

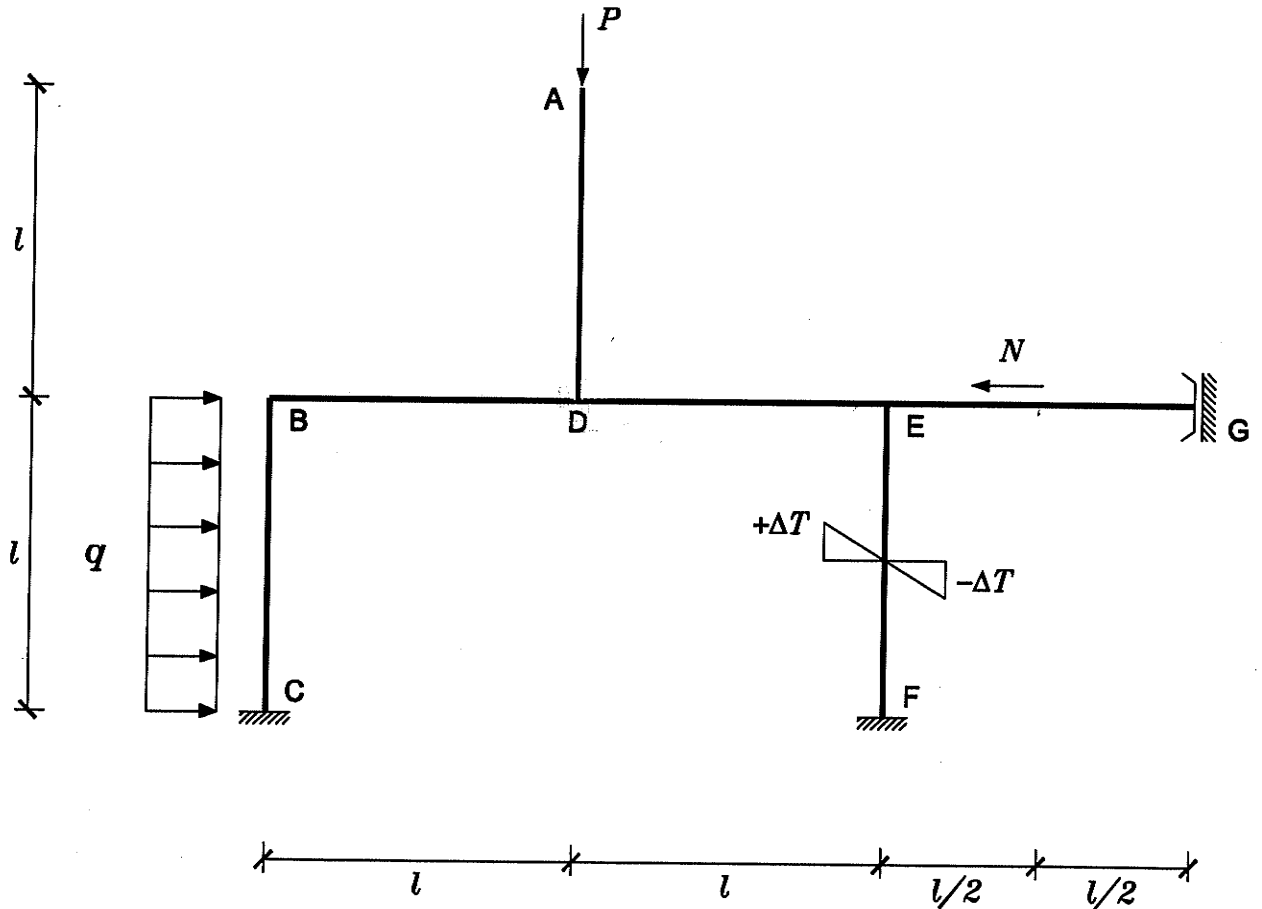
# TECNICA DELLE COSTRUZIONI

ALLIEVI CIVILI E EDILI

TEMA ESAME DEL 14 LUGLIO 2014

DOCENTI: PROF. ING. GIOVANNI A. PLIZZARI ESERCITATORE: ING. LUCA FACCONI  
ING. FAUSTO MINELLI

## Esercizio



$$P = \frac{28}{3} ql$$

