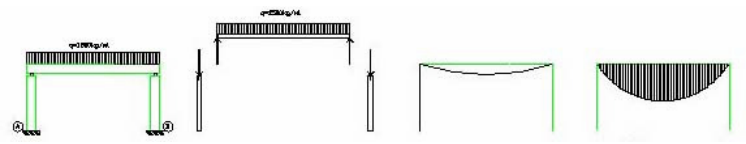
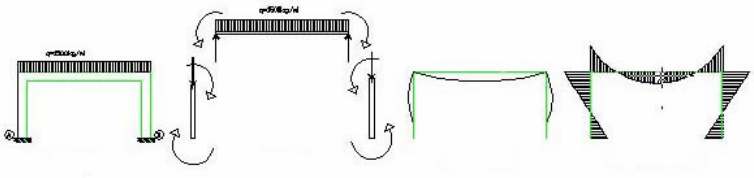
006

MARCOS HIPERESTATICOS

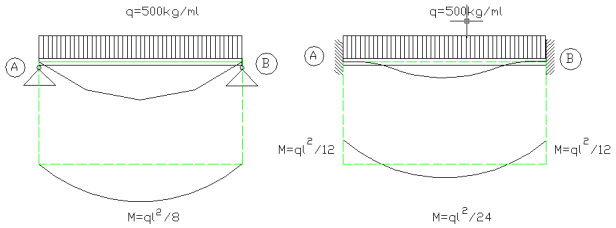
Verónica Veas B. – Gabriela Muñoz S.



