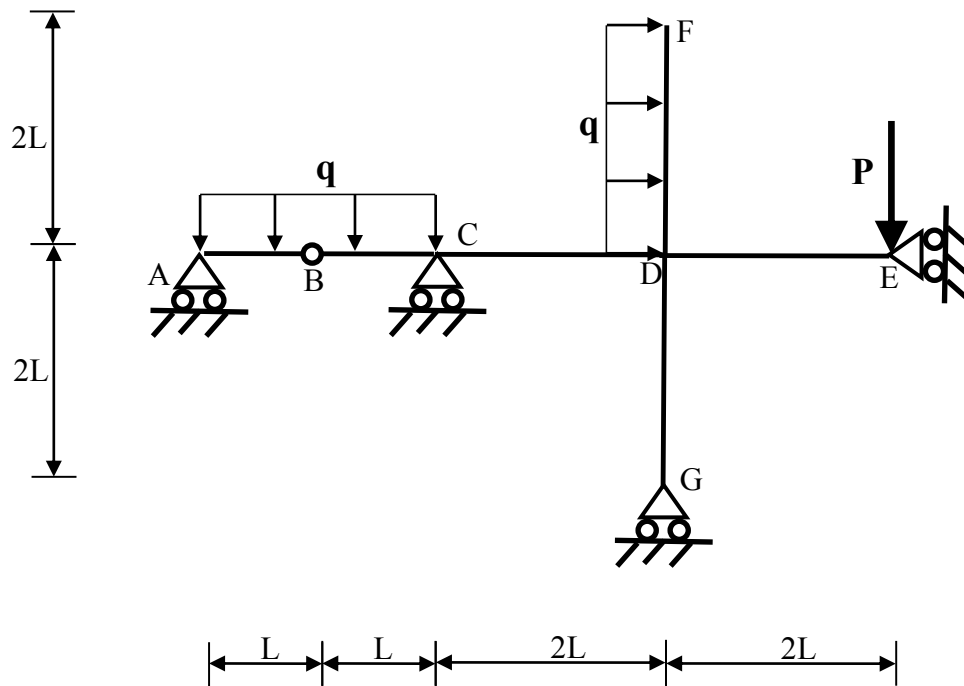


$$L = 1 \text{ m}, q = 20 \text{ kN/m}, P = 40 \text{ kN}$$
$$\sigma_{AMM} = 240 \text{ MPa}, E = 210 \text{ GPa}$$

La travatura isostatica in figura deve essere realizzata con profilati IPE.

- Disegnare i diagrammi quotati delle caratteristiche della sollecitazione.
- Dimensionare la travatura.
- Calcolare lo spostamento orizzontale del punto F.
- Calcolare nuovamente lo spostamento orizzontale di F considerando anche un cedimento verticale del vincolo in C pari a 1 cm.

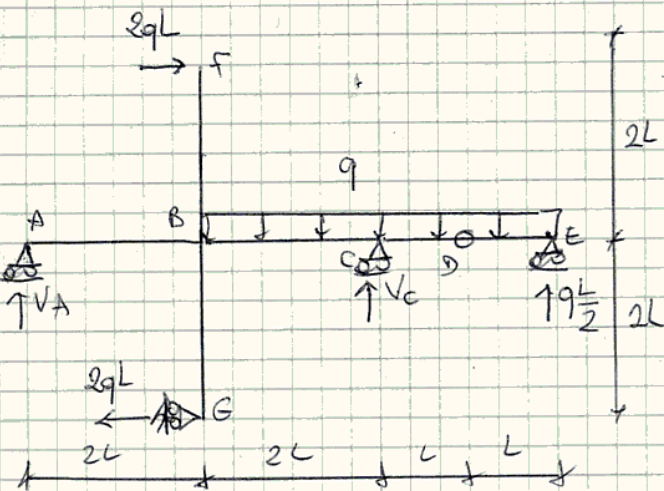


$$L = 1 \text{ m}, q = 15 \text{ kN/m}, P = 60 \text{ kN}$$
$$\sigma_{AMM} = 240 \text{ MPa}, E = 210 \text{ GPa}$$

La travatura isostatica in figura deve essere realizzata con profilati IPE.