$$\frac{\alpha \Delta T}{t} = \frac{53}{24} \frac{ql^2}{EJ}$$

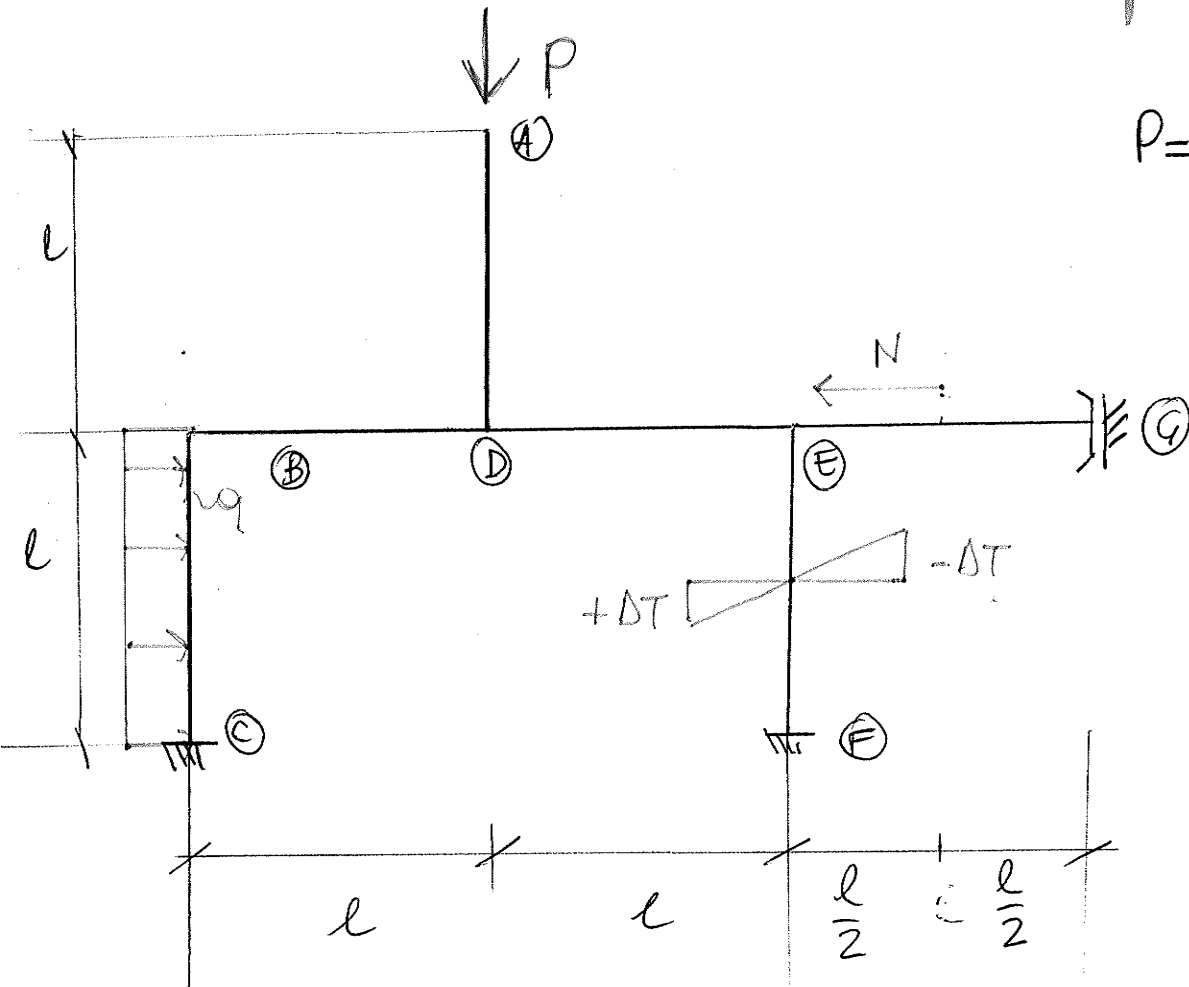
$$N = 3ql$$

Dato il telaio in figura

Si richiedono i grafici di:

1. Momento flettente (con il valore e la posizione dei massimi);
2. Taglio;
3. Azione assiale;
4. Deformata qualitativa con posizione dei flessi.

