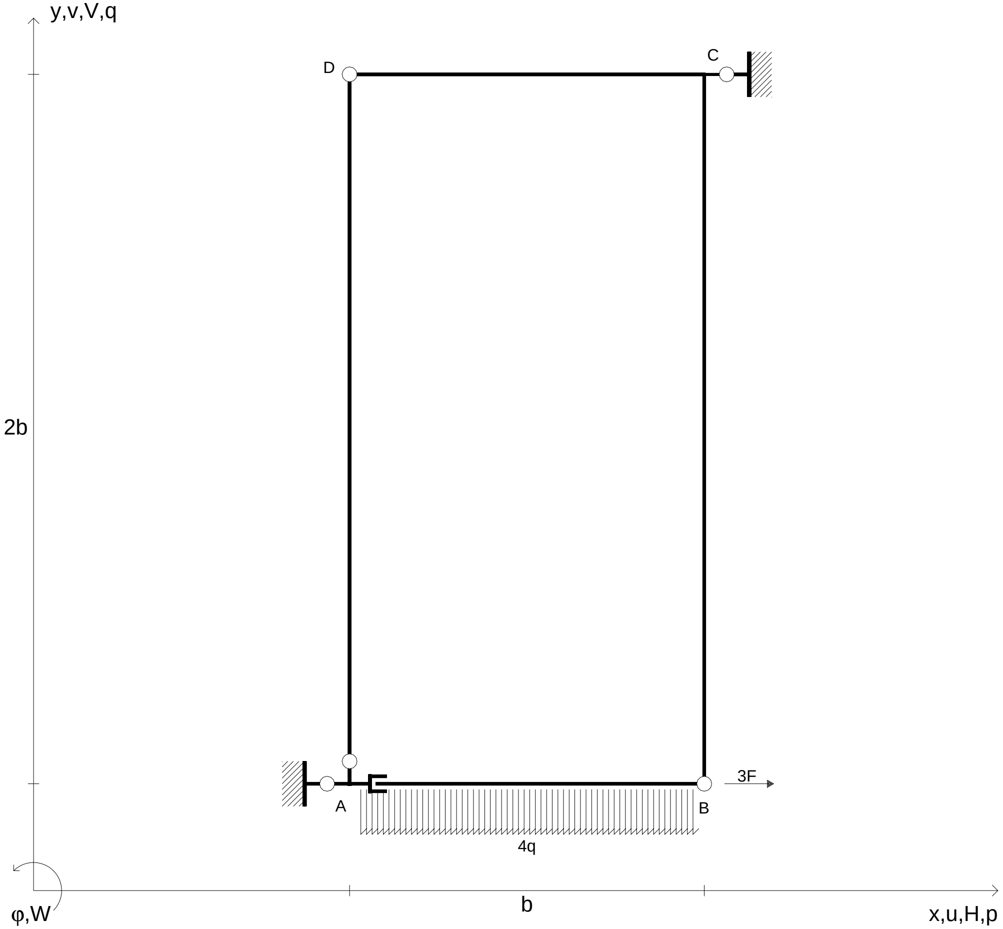
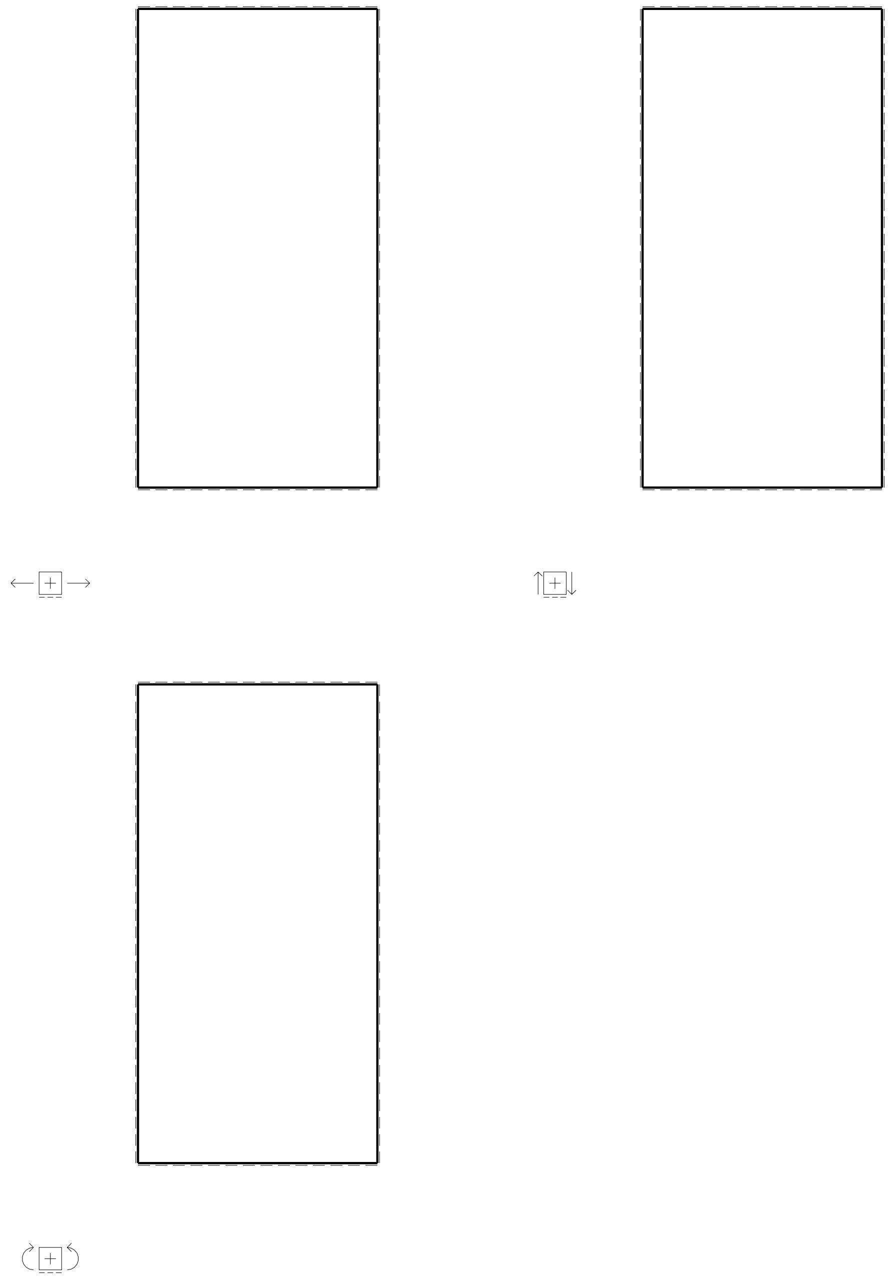


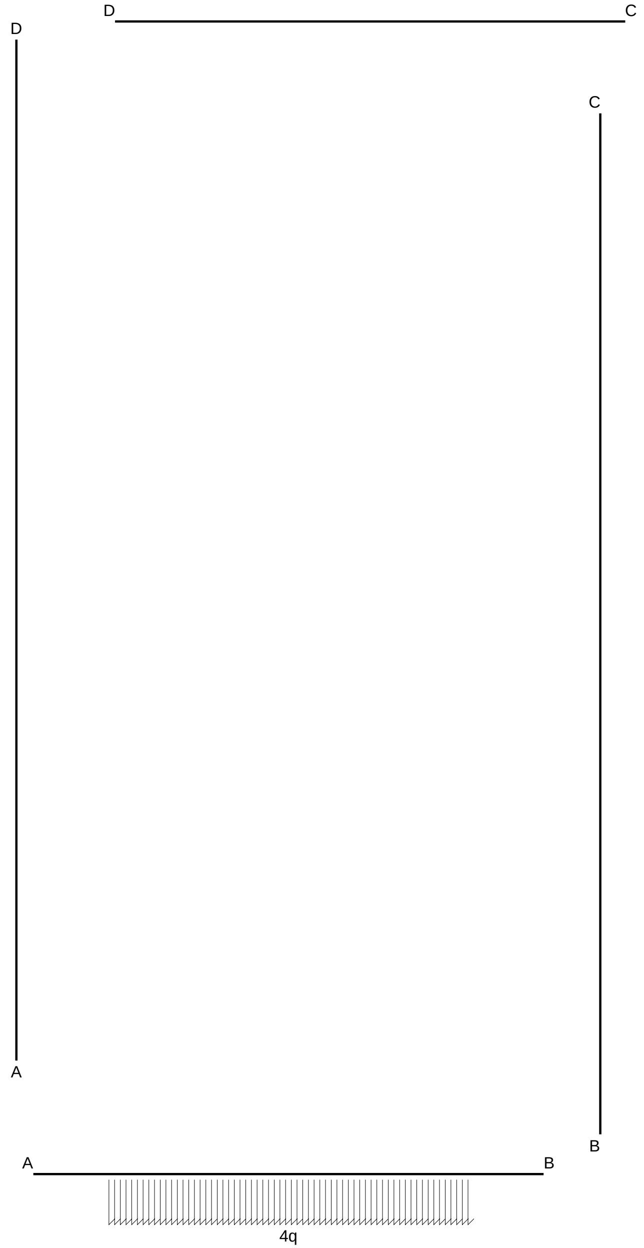
$H_B = 3F$

$q_{AB} = -4q = -4F/b$

Svolgere l'analisi cinematica.
Determinare matrice di congruenza e di equilibrio.
Determinare le reazioni vincolari a terra col PLV (Le=0).
Determinare le azioni interne in C col PLV (Le=0).
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi delle azioni interne nelle aste.



REAZIONI Nome: Es.N.035



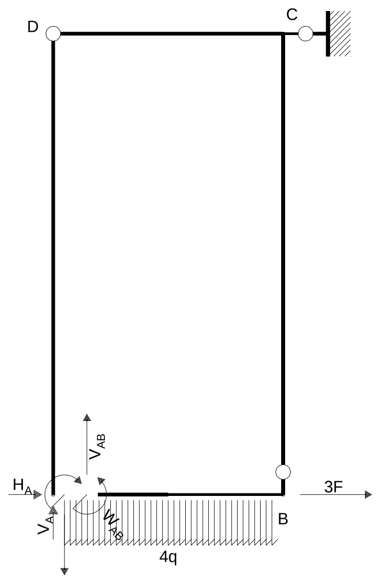
RISULTATI NUMERICI Nome: Es.N.035

REAZIONI

H_A =	V_A =	H_C =	V_C =

N_{DA} =

H_{AB} =	H_{BC} =	H_{CD} =
V_{AB} =	V_{BC} =	V_{CD} =
W_{AB} =	W_{BC} =	W_{CD} =
H_{BA} =	H_{CB} =	H_{DC} =
V_{BA} =	V_{CB} =	V_{DC} =
W_{BA} =	W_{CB} =	W_{DC} =



EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a C

$2H_Ab - V_Ab = -6Fb - 2qb^2$

Rotazione intorno a B: aste BA

$-V_{AB}b + W_{AB} = -2qb^2$

Rotazione intorno a D: aste DA

$2H_Ab - W_{AB} = 0$

Rapporto tra componenti nodo ZA

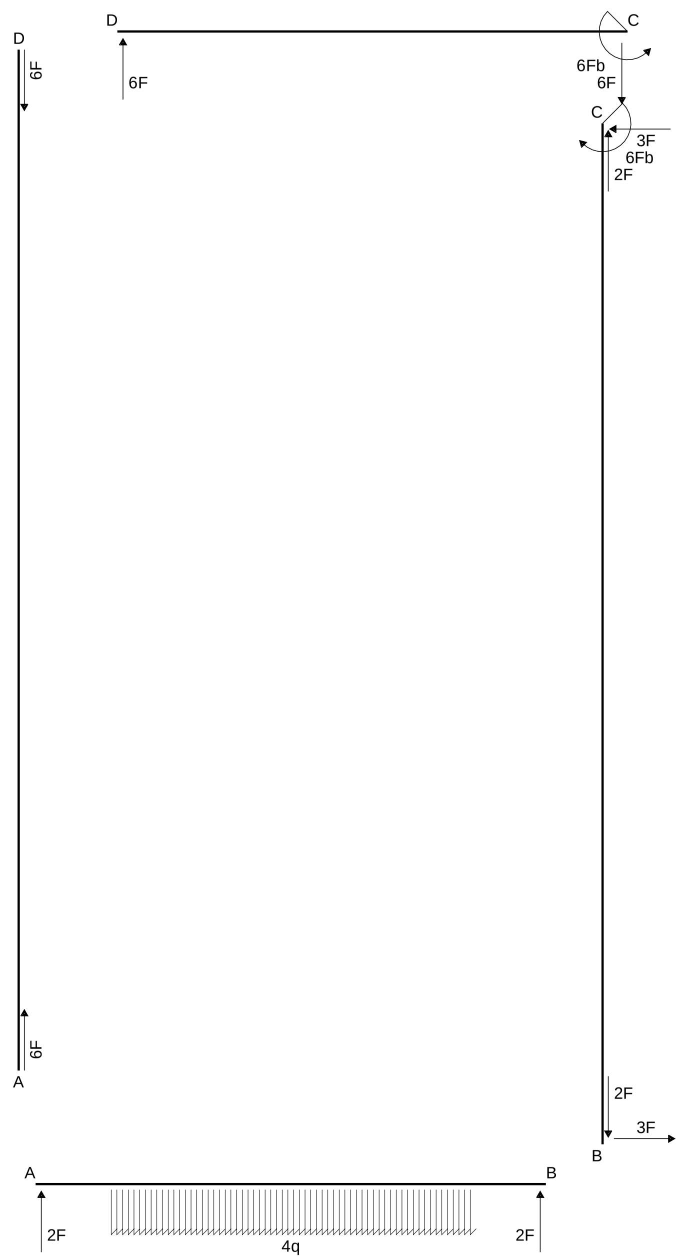
$-W_{AB} = 0$

Matrice di equilibrio

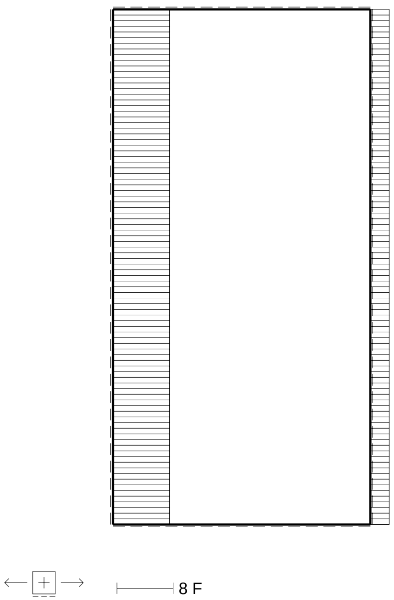
$$\begin{array}{c} \\ \varphi_C \\ \varphi_{BC} \\ \varphi_{DA} \\ \varphi_{AD} \end{array} \begin{array}{c} \begin{bmatrix} H_Ab & V_Ab & V_{AB}b & W_{AB} \end{bmatrix} \\ \begin{bmatrix} 2 & -1 & 0 & 0 \\ 0 & 0 & -1 & 1 \\ 2 & 0 & 0 & -1 \\ 0 & 0 & 0 & -1 \end{bmatrix} \end{array} = \begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} -6 & -2 \\ 0 & -2 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \end{array}$$

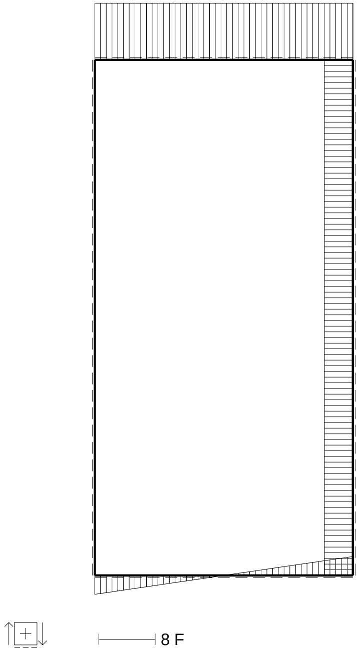
Soluzione del sistema

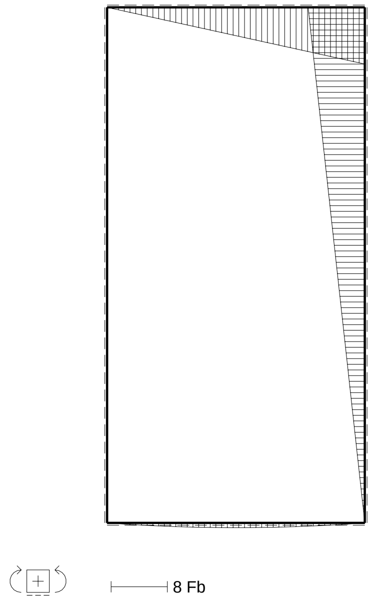
$$\begin{bmatrix} H_Ab \\ V_{AB}b \\ V_Ab \\ W_{AB} \end{bmatrix} = \begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 \\ 0 & 2 \\ 6 & 2 \\ 0 & 0 \end{bmatrix} \end{array}$$



AZIONI INTERNE Nome: Es.N.035







PROCEDIMENTO E RISULTATI Nome: Es.N.035

REAZIONI

$H_A = 0$ | $V_A = 6F + 2qb = 8F$ | $H_C = -3F = -3F$ | $V_C = -6F + 2qb = -4F$

$N_{DA} = -6F = -6F$

$H_{AB} = 0$ | $H_{BC} = 3F = 3F$ | $H_{CD} = 0$

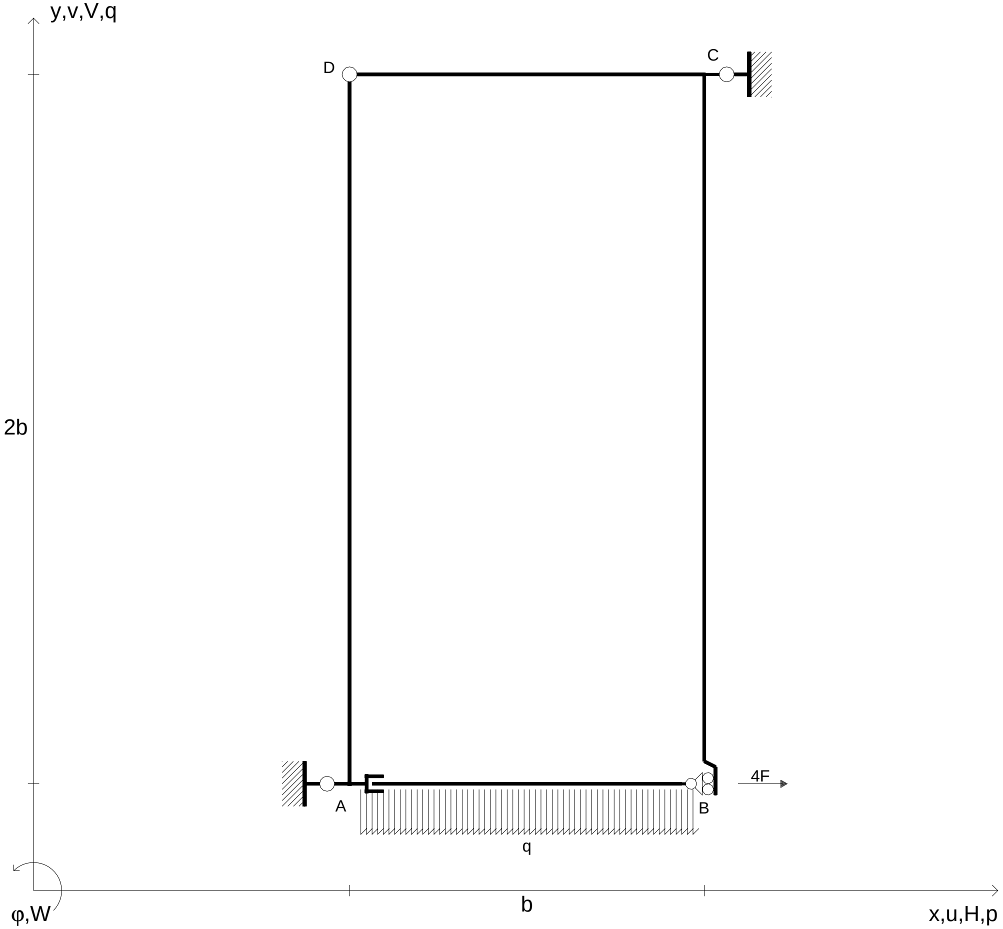
$V_{AB} = 2qb = 2F$ | $V_{BC} = -2qb = -2F$ | $V_{CD} = -6F = -6F$

$W_{AB} = 0$ | $W_{BC} = 0$ | $W_{CD} = 6Fb = 6Fb$

$H_{BA} = 0$ | $H_{CB} = -3F = -3F$ | $H_{DC} = 0$

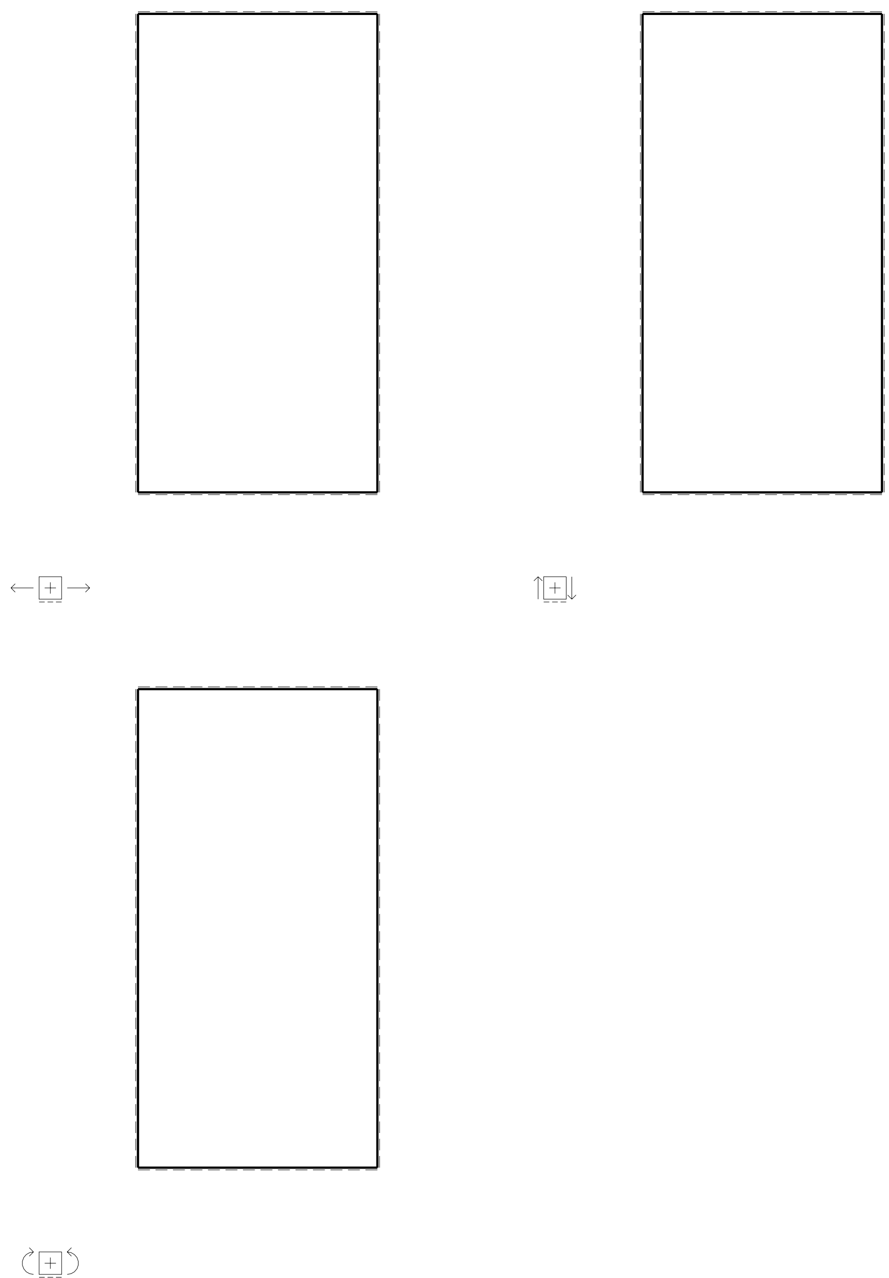
$V_{BA} = 2qb = 2F$ | $V_{CB} = 2qb = 2F$ | $V_{DC} = 6F = 6F$

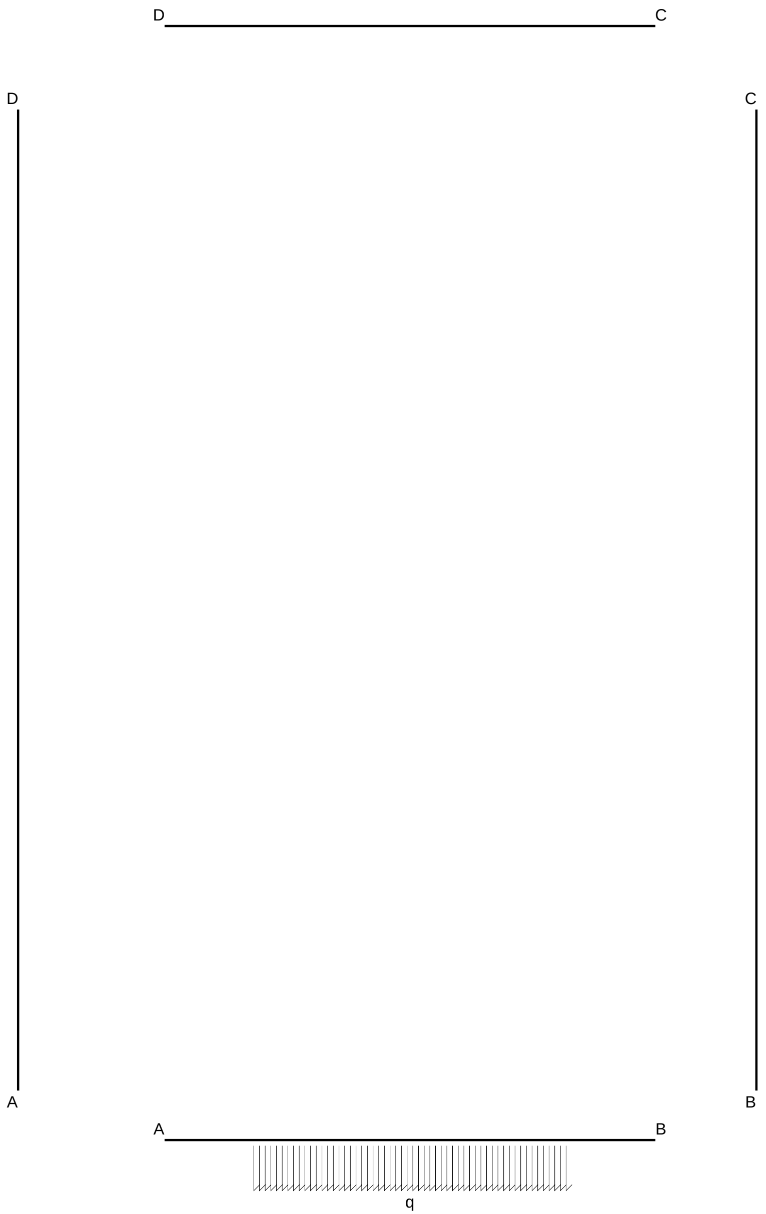
$W_{BA} = 0$ | $W_{CB} = -6Fb = -6Fb$ | $W_{DC} = 0$



$H_B = 4F$ $\qquad$ $q_{AB} = -q = -F/b$

Svolgere l’analisi cinematica.
Determinare matrice di congruenza e di equilibrio.
Determinare le reazioni vincolari a terra col PLV (Le=0).
Determinare le azioni interne in C col PLV (Le=0).
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi delle azioni interne nelle aste.