- Disegnare i diagrammi quotati delle caratteristiche della sollecitazione.
- Dimensionare la travatura.
- Calcolare la rotazione nel punto F.
- Calcolare nuovamente la rotazione in F considerando anche un cedimento verticale del vincolo in G pari a 1 cm.

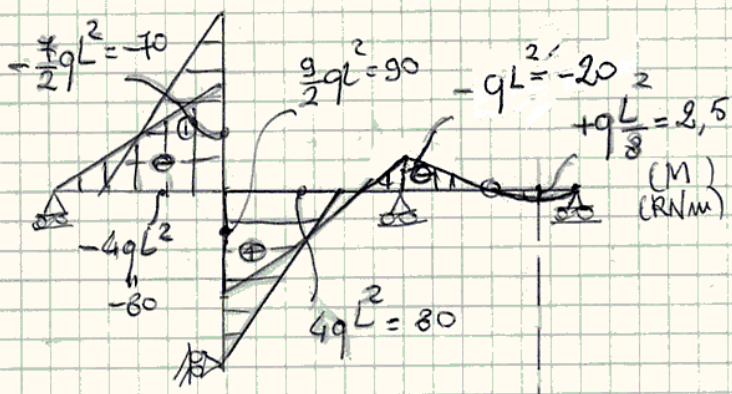
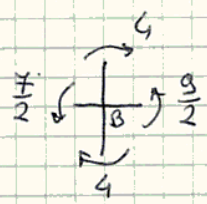
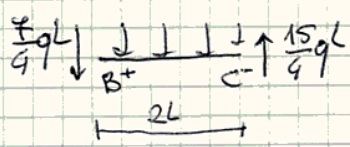
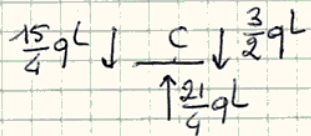
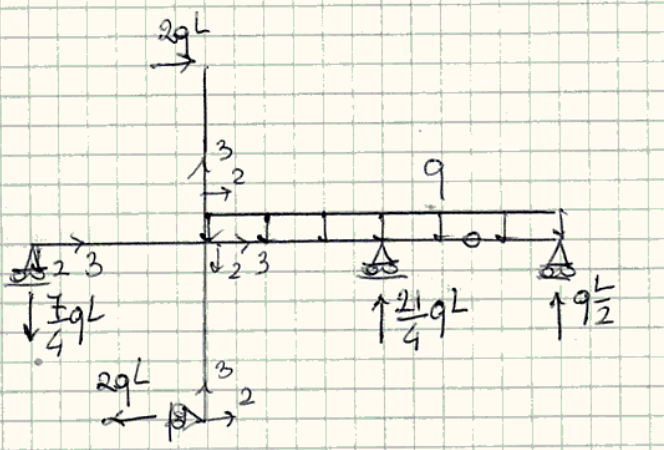
Risoluzione fila (A).



$$(A^*) \quad V_c \cdot 4L = -q \frac{L^2}{2} \cdot 4 + 2qL \cdot 4L + 4qL \cdot 4L = 21qL^3$$

