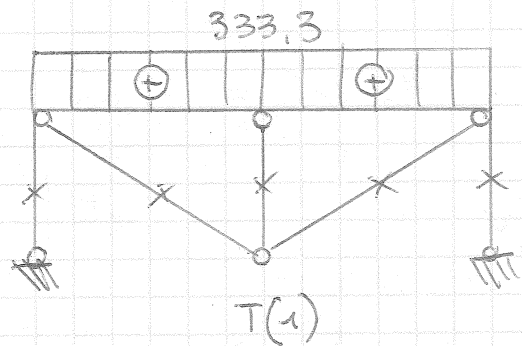
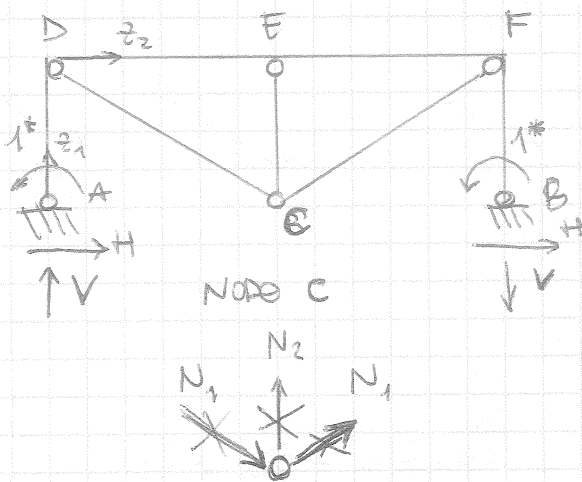
N(o)



T(o)



SISTEMA (1)



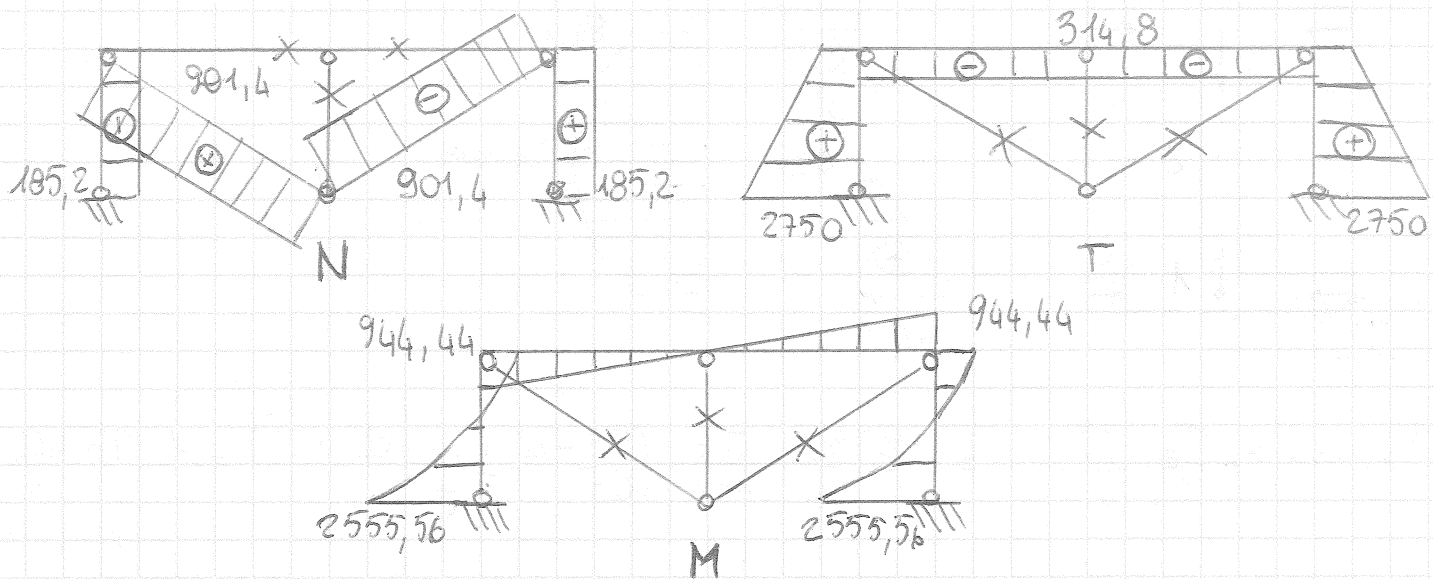
$$M_{10} = \frac{2}{EJ} \int_0^{\frac{2}{3}l} (+1) \left(-\frac{11}{12} qlz + \frac{qz^2}{2} \right) dz + \frac{2}{EJ} \int_0^l \left(1 + \frac{z}{e} \right) \left(\frac{7}{18} ql^2 - \frac{2}{9} qlz - \frac{ql^2 z^2}{4} \right) dz$$

$$= -\frac{46}{81} \frac{ql^3}{EJ}$$

$$M_{11} = \frac{2}{EJ} \int_0^{\frac{2}{3}l} (+1)^2 dz + \frac{2}{EJ} \int_0^l \left(1 + \frac{z}{e} \right)^2 dz$$

