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Program B (civil)

Course Geotechnical & foundation Engineering

Spring 2020

Mid term

Q1 Part A Ans

Define the follwing term

1) Plastic Equilibrium :- it is state of stress within a soil mass or a portion there of that has been deformed to such an extent that its ultimate shearing resistance is mobilized.

2) Angulr Distortion :- B, is the ratio of the the differential settlment δ and the distance L between two Points. it is crucial to understand before hand the range of tilt & anguls distortion that will Possibly cause unacceptable damage to the structure

3) Compressive index :- it 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 Past this kind of clayely soil is said to be normally consolidated clay

4) Ultimate Bearing Capacity :- it is the capacity of soil to support the loads applied to the ground ultimate bearing capacity is theoritical Maximum Pressure which can be

be can be supported without failure allowble bearing capacity is the ultimate bearing capacity divided by a factor of saftey

5) Poission Ratio of Soil :-

Plainly

Poission's ratio (n) is the negative of ratio of transversal strain to axial strain in an elastic material, which subjected to uniaxial stress.

Material : Poisson ratio

saturated clay : 0.40 — 0.50

Clay : 0.30 — 0.45

Sand : 0.20 — 0—45

Q 1
Part B
Ans

Given data

H = 6m

C = 0

$\phi = 30°$

$\gamma = 19.2$ kn/m³

slop = Horizontal = 1
Vertical = 3

Required :-

$N_{a/b} = ?$ , $V_{a/b} = ?$

Solution :-

$$P_{a/b} = \frac{\gamma \times H^2 \times K_a}{2}$$

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

$$K_a = \cos B \times \frac{\cos B - \sqrt{\cos^2 B - \cos^2 \Phi}}{\cos B + \sqrt{\cos^2 B - \cos^2 \Phi}}$$

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

$$K_a = 0.3948$$

$$K_a = 0.395$$

Now

$$P_{a/b} = \frac{19.2\ (6)^2 \times 0.395}{2}$$

$$= 136.512 \text{ KN/m}$$

$$N_{a/b} = P_{a/b} \cos B$$

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

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

$$V_{a/b} = P_{a/b} \sin B$$

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

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

Q2 Part A | What is bearing capacity. Also write factor effecting Bearing capacity.

Ans | Bearing Capacity:- it is the capacity of soil to support the loads applied to the ground. The bearing capacity of soil is Maximum average contact Pressure between foundation and the soil which Should not Produce shear failure in soil

factor 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 soil. in general strip square rectangulr and circulr shaped footing are used for soil 1 by keeping other parameter constant the effect of shape of footing on ultimate bearing capacity of soil is studied the values of of ultimate bearing capacity for soil-1 are determined by method given by Terzaghi and Bureau of Indian standard

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 diffrent soils by Keeping other Parameter 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 variation in depth of foundation the Propertie of Soil remain constant. the value of ultimate bearing capacities determined for diffrent soils by is code method given in tables

3) Effect of width of footing on Bearing Capacity :- It is an important Parameter which govern the ultimate bearing capacity of soil. for diffrent soil by Keeping other Parameter constant. the effect of width of strip footing on ultimate bearing capacity of soil is studied. the value of ultimate bearing capacties determined for diffrent soil by is code. method are in table

Q2 Part B

Given data

$L = 3m$
$B = 2m$
$D_f = 1.6m$

$F.O.S = 3$

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

$C = 20\ KN/m^2$

$\varphi = 20$

Required :-

$q^s = ?$

Solution :-

$q_u = CN_c.S_c d_c i_c + q N_q.S_q d_q i_q$
$+ \frac{1}{2}.\gamma N_\gamma.S_\gamma d_\gamma i_\gamma$

First for the shape factor :-

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

$= 45 + 20/2$

$= 55°$

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

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

$= 1.27 \simeq 1.3$

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

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

$$= 1.14$$

Depth Factor :-

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

$$= 1 + 0.2 \, 1.6/2 \, \tan 55$$

$$= 1.23$$

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

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

$$= 1.11$$

Now Putting values

$$q_u = C N_c \cdot S_c \cdot d_c \cdot i_c + q N_q \cdot d_q \cdot S_q \cdot i_q + 1/2 \, \gamma N_\gamma \, S_\gamma \cdot d_\gamma \cdot i_\gamma$$

$= (20 \times 14.8 \times 1.3 \times 1.23 \times 1) + (18 \times 1.6 \times 6.4 \times 1.11 \times 1.11 \times 1) + (0.5 \times 20 \times 2 \times 2.9 \times 1.11 \times 1.14 \times 1)$

$q_u = 762 \ KN/m^2$

$q_{n.u} = q - \gamma$

$762 - (18)(1.6)$

$733.2 \ KN/m^2$

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

$$= \frac{733.2}{3}$$

$= 244.4 + (18 \times 1.6)$

$= 273.2 \ KN/m^2$

total safe load on rectangule footing

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

$= 1639.2 \ KN$

C Q3 F Part A What is settlement. What are its type explain in detail ?

Ans

Settlement :-

Its is defined as the vertical movement of ground generally caused be changes in stress within the earth settlement is most likely to occur when increased vertical stresses are applied to the Ground on or above soft or loose soil stata

Types

I) immediate settlement
II) Consolidation settlement ($\Delta H_c$)
III) Secondry settlement ($\Delta H_c$)
IV) Immediate settlement computation
V) Secondary compression / Creep.
VI) Sands.
VII) Clay

I) Immediate Settlement :- immediate settlement take place as the load is applied or within a time Period of about 7 day

## ii) Consolidation Settlement ($\Delta H_c$)

It is time dependent and take months to years to devolp. The leaning tower of Paisa in italy has been undergoing Consoladation settlement for over 700 years. The lean is caused by consoladition settlment beign greater on one side This however is an extreame case. The Principal settlment for most Project occur in 3 to 10 years
Dominate in saturated/nearly saturated fine grained soil where consoldation theory applie

## 3) Secondary settlement / Creep ($\Delta H_c$)

Its occur under constant effective stress due to continous rearrangement of clay Particles into a more stable configuration.
Peredominates in highly Plastic clay and Organic clays.

## 4) Immediate settlement Calculations

formula

$$\Delta H_i = q_0 B \frac{1-\mu^2}{E_s} m I_s I_F$$

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

The Privious eauation fo Is is stricly applicable to flexible bases on the half space. in practice most foundation are flexible because even very thick footing deflect when loaded by superstructure load. if base is rigid reduce Is factor by about 7%. the half space may consist of either cohesion less material or any water contant. or unsaturated cohessive soils

## 5) Secondary Compression / Creep :-

After priamry consolidation the soil structure continous to adjust to the load for some additional time. This settlement is termed secondary compression. At the end of This the soil has reached a new Ko-state

To find secondary consolidation settlement in the field ($\Delta H_s$)

$$\Delta H_s = \Delta C_a \log \frac{t_{100(f)} + \Delta t}{t_{100(f)}}$$

6) Sands :-

Maximum total settlement = 40mm for isolated footing = 40 to 65 mm for rafts maximum differential settlement between adjustent columns = 25mm

Clay :-

Maximum total settlement = 65mm for isolated footings = 65 to 100mm for rafts maximum differential settlement may also be evaluated in term of angulr distoration given by : ($\Delta$Hdiff) = $\Delta/L$ where $\Delta$ = relative settlement between two Points and L = Horizontal distance between tpwo Points

Based on a large number of settlement observation and Performance of Structure

Q 3
Part B

Given data

$C_c = 0.31$
$P_1 = 130\ kN/m^2$
$e_o = 1.02$
$P_2 = 170\ kN/m^2$
$H = 5m$

Required :-

$e_1 = ?$ , $S_c = ?$

Solution :-

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

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

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

$e_1 = 0.983$

Now

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

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

$2.47 \times 0.03611 \times 1000$

$0.08920 \times 1000$

$S_2 = 89.39mm$

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