Submitted by: M. Zubair Khan

Submitted TO: Engr. Liaqat Ali

ID: 7677

Department: Civil Engineering

Subject: Geotechnical & Foundation Engineering

Assignment# 01

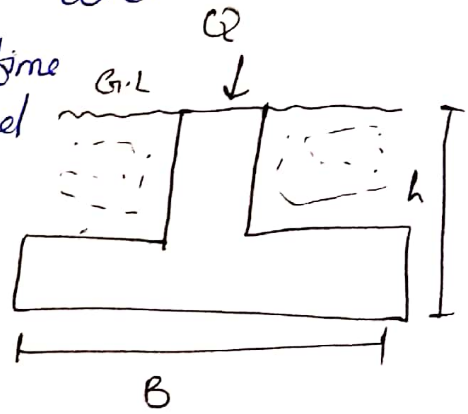
Iqra National University Peshawar

Q 1

Part A:

1. Ultimate bearing Capacity:

It is the maximum gross pressure at the base of footing with no shear failure in soil is Called ultime bearing Capacity it is denoted by q_u



2- Angular distortion:

when the wall and colum are Supported by two footing then the unequal settlement in this case is called Angular distortion

3- Plastic Equilibrium:

The transition from the state of plastic equilibrium to the state of plastic flow represents the failure of the mass. Since the weight of the mass assists in producing an expansion in a horizontal direction, the Subsequent failure is Called active failure.

Scanned with CamScanner

4. Compression index:

The Compression index is used to find the settlement in the normally Consolidated clay. The total stress applied is larger than the stress in the field, to which the soil sample has been undergone in the past. This kind of clayey soil is said to be normally consolidated clay.

Q 1:-

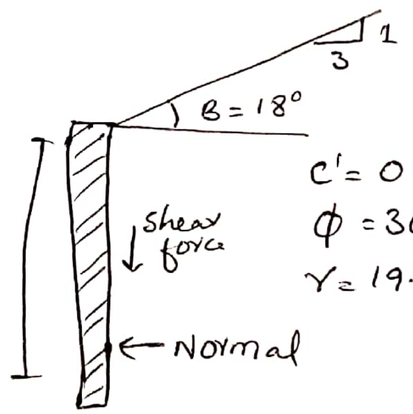
Part B

Problem:

A 6 meter tall Cantilever that has the following properties $c=0$, $\phi'=30$, $\gamma = 19.2\ KgN/m^3$ in the ground surface behaind the wall in inclined at a slop 3 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 renKine theory

Solution:

$C=0$
$H=6m$
$\phi = 30°$
$\gamma = 19.2 KN/m^3$
Slope
$(H=3, V=1)$



Required:

Normal force = ? $\frac{Na}{b} = \frac{Pa}{b} \cos\beta$

Shear force = ? $\frac{Va}{b} = \frac{Pa}{b} \sin\beta$

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

$\beta = 18°$

$$\frac{Na}{b} = \frac{\gamma H^2 Ka \cos\beta}{2}$$

where $Ka = \frac{\cos\beta\,(\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi'}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}$

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

$$\boxed{Ka = 0.395}$$

$$\frac{N_a}{b} = \frac{\gamma H^2 K_a}{2} \cos\beta$$

$$= \frac{19.2(6)^2(0.395)\cos(18^\circ)}{2}$$

$$\boxed{\frac{N_a}{b} = 130\ KN/m}$$

$$\frac{V_a}{b} = \frac{\gamma H^2 K_a}{2} \sin\beta \qquad \because \frac{P_a}{b} = \frac{\gamma H^2 K_a}{2}$$

$$\frac{V_a}{b} = \frac{(19.2)(6)^2(0.395)}{2} \times \sin(18^\circ)$$

$$\boxed{\frac{V_a}{b} = 42\ KN/m}$$

Q2

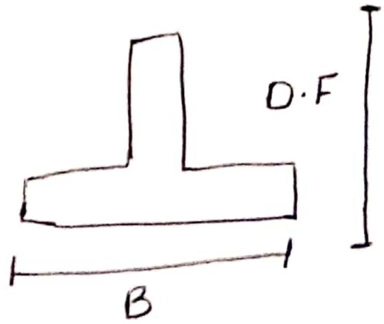
Part A :-

Bearing Capacity:
In Geotechnical engineering the bearing Capacity is defined as the ability of soil to support the applied load is called bearing Capacity of soil.
In other words the internal strength of the soil is called bearing Capacity.
It is denoted by q.

Factor effecting bearing Capacity:

Relative density: More the relative density of the soil more will be its angle friction ϕ
This will be more in case of dense soil as compared with medium and loose sand
With increase of relative density, N_q & N_γ will increase.
This increase in N_q & N_γ will cause increase in the bearing capacity
N_q & N_γ these are tarzagis bearing capacity factors.

Depth of footing:
The bearing capacity of soil will increase with increase of depth of the footing
This increasing will be more in case of dense soil as compared with medium and loose sand.



unit weight of the soil:

The bearing Capacity increase with the increase of unit weight of the soil more than unit weight of the soil more will be its bearing Capacity.

dense soil increase will be more as Compared with medium and loose.

width of the footing:

The bearing capacity will increase with the increase of width of the footing. More the width more will be the bearing Capacity.

This will be more in case of dense soil as compared with loose & medium

Location of water table:

Bearing Capacity decrease as the water table Comes near in location with footing

Q2 Part B:-

Problem:

What is the maximum safe load which Can be supported by a rectangular footing 2m by 3m with a safety factor of 3? The base of the footing is of 1.6m below this group surface The unit weight of soil is $18 KN/m^3$

(7)

The angle of shearing resistance ϕ is 20° and the unit cohesion C_u is 20KN/m³ use the meyerhof's analysis

Given data:

$\phi = 20^{\circ}$ D = 1.6m

L = 3m γ = 18 KN/m³

B = 2m F.O.S = 3

C = 20KN/m²

From table

$\phi = 20^{\circ}$

$(N_c = 14.8,\ N_{\gamma} = 2.9,\ N_q = 6.4)$

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

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

$\boxed{\alpha = 55^{\circ}}$

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

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

$\boxed{S_c = 1.2}$

$S_q = S_{\gamma} = 1 + 0.1\left(B/L\right)\tan^2\alpha$

$S_q = S_{\gamma} = 1 + 0.1\left(2/3\right)\tan^2(55^{\circ})$

$\boxed{S_q = S_{\gamma} = 1.09}$

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

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

$\boxed{d_c = 1.2}$

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

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

$\boxed{d_q = d_\gamma = 1.1}$

$q_u = cN_c S_c d_c + q N_q S_q d_q + \frac{1}{2} \gamma_B N_\gamma S_\gamma d_\gamma$

$= (20 \times 14.8 \times 1.2 \times 1.272) + (1.6 \times 18 \times 6.4 \times 1.09 \times 1.1)$
$+ \frac{1}{2}(18 \times 2 \times 2.9 \times 1.09 \times 1.1)$

$q_u = 462 + 234 + 66$

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

$q_{n.u} = q_u - (\gamma \times D_f)$ — δ'

$= 762 - (18 \times 1.6)$

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

$q_{n.s} = \frac{733.2}{3} = 244.4\ KN/m^2$

$q_s = q_{n.s} + \gamma \times D_f$

$q_s = 244.4 + 18 \times 1.6$

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

q_s on the hole area of the footing

$= A \times q_s$

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

$\boxed{\text{hole area} = 1639\ KN}$

Q 3

Part A

Settlement. when load is applied on the ground surface effect stresses will be produce due to these effective strain will be produce ~~due to~~ as result change in volume will take place and soil partical will more in the downward direction this downward movement is Called Settlement.

Types of Settlement

① Total settlement ② Differential settlement

① Total settlement/ uniform settlement. It is also called uniform settlement in this type of settlement every part of the structure settlement the equally. In this type of settlement the structure remain in its sound form. Total settlement take place in structure which is supported by ragid footing

Due to uniform settlement the utility service of the building Can be decrease such as water supply, electricity, sewage service, telephone etc.

Limitation of total settlement:

① To transfer the load of the structure to the soil which have enough bearing capacity

② To distribute the load over a large area.

② Differential settlement: Different amount of settlement is the same structure is called differential settlement. It is more undesireable as compared to total settlement because it is more danger than total settlement.

Q 3

Part B

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

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

Given data: $C_c = 0.28$

$e_1 = 1.02$

$P_1 = 130 KN/m^2$

$P_2 = 170 KN/m^2$

$H = 6m$

Required: $e_2 = ?$ $S_c = ?$

Solution:

(a) $$C_c = \frac{e_2 - e_1}{\log \frac{P_2}{P_1}}$$

$$\Rightarrow 0.28 = \frac{e_2 - 1.02}{\log\left(\frac{170}{130}\right)}$$

$$\Rightarrow 0.28 = \frac{e_2 - 1.02}{0.1165}$$

$$\Rightarrow 0.28 \times 0.1165 = e_2 - 1.02$$

$$\Rightarrow 0.03262 + 1.02 = e_2$$

$$\Rightarrow \boxed{e_2 = 1.05}$$

(b) $\delta_c = \frac{H}{1+e_1} \times C_c \log\left(\frac{P_2}{P_1}\right)$

$= \left(\frac{5}{1+1.02}\right) \times 0.28 \times \log\left(\frac{170}{130}\right)$

$= 0.080m$

$\boxed{\delta_c = 80\,mm}$