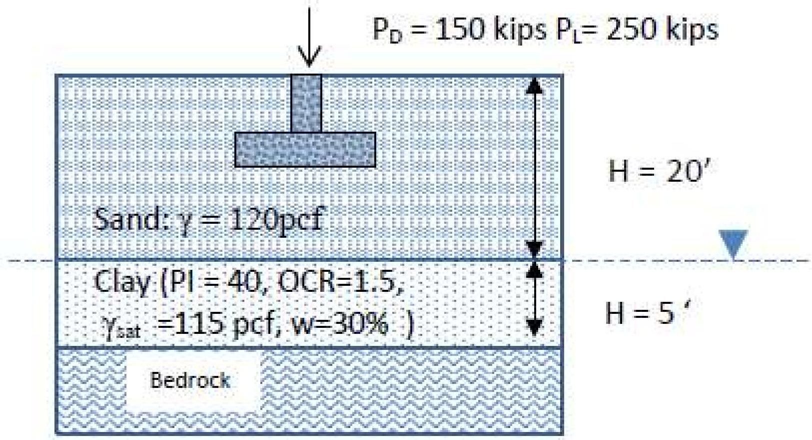
Given: A 10' x 10' building foundation is to be constructed in the layered soil profile shown in the figure below. Static groundwater level is 20 feet below grade.



Find:

1. Average effective stress increase in the clay layer due to Dead and Live load using Griffiths Method (1984).
2. Compression of the clay layer after primary consolidation.
3. If primary consolidation is completed 3 months after construction, calculate the additional settlement due to secondary consolidation of the clay layer 25 years after primary consolidation.

$P_D := 150 \cdot kip$ $\quad P_L := 250 \cdot kip$ $\quad D_f := 5\ ft$ $\quad B := 10ft$ $\quad L := 10ft$ $\quad \gamma_{sand} := 120pcf$

$A := B \cdot L$ $\quad PI := 40$

$$q_0 := \frac{(P_D + P_L)}{A} = 4 \cdot ksf$$

$H_1 := 20ft - D_f = 15 \cdot ft$ $\quad H_2 := 25ft - D_f = 20 \cdot ft$

For Ia(H1)

$$m_2 := \frac{\frac{B}{2}}{H_1} = 0.333$$

$$n_2 := \frac{\frac{L}{2}}{H_1} = 0.333$$

$I_a(H1) := .136$ [Figure 5.7]

For Ia(H2)

$$m_2 := \frac{\frac{B}{2}}{H_2} = 0.25$$

$$n_2 := \frac{\frac{L}{2}}{H_2} = 0.25$$

$I_a(H2) := .11$ [Figure 5.7]

$$\Delta\sigma_{avg} := 4 \cdot q_0 \cdot \frac{\left(H_2 \cdot I_a(H2) - H_1 \cdot I_a(H1)\right)}{H_2 - H_1} = 2.176 \cdot ksf$$

$w := .30 \qquad \gamma_w := 62.4pcf$

$$\gamma_{sat} := \left(\frac{e}{w}\right) \cdot \left[\frac{(1 + w)}{(1 + e)}\right] \gamma_w$$ [Table 1.3] $\gamma_{sat} := 115 \cdot pcf$

$$e_o := \left[\frac{1}{\left[\frac{\gamma_w \cdot (1 + w)}{\gamma_{sat} \cdot w}\right] - 1}\right] = 0.74$$

At center of clay layer:

$$\sigma'_o := \gamma_{sand} \cdot 20ft + \left(\gamma_{sat} - \gamma_w\right) \cdot \frac{(5ft)}{2} = 2.532 \times 10^3 \cdot psf$$

$$\sigma'_c := 1.5 \cdot \sigma'_o = 3.797 \times 10^3 \cdot psf$$

$$\Delta\sigma'_{avg} := \Delta\sigma_{avg}$$

$$\sigma'_o + \Delta\sigma'_{avg} = 4.708 \times 10^3 \cdot psf$$

$\sigma'_o < \sigma'_c < \sigma'_o + \Delta\sigma'_{avg}$ Therefore use equation 1.65 for primary consolidation settlement

$$C_c := \frac{\frac{PI}{100}}{74} = 5.405 \times 10^{-3}$$ [Equation 1.55]

$$C_s := \frac{\frac{PI}{100}}{370} = 1.081 \times 10^{-3}$$ [Equation 1.57]

$H_c := 5 \cdot ft$

$\Delta\sigma' := \Delta\sigma'_{avg}$

$$S_c := \left(\frac{C_s \cdot H_c}{1 + e_o}\right) \cdot \log\left(\frac{\sigma'_c}{\sigma'_o}\right) + \left[\frac{\left(C_c \cdot H_c\right)}{1 + e_o}\right] \cdot \log\left[\frac{\left(\sigma'_o + \Delta\sigma'\right)}{\sigma'_c}\right]$$ [Equation 1.65]

$S_c = 0.024 \cdot in$

SOLUTION