Shantilal Shah Engineering College- Bhavnagar

Applied Mechanics Department

B.E. 5th Semester (Civil Engineering)

(2150609) Soil Mechanics

Tutorial:1: Compaction & Consolidation of Soil

Q.1. A cylindrical specimen of a chohesive soil of 10cm diameter and 20cm lenght was prepared by compaction in amoudl. If the wet mass of the specimenwas 3.25kg and its water content was 15%, determine the dry denisity and the void ratio. If the specific grav ity of the particles was 2.7, fin the degree of saturation.

[Ans. 1.80gm/ml; 0.50;81%].

Q.2.The following are the results of a standard compaction test perfomed on a sample of soil.

Water Content (%)	7.7	11.5	14.6	17.5	19.7	21.2
Mass of wet soil (kg)	1.7	1.89	2.03	1.99	1.96	1.92

If the volume of the mould used was 950c.c. and the sepcific gravity of soil grains was 2.65, make necessary calulations and plot the water contetn -dry density curvve and obr ain the optimum water contetn and the maximum dry density.

[Ans. 15%;1.83 gm/ml]

Q.3. What are the factores that affect compation? Discuss in brief.

Q.4. What is the effect of compation on the engieering properties of the soil? How would you decide whether the soil should be compated the dry of optimum or the wet of opti–mum.

Q.5. What are the different methods of compatcion adopted in the field ? How would you select the type of rollter to be used?

Q.6 A footing has a size of 3.0 m by 1.50 m and it causes a pressure increment of 200 kN/m^2 at its base (Fig.1). Determine the consolidation settlement at the middle of the clay layer. Assume 2 : 1 pressure distribution and consider the variation of pressure across the depth of the clay layer. γ_w = 10 kN/m^3.

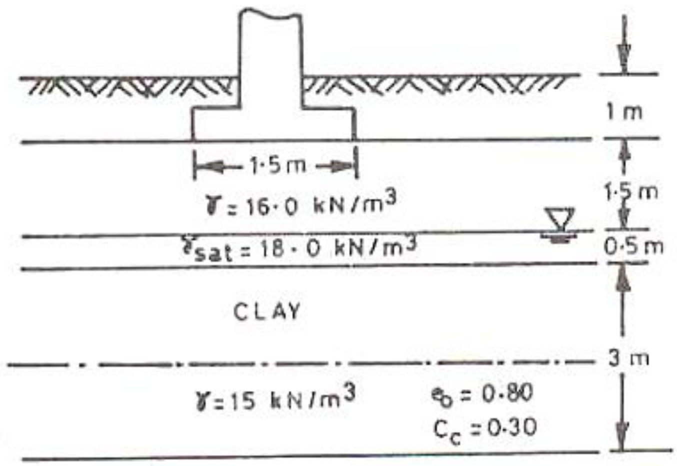

Fig.-1

[Ans. 99.41mm]

Q.7. A clay layer 4 m thick is subjected to a pressure of 55 kN/m^2. If the layer has a double drainage and undergoes 50% consolidation in one year, determine the coefficient of consolidation. Take Tv = 0.1%.If the coefficient of permeability is 0.020 m/yr, determine the settlement in one year and rate of flow of water per unit area in one year.

[Ans. 0.784 m^2/yr; 0.143m/yr; 0.072m^3/yr/m^2].

Q.8. Describe the consolidomctcr test. Show how the results of this test are used to pre dict the rate of settlement and the magnitude of settlement.

Q.9. Differentiate between primary consolidation and secondary consolidation.

Q.10. Differentiate between consolidation and compaction. Give examples.

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Tutorial:2: Shear Strength of Soil

Q.1. A series of direct shear tests was conducted on a soil, each test was crried was carried out till the sample faied. The followng resutls were obtaied.

Sample No.	Normal Stress (kN/m^2)	Shear Stress (kN/m^2)
1	15	18
2	30	25
3	45	32

Determine the cohesion intercept and the angle of shearing resistance.

[Ans. c =11kN/m^2. ϕ=26°].

Q.2 The following resuts were obtained from a series of consolidated undrained tests on a soil, in which the pore water pressure was not detemined. Determine the cohesionint ercept and the angle of shearing resistance.

Sample No.	Confining Pressure (kN/m^2)	Deviator stress at failure (kN/m^2)
1	100	600
2	200	750
3	300	870

[Ans. c =150kN/m^2. ϕ=24°].

Q.3. What is Mohr's strength theory for soils? Sketch typical strength envelops for a clean sand.

Q.4 Describe direct shear tes. What are its merits and demrits?

Q.5 Describe the triaxial shear tes. What are theadvanges of tiraxial sheart test over the direct shear test?

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Tutorial:3: Stability of Slopes & Earth Pressure

Q.1. A long natural slope in an overconsolidated clay (c' = 10kN/m^2, ϕ' = 25°, γ_{sat} = 20 N/m^2) is inclined at 10° to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a plane slip had developed at a depth of 5 m b elow the surface, determine the factor of safety. Take γ_w - 10 kN/m^3.

