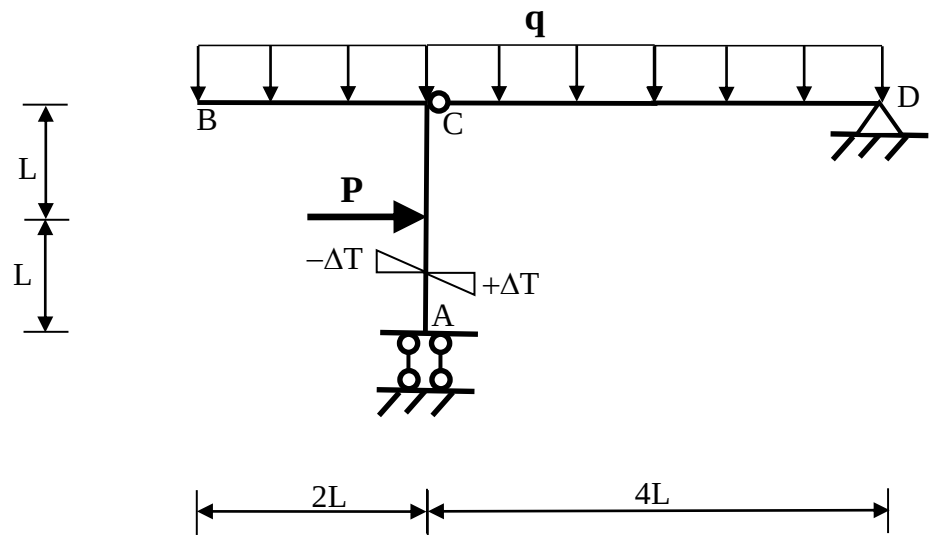
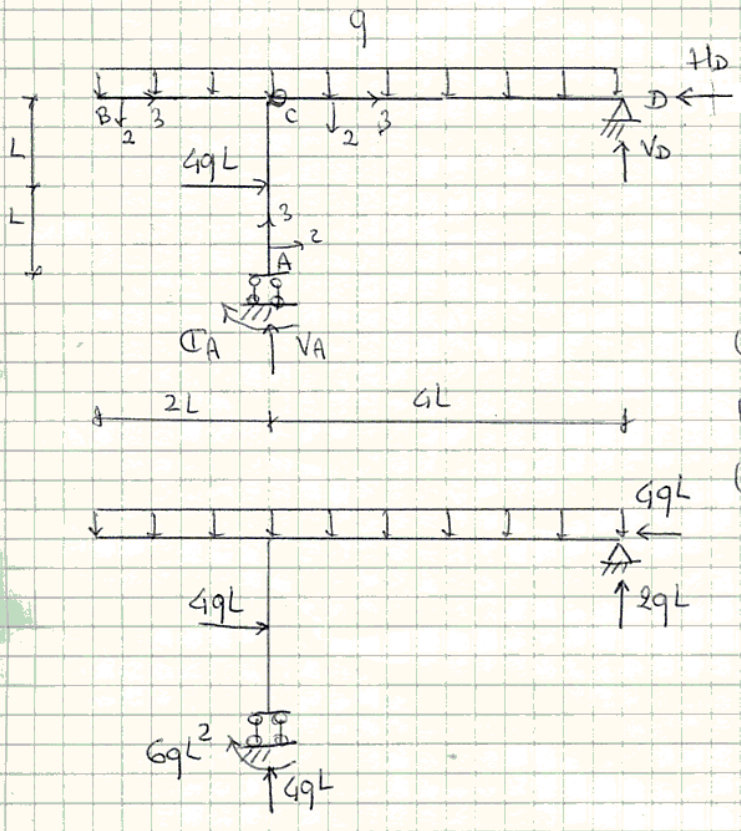
CORSO DI LAUREA IN INGEGNERIA MECCANICA
UNIVERSITÀ DI FERRARA
PROVA SCRITTA DI STATICA
11/01/2017



L= 1 m, q = 20 kN/m, P = 80 kN
σ_{AMM} = 240 MPa, E = 210 GPa, $\alpha = 10^{-5} °C^{-1}$

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 verticale in B.
- Calcolare nuovamente lo spostamento verticale in B considerando agente sul tratto AC anche un carico termico a farfalla di intensità $\Delta T = 10°C$.



