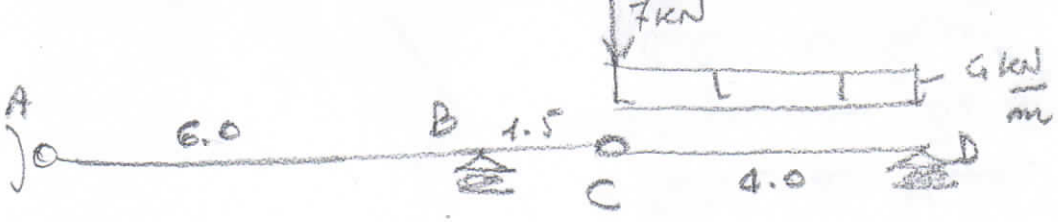
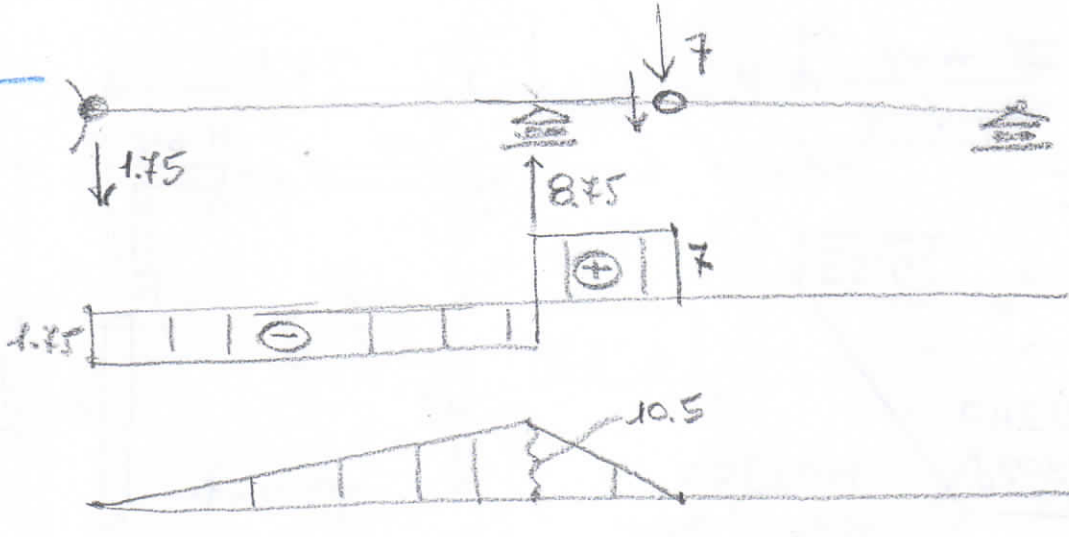