# TEMA ESAME 14 LUGLIO 2014



$$P = \frac{28}{3} qL$$

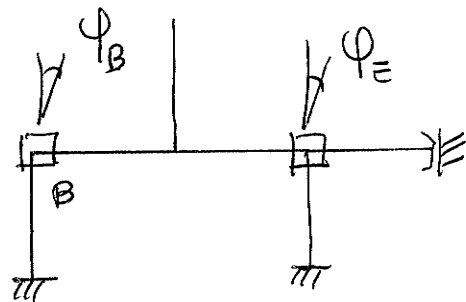
$$\frac{\alpha \Delta T}{t} = \frac{53}{24} \frac{qL^2}{EJ}$$

$$N = 3qL$$

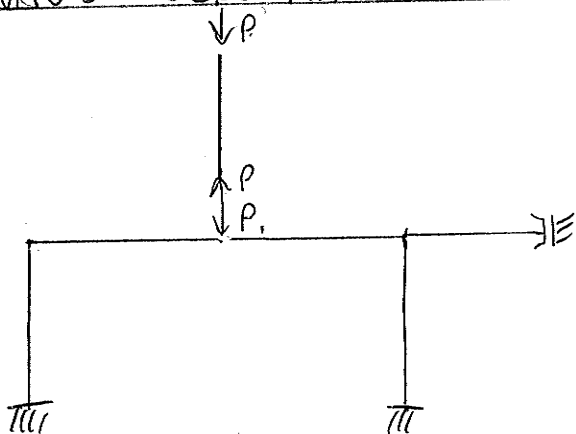
TELAIO A NODI FISSI

SISTEMA RISOLVENTE

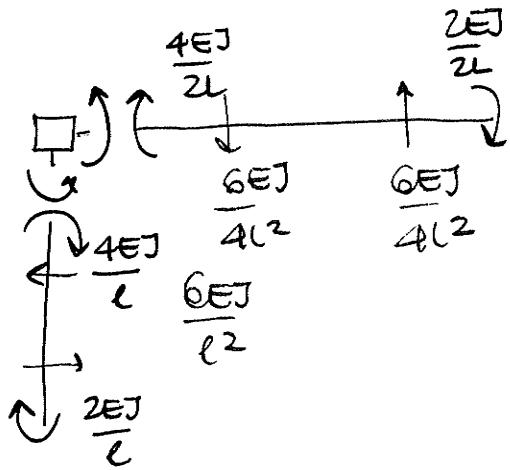
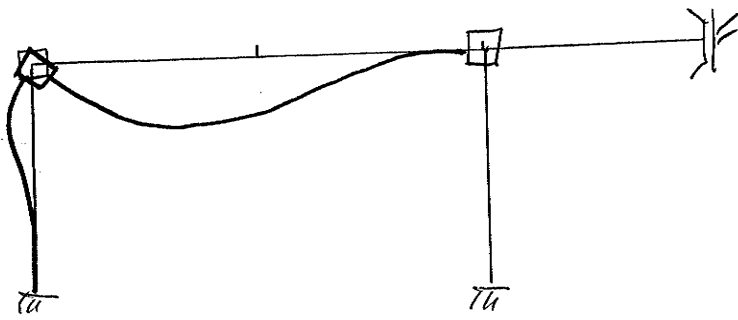
$$\begin{cases} M_{BB} \psi_B + M_{BE} \psi_E + M_{B\phi} = 0 \\ M_{EB} \psi_B + M_{EE} \psi_E + M_{E\phi} = 0 \end{cases}$$



