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Mid term Examination.

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(1) No 1(a)

Define the following term

a) plastic equilibriums- A body of soil is said to in state of plastic equilibrium if every part of soil is on the verge of failure is called plastic equilibrium

b) Angular Distorbtion:- It is defined as the ratio b/w the relative Deflection b/w two points in a foundation and the distance b/w them is called angular distorbtion.

c) ultimate Bearing capacity:- It is defined as the gross pressure intensity at the base of foundation which would case shear failure is called ultimate bearing capacity.

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poission Ratio of Soil:

It is denoted as

poission ratio(n) is the negative of ratio of transverse strain to the axial strain in an elastic materials which is subjected to an unaxial stress.

Compressive Index:

soil compressive Index is define as $cc = \frac{\Delta e}{\log_{10}(P_2/P_1)}$

Δ = change in void ratio

P_1 = pressure when Void ratio in e

P_2 = when void ratio is e_2.

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Q.No 01 (b)

A 6m tall cantilever wall retaining the soil that has the following properties

$C = 0$

$\phi = 30^\circ$

$\gamma = 19.2 kN/m^3$

And the ground surface behind the will is inclined at a slope of 3 horizontal and 1 Vertical. the wall has moved sufficently to develop active condition. Determine the total normal and shear forces acting on the back of this wall using Rankine theory

Given:-

$H = 6m$, $C = 0$

$\phi = 30^\circ$, $\gamma = 19.2 kN/m^3$

Slope $H = 1$, $V = 3$

Required:-

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

Solution:-

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

$B =$ $\tan B = 1/3$

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

$$\beta = 18^\circ$$

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

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

$$k_a = 0.3948$$

$$k_a = 0.395$$

$$P_{a/b} = \frac{19.8 \times (6)^2 \times 0.395}{2}$$

$$P_{a/b} = 136.512\ kN/m$$

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

$$= 13.6.512 \times \cos(18)$$

$$= 129.83\ kN/m$$

$$V_{a/b} = \frac{P_a}{b}\sin\beta$$

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

$$= 42.18\ kN/m$$

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~~R=0~~

Result :-

$N_{a/b} = 129.83 \text{ kN/m}$

$V_{a/b} = 42.18 \text{ kN/m}$

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Q No 2(a)

what is Bearing Capacity? Also write factor affecting bearing capacity.

ANSWER.

Bearing capacity:

the engineering property of the soil due to which it resist the applied load.

Denoted by q.

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

Factor effecting bearing capacity:

1- Relative Density of Soil.
2- Depth of footing
3- Breadth of footing
4- Unit weight of soil
5- water Table

Relative density of Soil.

more relative density of soil more will be its angle of friction more will be N_q, N_c, N_γ will increase of this bearing capacity increase.

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DEPTH OF Footing:-
With the increase of depth of foundation the bearing capacity of soil will increase. this increase will be more if soil is dense

Breadth of foundation:-
More the breath of foundation more will be bearing capacity of soil.

unit weight of Soil:-
Bearing capacity of soil is directly proportional to unit weight of soil. the bearing capacity of soil increase with increase in unit weight.

water table:-
As water table come near surface bearing capacity decreases.

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QNo 2 (b)

what is maximum safe load which can be supported by rectangular footing 2m-by-3m with factor of safty 3. the base of the footing is at 1.6m below the ground surface. the unit weight of soil is 18KN/m³. the angle of shear resisting Q = 20° (Nc = 14.8 Nq = 6.4 Nr = 2.9) unit cohesion cu = 20kN/m². use Myerhot analysis

Given data:

L = 3m, B = 2m

D = 1.6m

F. 0.S = 3

$\gamma = 18 kN/m^3$

Q = 20°

$cu = 20 kN/m^2$

Required:

qs = ?

Solution:

$qu = CNcscdc + qNqdqsq + 1/2 \gamma B Nr dr scr$

First for shape factor:

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

$\alpha = 55°$

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$S_c = 1 + 0.2 (B/L) \tan^2 \alpha$

$1.02 (2/3) \tan^2 (55)$

$S_c = 1.27 = 1.3$

$S_q = S_\gamma = 1 + 0.1 B/L \tan^2 \alpha$

$= 1.1 (2/3) \tan^2 (55)$

$S_q = S_\gamma = 1.4$

Depth factors

$d_c = 1 + 0.2 (D/B) \tan \alpha$

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

$d_c = 1.23$

$d_\gamma = d_q = 1 + 0.1 (D/B) \tan \alpha$

$1 + 0.1 (1.0/2) \tan (55)$

$= 1.11$

$q_u = c' N_c \cdot S_c \cdot d_c \times \gamma \cdot N_\gamma \cdot d_q \cdot S_\gamma + 1/2 \gamma \cdot B \cdot N_\gamma \cdot d_\gamma \cdot S_\gamma$

$(20 \times 14.8 \times 1.3 \times 1.23) + (18 \times 1.6) \times 6.4 \times 1.11 \times 1.14)$

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

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

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

$= 762 - (18 \times 1.6)$ $\quad \bar{\delta} = \gamma \times D$

$= 733.2\ kN/m^2$

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

$= \frac{733.2}{3}$

$= 244.4\ kN/m^2$

$q_s = q_{n.s} + \delta$

$244.4 + (1.6 \times 18)$

$q_s = 273.2\ kN/m^2$

Total Safe load on Rectangular footing

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

$= 1639.2\ kN$

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Q No 3 (a) What is Settlement? Explain types in detail.

Answer:-

SETTLEMENT:- when load is applied on the ground surface this will produce effective vertical stresses, due to these stresses effective vertical strain will be produced as a result of which the movement will occur in downward direction. this downward movement is called settlements

types of Settlements:-

= = = on the basic of movement of the structure it is divided in to two types.

i) Total settlements
ii) Differential settlements

total settlements:-

= = It is also called uniform settlement. In this type of settlement each part of structure will settle equally

P.T.O

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In uniform Settlement the failure of the Structure is not much as considered as with the differential Settlement.

the total Settlement mostly take place in the Structure which are constructed in rigid footing (raft).

In this type of Settlement the utility services such as water supply electricity Sewage line, telephone etc many be will remain Sound.

Differential Settlement:-

= = = Different Settlement in difference part of Same Structure is called differential Settlement

Differential Settlement is more danger then total Settlement.

It cause more damage to Structure

types of differential Settlement.

two types

① Tilt

② Angular distortion

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Q No 3 (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 170KN/m²
2) the total settlement of the stratum of 5m thickness.

Given:

$C_c = 0.31$

$P_1 = 130\ KN/m^2$

$e_c = 1.02$

$P_0 = 180\ KN/m^2$

$H = 5m$

Required:

void ratio, $e_1 = ?$

$S_c = ?$

Solution:

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

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

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$$0.31 = \frac{1.08 - e1}{\log_{10}(170/130)}$$

$$e1 = \boxed{0.54}$$

Now

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

$$= \frac{5}{1+1.08} \times 0.31 \log_{10}(170/130) \times 1000\,mm$$

$$Sc = 1003.487$$

RESULT:-

$e1 = 0.54$

$Sc = 1.003.487$

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