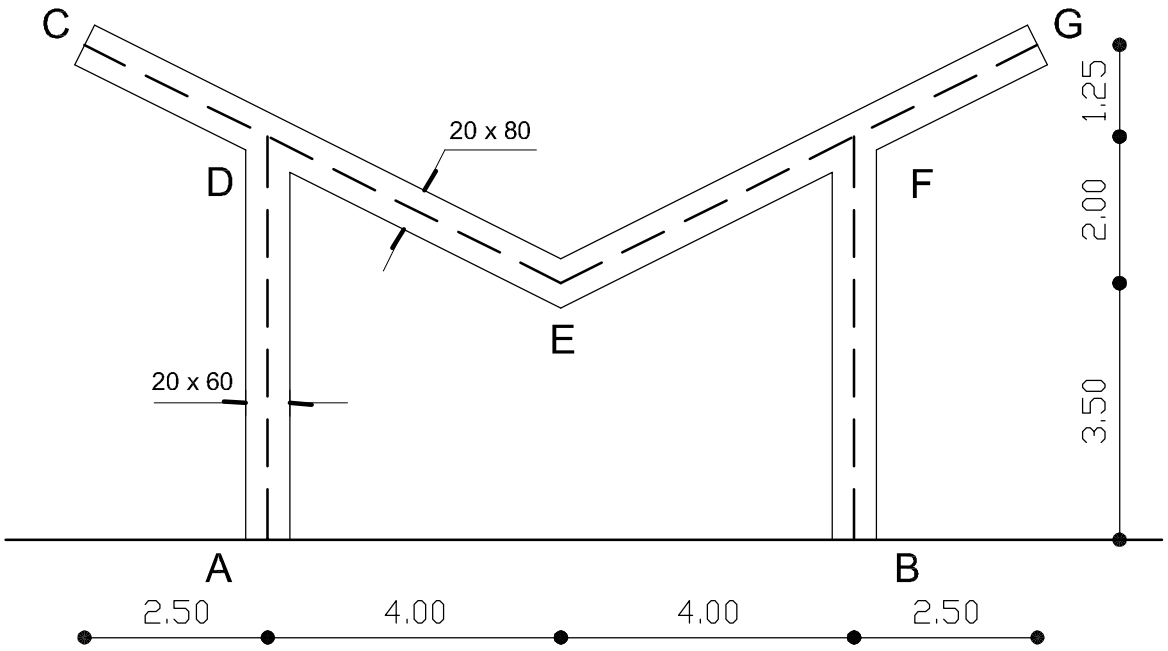
ESTABILIDAD DE LAS CONSTRUCCIONES II

Parte escrita del Examen
22 / 03 / 01

Estudiar el pórtico de hormigón armado cuya forma se indica. Sobre los tramos C-D-E-F-G una losa maciza, de 9cm de espesor, descarga 2400 daN/m de tramo.
Se piden diagramas de solicitaciones de las barras AD, CD y DE, y reacciones de apoyos.



1)

CARGAS: CE y EF

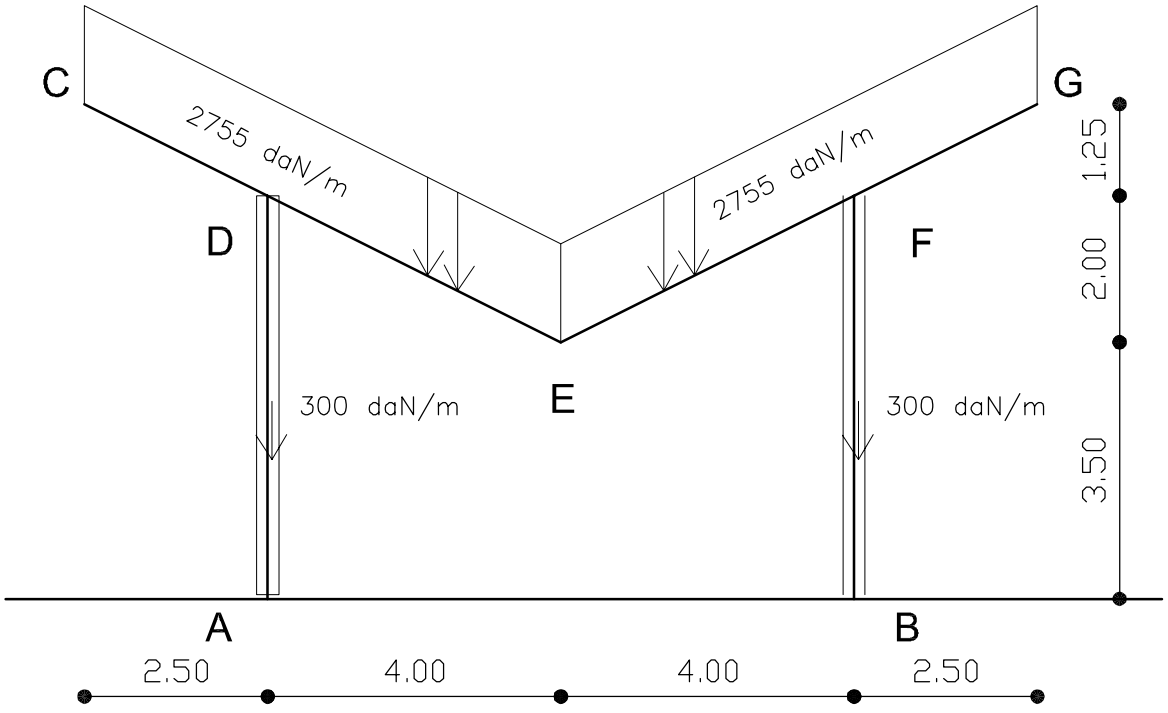
p.p.= 0,20 x (0,80 − 0.09) x 2500 = 355 daN/m

descarga de la losa = 2400 daN/m

2755 daN/m

AD y BF

p.p.= 0,20 x 0,60 x 2500 = 300 daN/m



Por tratarse de una estructura simétrica por nudo, se estudia media estructura, con el nudo central frenado. El momento final será el Momento Freno más el Momento transmitido.

DETERMINACIÓN DE LOS COEFICIENTES α Y β

TRAMO CD

l_H = 2.50 m

l_i = 2.795 m

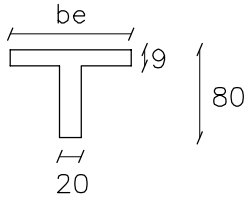
DETERMINACIÓN DE LOS COEFICIENTES α Y β (cont.)

