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Paper # Geotech

Section # "B"

module # 6th Semestr.

Date #

QNO:I Part A:

Define the following term:

i: **Plastic Equilibrium:**

It's defined as "that the state of stress within a soil mass or portion there of that has been deformed to such an extent that it's ultimate shearing resistance is Mobilized.

ii: **Angular Distortion:**

When two foundation support wall/coulum settle unequally it means that the structure is subjected to angular distortion:

iii: Poission Ratio of Soil :

It is the negative ratio of transversal strain to the axial strain in an elastic Material which is subjected to uniaxial Stress.

iv: Compressive index :

The term compressive Index is define as that 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 Part. This kind of clay soil is said be normally consolidation clay.

v: 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 that:

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

QNo # 1 ⇒ Part B

→ Given data

$H = 6m$

$c = 0$

$\phi = 30^\circ$

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

slope = Horizantle = 1

Vertical = 3

⇒ Required:

$N_a/n = ?$

$V_a/b = ?$

→ Soulation

We know that:

$$\frac{P_a}{b} = \frac{\gamma \times H^2 \times K_a}{2}$$

Where:

⇒ $B = \tan\beta (1/3)$

⇒ $\beta = 18.0^\circ$

⇒ $K_a = \cos(\beta) \times \frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}$

⇒ Put the value:

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

⇒ $\boxed{K_a = 0.3948}$ or

round off $\boxed{K_a = 0.395}$

Now we take P_a/b :

Than :

$$\Rightarrow \quad P_a/b = 19.2 \times (6)^2 \times 0.395$$

$$= \boxed{136.512 \text{ kN/m}}$$

Now

$$\Rightarrow \quad N_a/b = P_a/b \times \cos\beta$$

= Put value:

$$\Rightarrow \quad 136.512 \times \cos(18)$$

$$\Rightarrow \quad \boxed{N_a/b = 129.83 \text{ kN/m}}$$

Now we take another V_a/b :

Than :

$$V_a/b = P_a/b \sin\beta$$

Put value:

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

$$\Rightarrow \quad \boxed{V_a/b = 42.18 \text{ kN/m}}$$

Answer.

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Q No # 2 Part A :

What is bearing capacity. Also write factor effecting Bearing capacity ?.

Ans: **Bearing capacity :**

The load-carring capacity of foundation soil or rock which enables it to bear & transmit load from a structure.

⇒ The bearing capacity is also know as the internal strength.

⇒ It is denoted by " V ".

⇒ **Factor Affecting Bearing capacity :**

i: Relative Density :

→ Greater the relative density of soil higher will be the value of angle of internal friction " ϕ ". Higher the value of terzaghi bearing factor. (N_q , N_c , N_r) .

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

→ Relative density = $\dfrac{e_n - e}{e_{max} - e_{min}}$.

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ii: **Depth of Footing :**

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

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

iii: **Breath of Footing :**

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

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

iv: **Unit weight of soil :**

→ Bearing capacity of soil is directly proportional to unit weight of soil increase with increase in its weight.

→ It will be more in case of dense soil.

v: **Water Table :**

→ As the water take comes near to footing, the bearing capacity get decrease.

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Q No # 2 Part B

Problem:

⇒ **Given data:**

$L = 3m$

$B = 2m$

$D_f = 1.6m$

$F.O.S = 3$

$\gamma = 18 \, kN/m^2$

$c_u = 20 \, kN/m^2$

$\phi = 20^\circ$ ($N_c = 14.8$, $N_q = 6.4$, $N_\gamma = 2.9$) unit cohesion.

⇒ **Requried data:**

⇒ $q_s = ?$

⇒ **Solution:**

use meyerhof equation.

