NASRULLAH

7870

"B"

6th

Geothicnical Engineering

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Q1) (A) Define the following terms?

Angular Distortion:-
It is Defined as when two foundation Support wall/columns Settled unequally it mens the structure is subjected to angular distortion

Compressive index:- Compressive index Deformation charateristics of overconsulated soil it describes variation of the void ratio "e" as a function of charge of effective stress

$$C_c = \frac{\Delta e}{\log_{10}(P_2/P_1)}$$

Plastic Distortion:-
plastic Distortion is That state in a soil after which the soil could not resist more stress i.e ultimate shearing resistance of soil is ~~acheid~~ acheid.

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Ultimate bearing capacity:

It is the maximum pressure at the foundation of structure causing shear failure in the soil it is Denoted by "q_u"

Poisson Ratio of soil:

It is Defind as the negative ratio of transversal strain to the axial strain in an elastic material which is subjected to uniaxial stress

Q1) (B) A 6m tall cantilever wall retaining the soil that has following properties

- $c = 0$
- $\phi = 30°$
- $\gamma = 19.2\ kN/m^3$

The ground surface behind the wall is inclined at a slope of 3 horizontal and 1 vertical. The wall has moved sufficiently to develped active condition

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Determine the total normal and shear forces acting on the back of this wall using Rankine's theory.

Given Data

$H = 6m$, $C = 0$. $\phi = 30°$

$\gamma = 19.2 \ kN/m^3$, Slope $= H = 3 . V = 1$

Req

$\frac{N_a}{b} = ?$, $\frac{V_a}{b} = ?$

$$\frac{P_a}{b} = \frac{\gamma \times H^2 \times K_a}{2}$$

$\Rightarrow$ $\tan\beta = 1/3$

$\beta = \tan^{-1}(1/3)$

$\boxed{\beta = 18°}$

$$K_a = \cos\beta \times \frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}$$

$$K_a = \cos(18) \times \frac{\cos(18) - \sqrt{\cos^2(18) - \cos^2(30)}}{\cos(18) + \sqrt{\cos^2(18) - \cos^2(30)}}$$

$\boxed{K_a = 0.395}$

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NOW,

$$\frac{Pa}{b} = \frac{\gamma \times H^2 \times Ka}{2}$$

$$= \frac{19.2 \times 6^2 \times 0.395}{2}$$

$$\frac{Pa}{b} = 136.512 \ KN/m$$

$$\frac{Na}{b} = \frac{Pa}{b} \cos\beta$$

$$= 136.512 \cos(18)$$

$$\boxed{\frac{Na}{b} = 129.83 \ KN/m}$$

→ $$\frac{Va}{b} = \frac{Pa}{b} \sin\beta$$

$$= 136.512 \sin(18)$$

$$\boxed{\frac{Va}{b} = 42.18 \ NK/m}$$

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Q2 (A) What is bearing capacity. Also write factor Effecting bearing capacity?

Bearing capacity is the engineering property of a soil due to which the soil resist the applied load it is also called "internal strength of the soil" it is denoted by "q"

Factor Effecting bearing capacity

Relative capacity:

* Greater the relative density of soil, higher will be the value of angle internal friction which is denoted by "Ø" higher the value of angle of friction higher will be values of Terzaghi's bearing factors (Nc, Nq, Nr)

* Greater the value of Nc, Nq, Nr will result into higher value of bearing capacity.

* The soil having enough relative density will have enough bearing

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capacity.

$$\gamma_{relative} = \frac{e_{max} - e}{e_{max} - e_{min}}$$

Depth of Footing (DF):-

The bearing capacity of soil increase with the increase of depth of the footing. The increase will be maximum for the dense soil as compared to lose soil.

Breadth of Footing:

The bearing capacity of soil increase with the increase in the breadth of the footing. The increase will be maximum for dense soil as compared to loose soil.

Unit weight soil:-

The bearing capacity of soil increase with the increase in the unit weight of soil. This increase will be maxim

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For Dense Soil as compared to loose Soil.

water table:

If the water table increases the bearing capacity will Decrease b/c of the liquification of the Soil thus its bearing capacity will be Decreased.

Q2 (B) What is the maximum safe load which can be supported by rectangular footing 2m by 3m with a safty of 3. the base of the footing is at 1.6m below the ground surface - the unit weight of Soil is 18 KN/m^3. the angle of shear resistance $Q = 20°$ ($N_c = 14.8$, $N_q = 6.4$, $N_\gamma = 2.9$). Use Meyerhof's analysis unit cohesion $C_u = 20KN/m^2$

Given Data

$L = 3m$, $B = 2m$, $Df = 1.6m$

$\gamma = 18KN/m^3$, $Cu = 20KN/m^2$

$F.O.S = 3$, $\phi = 20°$

Req

$q_s = ?$

formula

$q_u = CN_c \cdot s_c d_c i_c + \bar{q} N_q \cdot s_q d_q i_q + \frac{1}{2} \gamma B N_\gamma \cdot s_\gamma d_\gamma \cdot i_\gamma$

