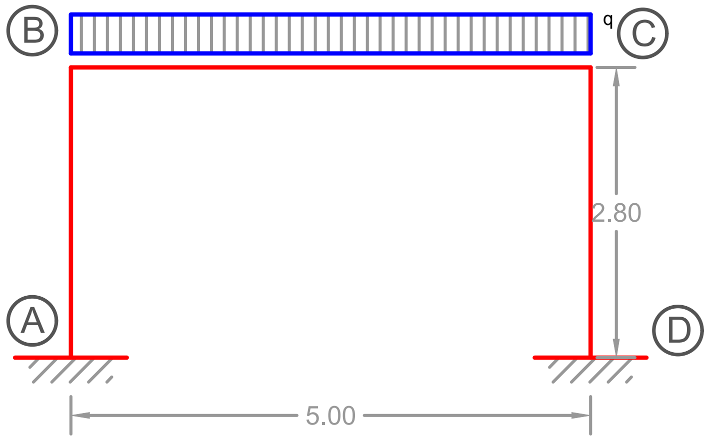
RESOLUCIÓN DE POR MEDIO DE TABLAS

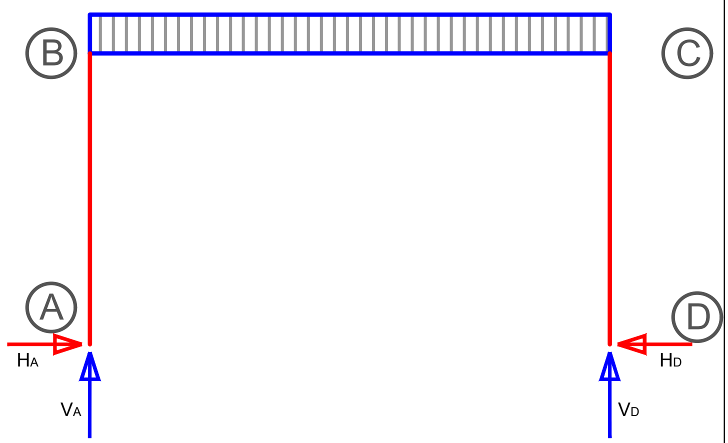
A continuación, proponemos resolver un pórtico por medio de las tablas que se encuentran en compendio.

A

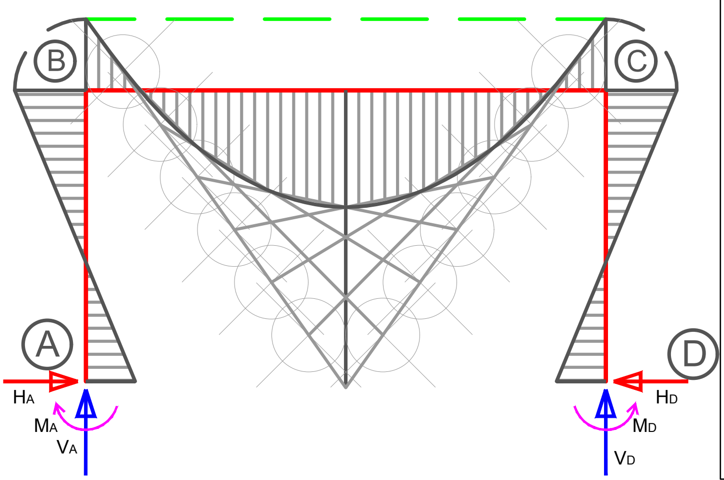


Partiremos de una sección para viga sabemos que $\frac{L}{15} = 0{,}33cm$ por lo que adoptaremos h=35cm y de base tomaremos b=25cm. Para las columnas tomaremos la siguiente sección h=35cm y b=25cm.
A estas secciones le sacaremos su inercia para obtener la rigidez relativa.
Sacaremos sus reacciones y los momentos flectores.

