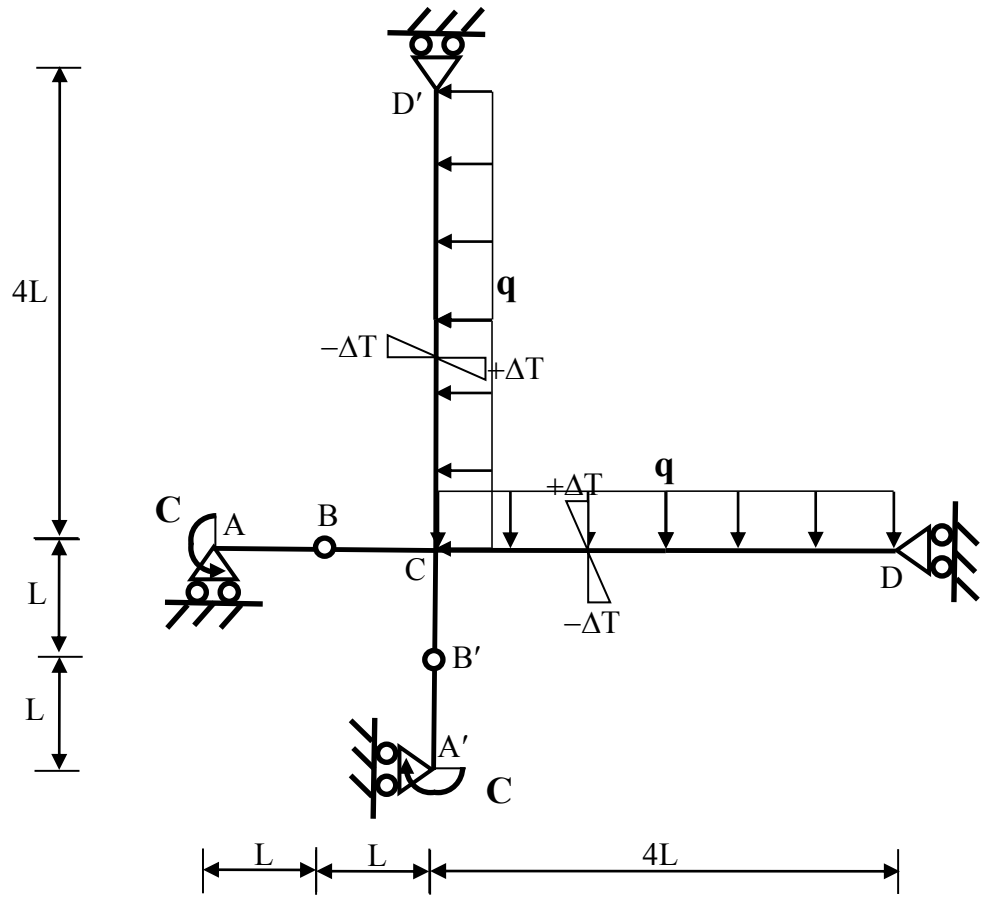
**CORSO DI LAUREA IN INGEGNERIA MECCANICA**
**UNIVERSITÀ DI FERRARA**
**PROVA SCRITTA DI STATICA**
**28/06/2017**

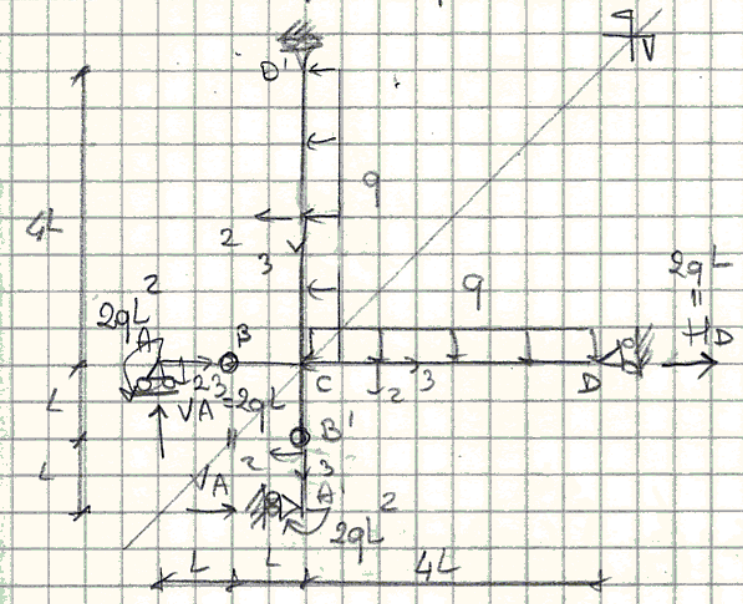



L= 1 m, q = 20 kN/m, C = 40 kN m
$\sigma_{AMM}$ = 240 MPa , E = 210 GPa, +ΔT = 10°C

La travatura staticamente determinata in figura deve essere realizzata con profilati IPE.

