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Sec : A
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Q.No 1

A/ Define the following terms:

1) Plastic Equilibrium

State of stress within a soil Mass or a Portion thereof that has been deformed to such on extent that its ultimate shearing resistance is Mobilized.

2/ Angular Distortion

B, is the ratio of the differential settlement δ and the distance between two Points. it is crucial to understand before hand the range of tilt and angular distortion that will possibly couse unacceptable damage to the structure.

3) compressive index

The compression index is used to find the settlement in the normally consolidated clay. The total stress applied is large than the stress in the field to which the soil sample has been undergone in the past. This kind of clayey soil is said to be normally consolidated clay.

4) Ultimate Bearing capacity:

In geotehnical engineering bearing capacity is the capacity is the theoretical Maximum Pressure which failure: allowable bearing capacity divided by a factor of safety

5) Poission Ratio of Soil:

Plainly, Poisson's ratio of (n) is the negative of ratio of transversal strain to the axial strain in an elastic Material which is subjected to an uniaxial stress

Material clay: 0.40 – 0.50
clay: 0.30 – 0.45
Sand: 0.20 – 0.45

Q.No2/ What is Bearing capacity. Also write factors effecting Bearing capacity.

Ans Bearing capacity:

In geotechnical engineering bearing capacity is the capacity of soil to support the loads applied to the ground. The bearing capacity of soil is the maximum average contact pressure between the foundation and the soil which should not produce shear failure in the soil.

factors effecting Bearing capacity.

1) Effect of shape of footing on Bearing capacity:

The shape of footing is an important parameter which governs the ultimate bearing capacity of the soil. In general strip, square rectangular and circular shaped footing are used for soil 1 by keeping other parameters constant of soil is studied. The values of ultimate bearing capacity for soil-1 are determined by methods ~~for soil 1~~ given by Terzaghi and Bureau ~~given~~ of indian standard. These values are tabulated in table.

~~Table No. Picture.~~

2/ Effect of depth of Footing on Bearing capacity

The depth of footing is important parameter which governs the ultimate bearing capacity of soil. For different soil by keeping other parameters constant, the effect of depth of strip footing on ultimate bearing capacity of soil is studied. In this study it is assumed that irrespective of properties of soil remain constant.

Effect of width of footing on Bearing capacity

The width of footing is important parameter which governs the ultimate bearing capacity of the soil. For different soils by keeping other parameters contant, the effect bearing capacity of soil is studied.

The values of ultimate bearing

of soil is studied. The values of ultimate bearing capacities determind for different soil by is code Method are shown in Table.

QN3/ What is settlement. What are its types explian in detail?

Ans/ Settement

In geotechnical engineering settlement is defined as the vertical movement of the ground, generally caused be settlement is most likely to occur when increased vertical stresses are applied to the ground on or above soft or loose soil stata

Types

1/ Immediate settlement

2/ consolidation settlement (ΔHc)

3/ Secondary Settlement / creep (ΔHc)

4/ Immediate settlement computation.

5/ Secondary compression / creep
6/ Sands

7/ Clays.

1/ Immediate Settement:

Immediate settement takes place as the load is applied or within a time period of about 7 days.

Predominate ~~se~~ in cohesion less soil and unsaturated clay.

2/ Consolidation settlement (ΔHC)

Consolidation settlements are time dependent and take months to years to develop. The leaning tower of Pisa in italy has been undergoing consolidation settlement for over 700 years. The lean is caused by consolidation settlement being greater on one side. ~~This~~ This however, is extreme case. The principal settlements for most projects occur in 3 to 10 year.

3/ **secondary settlement / creep (ΔH_c)**

occurs under constant effective stress due to continous rearrangement of clay particles into a more stable configuration.

predominates in highly plastic clays and organic clays.

④ **Immediate settlement calculations:**

Immediate Settlement computation Formula

$$\Delta H_i = q_o B \frac{1-u^2}{E_s} M I_s I_E$$

$$I_s = I_1 + \frac{1-2u}{1-u} I_2$$

5/ **secondary compression / creep**

After primary consolidation the soil structure contines to adjust to the load for some additonal time.

To Find secondary consolidation settlement in the field (ΔHs)

$$\Delta Hs = \Delta Ca \log \frac{t_{100}(f) + \Delta t}{t_{100}(f)}$$

6) **Sands**

Maximum total settlement = 40 mm for isolated footings = 40 to 65 mm for rafts

Miximum differential settlement between adjacent columns = 25 MM

7) **clays**

Maximum total settlement = 65 mm for isolated footings = 65 to 100 mm for rafts

Maximum differential settlement between adjacent colums = 40 MM.