B



C



Datos

$L = 5m$
$h = 2{,}80m$
$q = 4\,t/m$

Inercia de la sección

$$I_v = \frac{b.h^3}{12} = \frac{25cm \times 35^3cm^3}{12} = 89{,}32cm^4 = 0{,}0009m^4$$

$$I_c = \frac{b.h^3}{12} = \frac{25cm \times 35^3cm^3}{12} = 89{,}32cm^4 = 0{,}0009m^4$$

$$k = \frac{Rig_{Vig}}{Rig_{Col}} = \frac{I_v}{I_c}\frac{h}{L} = \frac{0{,}0009}{0{,}0009}\frac{2{,}80}{5{,}00}$$

$$\boldsymbol{k = 0,56}$$

Reacciones (Gráfico B)

$$V_A = V_D = \frac{q\,.L^2}{2} = \frac{4\,t/m\ .5m}{2} = \mathbf{10\ t}$$

$$H_A = H_D = \frac{q\,.L^2}{4.h(k+2)}$$

$$= \frac{4\,t/m\,.(5m)^2}{4.2{,}8m(0{,}56+2)} = \mathbf{3,48t}$$

Momentos Flectores (Gráfico C)

$$M_A = M_D = \frac{q\,.L^2}{12(k+2)}$$

$$= \frac{4\,t/m\,.(5m)^2}{12(0{,}56+2)} = \mathbf{3,25tm}$$

$$M_B = M_C = \frac{q\,.L^2}{6(k+2)}$$

$$= \frac{4\,t/m\,.(5m)^2}{6(0{,}56+2)} = \mathbf{6,51tm}$$

$$M_{max} = \frac{q\,.L^2}{24}.\frac{3k+2}{k+2} = \mathbf{5,98tm}$$

Dimensionamiento columnas

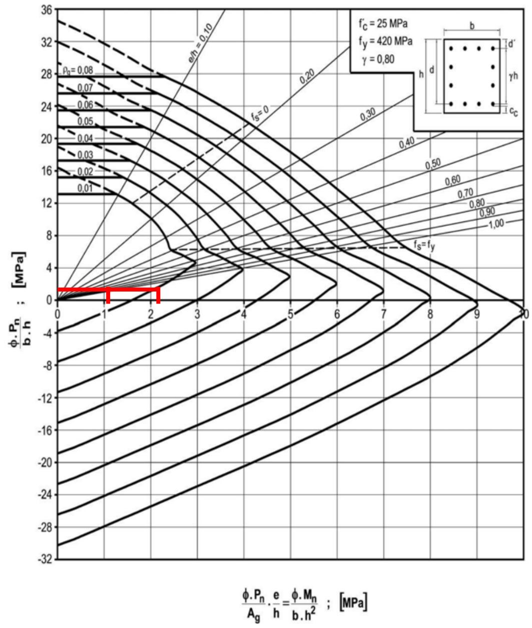
La sección adoptada es b=25cm h=35cm

$$S = 25cm \times 35cm = 875cm^2$$

$$P_U = {}^{qL}/_{2} = 10t$$

$$P_n = {}^{P_u}/_{b \times h} = \frac{100.000}{250 \times 350} = 1{,}14MPa$$

Buscamos en tabla $H = 25MPa$ $\quad \gamma = 0{,}80$
para armadura distribuidas



$$M_{uBase} = {}^{32500000}/_{25 \times 35^2} = 1{,}06MPa \ \rightarrow \rho = 0{,}01$$

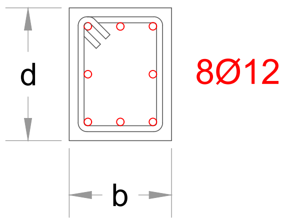
$$M_{uCabeza} = {}^{65100000}/_{25 \times 35^2} = 2{,}12MPa \rightarrow \rho = 0{,}01$$

