Mid Term Online Exam

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Section "A"

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Q NO 01 Part (a) Define the following Term

1) Plastic Equilibrium:-

Plastic Equilibrium is the state of stress with in a soil mass or a portion there of that has been deformed to such an extent that its ultimate shearing resistance is mobilized.

2) Angular Distortion:- (B)

angular distortion is the ratio of the differential settlement δ and the dischance I between two point

3) Compressive Index:-

Compressive index is use to find the settlement in the normally consolidated clay. the total stress applied is larger then the stress in the field to which the soil sample has been undergone.

in the past this kind of clayey soil is said to be normally consolidated clay.

4) Ultimate bearing capacity:-

Utimate bearing capacity is the theoretical maximum pressure which the soil can be supported without failure.

5) poission Ratio of soil

poission ratio is the negative ratio of transverse to axial strain.

Q No 01 Part (b) A 6m tall contilever wall retaining the soil that have the following properties.

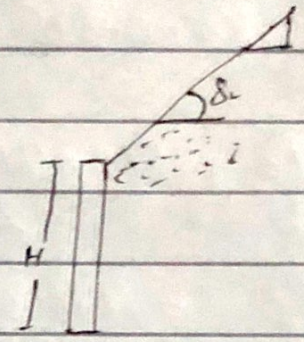
* $C = 0$

$\phi = 30^\circ$

$\gamma = 19.2 KN/m^3$

And the ground surface behind the wall is incliend at a slope of 3 horizental and 1 vertical, the wall has move sufficient to developed

active condition Determine the total normal and shear force acting on the back of this wall Using Rankine Theorey



Given Data:-

$H = 6m$

$C = 0$

$\phi = 30^\circ$

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

Slope $H = 3$, $V = 1$

Requirments-

$$\frac{Na}{b} = ?, \quad \frac{Va}{b} = ?$$

Solution:-

As we know that

$$\frac{Pa}{b} = \frac{\gamma \times H^2 \times Ka}{2} \longrightarrow eq\ (1)$$

$\beta =$

$$\tan\beta = \frac{1}{3}$$

$$\beta = \tan^{-1}\left(\frac{1}{3}\right)$$

$$\beta = 18^\circ$$

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

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

$Ka = 0.3948$

$Ka = 0.395$

$$\frac{Pa}{b} = \frac{19.2 \times (16)^2 \times 0.395}{2}$$

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

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

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

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

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

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

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

Q NO #09 Part (A) What is bearing capacity Also write factor affecting bearing capacity:

Bearing capacity:-

As engineering property of soil because of which when Load is applied on the ground surface and this Load is resisted then such capacity of soil is Called bearing capacity.

Factor Affecting bearing Capacity

1) **Relative density of soil:-**
if the Relative density of soil is greater. the value of angle of internal friction will be greater Higher will be terzaghi bearing capacity factor. due to which the value of Bearing capacity will increase

2) **Depth of footing:-**
the bearing capacity increase with increase of depth of footing.

3) Width of footing:-
with increasing the with of footing the bearing capacity is also increase.

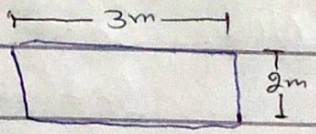
4) Unit weight of soil:-
increase the unit weight of soil the bearing capacity will be also increase

4) Cohesion of soil:-
if the soil is more cohesion value the bearing capacity is increase with this

5) Water Table:-
Water table is indirect relation with the bearing capacity dere to water the shear strength b/w the soil particals reduce hence ~~qu is~~ bearing capacity is decreas.

QNO2 Part(B) What is the maximum safe load which can be supported by rectangular footing 2m by 3m with a safe factor of 3 the base of footing is at 1.6 m below the ground surface the unit weight of soil is $18 KN/m^3$ the angle of sheare resistance $\phi = 20^\circ$ ($Nc = 14.8$, $Nq = 6.4$ $Nr = 2.9$). Unit cohesion $Cu = 20 KN/m^2$ Use Meyerhof analysis

Given Data :-



Dimension = B x L

= 2m x 3m

Df = 1.6m

Fos = 3

$\gamma = 18 KN/m^3$

$\phi = 20^\circ$ $Cu = 20 KN/m^2$

$Nc = 14.8$, $Nq = 6.4$ $Nr = 2.9$

Requirment :-

Maximum safe load = q_s = ?