Pilar-viga Deformación Momento



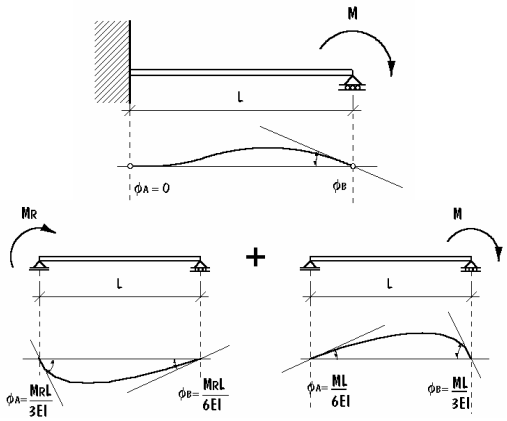
Marco rígido Deformación Momento



Viga articulada Viga empotrada

METODO DE CROSS
DISTRIBUCION DE MOMENTOS

a) Momento transmitido



$$\phi_A = 0$$

$$\frac{ML}{6EI} - \frac{M_R L}{3EI} = 0$$

$$M_R = \frac{M}{2}$$

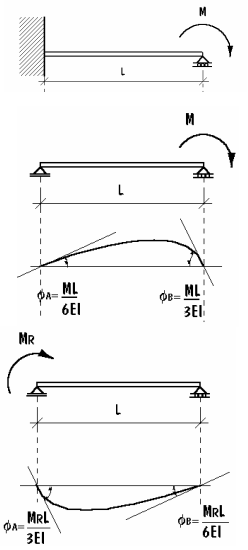
b) Rigidez

$$\phi_B = \frac{ML}{3EI} - \frac{M_R L}{6EI}$$

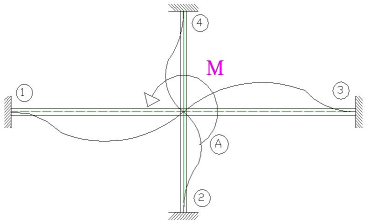
considerando $M_R = \frac{M}{2}$

$$\phi_B = \frac{ML}{3EI} - \frac{ML}{12EI} = \frac{ML}{4EI}$$

$$M = \phi_B * \frac{4EI}{L} \qquad M = \phi_B * k$$



c) Coeficiente de distribución



$$M = M_{A1} + M_{A2} + M_{A3} + M_{A4}$$

$$M = \phi_{A1}k_1 + \phi_{A2}k_2 + \phi_{A3}k_3 + \phi_{A4}k_4$$

$$\phi = \phi_{A1} = \phi_{A2} = \phi_{A3} = \phi_{A4}$$

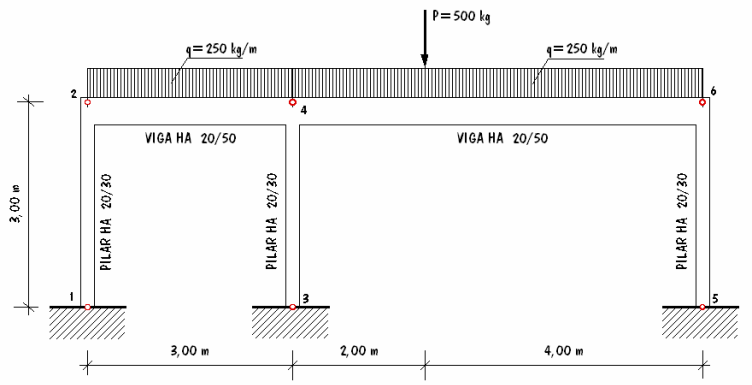
$$M = \phi(k_1 + k_2 + k_3 + k_4)$$

$$\phi = \frac{M}{k_1 + k_2 + k_3 + k_4} = \frac{M}{\sum k}$$

$$M = \phi * \sum k \qquad M_{A1} = \phi * k_1$$

$$M_{A1} = \frac{M}{\sum k} * k_1 \qquad M_{A1} = \frac{k_1}{\sum k} * M$$

Método de Cross: Ejemplo

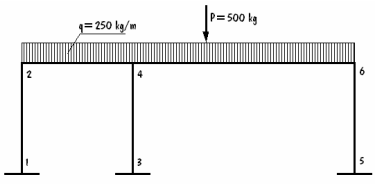


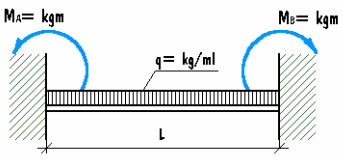
Momento de Empotramiento Perfecto

VIGA 2-4

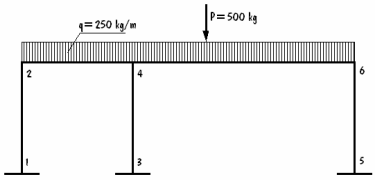
$$M_2 = \frac{qL^2}{12} = \frac{250\ 3^2}{12} = 187{,}50\ \text{kgm}$$

$$M_4 = \frac{qL^2}{12} = \frac{250\ 3^2}{12} = 187{,}50\ \text{kgm}$$





Momento de Empotramiento Perfecto

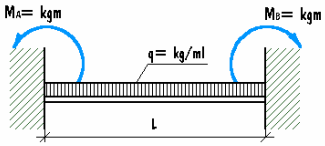


VIGA 4-6

$$M_{4a} = \frac{qL^2}{12} = \frac{250\ 6^2}{12} = 750\ \text{kgm}$$

$$M_{4b} = \frac{Pab^2}{L^2} = \frac{500\ 2\ 4^2}{6^2} = 444{,}44\ \text{kgm}$$

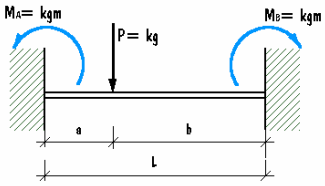
$$M_4 = 1194{,}44\ \text{kgm}$$



$$M_{6a} = \frac{qL^2}{12} = \frac{250\ 6^2}{12} = 750\ \text{kgm}$$

$$M_{6b} = \frac{Pa^2b}{L^2} = \frac{500\ 2^2 4}{6^2} = 222{,}22\ \text{kgm}$$

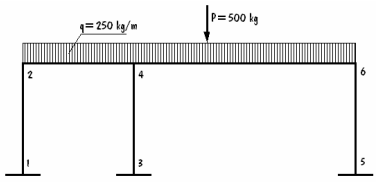
$$M_6 = 972{,}22\ \text{kgm}$$



RIGIDEZ DE LAS BARRAS

Factor de distribución

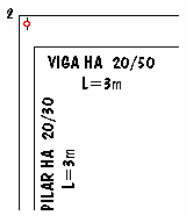
$$k = \frac{4EI}{L} \quad E = \text{constante} \quad k = \frac{I}{L}$$



$$k_1 = \frac{\frac{20\ 30^3}{12}}{300} = 150$$

$$k_2 = \frac{\frac{20\ 50^3}{12}}{300} = 694{,}44$$

NUDO 2



$$\%_{1-2} = \frac{150}{150 + 694{,}44} = 0{,}18$$

$$\%_{2-4} = \frac{694{,}44}{150 + 694{,}44} = 0{,}82$$

$$\frac{k_i}{\Sigma k} = \text{coef. de distribución}$$

RIGIDEZ DE LAS BARRAS

Factor de distribución

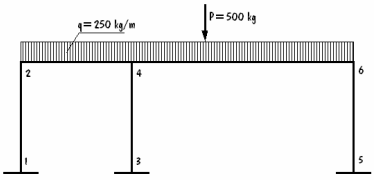
$k = \frac{4EI}{L}$ E = constante $k = \frac{I}{L}$

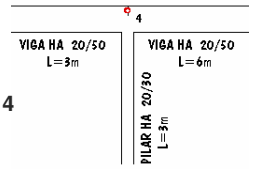
$$k_1 = \frac{\frac{20\ 30^3}{12}}{300} = 150$$

$$k_2 = \frac{\frac{20\ 50^3}{12}}{300} = 694{,}44$$

$$k_3 = \frac{\frac{20\ 50^3}{12}}{600} = 347{,}22$$

$\frac{k_i}{\Sigma k}$ = coef. de distribución





NUDO 4

$$\%_{3-4} = \frac{150}{150 + 694{,}44 + 347{,}22} = 0{,}13$$

$$\%_{2-4} = \frac{694{,}44}{150 + 694{,}44 + 347{,}22} = 0{,}58$$

$$\%_{4-6} = \frac{347{,}22}{150 + 694{,}44 + 347{,}22} = 0{,}29$$

RIGIDEZ DE LAS BARRAS

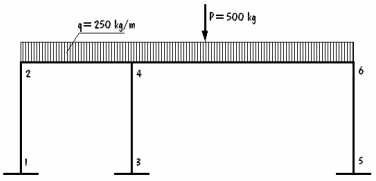
Factor de distribución

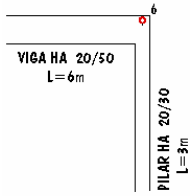
$k = \frac{4EI}{L}$ E = constante $k = \frac{I}{L}$

$$k_1 = \frac{\frac{20\ 30^3}{12}}{300} = 150$$

$$k_3 = \frac{\frac{20\ 50^3}{12}}{600} = 347{,}22$$

$\frac{k_i}{\Sigma k}$ = coef. de distribución





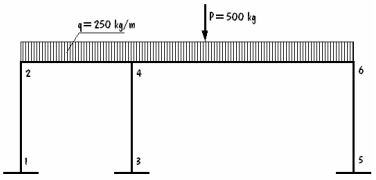
NUDO 6

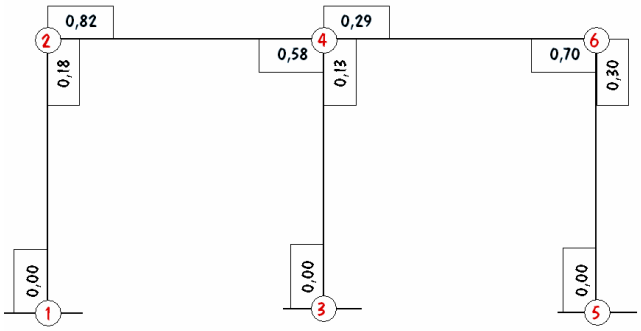
$$\%_{5-6} = \frac{150}{150 + 347{,}22} = 0{,}30$$

