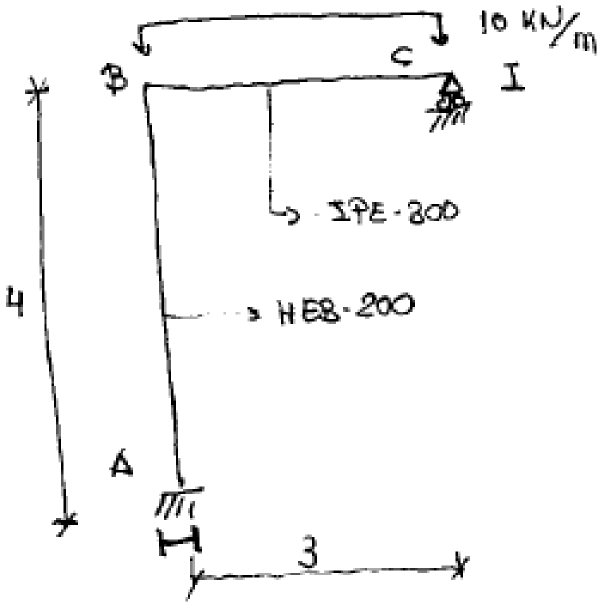
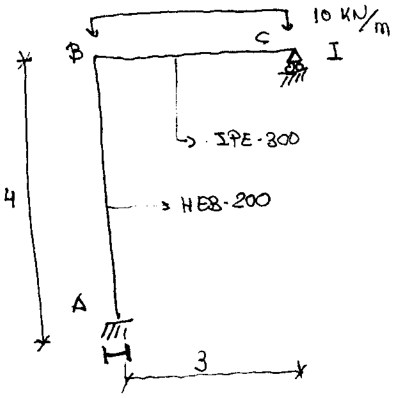
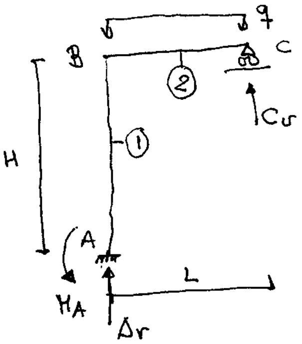
Actividad propuesta

Reacciones y solicitaciones del pórtico de la figura



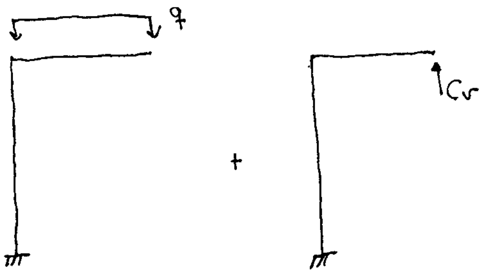


* Reacciones
* Solicitaciones
* tensiones

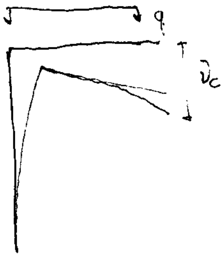


⇒ No tiene sentido que exista Δ_H.

* Estructura hiperestática la dividimos en 2.



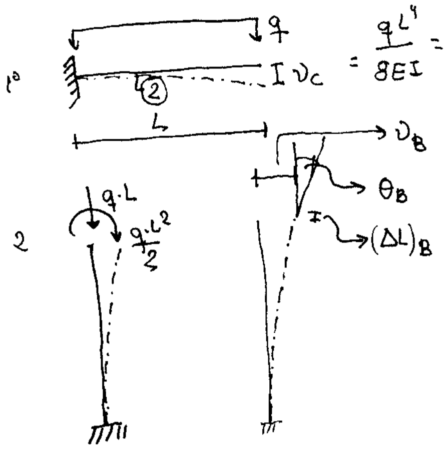
Condición: el desplazamiento vertical en "C" tiene que ser cero.



1º

$$v_C = \frac{qL^4}{8EI} = \frac{q\cdot L^4}{8\cdot E\cdot I_2}$$

2



$$(\Delta L)_B = \frac{N\cdot L}{AE} = \frac{q\cdot L\cdot H}{A_1\, E}$$

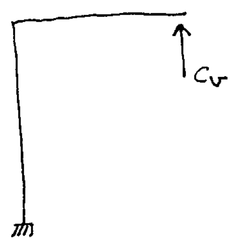
$$\theta_B = \frac{mL}{EI} = \frac{\frac{qL^2}{2}\cdot H}{E\cdot I_1}$$