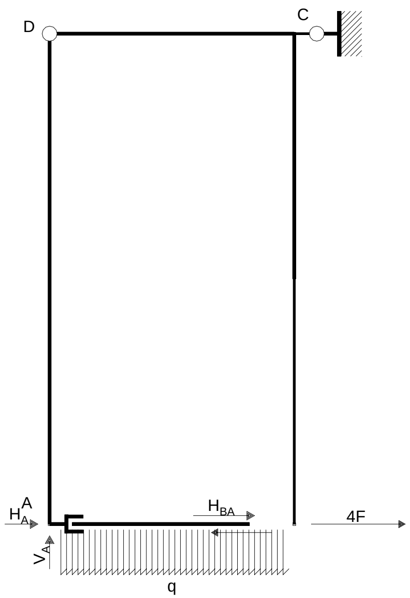




REAZIONI

H_A =	H_C =
V_A =	V_C =

H_{AB} =	H_{BC} =	H_{CD} =	H_{DA} =
V_{AB} =	V_{BC} =	V_{CD} =	V_{DA} =
W_{AB} =	W_{BC} =	W_{CD} =	W_{DA} =
H_{BA} =	H_{CB} =	H_{DC} =	H_{AD} =
V_{BA} =	V_{CB} =	V_{DC} =	V_{AD} =
W_{BA} =	W_{CB} =	W_{DC} =	W_{AD} =



EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a C

$2H_Ab - V_Ab = -8Fb - 1/2qb^2$

Rotazione intorno a D: aste DA AB

$2H_Ab + 2H_{BA}b = 1/2qb^2$

Traslazione orizzontale: aste AB

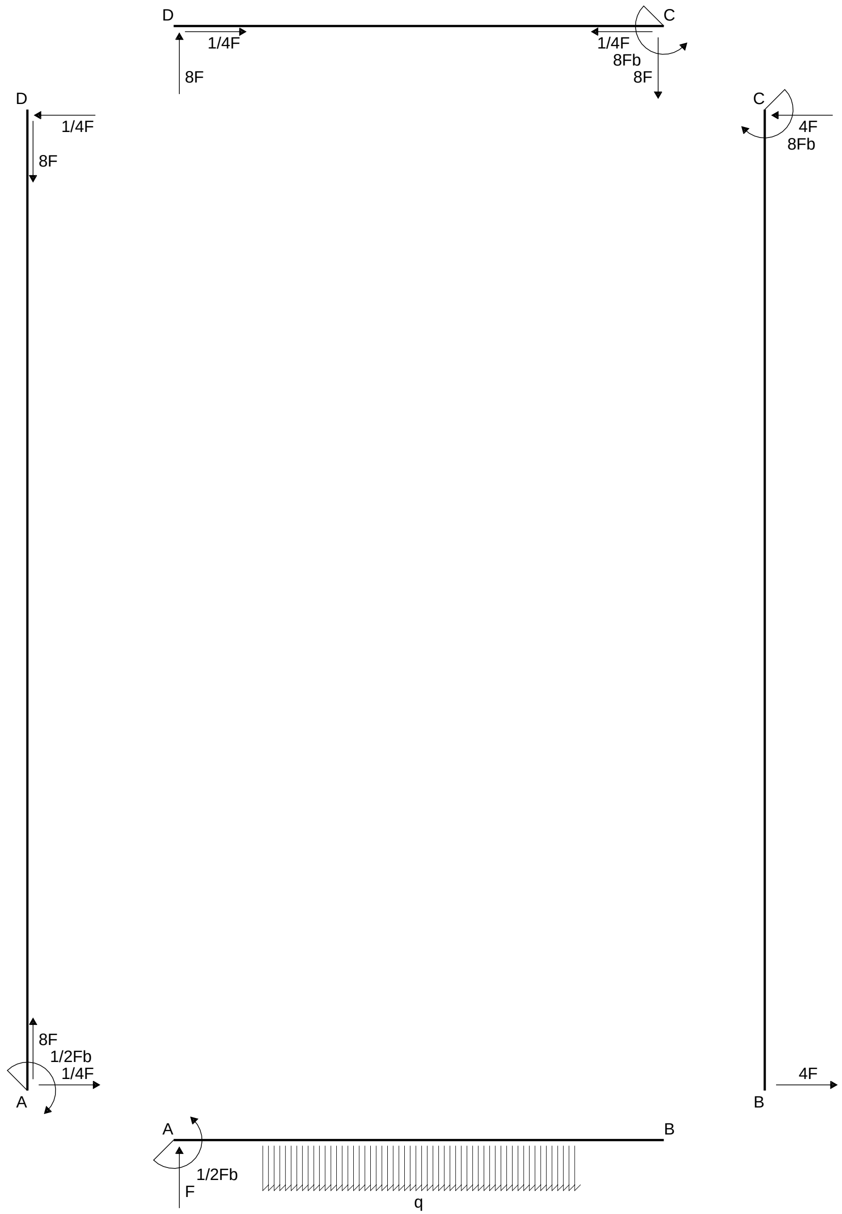
$H_{BA} = 0$

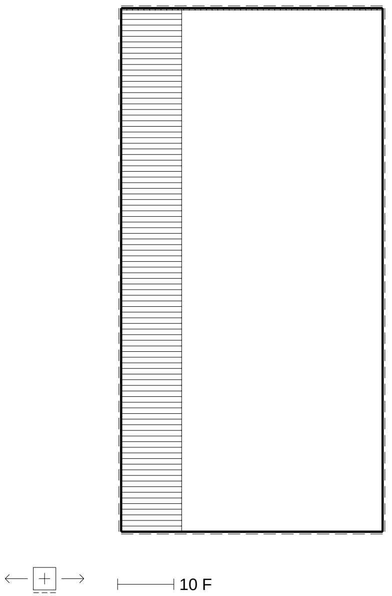
Matrice di equilibrio

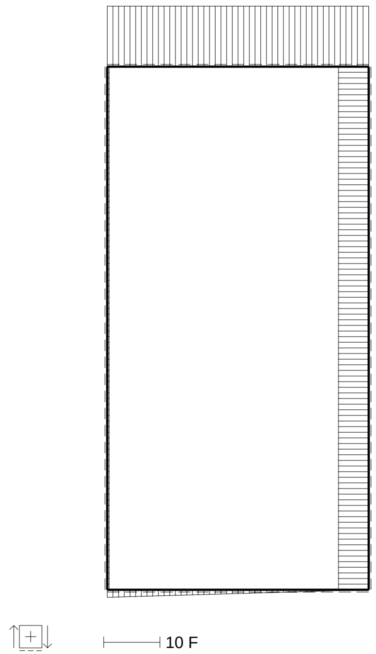
$$
\begin{array}{c} \\ \varphi_C \\ \varphi_{DA} \\ u_{AB} \end{array}
\begin{array}{c}
\begin{bmatrix} H_Ab & V_Ab & H_{BA}b \end{bmatrix} \\
\begin{bmatrix} 2 & -1 & 0 \\ 2 & 0 & 2 \\ 0 & 0 & 1 \end{bmatrix}
\end{array}
=
\begin{array}{c}
\begin{bmatrix} Fb & qb^2 \end{bmatrix} \\
\begin{bmatrix} -8 & -1/2 \\ 0 & 1/2 \\ 0 & 0 \end{bmatrix}
\end{array}
$$

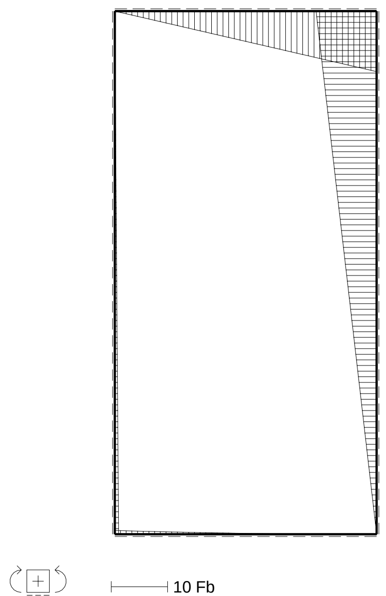
Soluzione del sistema

$$
\begin{bmatrix} H_Ab \\ V_Ab \\ H_{BA}b \end{bmatrix}
=
\begin{array}{c}
\begin{bmatrix} Fb & qb^2 \end{bmatrix} \\
\begin{bmatrix} 0 & 1/4 \\ 8 & 1 \\ 0 & 0 \end{bmatrix}
\end{array}
$$









REAZIONI

H_A = 1/4qb = 1/4F

V_A = 8F +qb = 9F

H_C = -4F -1/4qb = -17/4F

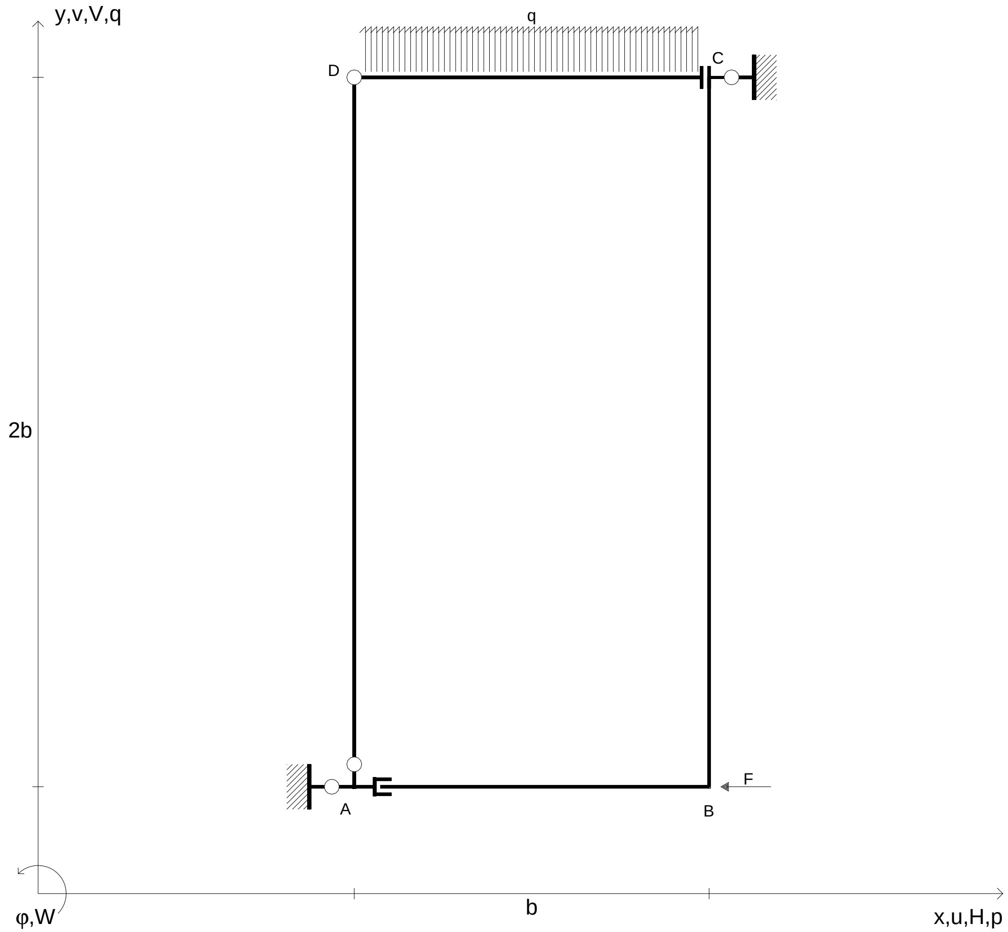
V_C = -8F = -8F

H_{AB} = 0
V_{AB} = qb = F
W_{AB} = 1/2qb^2 = 1/2Fb
H_{BA} = 0
V_{BA} = 0
W_{BA} = 0