$$\%_{4-6} = \frac{347{,}22}{150 + 347{,}22} = 0{,}70$$

MALLA

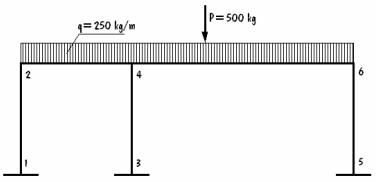
Factores de distribución

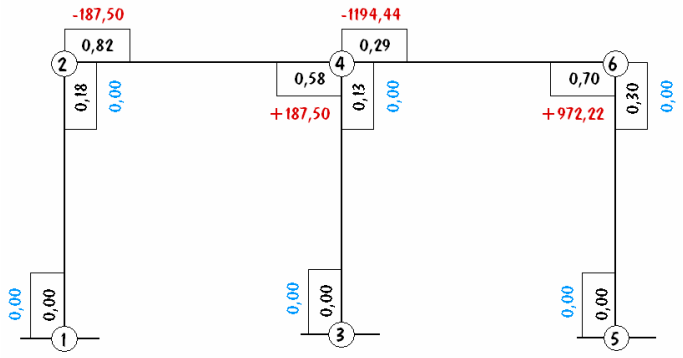




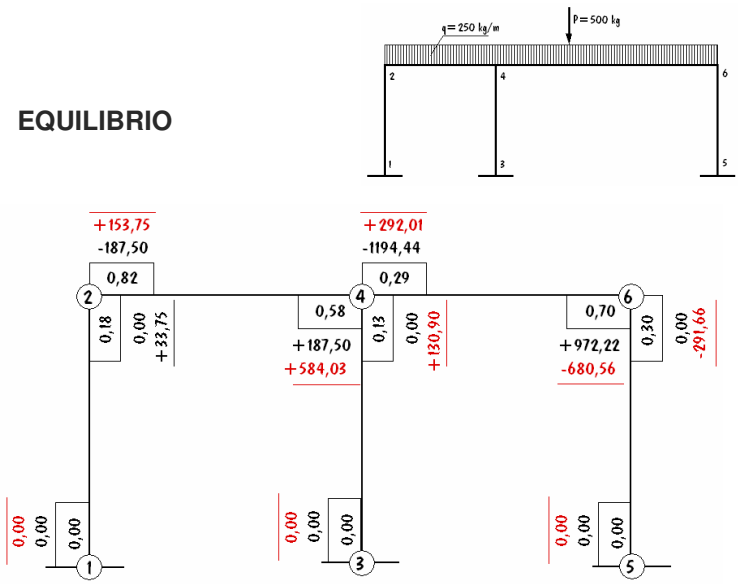
MALLA

