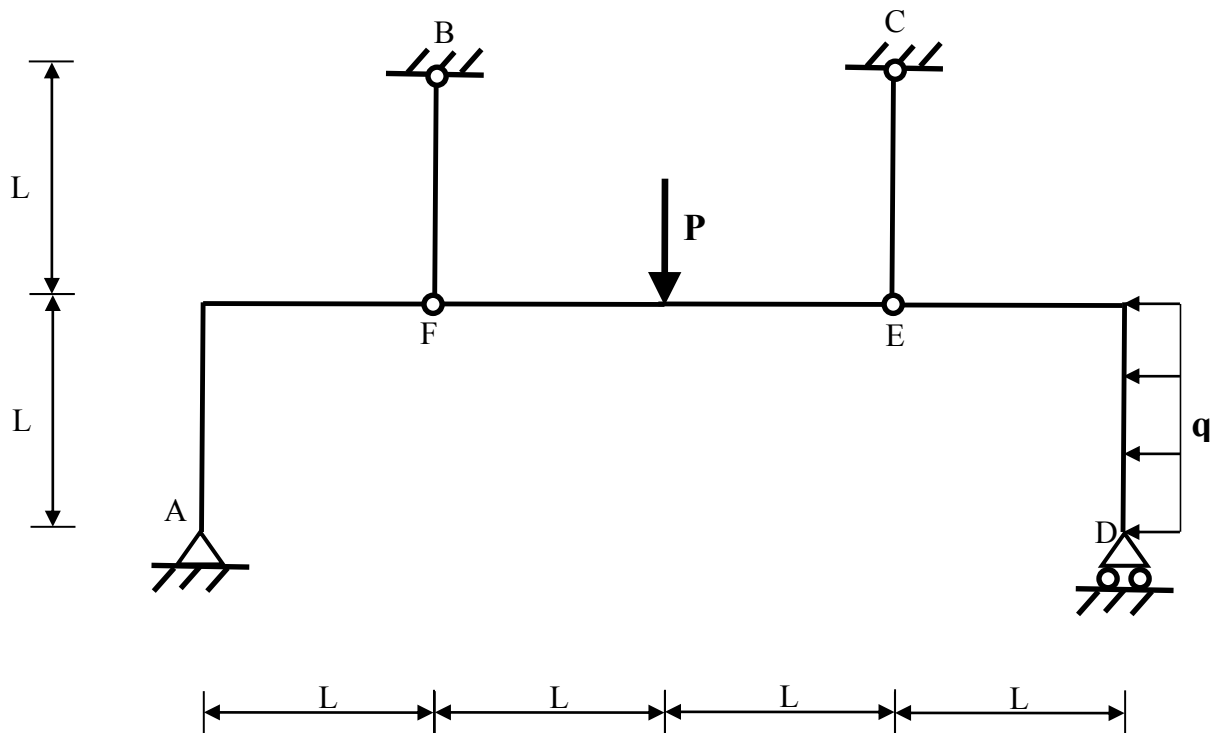


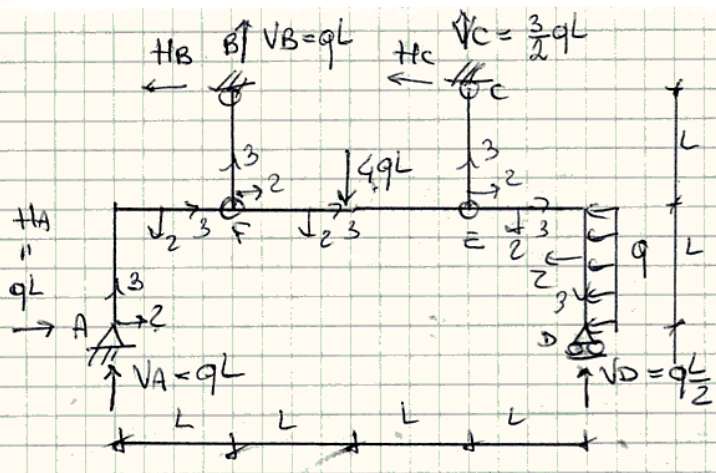
CORSO DI LAUREA IN INGEGNERIA MECCANICA
UNIVERSITÀ DI FERRARA
PROVA SCRITTA DI STATICA
07/09/2016