Armadura para las columnas

$$A_{SBase} = A_h.\rho = 875cm^2 \times 0.01 = 8{,}75cm^2$$

$$A_{SCabeza} = A_h.\rho = 875cm^2 \times 0.01 = 8{,}75cm^2$$

$$8{,}75cm^2 = 8\emptyset 12$$



La sección adoptada para las vigas es b=25cm h=35cm

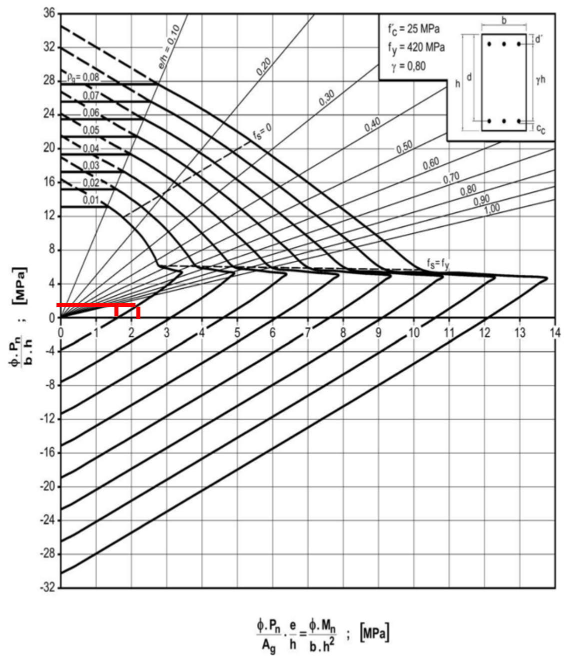
$$P_u = 10t$$

$$P_n = {}^{P_u}/_{b \times h} = \frac{100.000N}{250mm \times 350mm} = 1{,}14MPa$$

Buscamos en tabla $H = 25MPa$ $\quad \gamma = 0{,}80$ para armaduras en dos caras.

$$M_B = 6{,}51tm$$

$$M_{max} = 5{,}98tm$$



$$M_B = {}^{65100000}/_{25 \times 35^2} = 2{,}12MPa \ \rightarrow \rho = 0{,}011$$

$$M_{Max} = {}^{59800000}/_{25 \times 35^2} = 1{,}95MPa \rightarrow \rho = 0{,}009$$

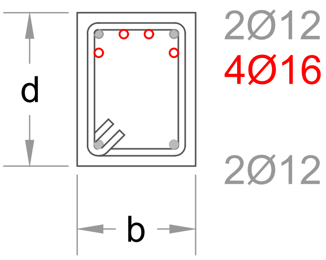
Armadura para la viga

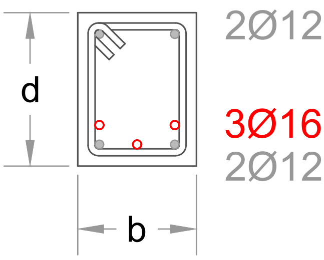
$$A_{SApoyo} = A_h.\rho = 875cm^2 \times 0.011 = 9{,}63cm^2$$

$$2\emptyset 12 + 4\emptyset 16 = 2{,}26 + 8{,}04 = 10{,}03cm^2$$

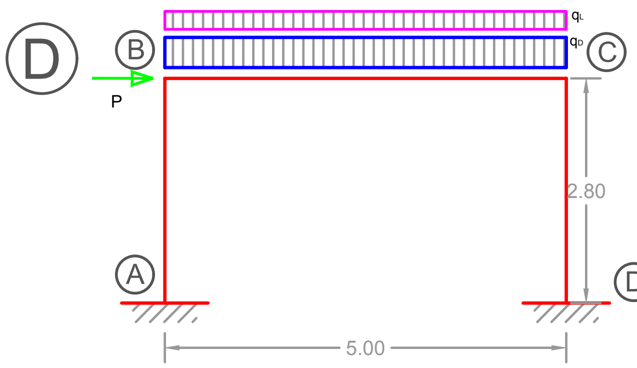
$$A_{SMax} = A_h.\rho = 875cm^2 \times 0.009 = 7{,}87cm^2$$

$$2\emptyset 12 + 3\emptyset 16 = 2{,}26 + 6{,}03 = 8{,}29cm^2$$





Resolveremos un ejercicio más complejo ya que incorporaremos distintas cargas y distintas combinaciones.

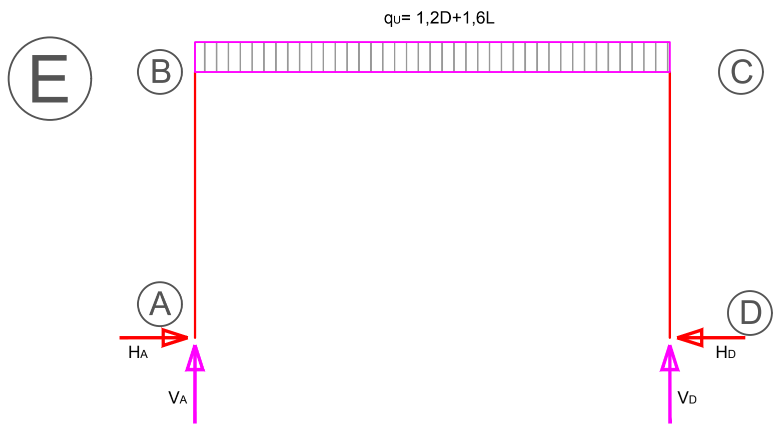


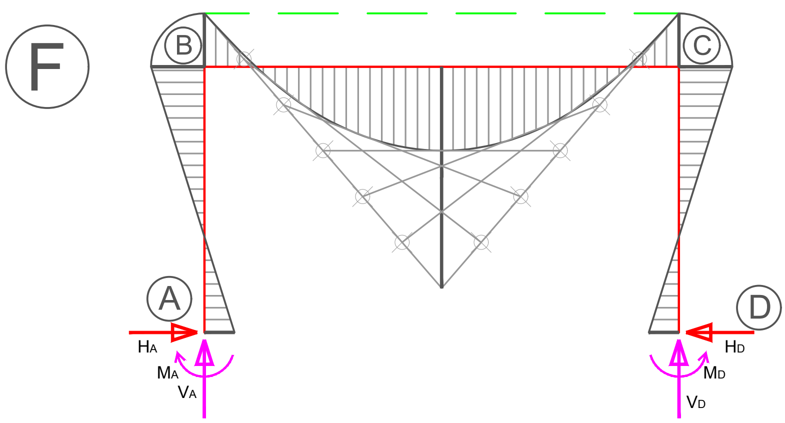
Las combinaciones posibles serán

$$\boldsymbol{C_1 = 1,2D + 1,6L}$$
$$\boldsymbol{C_2 = 1,2D + 0,5L \pm E_H}$$
$$C_3 = 0,8D + 0,5L \pm E_H$$

Tomaremos las combinaciones 1y 2 para este ejemplo.

Comenzaremos con la combinación C_1





Datos (Gráfico D)

$L = 5m$
$h = 2,80m$
$q_D = 3\ t/m$
$q_L = 1,5\ t/m$
$P = 4\ t$

Inercia de la sección

$$I_v = \frac{b.h^3}{12} = \frac{25cm \times 40^3 cm^3}{12} = 133,3cm^4 = 0,0013m^4$$

$$I_c = \frac{b.h^3}{12} = \frac{25cm \times 35^3 cm^3}{12} = 89,32cm^4 = 0,0009m^4$$

$$k = \frac{Rig_{Vig}}{Rig_{Col}} = \frac{I_v}{I_c}\frac{h}{L} = \frac{0,0013}{0,0009}.\frac{2,80}{5,00}$$

$$\boldsymbol{k = 0,80}$$

Cargas combinadas C_1

$$C_1 = 1,2D + 1,6L = 1,2\left(3\frac{t}{m}\right) + 1,6\left(1,5\frac{t}{m}\right) = 6\frac{t}{m}$$