MEP iniciales

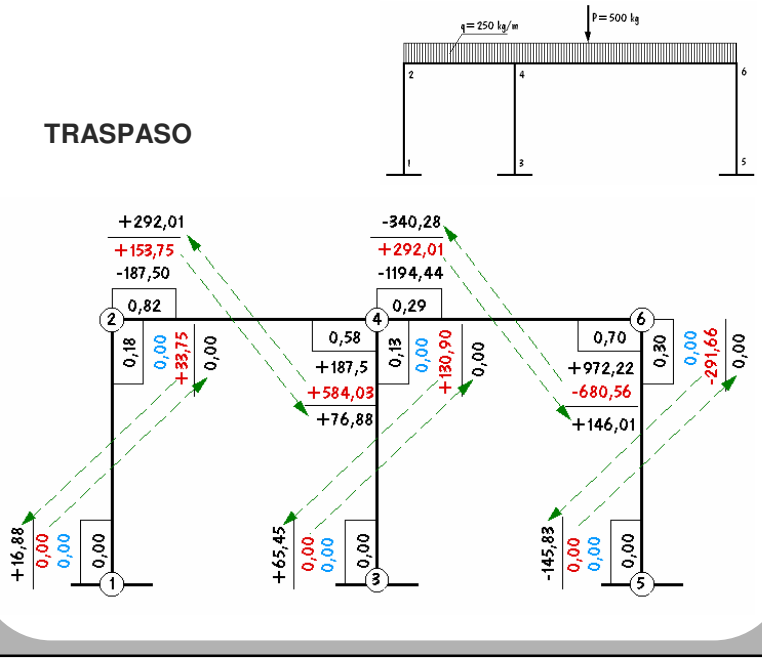




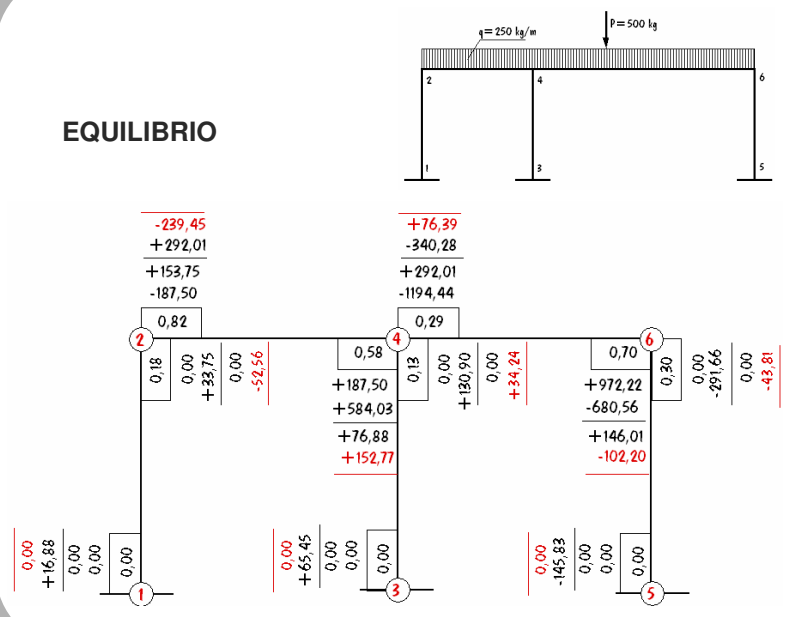
EQUILIBRIO



TRASPASO



EQUILIBRIO



MOMENTOS FINALES

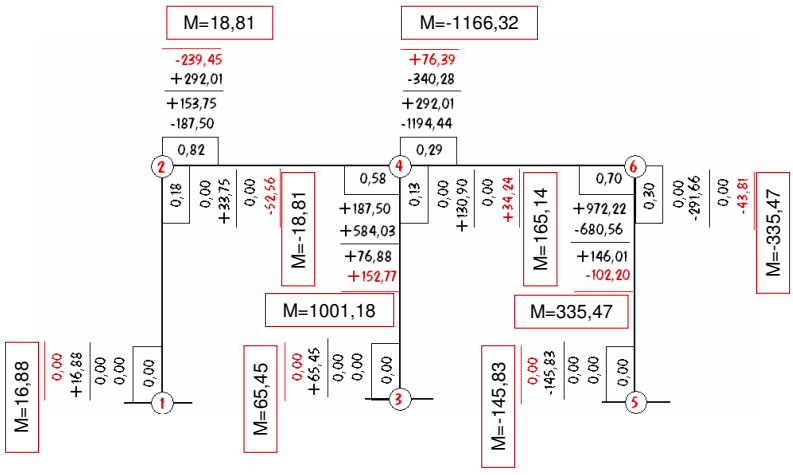


GRÁFICO DE MOMENTOS