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Section :- A

Subject: Soil Mechanics.

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Question #1(A)

Answer #(A)

(1) Shear strength:-

The maximum resistance to shear stresses before the failure is known as shear strength.

→ The shear stresses develop when the soil sample is subjected to direct comparision.

⇒ Main Constituents of Shear strength.

1. Friction resistance of Shear Strength.

Friction resistance offered by particle due to their shape and surface.

2- Cohesion and Adhesive.

3- Structural resistance offered by interlocking of particles.

2) Isobar:- (Pressure Bulb):-

The points below the ground surface have same vertical stresses. In other words, Isobar is a contour of equal stress.

Isobar is useful for determining the effect of load on the vertical stresses of various points Shape of Isobar is similar to electrical bulb or onion.

3) Compaction of Soil:-

Soil compaction is defined as the method of mechanically increasing the density of soil in construction, this is a significant part of the building process.

If performed improperly, settlement of the soil could occur and result in unnecessary maintenance costs or structure failure. Almost all types of building sites and construction projects utilize mechanical compaction techniques.

4- Effective Stresses:-

It is the combined effect of total stress and pore pressure that controls soil behaviour such as shear strength, compression and distortion. The difference between the total stress and the pore pressure is called the effective stress:

Effective Stress = total stress - Pore pressure

5) Shear Parameters-

Shear strength parameters, that is Cohesion (c) and angle of internal friction (ϕ) of the rock mass. Estimates of these parameters are usually not based on extensive field tests.

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Question #1(B)

Answer #1(B) Boussinesq's Theory of Vertical Stresses:-

His theory (1895) is based on following assumptions:

1) The soil medium is elastic:
The modulus of elasticity throughout the soil sample.

2) The soil medium is homogeneous:-
The properties of soil are same at every point of the soil sample).

3) The soil is Isotrophic:-
The properties of soil are same in every direction of soil sample.

4) The soil medium is Semi-infinite:
(it is not total infinite).

$$S_z = \frac{Q}{z^2} \times K_B$$

$$K_B = \frac{3}{2\pi}\left[\frac{1}{1+\left(\frac{x}{z}\right)^2}\right]^{5/2}$$

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Question # 2 (A)

Answer :-

Given Data:-

$V = 65\ ml = 0.000065\ m^3$ As, $1ml = 10^{-6}\ m^3$

$W = 0.96\ N.$

$W_d = 0.785\ N,$

$G_s = 2.65.$

Required:

$S = ?$

Solution:-

$$\gamma_B = \frac{\gamma_w \times (G_s + e x s)}{(1+e)} \rightarrow (1)$$

$$\gamma_B = \frac{W}{V} = \frac{0.96}{0.000065}$$

$$= 14769\ N/m^3.$$

$\gamma_w = 9800\ N/m^3$

As, $\gamma_s = \frac{W_s}{V_s} = V_s = 0.000030\ m^3$

$$e = \frac{V_v}{V_s}$$

$$V_s = \frac{W_s}{\gamma_s} = \frac{0.785}{25970}$$

$$e = \frac{0.000035}{0.000030}$$

Also,

$V = V_v + V_s$

$V_v = V - V_s$

$V_v = 0.000065 - 0.000030$

$V_v = 0.000035\ m^3$

$e = 1.167$

But,

$$G_s = \frac{\gamma_s}{\gamma_w}$$

$\gamma_s = G_s \times \gamma_w$

$\gamma_s = 2.65 \times 9800$

$\gamma_s = 25970\ N/m^3$

Putting all the values in (1)

Solve for it 'S"

$S = 0.527$ or, 52.7%

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Question # No 2 (B)

Given data:-

Wt. of wet Soil (kg)	1.89	2.14	2.17	2.21	2.22	2.16	2.07
Water Content (%)	5	8	9	11	12	15	20

Volume = 950 cm^3

Required data:-

γ_d = ?

