

Chapter 2:**PROBLEM 2**

GIVEN: Soil Profile shown in Figure P1.11

<u>Layer 1:</u>	e= 0.55	Gs= 2.66	$\gamma_w = 9.8 \text{ kN/m}^3$
<u>Layer 2:</u>	e= 0.48	Gs= 2.66	
<u>Layer 3:</u>	w= 0.348	Gs= 2.74	

FIND: Determine the total stress, pore water pressure, and effective stress at A,B,C, and D.

METHOD: A. Using the equations on table 1.3, we determine the soils dry and saturated unit weights.

B. With the dry and saturated unit weight we are able to calculate total stress. With the hydraulic stress we can obtain the effective stress using the equation: $\sigma' = \sigma - u$

SOLUTION:A. Determining γ for soil layers:

<u>Layer 1:</u>	$\gamma_d = G_s \cdot \gamma_w / (1 + e) =$	16.82 kN/m ³
<u>Layer 2:</u>	$\gamma_{sat} = (G_s + e) \gamma_w / (1 + e) =$	20.79 kN/m ³
<u>Layer 3:</u>	$\gamma_{sat} = \frac{(1 + w) G_s \cdot \gamma_w}{(1 + w \cdot G_s)} =$	18.53 kN/m ³

B. Determining total stress, pore pressure and effective stress on soil layers:To determine the total stress we use the formula: $\sigma = \gamma \cdot h$ Where γ , is dry for above the water table, and saturated for below the water table.

Table 11 - Total Stresses, Pore Pressures, and Effective Stresses for Soil Profile, in kPa.

Point	Height (m)	Total Stress, σ (kPa)	Pore Pressure, u (kPa)	Effective Stress, σ' (kPa)
A	0	0	0	0
B	3	50.45	0	50.45
C	1.5	81.64	14.7	66.94
D	5	174.30	63.7	110.60

PROBLEM 3

GIVEN: Normally consolidated clay layer, the following are given:

$h = 3 \text{ m}$ $e = 0.75$ $LL = 42$ $G_s = 2.72$ $\sigma' = 110 \text{ kN/m}^2$

FIND: Determine how much consolidation settlement would the clay undergo if the average effective stress on the clay layer is increased to 155 kN/m^2

METHOD: A. Use Eq. 1.51 to estimate the compression index.
B. Use Eq. 1.61 to determine the consolidation settlement due to increase in effective

SOLUTION:

$$C_c = 0.16401$$

$$S_c = 0.04187 \text{ m} = 41.87 \text{ mm}$$

PROBLEM 4

GIVEN: Referring to problem 1.12 assume that the clay layer is preconsolidated,

$$\sigma'_c = 130 \text{ kN/m}^2 \quad C_s = 1/5 \cdot C_c = 0.033$$

FIND: Estimate the consolidation settlement.

METHOD: A. Use Eq. 1.51 to estimate the compression index (from problem 12)
B. Check if use Eq. 1.62 or 1.65 to determine the consolidation settlement due to increase in effective stress

SOLUTION: If $\sigma'_c + \Delta\sigma' \leq \sigma'_c$, then we will use Eq. 1.62 $\therefore 155 > 130$
Since it is not, we must use Eq. 1.65

$$S_c = 0.02556 = 25.56 \text{ mm}$$

PROBLEM 5

GIVEN: The results of two consolidated-drained triaxial tests on a clay,

Test I: $\sigma_3' = 82.8 \text{ kN/m}^2$ $\sigma_1' = 329.2 \text{ kN/m}^2$

Test II: $\sigma_3' = 165.6 \text{ kN/m}^2$ $\sigma_1' = 558.6 \text{ kN/m}^2$

FIND: Determine the shear-strength parameters - that is c' and ϕ'

METHOD: A. Mohr's circle need to be plot for the test results

SOLUTION:

PROBLEM 6

GIVEN: The results of two consolidated-drained triaxial tests on a clay,

Test I: $\sigma_3' = 82.8 \text{ kN/m}^2$ $\sigma_1' = 329.2 \text{ kN/m}^2$

Test II: $\sigma_3' = 165.6 \text{ kN/m}^2$ $\sigma_1' = 558.6 \text{ kN/m}^2$

FIND: Determine the shear-strength parameters - that is c' and ϕ'

METHOD: A. Mohr's circle need to be plot for the test results

SOLUTION:

PROBLEM 13

GIVEN: The results of two consolidated-drained triaxial tests on a clay,

Test I: $\sigma_3' = 82.8 \text{ kN/m}^2$ $\sigma_1' = 329.2 \text{ kN/m}^2$

Test II: $\sigma_3' = 165.6 \text{ kN/m}^2$ $\sigma_1' = 558.6 \text{ kN/m}^2$

FIND: Determine the shear-strength parameters - that is c' and ϕ'

METHOD: A. Mohr's circle need to be plot for the test results

SOLUTION:

PROBLEM 14

GIVEN:

The results of a consolidated-undrained triaxial tests on a saturated normally consolidated

$$\sigma_3 = 13 \text{ lb/in}^2 \quad \sigma_1 = 32 \text{ lb/in}^2 \quad u_f = 5.5 \text{ lb/in}^2$$

FIND: Determine the shear-strength parameters - that is c and ϕ , c' and ϕ' .

METHOD: A. Mohr's circle need to be plot for the test results
B. Use Total Stress - Pore Pressure = Effective Stress to find total shear strength parameters.

SOLUTION: Determining the Total Stresses:

$$\sigma_3' = 7.5 \text{ lb/in}^2 \quad \sigma_1' = 37.5 \text{ lb/in}^2$$

PROBLEM 17

GIVEN: The results of two consolidated-drained triaxial tests on a clay,

$$\text{Test I:} \quad \sigma_3' = 82.8 \text{ kN/m}^2 \quad \sigma_1' = 329.2 \text{ kN/m}^2$$

$$\text{Test II:} \quad \sigma_3' = 165.6 \text{ kN/m}^2 \quad \sigma_1' = 558.6 \text{ kN/m}^2$$

FIND: Determine the shear-strength parameters - that is c' and ϕ'

METHOD: A. Mohr's circle need to be plot for the test results

SOLUTION:

PROBLEM 22

GIVEN: The results of two consolidated-drained triaxial tests on a clay,

$$\text{Test I:} \quad \sigma_3' = 82.8 \text{ kN/m}^2 \quad \sigma_1' = 329.2 \text{ kN/m}^2$$

$$\text{Test II:} \quad \sigma_3' = 165.6 \text{ kN/m}^2 \quad \sigma_1' = 558.6 \text{ kN/m}^2$$

FIND: Determine the shear-strength parameters - that is c' and ϕ'

METHOD: A. Mohr's circle need to be plot for the test results

SOLUTION:

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clay:
