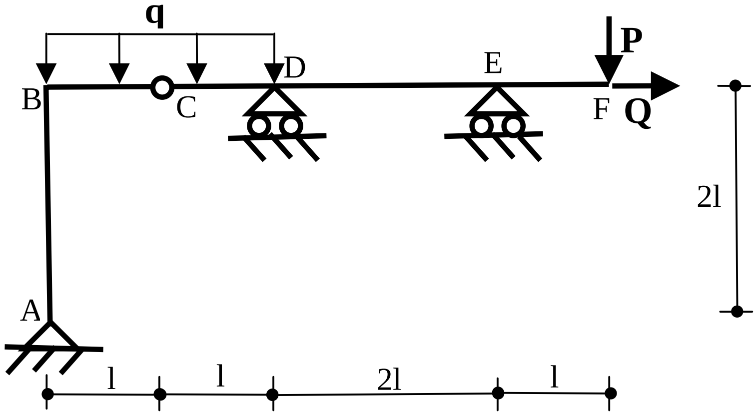
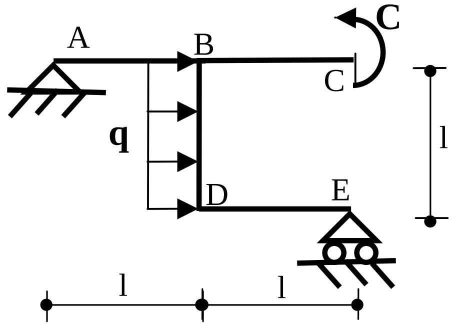
CORSO DI LAUREA IN INGEGNERIA MECCANICA
UNIVERSITÀ DEGLI STUDI DI FERRARA
PRIMA PROVA SCRITTA IN ITINERE DI STATICA
FERRARA, 29/10/2007

A

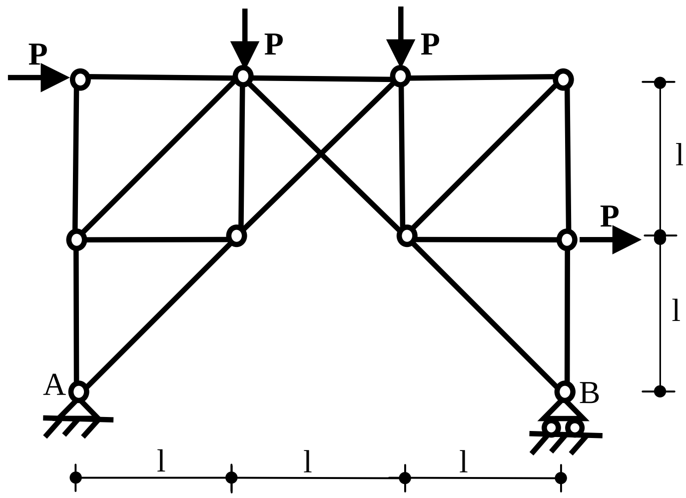
1) **Disegnare i diagrammi quotati delle azioni interne (N, T, M) per l=2m, q=1500 kg/m, P=Q=ql.**



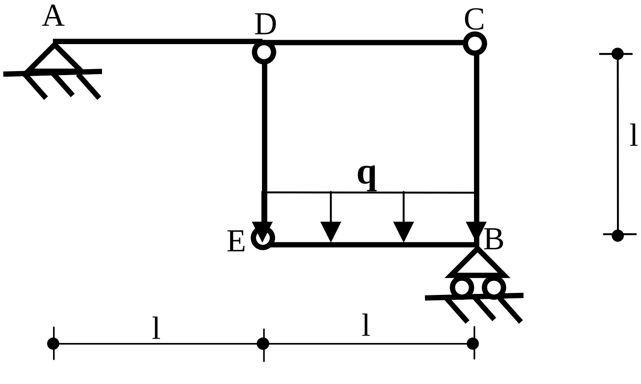
2) **Disegnare i diagrammi quotati delle azioni interne (N, T, M) per l=2 m, q= 1500 kg/m, C = ½ ql^2.**