Reacciones (Gráfico E)

$$V_A = V_D = \frac{q\,.L^2}{2} = \frac{6\,t/m\ .5m}{2} = \mathbf{15\ t}$$

$$H_A = H_D = \frac{q\,.L^2}{4.\,h(k+2)} = \frac{6\,t/m\,.(5m)^2}{4.2,8m(0,8+2)} = \mathbf{4,78t}$$

Momentos Flectores (Gráfico F)

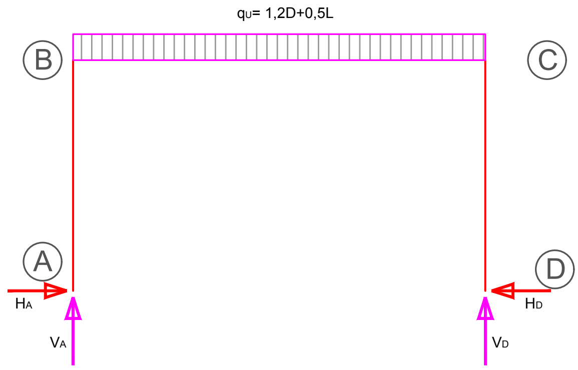
$$M_A = M_D = \frac{q\,.L^2}{12(k+2)} = \frac{6\,t/m\,.(5m)^2}{12(0,8+2)} = \mathbf{4,46tm}$$

$$M_B = M_C = \frac{q\,.L^2}{6(k+2)} = \frac{6\,t/m\,.(5m)^2}{6(0,8+2)} = \mathbf{8,92tm}$$

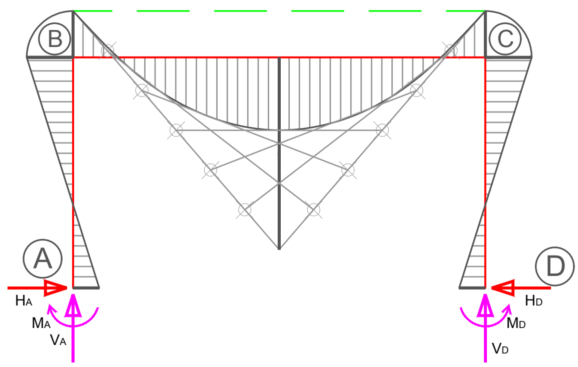
$$M_{max} = \frac{q\,.L^2}{24}.\frac{3k+2}{k+2} = \mathbf{9,81tm}$$

Continuaremos con la combinación C_2
Resolveremos por un lado las cargas verticales y por otro las cargas horizontales

G

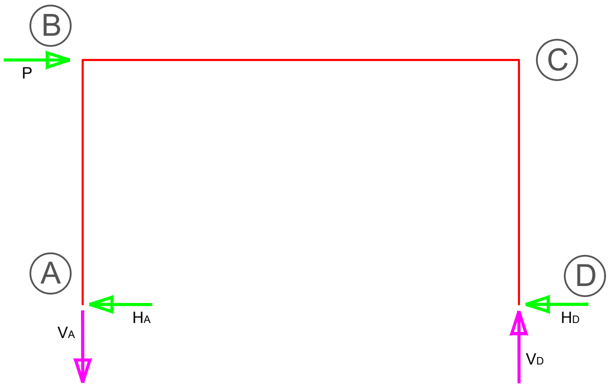


H

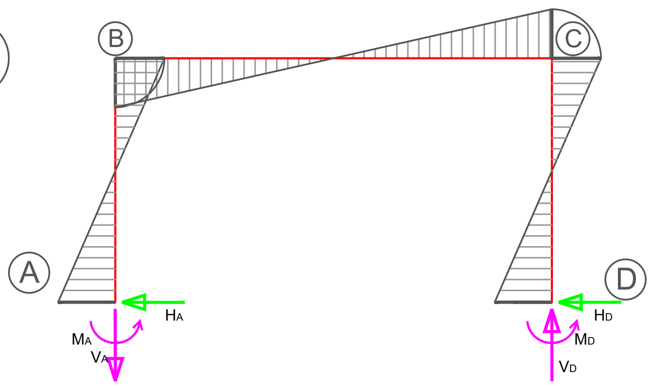


Resolveremos para carga lateral

I



J



Cargas combinadas C_2

$$C_1 = 1{,}2D + 0{,}5L =$$

$$1{,}2\left(3\frac{t}{m}\right) + 0{,}5\left(1{,}5\frac{t}{m}\right) = 4{,}35\frac{t}{m}$$

