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I.D — 7666

Subject — Soil Mechanics

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"FINAL PAPER"

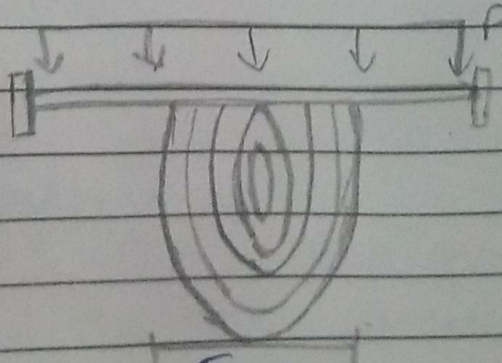
Quet:- 1 a:-

Define the following:-

Isobar:-

It is a line or curve joining the points of some stresses (vertical) is turned as Isobar.

→ Iso means same and bar means pressure/stress
→ It will also occur below the surface
→ It is contour of equal vertical stresses.
→ The area covered by the isobar is called a pressure bulb
→ Mostly the failure or settlement takes place here in line zone.
→ The shape of isobar is just like elettic bulb or onion
→ This is the zone in which stresses have significant effect on the settlement of structure.



Isobar

2- Effective Stresses:-

The stress which are due to self weight of the soil sample is termed as effective stresses

⇒ Mathematically :-

$$\sigma_e = \gamma \times z$$

3- Compaction:-

The process in which the soil particles are brought close to each other in order to improve the engneering properties of soil by some external effect.

⇒ The compaction mostly take place in sand soil

⇒ In this process the soil particles are come close to each other because the air voids are reduced or removed in the soil.

4- Shear Strength:-

The resistance offered by by the soil to the shear stresses before the failure of soil - It is termed as shear strength

Shear strength produced when two surface slides with eachother. The shear strength is the principal property of soil which directly or indirectly effect other properties of soil.

5. Shear Parameter:

The shear strength Parameters cohesion (C) and friction angle (ϕ) can be determined by different tests for different types of soil. The horizental force or shearing is applied till the failure. The shearing is normally applied on constant rate of strain.

Qust :- 1 b:-

What are the assumption..... condition?

Buossinesq's Theory of Venticle stress

His Theory (1895) is bassed on following assumptions

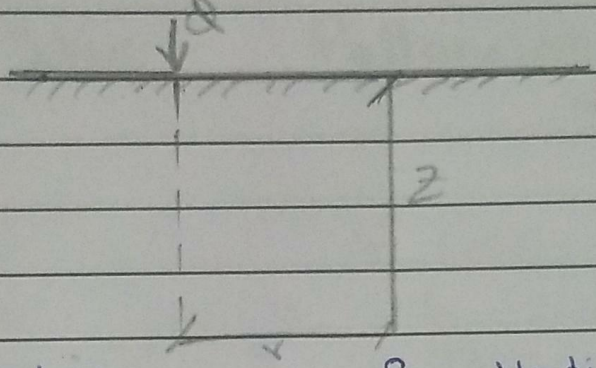
1- The soil medium is elastic. (The modulus of elasticity throughout the soil sample)
2- The soil medium is homogenous (The propertics of soil are same at every point of the soil sample)
3- The soil sample is weight less
4- The soil is isotroopic.
(The properties of soil are same in every direction of soil sample)
5 The soil sample is free from residual stress
6 The soil medium is some infinite (It is not total Infinite)

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

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

Cases of Point load Condition:-

Case 1:-

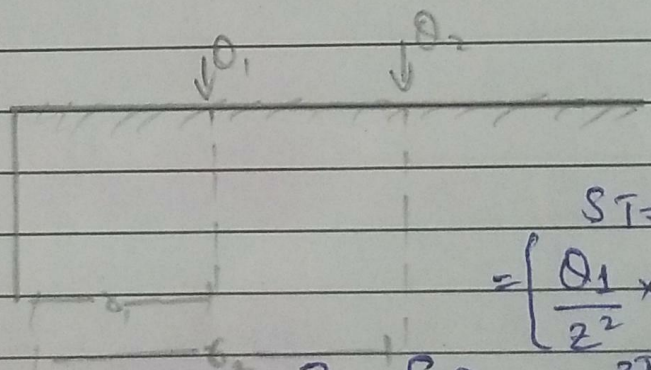


$$\delta_z = \frac{Q}{z^2} \times K_B$$

δ_z = Verticle stress at depth z
Q = Point or concentric load
K_B = Bousinesq's Constant

