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I-D :- "7209"

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Subject :- Geotechnical & Foundation Engineering

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Note: Attempt all questions.

Q.NO (01) (5+5)

Geotechnical & foundation

ID # 7209

A. Define the following terms:

1. Plastic Equilibrium
2. Angular Distortion
3. Compressive index
4. Ultimate Bearing Capacity
5. Poission Ratio of soil.

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

- C=0
- Ø=30°
- Υ= 19.2 KN/m^3

And the ground surface behind the wall is inclined at a slope of 3 horizontal 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 usking Rankine's Theory.

Q.NO(02) (5+5)

A. What is Bearing Capacity. Also write factors effecting Bearing capacity.

B. What is the maximum safe load which can be supported by rectangular footing 2m by 3m with a safety factor of 3. The base of the footing is at 1.6m below the ground surface. The unit weight of soil is 18KN/m^3 . The angle of shear resisting Ø=20° (N_c=14.8, N_q=6.4, N_Υ=2.9). Unit cohesion C_u=20 KN/m^2. Use Meyerhof analysis.

Q.NO (03) (5+5)

A. What is settlement. What are its types explian in detail ?

B. A soil has compressive index Cc=0.31. At a stress 130KN/m^2, the void ratio was 1.02. Calculate

0.28 120

1. The void ratio if the stress on the soil is increased to 170KN/m^2. 180
2. The total settlement of the stratum of 5m thickness. 6

**********Best of Luck**********

Question # 01:-

Part # A):- Define the following terms;

1)= **Plastic Equilibrium**:-

Plastic Equilibrium 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**:-

Angular Distortion is ~~the ratio of the different Settlement of Sp the distance~~ Particularly reduced by Conducting reverse-side tungsten inert gas (TIG) Heating at a fixed distance ahead of metal inert gas (MIG) Welding.

3)= **Compressive Index**:-

The compressive Index is used 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 ~~used~~ said to be normally Consilidated clay.

4)= **Ultimate Bearing Capacity**:-

In geotechanical Engineering, the Ultimate bearing capacity in the theoretical maximum pressure which can be Supported without failure, allowable bearing capacity is the ultimate bearing capacity elivided by a factor of Safety.

5)= Poission Ratio of Soil:-

Poission Ratio of Soil is the negative of ratio of transversal Strain to the axial Strain ~~to~~ ~~the~~ an elastic material, which is subjected to an unaixial stress. Poission Ratio is exactly the ratio between the Contraction & Extension.

Question # 1

Part # B:- A 6m tall Contieveler wall retaining the soil that have the following Properties;

⇒ $C = 0$

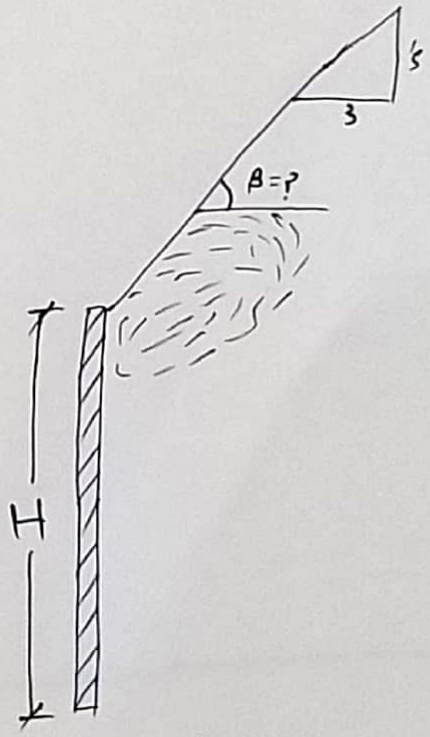
⇒ $\phi = 30°$

⇒ $\gamma = 19.2\ kN/m^3$

⇒ .....

Given Data:-

- $H = 6m$
- $\phi = 30°$
- Slope : $H = 1$
- $C = 0$
- $\gamma = 19.2\ kN/m^3$
- $V = 3$.



Required:-

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

Solution:-

$$\frac{Pa}{b} = \frac{\gamma \times H^2 \times Ka}{2}$$

$\beta =$

$\tan \beta = 1/3$.

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

$\boxed{\beta = 18°}$

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

$$Ka = \cos(18) \times \frac{\cos(18) - \sqrt{\cos^2(18) - \cos^2(30)}}{\cos(18) + \sqrt{\cos^2(18) - \cos^2(30}} = 0.3948$$

$\boxed{Ka = 0.395}$

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

$$= 136.512 \text{ KN/m}.$$

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

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

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

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

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

$$= 42.18 \text{ KN/m}.$$

%.

Question #02:-

Part # A) = Bearing Capacity:-

The bearing capacity of soil is defined as the capacity of the soil to bear the loads coming from the foundation. The pressure which the soil can easily with stand against load is called allowing bearing pressure.

= Factors Effecting Bearing Capacity:-

There are some important factors which effect the bearing capacity, which are as fallow;

1) = Type of soil
2) = Unit weight of soil.
3) = Surcharge load.
4) = Depth of foundation.
5) = Size of footing.
6) = Mode of failure.
7) = Shape of footings.
8) = Depth of water table.
9) = Eccentricity in footing load.
10) = Incilination of footing load.
11) = Incilination of ground.
12) = Inclination of base of foundation.

Question # 02.

Part # B:- what is the maximum Safe load which can be supported by rectangular footing 2m by 3m with a safety factor of 3. The base .....

Solution:-

Given Data:-

$L = 3m$, $B = 2m$, $Df = 1.6m$, $F.O.S = 3$

$\gamma = 18\ KN/m^3$, $C = 20\ KN/m^2$, $\phi = 20°$

Required:-

$qs = ?$

Solution:-

$$q_u = CN_c \cdot S_c \cdot d_c + q N_q \cdot d_q \cdot S_q + \frac{1}{2} \gamma \cdot B \cdot N_r \cdot d_r \cdot S_r$$

First for the shape factors

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

$$\alpha = 55°$$

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

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

$$S_c = 1.27 = 1.3$$

$$S_q = S_r = 1 + 0.1\ B/L \tan^2 \alpha$$

$$= 1 + 0.1 \left(\frac{2}{3}\right) \tan^2 (55)$$

$$S_q = S_r = 1.14$$

Depth factors:-

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

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

$$d_r = 1.23$$

$$d_r = d_q = 1 + 0.1 \times \left(\frac{D}{B}\right) \times \tan\alpha$$

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

$$= 1.11$$

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

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

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

$$q_{n.u} = 762 \text{ KN/m}^2$$

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

$$= 762 - (18 \times 1.6) \qquad \bar{\delta} = \gamma \times D$$

$$= 733.2 \text{ KN/m}^2$$

$$q_{n.s} = \frac{q_{n.u}}{F.O.S} = \frac{733.2}{3} = 244.4 \text{ KN/m}^2$$

$$q_s = q_{n.s} + \delta \Rightarrow 244.4 + (1.6 \times 18)$$

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

- Total Safe load on rectangular footing

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

$$= 1639.2 \text{ KN}$$

%

Question # 03.

Part # A) = Settlement:-

A Settlement is a gernal term used in archaeology, geography, landscape, history & other subjects for a Permanent or temporary Community in which People Live, without being Specific as to Size, Population or importance. A Settlement can therefore range in size from a small number of dwellings grouped together to the largest of cities with surrounding urbanized areas.

Types of Settlement:-

1) = Isolated Settlement:-

In Isloated Settlement consist of a single farm or house very remote from any other one Usually found in farming or hunting rural communities.

2) = Dispersed Settlement:-

A dispersed Settlement is made up of Serveral housel, Scattered or dispersed. One house may be upto one or more km from the next. This type of Settlement is Common in the Sahel.

3) = Nucleated or Compact Settlement:-

In a necleated or Compact Settlement, the building are clustered, linked by roads, & the Settlement itself may have a nearly circular or irregular Shape. Such Settlement Can be either Cultural or Urban, depending on the Size & the functions they Perform.

4)=Linear or elongated Settlement:-

A linear or elongated Settlement form a straight or curved line, following a line of movement, such as a road, river, coastlines or the foot of an elongated escarpment. This type of Settlement is found in ruler area, but Linear developments may constitute extensions of towns on their outskirts.

Question #03:-

Part * B:- A soil has Compressive index $C_c = 0.31$, At stress $130\ kN/m^2$, the void ratio was 1.02 Calculate:

1) = The void ratio -----
2) = The total Settlement -----

Given Data:-

C_c =
P_1 =
C_0 =
P_2 =
H =

Required:-

C_1 = ?
S_c = ?

Solution:-

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

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

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

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

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

S_c = mm.

%.