16.6) Isolated (Column/Spread) Footings
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- For a concentric axial load coming from a column (i.e., column load is at the centroid of the area of the footing), soil pressure is assumed to be uniformly distributed over the footing area. The footing bends in both directions; thus developing moments in both directions. Therefore, steel must be designed for moments in both directions.

**Design Procedure of Isolated Footings**

Given the following information:

- Column dimensions, \( c_L \) & \( c_B \) (mm)
- Service dead and live loads from column, \( P_D \) & \( P_L \) (kN)
- Allowable soil bearing pressure, \( q_{allow} \) (kN/m\(^2\))
- Depth of footing below finished ground line, \( h \) (m)
- Unit weight of soil, \( w_s \) (kN/m\(^3\))
- Unit weight of concrete, \( w_o \) (kN/m\(^3\))
- Surcharge paving (kN/m\(^2\))

Determine the following:

1) Dimensions of footing in the long/short directions, L & B.
2) Thickness of footing, \( h_c \).
3) Reinforcing steel in both directions.
1) Dimensions of footing in the long and short directions, $L$ & $B$.

Using *service* loads, the short and long direction of the footing can be determined.

$$\rightarrow q_{allow, net, approx} = q_{allow} - q_{avg} h - \text{Surcharge paving}$$

$$\rightarrow A_{req} = \frac{P_D + P_L}{q_{allow, net, approx}}$$

Rectangular footing, $B$ is set.

$$\rightarrow L_{req} = \frac{A_{req}}{B}$$

Rectangular footing, $B$ is set.

$$\rightarrow L_{req} = \sqrt{A_{req}}$$

2) Determine thickness of the footing, $h_c$.

Using *factored* loads, the thickness of the footing, $h_c$, can be determined.

$$\rightarrow P_u = 1.2P_D + 1.6P_L$$

$$\rightarrow A = BL \quad \text{or} \quad A = L^2 \quad \text{(for square footing)}$$

$$\rightarrow q_{u, net} = \frac{P_u}{A}$$
Footing thickness, $h_c$, is dictated by one-way and two-way shears (to avoid using shear reinforcement).

**a) One-way shear**

- An inclined crack forms at a distance $d$ from face of column, and propagates to the compression side across the footing width.
- Long direction controls since it gives a larger tributary area per unit width and, hence, a larger $V_u$. 


Example 1

A 400 mm concrete wall supports a dead load $w_D = 200 \, kN/m$ and a live load $w_L = 150 \, kN/m$. The allowable bearing pressure is $215 \, kN/m^2$ at the level of the bottom of the footing, which is 1.3 m below grade. Design a footing for the wall using $f'_c = 28 \, MPa$ concrete and Grade 420 steel.