As there is no "β" ∴ $i_c = i_q = i_\gamma = 1$

Shape Factor:-

$\alpha = (\phi/2 + 45)$

$\alpha = (20/2 + 45)$

$\boxed{\alpha = 55°}$

$s_c = 1 + 0.2 \frac{B}{L} \tan^2\alpha$

$1 + 0.2 (2/3) \tan^2(55)$

$= 1.27 \approx 1.3$

$s_q = s_\gamma = 1 + 0.1 \frac{B}{L} \tan^2\alpha$

$= 1 + 0.1 \, 2/3 \tan^2(55)$

$= 1.14$

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Depth Factor:-

$d_c = 1 + 0.2 \frac{D}{B} \tan\alpha$

$= 1 + 0.2\ 1.6/2\ \tan(55)$

$= 1.23$

$d_r = d_q = 1 + 0.1 \frac{D}{B} \tan\alpha$

$1 + 0.1\ 1.6/2\ \tan(55)$

$= 1.11$

putting values in the formula

$(20 \times 14.8 \times 1.3 \times 1.23 \times 1) + ((18 \times 1.6) \times 6.4 \times 1.1 \times 1.11 \times 1)$

$+ (0.5 \times 20 \times 2 \times 2.9 \times 1.11 \times 1.14 \times 1)$

$\boxed{q_u = 762\ KN/m^2}$

$\rightarrow q_{n.u} = q_u - \bar{S}$

$762 - (18 \times 1.6)$

$= \boxed{733.2\ KN/m^2}$

$\rightarrow q_{n.s} = \frac{q_{n.u}}{F.O.S} = \frac{733.2}{3} = 244.4\ KN/m^2$

$\rightarrow q_s = q_{n.s} + \bar{S} = q_{n.s} + \gamma D_f$

$= 244.4 + (18 \times 1.6)$

$\boxed{q_s = 273.2\ KN/m^2}$

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total safe load on rectangular footing

$A \times q_s = (2 \times 3) \times 273.2$

$= 1639.2\ kN$

Q3 (A) what is Settlement. what are it's types explain in Detail?

Settlement:-

when load is applied on the ground surface that will produce effective vertical strain will be produced as result of which the movement will occur in the downward Direction this downward movement is called Settlment

Types of settlment:-

on the basis of movement of the structure it is Devided into two types

1- total settlment
2- Defferential settlment

Total Settlment:-

it is also called uniform settlement

In This type of Settlment each part of Structure will settle equaily In uniform Settlment the failure of the structure is not much as considered as with Differen tail Settlment. The total settlment mostly take place in a structure which are constructed in rigid footing (In this type of Settlment the utility services such as water supply, electricity, sewage line, telephone etc may be Decreased and the structure will remain sound.

Limitation For total Settlment:

* The soil to which the load is to be transfer should be sufficient in bearing to resist the load which is to be applied on it

* To spread the comming load over a Large Area

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Differential Settlment:-

Differential settlment in Different part of the same structure is called Differential settlment. Differential settlment is more danger as compared with ideal uniform settlment, b/c it causes more Damage to a structure as compared to total settlment.

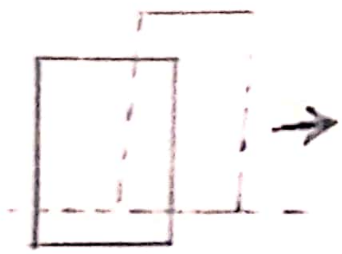
There are two types of Differential settlment.

i) Tilt

ii) Angular settlment.

Tilt:-

If the entire structure rotates due to unequal settlment is called tilt



Angular Distortion:-

When two foundation support wall/columns settle unequally it means the structure

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is Subjected to angular distortion

Q3 (B) A soil has compressive index $C_c = 0.31$. At a stress 130 KN/m² the void ratio was 1.02 calculate

1- The void ratio if the stress on the soil is increased to 170 KN/m²

2- The total settlement of the stratum of 5m thickness.

Given Data

$C_c = 0.31$, $P_1 = 130\ KN/m^2$

$e_0 = 1.02$, $P_2 = 170\ KN/m^2$

$H = 5m$

Req

$e_1 = ?$

$S_c = ?$

$$\rightarrow C_c = \frac{\Delta e}{\log_{10}(P_2/P_1)}$$

$$C_c = \frac{e_0 - e_1}{\log_{10}(P_2/P_1)}$$

$$0.31 = \frac{1.02 - e_1}{\log_{10}(170/130)}$$

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$$e_1 = 0.983$$

NOW

$$S_c = \frac{H}{1+e_0} \times C_c \log_{10}(P_2/P_1)$$

$$\frac{5}{1+1.02} \times 0.31 \log_{10}\left(\frac{170}{130}\right) \times 1000\,mm$$

$$S_c = 89.4\,mm$$

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