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

⇒ First find the slope factor:

We know that:

$$\Rightarrow \alpha = [45 + \phi/2]$$

Put value:

$$= [45 + 20/2]$$

$$\boxed{\alpha = 55^\circ}$$

Now

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

Put value!

$$= 1 + 0.2 \, [2/3] \tan^2 55^\circ$$

$$\boxed{S_c = 1.27 \approx 1.3}$$

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⇒ Now we Take Sq :

Where

$$\Rightarrow S_q = S_\gamma = 1 + 0.1\left[B/L\right] \tan^2 \alpha$$

Put values

$$= 1 + 0.1\left[2/3\right] \tan^2 55$$

$$\boxed{S_q = S_\gamma = 1.14}$$

⇒ Depth Factor:

We find Depth of Factor:

where:

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

Put value

$$1 + 0.2\left[1.6/2\right] \tan 55$$

$$\boxed{d_c = 1.23}$$

Now:

$$d_\gamma = d_q = 1 + 0.1\left[D/B\right] \tan\alpha$$

$$= 1 + 0.1\left[\frac{1.6}{2}\right] \tan 55$$

$$\boxed{d_\gamma = d_q = 1.11}$$

Now Putting the value in original Formula.

where:

$$q_u = [N_c \cdot S_c \cdot d_c \cdot i_c + q N_q \cdot d_q \cdot S_q \cdot i_q + \tfrac{1}{2} \gamma N_\gamma \cdot S_\gamma \cdot d_\gamma \cdot i_\gamma)$$

Put the value :

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

$$2 \times 2.9 \times 1.11 \times 1.14 \times 1)$$

by calculator:

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

NOW :

$$q_{n.u} = q_{u} \cdot \bar{\delta}$$

Put value:

$$= 762 - [18 \times 1.6]$$

$$\Rightarrow \boxed{q_{n.u} = 733.2 \text{ KN/m}^2}$$

Than :

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

Put value:

$$\Rightarrow \frac{733.2}{3}$$

$$\boxed{q_{n.s} = 244.4 \text{ kN/m}^2}$$

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

= Put the value.

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

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

⇒ Total slope load on rectangular Footing:

We know that !

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

$$\boxed{A \times q_s = 1639.2 \text{ KN}}$$

Answer.

Q No # 3 . Part a .

What is settlement . What are it's types. Explain in detail ?.

Ans:

Settlement:

When a soil deposite is loaded deformation will accur due to change in stress. The total vertical downword deformation at the surface resulting from the load is called Settlement.

⇒ **Types of settlement:**

On the bases of movement of structure it is divided into two/2 types.

1. Total Settlement
2. Differential settlement.

⇒ **Total Settlement:**

⇒ It is also called Uniform settlement.

⇒ When all the Points settle with an equal amount. the Settlement is know as uniform settlement.

⇒ This types of settlement may not endangor the structure stability but genrally effect the Utility of the structur by jomming doors & damaging the utility lines [sower, water supply & mains etc]

⇒ Limitation For total settlement:

- The Soil layer to which the load is to be transfer should be sufficiant in bearing to resist the load which is to be applied on it.

⇒ To spread the coming load over large area.

2: Differential settlement:

→ When different Parts of a structure settle by different magnitude, the settlement is called differential settlement.

⇒ Differential sttlement is more danger or considerable as compared with total or uniform settlement. because it cause more danger to a structure as compared to total settlement.

⇒ IF Soil is granular, then differential settlement will be 2/3 of the total maximum settlement.

⇒ Types of Differential settlement:

Q No # 3 Part B

Problem:

Given data:

$C_c = 0.31$

$P_1 = 130 \ kN/m^2$

$P_2 = 170 \ kN/m^2$

$C_o = 1.02$

$H = 5m.$

Required:

$e_1 = ?$

$S_c = ?$

Solution:

We know that:

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

Where:

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

Put value:

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

$$\boxed{e_1 = 0.983}$$

P.T.O

NOW :

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

Put the values:

$$= \frac{5}{1+0.2} \times 0.31 \log_{10}\left(\frac{170}{130}\right) \times 1000$$

$$= 2.47 \times 0.03611 \times 1000$$

$$= 0.08920 \times 1000$$

where:

$$\boxed{S_c = 89.39\,mm}$$

The End: