

Example 11.1 > Design of Wall Footing

A 400 mm concrete wall supports a dead load $D = 180 \text{ kN/m}$ and a live load $L = 140 \text{ kN/m}$.

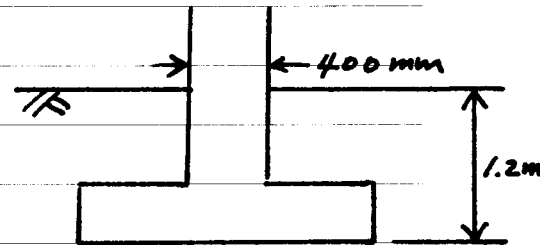
The allowable bearing pressure is $q_a = 200 \text{ kN/m}^2$ at the level of the bottom of the footing, which is 1.2 m below grade.

Design a footing for this wall using $f_{ck} = 21 \text{ MPa}$ and $f_y = 300 \text{ MPa}$.

Solution

- Assume the thickness of footing 300 mm.

footing concrete unit weight 24 kN/m^3



→ Footing weight per square meter is $24 \times 0.3 = 7.2 \text{ kN/m}^2$

- The weight of the $(1.2 - 0.3)$ meter fill on the top of the footing is $0.9 \times 16 = 14.4 \text{ kN/m}^2$
unit weight of soil

- The portion of the allowable bearing pressure that is available or effective for carrying the wall load is

$$q_e = 200 - (7.2 + 14.4) = 178.4 \text{ kN/m}^2$$

- The required width of the footing is

$$b = \frac{D + L}{q_e} = \frac{320}{178.4} = 1.79 = 1.8$$

• The bearing pressure for strength design of the footing is

$$q_u = \frac{1.2 \times 180 + 1.6 \times 140}{1.8} = 244 \text{ kN/m}^2$$

• The factored moment for strength design is

$$M_u = \frac{1}{8} \times 244 \times (1.8 - 0.4)^2 = 59.8 \text{ kN}\cdot\text{m/m}$$

• Assuming $d = 220 \text{ mm}$, the shear at section 2-2 is

$$V_u = 244 \left(\frac{1}{2} (1.8 - 0.4) - 0.22 \right) = 117 \text{ kN/m}$$

Shear usually governs the depth of footings, particularly since the use of shear reinforcements in footings is generally avoided as UNECONOMICAL.

• The design shear strength per meter is

$$\begin{aligned} \phi V_c &= \phi \left(\frac{1}{6} \sqrt{f_{ck}} b d \right) = (0.75) \left(\frac{1}{6} \right) \sqrt{21} (1,000) d \\ &= 572 d \text{ N/m} \end{aligned}$$

$$\therefore d = \frac{117}{0.572} = 205 \text{ mm}$$

Homework #5 Complete the design and sketch the reinforcements and Discuss it!