- Disegnare i diagrammi quotati delle caratteristiche della sollecitazione.
- Dimensionare la travatura.
- Calcolare lo spostamento verticale in D.
- Calcolare nuovamente lo spostamento verticale in D considerando anche il carico termico a farfalla nei tratti CD e CD′.

1)




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

$qL = 20\ kN$, $qL^2 = 20\ kNm$

$\mathbb{C} = 40\ kNm = 2qL^2$

$\rightarrow) \quad V_A + H_D - 4qL = 0$

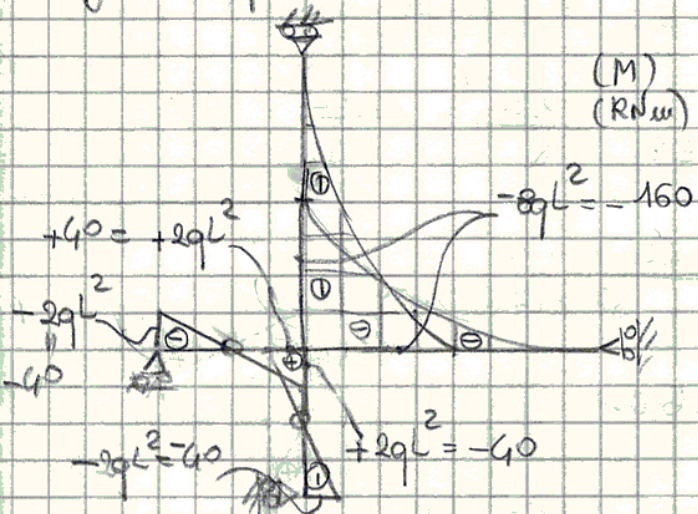
$\uparrow) \quad V_A + H_D - 4qL = 0$

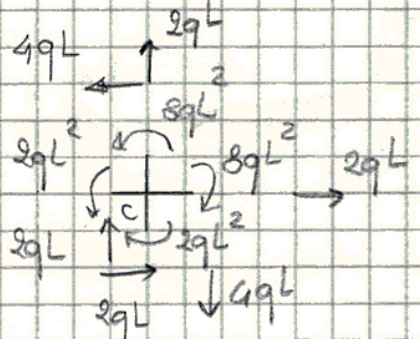
$(C\uparrow)) \quad V_A 2L - 2qL^2 + 8qL^2 = V_A 2L - 2qL^2 + 8qL^2$