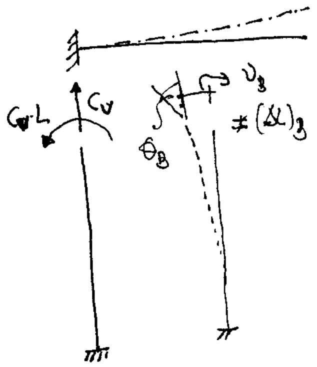
$$v_B = \frac{mL^2}{2EI} = \frac{\frac{qL^2}{2}\cdot H^2}{2\cdot E\, I_2}$$

Deformación total vertical en C

$$(v_C)_{TOTAL} = v_C + \overset{\text{normalmente despreciable}}{(\Delta L)_B} + \theta_B\cdot L = \frac{qL^4}{8EI_2} + \frac{qL\cdot H}{A_1\cdot E} + \frac{\frac{qL^2}{2}\cdot H}{E\cdot I_1}\cdot L$$

2º Caso





$$\neq v_c = \frac{qL^3}{3EI} = \frac{C_v \cdot L^3}{3 \cdot E \cdot I_2}$$

$$(\Delta L)_B = \frac{N \cdot L}{A E} = \frac{C_v \cdot H}{A_1 \cdot E}$$

$$v_B = \frac{mL^2}{2EI} = \frac{C_v \cdot L \cdot H^2}{2 E I_1}$$

$$\theta_B = \frac{mL}{EI} = \frac{C_v \cdot L \cdot H}{E \cdot I_1}$$

Deformación total vertical en C

$$(v_c)_{TOTAL} = v_c + (\Delta L)_B + \theta_B \cdot L = \frac{C_v \cdot L^3}{3EI_2} + \frac{C_v \cdot H}{A_1 \cdot E} + \frac{C_v \cdot L \cdot H}{E I_1} L$$

Ambas deformaciones son iguales

$$\frac{qL^4}{8 \cancel{E} I_2} + \frac{qLH}{A_1 \cdot \cancel{E}} + \frac{\frac{qL^2}{2} H}{E I_1} \cdot L = \frac{C_v L^3}{3 \cancel{E} I_2} + \frac{C_v \cdot H}{A_1 \cdot \cancel{E}} + \frac{C_v \cdot L \cdot H}{\cancel{E} \cdot I_1} L$$

Todo en cm y KN

$$q = 10 \frac{KN}{m} \frac{1\,m}{100\,cm} = 0'1 \frac{KN}{cm}$$

$L = 3\,m = 300\,cm$

$H = 4\,m = 400\,cm$

$I_2 = I_x(IPE\text{-}300) = 8360\,cm^4$

$A_1 = A(HEB\,200) = 78'1\,cm^2$

$I_1 = I_x(HEB200) = 5696\,cm^4$

$$\frac{0'1 \frac{KN}{cm} \times 300^4\,cm^4}{8 \times 8360\,cm^4} + \frac{0'1 \frac{KN}{cm} \times 300\,cm \times 400\,cm}{78'1\,cm^2} + \frac{\frac{0'1 \frac{KN}{cm} \times 300^2 cm^2}{2} \times 400\,cm}{5696\,cm^4} 300\,cm =$$

