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Q.No 1 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.

(2) Angular Distortion :-
⇒ When two foundation support wall/colum 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 unaxial stress.

(iv) **Compressive Index :-**

⇒ The term compressive index is define as 'That is used to find the sattlement 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 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 define as " 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

$H = 6m$

$C = 0$

$\phi = 30^\circ$

$\gamma = 19.2 KN/m^3$

slop = horizantle = 1

vertical = 3

Requried Data

$N_a/n = ?$

$V_a/b = ?$

Solution

As we Know that

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

where

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

$\beta = 18^\circ$

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

Put the value

$$K_a = \cos(180) \times \frac{\cos(180) - \sqrt{\cos^2(180) - \cos^2(30)}}{\cos(180) + \sqrt{\cos(180) - \cos^2(30)}}$$

$K_a = 0.3948$

or

$K_a = 0.395$

Now we take P_a/b

Than

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

$= 136.512$ KN/m

Now

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

Put value

$N_a/b = 136.512 \times \cos(180)$

$N_a/b = 129.83$ KN/m

Now we take another V_a/b

Than

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

Put value

$= 136.512 \times \cos(180)$

$\frac{V_a}{b} = 42.18$ KN/m

Ans

Q No 2 Part A

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

Ans **Bearing Capacity** :-

⇒ The load carrying capacity of foundation soil or rock which enables it to bear and transmit load from a structure.

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

⇒ It is denoted by "V"

⇒ **Factor effecting 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_γ)

⇒ Greater the value of N_c, N_γ, N_q will result in high value of bearing capacity.

⇒ Relative density = $\dfrac{e_m - e}{e_{max} - e_{min}}$

(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 dense soil as compared to loose soil.

iii) Breath of Footing ⇒ More the breath of Footing or fundation 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 cones near to footing. The bearing capacity get decrease.

Q No 2 Part B

Problem: **Given Data**

$L = 3m$

$B = 2m$

$D_f = 1.6m$

$F.O.S = 3$

$\gamma = 18 KN/m^2$

$C_v = 20 KN/m^2$

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

Required Data

$q_s = ?$

Solution

Use meyrief eqution

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

$\Rightarrow$ First for the slope factor

we know that

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

Put value

$= [45 + 20/2]$

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

Now

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

Put value.

$S_c = 1 + 0.2\ B/L\ \tan^2(55)$

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

Now we take S_q
where

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

Put values

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

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

Depth factor

we find depth of factors
where

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

put value

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

$$\boxed{d_c = 1.23}$$

Now

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

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

$$d_\gamma = d_q = 1.11$$

Now putting the value in original Furmula
where

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

Put the value

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

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

Now

$q_{n.u} = q_u . \bar{\sigma}$

Put value

$= 762 - [18 \times 1.6]$

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

Than

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

put value

$= \frac{733.2}{3}$

$q_{n.s.} = 244.4 KN/m^2$

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

Put the value

$= 244.4 + (18 \times 1.6]$

$q_s = 273.2 \ KN/m^2$

Total slope load on rectangular Footing

we Know that

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

$A \times q_s = 1639.2 \ KN$

Ans

Q No 3 Part A

What is settlement. what are its types Explain in detail?.

Ans Settlement

⇒ When a soil deposite is loaded deformation will occur due to change in stress.

⇒ The Total vertical downword deformation at the surface resulting from the load is called Settlement.

Types of Settement

⇒ on the bases of moment of structure it is divided into two types.

① Total Settlement

② Differential settlement.

① 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 endanger the structure stability but generally effect the utility of the structure by Joining doors and damaging the utility lines (sewer, water supply and mains etc)

⇒ Limitation For total settlement

⇒ The soil layer to which the load is to be transfer should be sufficant 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 settlement 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:-

⇒ Differential Settelment is of two types

⇒ Tilt

→ Angular Distortion

Q No 3 Part B

Problem

Given Data

$C_c = 0.31$

$P_1 = 130 KN/m^2$

$P_2 = 170 KN/m^2$

$e_0 = 1.02$

$H = 5m$

Required Data

$e_1 = ?$

$S_c = ?$

Solution

We know that

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

where

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

Put value

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

$$\boxed{e_1 = 0.983}$$

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

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