H_{BC} = 4F = 4F
V_{BC} = 0
W_{BC} = 0
H_{CB} = -4F = -4F
V_{CB} = 0
W_{CB} = -8Fb = -8Fb

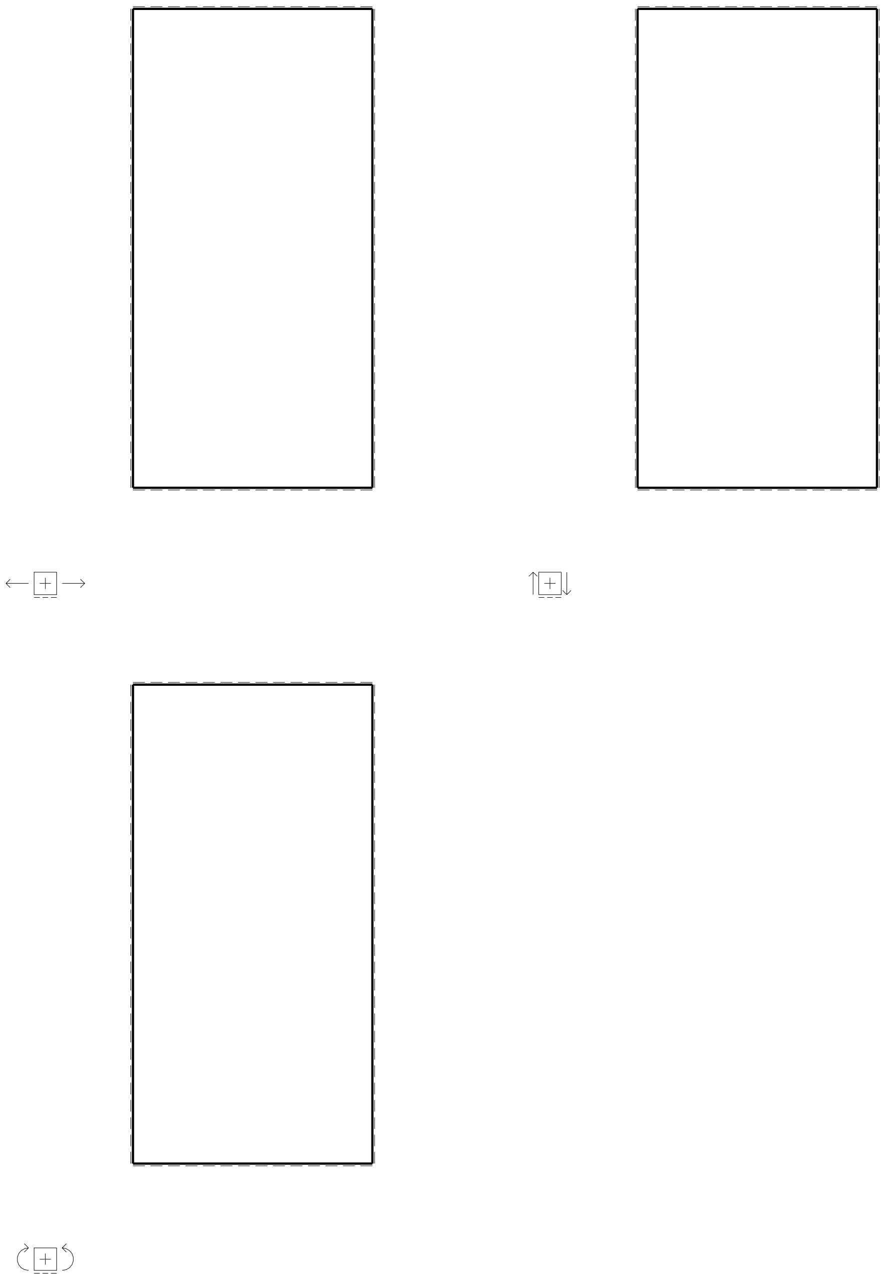
H_{CD} = -1/4qb = -1/4F
V_{CD} = -8F = -8F
W_{CD} = 8Fb = 8Fb
H_{DC} = 1/4qb = 1/4F
V_{DC} = 8F = 8F
W_{DC} = 0

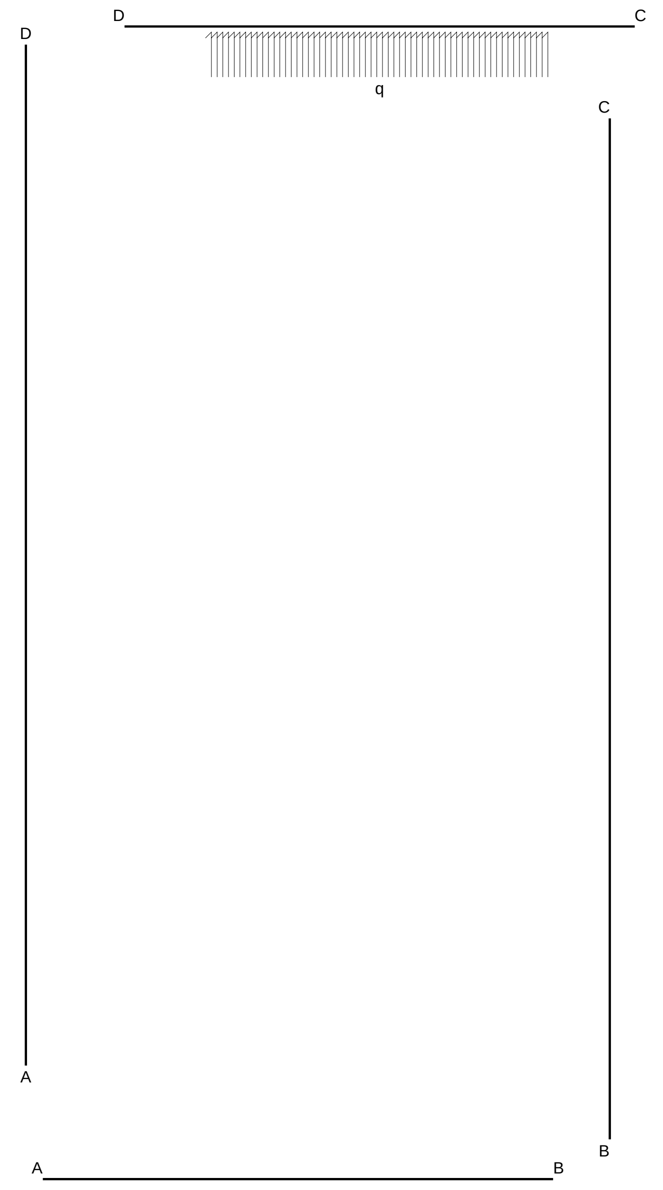
H_{DA} = -1/4qb = -1/4F
V_{DA} = -8F = -8F
W_{DA} = 0
H_{AD} = 1/4qb = 1/4F
V_{AD} = 8F = 8F
W_{AD} = -1/2qb^2 = -1/2Fb



H_B = -F q_{CD} = q = F/b

Svolgere l'analisi cinematica.
Determinare matrice di congruenza e di equilibrio.
Determinare le reazioni vincolari a terra col PLV (Le=0).
Determinare le azioni interne in C col PLV (Le=0).
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi delle azioni interne nelle aste.





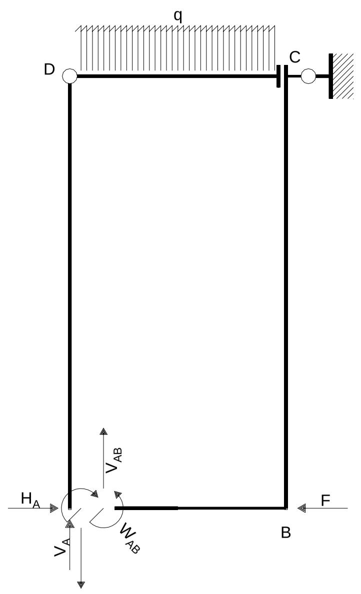
RISULTATI NUMERICI Nome: Es.N.037

REAZIONI

H_A = V_A = H_C = V_C =

N_{DA} =

H_{AB} =	H_{BC} =	H_{CD} =
V_{AB} =	V_{BC} =	V_{CD} =
W_{AB} =	W_{BC} =	W_{CD} =
H_{BA} =	H_{CB} =	H_{DC} =
V_{BA} =	V_{CB} =	V_{DC} =
W_{BA} =	W_{CB} =	W_{DC} =



EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a C

$2H_Ab - V_Ab = 2Fb + 1/2qb^2$

Traslazione verticale: aste CD DA

$V_A - V_{AB} = -qb$

Rotazione intorno a D: aste DA

$2H_Ab - W_{AB} = 0$

Rapporto tra componenti nodo ZA

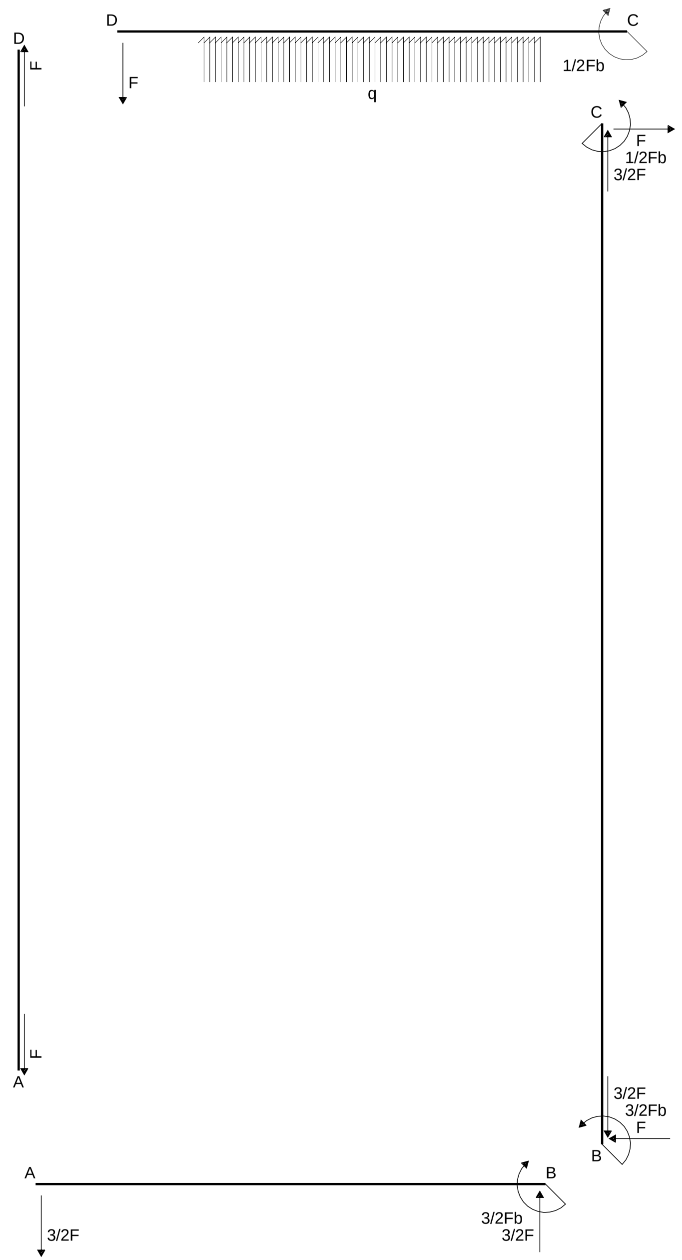
$-W_{AB} = 0$

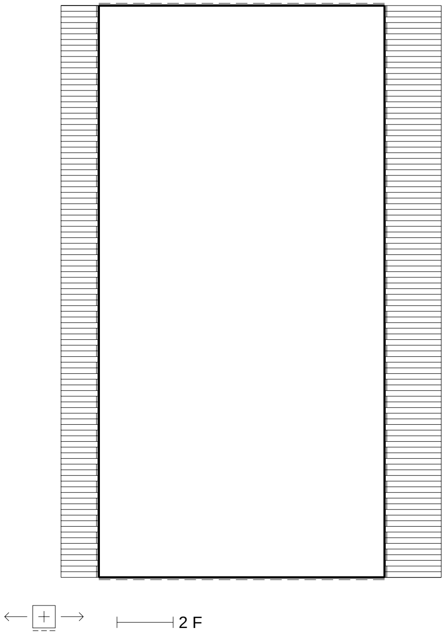
Matrice di equilibrio

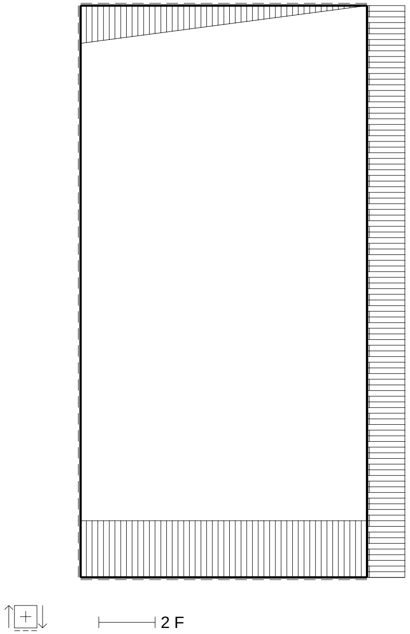
$$\begin{array}{c} \\ \varphi_C \\ v_{CD} \\ \varphi_{DA} \\ \varphi_{AD} \end{array} \begin{bmatrix} H_Ab & V_Ab & V_{AB}b & W_{AB} \\ 2 & -1 & 0 & 0 \\ 0 & 1 & -1 & 0 \\ 2 & 0 & 0 & -1 \\ 0 & 0 & 0 & -1 \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 2 & 1/2 \\ 0 & -1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

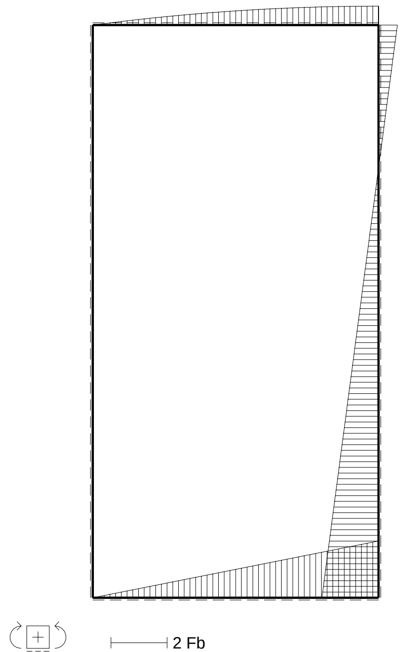
Soluzione del sistema

$$\begin{bmatrix} H_Ab \\ V_Ab \\ V_{AB}b \\ W_{AB} \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 0 & 0 \\ -2 & -1/2 \\ -2 & 1/2 \\ 0 & 0 \end{bmatrix}$$