$$\hookrightarrow V_c = \frac{21qL}{4}$$

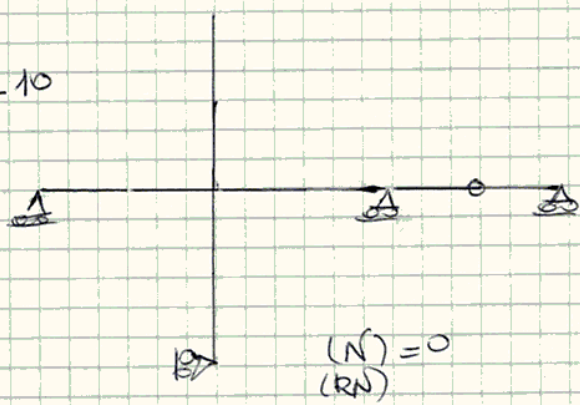
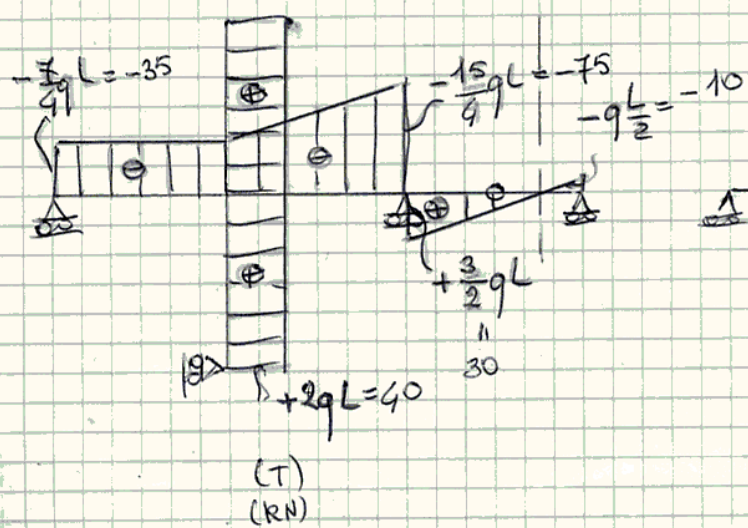
$$(T) \quad V_A = 4qL - \frac{21}{4}qL - q \frac{L}{2} = \frac{(16-21-2)}{4}qL = -\frac{7}{4}qL$$



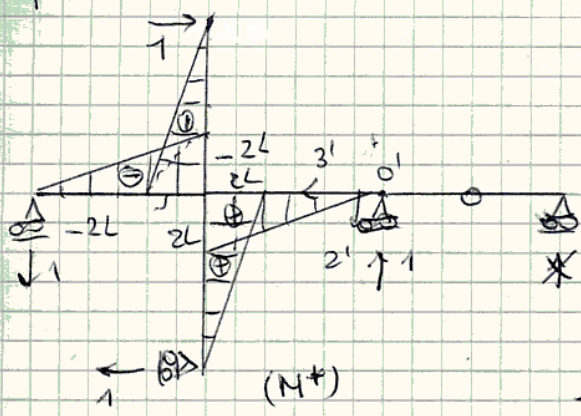
Dimensionamento:

$$W_1 \geq \frac{9}{2} \frac{qL^2}{\sigma_{adm}} = \frac{90 \cdot 10^8 \text{ cm}^3}{8240 \cdot 10^6} = 375 \text{ cm}^3$$

$$\rightarrow \text{IPE 270} \quad \begin{cases} W_1 = 428,9 \text{ cm}^3 \\ I_1 = 5790 \text{ cm}^4 \\ A = 45,95 \text{ cm}^2 \end{cases}$$



Spostamento orizzontale in F:



$$1. \delta_F = \frac{1}{EI_1} \left\{ \underbrace{\frac{1}{3} (2L)(-2L)\left(-\frac{7}{2}qL^2\right)}_{AB} + \underbrace{\frac{2}{3} (2L)(-2L)(-4qL^2)}_{BG \& BF} + \int_0^{2L} (x_3') \left( -qL + \frac{15}{4}qx_3' - \frac{qL^2}{2} \right) dx_3' \right\}_{BC}$$

$$1. \delta_F = \frac{qL^4}{EI_1} \frac{46}{3} + \left[ -\frac{1}{2} (2)^2 + \frac{15}{4} \frac{1}{3} (2)^3 - \frac{1}{2} \frac{1}{4} (2)^4 \right] \frac{qL^4}{EI_1}$$