$q = 20\ kN/m$, $L = 1\ m$, $qL = 20\ kN$

$P = 80\ kN = 4qL$ $\quad qL^2 = 20\ kNm$

Eq.ne disciolta in C: $V_D \cdot 4 = 4qL \cdot 2L$

$\hookrightarrow V_D = 2qL$

Eq.ni cardinali:

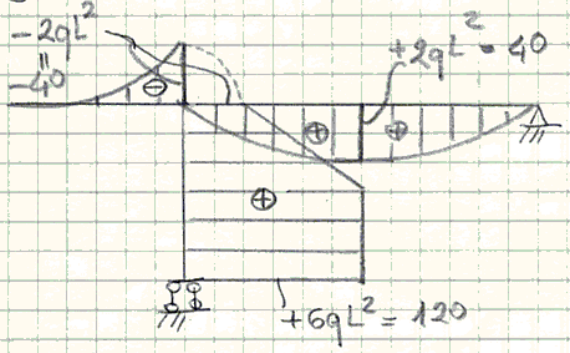
$(\rightarrow)\ H_D = +4qL$

$(\uparrow)\ V_A = 6qL - 2qL = 4qL$

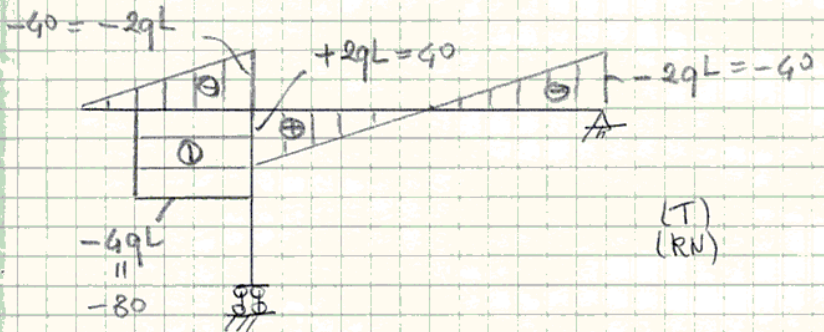
$(A\uparrow)\ C_A = 2qL \cdot 4L + 4qL \cdot 2L - 4qL \cdot 2L + 2qL \cdot L - 4qL \cdot L$

$= qL^2(8+2-4) = 6qL^2$

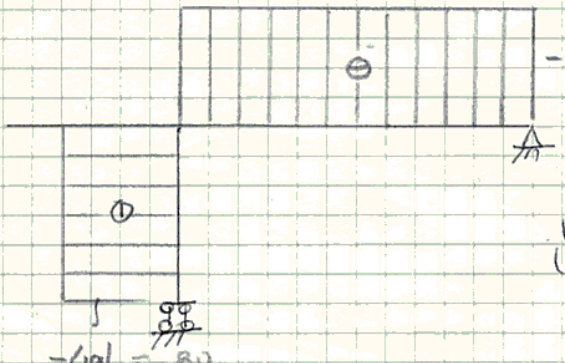
Diagrammi delle c.s.:



(M)
(kNm)



(T)
(kN)



(N)
(kN)

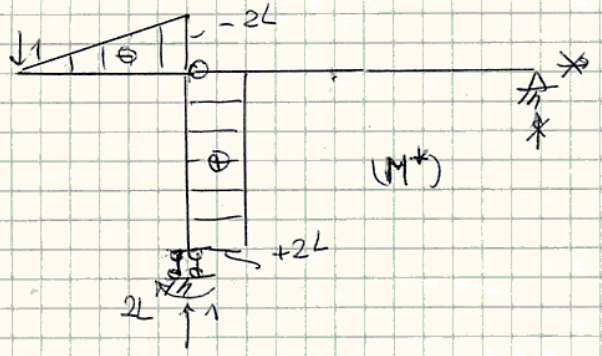
Dimensionamento:

$$W_1 \geq \frac{M_1}{\sigma_{AMM}} = \frac{6qL^2}{\sigma_{AMM}} = \frac{120 \cdot 10^2}{240 \cdot 10^6}\ m^3 = \frac{12000}{24}\ cm^3 = 500\ cm^3$$

IPE 300
- $W_1 = 557{,}1\ cm^3$
- $I_1 = 8356\ cm^4$
- $A = 53{,}81\ cm^2$
- $H = 30\ cm$

Spostamento verticale in B:

$$1 \cdot v_B = \frac{1}{EI_1}\int_0^{2L}\left(-q\frac{x_3^2}{2}\right)(-x_3)\,dx_3 + \frac{2L}{EI_1}\left[L\cdot 6qL^2 + \left(6qL^2+2qL^2\right)\times\frac{L}{2}\right]$$



$$= \frac{1}{EI_1}\frac{q}{2}\left[\frac{x_3^4}{4}\right]_0^{2L} + \frac{1}{EI_1}\,2qL^4(6+4)$$

$$= \frac{qL^4}{EI_1}(2+20) = \frac{22qL^4}{EI_1} = \frac{22\cdot 20\cdot 10^3\cdot 10^2}{210\cdot 8356\cdot 10^9\cdot 10^{-8}}\ cm$$

$$= 2{,}51\ cm$$

Spostamento verticale in B anche in presenza del caso termico:

$$1 \cdot v_B = \frac{22qL^4}{EI_1} + \int_0^{2L} 2L\,X_t\,dx_3 = \frac{22qL^4}{EI_1} + 4L^2X_t = \frac{22qL^4}{EI_1} + \frac{8\alpha\Delta T L^2}{H}$$

$$= (2{,}51+0{,}27)\ cm = 2{,}78\ cm$$