Geotechnical Engineering–I

BSc Civil Engineering – 4th Semester

Lecture # 22

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by

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Lecture Handouts: https://groups.google.com/d/forum/geotec-1

CONSOLIDATION – SUMMARY

$\Delta\sigma = \Delta\sigma' + \Delta u$

$$t = \left(\frac{T \cdot H^2}{C_V}\right)$$

$$T = \frac{\pi}{4}\left(\frac{u}{100}\right)^2; \qquad \text{for } u \le 60\%$$

$$T = 1.781 - 0.933 \cdot \log_{10}(100 - u); \qquad \text{for } u > 60\%$$

$$H_S = \frac{W_S}{G_S \cdot \gamma_w \cdot A} \qquad e_0 = \frac{H \cdot (G_S \cdot \gamma_w \cdot A) - W_S}{W_S}$$

$$m_V = \frac{\Delta V / V}{\Delta\sigma} = \frac{\Delta H / H}{\Delta\sigma} \qquad C_C = \frac{\Delta e}{\log p_2 / p_1}$$

$$C_C = 0.009 \cdot (LL - 10) \qquad C_r = 0.1 \cdot C_C$$

Terzaghi & Peck (1948)

$$settlement = S_c = \frac{\Delta e}{1 + e_o} H$$

For NCC

$$S_c = H\left(\frac{C_c}{1+e_o}\right)\left(\log\frac{\sigma_{vo}'+\Delta\sigma'}{\sigma_{vo}'}\right)$$

For OCC

$$S_c = H\left(\frac{C_r}{1+e_o}\right)\left(\log\frac{\sigma_{vo}'+\Delta\sigma'}{\sigma_{vo}'}\right)$$

If OCC is loaded beyond σ_p'

$$S_c = H\left(\frac{C_r}{1+e_o}\right)\left(\log\frac{\sigma_p'}{\sigma_{vo}'}\right) + H\left(\frac{C_c}{1+e_o}\right)\left(\log\frac{\sigma_{vo}'+\Delta\sigma'}{\sigma_p'}\right)$$

Practice Problem #6

Given

When the total pressure acting at midheight of a consolidating clay layer is 200 kN/m^2, the corresponding void ratio of the clay is 0.98. When the total pressure acting at the same location is 500 kN/m^2, the corresponding void ratio decreases to 0.81.

Required

The void ratio of the clay if the total pressure acting at midheight of the consolidating clay layer is 1000 kN/m^2.

Practice Problem #7

A stratum of normally loaded *clay of 7m thick* is located at a *depth of 12m* below ground level. The *natural moisture content* of the clay is *43%* and its *liquid limit is 48%*. The *specific gravity* of the solid particles is *2.76*. The *water table* is located at a *depth of 5m* below the ground surface. The soil is *sand above the clay* stratum. The *submerged unit weight of the sand is 11 kN/m^3* and the same weighs *18kN/m^3 above the water table*. The average *increase in pressure* at the center of the clay stratum is *120 kN/m^3* due to the weight of a building that will be constructed on the sand above the clay stratum. Estimate the *expected settlement* of the structure.

Practice Problem #8

A soil profile is shown in Figure 11.18. If a uniformly distributed load, $\Delta\sigma$, is applied at the ground surface, what is the settlement of the clay layer caused by primary consolidation if

a. The clay is normally consolidated
b. The preconsolidation pressure $(\sigma_c') = 190\ \text{kN/m}^2$
c. $\sigma_c' = 170\ \text{kN/m}^2$

Use $C_s \approx \frac{1}{6} C_c$.

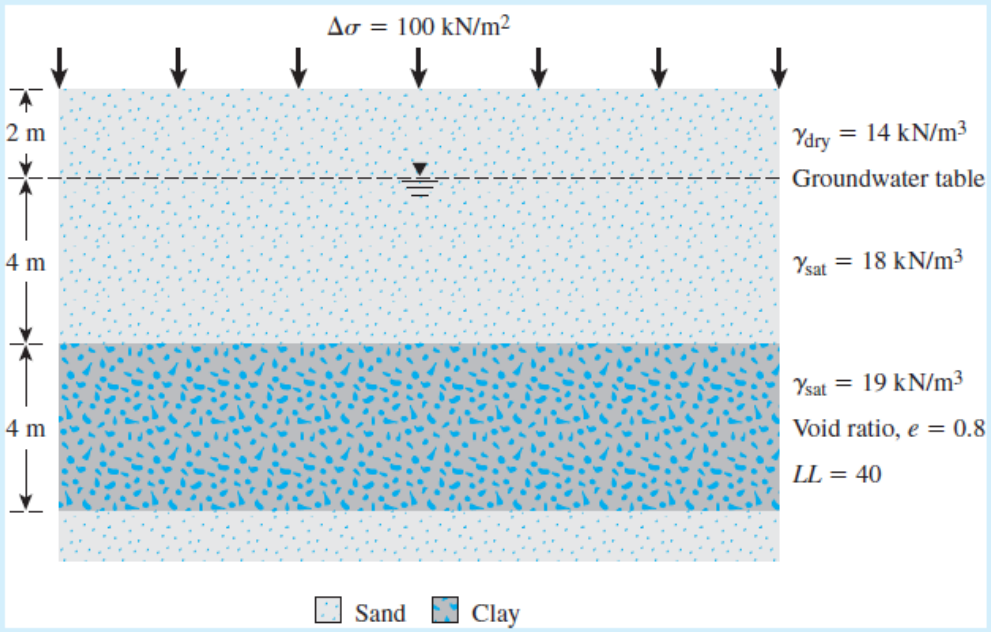

Figure 11.18

CONCLUDED