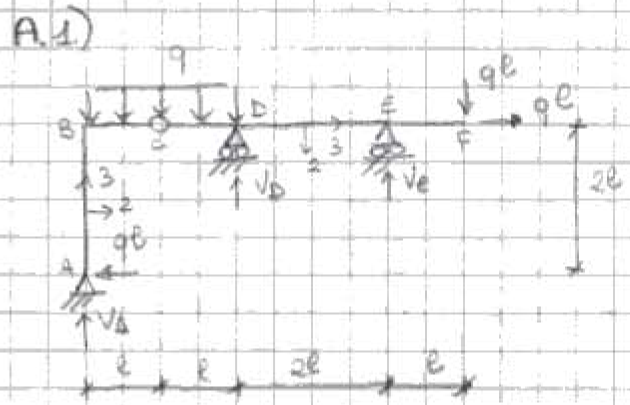
3) **Calcolare lo stato di sollecitazione per l=2m, P= 3000 kg.**



4) **Disegnare i diagrammi quotati dell'azione interna(N,T,M) per l=2m, q=1500 kg/m.**



A.1)



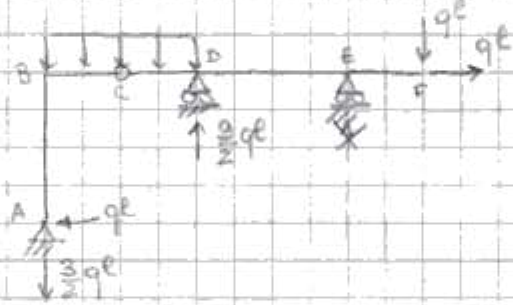
Eq.ne della sconnessione in C:

$(C\circlearrowleft)_{ABC} \quad -V_A l - 2ql^2 + q\frac{l^2}{2} = 0 \rightarrow V_A = -\frac{3}{2}ql$

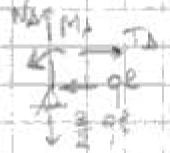
Eq.ni cardinali della Statica:

$(D\circlearrowleft) \quad V_E\, 2l - \cancel{3ql^2} + \cancel{ql^2} + \frac{3}{2}\cancel{ql}\, 2l - 2ql^2 = 0 \rightarrow V_E = 0$

$(\uparrow) \quad V_D = 3ql + \frac{3}{2}ql = \frac{9}{2}ql$



Equilibrio puntuale in A:

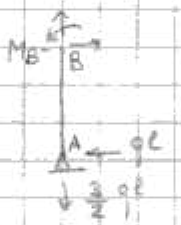


$N_A = \frac{3}{2}ql$

$T_A = ql$

$M_A = 0$

Equilibrio di AB



$M_B^- = 2ql^2$

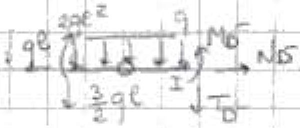
Equilibrio in B:

$N_B^+ = ql$

$T_B^+ = -\frac{3}{2}ql$

$M_B^+ = 2ql^2$

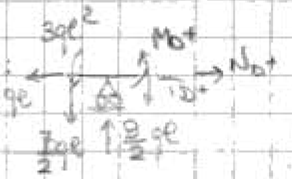
Equilibrio di BD:



$T_D^- = -\frac{3}{2}ql - 2ql = -\frac{7}{2}ql$

$M_D^- = \cancel{2ql^2} - 3ql^2 - \cancel{2ql^2} = -3ql^2$

Equilibrio in D:

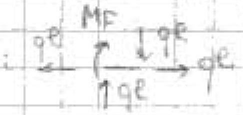


$N_D^+ = ql$

$T_D^+ = ql$

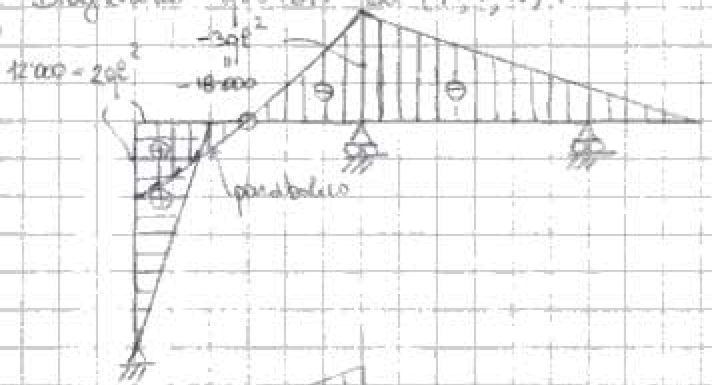
$M_D^+ = -3ql^2$

Equilibrio in F:

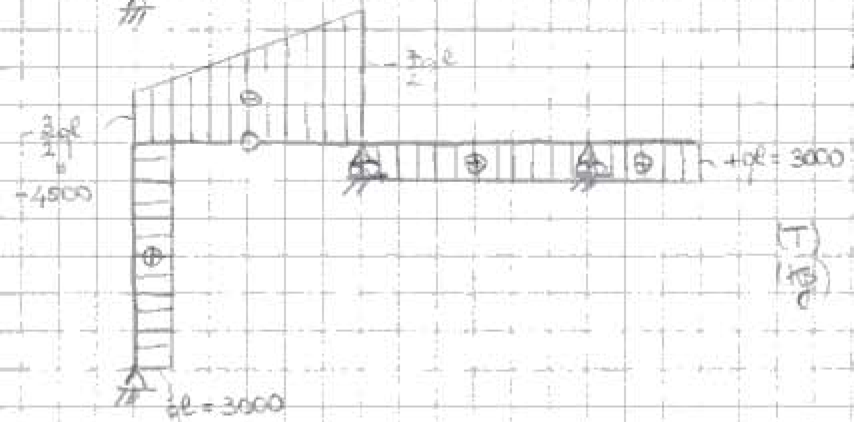


$M_F = 0$

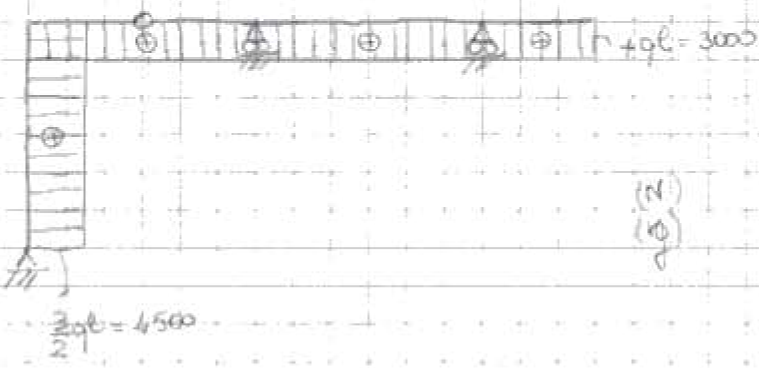
Diagrammi quotati di (M, T, N):



(M)
(Kgm)

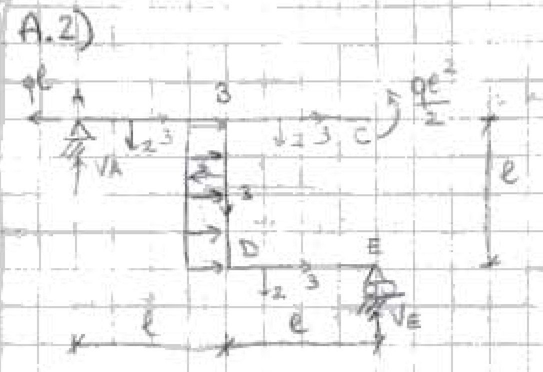


(T)
(Kg)



(N)
(Kg)

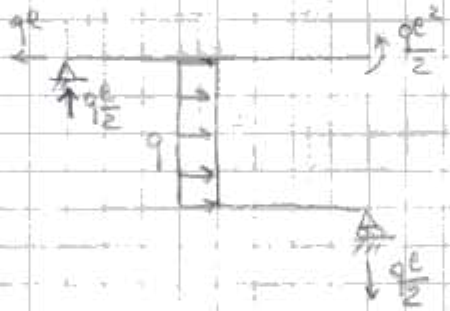
A.2)



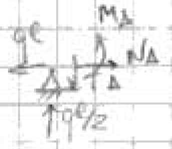
Equazioni cardinali della Statica:

(A↺) $V_E\, 2\ell + q\frac{\ell^2}{2} + q\frac{\ell^2}{2} = 0 \rightarrow V_E = -q\frac{\ell}{2}$

(↑) $V_A = -V_E = q\frac{\ell}{2}$

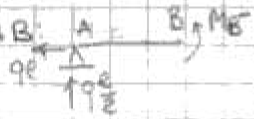


Equilibrio in A:



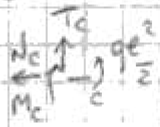
$N_A = q\ell$
$T_A = q\ell/2$
$M_A = 0$

Equilibrio di AB:



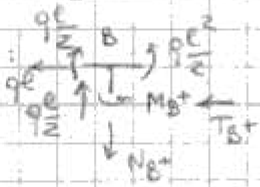
$M_B^- = q\frac{\ell^2}{2}$

Equilibrio in C:



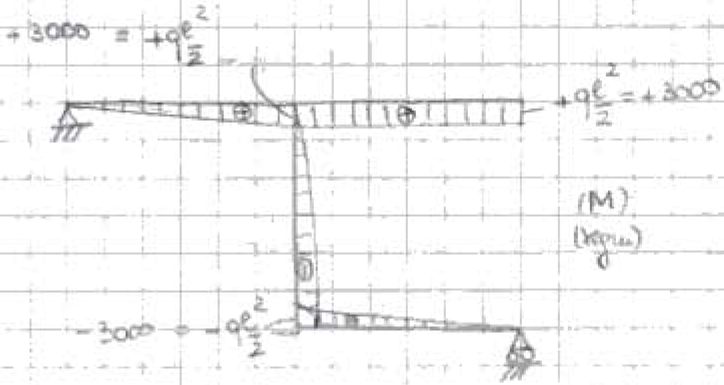
$N_C = 0$
$T_C = 0$
$M_C = q\frac{\ell^2}{2}$

Equilibrio in B:



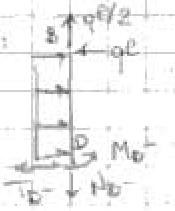
$N_{B^+} = q\frac{\ell}{2}$
$T_{B^+} = -q\ell$
$M_{B^+} = q\frac{\ell^2}{2} - q\frac{\ell^2}{2} = 0$

Diagrammi quotati dell' azione interna:



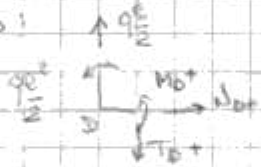
(M)
(kgm)

Equilibrio di BD:

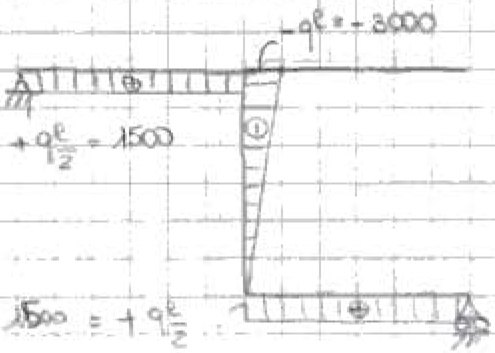


$T_{D^-} = q\ell - q\ell = 0$
$M_{D^-} = q\frac{\ell^2}{2} - q\ell^2 = -q\frac{\ell^2}{2}$

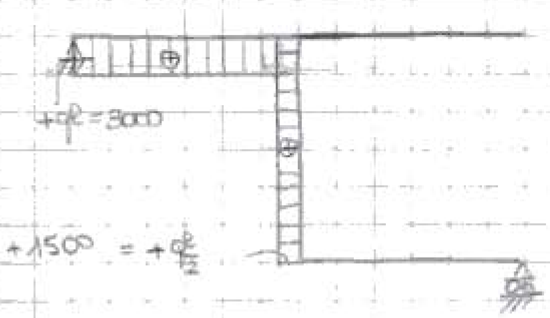
Equilibrio in D:



$N_{D^+} = 0$
$T_{D^+} = q\frac{\ell}{2}$
$M_{D^+} = -q\frac{\ell^2}{2}$



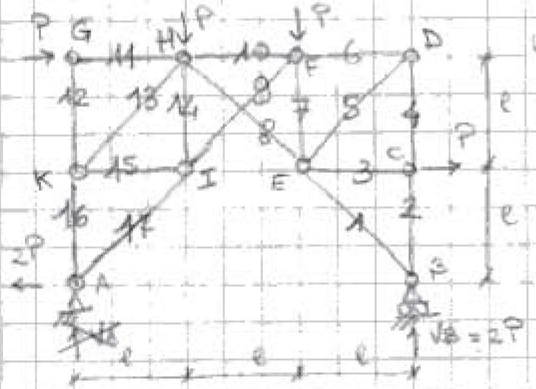
(T)
(kg)