TRAMO DE

$l_H = 4.00$ m

$l_i = 4.47$ m

Sección de inercia constante. Por los vínculos, $\alpha = 1$, $\beta = 1$



be = 6 hf+bw = 6x9+20 = 74 cm

$\frac{bw}{be} = \frac{20}{74} = 0{,}270$

$\frac{hf}{h} = \frac{9}{80} = 0{,}113$

$\psi = 0{,}42$

$$I = \frac{0{,}42 \times 74 \times 80^3}{12}$$

TRAMO AD

$l = 5.50$ m

Sección de inercia constante. Por los vínculos, $\alpha = 1$, $\beta = 1$

$$I = \frac{b \times H}{12^3} = \frac{20 \times 60}{12^3}$$

DETERMINACIÓN DE RIGIDECES DE TRAMOS Y DE COEFICIENTES DE REPARTICIÓN

$\chi = \frac{I}{I \text{ real}}$ $\quad I_{AD} = 1$ $\quad I \text{ real AD} = 5.50$ $\quad \chi = \frac{1}{5.50} = 0{,}18$

$I = \frac{I \text{ propia}}{I \text{ unidad}}$ $\quad I_{DE} = \frac{\frac{0.42 \times 74 \times 80^3}{12}}{\frac{20 \times 60^3}{12}} = 3.68$ $\quad I \text{ real DE} = 4.47$ $\quad \chi = \frac{3.68}{4.47} = 0.82$

NUDO D

$$r = \frac{\alpha \ \chi}{\sum \alpha \chi}$$

$$r_{DA} = \frac{0.18}{1.00} = 0.18$$

$$r_{DE} = (1 - 0{,}18) = 0.82$$

COEFICIENTES

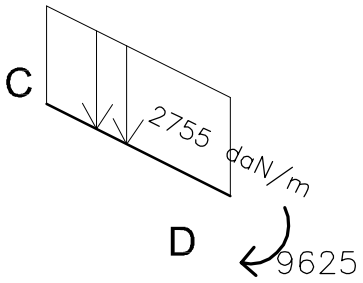
BARRA	luz real	α	β	rel. In.	χ	$\alpha\chi$
AD	5,50	1	0,5	1	0,18	0,18
DE	4,47	1	0,5	3,68	0,82	0,82

DETERMINACIÓN DE LOS MOMENTOS DE EMPOTRAMIENTO PERFECTO (M.E.P.)

Se determinan los M.E.P. donde corresponde: son los provocados por cargas perpendiculares al eje de tramo.

TRAMO AD No corresponde.

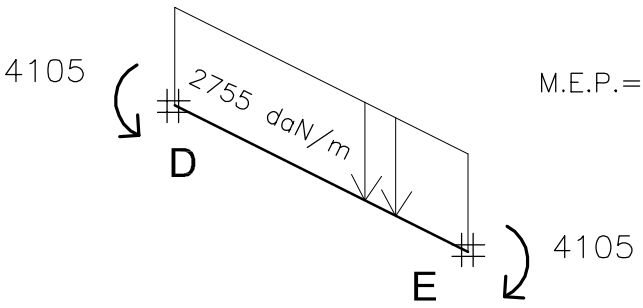
TRAMO CD



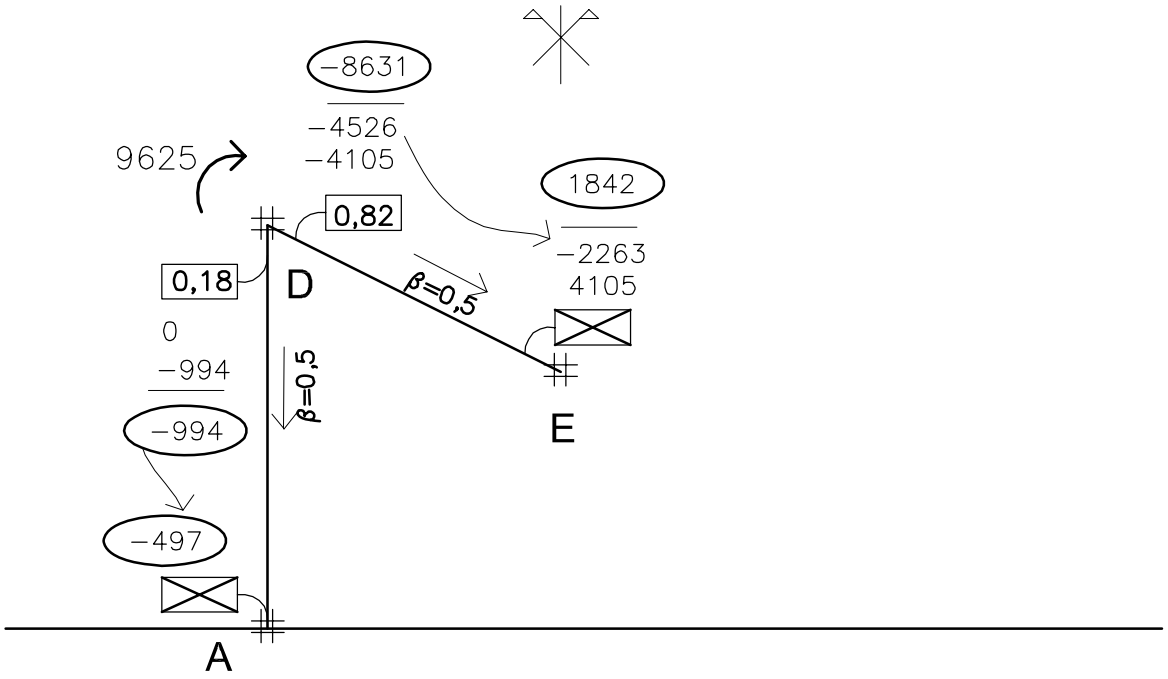
$$M = \frac{p.l_r.l_h}{2} = \frac{2755x2,795x2,5}{2} = 9625 \text{ daNm}$$