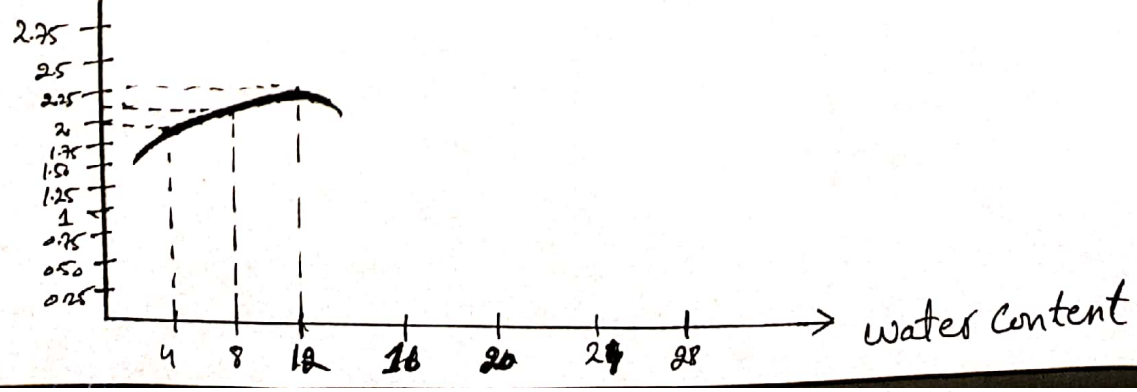
OMC = ?

Compaction Curve = ?

Solution:-

As we know that,

Wt of wet Soil (g)	1890	2140	2170	2210	2220	2160	2070
water content (%)	5	8	9	11	12	15	20
Bulk unit weight % 1890/950 (γ_B)	1.98	2.75	2.28	2.33	2.34	2.27	2.18
γ_d $\gamma_d = \frac{\gamma_B - 1.98}{1 + w + 0.05}$	1.89	2.08	2.09	2.10	2.09	1.97	1.82
γ_d			γ_d max =	2.10			



Question #3(A)

Answer #3(A)

California Bearing Ratio Test (CBR):-

This method is used to find out the Strength of Subgrade used for the design of road. Developed by California state of highway department.

⇒ In this method of 5kg of soil specimen is taken Water is added to it unit it reaches to O.M.C.

→ Then the CBR mould is cleaned.

→ Then mould is filled with prepared soil Sample, 1/3 part of the mould is filled. The layer is compacted by giving 56 blows distributed.

→ In this way the mould is filled in five layers after the fifth layer the excess of soil is struck off. Then the mould which containing the soil specimen is placed in CBR machine, load is applied in such away that the Penetration load rate is 1.25 mm/min or 0.05"/min.

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CBR Value =

$$\frac{\text{Load required for 0.1" Penetration of the Plunger in the soil Sample}}{\text{Standard load required for 0.1" penetration of the Plunger in the standard material (crushed stones)}} \times 100$$

Standard Load:-

0.1" penetration = 3000 lbs

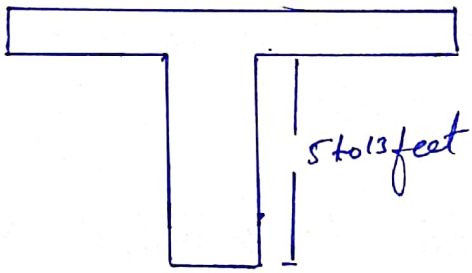
0.2" penetration = 4500 lbs

Question # 03 (B):-

Answer

⇒(1) Probing:- (Probing or sounding)

It consist of a rod, dia of rod is 1/4 inch to 1 inch length of rod will be 5 to 13 feet it ~~test~~ consist of handle.



⇒(2) Auger Boring:- → Hand operated Auger

→ Power operated Auger

This method is used for soil exploration it is a sample method.

Maximum depth for this exploration is 10m or 32 feet.

⇒ 3) Test Pits:-

Maximum depth of pit is 5m to 6m this test is perform where boring is difficult.

Especially for gravity soil.

4) Types of Deep Exploration:-

a) Wash boring:-

Consist of steel pipe which dia 2 to 8 inch and length is 5 to 10 ft.

In this method ~~is~~ pump is used to pump out soil and water, then the soil particles are allowed to settle and water is removed then the soil is tested in lab.

b) Percussion Boring:-

This percussion drilling is done upto a depth of 25m. It is also called cable tool drilling.

→ This is a method of heavy equipment.

→ This expensive method is time consuming process.