(N)
(kg)

A.3)

Eq.ni cardinali della Statica:



$(A\circlearrowleft)\quad V_B 3\ell = (P\ell + P2\ell)2 = 6P\ell \rightarrow V_B = 2P$

$(\uparrow)\quad V_A = 0$

Metodo dell'equilibrio ai nodi:

B: $\begin{cases} N_1 = 0 \\ N_2 = -2P \end{cases}$

C: $\begin{cases} N_3 = P \\ N_4 = -2P \end{cases}$

D: $\begin{cases} N_5 \frac{\sqrt{2}}{2} = 2P \rightarrow N_5 = 2\sqrt{2}P \\ N_6 = -N_5 \frac{\sqrt{2}}{2} = -2P \end{cases}$

E: $\begin{cases} N_8 \frac{\sqrt{2}}{2} = P + 2\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} = 3P \\ N_7 = -N_8\frac{\sqrt{2}}{2} - 2\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} = -5P \end{cases}$

F: $\begin{cases} N_9 \frac{\sqrt{2}}{2} = 5P - P = 4P \\ N_{10} = -2P - N_9\frac{\sqrt{2}}{2} = -6P \end{cases}$

G: $\begin{cases} N_{11} = -P \\ N_{12} = 0 \end{cases}$

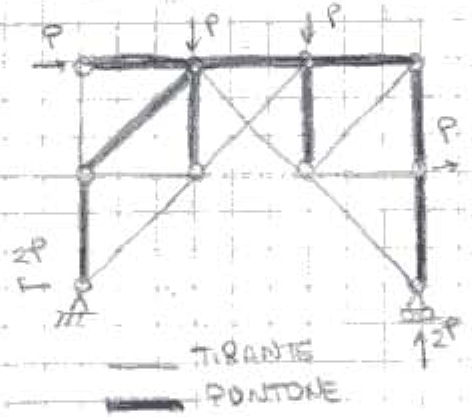
H: $\begin{cases} N_{13}\frac{\sqrt{2}}{2} = P - 6P + 3\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} = -2P \\ N_{14} = -P - 3\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} - N_{13}\frac{\sqrt{2}}{2} = -2P \end{cases}$

I: $\begin{cases} \frac{\sqrt{2}}{2}N_{17} = -2P + 4\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} = +2P \\ N_{15} = -N_{17}\frac{\sqrt{2}}{2} + 4\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} = 2P \end{cases}$

K: $\begin{cases} 2\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} = 2P \\ N_{16} = -2\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} \end{cases}$

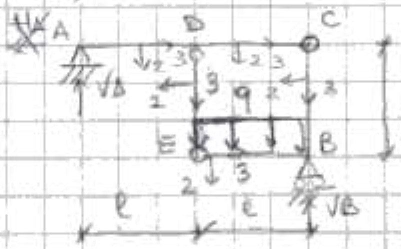
A: $\begin{cases} 2P = 2\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} \\ 2P = 2\cancel{\sqrt{2}}P\frac{\cancel{\sqrt{2}}}{\cancel{2}} \end{cases}$

ASTA	N	Kg
1	0	0
2	$-2P$	-6000
3	$+P$	+3000
4	$-2P$	-6000
5	$2\sqrt{2}P$	+8485
6	$-2P$	-6000
7	$-5P$	-15000
8	$3\sqrt{2}P$	12727
9	$4\sqrt{2}P$	16970
10	$-6P$	-18000
11	$-P$	-3000
12	0	0
13	$-2\sqrt{2}P$	-8485
14	$-2P$	-6000
15	$+2P$	+6000
16	$-2P$	-6000
17	$+2\sqrt{2}P$	-8485



A.4)

Eq.ni cardinali della Statica:

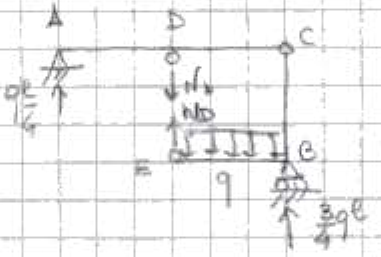


(→) $H_A = 0$

(A↺) $V_B 2l = ql\frac{3}{2}l \rightarrow V_B = \frac{3}{4}ql$

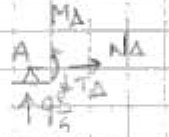
(↑) $V_A = ql - V_B = \frac{ql}{4}$

Eq.ne ausiliarie:



$(C\circlearrowleft)_{ADC}$ $N_D l = q\frac{l}{4}2l \rightarrow N_D = q\frac{l}{2}$

Equilibrio in A:

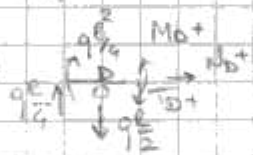


$N_A = 0$
$T_A = q\frac{l}{4}$
$M_A = 0$

Equilibrio di AD:

$M_D^- = q\frac{l^2}{4}$

Equilibrio in D:

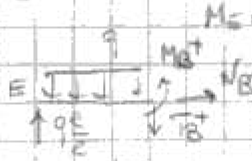


$N_D^+ = 0$
$T_D^+ = -q\frac{l}{4}$
$M_D^+ = q\frac{l^2}{4}$

Equilibrio in E:

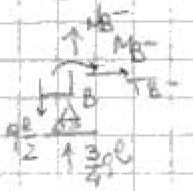
$N_E = 0$
$T_E = q\frac{l}{2}$
$M_E = 0$

Equilibrio di EB:



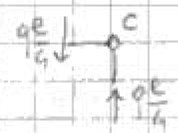
$N_B^+ = 0$
$T_B^+ = -q\frac{l}{2}$
$M_B^+ = q\frac{l^2}{2} - q\frac{l^2}{2} = 0$

Equilibrio in B:

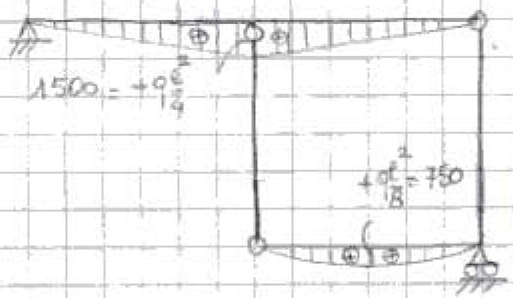


$N_B^- = -q\frac{l}{4}$
$T_B^- = 0$
$M_B^- = 0$

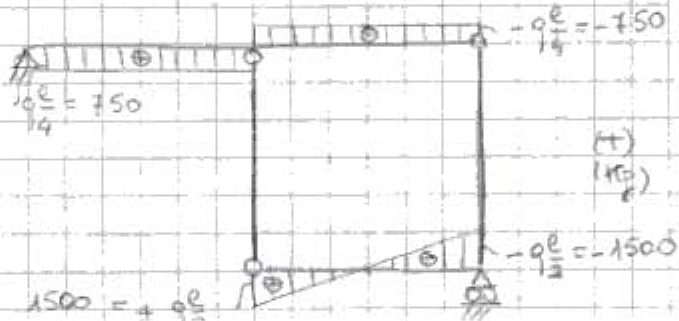
Equilibrio in C:



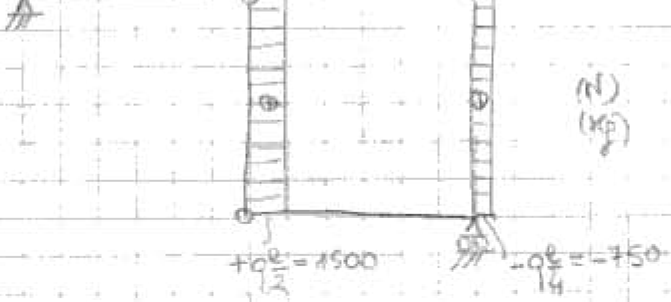
Diagrammi quotati di (M,T,N):



(M)
(kNm)



(T)
(kN)



(N)
(kN)