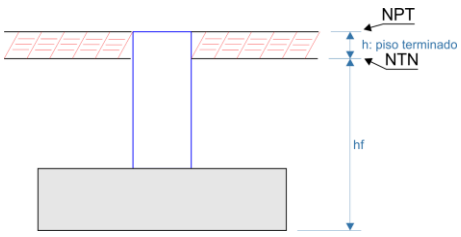
FORMULARIO CIMENTACIONES – DISEÑO DE ZAPATA AISLADA



1. Predimensionamiento de columna:

$$t_1 \times t_2 = \frac{\alpha P}{k \cdot f'_c}$$

2. Factor de Seguridad (FS)

$$U_{est} = 1.4CM + 1.7CV$$

$$Pss = CM + 0.25CV$$

$$CS = \frac{2}{3} Z \cdot U \cdot S \cdot Pss$$

$$U_{din} = 1.25CM + 1.25CV + CS$$

3. Calculo del q.neto

$$q_{net} = \frac{q_{ult}}{FS} - S/C - \gamma_p h_f$$

4. Predimensionamiento de zapata

$$A = \frac{Ps}{q_{net}}$$

$$T = \sqrt{A} + \left[\frac{t_1 - t_2}{2}\right]$$

$$S = \sqrt{A} - \left[\frac{t_1 - t_2}{2}\right]$$

5. Presiones

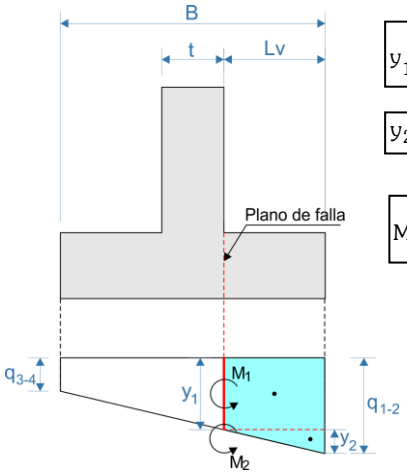
$$Ex < \frac{T}{6} \qquad Ey < \frac{S}{6}$$

$$q_i = \frac{Ps}{A}\left(1 \pm \frac{6Ex}{S} \pm \frac{6Ey}{T}\right)$$

$$q_1 < q_{net}$$

6. Punzonamiento

$$q_i = \frac{Us}{A}\left(1 \pm \frac{6Ex}{S} \pm \frac{6Ey}{T}\right)$$



$$y_1 = q_{3-4} + \frac{(q_{1-2} - q_{3-4})(B - Lv)}{B}$$

$$y_2 = q_{1-2} - y_1$$

$$Mu = y_1 \frac{(Lv)^2}{2} + y_2 \frac{(Lv)^2}{3}$$

7. Peralte efectivo (d)

$$\rho_{min} = 0.7 \frac{\sqrt{f'_c}}{f_y} \qquad \rho_d = 175\% \cdot \rho_{min} \qquad \omega = \rho_d \frac{f_y}{f'_c}$$

$$d = \sqrt{\frac{Mu}{\phi f'_c \cdot b \cdot \omega(1 - 0.59\,\omega)}} \qquad d_{real} = hz_{real} - \phi/2 - r$$

8. Cortante (Vc)

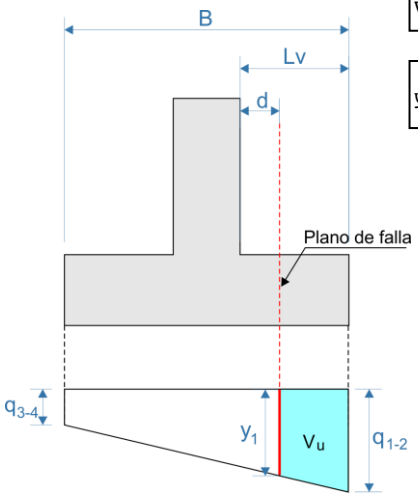
$$Bc = \frac{t_1}{t_2} \qquad m = t_1 + d_{real} \qquad n = t_2 + d_{real}$$

$$bo = 2(m + n)$$

$$Vc = \begin{cases} 0.27\left(2 + \frac{4}{Bc}\right)\sqrt{f'_c}\, b_o\, d \\ 0.27\left(2 + \frac{\alpha d}{b_o}\right)\sqrt{f'_c}\, b_o\, d \\ 1.06\sqrt{f'_c}\, b_o\, d \end{cases}$$

$$Vu = Pu - q_p A_{col} \qquad Vn = \frac{Vu}{\phi} \qquad Vn \le Vc$$

9. Cortante



$$Vc = 0.53\sqrt{f'_c}\, bd$$

$$y_1 = q_{3-4} + \frac{(q_{1-2} - q_{3-4})(B - Lv + d)}{B}$$

$$y_2 = q_{1-2} - y_1$$

$$Vu = \left(\frac{q_{1-2} + y_1}{2}\right)(Lv - d)$$

$$Vn = \frac{Vu}{\phi} \qquad Vn \le Vc$$

10. Aplastamiento

Columna

$$Pnb = 0.85 f'_c \, A_{col} \qquad Pn = \frac{Pu}{\phi} \qquad Pnb \geq Pn$$

Zapata

$$X_o = B \times \frac{t_2}{t_1} \leq b \qquad A_2 = X_o B$$

$$A_o = \sqrt{\frac{A_2}{A_{col}}} \times A_{col} \leq 2A_{col}$$

$$Pnb = 0.85 f'_c \, A_o \qquad Pnb \geq Pn$$

11. Flexión

$$a = \frac{2d - \sqrt{4d^2 - \frac{8Mu}{0.85 \phi f'_c \, b}}}{2} \qquad As = \frac{Mu}{\phi f_y \left(d - \frac{a}{2} \right)}$$

$$\rho = \frac{As}{bd} \qquad Ru = \frac{Mu}{bd^2} \qquad \rho = \frac{Ru}{\phi fy (1 - 0.59\omega)}$$

Verificación

$$\rho b = 0.85 \frac{f'_c}{f_y} \left(\frac{6000}{6000 + f_y} \right) \qquad \rho máx = 0.5 \rho b$$

12. Varilla

$$n°v = \frac{As}{\phi}$$

$$exc = \left(\frac{Areal - As}{As} \right) \times 100 \leq 11\% \qquad Sr = \frac{B - 2r - n°v \times \phi}{n°v - 1}$$