F

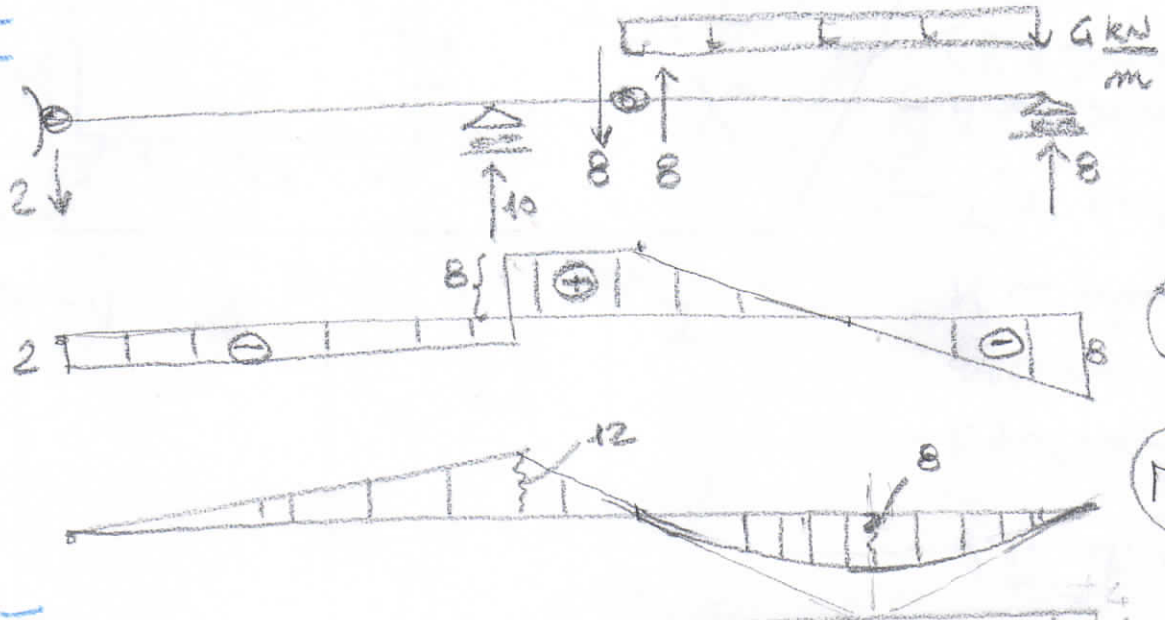


$T(z)^F$

$M(z)^F$

F

q

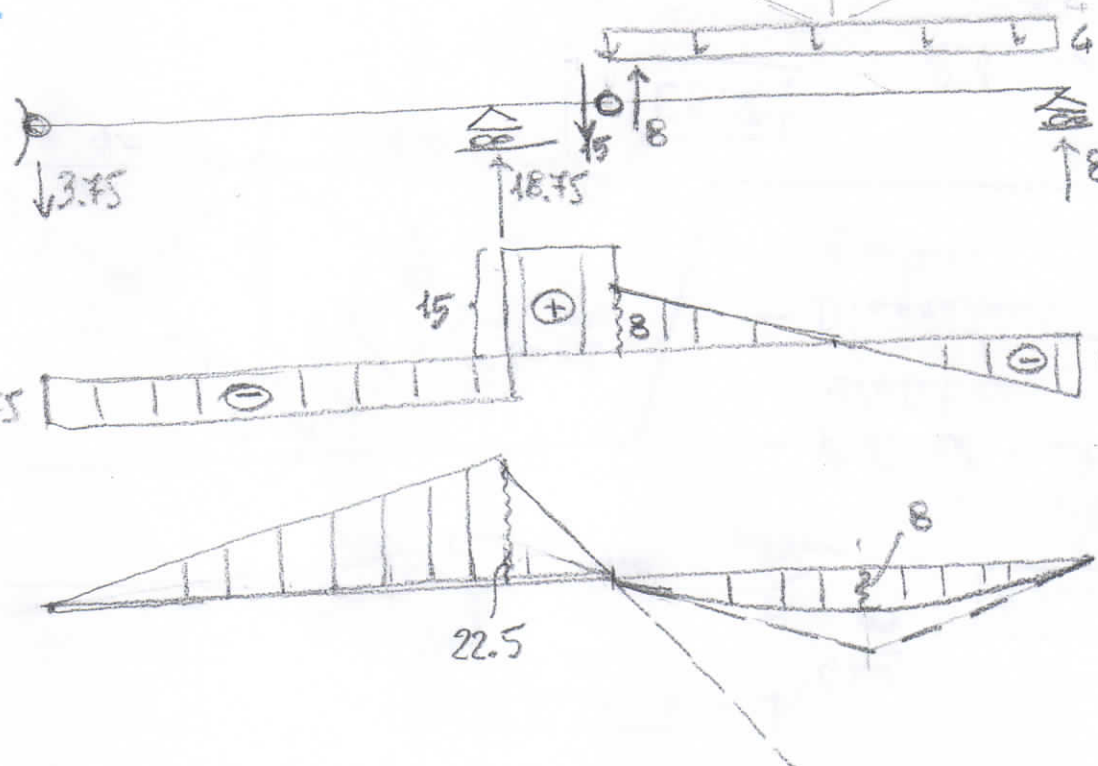


$T(z)^q$

$M(z)^q$

q

F+q

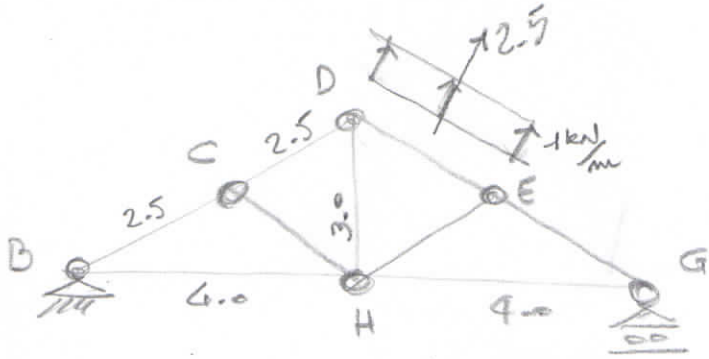


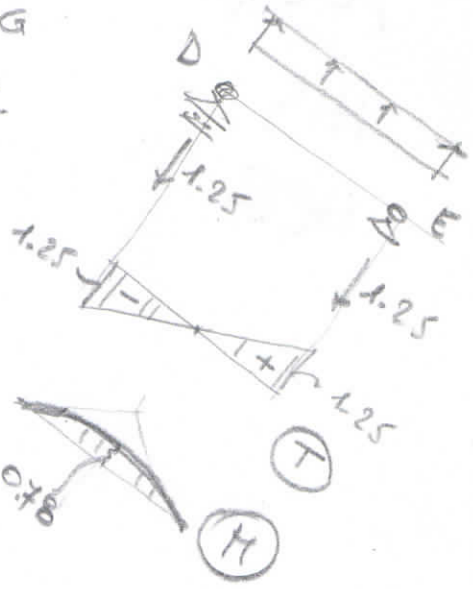
$T(z)^{Tot}$

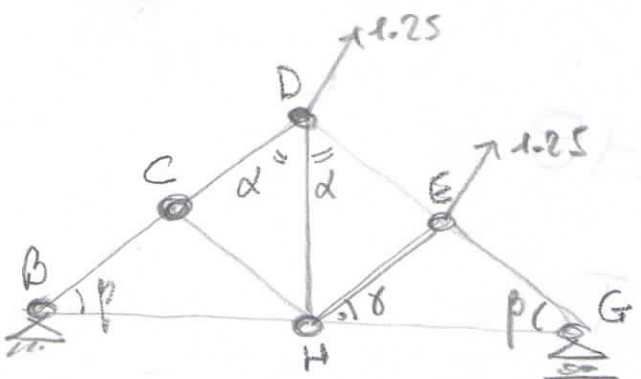
$M(z)^{Tot}$

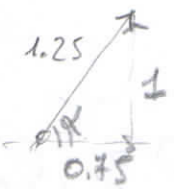
T+Q

ES. 2









$tg\alpha = \frac{6}{3}$ $\quad tg\beta = \frac{3}{4}$

$\alpha = 53.1^\circ = 0.927$

$\beta = 36.9^\circ = 0.644$

2

1.25

0.422

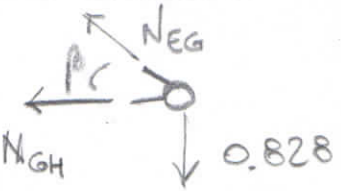
1.172

1.25

0.422

0.828

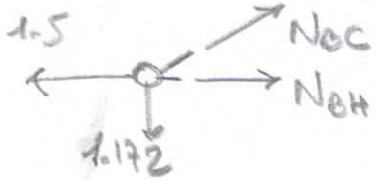
modo G (1° modo)



$$\begin{cases} N_{GH} + N_{EG}\cos\beta = 0 \\ N_{EG}\cdot \operatorname{sen}\beta - 0.828 = 0 \end{cases}$$

$N_{EG} = 1.38 \quad N_{GH} = -1.10$

modo B (2° modo)

