Name Zamarud Shah

ID 7463

Submitted TO Engr. Liaqat Ali

Subject Geotechnicical Engineering.

Semester 12th

Date 27/06/2020

Q1:- Name the force acting on dam. Explain any five of them in detial;

Ans:- Following are the forces acting on dams.

(i) water pressure.
(ii) uplift pressure
(iii) wave pressure
(iv) Silt pressure
(v) Ice pressure
(vi) Self weight ~~pressure~~ of dam
(vii) Seismic forces

① Self weight of Dam :- The weight of the dam and its foundation is a major resisting force. it can be completed using the following equation.

$$W = \gamma_m \text{ Volume}$$

where γ_m = unit weight of dam material

(ii) silt pressure :- it is a pressure that is caused by the deposition of the silt on the bed of the dam causing at h/3 from the base and can be computed using equation.

$$P_{silt} = 0.5\ \gamma_s h^2 K_a$$

where
K_a = Coefficient of active earth pressure of silt which is equal to

$$\frac{1 - \sin\phi}{1 + \sin\phi}$$

ϕ = angle of internal friction of soil, cohesion neglected.
γ_s = submerged unit weight of silt material.

h = height of silt deposited

(iii): Wave pressure:- waves are generated on the pressure of the reservoir by the blow away ~~words~~ winds which exerts a pressure

- Wave pressure depends upon waves height which is given by.

For F < 32km

$$h_w = 0.32\sqrt{PV} + 0.763 - 0.271 \times F^{1/4}$$

For $h_w = 0.32\sqrt{VF}$

where h_w = height of water from the top of crest to bottom of trough in meters.

V = wind velocity in Km/hr

F = Fetch or straight length of water expanse in Km.

The maximum pressure intensity due to wave action occurs when it acts at 0.J.

Total forces due to water wave action is given by

$$P_w = 0.5(2.4 \gamma_w h_w)^{3/8} h_w$$

(iv) Ice pressure: The pressure of ice which may be formed on the water surface of the reservoir in cold countries may sometimes melt and expand. The dam face is subjected to the thrust and exerted by the expanding ice. This force acts linearly along the length of the dam and at the reservoir level. The magnitude of these forces varies from 250 to 1500 Kcm it depends upon the temperature

(V):- Seismic forces: Dynamic loads created due to earthquake must be considered in the design of all major dams located in high risk, seismic regions. Earthquake produces waves in every possible direction. However it has to be ~~[illegible]~~ resolved into verticle and Horizental component for the design purpose. The Horizental component had greater effect. Seismic vibration influence both dam ~~[illegible]~~ body and water in the reservoir of dam. So they generated dynamic loads are due to ~~[illegible]~~ inertia of the dam and hydrodynamic forces by the water in the reservoir.

(B):- Define the following terms:

(1) Liquification of soil :- Effective stresses are the stresses which keep the soil particles in contact with each other if the effective stresses decrease the soil loose its strength when the effective stresses become zero then soil will change to liquified state.

(2) Butress dam :- A Butress dam is a dam with a solid water tight upstream side that is supported at intervals on the downstream side by a series of buttresses or supports. The dam wall may be straight or curved. Most buttress dams are made of reinforced current and are heavy pushing the dam into ground.

(3) infinite slope :- The slope which have infinite area and finite depth such a slope is called infinite slope.

Example :- Natural slope is Hills, mountary deserts etc.

In infinite slope the failure will be in the form of sliding.

(4) :- pier foundation :- The vertical member which have longer dia as compared to the underground soil. They are constructed by cost in site process.

(5) Dynamic load :- Dynamic load occurs when loading conditions are changing with time. it may be in the form of earthquake operation of heavy ~~mea~~ machinary, wave motion, wind etc. due to dynamic load the settlement chances may increase

---

Q2:- (A) Define Shallow foundation. Explain types of shallow foundation in detail with appropriate sketch?

Ans:- Shallow foundation:- According to Terzaghi:-

Foundation in which the depth of foundation is less than the breath then such foundation is termed as shallow foundation.

According to Skempton:

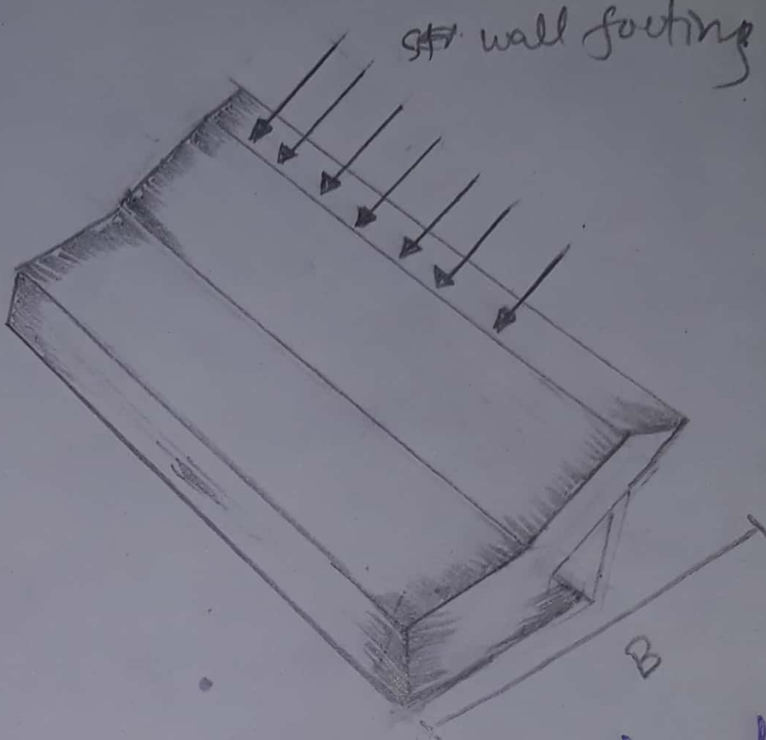
The foundation in Df/B ratio is less than 2.5 such foundation is termed as shallow foundation

Df = Depth of foundation
B = Breath of the foundation.

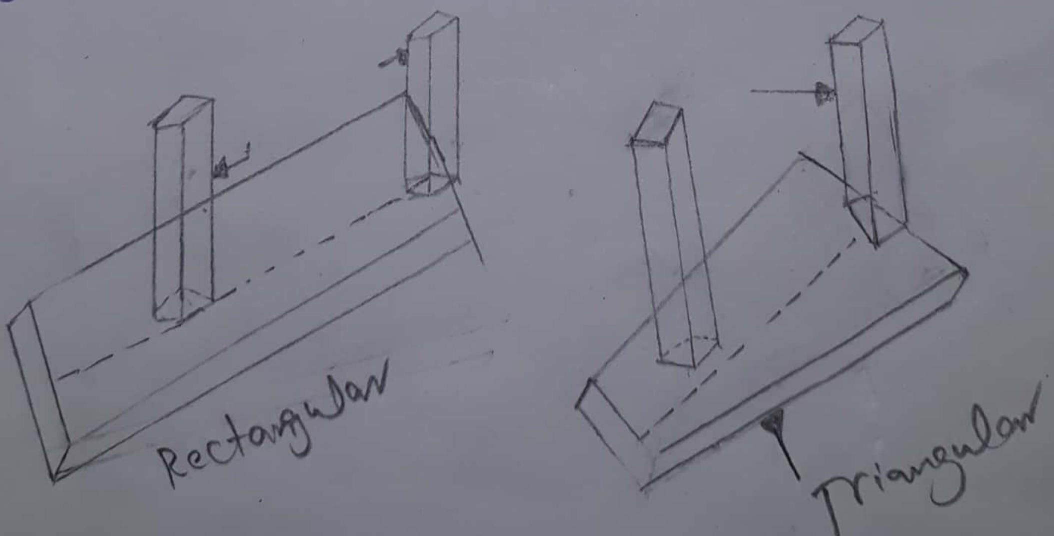
Types of shallow foundation:- Types of shallow foundation are given below.

1. Wall footing / strip footing
2. Combine footing.
3. Mat / Raft footing.
4. Column footing
5. strapped footing.

1: Wall footing :- it is a footing which run across the length of the footing.

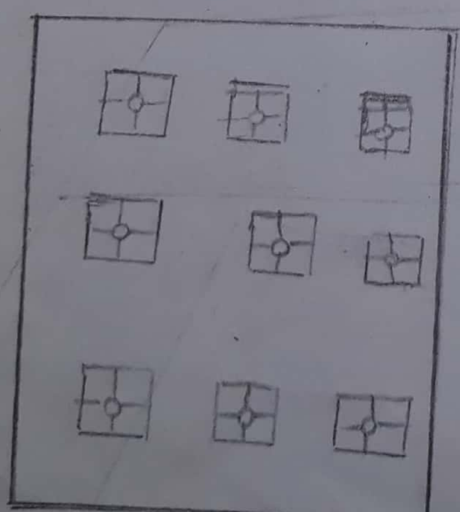


2:- combined footing :- Footing which constructed for two or more columns to transfer the load of these columns safely the soil then such footing is called combine footing.