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

Case 2 :-

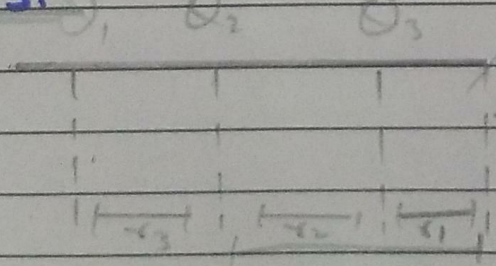


$$S_T = S_1 + S_2$$

$$= \left[\frac{Q_1}{z^2} \times K_{B_1}\right] + \left[\frac{Q_2}{z_2} \times K_{B_2}\right]$$

$$\text{Total Verticle Stresses} = \left[\frac{Q1}{z^2} \times \frac{3/2}{\left[1+(r_1/z)^2\right]^{5/2}}\right] + \left[\frac{Q_2}{z^2} \times \frac{3/2}{\left[1+(r_2/z)^2\right]^{5/2}}\right]$$

Case 3:-



$$S_T = S_1 + S_2 + S_3$$

$$= \frac{Q_1}{z^2} \times K_{B_1} + \frac{Q_2}{z^2} \times K_{B_2} + \frac{Q_3}{z^2} \times K_{B_3}$$

$$\left[\frac{Q_1}{z^2} \times \frac{3/2\,\bar{\lambda}}{\left[1+(r_1/z)^2\right]^{5/2}}\right] + \left[\frac{Q_2}{z^2} \times \frac{3/2\,\bar{\lambda}}{\left[1+(r_2/z)^2\right]^{5/2}}\right] +$$

$$\left[\frac{Q_3}{z^2} \times \frac{3/2\,\bar{\lambda}}{\left[1+(r_3/z)^2\right]^{5/2}}\right]$$

Que :- 2A

A sample of soil .....
..... saturation ?

Solution :- Given data :-

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

$w = 0.96 N$
$w_s = 0.785 N$
$G_s = 2.65$

Required :-

$S = ?$

Solution :-

$$\gamma_B = \frac{\gamma_w \times (G_s + e \times s)}{1 + e} \quad \text{---(1)}$$

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

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

given value of $\gamma_w = 9800\ N/m^3$

$e = V_v / V_s$

As we know that $\Rightarrow V_s = 0.000030 m^3$

Also find $V_v \Rightarrow \quad V = V_v + V_s$

$$V_v = V - V_s$$

$$V_v = 0.000065 - 0.000030 \Rightarrow 0.000035 m^3$$

$$\boxed{V_v = 0.000035\ m^3}$$

So As $\quad e = \frac{V_v}{V_s}$

Putting values

$$e = \frac{0.000035}{0.000030} \Rightarrow \boxed{1.167}$$

As

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

But

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

$$\gamma_s = G_s \times \gamma_w$$

$$\gamma_s = 2.65 \times 9800 \Rightarrow \boxed{25970\ N/m^3}$$

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So

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

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

Putting values

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

$$V_s = 3.022 \times 10^{-5}$$

Putting all value in eqn (1)

$$\gamma_B = \frac{\gamma_w \times (G_s + e \times S)}{(1+e)}$$

$$S = \frac{G_s \times \gamma_B - e}{e + \gamma_w}$$

$$S = \frac{2.65 \times 14769 - 1.167}{9800 - 1.167}$$

$$S = 0.527 \quad \text{or} \quad 52.7\%$$

Que:- 2b:-

The Following data was obtained From ..... samples:

Soil sample gram	Water Content
1890	5
2140	8
2170	9
2210	11
2220	12
2160	15
2070	20