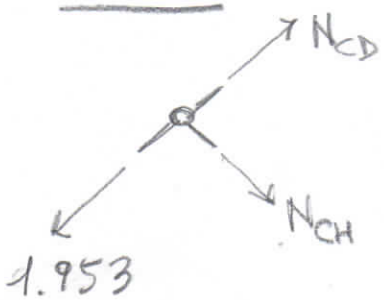


$$\begin{cases} -1.5 + N_{BH} + N_{BC}\cos\beta = 0 \\ -1.172 + N_{BC}\operatorname{sen}\beta = 0 \end{cases}$$

$N_{BC} = 1.953$

$N_{BH} = -0.0625$

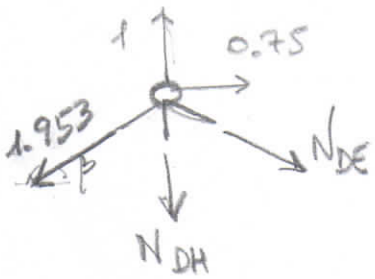
nodo C (3° nodo)



$N_{CH} = 0$

$N_{CD} = 1.953$

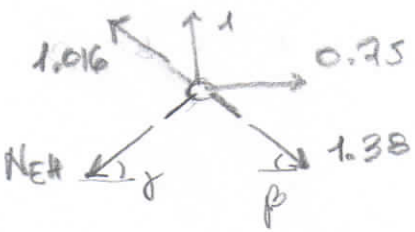
nodo D (4° nodo)



$$\begin{cases} 0.75 - 1.953\cos\beta + N_{DE}\cos\beta = 0 \\ -1.953\sin\beta + 1 - N_{DH} - N_{DE}\sin\beta = 0 \end{cases}$$