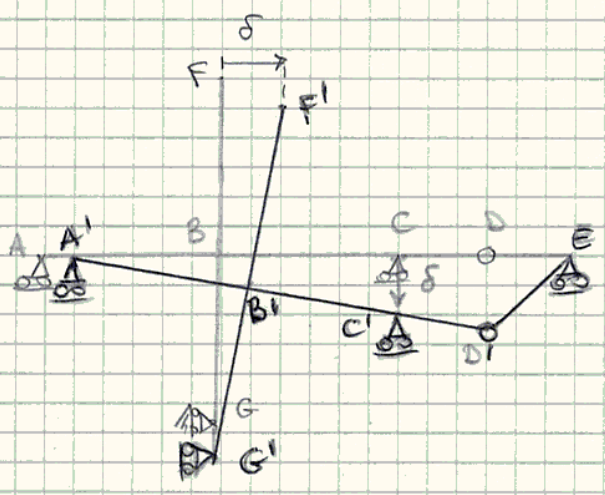
$$= \frac{qL^4}{EI_1} \left[ \frac{46}{3} - 2 + 10 - 2 \right] = \frac{qL^4}{EI_1} \left[ \frac{46}{3} + 6 \right] = \frac{64}{3} \frac{qL^4}{EI_1}$$

$$= \frac{64}{3} \frac{21 \cdot 10^3 \cdot 10^2}{21 \cdot 10^8 \cdot 5799 \cdot 10^{-8}} \text{ cm}$$

$$= \frac{64 \cdot 2000}{3 \cdot 21 \cdot 579} \text{ cm} = 3,5 \text{ cm}$$

Spostamento orizzontale in F compressivo del cedimento (abbassamento) in C:

$$1. \delta_F = \frac{64}{3} \frac{qL^4}{EI_1} + (6)(+1) = (3,5 + 1) \text{ cm} = 4,5 \text{ cm}$$



Risoluzione filo (B)

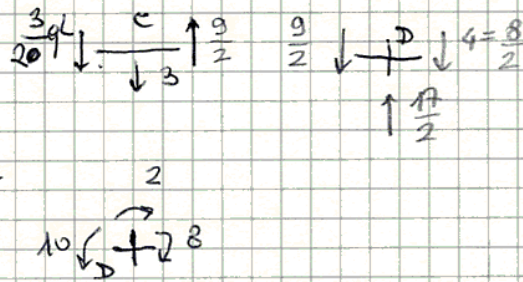
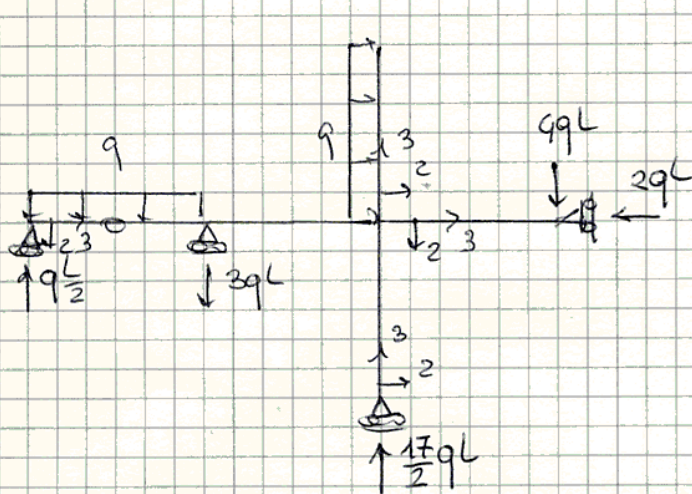
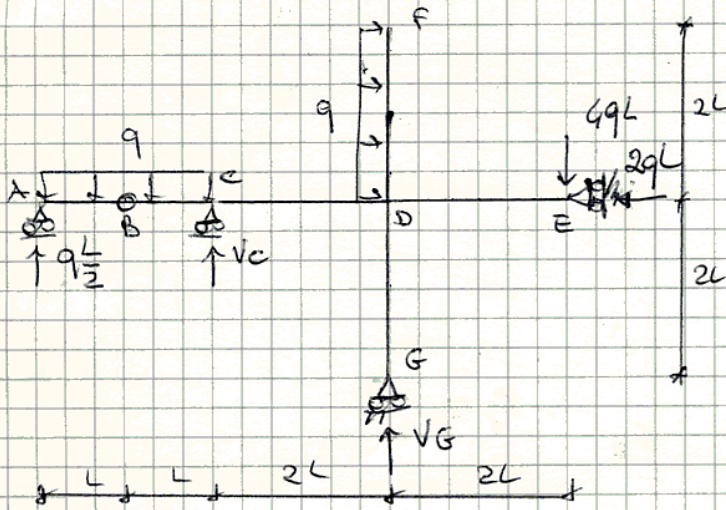
$$(D) V_c 2L + 2qL^2 + 8qL^2 + q \frac{L}{2} 4L - 2qL 3L = 0$$

