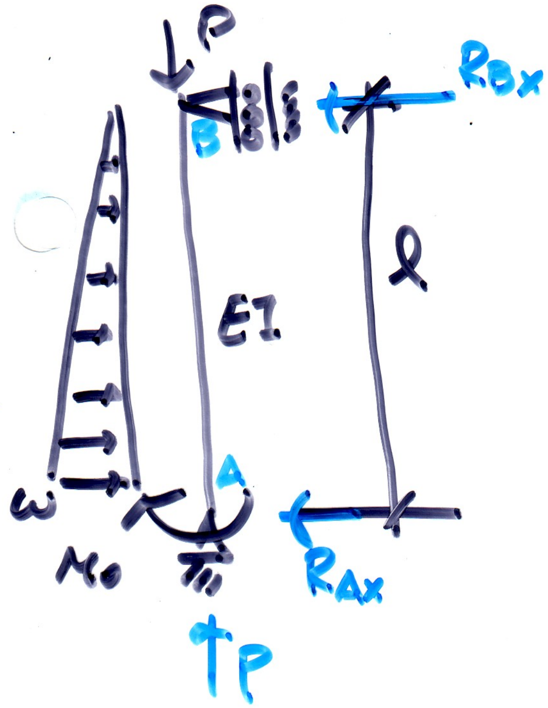
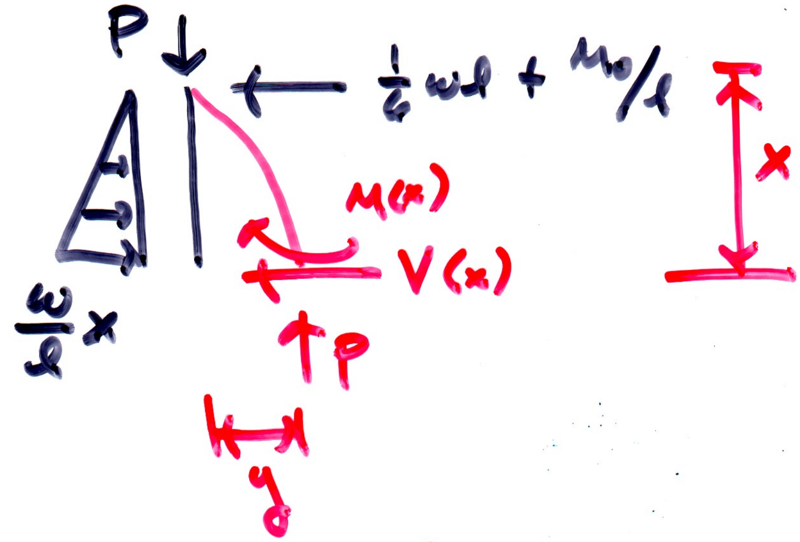


$$\Sigma M_A = 0$$

$$R_{Bx}\,\ell = \frac{1}{2}\omega \ell \cdot \frac{\ell}{3} + M_0$$

$$R_{Bx} = \frac{1}{6}\omega \ell + \frac{M_0}{\ell}$$



$$M(x) + \frac{1}{2}\frac{\omega}{\ell}x \cdot x \cdot \frac{x}{3} = Py + \left(\frac{1}{6}\omega\ell + M_0/\ell\right)x$$

$$EI\frac{d^2y}{dx^2} + Py = \frac{1}{6}\frac{\omega}{\ell}x^3 - \left(\frac{1}{6}\omega\ell + \frac{M_0}{\ell}\right)x$$

$$\frac{d^2y}{dx^2} + k^2 y = \frac{1}{6}\frac{\omega}{EI\ell}x^3 - \frac{1}{EI}\left(\frac{1}{6}\omega\ell + \frac{M_0}{\ell}\right)x$$

$$\hookrightarrow y_h = C_1 \sin kx + C_2 \cos kx$$

$$y_p = C_3 x^4 + C_4 x^3 + C_5 x^2 + C_6 x + C_7$$

$$\hookrightarrow \frac{dy}{dx} = 4C_3 x^3 + 3C_4 x^2 + 2C_5 x + C_6$$

$$\frac{d^2y}{dx^2} = 12C_3 x^2 + 6C_4 x + 2C_5$$

$$12C_3x^2 + 6C_4x + 2C_5 + K^2(C_3x^4 + C_4x^3 + C_5x^2 + C_6x + C_7) =$$

$$\frac{1}{6}\frac{w}{EI\ell}x^3 - \frac{1}{EI}\left(\frac{1}{6}w\ell + \frac{M_o}{\ell}\right)x$$

