TABLAS DE RIGIDECES

SOLUCIONES DE BARRAS EMPOTRADA - EMPOTRADA Y EMPOTRADA-ARTICULADA

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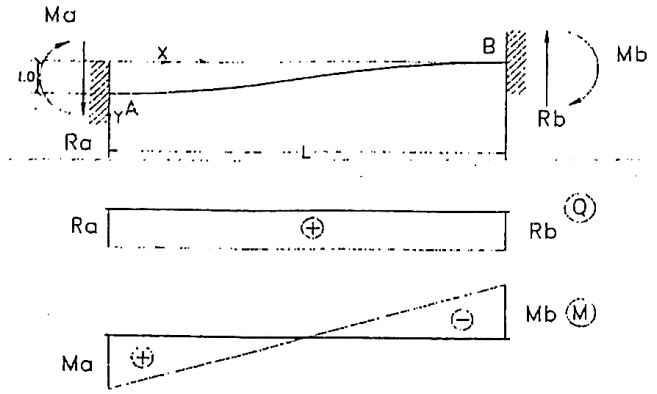
BARRA EMP–EMP CARGADA CON UN DESPLAZAMIENTO "LO" EN A:



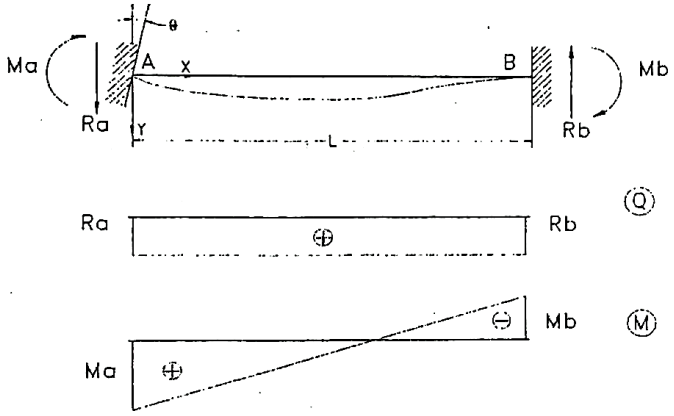
$$Ra = \frac{12 * E * J * LO}{L^3}$$

$$Rb = \frac{12 * E * J * LO}{L^3}$$

$$Ma = \frac{6 * E * J * LO}{L^2}$$

$$Mb = \frac{6 * E * J * LO}{L^2}$$

BARRA EMP–ARTIC CARGADA CON UN GIRO EN A:



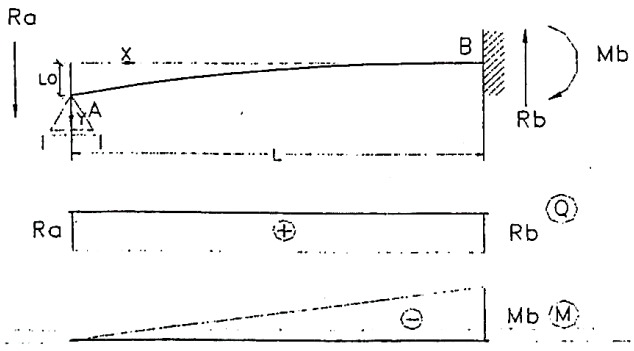
$$Ra = \frac{6 * E * J * \theta}{L^2}$$

$$Rb = \frac{6 * E * J * \theta}{L^2}$$

$$Ma = \frac{4 * E * J * \theta}{L}$$

$$Mb = \frac{2 * E * J * \theta}{L}$$

BARRA ARTIC–EMP CARGADA CON UN DESPLAZAMIENTO "LO" EN A:

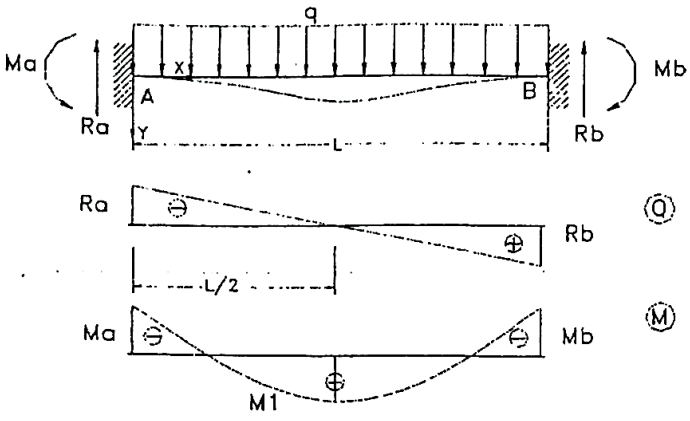


$$Ra = \frac{3 * E * J * LO}{L^3}$$

$$Rb = \frac{3 * E * J * LO}{L^3}$$

$$Ma = \frac{3 * E * J * LO}{L^2}$$

BARRA EMP–EMP CARGADA CON UNA CARGA UNIFORME:



$$Ra = \frac{q}{2} * L$$

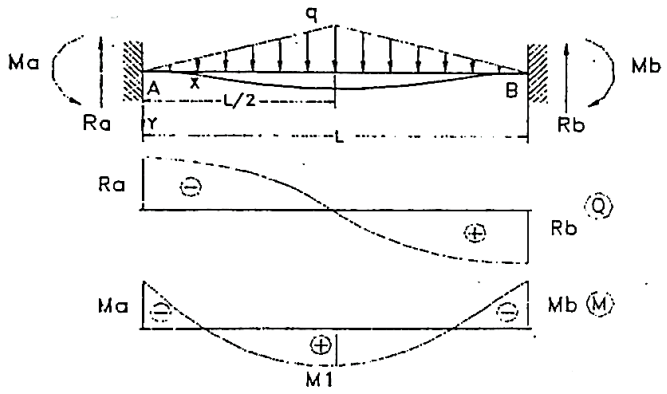
$$Rb = \frac{q}{2} * L$$

$$Ma = \frac{q}{12} * L^2$$

$$Mb = \frac{q}{12} * L^2$$

Si $X1 = \frac{L}{2}$ —— $M1 = \frac{q}{24} * L^2$

BARRA EMP–EMP CARGADA CON CARGA TRIANGULAR:



$$Ra = \frac{q}{4} * L$$

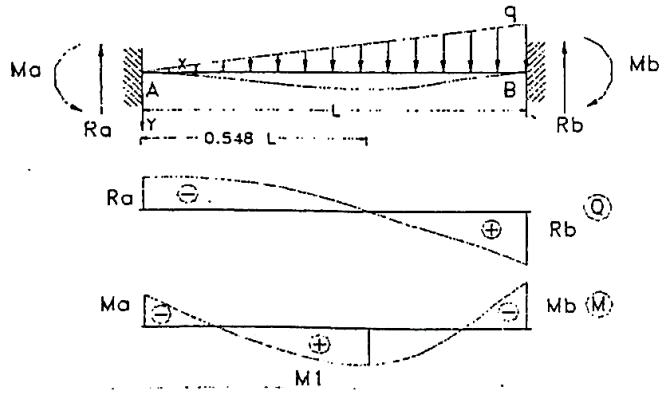
$$Rb = \frac{q}{4} * L$$

$$Ma = \frac{5}{96} * q * L^2$$

$$Mb = \frac{5}{96} * q * L^2$$

Si $X1 = \frac{L}{2}$ —— $M1 = \frac{q}{32} * L^2$

BARRA EMP–EMP CARGADA CON UNA CARGA LINEAL:



$$Ra = \frac{3}{20} * q * L$$

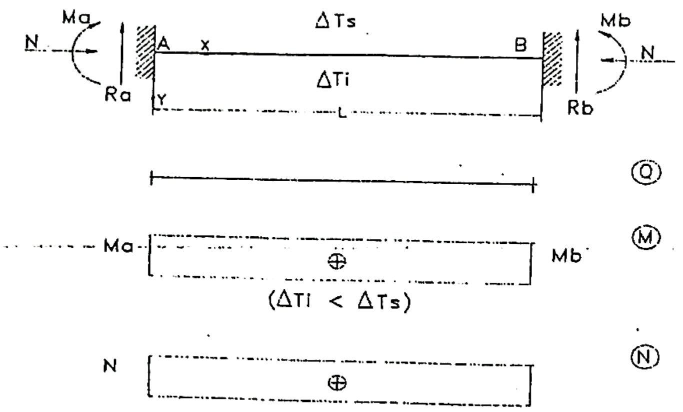
$$Rb = \frac{7}{20} * q * L$$

$$Ma = \frac{q}{30} * L^2$$

$$Mb = \frac{q}{20} * L^2$$

Si $X1 = 0.548 * L$ —— $M1 = \frac{q}{46.6} * L^2$

BARRA EMP–EMP CARGADA CON TEMPERATURA:



$Ra = 0$

$Rb = 0$

Ⓠ Ⓜ

$Ma = \lambda * \frac{(\Delta Ti - \Delta Ts)}{h} * E * J$

$Mb = \lambda * \frac{(\Delta Ti - \Delta Ts)}{h} * E * J$

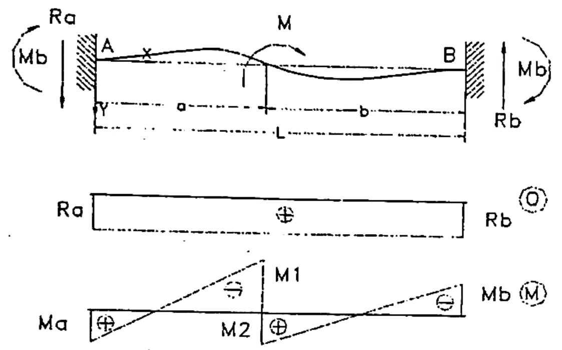
λ : coeficiente de dilatacion lineal del material

Ⓝ

$N = \lambda * \Delta TG * E * A$

$\Delta TG = \frac{(\Delta Ti + \Delta Ts)}{2} < 0$

BARRA EMP–EMP CARGADA CON UN MOMENTO M A UNA DISTANCIA a:



$Ra = 6 * M * \frac{a * b}{L^3}$

$Rb = 6 * M * \frac{a * b}{L^3}$

$Ma = M * \frac{b}{L^2} * (2 * a - b)$

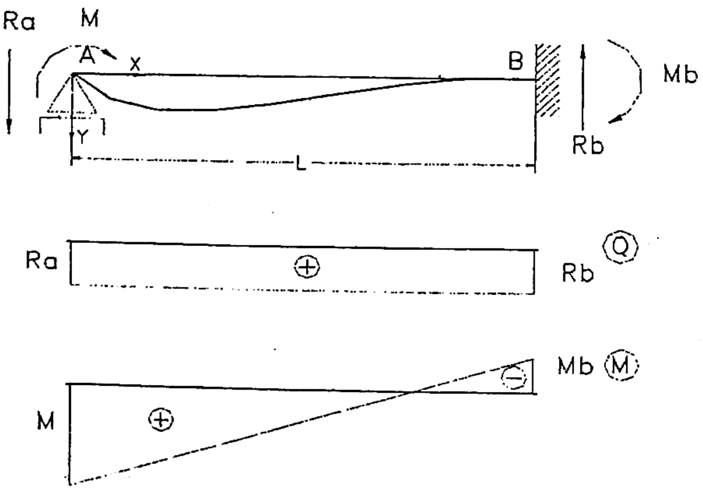
$Mb = M * \frac{a}{L^2} * (2 * b - a)$

En $X1 = a$ →

$M1 = M * (1 - 4 * \frac{a}{L} + 9 \frac{a^2}{L^2} - 6 * \frac{a^3}{L^3})$

$M2 = M * (4 * \frac{a}{L} - 9 \frac{a^2}{L^2} + 6 * \frac{a^3}{L^3})$

BARRA ARTIC–EMP CARGADA CON UN MOMENTO M EN A:

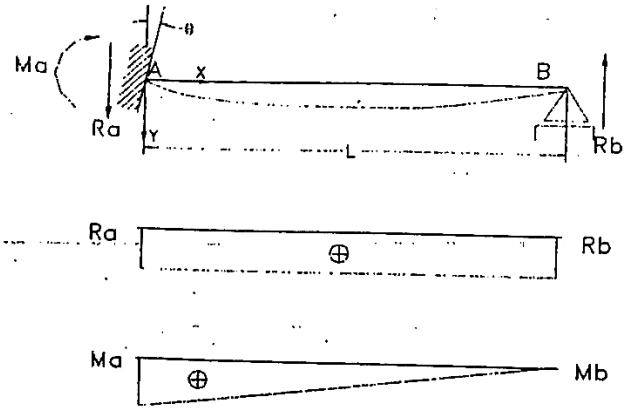


$Ra = \frac{3}{2} * \frac{M}{L}$

$Rb = \frac{3}{2} * \frac{M}{L}$

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

BARRA EMP–ARTIC CARGADA CON UN GIRO EN A:

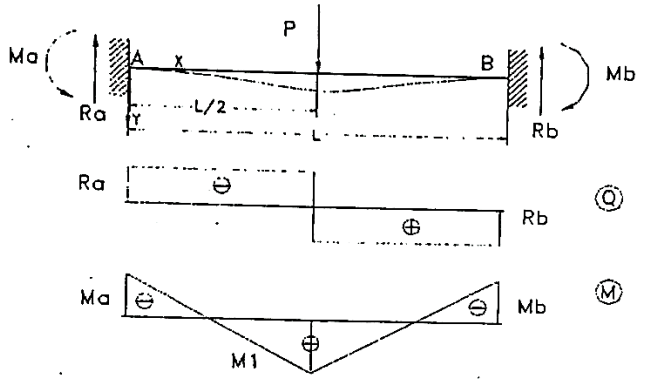


$$Ra = \frac{3 * E * J * \theta}{L^2}$$

$$Rb = \frac{3 * E * J * \theta}{L^2}$$

$$Ma = \frac{3 * E * J * \theta}{L}$$

BARRA EMP–EMP CARGADA CON UNA CARGA P EN L/2:



$$Ra = \frac{1}{2} * P$$

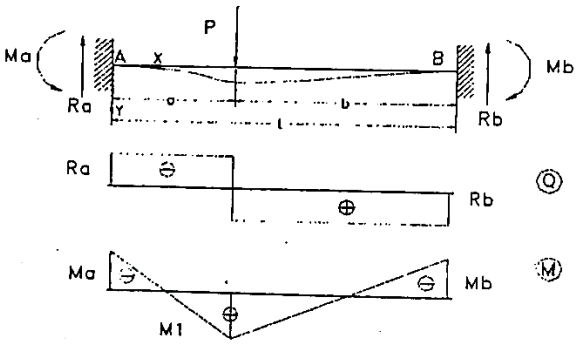
$$Rb = \frac{1}{2} * P$$

$$Ma = \frac{1}{8} * P * L$$

$$Mb = \frac{1}{8} * P * L$$

Si $X1 = \frac{L}{2} \longrightarrow M1 = \frac{1}{8} * P * L$

BARRA EMP–EMP CARGADA CON UNA CARGA P EN a:



$$Ra = P * \frac{b^2}{L^3} * (3 * a + b)$$

$$Rb = P * \frac{a^2}{L^3} * (3 * b + a)$$

$$Ma = P * a * \frac{b^2}{L^2}$$

$$Mb = P * b * \frac{a^2}{L^2}$$

Si $X1 = a \longrightarrow M1 = 2 * P * \frac{a^2 * b^2}{L^3}$

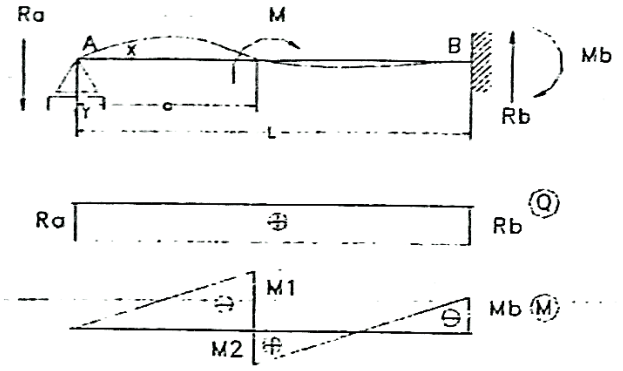
Si $a < b \longrightarrow |Mb| < |M1| < |Ma|$

Si $a > b \longrightarrow |Ma| < |M1| < |Mb|$

Si $a = \frac{L}{3} \longrightarrow Ma = \frac{4}{27} * P * L$

(máximo posible)

BARRA ARTIC–EMP CARGADA CON UN MOMENTO M A UNA DISTANCIA a:



$$Ra = \frac{3}{2} * \frac{M}{L} * \left(1 - \frac{a^2}{L^2}\right)$$

$$Rb = \frac{3}{2} * \frac{M}{L} * \left(1 - \frac{a^2}{L^2}\right)$$

$$Mb = \frac{M}{2} * \left(1 - 3 * \frac{a^2}{L^2}\right)$$

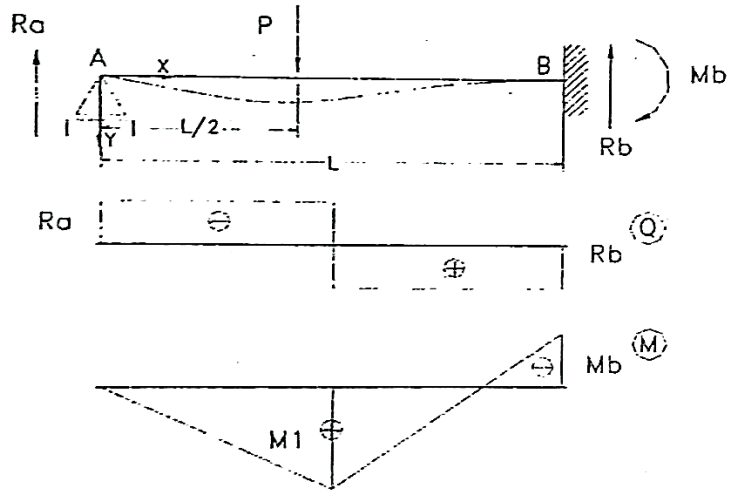
$$M1 = \frac{3}{2} * M * \frac{a}{L} * \left(1 - \frac{a^2}{L^2}\right)$$

$$M2 = M * \left[1 - \frac{3}{2} * \frac{a}{L} * \left(1 - \frac{a^2}{L^2}\right)\right]$$

Si $a < 0.275 * L$ ⟶ $|M1| < |Mb|$

Si $a = 0.577 * L$ ⟶ $Mb = 0$

BARRA ARTIC–EMP CARGADA CON UNA CARGA P EN L/2:

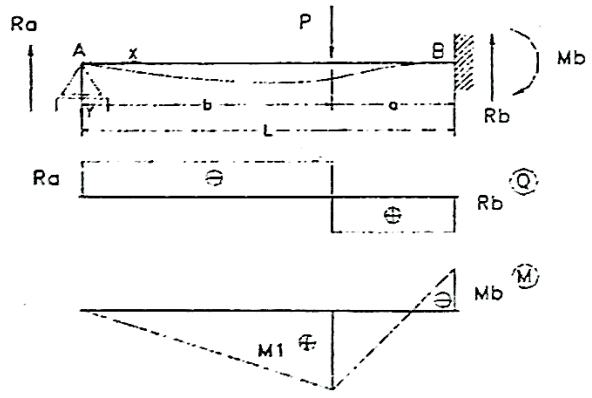


$$Ra = \frac{5}{16} * P$$

$$Rb = \frac{11}{16} * P$$

$$Mb = \frac{3}{16} * P * L$$

BARRA ARTIC–EMP CARGADA CON UNA CARGA P A UNA DISTANCIA b:



$$Ra = \frac{P}{2} * \frac{a^2}{L^2} * \left(3 - \frac{a}{L}\right)$$

$$Rb = \frac{P}{2} * \frac{b}{L} * \left(3 - \frac{b^2}{L^2}\right)$$

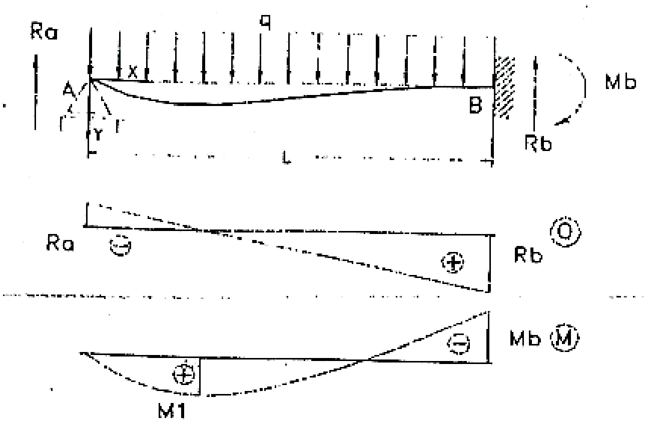
$$Mb = \frac{P * a * b}{2 * L^2} * (L + b)$$

$$M1 = \frac{P * a^2 * b}{2 * L^2} * \left(3 - \frac{a}{L}\right)$$

Si $a = 0.634 * L$ ⟶ $M1 = 0.174 * P * L$

Si $a = 0.423 * L$ ⟶ $Mb = 0.193 * L$

BARRA ARTIC–EMP CARGADA CON UNA CARGA UNIFORME:



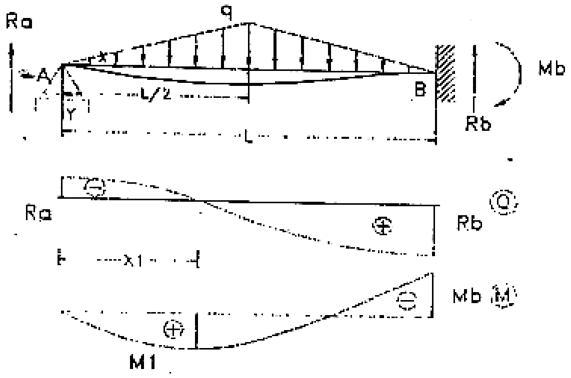
$$Ra = \frac{3}{8} * q * L$$

$$Rb = \frac{5}{8} * q * L$$

$$Mb = \frac{1}{8} * q * L^2$$

$$\text{En } x1 = \frac{3}{8} * L \rightarrow M1 = \frac{9}{128} * q * L^2$$

BARRA ARTIC–EMP CARGADA CON UNA CARGA LINEAL CON MAX EN L/2:



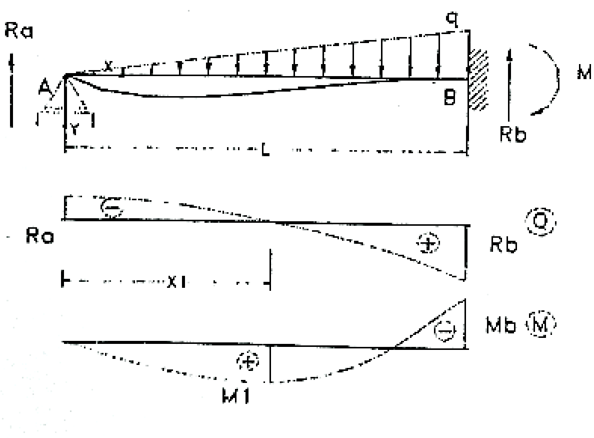
$$Ra = \frac{11}{64} * q * L$$

$$Rb = \frac{21}{64} * q * L$$

$$Mb = \frac{5}{64} * q * L^2$$

$$\text{En } x1 = 0.415 * L \rightarrow M1 = \frac{3}{64} * q * L^2$$

BARRA ARTIC–EMP CARGADA CON UNA CARGA LINEAL CON MAX EN B:



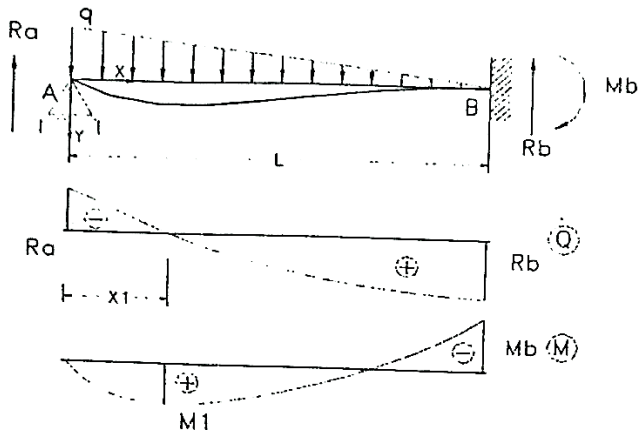
$$Ra = \frac{1}{10} * q * L$$

$$Rb = \frac{2}{5} * q * L$$

$$Mb = \frac{1}{15} * q * L^2$$

$$\text{En } x1 = 0.447 * L \rightarrow M1 = \frac{q}{15 * \sqrt{5}} * L^2$$

BARRA ARTIC–EMP CARGADA CON UNA CARGA LINEAL CON MAX EN A:



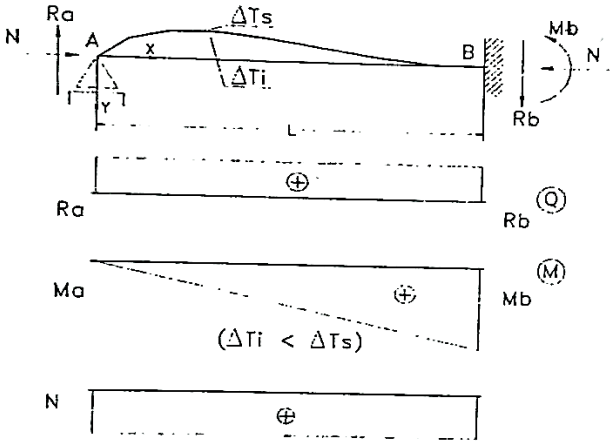
$$Ra = \frac{11}{40} * q * L$$

$$Rb = \frac{9}{40} * q * L$$

$$Mb = \frac{7}{120} * q * L^2$$

En $x1 = 0.329 * L \longrightarrow M1 = \frac{q * L^2}{23.6}$

BARRA ARTIC–EMP CARGADA CON TEMPERATURA:



$$Ra = \frac{3}{2} * \frac{\lambda}{L} * (\Delta Ti_h - \Delta Ts) * E * J$$

$$Rb = \frac{3}{2} * \frac{\lambda}{L} * (\Delta Ti_h - \Delta Ts) * E * J$$

$$Mb = \frac{3}{2} * \lambda * (\Delta Ti_h - \Delta Ts) * E * J$$

λ : coeficiente de dilatación lineal del material

$$N = \lambda * \Delta TG * E * A$$

$$\Delta TG = \left(\Delta Ti + \frac{\Delta Ts}{2}\right) < 0$$