TRAMO DE

Inercia constante
Carga uniforme
} Tabla II–2

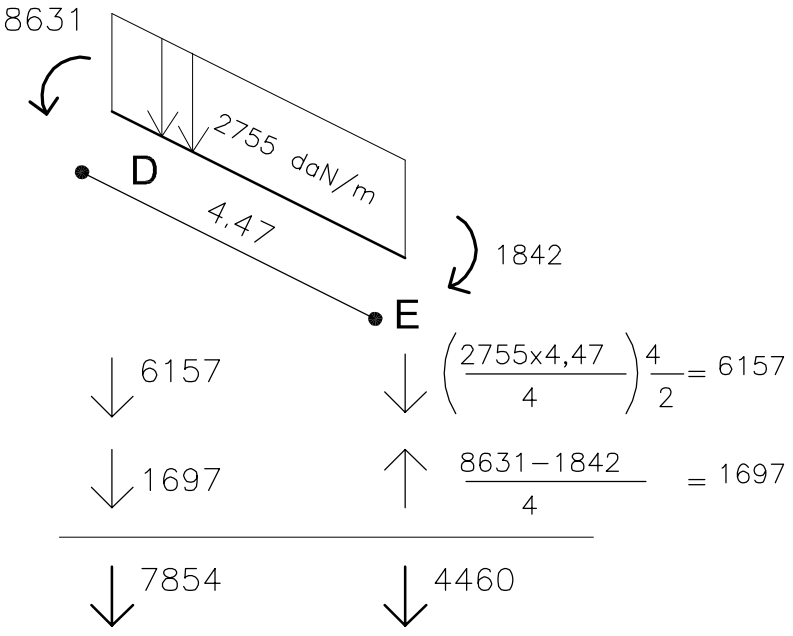


$$M.E.P. = \frac{p.l_h.l_i}{12} = \frac{2755x4x4,47}{12} = 4105 \text{ daNm}$$

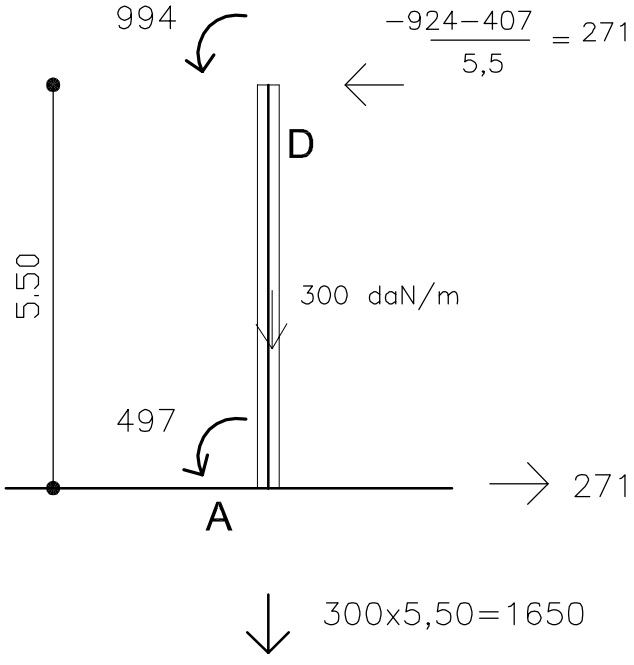


DESCARGAS DE TRAMO

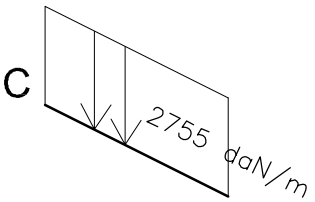
TRAMO DE



TRAMO AD

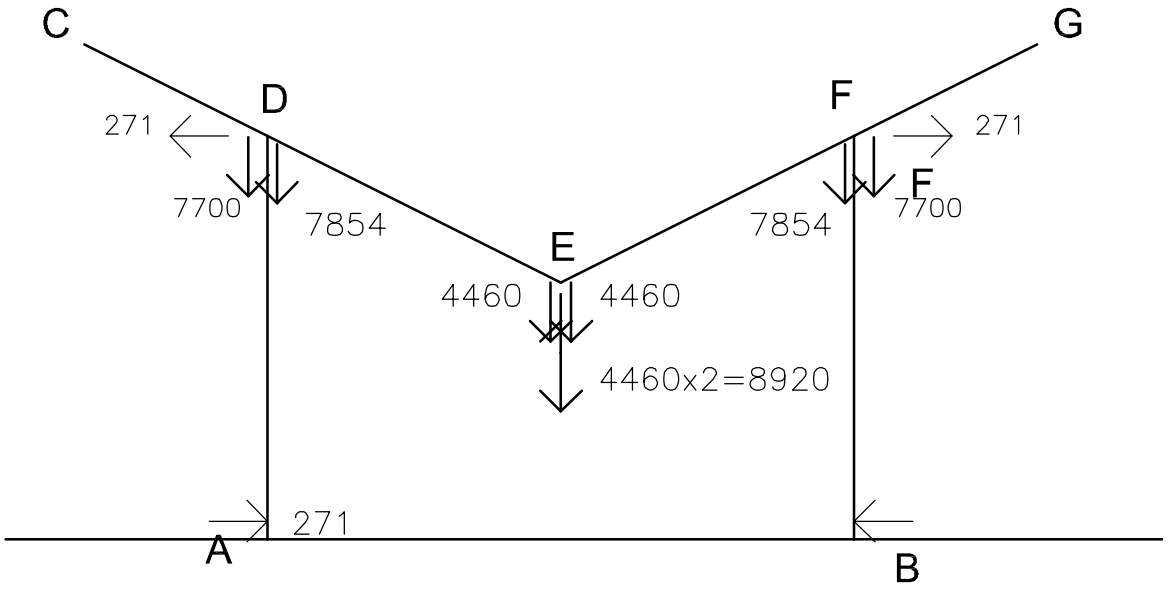


TRAMO AD

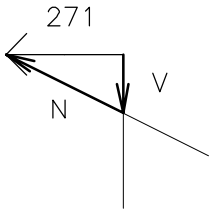


2755x2,795 = 7700 ↓ D

DESCARGAS EN NUDOS



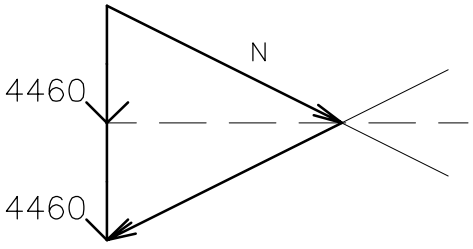
Vemos los caminos materiales que recorren las fuerzas.
Construimos una dinámica de fuerzas.



La resolución puede ser gráfica, midiendo en la dinámica (a escala) el valor de la fuerza.

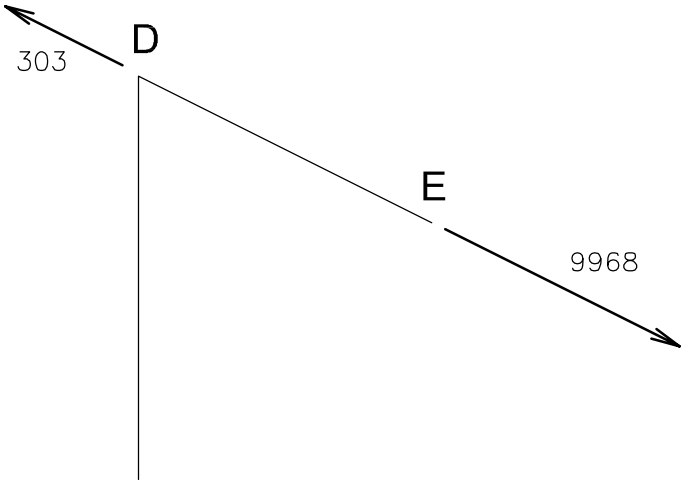
O analítica (en este caso por semejanza de triángulos):

