ID#7879

Question no: 1

Part:(A): Define the following terms:

1: PLASTIC EQUILIBRIUM:

State of stress within a Soil mass or a portion that has been deformed to such an extent That its ultimate shearing resistance is mobilized.

2: ANGULAR DISTORTION:

when the walls and columns are seperated by two footing then the unequal settelment in such a case is called angular Distortion.

3: COMPRESSIVE INDEX:

when load applied, void ratio changes (Δe), due to change in void ratio (Δe) The pressure changes (P_2, P_1) when this is drawn in logrithmic Scale then such is called compressive index. denoted by "Cc".

4: ULTIMATE BEARING CAPACITY:

The maximum pressure at the base of footing which causes shear failure in the soil.
It is denoted by (q_u)

5: POISSION RATIO OF SOIL:

Plainly, ~~Poisson~~ poisson Ratio is the nagative ratio of transvesal strain to the axial strain in an elastic material, which is subjected to an uniaxial stress.

Question no 1:

Part (B) : A 6m tall Cantilever wall retaining the Soil that has the following Properties: $C=0$, $\phi=30°$ $\gamma=19.2\ KN/m^3$ and the ground Surface behind the wall is inclined at a slope of 3 horizontal and 1 verticle. The wall has moved sufficiently to ~~Produce~~ develop active condition. Determine the total normal and shear forces acting on the back of this wall using Rankine's THEORY.

Given data:

$H=6m$, $C=0$, $\phi=30°$, $\gamma=19.2\ KN/m^3$

Slope = H=1, V=3

Required:

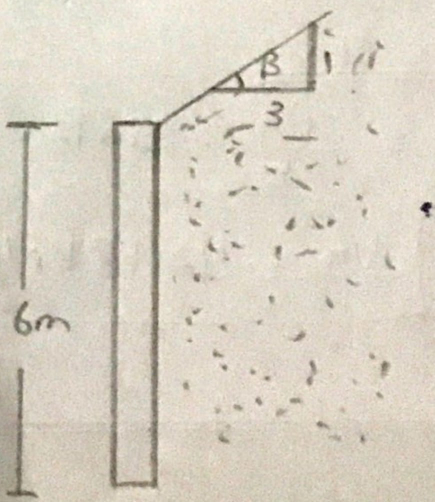
Total Normal force $\left(\frac{Na}{b}\right)=?$

Total Shear force $\left(\frac{Va}{b}\right)=?$

Solution:

As we know

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



As $\tan(\beta)=\frac{\text{PePendicular}}{\text{Base}}$

$\tan(\beta)=1/3$

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

$\boxed{\beta=18°}$

Scanned with CamScanner

Also Ka is given by,

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

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

$$= 0.951 \times \frac{0.951 - \sqrt{0.904 - 0.75}}{0.951 + \sqrt{0.904 - 0.75}}$$

$K_a = 0.3948$

$\boxed{K_a = 0.395}$.

Now by formula. Active force $\frac{P_a}{b} = \frac{\gamma \cdot H^2 \cdot K_a}{2}$

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

$\boxed{\frac{P_a}{b} = 136.52 \text{ kN/m}}$

Normal force: $\frac{N_a}{b} = \frac{P_a}{b} \cdot \cos\beta$

$= 136.52 \times \cos(18) = 129.83$

$\boxed{\frac{N_a}{b} = 129.83 \text{ kN/m}}$.

Shear force:

$\frac{V_a}{b} = \frac{P_a}{b} \cdot \sin\beta \cdot \quad = 136.52 \times \sin(18)$

$\boxed{\frac{V_a}{b} = 42.18 \text{ kN/m}}$.

Question no: 2

PART(A): what is bearing Capacity. Also write factors effecting Bearing Capacity:

⇒ BEARING CAPACITY:

Bearing capacity is the engineering property of soil due to which the load applied on the ground surface, and this load is resisted then such capacity of soil is called bearing capacity.
Denoted by "q" and also called internal strength of soil.

⇒ FACTORS EFFECTING BEARING CAPACITY:

a: RELATIVE DENSITY:

⇒ Greater the value of Relative Density of soil Greater will be internal friction (ϕ).

⇒ Higher the value of internal friction (ϕ) higher will be the value of torzique bearing capacity factors (N_c, N_q, N_γ). Due to which the value of bearing capacity will increase. ($RD \propto \phi$)

b: DEPTH OF FOOTING:

In case of Dense Soil as compare to lose soil with increase of Depth of footing the value of Bearing Capacity will increase.

C: WIDTH Of FOOTING:

The Bearing Capacity increase with the increase of width of the footing this increase will be maximum for the dense Soil as compare with lose Soil.

d: UNIGT WEIGHT Of SOIL:

Increase in unit weight of Soil $\propto$ Increase in bearing capacity of soil.

e: Cohesion of the Soil:

Bearing Capacity will be more for clay instead of Sand Because in Sand Cohesion is Zero.

$$q_u = \cancel{cN_c}^{=0} + qN_q + 0.5\gamma B N_\gamma = \boxed{\text{Sand}}.$$

$$q_u = cN_c + qN_q + 0.5\gamma B N_\gamma = \boxed{\text{Clay}}.$$

F: WATER TABLE:

water table become in Soil near footing So it will Cause slipping function towards Bearing Capacity So water table near footing will be having low Bearing capacity instead of water table away from footing.

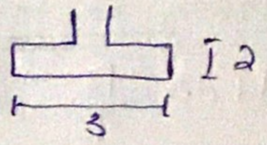
ID#7879

Question no: 2

Part (b): what is the maximum Safe load which can be Supported by rectangular footing 2m by 3m with a Safty factor of 3. The base of footing is at 1.6m below the ground Surface. The unit weight of Soil is $18 KN/m^3$. 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 Meyerhof analysis.

Given Data:

Rectangular footing 2m × 3m
$b = 2m$, $L = 3m$



Factor of safty = 3

($N_c = 14.8$, $N_q = 6.4$, $N_\gamma = 29$)

$d = 1.6m$

$\gamma_s = 18 KN/m^3$.

$\phi = 20°$

$C_u = 20 KN/m^2$.

Required:

Maximum safe load = ?

Solution:

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

(P.t.o)

* for shape factor:

$S_c = 1 + 0.2 \frac{B}{L} \tan^2 \alpha$ $\left(\alpha = 45 + \frac{\phi}{2} \right)$

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

$\alpha =$

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

$\boxed{S_c = 1.27}$.

$\Rightarrow S_q = S_\gamma = 1 + 0.1 \frac{B}{L} \tan^2 \alpha$ $(\alpha = 55)$

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

$\boxed{S_q = S_\gamma = 1.14}$

For depth factor:

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

$\boxed{d_c = 1.23}$

$d_\gamma = d_q = 1 + 0.1 \left(\frac{D}{B} \right) \tan \alpha = 1 + 0.1 \left(\frac{1.6}{2} \right) \tan(55)$

$\boxed{d_\gamma = d_q = 1.11}$.

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

$q_u = (20 \times 14.8 \times 1.3 \times 1.23 \times 1) + (18 \times 1.6 \times 6.4 \times 1.1 \times 1.11 \times 1) +$
$(0.5 \times 20 \times 2 \times 2.9 \times 1.11 \times 1.14 \times 1)$

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

(Pt.o)

Now

Maximum Safe load = ?

As we know: $q_s = q_{ns} + q$.

$$q_{ns} = \frac{q_{nu}}{F}$$

$$q_{nu} = q_u - q \qquad (q = D_f \times \gamma)$$

$q = 1.6 \times 18$

$q = 28.8$.

So $q_{nu} = q_u - q$.

$q_{nu} = 733.2\ kN/m^2$.

Now

$$q_{ns} = \frac{q_{nu}}{F} = \frac{733.2}{3}$$

$q_{ns} = 244.4\ kN/m^2$.

Now $q_s = q_{ns} + q. = 244.4 + 28.8.$

$q_s = 273.2\ kN/m^2$.

⇒ Total Safe load on Rectangular footing:

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

$q_s = 1639.2\ kN$.

ID # 7879

Question no:3

Part (a): what is settelment. what are its type.

SETTELMENT:

The soil beneth the structure is week in strength so when the load is applied in the form of building then the soil will sink in the downward direction, this sinking of soil is called settelment.

TYPES OF SETTELMENT:

1) Total Settelment.
2) Differential Settelment.

1) TOTAL SETTELMENT:

-> Also called uniform settelment.
-> In uniform settelment failure of structure as compare to differential settelment.
-> The total settelment mostly take place in rigid footing.
-> In this type of settelment mostly utility services get disturbed and utility services included in this type of settelment.

Question no 3:

Part(b): A Soil has a compressive index $C_c = 0.31$. At a stress $130 kN/m^2$, The void ratio was 1.02.

Calculate (i) The void ratio if the stress on the soil is incresed to $170 kN/m^2$.

(ii) The total settelment of the stratum of 5m thickness

Given data:

$C_C = 0.31$

$P_1 = 130 kN/m^2$.

$e_0 = 1.02$

$P_2 = 170 kN/m^2$.

$H = 5m$

Required:

(i) $e_1 = ?$

(ii) $S_c = ?$

Solution:

(i): $C_C = \frac{\Delta e}{\log_{10}\left(\frac{P_2}{P_1}\right)}$, $C_C = \frac{e_0 - e_1}{\log_{10}\left(\frac{P_2}{P_1}\right)} = 0.31 = \frac{1.02 - e_1}{\log_{10}(170/130)}$

$e_1 = 0.983$ at $P_2 = 170 kN/m^2$.

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

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

$S_c = 89.39$ mm Total Settelment.

ID=7879

2) DIFFERENTIAL SETTELMENT:

-> Differential Settelment in a different parts of the Same Structure is called differential Settelment.

-> Differential Settelment is more dangerous or undesirable as compared with total settelment because whole structure get disturbed in different positions.

TYPES OF DIFFERENTIAL SETTELMENT:

i) TILT:

when the structure rotates due to unequal settelment then it is called tilt.

ii) ANGULAR DISTORTION:

when the walls and columns are seperated by two footing Then the unequal Settelment in Such a case is called angular distortion.