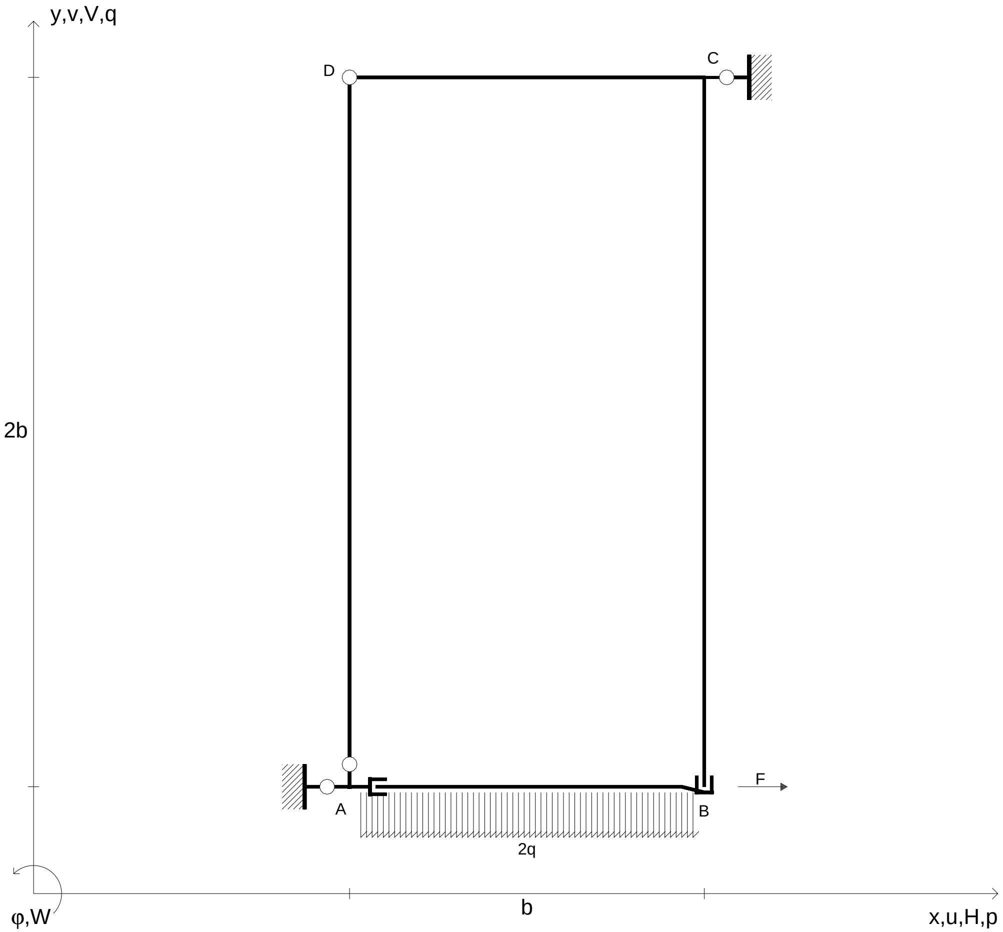


REAZIONI

$H_A = 0$ $V_A = -2F -1/2qb = -5/2F$ $H_C = F = F$ $V_C = 2F -1/2qb = 3/2F$

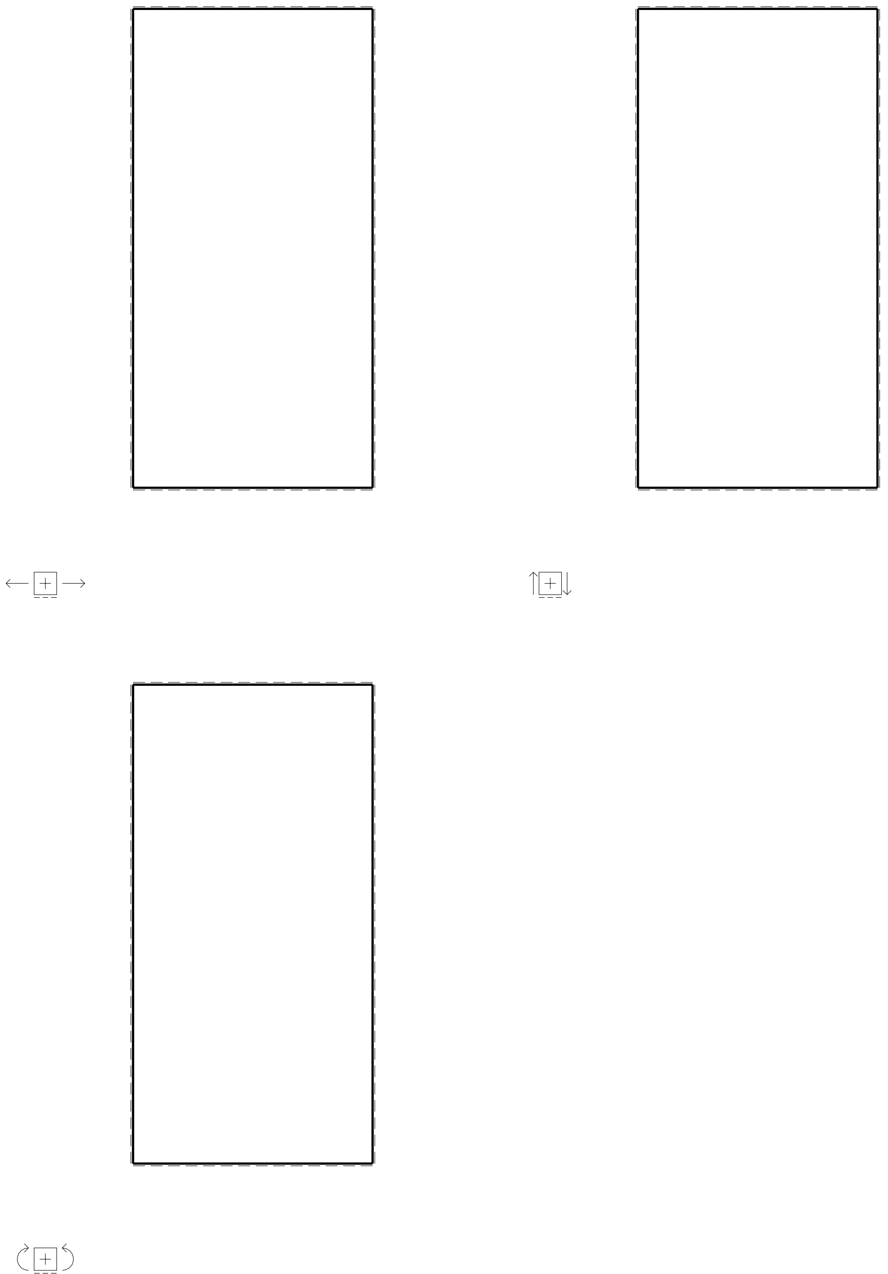
$N_{DA} = qb = F$

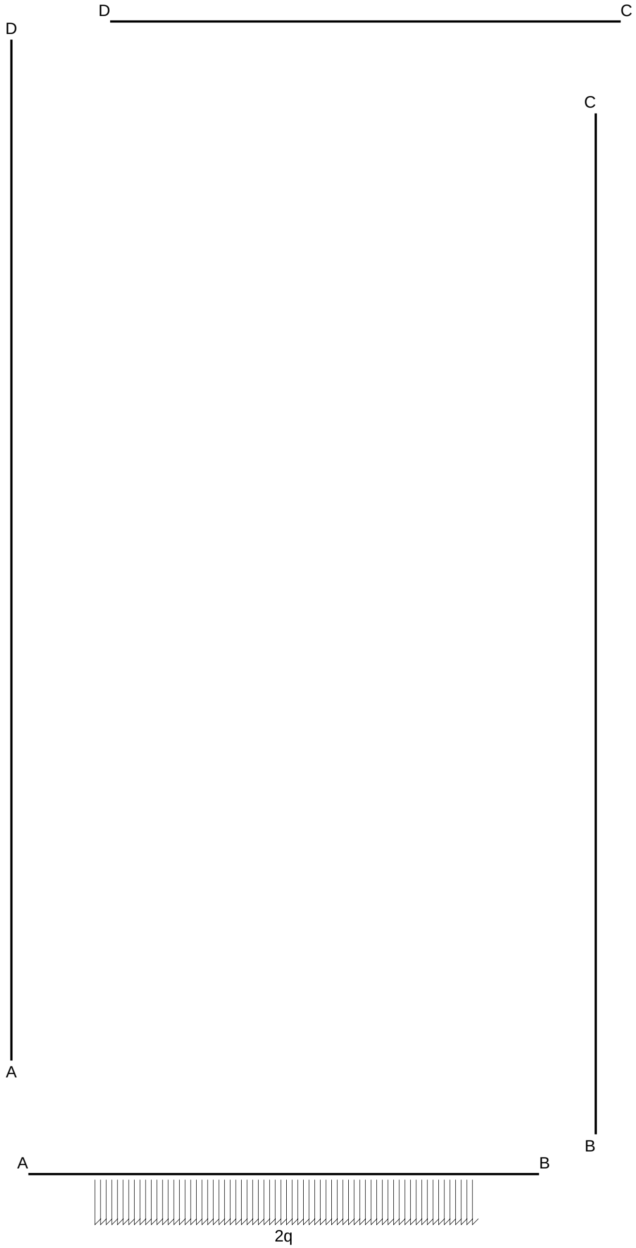
$H_{AB} = 0$	$H_{BC} = -F = -F$	$H_{CD} = 0$
$V_{AB} = -2F +1/2qb = -3/2F$	$V_{BC} = -2F +1/2qb = -3/2F$	$V_{CD} = 0$
$W_{AB} = 0$	$W_{BC} = 2Fb -1/2qb^2 = 3/2Fb$	$W_{CD} = -1/2qb^2 = -1/2Fb$
$H_{BA} = 0$	$H_{CB} = F = F$	$H_{DC} = 0$
$V_{BA} = 2F -1/2qb = 3/2F$	$V_{CB} = 2F -1/2qb = 3/2F$	$V_{DC} = -qb = -F$
$W_{BA} = -2Fb +1/2qb^2 = -3/2Fb$	$W_{CB} = 1/2qb^2 = 1/2Fb$	$W_{DC} = 0$



$H_B = F$ $q_{AB} = -2q = -2F/b$

Svolgere l'analisi cinematica.
Determinare matrice di congruenza e di equilibrio.
Determinare le reazioni vincolari a terra col PLV (Le=0).
Determinare le azioni interne in C col PLV (Le=0).
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi delle azioni interne nelle aste.



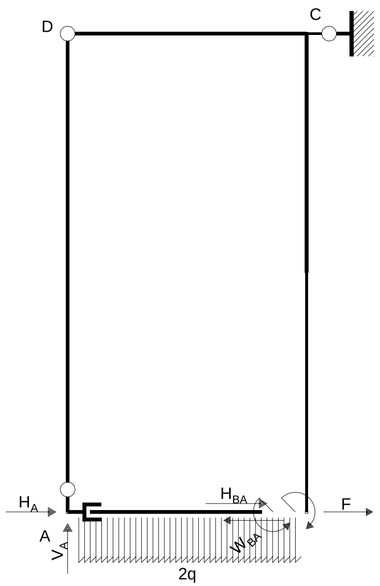


REAZIONI

$H_A =$ $V_A =$ $H_C =$ $V_C =$

$N_{DA} =$

$H_{AB} =$	$H_{BC} =$	$H_{CD} =$
$V_{AB} =$	$V_{BC} =$	$V_{CD} =$
$W_{AB} =$	$W_{BC} =$	$W_{CD} =$
$H_{BA} =$	$H_{CB} =$	$H_{DC} =$
$V_{BA} =$	$V_{CB} =$	$V_{DC} =$
$W_{BA} =$	$W_{CB} =$	$W_{DC} =$



EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a C

$2H_Ab - V_Ab = -2Fb - qb^2$

Rotazione intorno a D: aste DA AB

$2H_Ab + 2H_{BA}b + W_{BA} = qb^2$

Rotazione intorno a A: aste AB

$W_{BA} = qb^2$

Traslazione orizzontale: aste AB

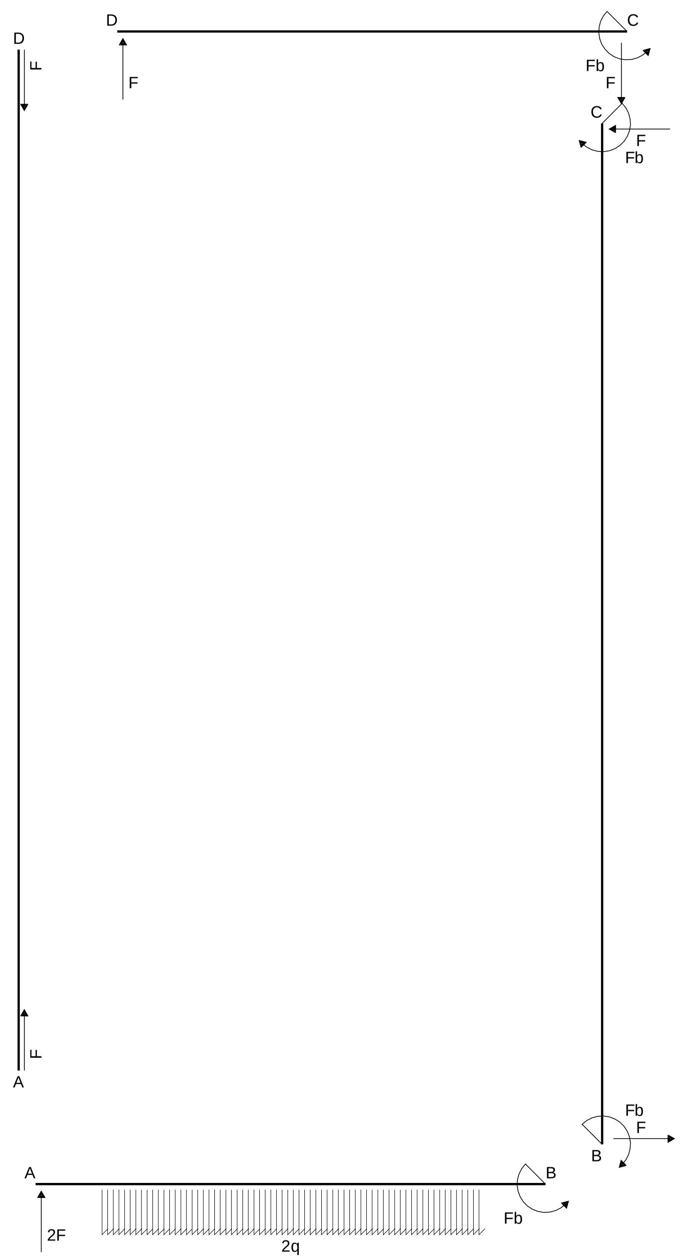
$H_{BA} = 0$

Matrice di equilibrio

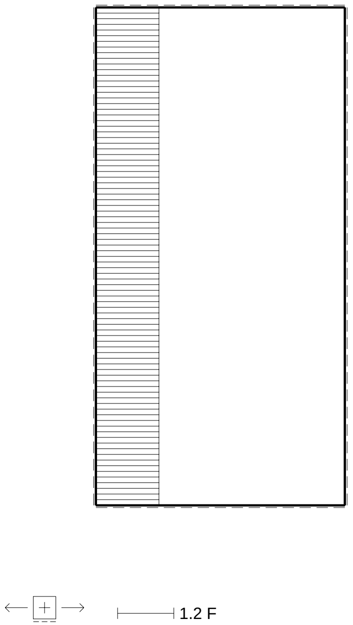
$$
\begin{array}{c}
 \\ \varphi_C \\ \varphi_{DA} \\ \varphi_{AD} \\ u_{AB}
\end{array}
\begin{array}{c}
\begin{bmatrix} H_Ab & V_Ab & H_{BA}b & W_{BA} \end{bmatrix} \\
\begin{bmatrix} 2 & -1 & 0 & 0 \\ 2 & 0 & 2 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}
\end{array}
=
\begin{array}{c}
\begin{bmatrix} Fb & qb^2 \end{bmatrix} \\
\begin{bmatrix} -2 & -1 \\ 0 & 1 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}
\end{array}
$$

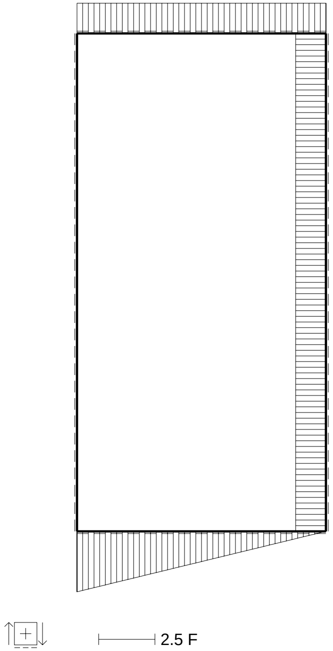
Soluzione del sistema

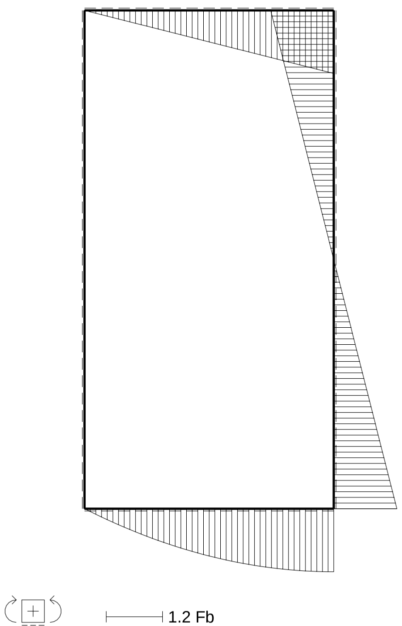
$$
\begin{bmatrix} H_Ab \\ V_Ab \\ W_{BA} \\ H_{BA}b \end{bmatrix}
=
\begin{array}{c}
\begin{bmatrix} Fb & qb^2 \end{bmatrix} \\
\begin{bmatrix} 0 & 0 \\ 2 & 1 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}
\end{array}
$$



AZIONI INTERNE Nome: Es.N.038







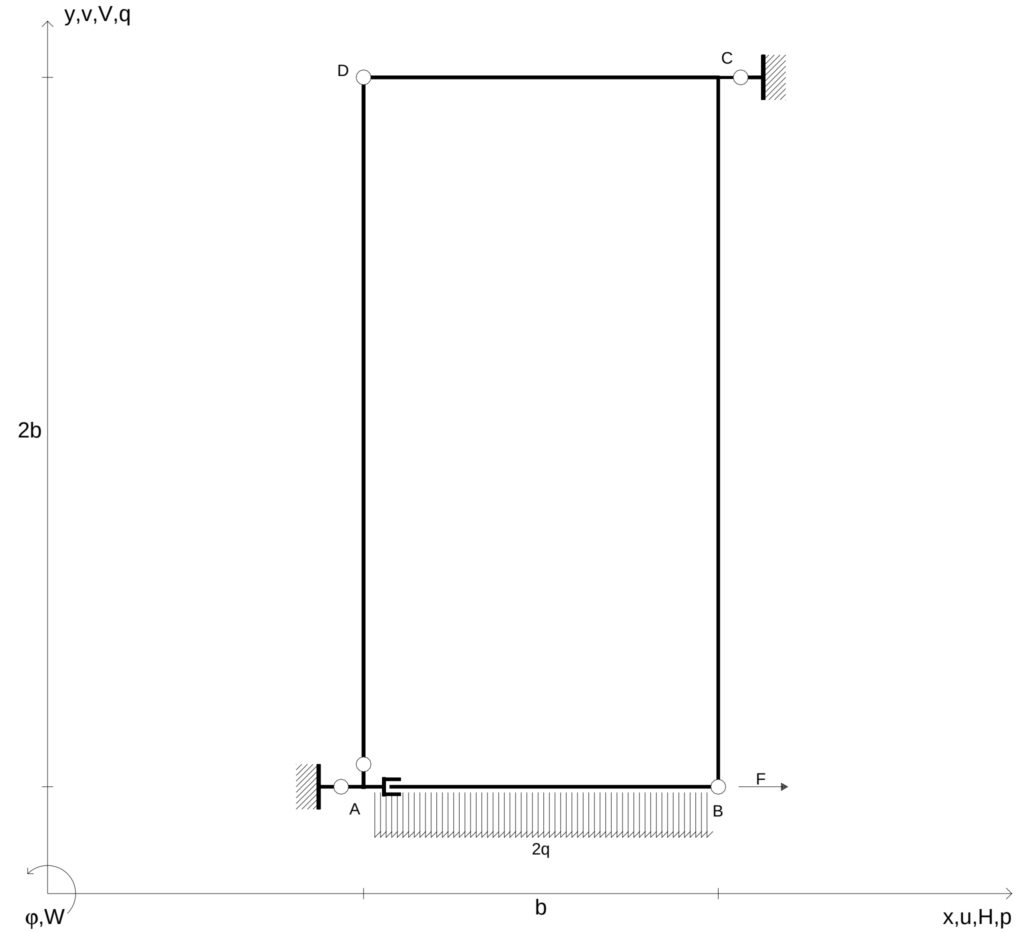
PROCEDIMENTO E RISULTATI Nome: Es.N.038

REAZIONI

$H_A = 0$ $V_A = 2F + qb = 3F$ $H_C = -F = -F$ $V_C = -2F + qb = -F$

$N_{DA} = -2F + qb = -F$

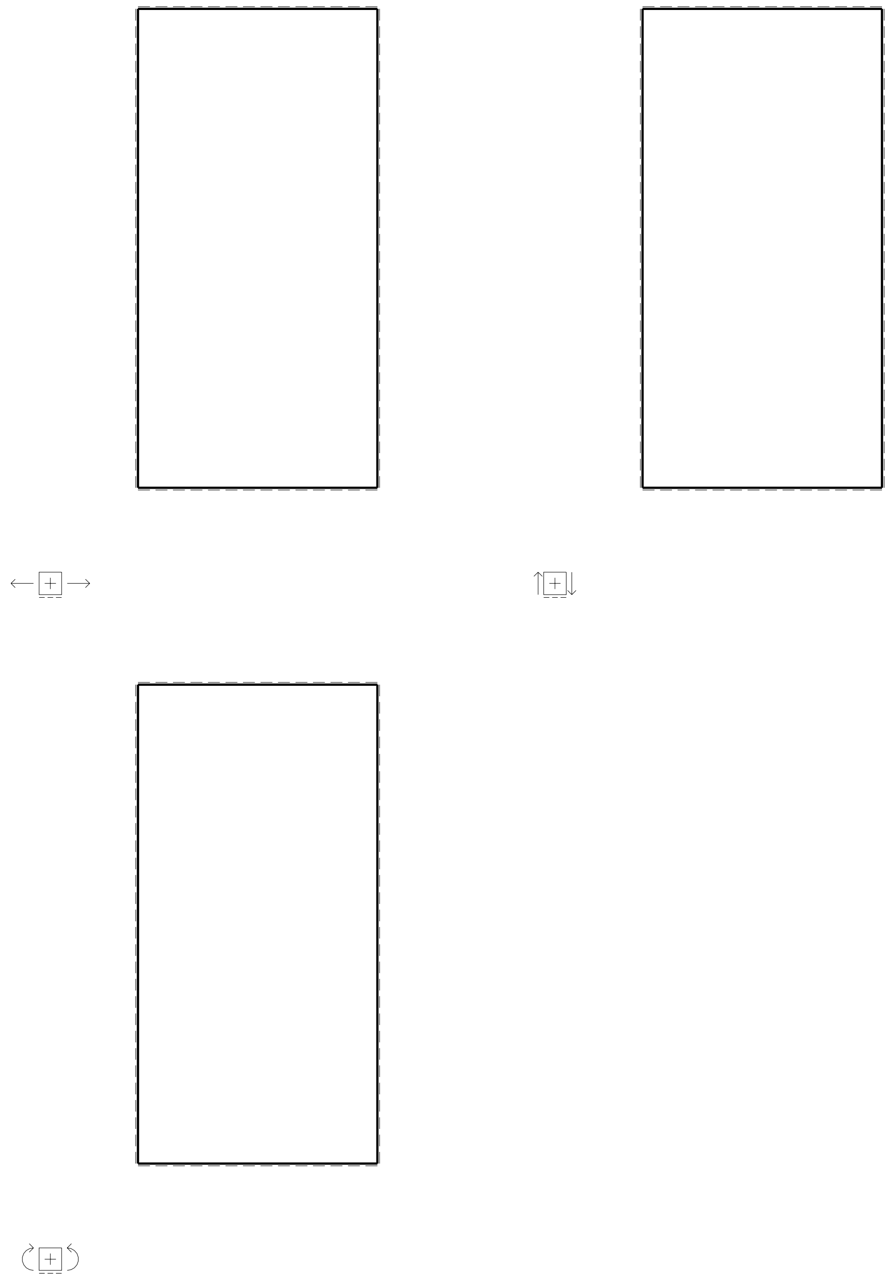
$H_{AB} = 0$	$H_{BC} = F = F$	$H_{CD} = 0$
$V_{AB} = 2qb = 2F$	$V_{BC} = 0$	$V_{CD} = -2F + qb = -F$
$W_{AB} = 0$	$W_{BC} = -qb^2 = -Fb$	$W_{CD} = 2Fb - qb^2 = Fb$
$H_{BA} = 0$	$H_{CB} = -F = -F$	$H_{DC} = 0$
$V_{BA} = 0$	$V_{CB} = 0$	$V_{DC} = 2F - qb = F$
$W_{BA} = qb^2 = Fb$	$W_{CB} = -2Fb + qb^2 = -Fb$	$W_{DC} = 0$

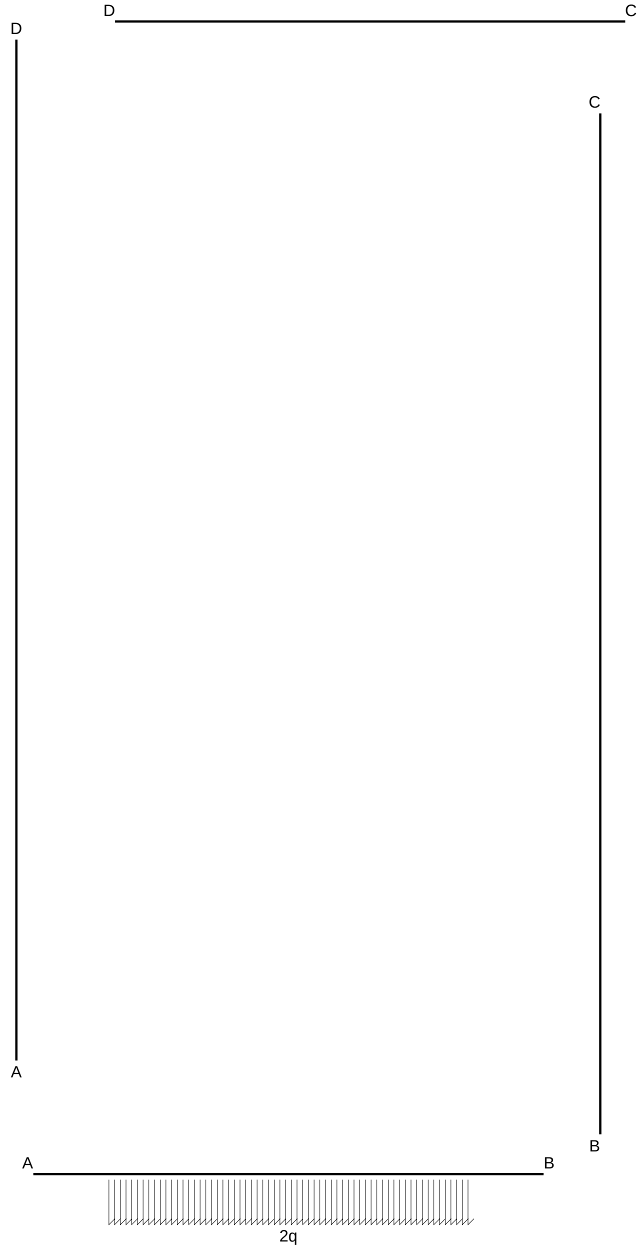


$H_B = F$

$q_{AB} = -2q = -2F/b$

Svolgere l'analisi cinematica.
Determinare matrice di congruenza e di equilibrio.
Determinare le reazioni vincolari a terra col PLV (Le=0).
Determinare le azioni interne in C col PLV (Le=0).
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi delle azioni interne nelle aste.