The differential settlement may also be evaluated in terms of the angular distortion given by: ($\Delta H diff$) = Δ / L

Question 01(b)

A 6M tall contilevers will retaineng th Soil that has the following prperties.

$c = 0$

$\phi = 30$

$\gamma = 19.2\ KN/M^3$

And the groud surface bewind the wall is inclined at a shape of 3 horizental and vertical The wall has Moved sufficently to develop active conditio

Given data :-

$H = 6M$

$c = 0$

$\phi = 30°$

$\gamma = 19.2\ KN/M^2$

slope = Horizental = 1
vertical = 3

Required:-

$\frac{Na}{b} = ?$

$\frac{Va}{b} = ?$

Solution :-

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

$B = \tan B (\frac{1}{3})$

$B = 18^{0}$

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

$$Ka = \cos(18) \times \frac{\cos(18) - \sqrt{\cos^{2}(12) - 113^{2}(3c)}}{\cos(18) + \sqrt{\cos^{2}(16) - \cos^{3}20)}}$$

$Ka = 0.3948$

$Ka = 0.395$

Now

$$\frac{Pa}{b} = \frac{19.2 \times (6^{2}) \times 0.395}{2}$$

$= 136.512 \text{ KN/m}$

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

$= 136.512 \times \cos(18)$

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

$$\frac{V_a}{b} = \frac{P_a}{b} \sin\beta$$

$$= 136.512 \times \sin(18)$$

$$\boxed{\frac{V_a}{b} = 42.18 \text{ KN/M}}$$

Question 02

(b)

What is the Maximum safe load which can be supported by rectangular footing 2m by 3M with a safety Factor of 3.

Given data ::

$L = 3M$

$B = 2M$

$D_f = 1.6M$

$F.o.S = 3$

$\gamma = 18 \text{ KN/m}^3$

$c = 20 \text{ KN/m}^3$

$\phi = 20$

Required ::

$q_s = ?$

Solution:

$$q_u = cN_c \cdot S_c d_c i_c + qN_q \cdot S_q d_q + \frac{1}{2}\gamma N_\gamma S_\gamma d_\gamma i_\gamma$$

First for the shape factor:

$\alpha = (45 + \frac{\phi}{2})$

$= 45 + \frac{20}{2}$

$= 55^{0}$

$S_c = 1 + 0.2 \frac{B}{L} \tan^2 55$

$= 1.27 \simeq 1.3$

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

$= 1 + 0.1 \frac{2}{3} \tan^2 55$

$\boxed{= 1.14}$

Depth Factor:

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

$= 1 + 0.2 \frac{1.6}{2} \tan 55$

$= 1.23$

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

$= 1 + 0.1 (\frac{1.6}{2}) \tan 55$

$= 1.11$

Now Putting values:

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

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

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

$q_u = 762 \ KN/m^2$

$q_{nu} = q_u - \bar{\sigma}$

$762 - (18 \times 1.6)$

$733.2 \ KN/m^2$

$q_{n.s} = \frac{q_{nu}}{F.O.S}$

$= \frac{733.2}{3} = 244.4 \ KN/m^2$

$= 244.4 + (18 \times 1.6)$

$273.2 \ KN/m^2$

Total safe load on rectangular footing $A \times q_s = (2 \times 3) + 273.2$

$= 1639.2 \ KN$

Question 03

(b) A soil has compresive index $C_1 = 0.31$ at a stress $130\ KN/m^2$ the void ratio was 1.02 calulate.

Given data

$C_1 = 0.31$

$P_1 = 130\ KN/m^2$

$e_o = 1.02$

$P_1 = 170\ KN/m^2$

$H = 5M$

Required:

$e_1 = ?$

$S_c = ?$

solution:

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

$$= \frac{e_o - e}{\log_{10}\left(\frac{P_2}{P_1}\right)}$$

$$0.31 = \frac{1.02 - e_1}{\log_{10}\left(\frac{170}{30}\right)}$$

$$\boxed{e_1 = 0.983}$$

Now

$$S_1 = \frac{H}{1+e_o} \times C_c \log_{10}\left(\frac{P}{P_1}\right)$$

$$= \frac{5}{141.02} \times 0.31 \log\left(\frac{170}{130}\right) \times 1000$$

$$2.47 \times 06\,3611 \times 1000$$

~~0.08920 x 1000~~

$$0.08920 \times 1000$$

$$\boxed{\delta c = 89.39\,MM}$$