ANALISI DELL'APPENDICE ISOSTATICA AD



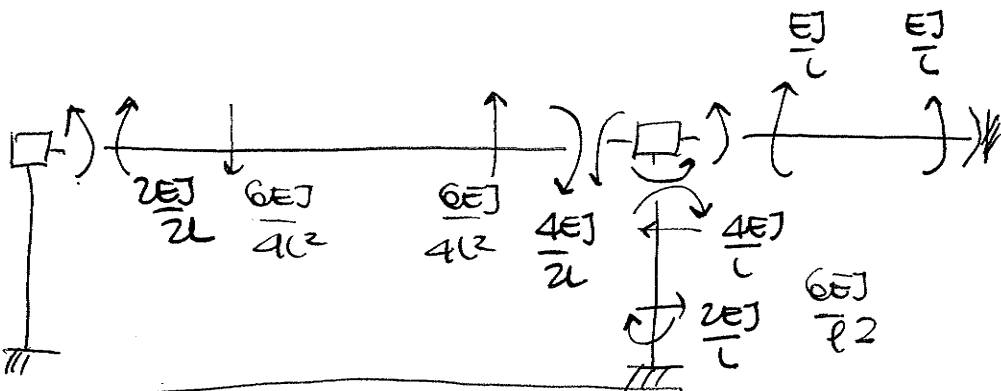
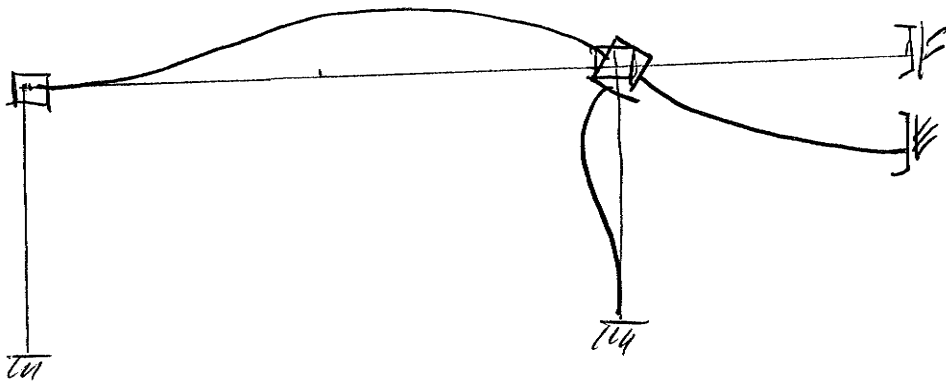
CASO 1:  $\psi_B = 1$



$$M_{BB} = \frac{4EJ}{l} + \frac{2EJ}{l} = \frac{6EJ}{l}$$

$$M_{EB} = \frac{EJ}{l}$$

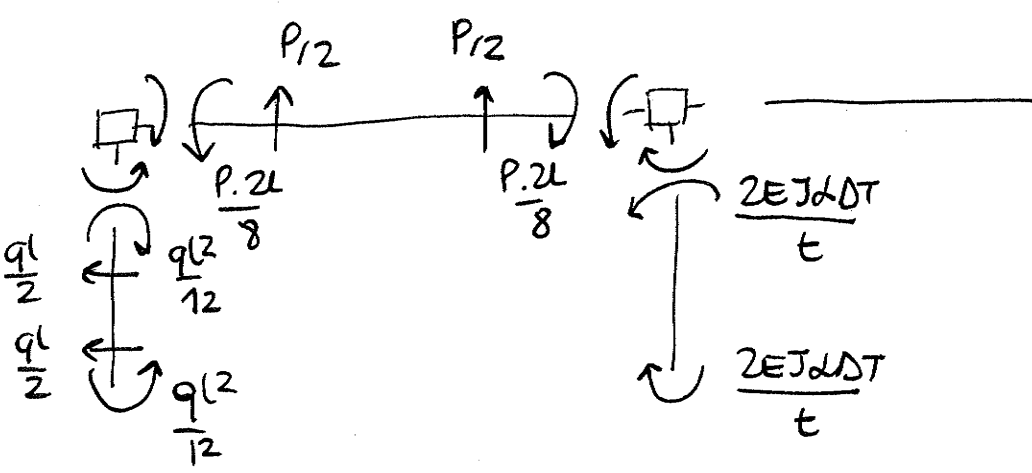
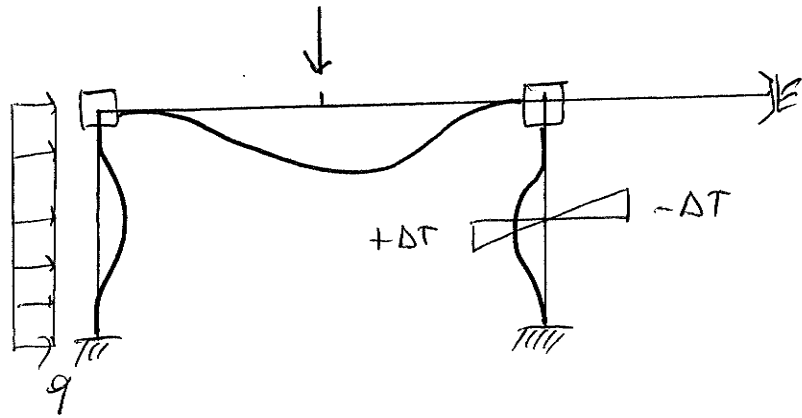
CASO 2:  $\psi_E = 1$