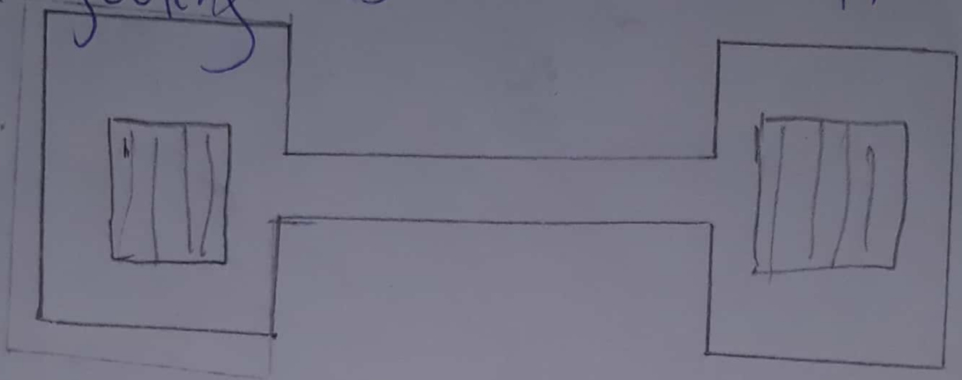


- if the load of the columns are uniform mean equal in magnitude then the Shape the shape of combine footing will rectangular
- if the load of the columns are not uniform mean not equal in magnitude then the shape of combine footing will trapezoidal.

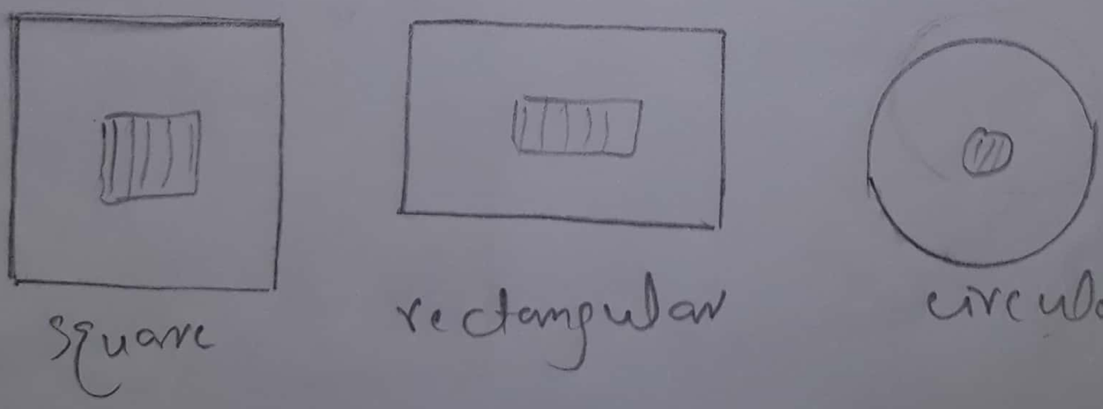
(5) Raft footing :- it is that footing which is constructed and covers of the area of the entire structure this type of footing is is provided then the soil is weak in bearing mean having weak bearing capacity.



④:- Strapped footing :- Footing in which the outer column is connected with the inner column by means of tie beam or strap such a footing is called strapped footing.



⑤ column footing :- Footing which is constructed for a single column and transfer its load safely to the soil is called column. This column may be circular, rectangular or square shape



Q2:- (B): Why ground improvement techiniques are important. Explain methods of ground improvement in detail along with appropriate Sketch.

Ans:- The soil which volumetric changes takes place to Shrinkage and swelling such soil needs ground improvement techiniques.

→ The soil which is organic in nature.

→ The Soft Soil also required ground improvement techiniques.

→ The soil which is Sandy and gravely.

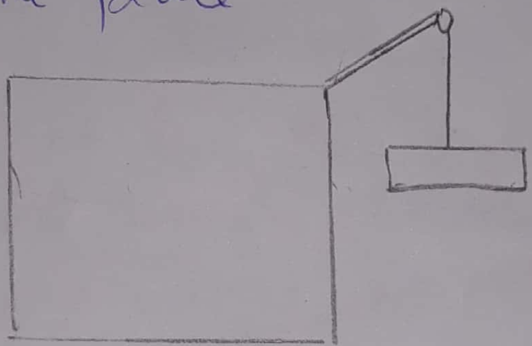
Methods of ground improvement techiniques are given below.

(1) Removal and Replacement of soil :- This is an oldest and simple method. This method is performed on loose Soil.