$L = 1 \text{ m}$, $q = 20 \text{ kN/m}$, $P = 80 \text{ kN}$
 $\sigma_{\text{AMM}} = 240 \text{ MPa}$, $E = 210 \text{ GPa}$

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

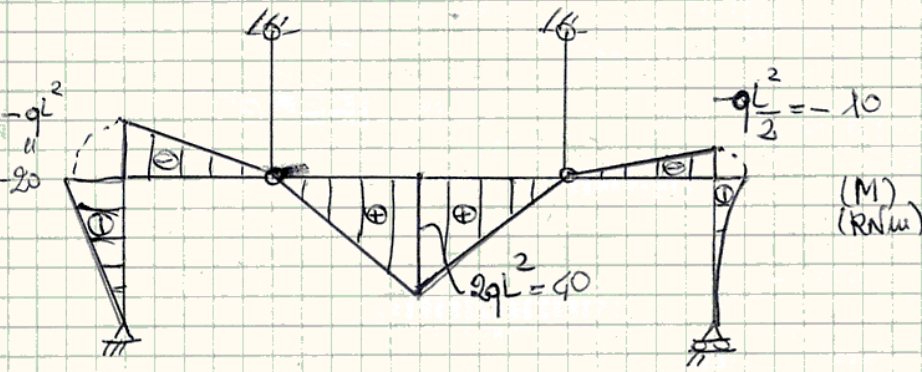
- Disegnare i diagrammi quotati delle caratteristiche della sollecitazione.
- Dimensionare la travatura.
- Calcolare lo spostamento orizzontale nel punto D.
- Calcolare nuovamente lo spostamento orizzontale in D considerando anche un abbassamento verticale pari a 1 centimetro del vincolo in C.



$$\begin{aligned}
 \rightarrow HA &= qL \\
 (F\uparrow)_{AF} \quad VA &= qL \cdot 4 \\
 (E\uparrow)_{ED} \quad VD &= q \cdot \frac{L}{2} \\
 (F\uparrow)_{BF} \quad HB &= 0 \\
 (E\uparrow)_{EC} \quad HC &= 0 \\
 (F\uparrow) \quad q \cdot \frac{L}{2} \cdot 3x - q \cdot \frac{L}{2} + Vc \cdot 2x - 4qL + q \cdot \frac{L}{2} - qL &= 0 \\
 \rightarrow 2Vc &= (4 + \frac{1}{2} - \frac{3}{2})qL = 3qL \\
 \rightarrow Vc &= \frac{3}{2}qL \\
 (\uparrow) VB &= 4qL - qL - \frac{qL}{2} - \frac{3}{2}qL = qL
 \end{aligned}$$

Diagrammi quotati:

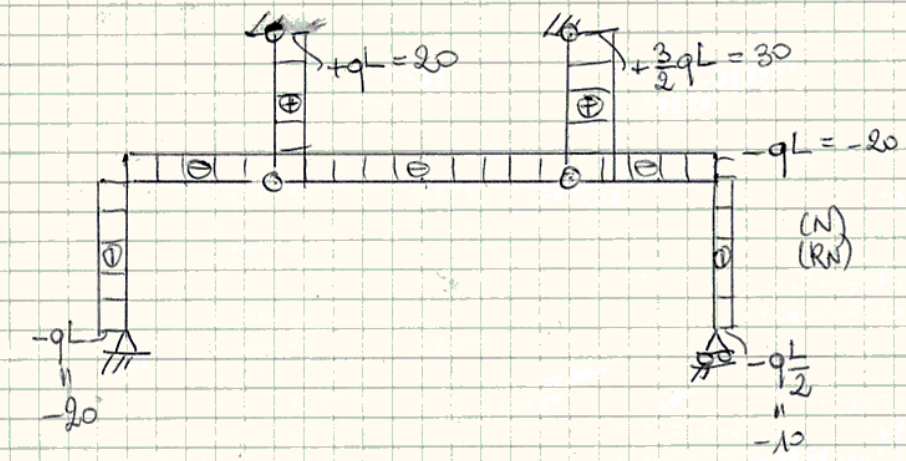
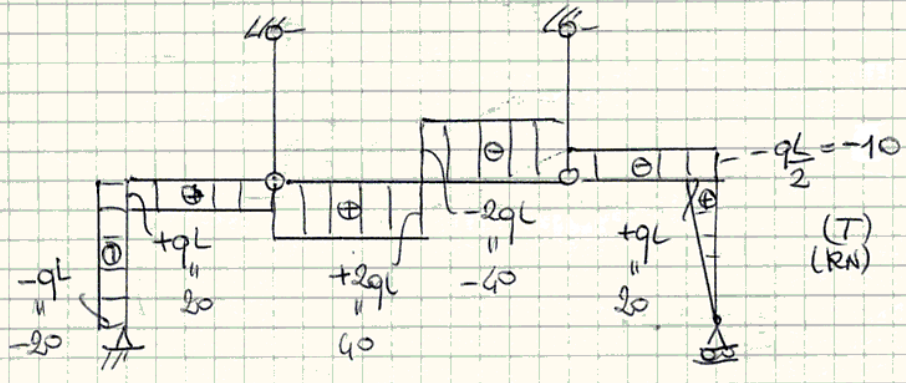
$$\begin{aligned}
 qL &= 20 \text{ kN} \\
 qL^2 &= 20 \text{ kNm}
 \end{aligned}$$