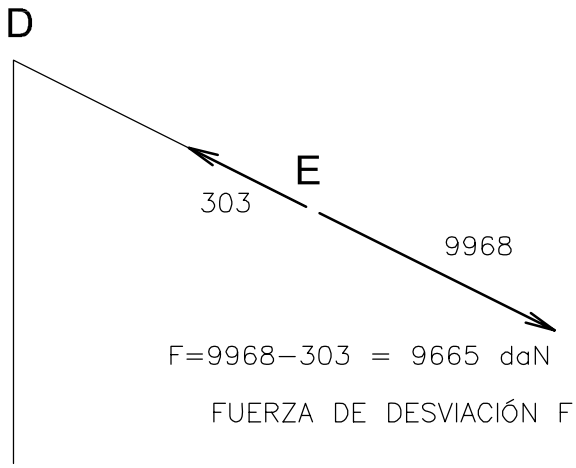
$$\frac{271}{4} = \frac{N}{4,47} \Rightarrow N=303 \text{ daN}$$



$$\frac{4460}{2} = \frac{N}{4,47} \Rightarrow N=9968 \text{ daN}$$

FUERZA DE DESVIACIÓN



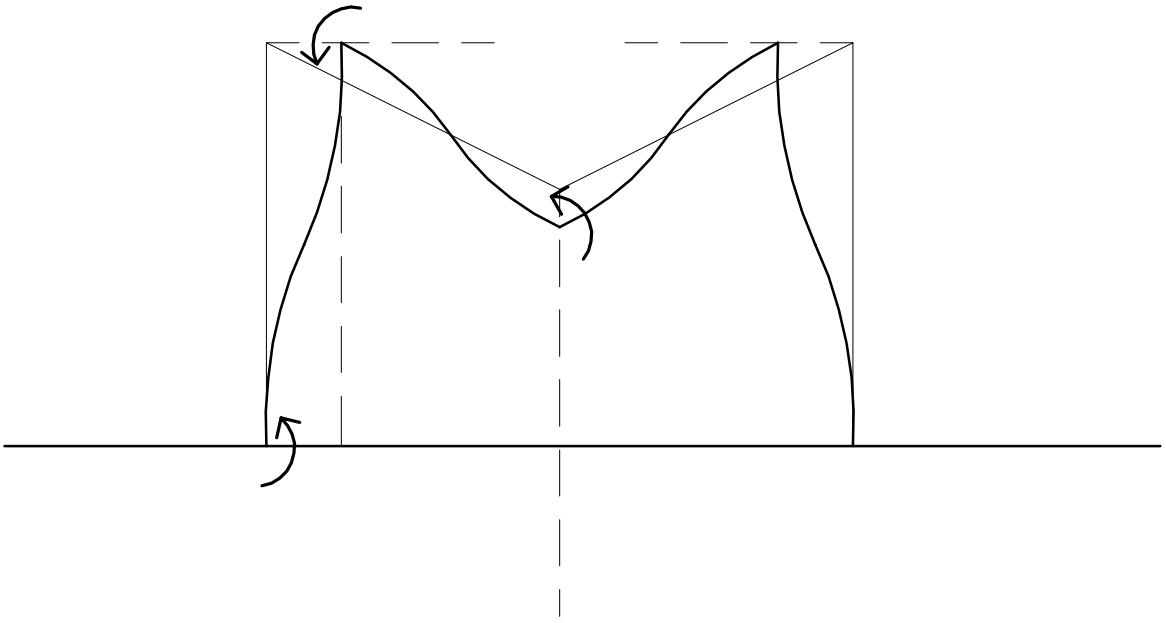


F=9968−303 = 9665 daN

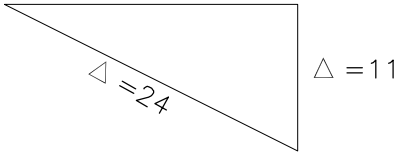
FUERZA DE DESVIACIÓN F

Esta fuerza no encuentra caminos materiales para su canalización, y se producirá una deformación por flexión de la estructura.

La deformada se construirá siguiendo las reglas de la deformación.



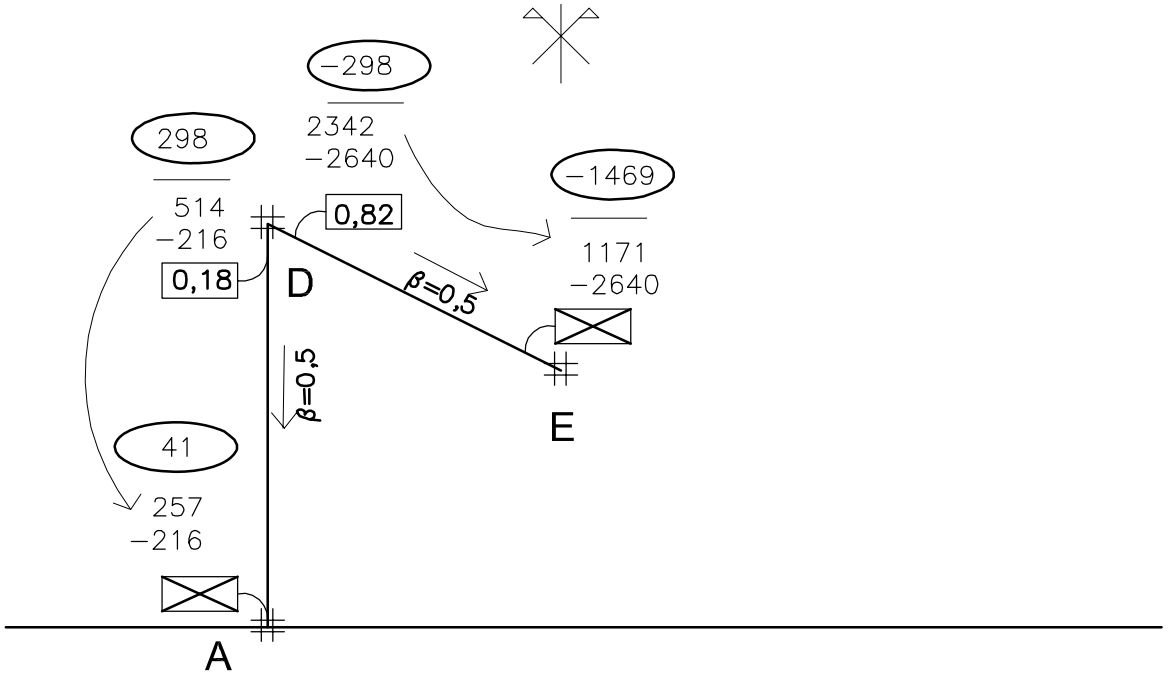
DETERMINACION DE △



M.E.P. 2° CROSS

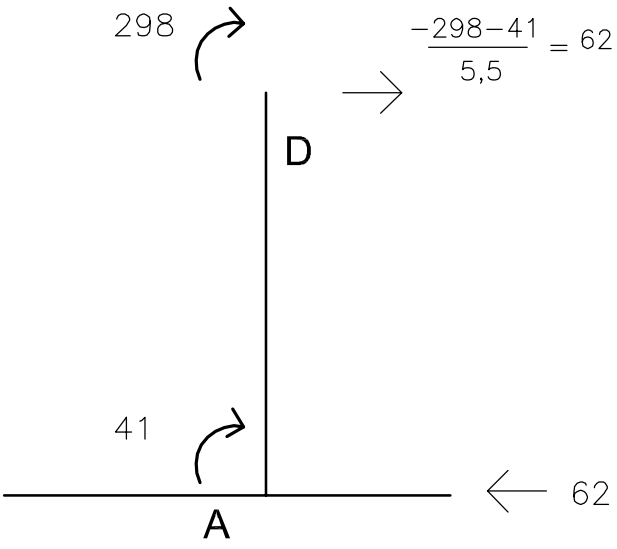
$$DE = 6x0,82 \times \frac{24X100}{4,47} = 2640$$