$\hookrightarrow C_3 = 0$

$\hookrightarrow \frac{P}{EI}C_4 = \frac{1}{6}\frac{w}{EI\ell} \Rightarrow C_4 = \frac{1}{6}\frac{w}{P\ell}$

$\hookrightarrow C_5 = 0$

$\hookrightarrow 6\left(\frac{1}{6}\frac{w}{P\ell}\right) + \frac{P}{EI}C_6 = -\frac{1}{EI}\left(\frac{1}{6}w\ell + \frac{M_o}{\ell}\right)$

$$C_6 = -\frac{w\ell}{6P} - \frac{M_o}{P\ell} - \frac{wEI}{P^2\ell}$$

$\hookrightarrow C_7 = 0$

$$\Rightarrow y = C_1\sin Kx + C_2\cos Kx + \frac{1}{6}\frac{w}{P\ell}x^3 - \left(\frac{w\ell}{6P} + \frac{M_o}{P\ell} + \frac{wEI}{P^2\ell}\right)x$$

$\hookrightarrow$ Condiciones i) $x = 0,\ y = 0$ 2) $x = \ell,\ y = 0$

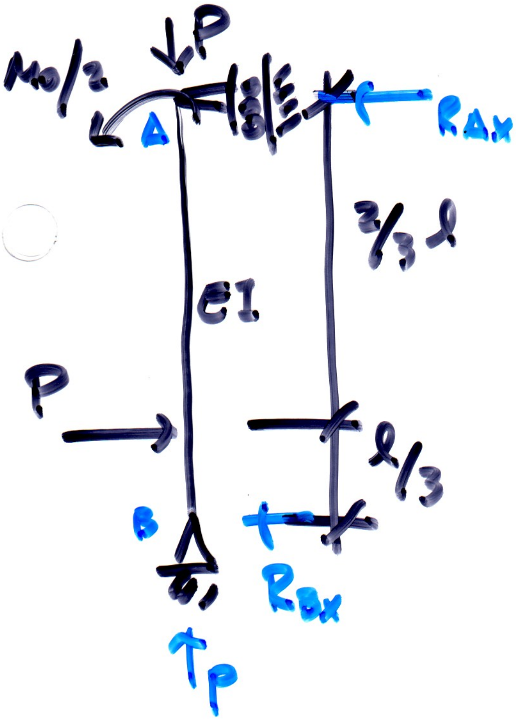
1) $0 = C_2$

2) $0 = C_1\sin K\ell + \frac{1}{6}\frac{w}{P\ell}\ell^3 - \left(\frac{w\ell}{6P} + \frac{M_o}{P\ell} + \frac{wEI}{P^2\ell}\right)\ell$

$$\hookrightarrow C_1 = \frac{M_o}{P\sin K\ell} + \frac{wEI}{P^2\sin K\ell}$$

$$\boxed{\Rightarrow y = \left(\frac{M_o}{P\sin K\ell} + \frac{wEI}{P^2\sin K\ell}\right)\sin Kx + \frac{1}{6}\frac{w}{P\ell}x^3 - \left(\frac{w\ell}{6P} + \frac{M_o}{P\ell} + \frac{wEI}{P^2\ell}\right)x}$$