$$\rightarrow 2V_c L = (-12 + 6) qL^2 = -6qL^2$$

$$\rightarrow V_c = -3qL$$

$$(1) V_G = 2qL + 6qL - q \frac{L}{2} + 3qL$$

$$= (9 - \frac{1}{2}) qL = \frac{17}{2} qL$$

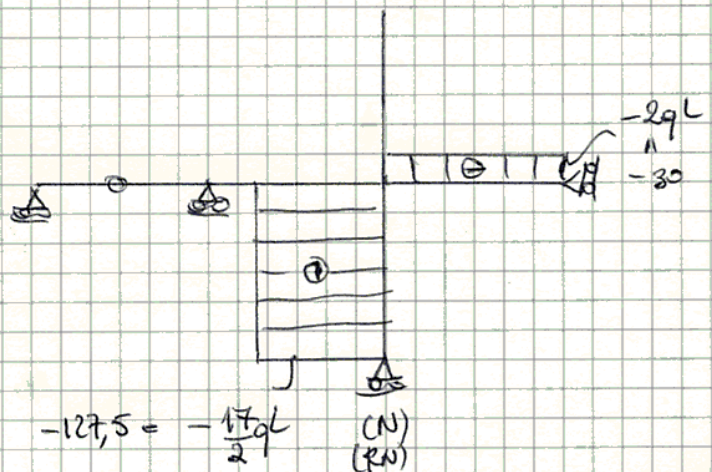
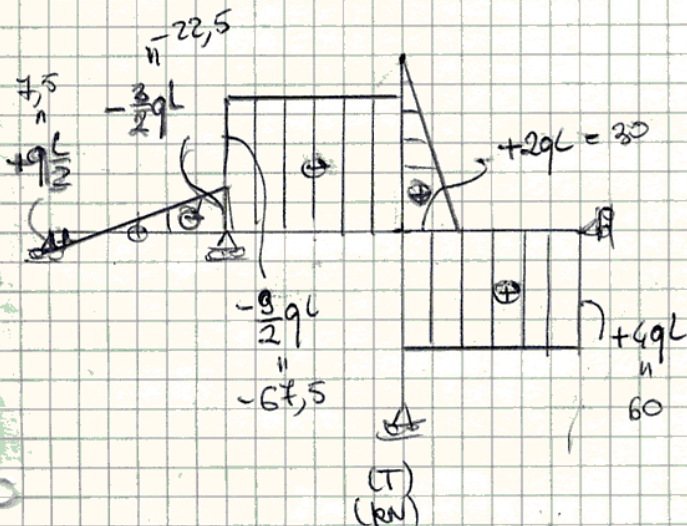
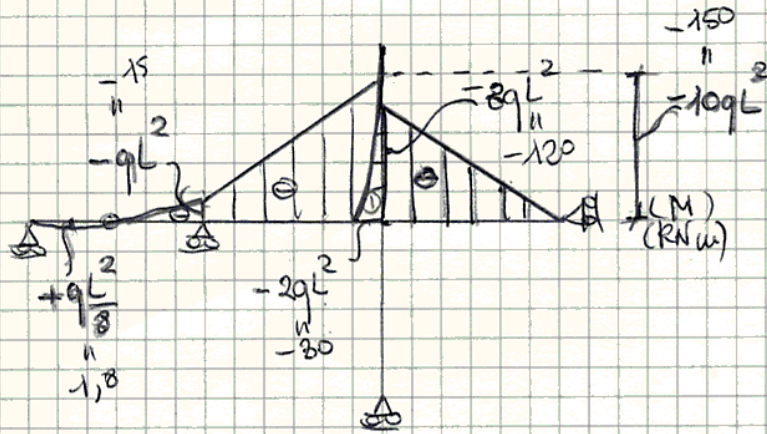