$$DA = 6x0,18 \times \frac{11X100}{5,50} = 216$$

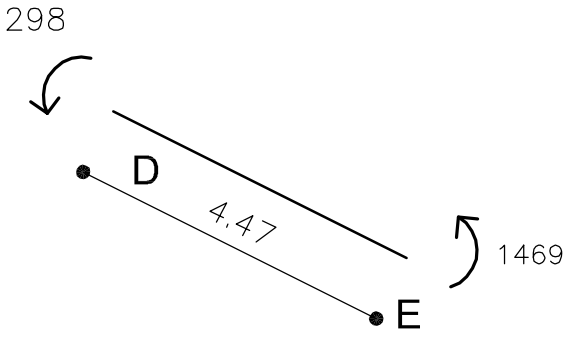


DESCARGAS DE TRAMO

TRAMO AD

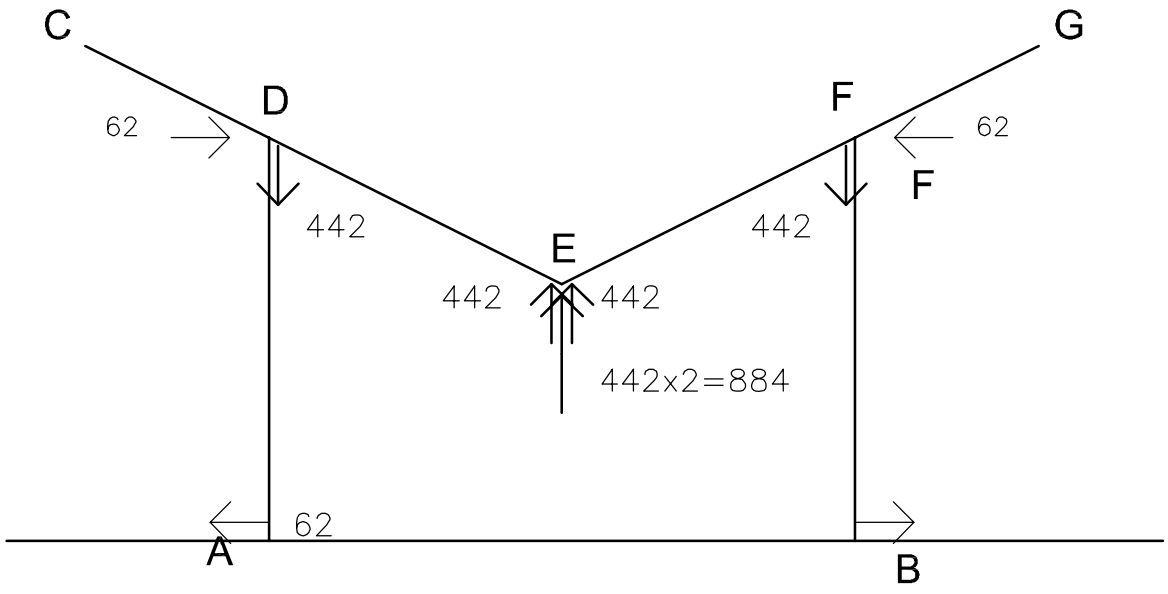


TRAMO DE



$\downarrow 442$ $\qquad$ $\uparrow \frac{-298-1469}{4} = 442$

DESCARGAS EN NUDOS



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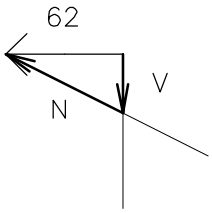
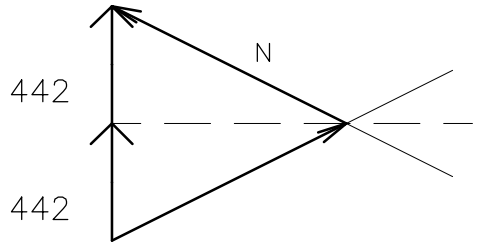
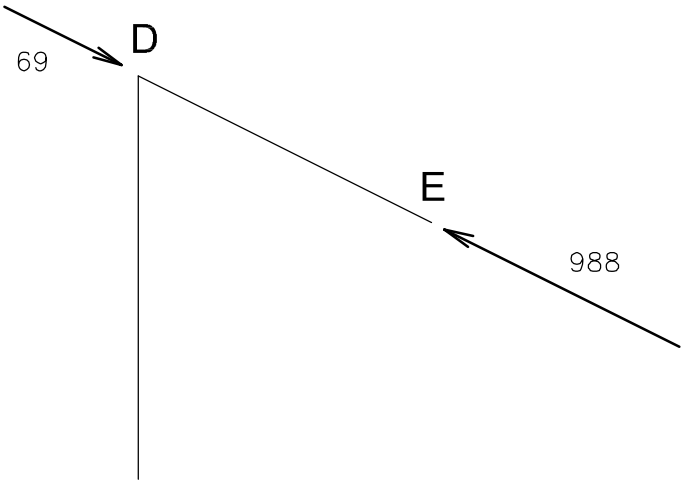


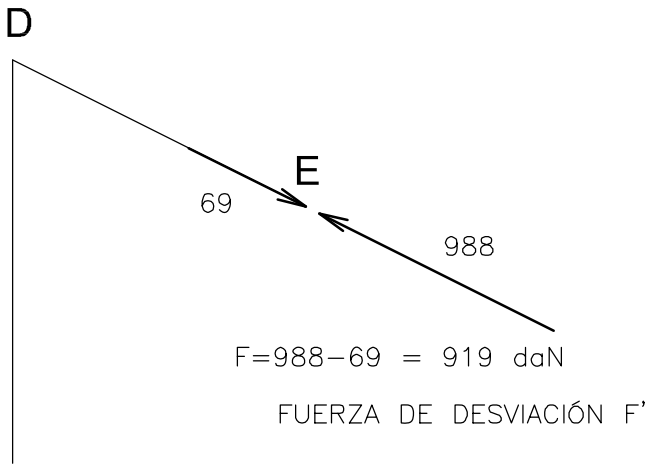
$\frac{62}{4} = \frac{N}{4,47} \Rightarrow N=69 \ \text{daN}$



$$\frac{442}{2} = \frac{N}{4,47} \Rightarrow N=988 \text{ daN}$$

FUERZA DE DESVIACIÓN F'