The volume of mold is 950 cm^3

Find:-

(i) γ_d
(ii) OMC
(iii) Compaction Curve

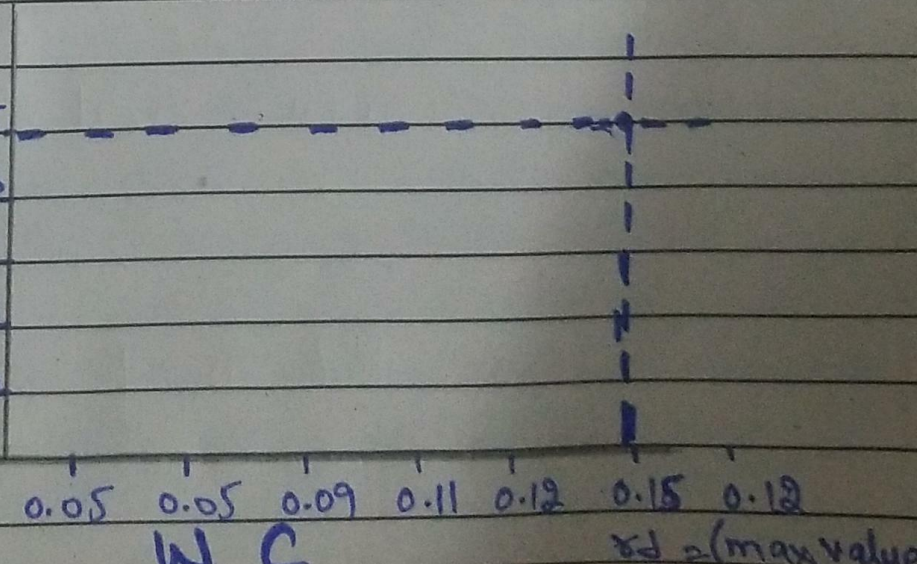
Solution:-

Volume of model = 950 cm^3

wt of Sample (g)	Water Content %	Bulk Unit wt g/cm³
→ 1890	5	1890/950 = 1.989
→ 2140	8	2140/950 = 2.253
→ 2170	9	2170/950 = 2.284
→ 2210	11	2210/950 = 2.326
→ 2220	12	2220/950 = 2.337
→ 2160	15	2160/950 = 2.274
→ 2070	20	2070/950 = 2.179

γ_d (g/cm³)
→ 1.894
→ 2.086
→ 2.095
→ 2.095
→ 2.086
→ 1.977
→ 1.86

Compaction Curve



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As we know that

$$\gamma_d = \frac{\gamma_b}{1+w}$$

"eg"

$$\gamma_d = \frac{1.98}{1+0.05} = 1.89$$

Ques 3a)

Explain CBR ---------- investigation:-

California Bearing ratio test:

CBR Test:-

This method is used to find out the strength of subgrade used for the design of road. It is developed by California state of highway department.

In this method 5kg of soil speciman is taken then water is added to it upto it reaches to 0.9C. Then the CBR mould is cleared. Then mould is filled with prepared soil sample 1/3 put of the mould is filled. The layer is compacted by giving 56 blows distribution. In this way the mould is filled in 5 layes after the fifth layer the soil placement is stoped. Then the mould which containing the soil sample specimen is place in CBR machine.

load is applied is such away that the penetration load rate is 1.25mm/min or 0.5"/min

CBR Value = $\frac{\text{load required for Penetration of the plunger in soil}}{\text{Standard load required for 0.1" Penetration of plunger in standard material (crush stones).}} \times 100$

Vertical stresses Under Circular area

$S_z = q + I_f$

$I_f = I_c = 1 - \frac{1}{\left[1+\left(\frac{D}{2z}\right)^2\right]^{3/2}}$

$I_f = I_C = 1 - \frac{1}{\left[1+\left(\frac{r}{z}\right)^2\right]^{3/2}}$

Vertical stresses Under uniformly loaded rectangular or Square area.

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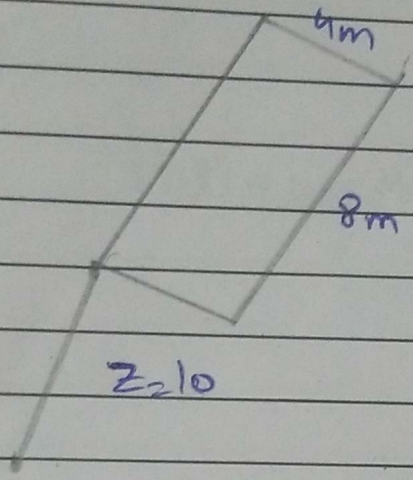

$$S_z = \frac{\Sigma}{4\pi}\left[\frac{2mn(m^2+n^2+1)^{1/2}\times(m^2+n^2+2)+\tan^{-1}\times(2mn(m^2+n^2+1)^{1/2}}{(m^2+n^2+m^2n^2+1)(m^2+n^2+1)\quad(m^2+n^2+m^2n^2+1}\right]$$

$$m = \frac{L}{Z}, \quad n = \frac{B}{Z}$$

The longer side will be "L"
The shorter side will be "B".

Qu 3 b) :-

Explain following . . . detail?

Answer:-

1- Poobing :-

→ It consists of rod
→ The dia of rod is 1/4" - 1"
→ Having a handle at the top of apparatus, for pushing in and out purpose

2. Auger Boring :-

→ This is performed by

- Hand operated Auger
- Power operated Auger

→ This is a simple method of soil exploration
→ Max depth for this exploration 10m(33)

3. Test Pits:-

→ Max depth of this pit is 5m-6m.

→ This test pit are performed where boris is difficult.

→ Specially in case of gravelly soil.

4. Wash boring:-

→ It consist of steel pipes.

→ It's diameter is equal to 2"-8"

→ It's length is equal to 5'-10".

→ In this method a pump is used to pump out soil + water is removed then the soil is tested in labs.

5. PERCUSSION BORING:-

→ This percussion boring is performed upto a depth of 25m

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→ This is also called cable tool drilling

→ This is a method of heavy equipment

→ This is an expensive method time consuming boring.