Reacciones (Gráfico G)

$$V_A = V_D = \frac{q\,.L}{2} = \frac{4{,}35\,t/m\ .5m}{2} = \mathbf{10,87\ t}$$

$$H_A = H_D = \frac{q\,.L^2}{4.\,h(k+2)} = \frac{4{,}35\,t/m\,.(5m)^2}{4.2{,}8m(0{,}8+2)} = \mathbf{3,46t}$$

Momentos Flectores (Gráfico H)

$$M_A = M_D = \frac{q\,.L^2}{12(k+2)} = \frac{4{,}35\,t/m\,.(5m)^2}{12(0{,}8+2)} = \mathbf{3,23tm}$$

$$M_B = M_C = \frac{q\,.L^2}{6(k+2)} = \frac{4{,}35\,t/m\,.(5m)^2}{6(0{,}8+2)} = \mathbf{6,47tm}$$

$$M_{max} = \frac{q\,.L^2}{24}.\frac{3k+2}{k+2} = \mathbf{7,11tm}$$

Cargas Lateral P

$$P = 4\,t$$

Reacciones (Gráfico I)

$$V_A = V_D = \frac{3Phk}{L(6k+1)} = \frac{3\times 4t\times 2{,}8m\times 0{,}8}{5m(6\times 0{,}8+1)} = \mathbf{0,92\ t}$$

$$H_A = H_D = \frac{P}{2} = \frac{4t}{2} = \mathbf{2t}$$

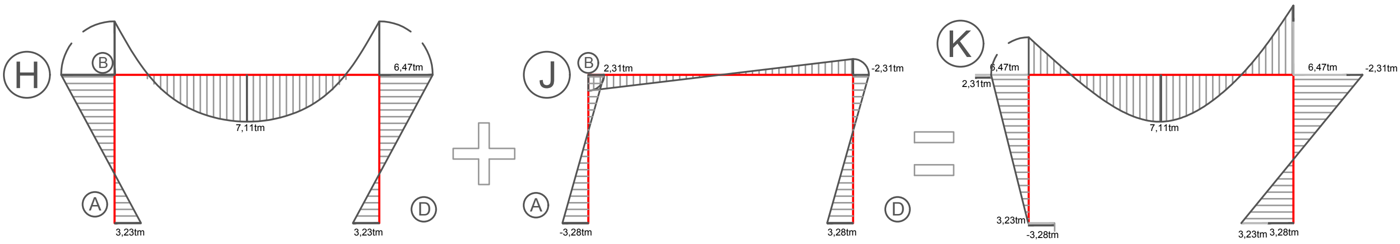
Momentos Flectores (Gráfico J)

$$M_A = -\frac{Ph}{2}\frac{3k+1}{6k+1} = -\frac{4t.\,2{,}8m}{2}\frac{3\times 0{,}8+1}{6\times 0{,}8+1} = \mathbf{-3,28tm}$$

