

Problems:

A footing 2m square, rest on a soft clay soil with its base at a depth of 1.5m from ground surface. The clay stratum is 3.5m thick & is underlain by a firm sand stratum. The void ratio of clay is 1.08 & compression index 0.18 cohesion is 50 kN/m^2 . Compute the settlement that would result if the load intensity equal to the safe bearing pressure of soil were allowed to act on the footing. Natural water table is quite close to the ground surface. For given conditions, bearing capacity factor (N_c) is obtained as 6.9. Take factor of safety as 3. Assume load spread of 2 (vertical) to 1 horizontal.

Solution:-

$$c = 0.5 \text{ kg/cm}^2 = 5 \text{ t/m}^2$$

a) Determination of submerged unit weight γ'

$$\gamma' = \frac{G-1}{1+e} \gamma_w$$

$$e = w_{\text{sat}} G = 0.4 \times 2.7 = 1.08$$

$$\gamma_w = 1 \text{ t/m}^3$$

$$\gamma' = \frac{2.7 - 1}{1 + 1.08} \times 1$$

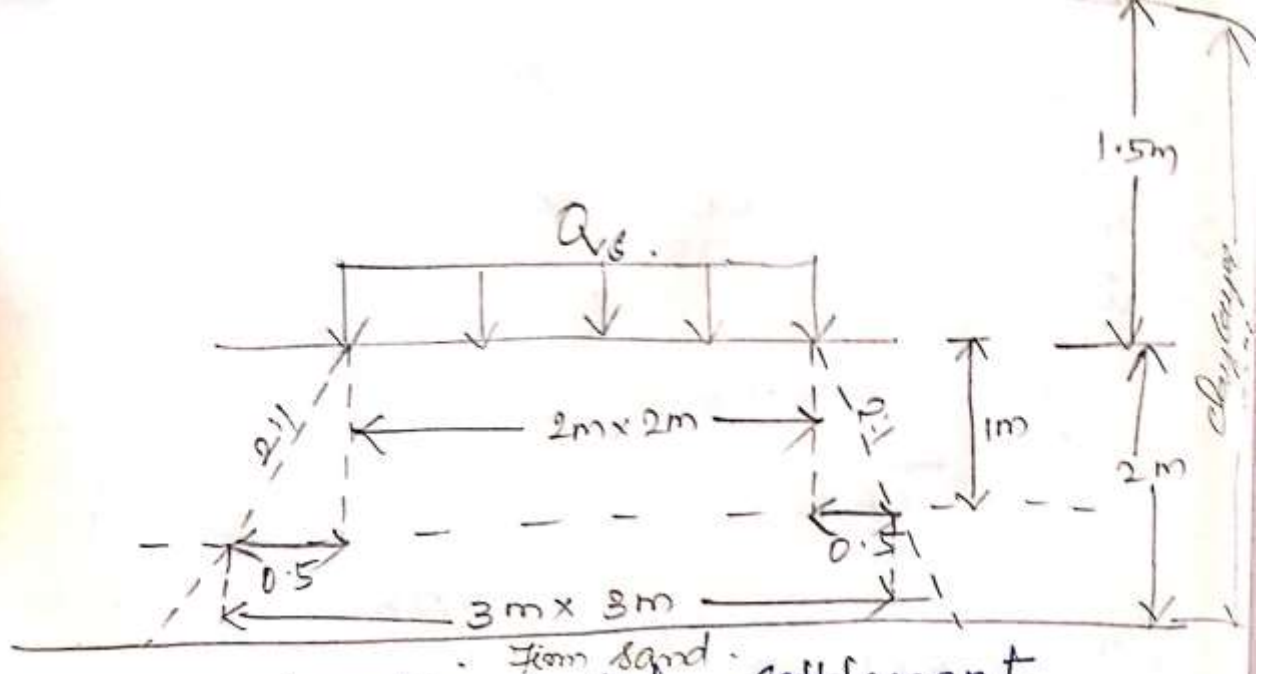
$$\gamma' = 0.817 \text{ t/m}^3$$

b) Determination of footing load:-

$$q_{nf} = c N_c = 5 \times 6.9 = 34.5 \text{ t/m}^2$$

$$q_s = \frac{q_{nf} + \gamma' D}{3} = \frac{34.5 + 0.817 \times 1.5}{3} = 12.726 \text{ kN/m}^2$$

$$Q_s = q_s \times \text{Area} = 12.726 \times 2 \times 2 = 50.9 \text{ t}$$



c) Determination of settlement
 Consider level AA at mid depth of clay.

$$\sigma'_0 = \gamma'(2.5) = 0.817 \times 2.5 = 2.043 \text{ t/m}^2$$

$$\text{Area of spread at level AA} = 3 \times 3 = 9 \text{ m}^2$$

$$\Delta \sigma' = \frac{Q_s}{A} = \frac{50.9}{9} = 5.656 \text{ t/m}^2$$

$$C_c = 0.009(W_L - 10) = 0.009(30 - 10) = 0.18$$

$$e_0 = e = 1.08$$

$$\Delta H = \frac{C_c \cdot H}{1 + e_0} \log_{10} \frac{\sigma'_0 + \Delta \sigma'}{\sigma'_0}$$

$$= \frac{0.18 \times 2}{1 + 1.08} \log_{10} \frac{2.043 + 5.656}{2.043} = 0.11 \text{ m} = 11 \text{ cm}$$