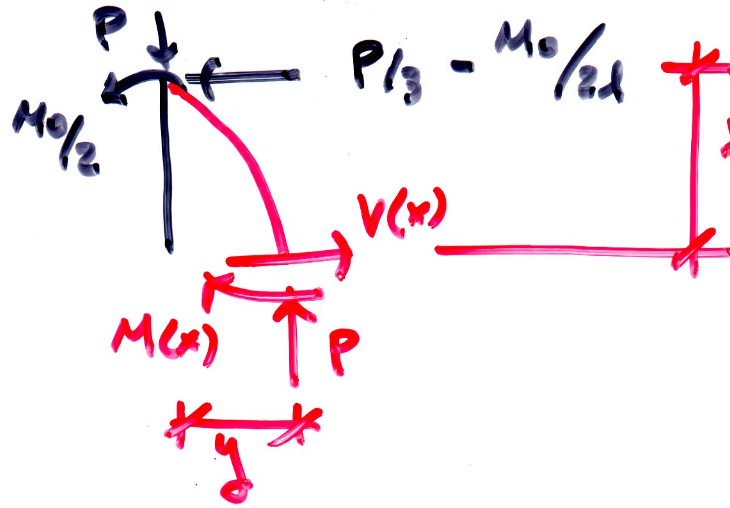
Encuentre $y = f(x)$ para $0 < x \leq \frac{2}{3} l$



$$\Sigma M_B = 0$$

$$R_{Ax} \cdot l = P \cdot \frac{l}{3} - \frac{M_0}{2}$$

$$R_{Ax} = \frac{P}{3} - \frac{M_0}{2l}$$



$$M(x) = Py + \left(P/3 - M_0/2l \right)x + M_0/2$$

$$EI \frac{d^2y}{dx^2} + Py = -\frac{M_0}{2} - \left(\frac{P}{3} - \frac{M_0}{2l} \right)x$$

$$\frac{d^2y}{dx^2} + k^2 y = -\frac{M_0}{2EI} - \frac{1}{EI}\left(\frac{P}{3} - \frac{M_0}{2l} \right)x$$

$\hookrightarrow$ $y_h = C_1 \sin kx + C_2 \cos kx$

$y_p = C_3 x^2 + C_4 x + C_5$

$\hookrightarrow$ $\frac{dy}{dx} = 2C_3 x + C_4$

$\frac{d^2y}{dx^2} = 2C_3$

$$2C_3 + \frac{P}{EI}\left(C_3 x^2 + C_4 x + C_5\right) = -\frac{M_0}{2EI} - \frac{1}{EI}\left(\frac{P}{3} - \frac{M_0}{2l}\right)x$$

$\hookrightarrow C_3 = 0$

$\hookrightarrow \frac{P}{EI} C_4 = -\frac{1}{EI}\left(\frac{P}{3} - \frac{M_0}{2l}\right) \Rightarrow C_4 = -\frac{1}{3} + \frac{M_0}{2Pl}$

$\hookrightarrow \frac{P}{EI} C_5 = -\frac{M_0}{2EI} \Rightarrow C_5 = -\frac{M_0}{2P}$

$$\Rightarrow y = C_1 \sin kx + C_2 \cos kx - \left(\frac{1}{3} - \frac{M_0}{2Pl}\right)x - \frac{M_0}{2P}$$

$\hookrightarrow$ Condiciones : 1) $x=0$, $y=0$, 2) $x=0$, $V(x) = \frac{P}{3} - \frac{M_0}{2l}$

1) $0 = C_2 - \frac{M_0}{2P} \Rightarrow C_2 = \frac{M_0}{2P}$

$$\Rightarrow y = C_1 \sin kx + \frac{M_0}{2P}\cos kx - \left(\frac{1}{3} - \frac{M_0}{2Pl}\right)x - \frac{M_0}{2P}$$

$$y' = C_1 k \cos kx - \frac{M_0}{2P} k \sin kx - \left(\frac{1}{3} - \frac{M_0}{2Pl}\right)$$

$$y'' = -C_1 k^2 \sin kx - \frac{M_0}{2P} k^2 \cos kx$$

$$y''' = -C_1 k^3 \cos kx + \frac{M_0}{2P} k^3 \sin kx$$

$$\Rightarrow -EI\left(-C_1 k^3 \cos kx + \frac{M_0}{2P} k^3 \sin kx\right) - P\left(C_1 k \cos kx - \frac{M_0}{2P} k \sin kx - \frac{1}{3} + \frac{M_0}{2Pl}\right) = \frac{P}{3} - \frac{M_0}{2l}$$

