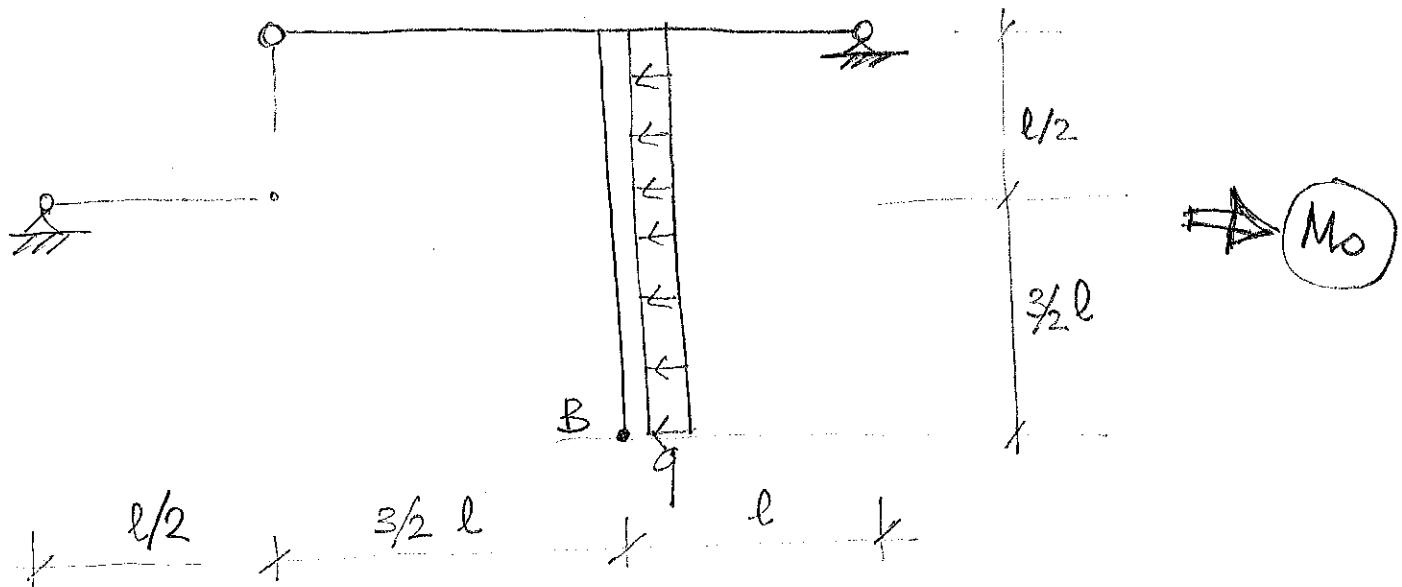


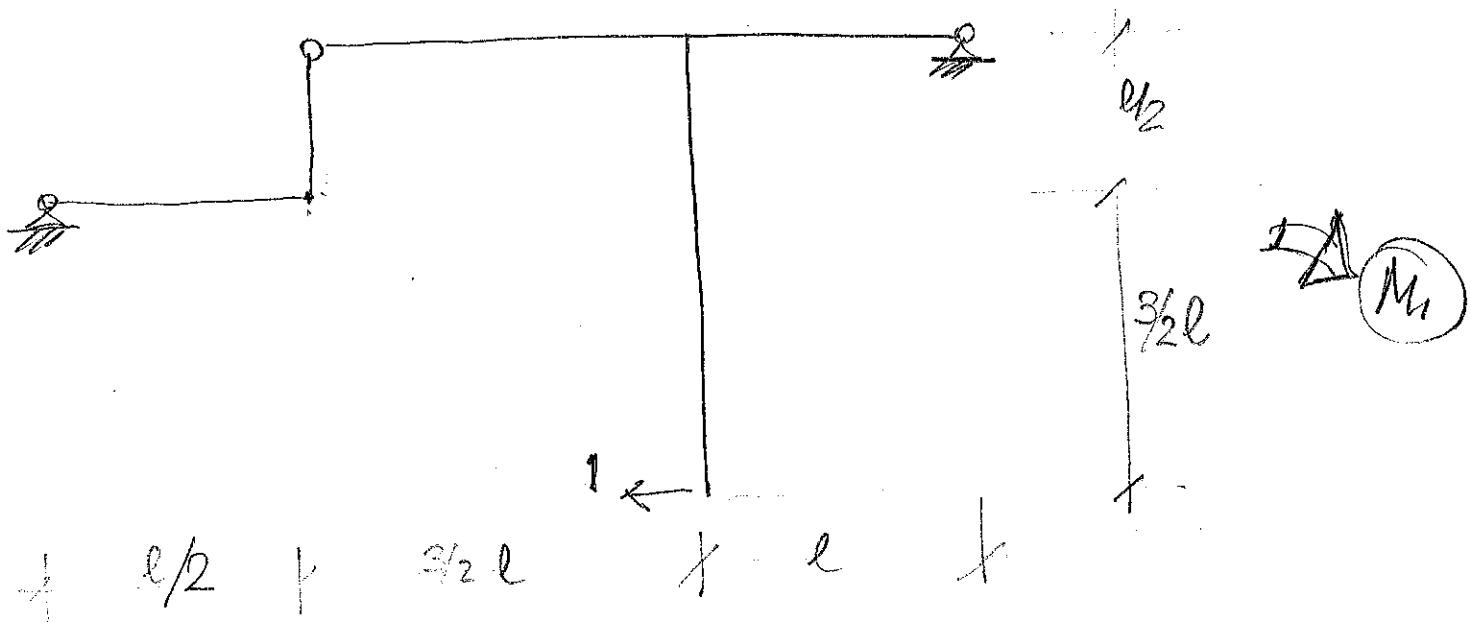
(8)

ESEMPIO

calcolo sullo spostamento orizzontale in B