$N_{DE} = 1.016 \qquad N_{DH} = -0.781$

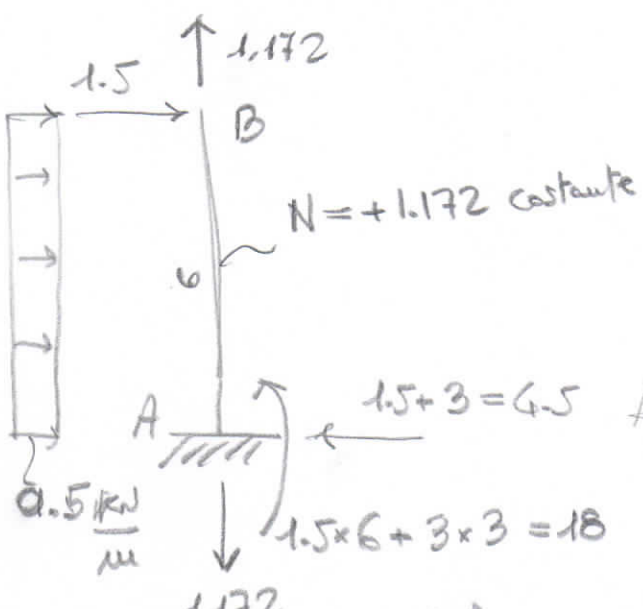
nodo E

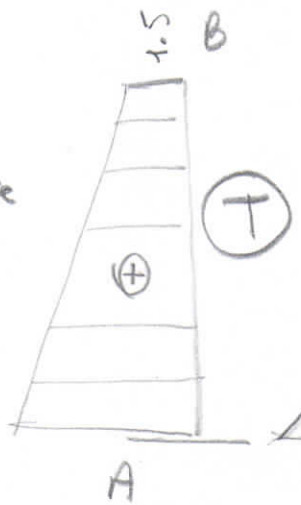


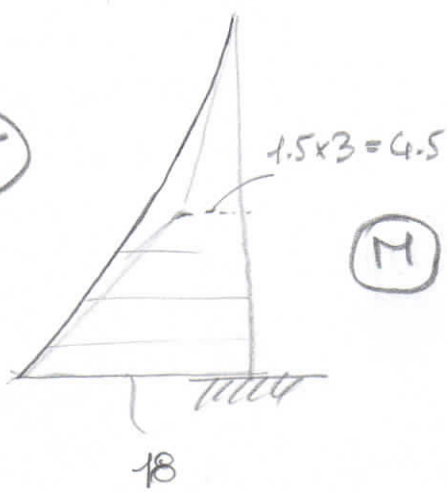
$tg\,\gamma = \frac{1.5}{2}$

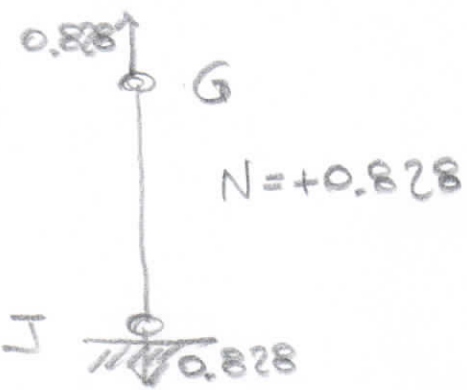
$0.75 - 1.016 \times \cos\beta + 1.38 \times \cos\beta - N_{EH}\cos\gamma = 0$