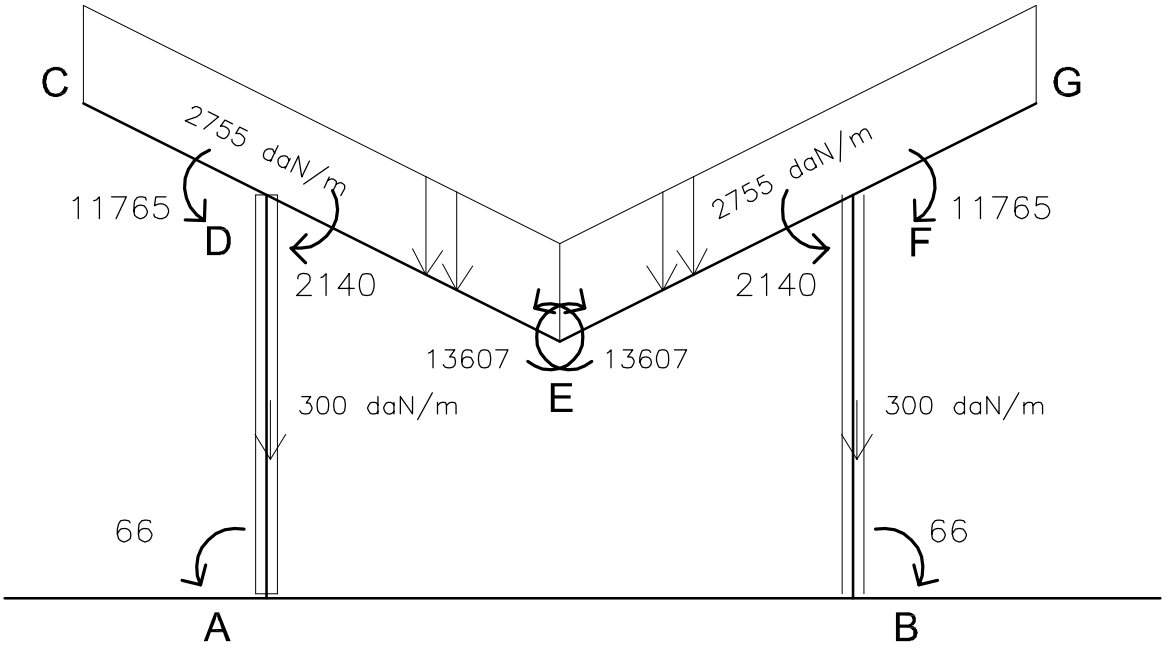


Esta fuerza debe tener sentido contrario a F.

MOMENTOS FINALES

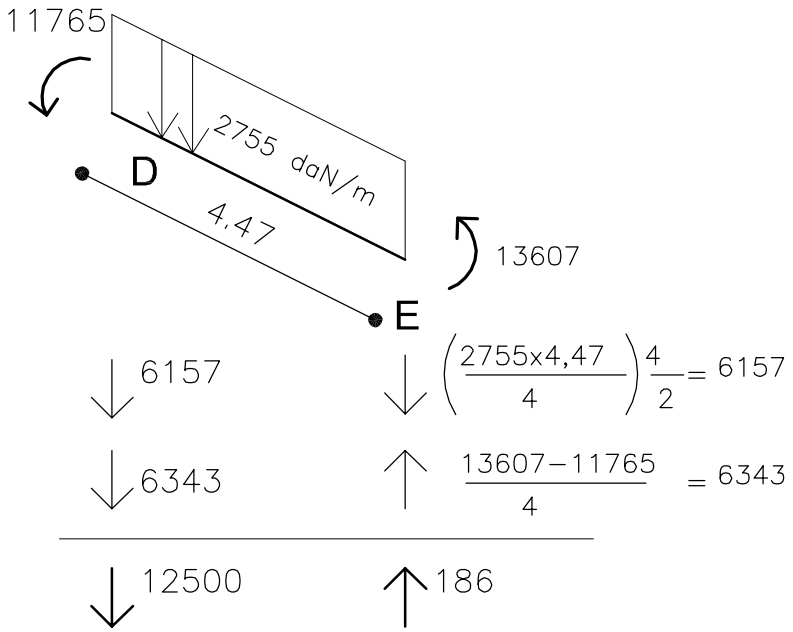
$$\alpha = \frac{9665}{919} = 10,51687$$

BARRA	M. 1er CROSS	M. 2do CROSS x α	M. FINALES
DA	−994	+3134	+2140
DE	−8631	−3134	−11765
ED	+1842	−15449	−13607
AD	−497	+431	−66