con il metodo delle potenze



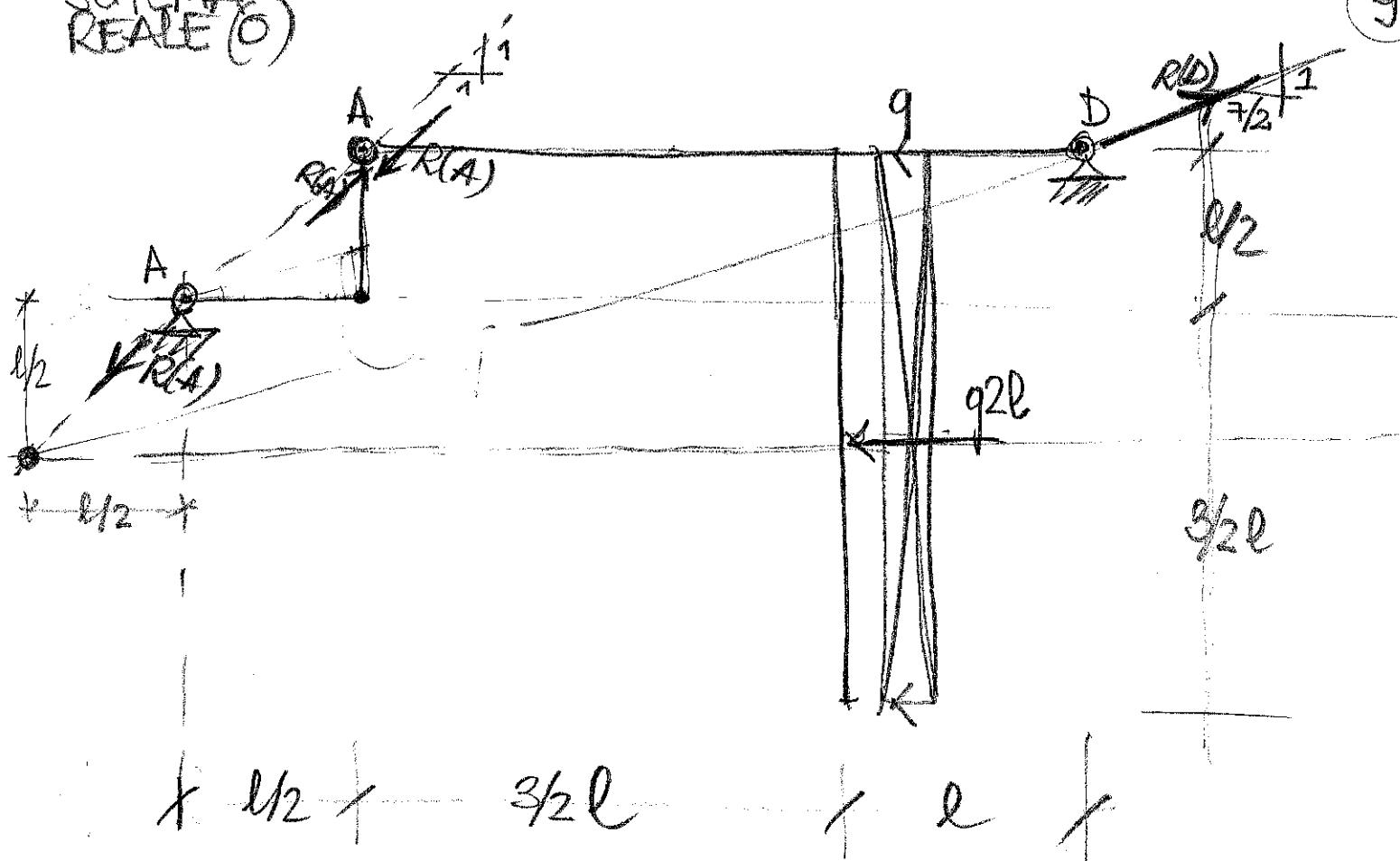
si aggiunge uno schema virtuale con forza virtuale
orizzontale in B