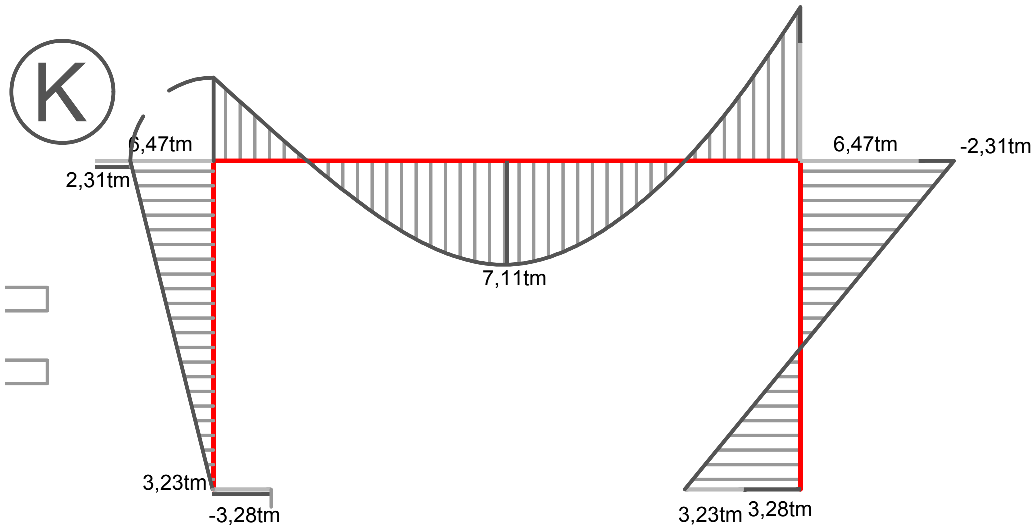
$$M_B = -M_C = \frac{Ph}{2}\frac{3k}{6k+1} = \frac{4t.\,2{,}8m}{2}\frac{3\times 0{,}8}{6\times 0{,}8+1} = \mathbf{2,31tm}$$

$$M_D = \frac{Ph}{2}\frac{3k+1}{6k+1} = \mathbf{3,28tm}$$

El grafico resultante es el siguiente



Ampliamos el grafico K



Pasando en limpio los valores obtenidos

$V_A = 10{,}87t$ $\qquad$ $V_D = 10{,}87t$ $\qquad$ gráfico G

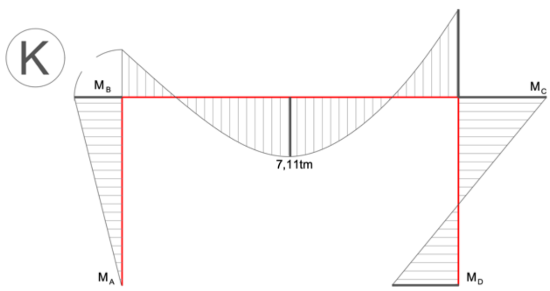
$V_A = -0{,}92t$ $\qquad$ $V_D = 0{,}92t$ $\qquad$ gráfico I

$V_A = 9{,}95t$ $\qquad$ $V_D = 11{,}79t$

Los valores obtenidos del grafico K son los siguientes:

$M_B = 4{,}16tm$ $\qquad$ $M_C = 8{,}78tm$

$M_B = -0{,}05tm$ $\qquad$ $M_D = 6{,}51tm$



Dimensionamiento columnas

La sección adoptada es b=25cm h=35cm

$$S = 25cm \times 35cm = 875cm^2$$

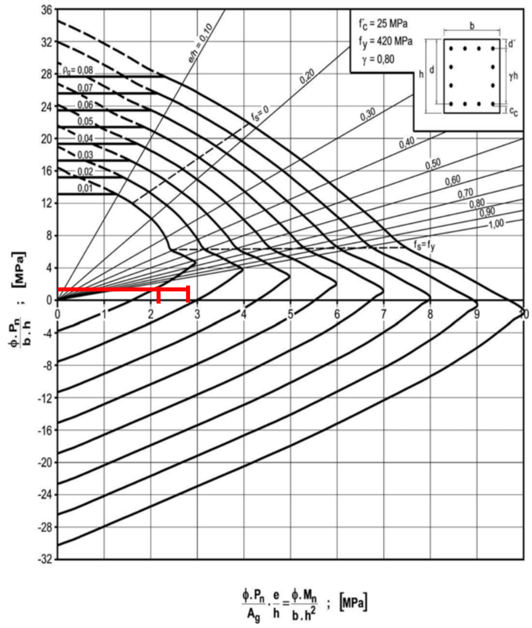
$$P_U = 11{,}79t$$

$$P_n = {P_u}/{b \times h} = \frac{117.900}{250 \times 350} = 1{,}34MPa$$

Buscamos en tabla $H = 25MPa$ $\gamma = 0{,}80$ para armadura distribuidas

$$M_{uCabeza} = {87800000}/{25 \times 35^2} = 2{,}86MPa \rightarrow \rho = 0{,}015$$