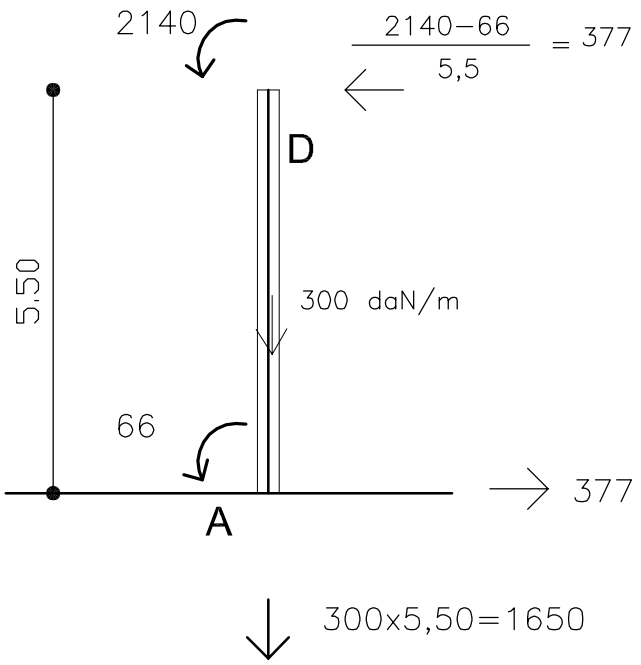


DESCARGAS DE TRAMO

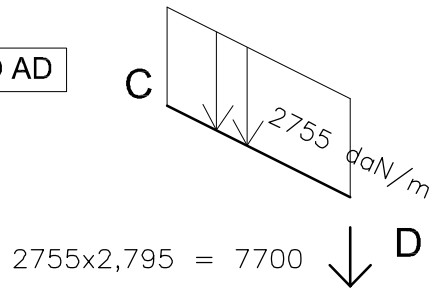
TRAMO DE



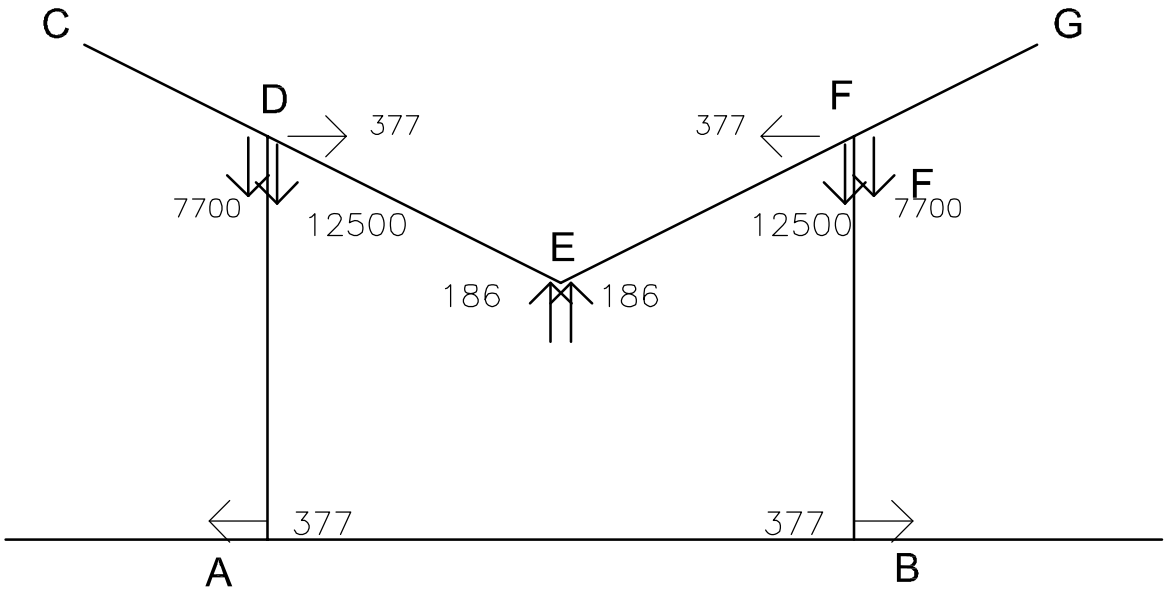
TRAMO AD

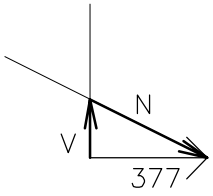


TRAMO AD



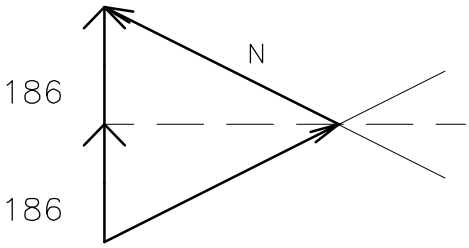
DESCARGAS EN NUDOS Y REACCIONES



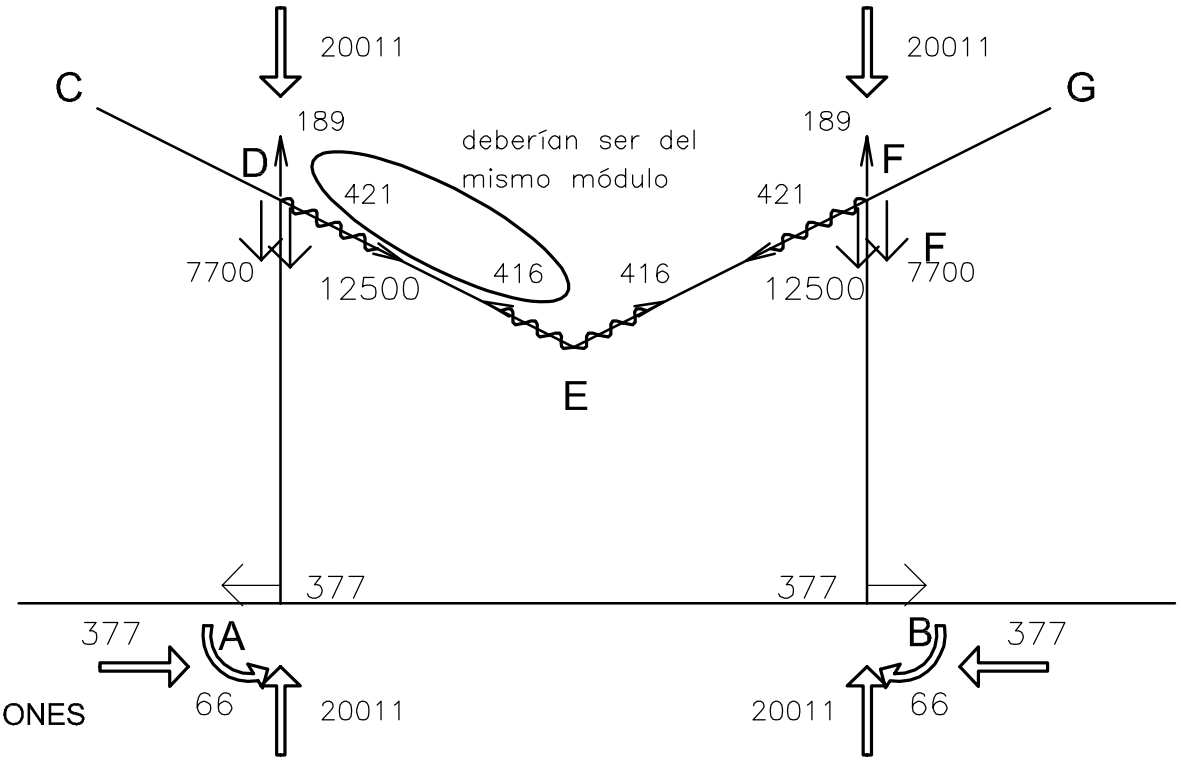


$$\frac{377}{4} = \frac{N}{4{,}47} \Rightarrow N=421 \ \text{daN}$$

$$\frac{377}{4} = \frac{V}{2} \Rightarrow V=189 \ \text{daN}$$



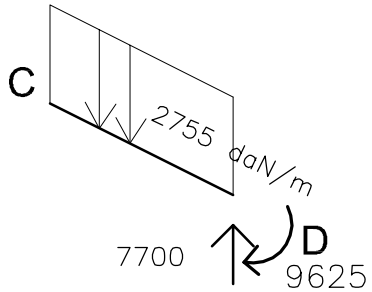
$$\frac{186}{2} = \frac{N}{4{,}47} \Rightarrow N=416 \ \text{daN}$$