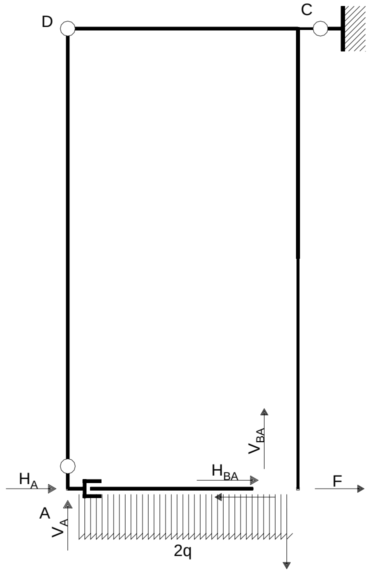


REAZIONI

H_A = V_A = H_C = V_C =

N_{DA} =

H_{AB} =	H_{BC} =	H_{CD} =
V_{AB} =	V_{BC} =	V_{CD} =
W_{AB} =	W_{BC} =	W_{CD} =
H_{BA} =	H_{CB} =	H_{DC} =
V_{BA} =	V_{CB} =	V_{DC} =
W_{BA} =	W_{CB} =	W_{DC} =



EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a C

$2H_Ab - V_Ab = -2Fb - qb^2$

Rotazione intorno a D: aste DA AB

$2H_Ab + 2H_{BA}b + V_{BA}b = qb^2$

Rotazione intorno a A: aste AB

$V_{BA}b = qb^2$

Traslazione orizzontale: aste AB

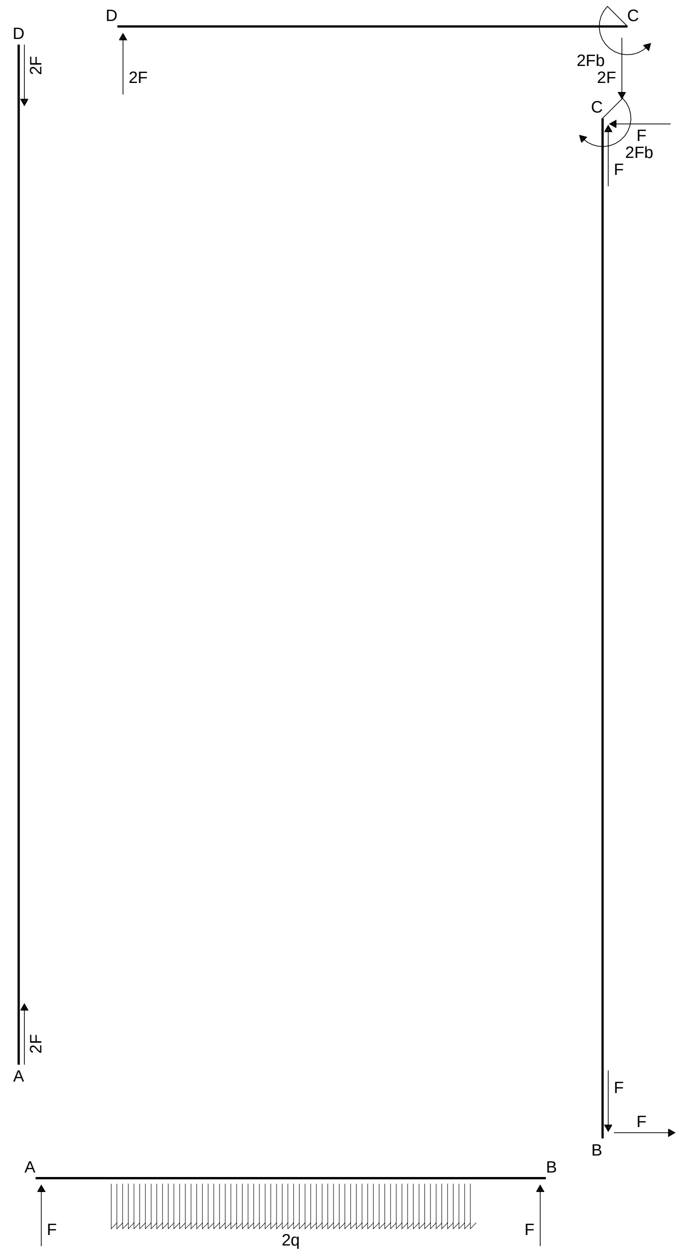
$H_{BA} = 0$

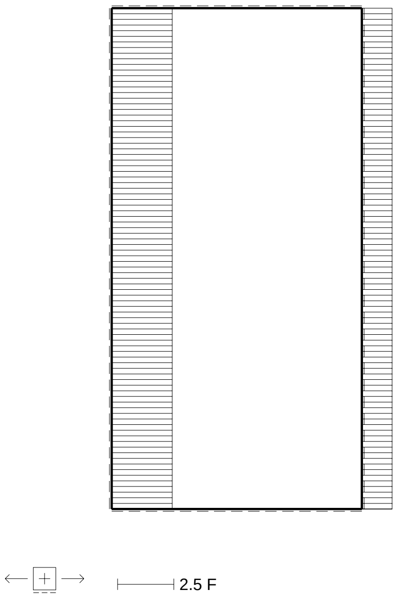
Matrice di equilibrio

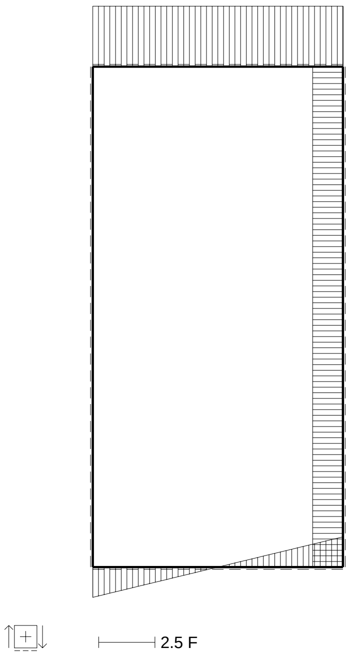
$$\begin{array}{c} \\ \varphi_C \\ \varphi_{DA} \\ \varphi_{AD} \\ u_{AB} \end{array} \begin{array}{c} \begin{bmatrix} H_Ab & V_Ab & H_{BA}b & V_{BA}b \end{bmatrix} \\ \begin{bmatrix} 2 & -1 & 0 & 0 \\ 2 & 0 & 2 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array} = \begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} -2 & -1 \\ 0 & 1 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \end{array}$$

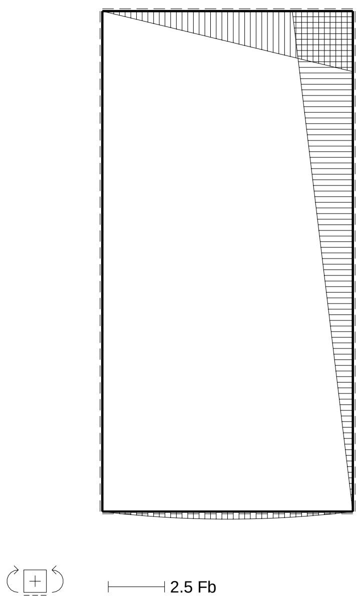
Soluzione del sistema

$$\begin{bmatrix} H_Ab \\ V_Ab \\ V_{BA}b \\ H_{BA}b \end{bmatrix} = \begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 \\ 2 & 1 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \end{array}$$







