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Question:- 1"

① "Angular distortion"

AM:

When two Foundations Support walls / Colums Settle unevenly it means the Structure is subjected to angular distortion.

② "Compressive Index"

The Compresive Index is Used to Find the Settlement in the normally Consolidated Clay.

The total stress applied is larger than the stress in the field.

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

(3) "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 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, it may be understood to be the UBC

(4) "Plastic equilibrium"

State of stress within a soil mass or a portion there of that has been deformed to such an extant that its ultimate shearing.

(5) "Poission Ratio of Soil"

Poission ratio is the negative of ratio of transverse strain to the axial strain. In an elastic material. which is subjected to an uniaxial stress.

(B)

Given data:-

Ans:

$H = 6m$

$C = 0$

$\phi = 30^\circ$

$\gamma = 19.2\ KN/m^2$

Slope = Horizontal = 1

Vertical = 3

Required:-

$\frac{N_q}{n} = ?$

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

Solution:-

$$\frac{P_q}{b} = \frac{\gamma \times H^2 \times K_q}{2}$$

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

$$B = 18.0^\circ$$

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

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

$$K_a = 0.3948$$

$$K_a = 0.395$$

Now

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

$$\boxed{\frac{P_a}{b} = 136.512\ KN/m}$$

$$\frac{N_a}{b} = \frac{P_a}{b} \times \cos B$$

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

$$\frac{N_a}{b} = 129.83 \text{ KN/m}$$

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

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

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

Q: 2 (a)

Bearing Capacity:-

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

Denoted by: "q"

Or

The internal strength of the soil is called bearing capacity:

Factor Effecting B.C

(1) "RELATIVE DENSITY of SOIL"

~~Not~~

More relative density of soil

More will be its angle of Friction. More will be its N_q, N_c, N_γ. with Increase of this (N_q, N_c, N_γ) the bearing Capacity will Increase. This will Increase more for dense Soil as Compared with medium and loose.

N_q, N_c, N_γ: Terzaghi bearing Capacity Factors.

(2) "DEPTH of Footing"

With Increase of depth of Foundation the

Bearing Capacity of Soil will Increase. This Increase will be more in Case of dense Sand/Soil as Compared with loose or medium Sand/Soil

(3) "BREADTH of Foundation"

More the breadth of 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/Sand

(4) "UNIT WEIGHT of Soil"

Bearing Capacity of Soil is directly Propotional to unit weight of Soil.

The bearing of Soil Increase with Increase in its unit weight.

it will be more in Case of dense Soil/Sand as Compared with loose or medium Soil/Sand

"WATER TABLE" (11)

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

:- Terzaghi's Bearing Capacity Theory

:- Footing is long strip or Continous and soil will be homogenous and having shear parameter (C, ϕ).

⇒ The analysis will be in 2D condition

- The load will be concentric and vertical
- The base of Footing will be at shallow depth

Q.No 3 :- Part (b)

(12)

(b) Ans:

Given data:

$L = 3m$

$B = 2m$

$D_f = 1.6m$

$F.O.S = 3$

$\gamma = 18 KN/m^3$

$C = 2.0 KN/m^2$

$\phi = 30^\circ$

Required:

$q_s = ?$

Solution:-

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

(B)

Ist For Slope Factor:

$$\alpha = \left[45 + \frac{\phi}{2}\right]$$

$$= \left[45 + \frac{30}{2}\right]$$

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

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

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

$$\boxed{S_c = 1.37 \approx 1.3}$$

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

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

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

Depth factor:

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

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

$$d_c = 1.23$$

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

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

$$d_\gamma = d_q = 1.11$$

Now putting values

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

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

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

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

$= 726 - (18 \times 1.6)$

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

$q_{n.s} = \frac{q_{n.u}}{f.o.s} = \frac{733.2}{3} = 244.4\ KN/m^2$

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

$= 244.4 + (18 \times 1.6)$

$q_s = 273.2\ KN/m^2$

Total Safe load on Rectangular Footing

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

$= 1639.2\ KN$

Q:- 3:-

⇒ SETTLEMENT:-

When load is applied on the ground surface this will produce effective vertical stresses, due to these stress the effective vertical strain will be produced as result of which the movement will occur in the downward direction. This downward movement is called Settlement.

Types of Settlement:-

(1) Total Settlement:-

In this type of Settlement each part of the structure will Settle equally. it's failure of the Structure is not much as Considered as with the differential Settlement.

⇒ Total Settlement mostly take Place in the structure which are Constructed in the rigid footing.

in this Settlement the utility Services such as water supply, electricity, Sewage line, telephone etc may be decrease and the structure will remain Sound.

(2) "DIFFERENTIAL SETTLEMENT"

Different Settlement in different parts of the Same structure is called differential Settlement.

⇒ Differential Settlement is more dangers as Compared with total Settlement. Because it Cause more damage to the structure.

(D)

(19)

Ans

Given data

$C_c = 0.31$

$P_1 = 130 KN/m^2$

$P_2 = 170 KN/m^2$

$e_o = 1.02$

$H = 5m$

Calculate:

$e_1 = ?$

$S_c = ?$

Solution:

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

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

0.31

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

$$\boxed{e_1 = 0.983}$$

Now $$S_c = \frac{H}{1+e_e} \times C_c \log_{10}(P_2/P_1)$$

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

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

$$= 0.0892 \times 1000$$

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