2) $C_1 EI k^3 - C_1 P k + P/3 - M_0/2l = P/3 - M_0/2l \rightsquigarrow C_1 = 0$

$$\Rightarrow \boxed{y = \frac{M_0}{2P}\cos kx - \left(1/3 - M_0/2Pl\right)x - M_0/2P}$$

Longitud Efectiva para las columnas de un marco

K depende de la rigidez relativa de las columnas con respecto a las vigas que llegan a cada nudo (G).

$$G = \frac{\sum E_c I_c / L_c}{\sum E_g I_g / L_g} = \frac{\sum I_c / L_c}{\sum I_g / L_g} \begin{matrix} \} \text{ columnas} \\ \\ \} \text{ vigas} \end{matrix}$$

$$E_c = E_g = E = 29{,}000 \text{ ksi}$$

$\Rightarrow$ Con los valores de G_A y G_B se entra en los nomogramas de Jackson-Mooreland y se determina K gráficamente.

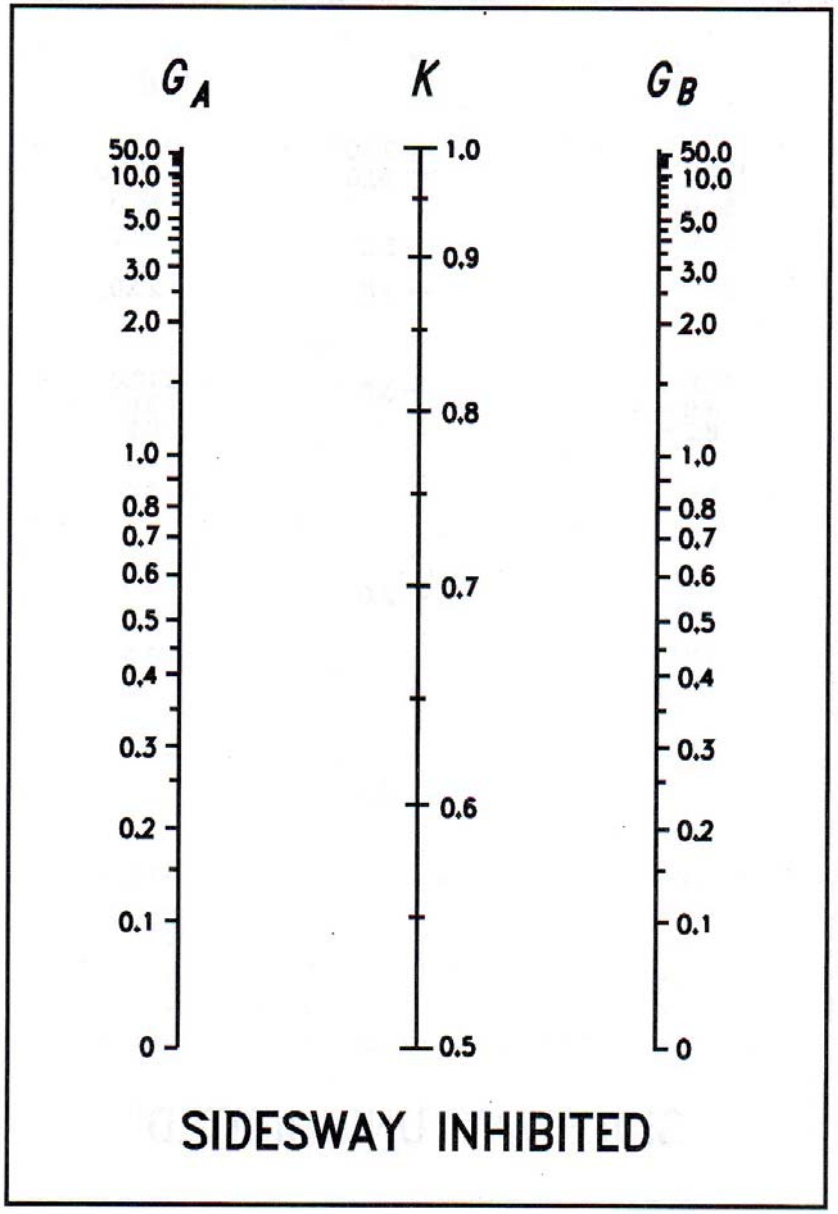
Para las columnas de Planta Baja:

 $\rightsquigarrow$ $G = 10$

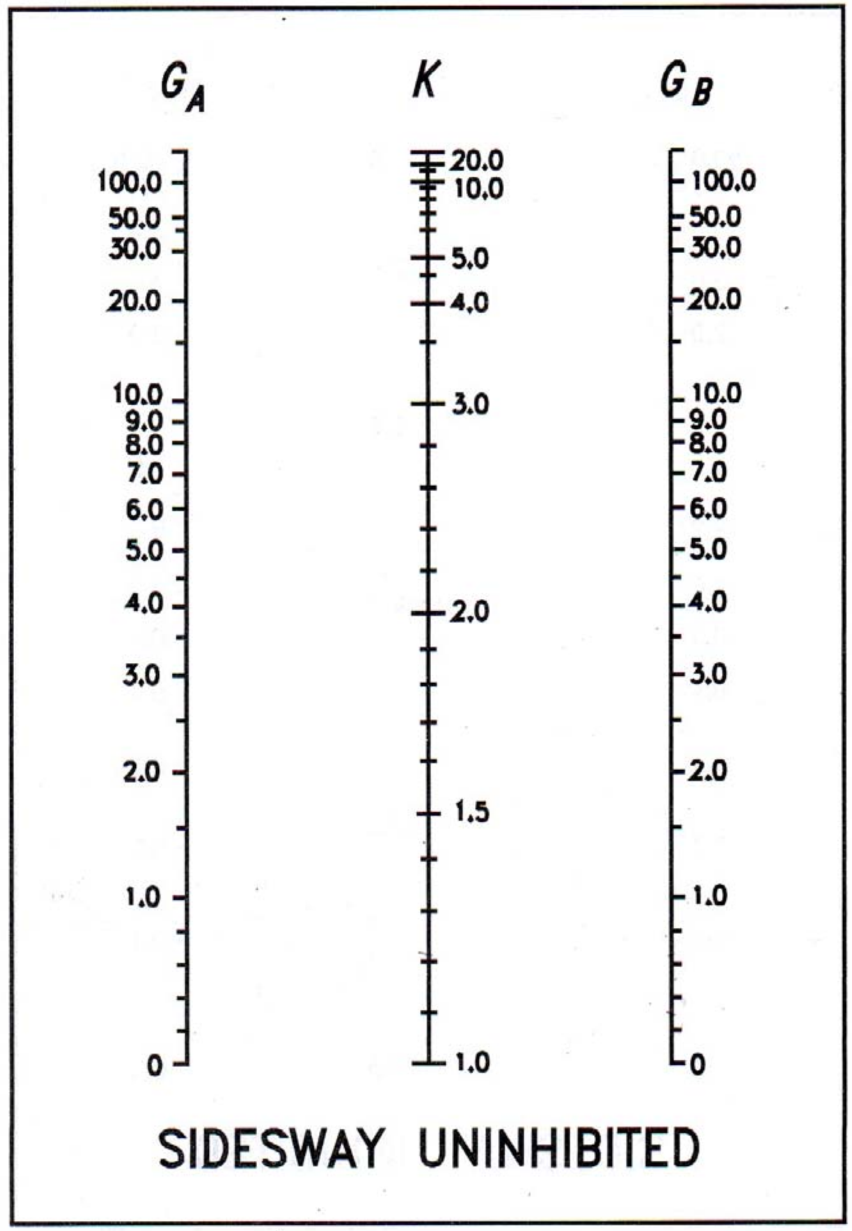
 $\rightsquigarrow$ $G = 1$

Nota: $0.5 \leq K \leq 1.0$ $\rightsquigarrow$ Marcos Arriostrados Lateralmente

$1.0 < K < \infty$ $\rightsquigarrow$ ✓ No ✓ ✓



G_A
K
G_B
50.0
10.0
5.0
3.0
2.0
1.0
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.0
0.9
0.8
0.7
0.6
0.5
SIDESWAY INHIBITED



G_A
K
G_B
100.0
50.0
30.0
20.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
20.0
10.0
5.0
4.0
3.0
2.0
1.5
1.0
SIDESWAY UNINHIBITED