Solution:

As we know that

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

Now $i_c = i_q = i_\gamma = 1$

Then

$$q_u = C N_c S_c d_c + q N_q S_q d_q + 0.5 \gamma B N_\gamma S_\gamma d_\gamma$$

First find the slope factor

$$\alpha = 45 + \phi/2 = 45 + \frac{20}{2}$$

$$\alpha = 55^\circ$$

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

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

$S_c = 1.3$

$\phi > 10$

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

$S_\gamma = S_q = 1 + 0.1 (\frac{2}{3}) \tan^2 (55)$

$S_\gamma = S_q = 1.14$

Now

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

$d_\gamma = d_q = 1 + 0.1 (\frac{1.6}{2}) \tan (55)$

$d_\gamma = d_q = 1.11$

Now $d_c = 1 + 0.2\left(\frac{D}{B}\right)\tan\alpha$

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

$d_c = 1.23$

As

$q_u = CN_cS_cd_c + \bar{q}N_qS_qd_q + 0.5\gamma BN_\gamma S_\gamma d_\gamma$

$q_u = (20 \times 14.8 \times 1.3 \times 1.23) + ((18 \times 1.6) \times 6.4 \times 1.1 \times 1.14) + (0.5 \times 20 \times 2 \times 2.9 \times 1.11 \times 1.14)$

$q_u = 762\ KN/m^2$

NOW

$q_{n.u} = q_u - \bar{S}$ $\qquad \bar{S} = \gamma \times D_f$

$q_{n.u} = 762 - (18 \times 1.6)$

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

Then

$$q_{n.s} = \frac{q_{n.u}}{F.O.S} = \frac{733.2}{3}$$

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

NOW

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

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

$q_s = 273.2\ KN/m^2$

Total safe Load on Rectangular footing $A \times q_s$

$(2 \times 3) \times 273.2$

$\boxed{1639.2\ KN}$

Q No 03 Part (A) What is Settlement what are its type explain in detail.

Settlement:-

When load is applied on the ground surface this will be produce effective vertical stress, due to these stress the effective vertical strain will be produced as a result of which the Movement will occure in the downward movement is called Settlement

Type of settlement:-

there are two type of settlement on the basis of movement of structure.

1) Total Settlement
2) Differential Settlement

① ⇒ Total Settlement:-

this type of settlement is also called uniform settlement

In total settlement each part of structure will settle equally
→ In Uniform settlement the failure of the structure is not much as considered as with the differential Settlement
A Uniform settlement mostly occurse in that structure ~~is not~~ which are constricted in rigid footing
⇒ In this type of settlement the utility services such as water supply electricity, sewage line telephone etc.
Limitation for Total Settlements
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 in different part of same structure is called differential Settlement

→ Differential settlement are more dangerious or undesirable as compare with total Settlement, becuse they are cause more damage to a structure.

Type of Differential Settlement:-

1) Tilt
2) Angular Distortion

1) ⇒ **Tilt:-**

If the entire structure rotate due to unequal Settlement is called Tilt

2) ⇒ **Angular Distortion**

when two foundation Support walls/coloum settle unequally its mean the Structure to angular distortion.

Q No 03 Part (b)

A soil has compressive index $C_c = 0.31$ At a stress 130 KN/m² the void ratio was 1.02

Calculate

1) The void ratio if the stress on the soil is increase to 170 KN/m²
2) The total settlement of the Stratum of 5m thickness.

Given Data:-

$C_c = 0.31$

$P_1 = 130\ KN/m^2$

$e_o = 1.02$

$P_2 = 170\ KN/m^2$

$H = 5m$

Requirment:-

$e_1 = ?$

$S_c = ?$

Solution:

As we know that

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

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

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

$$0.31 = \frac{1.02 - e_1}{0.1165}$$

$$0.0361 = 1.02 - e_1$$

$$e_1 = 1.02 - 0.0361$$

$$\boxed{e_1 = 0.984}$$

* $S_c = ?$

As we know that

$$S_c = \frac{H}{1+e_o} \times C_c \log\left(\frac{P_2}{P_1}\right)$$

$$S_c = \frac{5}{1+0.02} \times 0.31 \log\left(\frac{170}{130}\right)$$

$$S_c = 0.08939\,m$$

$$\boxed{S_c = 84.3978\,mm}$$