I due momenti M_o , M_1 relativi ai due schemi
sono risolti per via grafica.

SCHEMA
REALE (O)

(9)



EPL. RISULTANTI

$$\left\{ \bar{R}(A) + 2ql = \frac{7}{2} \bar{R}(D) \right.$$

$$\left. \bar{R}(D) = \bar{R}(A) \right.$$



$$\left\{ \begin{array}{l} \bar{R}(D) = \frac{4}{5} ql \\ \bar{R}(A) = \frac{4}{5} ql \end{array} \right.$$

$$\begin{aligned} R(A) &= \bar{R}(A)\sqrt{2} \\ R(D) &= \bar{R}(D)\frac{\sqrt{53}}{2} \end{aligned}$$

$$\begin{cases} \bar{R}(D) = \frac{7}{2} \\ 14/5 ql \end{cases}$$

$$\begin{cases} R(A) = 4/5 ql \\ R(D) = 7/5 ql \end{cases}$$

10

Mo

el₂

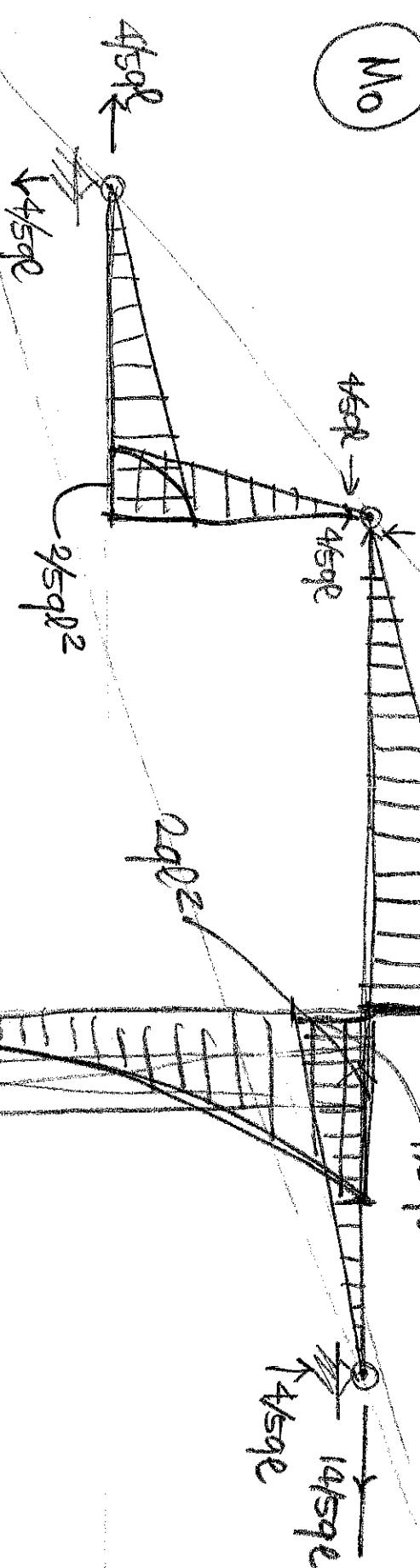
SPL

6/5 q₀²

l

4/5 q₀²

K

14/5 q₀
4/5 q₀

verfied by
T.O.L. At now
do moments

7/5q₀

X 8 X

SUMA VERTUALE (1)

(2)

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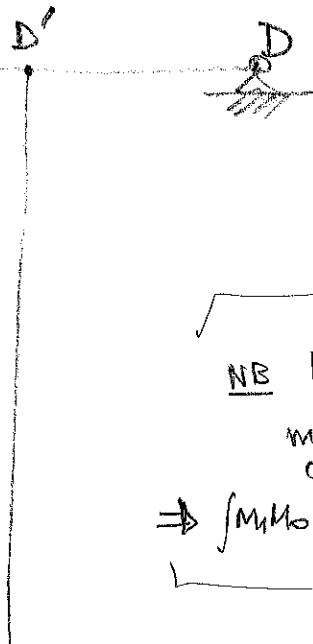
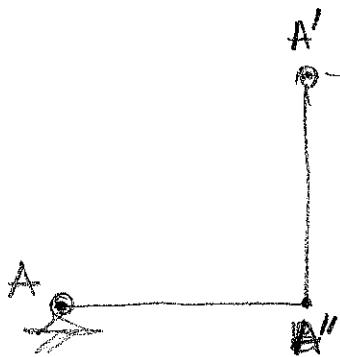
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(12)

semplificazione

NB In tutti i tratti
l'eccentricità
misurata coincide
con il misurato