$$M_{uBase} = {65100000}/{25 \times 35^2} = 2{,}12MPa \rightarrow \rho = 0{,}01$$



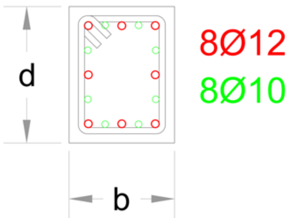
Armadura para las columnas

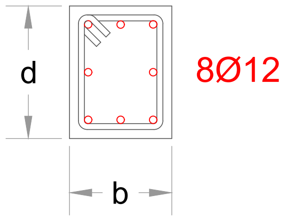
$$A_{SCabeza} = A_h.\rho = 875cm^2 \times 0.015 = 13{,}125cm^2$$

$$13{,}125cm^2 = 8\emptyset12 \;\; 8\emptyset10$$

$$A_{SCBase} = A_h.\rho = 875cm^2 \times 0.01 = 8{,}75cm^2$$

$$8{,}75cm^2 = 8\emptyset12$$





La sección adoptada para las vigas es b=25cm h=35cm

$$P_U = 11{,}79t$$

$$P_n = {P_u}/{b \times h} = \frac{117.900}{250 \times 350} = 1{,}34MPa$$

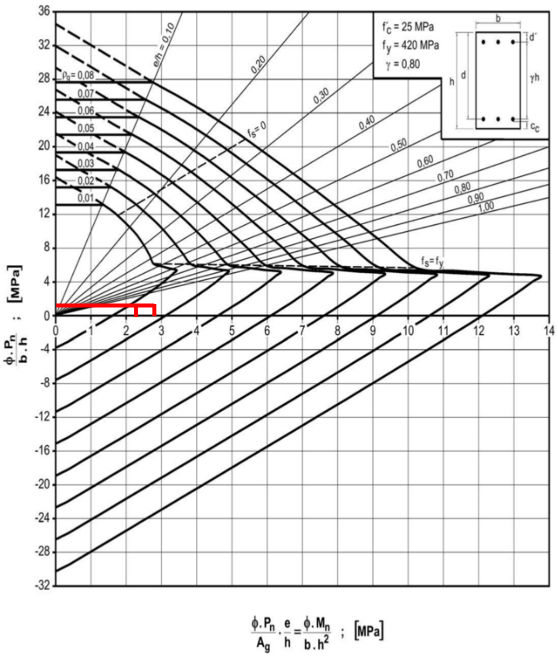
Buscamos en tabla $H = 25MPa$ $\gamma = 0{,}80$ para armaduras en dos caras.

$$M_C = 8{,}78tm$$

$$M_{max} = 7{,}11tm$$

$$M_C = {87800000}/{25 \times 35^2} = 2{,}86MPa \rightarrow \rho = 0{,}015$$

$$M_{Max} = {71100000}/{25 \times 35^2} = 2{,}32MPa \rightarrow \rho = 0{,}011$$



Armadura para la viga

$$A_{SApoyo} = A_h.\rho = 875cm^2 \times 0.015 = 13{,}125cm^2$$

$$2\emptyset12 + 6\emptyset16 = 2{,}26 + 12{,}06 = 14{,}32cm^2$$

$$A_{SMax} = A_h.\rho = 875cm^2 \times 0.011 = 9{,}625cm^2$$

$$2\emptyset12 + 4\emptyset16 = 2{,}26 + 8{,}04 = 10{,}3cm^2$$