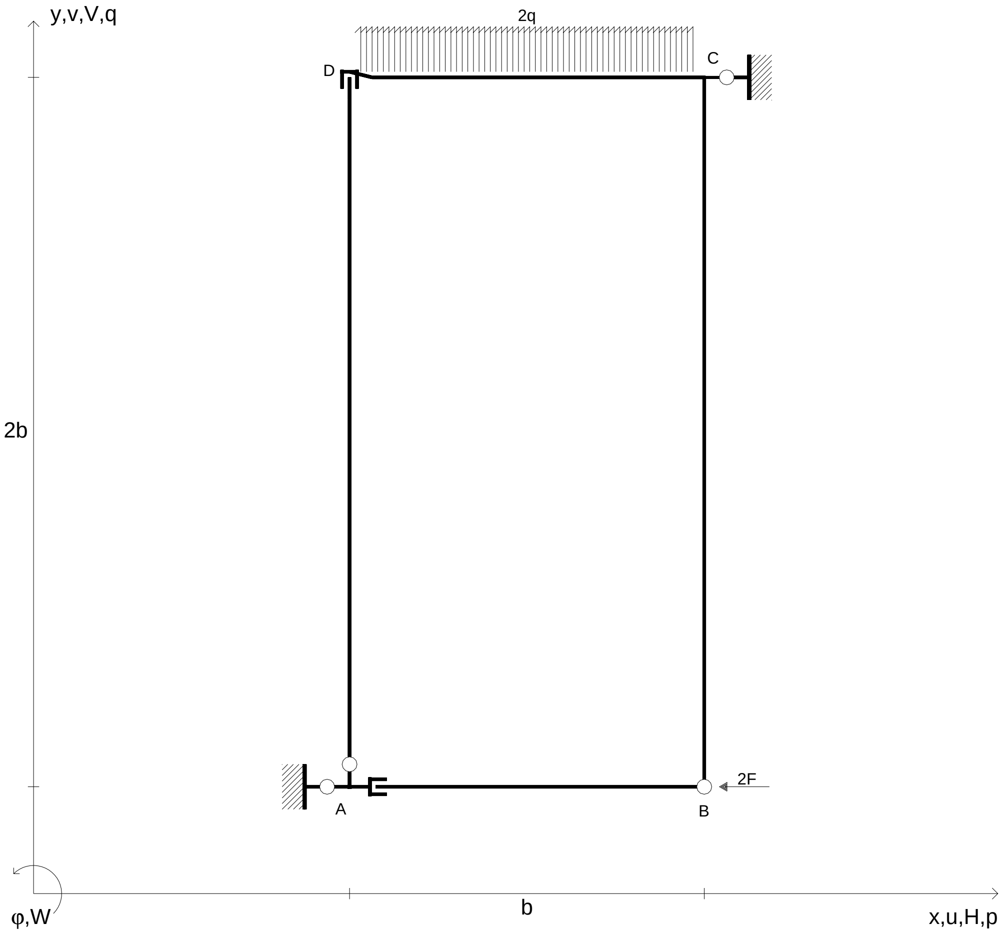


REAZIONI

$H_A = 0$ $V_A = 2F + qb = 3F$ $H_C = -F = -F$ $V_C = -2F + qb = -F$

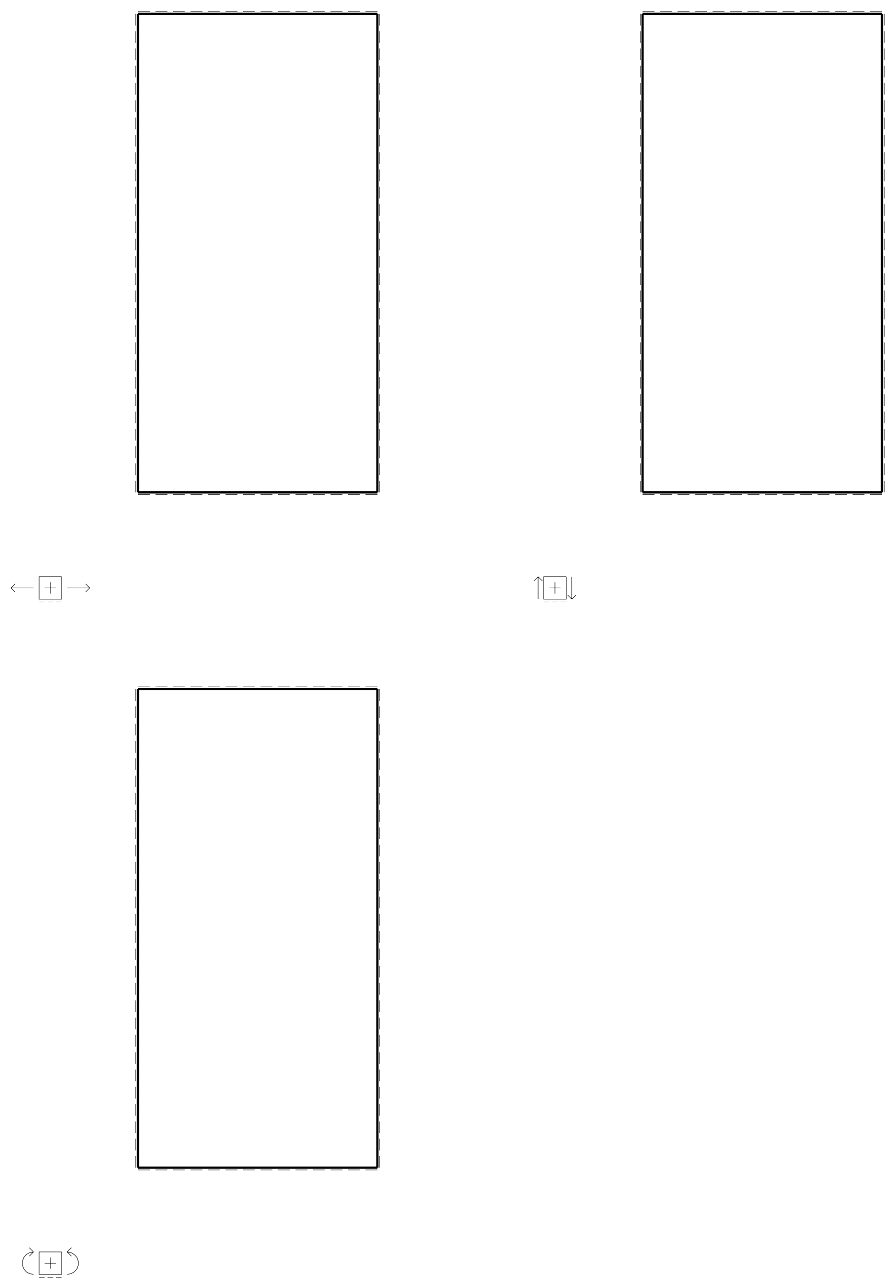
$N_{DA} = -2F = -2F$

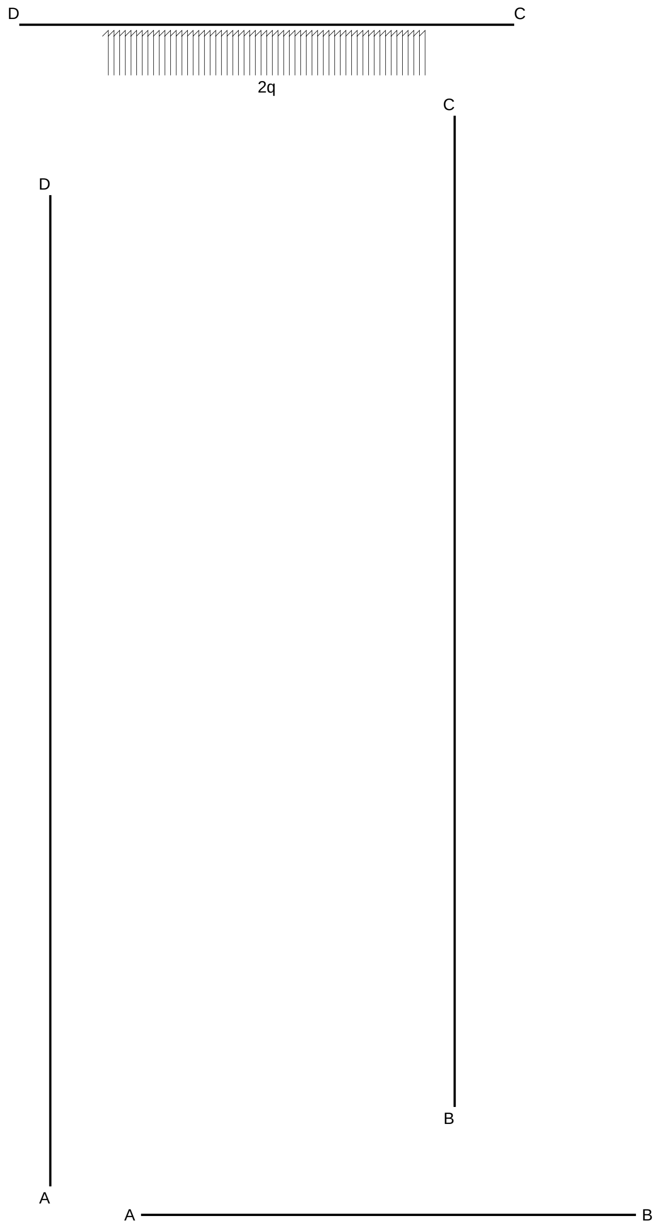
$H_{AB} = 0$	$H_{BC} = F = F$	$H_{CD} = 0$
$V_{AB} = qb = F$	$V_{BC} = -qb = -F$	$V_{CD} = -2F = -2F$
$W_{AB} = 0$	$W_{BC} = 0$	$W_{CD} = 2Fb = 2Fb$
$H_{BA} = 0$	$H_{CB} = -F = -F$	$H_{DC} = 0$
$V_{BA} = qb = F$	$V_{CB} = qb = F$	$V_{DC} = 2F = 2F$
$W_{BA} = 0$	$W_{CB} = -2Fb = -2Fb$	$W_{DC} = 0$



$H_B = -2F$ $q_{CD} = 2q = 2F/b$

Svolgere l’analisi cinematica.
Determinare matrice di congruenza e di equilibrio.
Determinare le reazioni vincolari a terra col PLV (Le=0).
Determinare le azioni interne in C col PLV (Le=0).
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi delle azioni interne nelle aste.



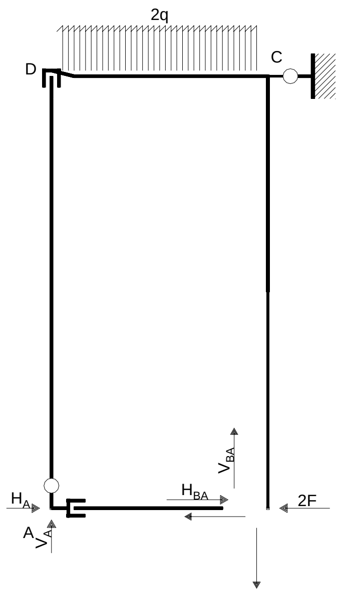


REAZIONI

H_A = V_A = H_C = V_C =

H_{AB} =	H_{BC} =	H_{CD} =
V_{AB} =	V_{BC} =	V_{CD} =
W_{AB} =	W_{BC} =	W_{CD} =
H_{BA} =	H_{CB} =	H_{DC} =
V_{BA} =	V_{CB} =	V_{DC} =
W_{BA} =	W_{CB} =	W_{DC} =

H_{DA} =
V_{DA} =
W_{DA} =
H_{AD} =
V_{AD} =
W_{AD} =



EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a C

$2H_Ab - V_Ab = 4Fb + qb^2$

Traslazione verticale: aste DA AB

$V_A + V_{BA} = 0$

Rotazione intorno a A: aste AB

$V_{BA}b = 0$

Traslazione orizzontale: aste AB

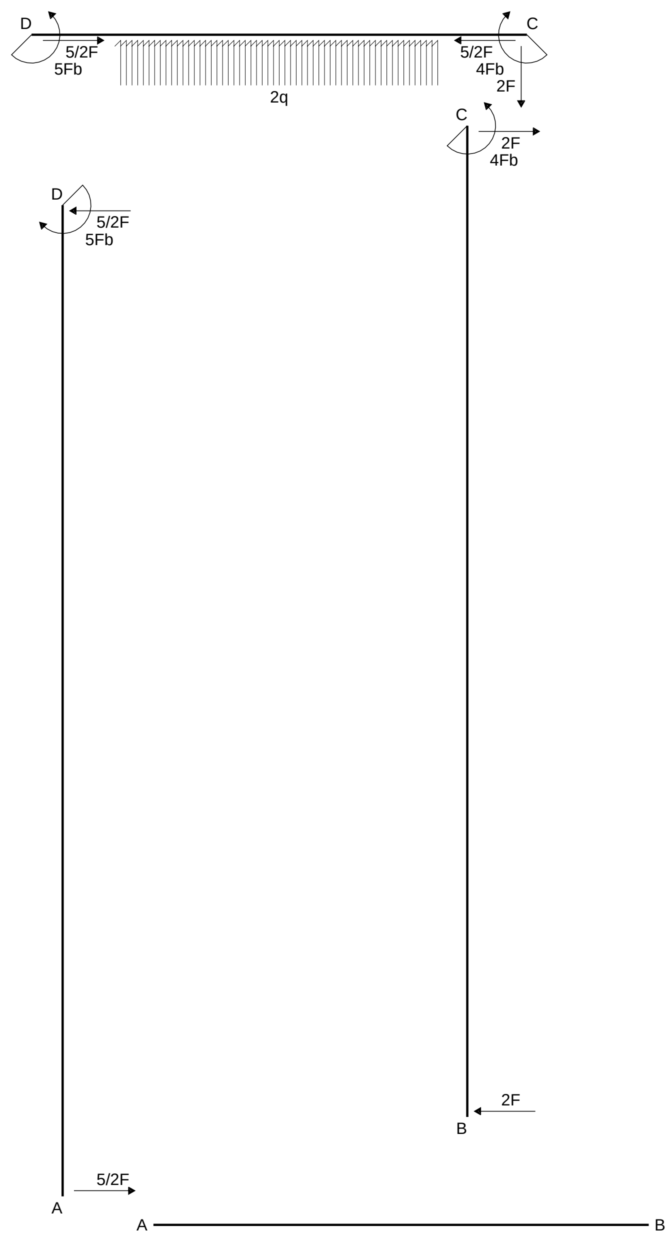
$H_{BA} = 0$

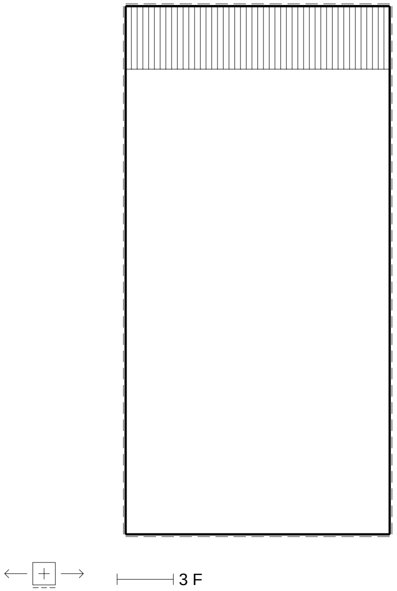
Matrice di equilibrio

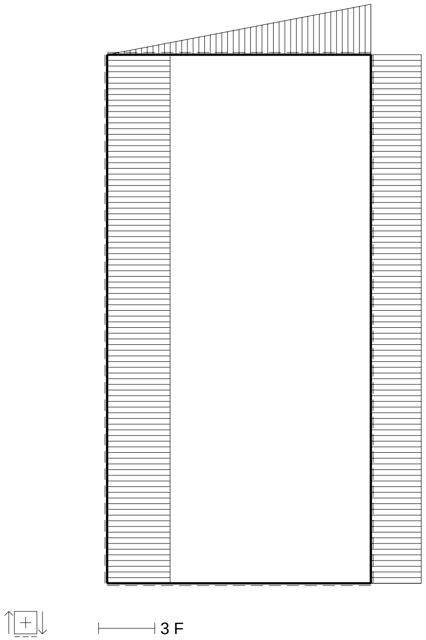
$$
\begin{array}{c} \\ \varphi_C \\ v_{DC} \\ \varphi_{AD} \\ u_{AB} \end{array}
\begin{array}{c} \begin{bmatrix} H_Ab & V_Ab & H_{BA}b & V_{BA}b \end{bmatrix} \\ \begin{bmatrix} 2 & -1 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}
=
\begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} 4 & 1 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \end{array}
$$

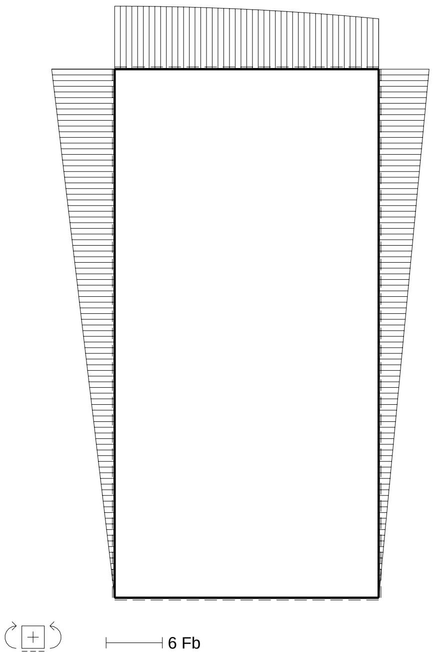
Soluzione del sistema

$$
\begin{bmatrix} H_Ab \\ V_Ab \\ V_{BA}b \\ H_{BA}b \end{bmatrix}
=
\begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} 2 & 1/2 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \end{array}
$$









REAZIONI

H_A = 2F +1/2qb = 5/2F V_A = 0 H_C = -1/2qb = -1/2F V_C = -2qb = -2F

H_{AB} = 0
V_{AB} = 0
W_{AB} = 0
H_{BA} = 0
V_{BA} = 0
W_{BA} = 0

H_{BC} = -2F = -2F
V_{BC} = 0
W_{BC} = 0
H_{CB} = 2F = 2F
V_{CB} = 0
W_{CB} = 4Fb = 4Fb

H_{CD} = -2F -1/2qb = -5/2F
V_{CD} = -2qb = -2F
W_{CD} = -4Fb = -4Fb
H_{DC} = 2F +1/2qb = 5/2F
V_{DC} = 0
W_{DC} = 4Fb +qb^2 = 5Fb

H_{DA} = -2F -1/2qb = -5/2F
V_{DA} = 0
W_{DA} = -4Fb -qb^2 = -5Fb
H_{AD} = 2F +1/2qb = 5/2F
V_{AD} = 0
W_{AD} = 0

@ Adolfo Zavelani Rossi, Politecnico di Milano