$$\Rightarrow \int M_1 M_0 = \frac{4}{3} l \frac{M_{11}}{2} \frac{M_{00}}{2}$$

$$\begin{aligned}
 V(B) &= \int M_1 \frac{M_0}{EJ} = \underbrace{\frac{4}{3EJ} \frac{l}{2} \frac{2/5ql^2}{2} \frac{2/5l}{2}}_{\text{struttura}} + \underbrace{\frac{4}{3EJ} \frac{l}{2} \frac{2/5ql^2}{2} \frac{2/5l}{2}}_{\text{tratto } A''-A'} \\
 &\quad + \underbrace{\frac{4}{3EJ} 2l \frac{6/5ql^2}{2} \frac{6/5l}{2}}_{\text{tratto } A'-B} + \underbrace{\frac{4}{3EJ} l \frac{4/5ql^2}{2} \frac{4/5l}{2}}_{\text{tratto } D'-D} \\
 &\quad + \underbrace{\frac{4}{3EJ} 2l \frac{2ql^2}{2} \frac{2l}{2}}_{\text{tratto } B'-B} - \underbrace{\frac{2}{3EJ} 2l \frac{q(2l)^2}{8} \frac{2l}{2}}_{\text{tratto } B'-B}
 \end{aligned}$$

$$= \frac{ql^4}{EJ} \left(2 \frac{4}{3} \frac{l}{2} \frac{ql^3}{5^2} + \frac{4}{3} \frac{3}{2} \frac{l}{4} \frac{6^2}{5^2} ql^3 + \frac{4}{3} \frac{4}{5^2} ql^3 - \frac{2}{3} ql^4 \right)$$

$$= \frac{ql^4}{EJ} \frac{8 + 3 \cdot 6^2 + 16 \cdot 2 + 8 \cdot 2 \cdot 5^2 - 2 \cdot 2 \cdot 5^2}{6 \cdot 25} = \frac{224 ql^4}{75 EJ}$$