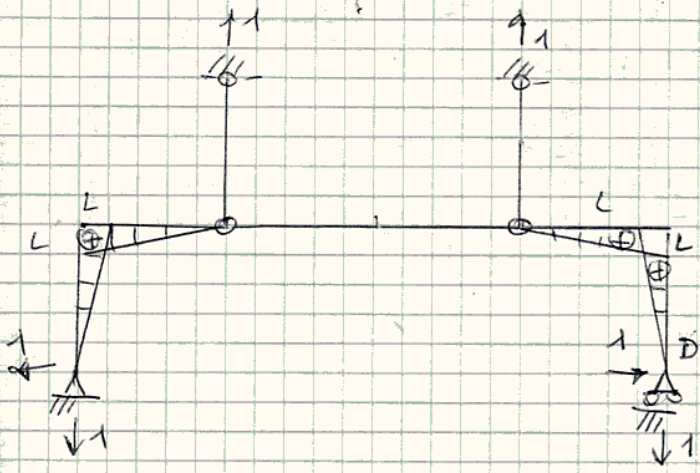
Dimensionamento:

$$W_1 \geq \frac{M}{\sigma_{adm}} = \frac{1 \cdot 10^3 \cdot 10^6}{240 \cdot 10^6} \text{ cm}^3 = 167 \text{ cm}^3$$

IPE 200 $\left\{ \begin{aligned} W_1 &= 194,3 \text{ cm}^3 \\ I_1 &= 1943 \text{ cm}^4 \end{aligned} \right.$



Spostamento orizzontale in D:



$$1 \cdot v_D = \frac{1}{EI} \left[\int_0^L x \left(-q \frac{x^2}{2} \right) dx + \frac{1}{3} L L \left(-q \frac{L^2}{2} \right) + 2 \frac{1}{3} L L \left(-q L^2 \right) \right]$$

$$1 \cdot v_D = \frac{1}{EI} \left\{ -q \frac{L^4}{8} - \frac{q L^4}{6} - \frac{2}{3} q L^4 \right\}$$

$$= -\frac{23}{24} \frac{q L^4}{EI} = -\frac{23 \cdot 20 \cdot 10^3}{24 \cdot 210 \cdot 10^8} \frac{1}{1943} \frac{m^4}{m^3}$$

$$1 \cdot v_D = -0,47 \text{ cm}$$

Spostamento orizzontale in D considerando del cedimento in C.

$$1 \cdot v_D - 1 \cdot v_C = -\frac{23}{24} \frac{q L^4}{EI}$$

$\underbrace{\hspace{10em}}_{L_e} \quad \underbrace{\hspace{10em}}_{L_i} \quad (*)$

$$\rightarrow 1 \cdot v_D = v_C - \frac{23}{24} \frac{q L^4}{EI} = (1 - 0,47) \text{ cm} = 0,53 \text{ cm}$$

Interpretazione meccanica delle

termine (*):

- configurazione iniziale
- configurazione deformata in presenza del solo cedimento verticale in C.