$$= \frac{2l}{EJ}$$

$$X_1 = -\frac{M_{10}}{M_{11}} = 2555,56 \text{ Nm}$$



2) $M_A = 2555,6 \text{ Nm}$

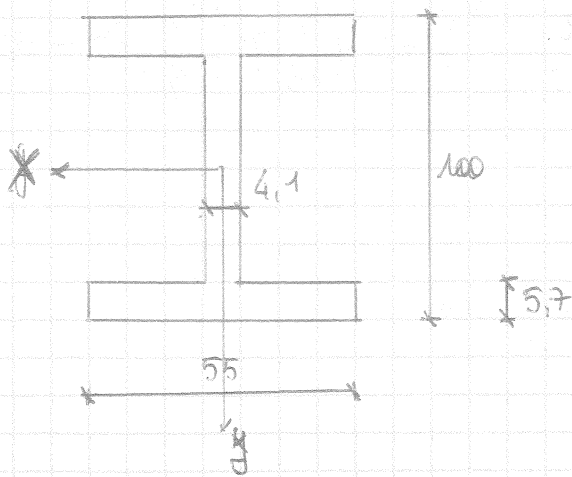
$N_A = 185,2 \text{ N}$

$T_A = 2750 \text{ N}$

PROGETTO

$$W_{min} = \frac{M_A}{\sigma'_{amm}} = \frac{2555,6 \cdot 1000}{190} = 13451 \text{ mm}^3$$

Adatto IPE 100

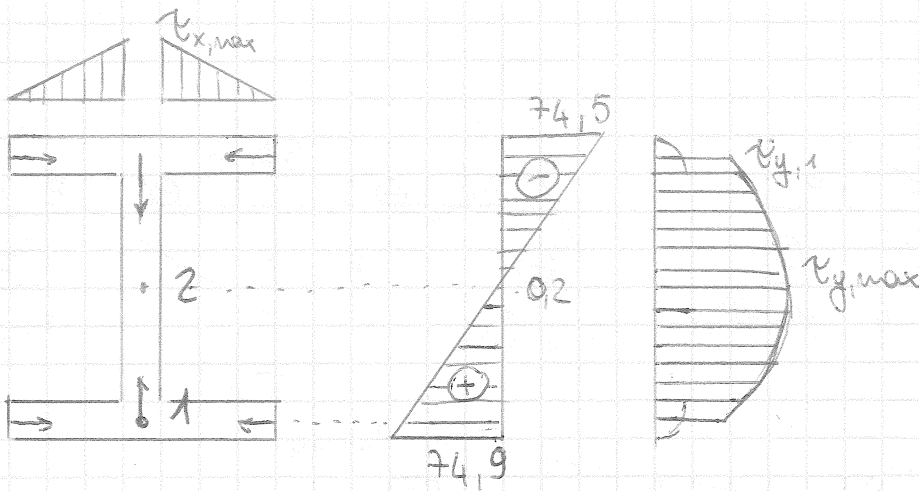


$$A = 10,32 \text{ cm}^2$$

$$W_x = 34,20 \text{ cm}^3$$

$$I_x = 171 \text{ cm}^4$$

$$\sigma_{\text{max}} = \frac{N_A}{A} + \frac{M_A}{W} = \frac{185,2}{10,32 \cdot 100} + \frac{2555,6 \cdot 1000}{34,20 \cdot 1000} = 74,90 \text{ MPa}$$



$$\tau_{x, \text{max}} = - \frac{T_y \cdot S_x^*}{I_x \cdot b} = - \frac{2750 \cdot 5,7 \cdot (55 - 4,1) \cdot (100 - 5,7)}{4 \cdot 171 \cdot 10^4 \cdot 5,7} = -1,93 \text{ MPa}$$

$$\tau_{y, 1} = - \frac{T_y \cdot S_x^*}{I_x \cdot b} = - \frac{2750 \cdot 55 \cdot 5,7 \cdot (100 - 5,7)}{2 \cdot 171 \cdot 10^4 \cdot 4,1} = -5,8 \text{ MPa}$$

$$\tau_{y, \text{max}} = - \frac{T_y \cdot S_x^*}{I_x \cdot b} = - \frac{2750 \cdot (55 \cdot 5,7 \cdot (100 - 5,7) \cdot 2 + 4,1 \cdot (50 - 5,7)^2 \cdot 2)}{171 \cdot 10^4 \cdot 4,1} = -7,37 \text{ MPa}$$

$$\sigma_{\text{id}, 1} = \sqrt{\sigma_{z, 1}^2 + 3 \tau_{y, 1}^2} = \sqrt{74,9^2 + 3 \cdot 5,8^2} = 75,6 < 190 \text{ MPa} \quad \text{OK}$$

$$\sigma_{\text{id}, 2} = \sqrt{0,2^2 + 3 \cdot 7,37^2} = 12,8 < 190 \text{ MPa} \quad \text{OK}$$

$$3) A_{\phi} = 5^2 \pi = 78,54 \text{ mm}^2$$

$$M_{10}^N = \frac{2}{EA} \int_0^{l/\cos\alpha} \left(\frac{qz}{4\cos\alpha} \right) \cdot 0 \, dz = 0$$

$$M_{11}^N = 0$$

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

Tenendo conto della deformabilità assiale nelle aste soggette solo a sforzo normale, non comporta variazioni nei diagrammi delle sollecitazioni.