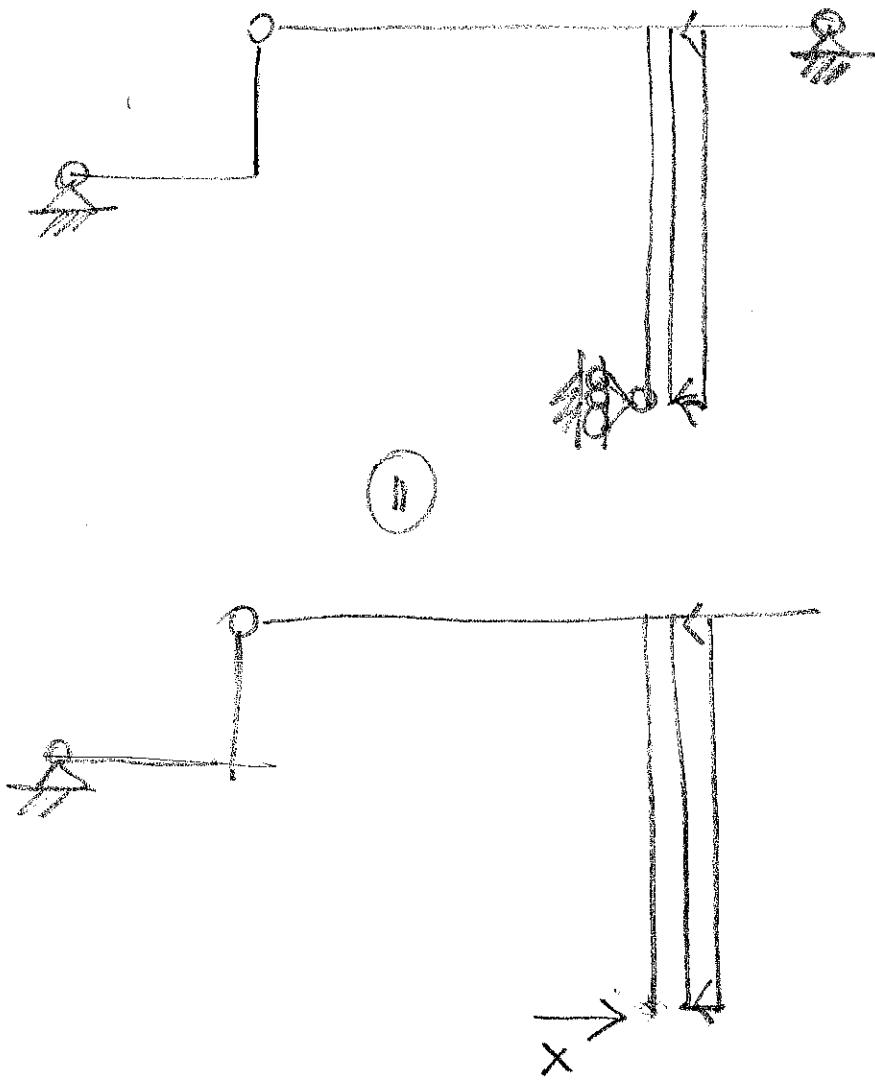
NB se lo schema reale è in realtà il risultato di uno schema iperstatico con X in corrispondenza dello spostam- orizzontale in B
 (vedi figura)

(13)

allora

$$M_X = -X M_1$$

è il diagramma
 dello schema virtuale
 (I) con X al posto
 della forza unilaterale.



La sovrapposibilità
 degli effetti ammette
 quindi come momento
 complessivo della
 struttura iperstatica

$$M = M_0 + M_X = \\ = M_0 - X M_1$$

e quindi anche lo
 spostamento è

$$v(B) = v_0(B) - X v_1(B)$$

Lo spostam- dello struttura iperstatica deve essere
 per ragioni cinematiche nullo, cioè

spostam-
 calcolato
 prima
 con
 carico su
 struttura
 isostatica

$$0 = v(B) = \underbrace{\int_{\text{struttura}} M_1 \frac{M_0}{EJ}}_{V_0(B)} - X \underbrace{\int_{\text{struttura}} M_1 \frac{M_1}{EJ}}_{V_1(B)}$$