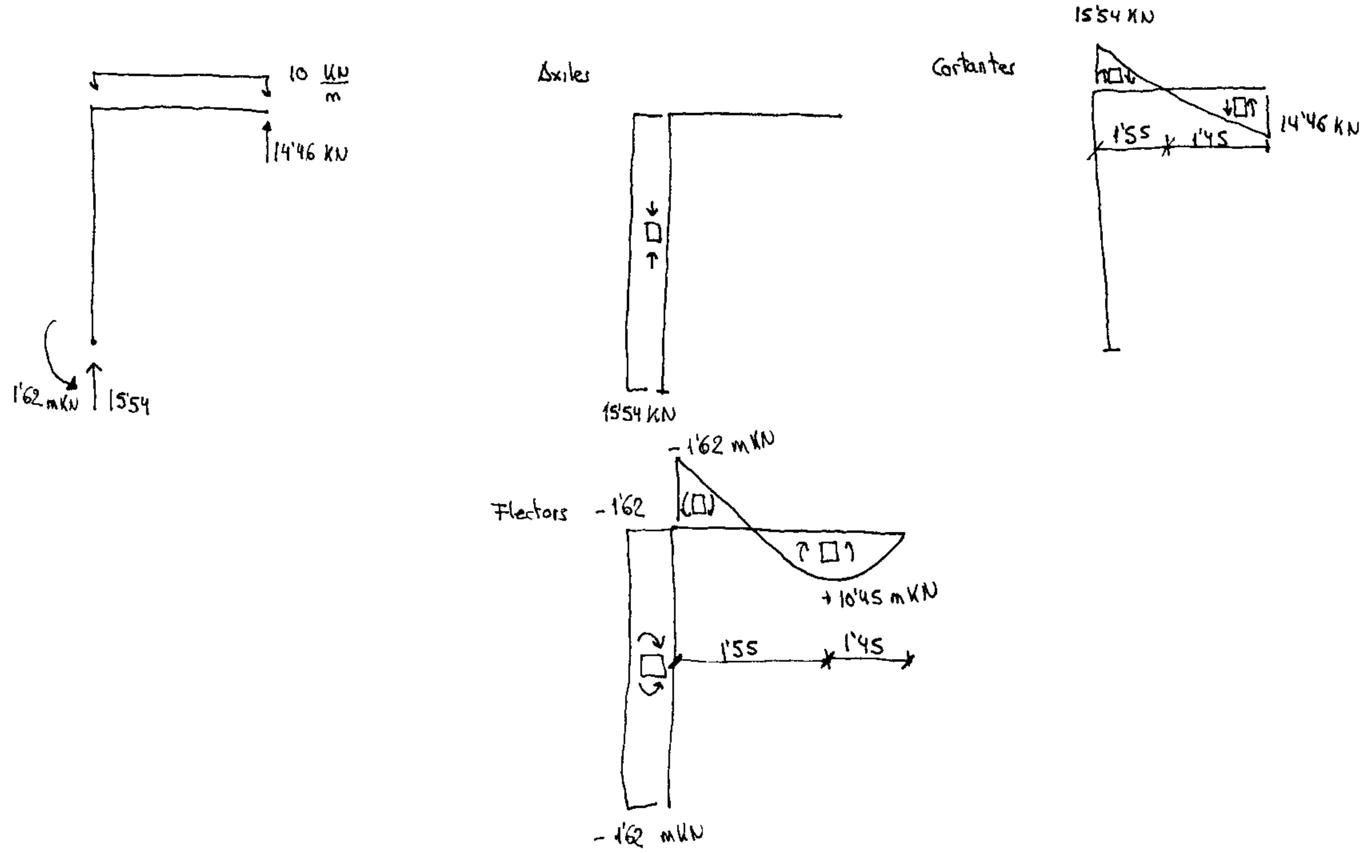
$$= \frac{C_v \cdot 300^3\,cm^3}{3 \cdot 8360\,cm^4} + \frac{C_v \cdot 400\,cm}{78'1\,cm^2} + \frac{C_v \cdot 300\,cm \cdot 400\,cm}{5696\,cm^4} 300\,cm$$

$12111 + 154 + 94803 = 1077\,C_v + 5\,C_v + 6320\,C_v \Rightarrow \underline{C_v = 14'46\ KN}$

$\underline{\Delta_V} = 10 \times 3 - 14'46 = \underline{15'54\ KN}$

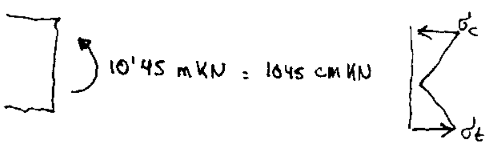
$\Sigma M_\Delta = 0 \quad -qL\frac{L}{2} + C_v \cdot 3 + M_\Delta = 0 \qquad \underline{M_\Delta} = \frac{qL^2}{2} - 3 \cdot C_v = \frac{10 \times 3^2}{2} - 3 \times 14'46 = \underline{1'62\ KN \cdot m}$

Solicitaciones



Tensiones:

Viga



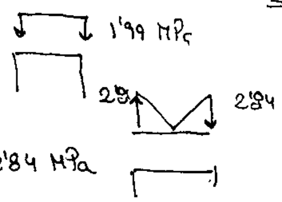
$\sigma = \frac{M}{W} = \frac{1045\ cm\,KN}{557\ cm^3} = 1'876\ \frac{KN}{cm^2} = 1876\ \frac{N}{cm^2} \cdot \frac{100^2\ cm^2}{1\ \ m^2}$

$= 1876 \times 10^4\ \frac{N}{m^2} = 18'76 \times 10^6\ \frac{N}{m^2} = 18'76\ MPa < \underline{275\ MPa}$

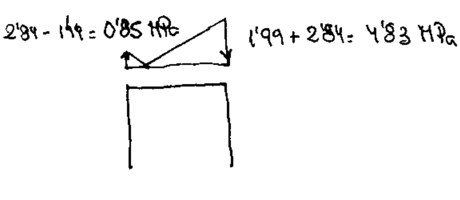
$\underline{OK}$

Pilar

Axil $\sigma = \frac{N}{A} = \frac{15540\ N}{78'1\ cm^2} = 199\ \frac{N}{cm^2} = 1'99\ MPa$



Flector $\sigma = \frac{M}{W} = \frac{162\ cm\,KN}{570\ cm^3} = 0'284\ \frac{KN}{cm^2} = 284\ \frac{N}{cm^2} = 2'84\ MPa$



$\underline{\underline{OK}}$