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MID TERM EXAM

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Subject # Geotech

Section # "C"

Submitted To

"Engr - Liaqat"

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Q1 Define the following term?

Pasta) 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.

b) Angular distortion :-

Angular distortion is the ratio of the differential settlement s and the distance dischance I between two point.

c) 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 in the past this kind of clayey soil is said to be normally Consolidated clay.

d) Ultimate bearing Capacity:-
Ultimate bearing capacity is the theoretical maximum pressure which the soil can be supported with out failure.

e) Poission Ratio of Soil:-
Poission ratio is the negative ratio of transverse to axial strain.

Qu 1 b) A 6m tall cantilever wall retaining the soil that has the following properties.

* $C = 0$
$\phi = 30^\circ$
$\gamma = 19.2\ KN/m^3$

And ground surface behind the wall is inclined at a slope of 3 horizental and 1 vertical, the wall has move sufficient to developed active condition. Determine the total normal and sheel force acting on the back of this wall using rankine theory.

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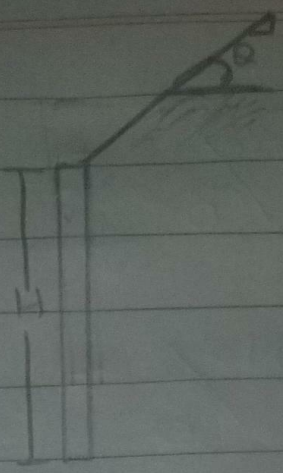

$H = 6\ m$

$C = 0$

$\phi = 30°$

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

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

Requirment:-

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

Solution:-

As we know that

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

$\beta =$

$$\tan\beta = 1/3 \Rightarrow \beta = \tan^{-1} 1/3$$

$$\beta = 18°$$

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

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

$Ka \Rightarrow 0.3948$

$Ka \Rightarrow 0.395$

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

$$P_a/_b = 136.512 \text{ KN/m}$$

$$N_a/_b = P_a/_b \cos\beta$$

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

$$N_a/_b \Rightarrow 129.83 \text{ KN/m}$$

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

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

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

Qu 29 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.

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* 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 which increase of depth of footing.

3- Width of footing:-
With increasing width 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 increasing.

5- 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 due to water the shear strength blw the soil particles reduce hence bearing capacity is decrease.

Qu25) What is the max safe load which can be supported by rectangular footing 2m by 3m with a single factor of 3 The base of footing at 1.6m below the ground surface. The unit weigh of soil is 18 KN/m³. The angle of shease resistance $\phi = 20°$ ($N_c = 14.8$, $N_q = 6.4$, $N_r = 2.9$) Unet Cohension $C_u = 20\ KN/m^2$ Use meyer hof analysis.

Give data :-

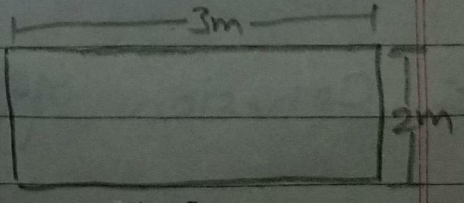
Dimension = B x L => 2m x 3m

D.f => 1.6 m

FOS => 3

$\gamma = 18\ KN/m^3$

$\phi = 20°$



$C_u = 20\ KN/m^3$

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$N_c = 14.8$, $N_q = 6.4$, $N_\gamma = 2.9$

Required:-

Maximum Safe load $= q_s = ?$

Solution:-

As we know that

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

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

$$q_u = CN_c S_c d_c + qN_a S_q d_q + 0.5\gamma B N_\gamma S_\gamma d_\gamma$$

First find the slope factor:-

$$\alpha = 45 + \phi/2 = 45 + 20/2$$

$$\alpha = 55^\circ$$

Now

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

$$\Rightarrow 1 + 0.2 (2/3) \tan^2 (55)$$

$$S_c = 1.3$$

$\phi > 10$

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

$$\Rightarrow 1 + 0.1 (2/3) \tan^2 (55)$$

$$S_\gamma = S_q = 1.14$$

Now

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

$$d_\gamma = d_q = 1 + 0.1 (1.6/2) \tan (55)$$

$$d_\gamma = d_q = 1.11$$

Now

$$dc = 1 + 0.2\left(\frac{D}{B}\right)\tan\alpha$$
$$= 1 + 0.2\left(\frac{1.6}{2}\right)\tan 55$$

$$dc = 1.23$$

As

$$q_u = CN_c S_c d_c + qN_q S_q d_q + 0.5\gamma B N_\gamma S_\gamma d_\gamma .$$

$$= (20 \times 14.8 \times 1.3 \times 1.23) + ((18 \times 1.6) \times 6.4 \times 1.1 \times 1.4) +$$

$$(0.5 \times 20 \times 2 \times 2.9 \times 1.11 \times 1.14)$$

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

Now

$$q_{n.u} = q_u - \bar{S} \qquad \bar{S} = \gamma \times Df$$
$$= 762 - (18 \times 1.6)$$
$$q_{n.u} = 733.9 \text{ kN/m}^2$$

Then

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

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

Now

$$q_s = q_{n.s} + \bar{S} \Rightarrow 244.4 + (18 \times 1.6)$$
$$q_s = 273.2 \text{ kN/m}^2$$

Total safe load on Rectangular footing

$$A \times q.s$$
$$(2 \times 3) \times 273.2$$
$$\Rightarrow \boxed{163.2 \text{ kN}}$$

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Qu3a What is settlement what are Pls types explain 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.

Types of settelment :-

There are two types.

i- Total settlement
ii- Differential settlement.

i- Total settlement :-

This type is also called Uniform settlement

In total settlement each part of structure will settle equally.

→ In uniform settlement the failure of structure is not much considered as with differential settlement.

It mostly occure in that

structure which are constructed in rigid footing.

In this type of settlement the utility service such as water supply electricity, Sewage line telephone etc.

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.

ii- Differential Settlement :-

Differential settlement in different part of same structure is called differential settlement.

Differement settlement are more dangerious or undesirable as compare with total settlement, Cause more damage to a structure.

Types of differential settlement :-

1- Tilt
2- Angular distortion.

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1- Tilt:-
If the entire structure rotate due to unequal settlement is called tilt

2- Angular distortion:-
When two foundation support walls/column settle unequaly it's mean the structure to angular distortion.

Qu3b) A soil has compressive index $C_c = 0.31$. At a stress 130 KN/m². The void ratio was 1.02 calculat

1- The void ratio of stress on the soil is increase to 170 kn/m²
2- The total settlement of the stratum of 5m thickness.

Given data:-

$C_c = 0.31$
$P_1 = 130\ KN/m^3$
$e_0 = 1.02$
$P_2 = 170\ KN/m^2$
$H = 5m$

Reqvirment:-

$e_1 = ?$
$S_c = ?$

Solution

As we know that

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

$$C_c = \frac{e_0 - e_1}{\log(P_2/P_1)}$$

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

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

$$0.031 = 1.02 - e_1$$

$$e_1 = 1.02 - 0.031$$

$$\boxed{e_1 = 0.984}$$

$S_c = ?$

As we know that

$$S_c = \frac{H}{1+e_0} \times C_c \log\left(P_2/P_1\right)$$

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

$$S_c = 0.08939\ m$$

$$\boxed{S_c = 89.3978\ mm}$$