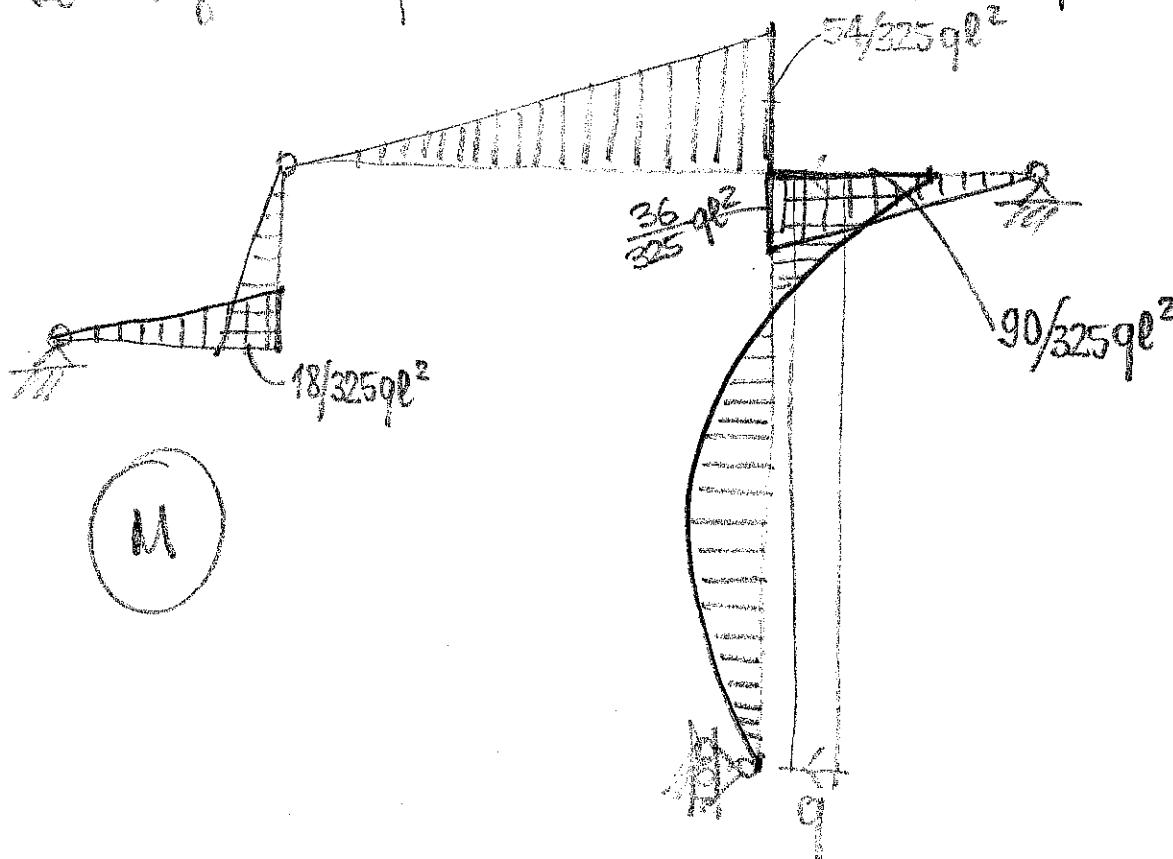
Se si calcola $\frac{M_1 M_1}{EJ}$ come fatto in precedenza
(si vede il diagramma M_1 a pag. 11) si ha

$$\therefore V_1(B) = \frac{l}{3EJ} \left(\frac{2}{5}l \frac{2}{5}l + \frac{2}{5}l \frac{2}{5}l + \frac{6}{5}l \frac{6}{5}l + \frac{4}{5}l \frac{4}{5}l + 2l \cdot 2l \right)$$

$$= \frac{l^3}{75EJ} (4 + 4 + 36 + 16 + 200) = \frac{260l^3}{75EJ}$$

$$\Rightarrow X = \frac{224}{75} \frac{ql^4}{EJ} \frac{75EJ}{260l^3} = \frac{56}{65} ql$$

Il diagramma finale $M = M_0 - KM_1$ è quindi



$$-\frac{2}{5}l \cdot \frac{56}{65}ql + \frac{2}{5}ql^2 = 2 \cdot \frac{9}{325}ql^2 \dots$$

$$-2l \cdot \frac{56}{65}ql + 2ql^2 = 2 \cdot \frac{9}{65}ql^2 = \frac{10 \cdot 9}{325}ql^2$$