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Q1 Define the following terms.

Ans

1) Plastic Equilibrium.

In this state the soil will real to failure or verge to failure.

2) Angular Distortion:

When two foundations support wall or column settle unequally it means the structure is subjected to angular distortion.

3) Compressive Index:

The compressive Index is used to find the settlement in the normally consolidated clay. The total stress applied is larger 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:

It is the least pressure which would cause shear failure if the supporting soil immediately below and adjacent to a foundation

The ultimate bearing capacity is defined as:

The maximum grose pressure intensity at the base of the foundation at which the soil does not fail in shear when the term bearing capacity is used.

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5) Poission ratio of soils

it is the negative ratio of transversal strain to the axial strain in an elastic material which is subjected to uniaxial stress.

Q1 (b)

Given data

$H = 6m$

$C = 0$

$\phi = 30^\circ$

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

Required

$\frac{N\alpha}{h} = ?$

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

Sol

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

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

$\beta = 18^\circ$

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

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

$Ka = 0.3948$

$Ka = 0.395$

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

$= 136.512$ kN/m

$$\frac{N_a}{b} = \frac{P_a}{b} \cos\beta$$

$= 136.512 \times \cos(18)$

$= 129.83$ kN/m

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

$= 136.512 \times \sin(18)$

$= 42.18$ kN/m

Q2: What is Bearing Capacity. Also write factors effecting Bearing capacity?

Ans: Bearing Capacity:

In Geotechnical Engineering bearing capacity is define as The engineering property of the soil due to which it resist the applied load. Denoted by q.

In other words the internal strength of the soil is called bearing Capacity.

Factor effecting bearing capacity:

1) Relative density: More the relative density of the soil more will be it's angle of friction. More will be the N_q, N_c, N_γ. with increase of this (N_q, N_c, N_γ) the bearing capacity will increase This will increase more for dense Soil/Sand as compared with medium and loose

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2) Depth of the Footing:

With the increase of depth of the foundation the bearing capacity of soil will increase. This increase will be more in case of dense sand/soil as compared with loose or medium sand/soil

3) Breadth of the foundation:

More the breadth of foundation more will be the bearing capacity of soil.

it will be more in case of dense soil/sand as compared with loose as medium soil/sand.

4) Unit weight of soil:

Bearing capasity of soil is directly proportional to unit weight of soil. The bearing capacity of soil increase with increase in its unit weight. it will be more in case of dense soil/sand as compared with loose as medium soil/sand.

5) Water table:

As water table comes near to footing, the bearing capasity get decreases.

Q2(b) Given data

$L = 3m$

$B = 2m$

$D_f = 1.6m$

$F.O.S = 3$

$\gamma = 18\ kN/m^3$

$C = 20\ kN/m^2$

$\phi = 20^\circ$

Required:

$q_s = ?$

Sol)

First for the slope factor

$\alpha = \left(45 + \frac{\phi}{2}\right) = \left(45 + \frac{20}{2}\right)$

$\alpha = 55^\circ$

$S_c = 1 + 0.2 \left(\frac{B}{L}\right) \tan^2 \alpha$

$= 1 + 0.2 \left(\frac{2}{3}\right) \tan^2 (55)$

$S_c = 1.27 = 1.3$

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

$= 1 + 0.1 \left(\frac{2}{3}\right) \tan^2 (55)$

$S_q = S_\gamma = 1.14$

Depth factor:

$d_c = 1 + 0.2\left(\frac{D}{B}\right)\tan\alpha$

$= 1 + 0.2\left(\frac{1.6}{2}\right)\tan(55)$

$d_\gamma = 1.23$

$d_\gamma = d_q = 1 + 0.1\left(\frac{D}{B}\right) \times \tan\alpha$

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

$= 1.1$

$q_u = C \cdot N_c \cdot S_c \cdot d_c + q \cdot N_q \cdot d_q \cdot S_q + \frac{1}{2}\gamma \cdot B \cdot N_\gamma \cdot d_\gamma \cdot S_\gamma$

$= (20 \times 14.8 \times 1.3 \times 1.23) + ((18 \times 1.6) \times 6.4 \times 1.1 \times 1.14)$

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

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

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

$= 762 - (18 \times 1.6)$

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

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

$q_s = q_{n.s} + \bar{\sigma} \Rightarrow 244.4 + (1.6 \times 18)$

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

Total safe load on Rectangular footing

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

$= 1639.2 \text{ KN}$

Q3(b) Given data

$C_c = 0.31$

$P_1 = 130\ kN/m^2$

$e_0 = 1.02$

$P_2 = 170\ kN/m^2$

$H = 5\ m$

Required

$e_1 = ?$

$S_c = ?$

Sol

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

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

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

$$e_1 = 0.983$$

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

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

$$S_c = 89.39\ mm$$

Q, Wh... settlement. What are its types Explain in detail?

Ans. When load is applied on the ground surface this will produce effective vertical stresses, due to these stresses the effective vertical strain will be produced as result of which the movement will occur in the downward direction. This downward movement is called settlement.

Types of settlements:

Two types

① Total settlement
2) Differential settlement.

1) Total settlement:

It is also called uniform settlement. In this type of settlements each part of structure will settle equally. In uniform settlement the failure of structure is not much as ~~compared~~ considered as with the differenal settlment. The total settlement take place in the structure which are constructed in rigid footings (raft)

Limitation for Uniform/Total Settlement:

The soil layer to which the load is to be transfer should be sofficent in bearing to resist the load which is to be applied on it.

The spread of the coming load over a large area.

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2) Differential Settlement:

Different settlement in different part of the same structure is called differential settlement.

Differential settlement is more dangerous or undesirable as compared with total uniform settlement. because it causes more damage to a structure as compared to total/Uniform settlement.

Types of differential settlement:

1) Tilt

2) Angular distortion:

1) Tilt:

If the entire structure rotates due to unequal settlement is called tilt.

2) Angular Distortion:

When two foundation support wall/column settle unequally it means the structure is subjected to angular distortion.