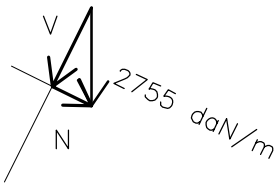


REACCIONES

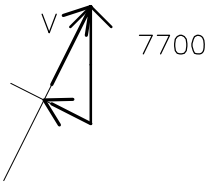
DIAGRAMAS DE SOLICITACIONES

TRAMO CD

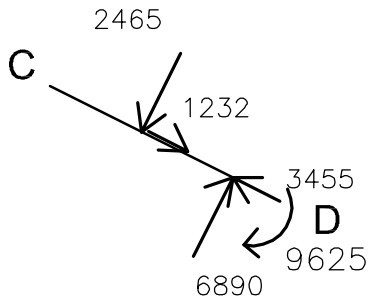




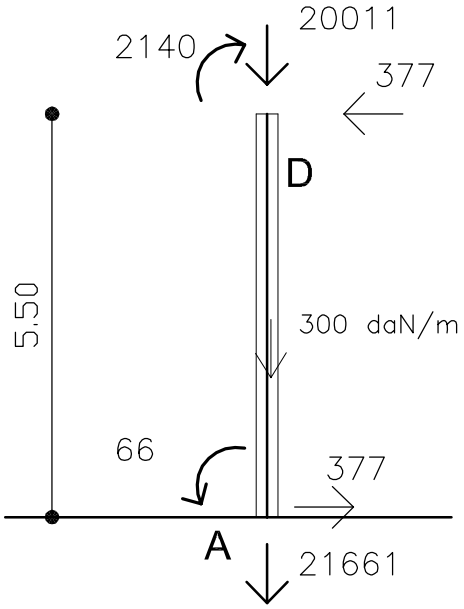
$$\frac{2755}{4,47} = \frac{N}{2} = \frac{V}{4} \Rightarrow \begin{matrix} N=1232 \text{ daN} \\ V=2465 \text{ daN} \end{matrix}$$

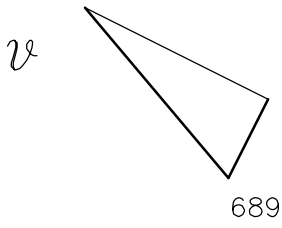


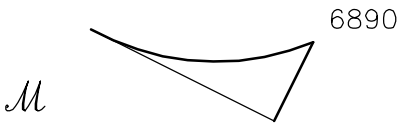
$$\frac{7700}{4,47} = \frac{N}{2} = \frac{V}{4} \Rightarrow \begin{matrix} N=3455 \text{ daN} \\ V=6890 \text{ daN} \end{matrix}$$

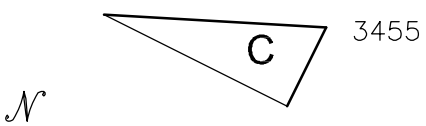


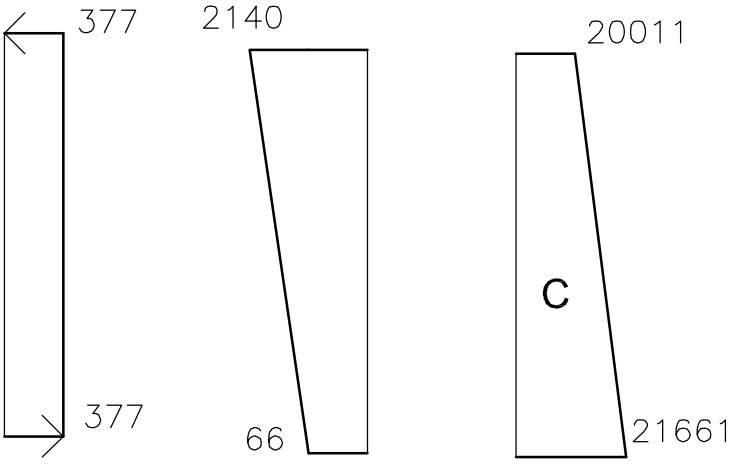
TRAMO AD



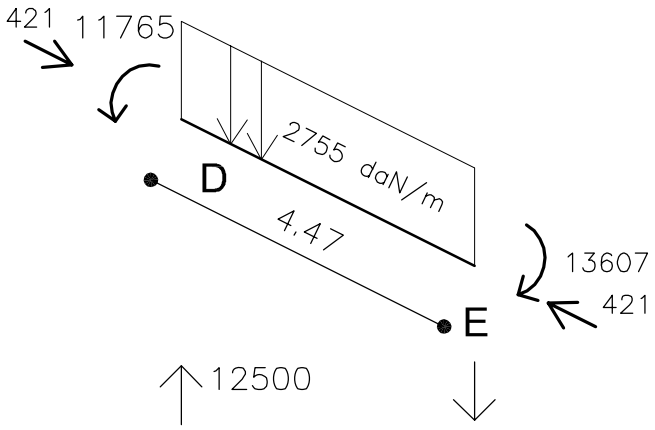


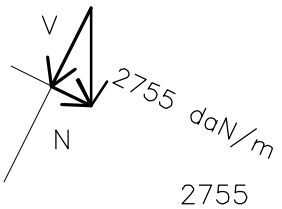




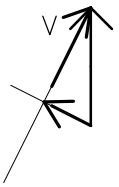


TRAMO DE

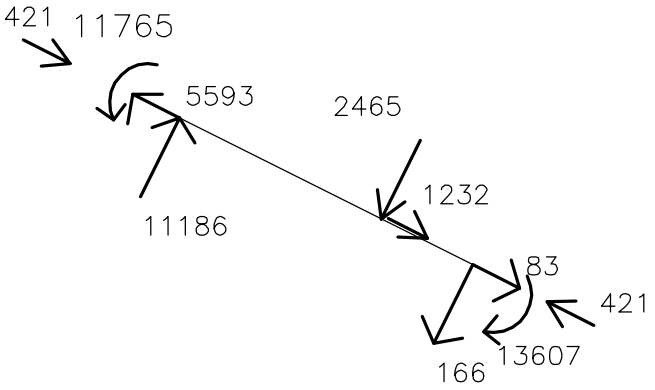


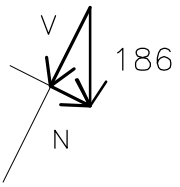


$$\frac{2755}{4,47} = \frac{N}{2} = \frac{V}{4} \Rightarrow \begin{matrix} N=1232 \text{ daN} \\ V=2465 \text{ daN} \end{matrix}$$



$$\frac{12500}{4,47} = \frac{N}{2} = \frac{V}{4} \Rightarrow \begin{matrix} N=5593 \text{ daN} \\ V=11186 \text{ daN} \end{matrix}$$





$$\frac{186}{4,47} = \frac{N}{2} = \frac{V}{4} \Rightarrow \begin{matrix} N=83 \text{ daN} \\ V=166 \text{ daN} \end{matrix}$$