[Ans. 1.90].

Q.2. An unsupported slope is shown in Fig. 1. Determine the factor of safety against sliding for the trial slip surface. Take c = 50 kN/m^2, and ϕ = 0. The weight of the w edge ABD is 2518 kN and acts at a horizontal distance of 11 m from the vertical AO.

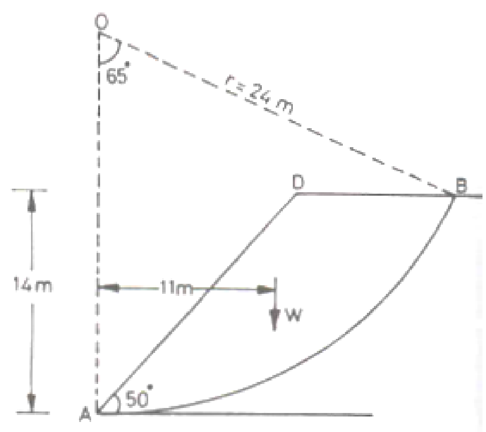

Fig.-1

[Ans. 1.18].

Q.3. What are the assumptions that are generally made in the analysis of the stability of slopes? Discuss briefly their validity.

Q.4. What are different types of slope failures?

Q.5. Derive an expression for the factor of safety of an infinite slope in a cohesionless soil. What is the effect of steady seepage parallel to the slope on the stability?

Q.6. Determine the lateral earth pressure at rest per unit length of the wall shown in Fig. 2. Also determine the location of the resultant earth pressure. Take K_0= 1-sinϕ' and γ_w- 10 kN/m^3.

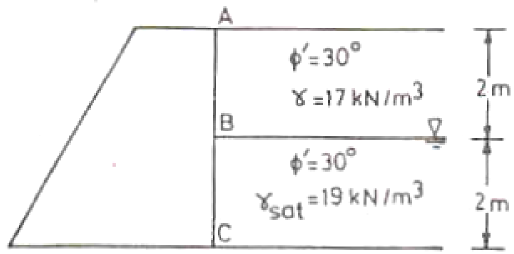

Fig.-2

[Ans. 80kN; 1.23m from base]

Q.7. Determine the active pressure on the retaining wall shown in Fig. 3, Take γ_w = 10 kN/m^3.

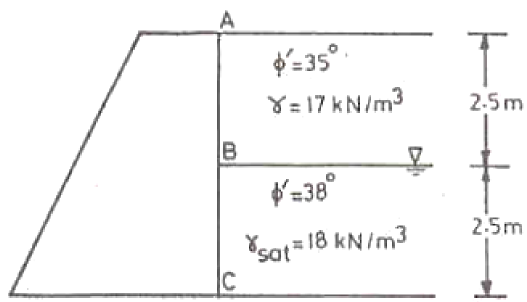

Fig.-3

[Ans. 77.0kN; 1.44m from base]

Q.8. What are different types of earth pressure ? Give examples.

Q.9. Define earth pressure at rest. Show the earth pressure distribution on a retaining wall, assuming the soil is dry.

Q.10. What are the assumptions in Coulombs theory? Compare Rankine's theory and Coulombs theory.

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Tutorial:4: Stress Distribution of Soils

Q.1. Calculate the vertical stress at a point P at a depth of 2.5 m directly under the c entre of the circular area of radius 2 m and subjected to a load 100 kN/m2. Also c alculate the vertical stress at a point Q which is at the same depth of 2.5 m but 2. 5 m away from the centre of the loaded area.

[Ans. At P point 52.39kN/m^2; at Q point 20kN/m^2].

Q.2. An L— shaped building in plan (Fig. 1) exerts a pressure of 75 kN/m^2 on the soil . Determine the vertical stress increment at a depth of 5 m below the interior corner P.

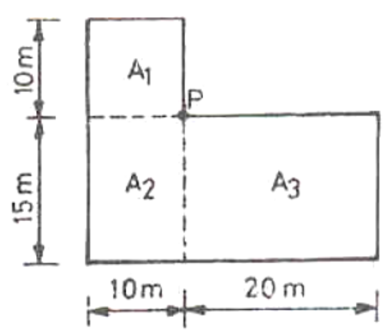

Fig.-1

[Ans. 53.65kN/m^2].

Q.3. Derive an expression for the vertical stress at a point due to a point load, using Boussinesq's theory.

Q.4. Explain Westergaard's theory for the determination of the vertical stress at a p oint. How is it different from Boussinesq's solution ?

Q.5. Discuss the basis of the construction of Newmark's influence chart. How is it used ?

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Tutorial:5: Basics of foundation

Q.1. What are different types of shallow foundations? Explain with the help of sketches.

Q.2. How would you fix the depth of foundation ? Discuss Rankine's formula for the minimum depth.

Q.3. Discuss various types of loads that are to be considered in the design of foundations.

Q.4. Describe the general procedure for the design of a shallow foundation.

Q.5. Describe the steps in choosing types of foundation.