NAME :-

NAVEED AHMAD

I.D :-

7880

SECTION :-

B

SEMESTER :-

6th

SUBJECT :-

GEOTEC & FOUNDATION ENGG

INSTRUTOR :-

ENGR LIAQAT

QUISTION- 1 (a)

Define the following terms.

PLASTIC EQUILIBRIUM:

A body of soil is said to be in state of plastic equillibrium if every part of soil is on the verge of failure Such type of equillibrium is known as plastic equillibrium.

ANGULAR DISTORTION:

The ratio between the relative deflection between two points in a foundation and the distance between them is known as angular distortion

OR.

When two foundation supports wall, columns settles unequally it means structure is subjected to angular distortion.

COMPRESSIVE INDEX:

The slope taken from virgin compressive curve is termed as compressive index.

This is denoted by symbol C_c.

The compressive index is used to find the settlment in normally consolidated clay.

The expression to find the compressive index is

$$C_c = \frac{\Delta e}{\Delta \log \sigma}$$

ULTIMATE BEARING CAPACITY:

The maximum pressure at the base of footing with shear failure in the soil is denoted by q_u.

(3)

POISSON RATIOA OF SOIL :-

Poisson ratio is measure of poisson ratio effect. That describe expansion or contraction of material in directions perpendicular to the direction of loading. The value of poisson ratio is the negitive of the ratio of transverse strain to axial strain.

Q-1 <b>

A six meter tall cantilever (beam) wall retaining the soil that has the following properties

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

and the ground surface behind the wall is inclined at a slope of 3 horizantal 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 Rankin Theory.

GIVEN DATA:

$H = 6m$, $C = 0$

$\phi = 30^\circ$, $V = 3$

$\gamma = 19.2 KN/m^3$ $H = 1$.

REQUIRED:-

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

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

(5)

SOLUTION:-

$$\frac{Pa}{b} = \frac{\gamma H^2 K a}{2}$$

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

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

$$B = 18^\circ$$

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

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

$$Ka = 0.3949$$

$$\frac{Pa}{b} = \frac{19.2 \times 6 \times 0.3949}{2}$$

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

$$\frac{Na}{b} = \frac{pa}{b} \cos B$$

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

$$129.83 \text{ KN/m}$$

(6)

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

$$\frac{Va}{b} = 136.512 \times \sin(18)$$

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

ANSWER:

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

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

(7)

QUISTION- 2<a>

BEARING CAPACITY:-

In Geotechnical engineering bearing capacity is defined as the engineering property of the soil due to which it resists the applied load.
It is denoted by q.
In other words the internal strength of the soil is called bearing capacity

FACTORS EFFCTING BEARING CAPACITY.

Following are the factors that effed bearing capacity.

- Relatwe density of soil
- Depth of the footing
- Bed of the foundation
- Unit weight of soil
- Water Table

RELATIVE DENSITY OF SOIL:

More the relative density of the soil more will be it's angle of friction, More will the Nq, Nc, Nγ Nilk increase of this Nq, Nc, Nγ the bearing capacity will be increased. This will increase more for dense soil as compared to medium and base.

Nq, Nc, Nγ are factors of Terzaghi Bearing capacity.

DEPTH OF THE FOOTING:

Nilk the increase of the depth of the footing (df) or foundation the bearing capacity of soil will increase. This increase will be more in a dense sand / soil as compared to loose or mediwm soil or sand,

BREDTH OF THE FOUNDATION:-

More the Bredth of the foundation more will be the bearing capacity of soil. It will be more in a case of dense soil or sand as compared to loose and medium soil / sand.

UNIT WEIGHT OF SOIL:-

Bearing capacity of soil is directly proportional to unit weight of soil. as the bearing capacity of soil increase with increase in unit weight of soil. It will be more in case of dense sand / soil as compared to loose and medium sand soil

WATER TABLE:-

Water table is inversely proportional to bearing capacity as water table comes near the footing bearing capacity decreases.

Q-2 (b) (10)

What is maximum safe load which can be supported by rectangular footing 2m x 3m with factor of safety 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 $\phi = 20°$ ($N_c = 14.8$, $N_q = 6.4$, $N_\gamma = 2.9$) unit cohesion $C_u = 20 KN/m^2$. Use. Myerhot anglysis.

GIVEN DATA:-

$L = 3m$

$B = 2m$

$D = 1.6m$

$FOS = 3$

$\gamma = 18 KN/m^3$

$\phi = 20°$

$C_u = 20 KN/m^2$.

REQUIRED :-

$q_s = ?$.

SOLUTION:-

$$q_u = cNcscdc + qNqdqSq + \frac{1}{2}\gamma \cdot B \cdot N\gamma \cdot d\gamma \cdot S\gamma .$$

Shape factor:-

$$\alpha = \left(45 + \frac{\phi}{2}\right)$$

$$\Rightarrow \left(45 + \frac{20}{2}\right)$$

$$\alpha = 55^\circ$$

$$Sc = 1 + 0.2\left(B/L\right)\tan^2\alpha$$

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

$$Sc = 1.27 \cong 1.3$$

$$Sq = S\gamma = 1 + 0.1\ B/L \tan\alpha$$

$$1.1\left(\frac{2}{3}\right)\tan^2(55)$$

$$S\gamma = Sq = 1.14.$$

Depth factor:

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

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

$$d_c = 1.23$$

$$d_q = d_\gamma = 1 + 0.1\left(\frac{D}{B}\right)\tan\alpha.$$

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

$$d_\gamma = d_q \cdot 1.1$$

$$q_u = C \cdot N_c \cdot S_c d_c \times q \cdot N_q d_q S_q + \tfrac{1}{2} \cdot \gamma \cdot B \cdot N_\gamma \cdot d_\gamma \cdot S_\gamma.$$

$$(20 \times 14.8 \times 1.3 \times 1.23)\ (18 \times 1.6) \times 6.4 \times 1.11 \times 1.14)$$

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

$$q = 762\ KN/m^2$$

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

$$762 - 18 \times 1.6)$$

$$\Rightarrow 733.2\ KN/m^2$$

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

$$\Rightarrow \frac{733.2}{3}$$

$$\Rightarrow 244.4 \text{ KN/m}^2.$$

$$q_s = q_{ns} + s.$$

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

$$q_s = 273.2 \text{ KN/m}^2$$

Total safe load on footing

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

1639.2 KN

QUESTION - 3 (a)

WHAT IS SETTLEMENT:-

When 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 moment will occur in downward direction. This down word moment is called settlment.

TYPES:-

On the basis of moment of structure it is divided into two types.

1- Total settlment.

2- differential settlment.

TOTAL SETTLMENT :-

Total settlment is also called uniform settlment. In this type of settlment each part of structure will settle equally.

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

The total settlment mostly take place in the structure which are constructed in regid footing.

In this type settlme the utility services such as water supply, electricity sewage line, telephone etc may be decreased and the structure will remain sound.

LIMITATION FOR TOTAL SETTLEMENT:-

The soil layer to which the load is to be transferd. 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:-

Deffevent settlment in different parts of the same structure is called differential settlment.

Differential settlment is more danger or undesirable as compared to total settlment because it cause more settmout. or damage to a structure

TYPES OF DIFFERENTIAL SETTLMENT:-

1- Tilt
2- Angular distortion

Q-3 (b)

A soil has compressive index $C_c = 0.31$. at a stress $130\ KN/m^2$. the voids ratio was 1.02
Calculate The voids ratio if the stress on the soil is increased to $170\ KN/m^2$.
The total settlement of stratum of 5m thickness

GIVEN DATA:-

$C_c = 0.31$.
$P_1 = 130\ KN/m^2$
$e_1 = 1.02$
$P_2 = 170\ KN/m^2$
$H = 5m$.

REQUIRED:-

Voids ratio $e = ?$
$S_c = ?$

SOLUTION:-

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

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

(18)

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

$$\boxed{e_1 = 0.54}$$

$$S_c = \frac{H}{1+e_0} \times C_c \log_{10}\left(\frac{P_2}{P_1}\right)$$

$$\frac{5}{1+1.02} \times 0.31 \log_{10}\left(\frac{170}{130}\right) \times 1000\ mm$$

$$\boxed{S_c = 1003.427.}$$