$$M_{EE} = \frac{4EJ}{2l} + \frac{4EJ}{l} + \frac{EJ}{l} = \frac{9EJ}{l}$$

$$M_{BE} = \frac{EJ}{l}$$

CASO 3: CARICHI  $\neq 0$



$$M_{B\phi} = \frac{qL^2}{12} - \frac{PL}{4}$$

$$M_{A\phi} = \frac{PL}{4} - \frac{2EJ\Delta T}{l}$$

# SISTEMA RISOLVENTE

$$\begin{cases} M_{BB}\psi_B + M_{BE}\psi_E + M_{B\emptyset} = 0 \\ M_{EB}\psi_B + M_{EE}\psi_E + M_{E\emptyset} = 0 \end{cases}$$

$$\begin{cases} \frac{6EJ}{l}\psi_B + \frac{EJ}{l}\psi_E + \left( \frac{qL^2}{12} - \frac{28qL^2}{3 \cdot 4} \right) = 0 \\ \frac{EJ}{l}\psi_B + \frac{7EJ}{l}\psi_E + \left( \frac{28qL^2}{3 \cdot 4} - \frac{2EJ \cdot 53}{24 \cdot 12} \frac{qL^2}{EJ} \right) = 0 \end{cases}$$

$$\begin{cases} \frac{6EJ}{l}\psi_B + \frac{EJ}{l}\psi_E + \left( \frac{qL^2}{12} - \frac{7qL^2}{3} \right) = 0 \\ \frac{EJ}{l}\psi_B + \frac{7EJ}{l}\psi_E + \left( \frac{7}{3}qL^2 - \frac{53}{12} \frac{qL^2}{EJ} \right) = 0 \end{cases}$$

$$\begin{cases} 6\psi_B + \psi_E + \left( -\frac{9}{4} \frac{qL^3}{EJ} \right) = 0 \\ \psi_B + 7\psi_E + \left( -\frac{25}{12} \frac{qL^3}{EJ} \right) = 0 \quad (\cdot 6) \end{cases}$$