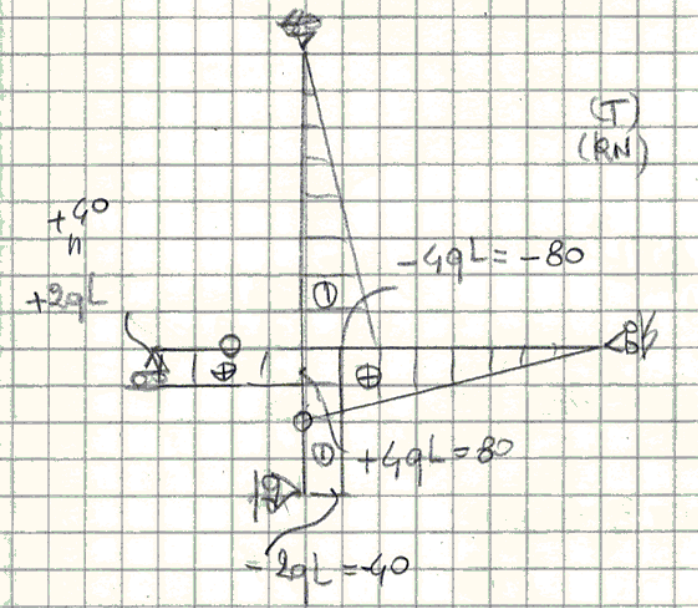
$(B\uparrow)_{AB}) \quad V_A L = 2qL^2$

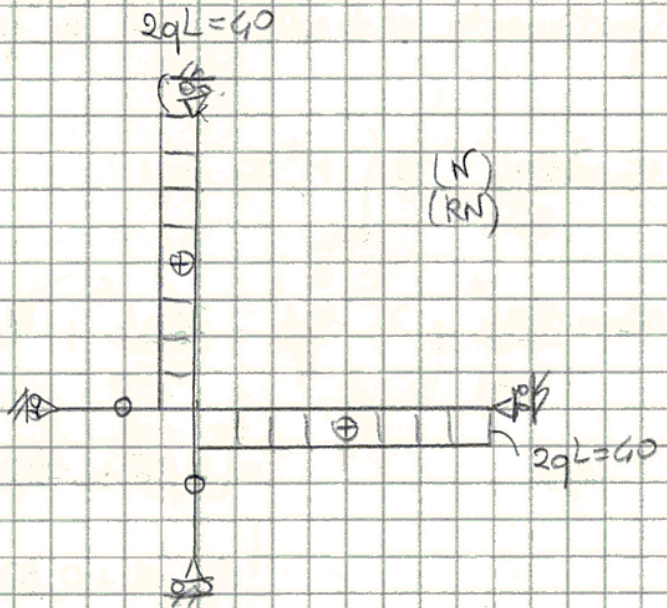
$\hookrightarrow H_D = -V_A + 4qL = +2qL$

Diagramme quotés :



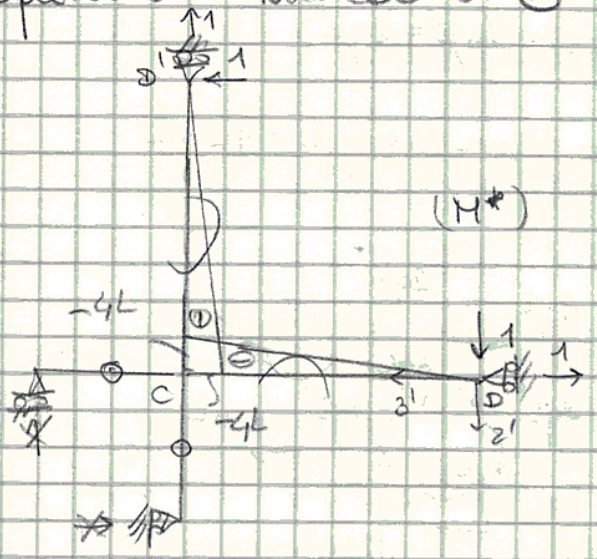
2)

$$W_1 \geq \frac{M_{max}}{\sigma_{AMM}} = \frac{8qL^2}{\sigma_{AMM}} = \frac{160 \cdot 10^3}{240 \cdot 10^6} 10^6 \, cm^3 = 667 \, cm^3$$

IPE 330

$$\begin{cases} W_1 = 713,1 \, cm^3 \\ A = 62,61 \, cm^2 \\ H = 330 \, mm \\ I_1 = 11770 \, cm^4 \end{cases}$$

3) Spostamento verticale in D




$$\chi \cdot v_D = \frac{1}{EI_1} \int_0^{4L} (-x_3') \left(-q \frac{x_3'^2}{2}\right) dx_3'$$

$$= \frac{1}{EI_1} \frac{q}{2} \left[\frac{x_3'^4}{4}\right]_0^{4L}$$

$$= \frac{1}{EI_1} \frac{q}{8} 256 = \frac{32qL^4}{EI_1}$$

$$= \frac{32,20 \cdot 10^3 \cdot 10^2}{210 \cdot 10^3 \, 11770 \, 10^{-8}} \, cm$$

$$= 2,6 \, cm$$

4) Spostamento verticale in D in presenza del cinematismo:

$$\chi v_D = \frac{32qL^4}{EI_1} + \chi \int_{CD} H^* \chi_t \, dx_3'$$

$$v_D = \frac{32qL^4}{EI_1} + \chi_t \frac{16L^2}{8} = \frac{32qL^4}{EI_1} + \frac{16 \alpha \Delta T L^2}{H}$$

$$= \left(2,6 + \frac{16 \cdot 10^5 \cdot 10 \cdot 10^{-4}}{33}\right) cm$$

$$= (2,6 + 0,5) \, cm = 3,1 \, cm$$