Dimensionamento:

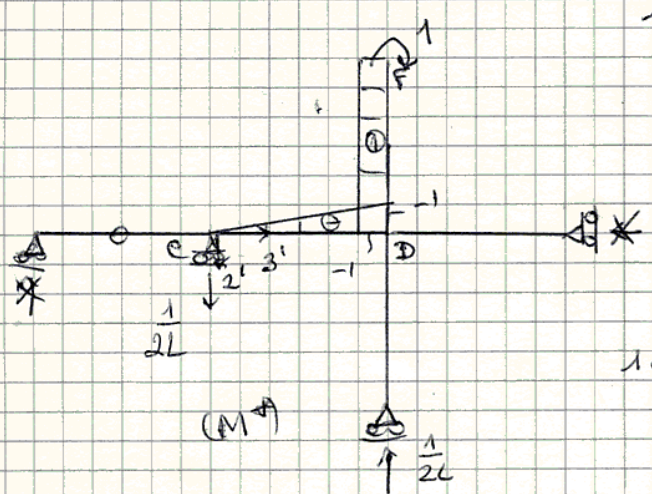
$$W_1 \geq \frac{10qL^2}{6\sigma_{AMM}} = \frac{15 \cdot 10 \cdot 10^3}{240 \cdot 10^6} = 625 \text{ cm}^3$$

IPE 330

$$\left\{ \begin{array}{l} W_1 = 713,1 \text{ cm}^3 \\ I_1 = 11770 \text{ cm}^4 \\ A = 62,61 \text{ cm}^2 \end{array} \right.$$



Rotazione w F:



$$1. \varphi_F = \frac{1}{EI_1} \left\{ \underbrace{\frac{1}{3} (2L) (-2qL^2) (-1)}_{\text{tratto FD}} + \underbrace{\int_0^{2L} \left( \frac{-x_3'}{2L} \right) \left( -qL - \frac{q}{2} qL x_3' \right) dx_3'}_{\text{tratto CD}} \right\}$$

$$1. \varphi_F = \frac{1}{EI_1} \left\{ \frac{4}{3} qL^3 + \left[ \frac{qL}{2} \frac{1}{2} (2L)^2 + \frac{q}{4} \frac{1}{3} (2L)^3 \right] \right\}$$

$$= \frac{qL^3}{EI_1} \left\{ \frac{4}{3} + 1 + \frac{18}{3} \right\} = \frac{25}{3} \frac{qL^3}{EI_1}$$

$$\varphi_F = \frac{25 \cdot 15 \cdot 10^3}{3 \cdot 2 \cdot 10^8 \cdot 11770 \cdot 10^{-8}} = 0,5 \cdot 10^{-2} = 0,3^\circ$$

Rotazione w F in presenza di un abbassamento verticale di  $\delta$  w G.

$$1. \varphi_F = \frac{1}{2L} \delta = \frac{25}{3} \frac{qL^3}{EI_1}$$

$$\rightarrow \varphi_F = \frac{25}{3} \frac{qL^3}{EI_1} + \frac{\delta}{2L} = \left( 0,5 \cdot 10^{-2} + \frac{1}{200} \right) = 0,01 = 0,57^\circ$$

