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MID Term Exam

Q1) a) Define the following terms:-

1) Plastic Equilibrium:-

It is defined as "The state of stress with in a soil mass that has been deform to such an extant that its ultimate shearing resistance is mubilized."

2) "Ultimate Bearing Capacity:-" It is defined as "The maximum gross pressure intensity at the base of foundation at which the soil

does not fail in shear when the term bearing capacity is used.

3) "Compressive Index:-" Compressive Index is used to find the settlement in the normally consolidated clay. The total stress applied is larger then the stress in field due to which the soil sample has been undergone. this type of clay soil is said to be normally consolidated soil.

4) "Poission Ratio of Soil:-" It is defined as "The negative Ratio of transveral stress to the axial strain in the elastic material which is subjected to uniaxial stress.

5) "Angular Distortion:-" When two foundation supports wall and column settle unequally it mean the structure is subjected to angular distortion.

Q1b) "Given Date:-"

$H = 6m$

$C = 0$

$\phi = 30°$

Slope = Horizental = 1

Verticle = 3

"Required:-"

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

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

Sol:-

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

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

$B = 18°$

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

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

$Ka = 0.394$

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

$= 136.512 \text{ KN/m}$

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

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

$$\boxed{\frac{Na}{b} = 129.8 \text{ KN/m}}$$

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

$$= 136.512 \sin(18)$$

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

Q2a) What is bearing Capacity, Also write factors effecting Bearing Capacity.

Bearing Capacity :-" It is an engineering property of soil due to which the soil resist the applied load.

→ The bearing capacity is also known as the internal strength.

→ It is denoted by "q"

"Factor Affecting Bearing Capacity :-" Following are the factor which affects the bearing Capacity.

1) "Relative Density:-"

→ Greater the relative density of soil higher will be the value of angle of internal friction "ϕ". Higher the value of internal friction higher will be the value of terzaghi bearing factor.

→ Greater the value of N_c, N_r, N_q will result in high value of bearing capacity.

→ The soil have enough relative Density will have enough bearing capacity.

→ Relative Density ⇒ $\gamma_{relative} = \frac{e_m - e}{e_{max} - e_{min}}$

2) "Depth of Footing:-"

The bearing capacity of soil increases with the increase of depth of footing.

→ This increase will be maximum for the dense soil as compared to loose soil.

3) "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 its unit weight.

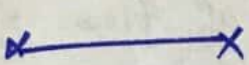
4) "Water Table:-"

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

⑤ "Breadth of footing :-"

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

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



"Q2(b) :-" "Given Data :-"

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

F.O.S = 3
$\gamma = 18 KN/m^3$
$C = 20 KN/m^2$
$\phi = 20°$

"Required :-"

$q_s = ?$

"Solution :-"

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

"First for the shape factor :-"

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

$$= \left(45 + \frac{20}{2}\right) = 55°$$

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

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

$$= 1.27 \simeq 1.3$$

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

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

$$= 1.14$$

"Depth Factor:-"

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

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

$$= 1.23$$

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

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

$$= 1.11$$

Now putting values.

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

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

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

$$= 762 - (18 \times 1.6)$$

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

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

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

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

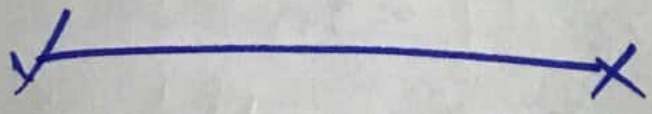
$$= 244.4 + (18 \times 1.6)$$

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

"Total Safe load on rectangular Footing:"

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

$$= 1639.2 \text{ KN}$$



Q3 a) (9)

What is settlement. What are its type and explain in detail?

Ans:- "Settlement:"

It is defined as "When a soil deposite is loaded, deformation will occur due to change in stress - the total verticle downward deformation at the surface resulting from the load is called settlement.

"Type of Settlement:-"

On the basis of movement of structure it is devided into two types:

- Total Settlement
- Differential Settlement

"Total Settlement:-"

→ Also known as uniform settlement.

→ When all the points settle with an equal amount, the settlement is known as uniform settlement.

→ This type of settlement is possible only under rigid foundation loaded with uniform pressure and resting on uniform soil deposite which is very rare possibility.

This type of Settlement may not endanger the structure stability but generally affects the utility of the structure by Jamming doors and damaging the utility lines.

"Limitation for total Settlement:-"

The soil layer 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 coming load over a large area.

"Differential Settlement:-"

- Differential Settlement is more danger as compared with total or uniform Settlement. because it cause more damage to a structure as compared to total Settlement.
- When different parts of structure settle by different magnitude, the Settlement is called differential Settlement.
- If Soil is granular, then differential Settlement will be 2/3 of the total maximum Settlement.
- In case of cohesive soil, possible differential Settlement is about 1/3 of the maximum settlement

"Types of Differential Settlement:"

There are two types of differential settlement:-

1. Tilt
2. Angular Distortion.

Q3 b) "Given Data:-"

$C_c = 0.31$

$P_1 = 130 KN/m^2$

$e_0 = 1.02$

$P_2 = 170 KN/m^2$

$H = 5m$

"Required:-"

$e_1 = ?$

$S_c = ?$

"Solution:-"

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

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

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

$$e_1 = 0.983$$

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

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

$= 2.47 \times 0.0361 \times 1000$

$S_c = 89.39\ mm$