$$6\psi_B + \psi_E = + \frac{9}{4} \frac{qL^3}{EJ}$$

$$\ominus$$

$$6\psi_B + 42\psi_E = + \frac{25}{2} \frac{qL^3}{EJ}$$

$$\text{" } + 41\psi_E = + \frac{41}{4} \frac{qL^3}{EJ}$$

$$\boxed{\psi_E = \frac{1}{4} \frac{qL^3}{EJ}}$$

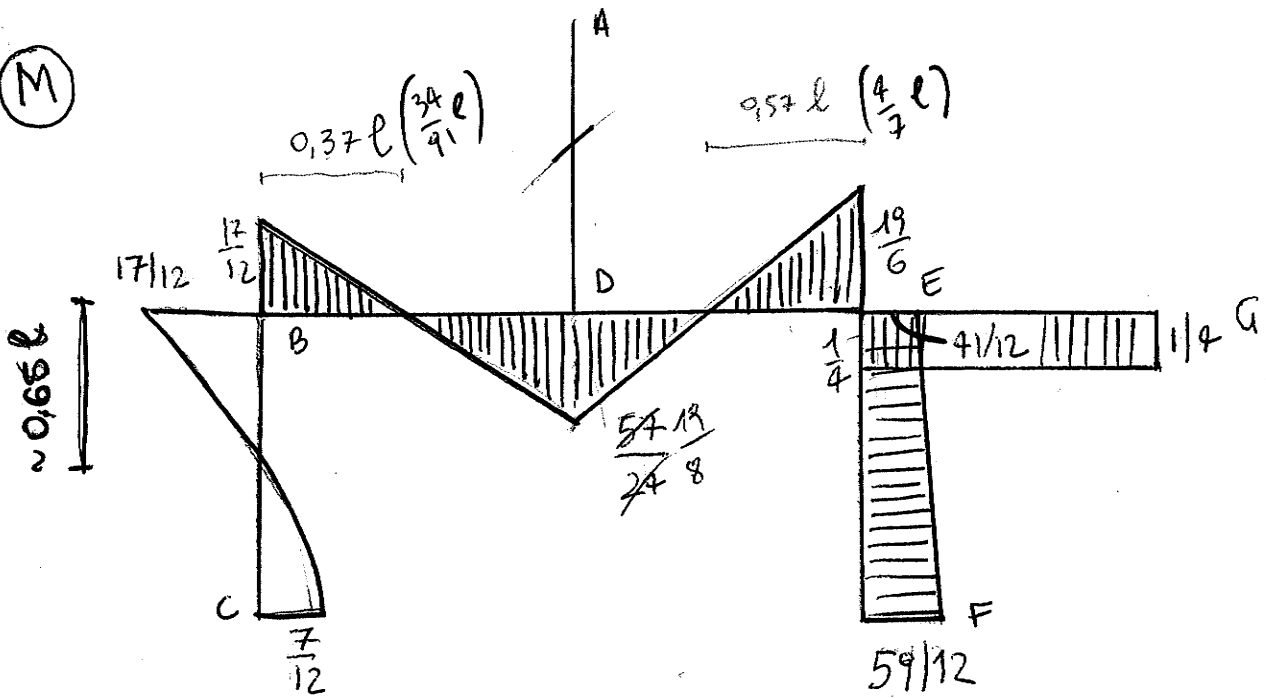
$$6\psi_B + \frac{1}{4} \frac{qL^3}{EJ} = \frac{9}{4} \frac{qL^3}{EJ}$$

$$6\psi_B = \left( \frac{9}{4} - \frac{1}{4} \right) \frac{qL^3}{EJ}$$

$$6\psi_B = \frac{8}{4} \frac{qL^3}{EJ} \quad \psi_B = \frac{8}{4 \cdot 6} \frac{1}{6} \frac{qL^3}{EJ} = \frac{1}{3} \frac{qL^3}{EJ}$$

$$\boxed{\begin{aligned} \psi_E &= \frac{1}{4} \frac{qL^3}{EJ} \\ \psi_B &= \frac{1}{3} \frac{qL^3}{EJ} \end{aligned}}$$

(M)



$M_{max}$ :

$$\frac{17}{12} q \cdot l^2 - \frac{91}{24} q \cdot l \cdot l = \frac{57}{24} q l^2$$

Flexi:

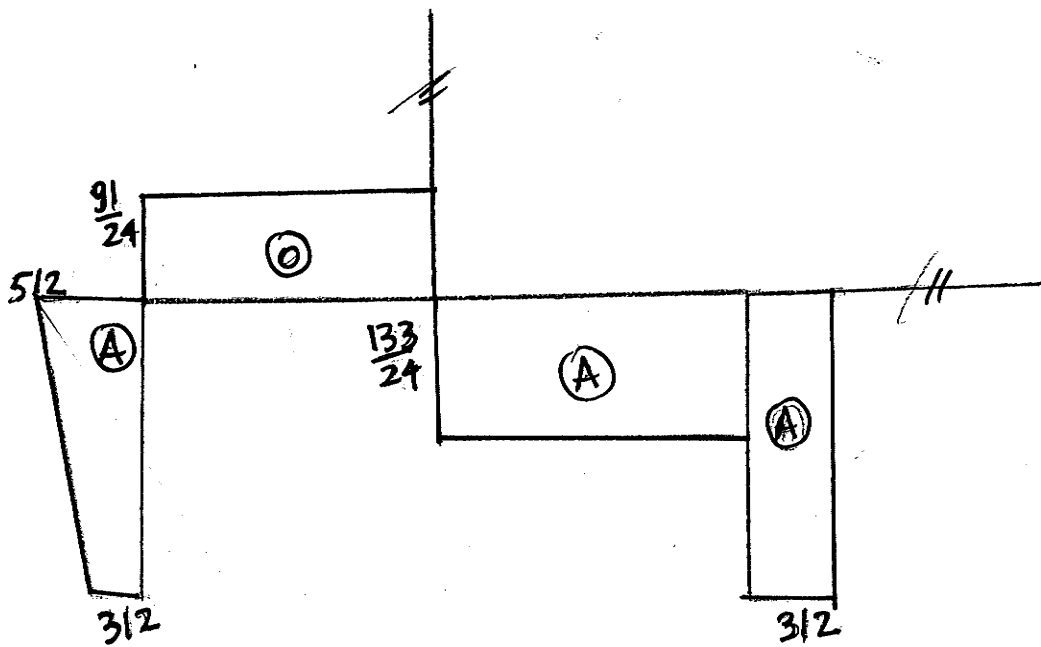
$$\frac{17}{12} q l^2 - \frac{91}{24} q l \cdot x = 0 \quad \frac{17}{12} l = \frac{91}{24} x \quad x = \frac{34}{91} l \approx 0,37 l \quad \text{ASTA BD}$$

$$\frac{19}{6} q l^2 - \frac{133}{24} q l \cdot x = 0 \quad \frac{19}{6} l = \frac{133}{24} x \quad x = \frac{19 \cdot 24}{6 \cdot 133} = \frac{76}{133} l \approx 0,57 l \quad \text{ASTA DE}$$

$$\frac{17}{12} q l^2 - \frac{5}{2} q l x + q x^2 = 0 \quad \text{ASTA CB}$$

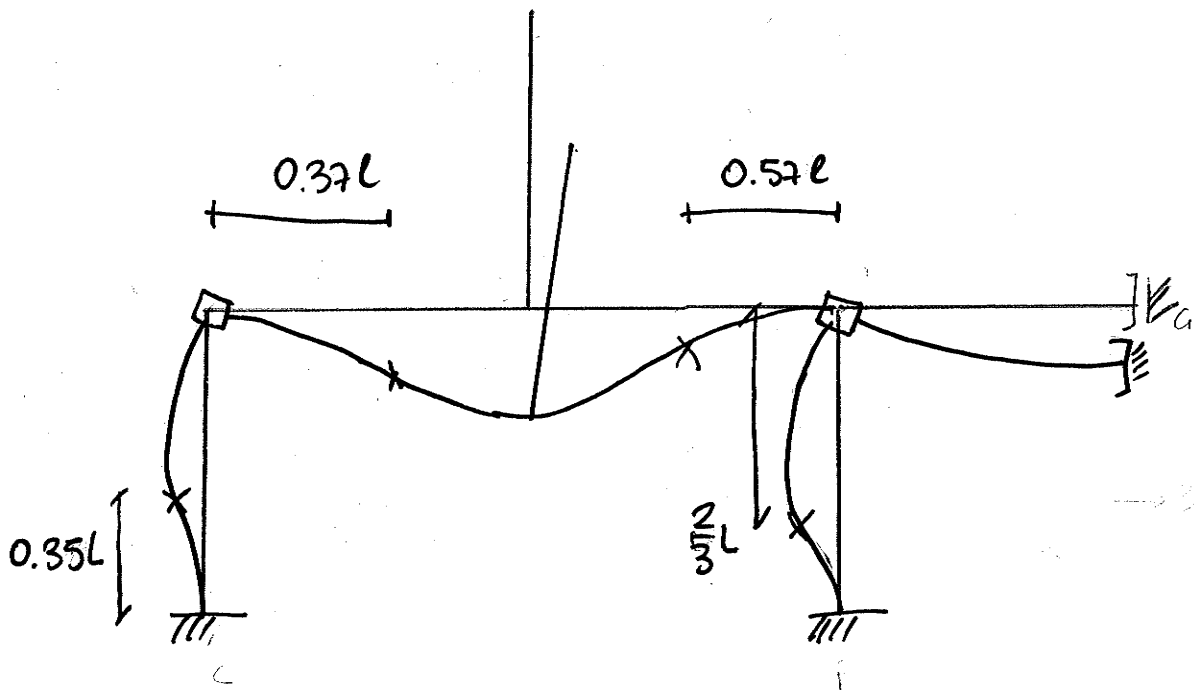
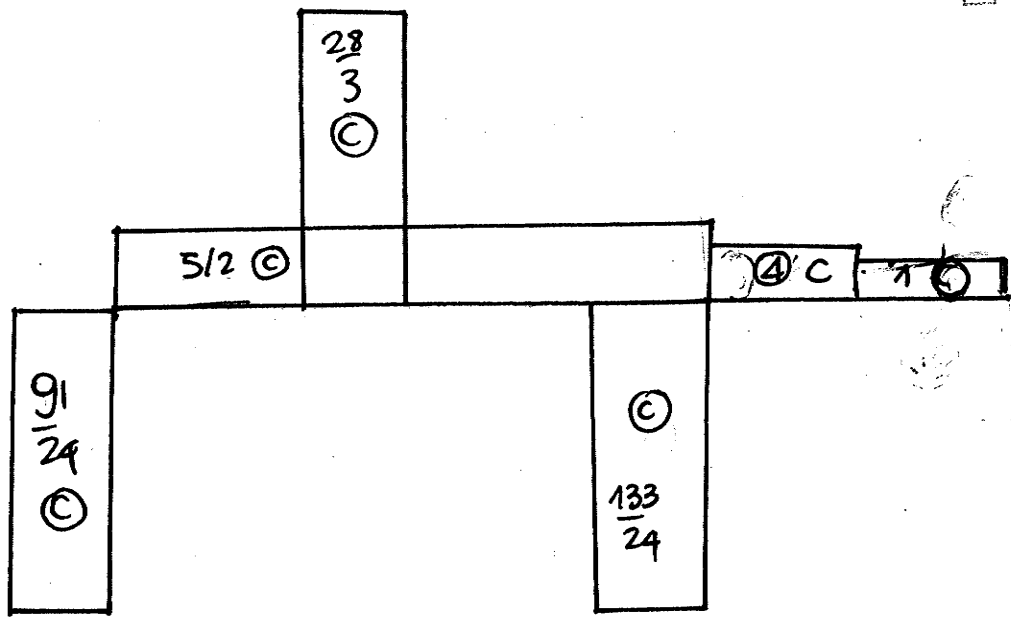
$$\frac{x^2}{2} - \frac{5}{2} x + \frac{17}{12} = 0 \quad x_{min} = \frac{5}{2} \pm \sqrt{\frac{25}{4} - \frac{17}{6}} = \frac{5}{2} \pm \sqrt{\frac{41}{12}} = \frac{5}{2} \pm 1,84 \approx 0,66 l$$

(V)



(5)

(N)



Deformata termica (ASTA EF)

De extremo E:

$$M(x) = \frac{41}{12} q l^2 + \frac{3}{2} q l x$$

$$y'' = \frac{1}{ES} \left( \frac{41}{12} q l^2 + \frac{3}{2} q l x \right) - 2 \cdot \frac{53}{24} \frac{q l^2}{ES}$$

$$\frac{41}{12} q l^2 + \frac{3}{2} q l x - \frac{53}{12} q l^2 > 0$$

$$x > \frac{2}{3} l \rightarrow x > \frac{2}{3} l$$

(6)