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MID-Term Examination Civil Engineering Department

Q No 1 (part A)

Define the following Terms:

1) plastic Distortion:-

The State of stress with in a soil mass of a portion threat that has been deformed of a portion to such an extent that it ultimate shearing resistance is mobilized.

2) compressive index:-

The compressive is used to find the settlement in the normally consolidated clay the total stress in the field to which the soil sample has been under gone in the past this kind of claysy soil is said to be normally consolidated clay.

3) Ultimate Bearing capacity.

It is denoted by (q_{lw})

The max pressure at the base of the footing which cause shear failure in the soil. The soil can be supported with out failure.

4) Angular Distortion:

It is a type of differential settlement. It is the un equal settlement of two foundations support wall columns of the structure.

5) Poison Ratio of Soil:

Poison ratio represents a change in shape of a material while the volume is maintained constant.

In soil terminology, poissons ratio also know as the co-efficient of Lateral expansion and is effected by the following factors.

a) The soil is a descrete and startified medium, mostly not elastic and anisotropic.
b) The soil is not deformed linearly. Poisson's ratio in soil mechanics is a rather conditional parameter.

Question No 1 (Part B)

A 6m tall cantilever wall retaining the soil that has the following properties

$C=0$, $\phi=30$, $\gamma = 19.24\ N/m^3$

And the ground surface behind the wall is inclinde at a slope of horizental and 1 vertical the wall has moved sufficiently to develop active condition determine the total normal and shear forces acting on the back of this wall Using Rankines Theory.

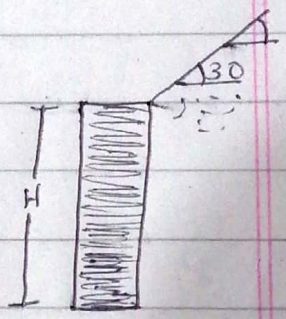
Given data:

$H=6m$

$\phi=30$

$\gamma=19.24\ N/m^3$

Slope $H=3, V=1$



Requirements:

$$Na/b = ? \quad Va/b = ?$$

Solution:-

We Know That

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

$\beta = 18^\circ$

$\tan\beta = 1/3$

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

$\beta = 18^\circ$

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

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

$Ka = 0.3948$

$Ka = 0.395$

$Pa/b = 19.2 \times (6)^2 \times 0.395$

$\boxed{Pa/b = 136.512\ kN/m}$

$Na/b = Pa/b \cos\beta$

$= 136.512 \times \cos(18)$

$\boxed{Na/b = 129.83\ kN/m}$

$Va/b = Pa/b \sin\beta$

$136.512 \times \sin(18)$

$\boxed{Va/b = 42.18\ kN/m}$ answer

(Question No 2)

what is bearing capacity. Also write factors affecting bearing capacity.

Bearing capacity:

It is an Engineering property of soil because of which when load is applied on the ground surface, then the capacity of soil due to which this applied load is resisted is called bearing capacity of that soil. Denoted by 'q'

It is also called the internal strength of the soil.

Factor affecting bearing capacity =>

Relative density of the soil.

Greater the relative density of the soil higher will be the value of angle of internal friction (Φ) and higher will be Terzaghii bearing capacity factors, (N_c, N_q, N_γ) due to which the

value of bearing capacity will increase.

Depth of the footing:

The bearing capacity increases with the increase in depth of the footing (D_f), and this increase will be max for the dense soil as compared to loose or medium sand.

Width of the footing:-

The bearing capacity increase with increase of width of the footing will increase will be max for the dense soil as compared to base sand.

Footing will be the bearing capacity is also increase.

Unit weight of soil:

It has a direct relation with the bearing capacity of a soil. Increase in unit weight of soil

of soil cause increase in the bearing capacity of soil.

Water table:

A water table come near to footing the bearing capacity get decrease.

water table is indirect relation with bearing capacity due to the water shear strength and the soil particles reduce hence bearing capacity is decreases.

Cohesion of the soil:

The bearing capacity of a soil is more cohession value to the bearing capacity is increase with this cohesion of the soil.