$N_{EH} = 1.302$





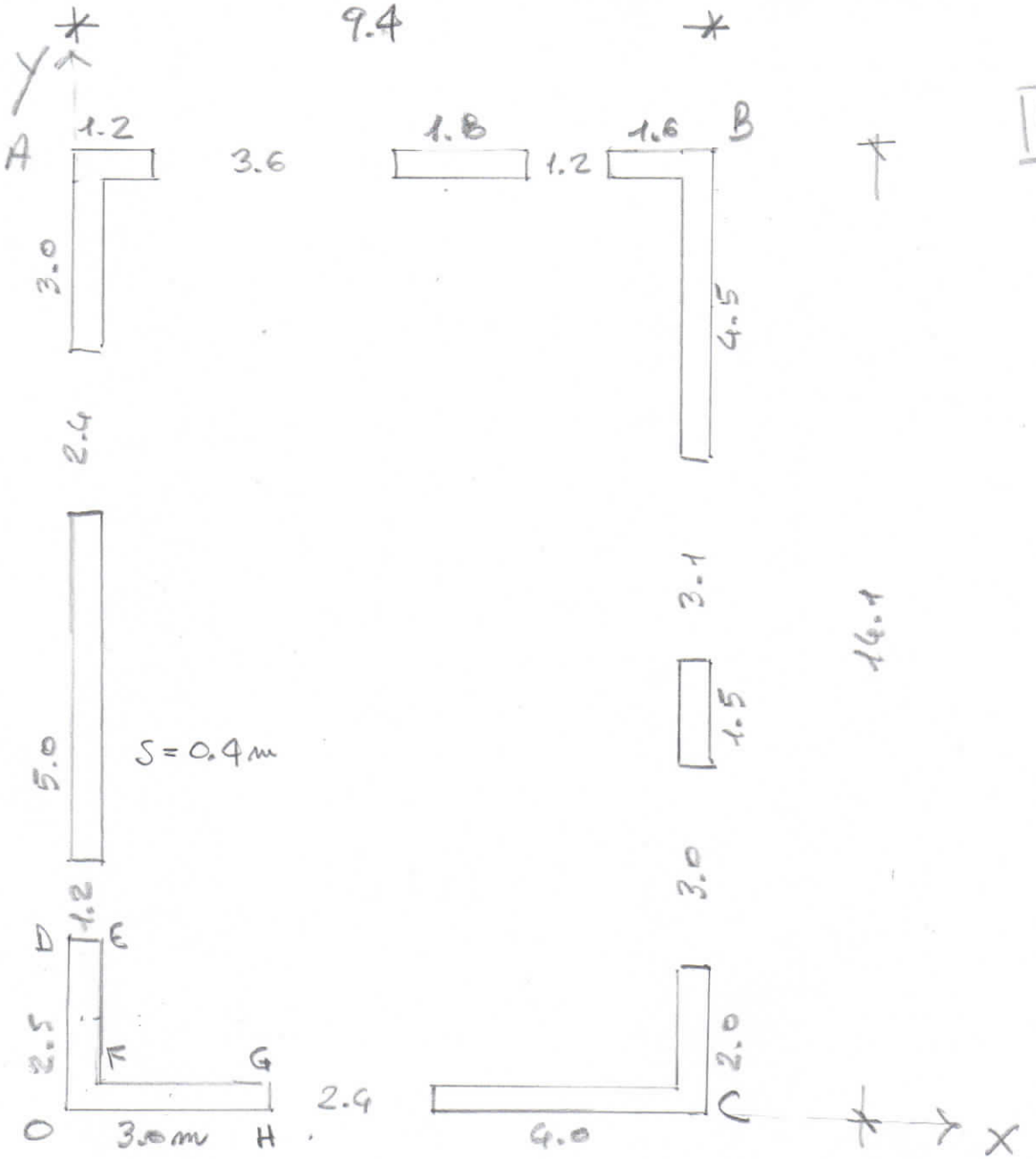




$$W_G = \frac{828\ N \times 6000\ mm}{2000 \times 1000} = 0.2\ mm$$

verso l'alto

ES.3



$$A = (1.2+1.8+1.6+4.1+1.5+1.6+4+3+2.1+9+2.6)\times 0.4 = 11.4\,m^2$$

$$S_x = \overbrace{7\times 0.4\times 0.2}^{OC} + 2.1\times 0.4\times(1.05+0.4) + \overbrace{5\times 0.4\times(2.5+1.2+2.5)}^{OA} +$$

$$+ 2.6\times 0.4\times(1.3+2.4+5+1.2+2.5) + \overbrace{1.2\times 0.4\times 13.9}^{AB} + 2\times 0.4\times 13.9 +$$

$$+ 1.6\times 0.4\times 13.9 + \overbrace{4.1\times 0.4\times(14.1-0.4-2.05)}^{BC} + 1.5\times 0.4\times(2+3+$$

$$+ 0.75) + 1.6\times 0.4\times 1.2 = 77.086\,mc$$

$$S_y = \overbrace{(14.1-2.4-1.2)}^{OA}\times 0.4\times 0.2 + \overbrace{(14.1-3.1-3.0)}^{BC}\times 0.4\times 9.2$$

$$+ 0.8\times 0.4\times 0.8 + \overbrace{1.8}^{AB}\times 0.4\times 5.7 + 1.2\times 0.4\times 8.4 +$$

$$+ 2.6\times 0.4\times 1.7 + 3.6\times 0.4\times 1.2 = 50.808\,mq$$

$$X_G = 4.457\,m \qquad Y_G = 6.664$$

$$I_{x_G}^{ODEFGH} = \frac{3\times 0.4^3}{12} + 3\times 0.4\times\left(6.664-0.2\right)^2 +$$

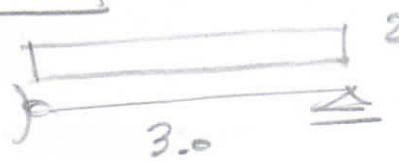
$$+ 0.4\times\frac{2.1^3}{12} + 0.4\times 2.1\times\left(6.664-(1.05+0.4)\right)^2 = 73.310\ m^4$$

$$I_{x_G y_G}^{ODEFGH} = 3\times 0.4\left[1.5-4.457\right]\left[0.2-6.664\right] +$$

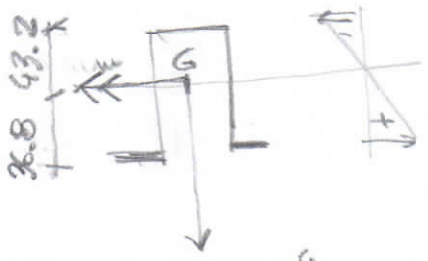
$$+ 2.1\times 0.4\times\left[0.2-4.457\right]\left[1.05+0.4-6.664\right] =$$

$$= 41.582\ m^4$$

ES. 4



$$M_{max} = 2\times\frac{3^2}{8} = 2.25\ kN\,m$$



$$I_x = 42.6\ cm^4$$

$$\sigma_{max}^{comp} = -\frac{2.25\times 10^6}{42.6\times 10^4}\times 43.2 = -228.17\ \frac{N}{mm^2}$$

$$\sigma_{max}^{trat} = \frac{2.25\times 10^6}{42.6\times 10^4}\times 36.8 = 194.37\ \frac{N}{mm^2}$$