Question No 2 (part B)

What is the maximum safe load which can be supported by rectangular footing 2m by 3m with a F.S. safety factor of 3. The base of the footing is at 1.6m below the ground surface The unit weight of soil is 18 KN/m³ The angle of shear resisting $\phi = 20^\circ$ ($N_c = 14.8$ $N_q = 6.4$, $N_\gamma = 2.9$) Unit cohesion $C_u = 20\ KN/m^2$ use mayerhaf analysis.

Given Data:-

Dimension = B x L = 2m x 3m

Df = 1.6 m

FOS = 3

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

$\phi = 20^\circ$

$C_u = 20\ KN/m^2$

$N_c = 14.8$ $N_q = 6.4$

$N_\gamma = 2.9$

Requirement:-

Maximum safe load = q_s = ?

Solution:-

We know that

↳ $q_u = C N_c S_c d_c i_c + q N_q s_q d_q i_q$

↳ $+ 1/2\ \gamma B N_\gamma s_\gamma d_\gamma i_\gamma$

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

Then

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

first find the Slope factor.

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

$\alpha = 55^\circ$

NOW

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

$S_c = 1 + 0.2 (2/3) \tan\phi (55)$

$\phi > 10$

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

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

NOW

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

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

NOW

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

$d_c = 1 + 0.2 (1.6/2) \tan (55)$

As.

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

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

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

NOW

$q_{n.u} = q_u - s$ $\quad S = \gamma \times D_f$

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

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

Then

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

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

NOW

$q_s = q_{n.s} + \bar{5}$

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

$q_s = 273.2\ KN/m^2$

Total Safe Load on Rectangular footing $A \times q.s$

$(2 \times 3) \times 273.2$

$\boxed{1639.2\ KN}$

(2)

Q No 3 (A) What is settlement, what are it types explain in detail.

Settlement

When the load is applied on the ground surface this will produce effective vertical stresses.

Due to these stresses the effective vertical strain will be produced as result of which the movement will occure in the down ward direction, the down ward movement called settlement.

Types of settlement:

on the basis of movement of the structwe it divided in to two types.

1- Uniform Settlement

when a building foundation settles by the same amount over its entire area, effecting lowering

the structure in place, this type of settlement is called uniform settlements

It is also called total settlement
The failure caused in the structure due to settlement is not much as compared to differential settlemant

uniformly settlement mostly take place when the footing of the structure is rigid.

Limitation for uniform 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.

2- Differential settlement:

Differential settlement in different parts of the same structure is called differential

(2)

settlement.

Differential settlements it more danger or undesiable as compared with total unifor settlement because it causes more damage to a structure as compared to total uniform settlement.

Types of differential settlements.

(3)

Two types

1- Tilt if the entire structure rotate due to unequal settlement is called Tilt.

2- Angular Distortion

When two foundations support walls settle unequally it means the structure is subjected to angular distortion.

Component of settlement in foundation

i- immediate settlement.
ii- primary considilation settlement.
iii- Secondly consiladation settlement.

Question NO 3 (part B)

A Soil has compressive index $C_c = 0.31$ At a Stress 130 KN/m^2 the Void ration Was 1.02
Calculate 1- The void ratio if the Stress on the Soil in Creased to 170 KN/m^2.
2- the Total Settlement of the Stratum of 5m thickness.

Given Data.

$C_c = 0.31$

$P_1 = 130 KN/m^2$

$e_0 = 1.02$

$P_2 = 170 KN/m^2$

$H = 5m$

Requirement:-

$e_1 = ?$

$S_c = ?$

Solution:-

we Know that

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

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

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

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

$0.0361 = 1.02 - l_1$

$l_1 = 1.02 - 0.036$

$\boxed{l_1 = 0.984}$

→ $S_c = ?$

$S_c = H/1+e_0 \times C_c \log(P_2/P_1)$

$S_c = 5/1+0.02 \times 0.31 \log(170/130)$

$S_c = 0.08939\ m$

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