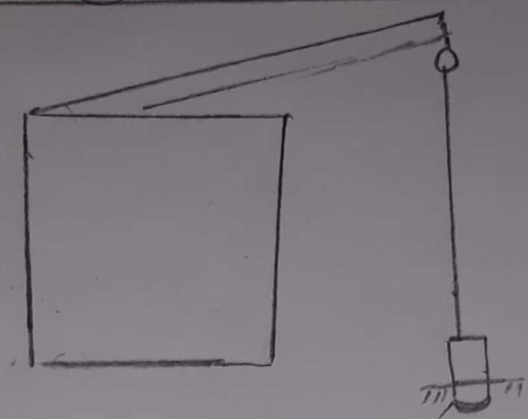
In this method the unsuitable soil is replaced with compacted fill. In this method the same soil is used to refill the higher compaction and better engineering properties.

This method is applicable above the ground water table.

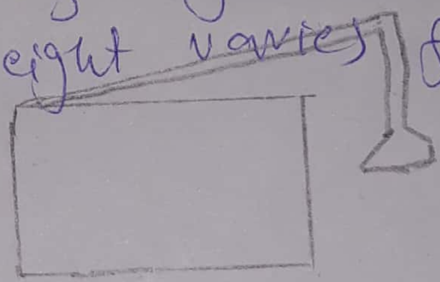
(2) Dynamic computation :- This method is used to increase the bearing capacity of soil. This also increase the consolidation rate. This method also increase the density of soil. In this method is actually densification of soil take place



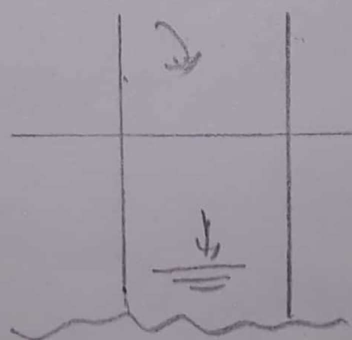
(3) Vibro compaction :- it is also called vibro densification. In this method the compaction take place at a ~~cont~~ certain depth in granular soil through vibratory probe. this vibratory probe is run by an electric motor. This penetration of probe is enhance by ejecting water at the top of the probe.



(4) Rapid impact compaction :- Impact energy is applied to surface of ground as a result of which densification of soil take place upto a depth of 15'. This impact energy is actually applied through hydralic ramp the hydraulic ramp weight varies from 4-8 tons



(5) concrete column :- vibre concrete is a ~~gravel~~ ground improvement techniques which transfer the load from weak strata to hard strata by using strength concrete.



Q3:- An infinitely long slope having an inclination of 26° in an area is underlain by firm cohesive soil ($G = 2.72$, $e = 0.50$). There is a thin weak layer of soil 6m ~~ft~~ below and parallel to the slope surface is $c = 25\ KN/m^2$, $\phi = 16°$. Compute the factor of safety when the slope is dry. If ground water flow could occur parallel to the slope on the ground surface what factor of safety would result.

Given data:- $c = 25\ KN/m^2$

$\phi = 16°$

$G = 2.72$

$e = 0.50$

Required:

F_c (F.O.S) when soil is dry

F_c (F.O.S) when there is seepage in soil.

Sol:- $$F_c = \frac{c}{\gamma_d \times H \times \sin i \times \cos i} + \frac{\tan\phi}{\tan 26} \rightarrow (1)$$

$$\gamma_d = \frac{G_s \times \gamma_w}{1+e} = \frac{2.72 \times 9.8}{1+0.5}$$

$$\boxed{\gamma_d = 17.8 \text{ KN/m}^3}$$

put the values in eq ①

$$F_c = \frac{25}{17.8 \times 6 \times \sin(26^\circ) \times \cos(26^\circ)} + \frac{\tan 16^\circ}{\tan 26}$$

$$\boxed{F_c = 1.18}$$

where there is seepage of water.

$$F_c = \frac{c}{\gamma \times H \times \sin i \times \cos i} + \frac{\gamma'}{\gamma} \times \frac{\tan \phi}{\tan i}$$

$$\gamma' = \gamma - \gamma_w$$

$$\gamma = \frac{G + e}{1+e} \times \gamma_w$$

$$\gamma = \frac{2.72 + 0.5}{1+0.5} \times 9.8$$

$$\boxed{\gamma = 21.04 \text{ KN/m}^3}$$

$\gamma' = \gamma - \gamma_w$

$\gamma' = 21.04 - 9.8$

$\boxed{\gamma' = 11.24 \ KN/m^3}$

$$F_c = \frac{25}{21.04 \times 6 \times \sin 26^\circ \times \cos 26^\circ} + \frac{11.24}{21.04} \times \frac{\tan(16^\circ)}{\tan(26^\circ)}$$

$\boxed{F_c = 0.816}$

Q4: (A) it is proposed to constructed a 10m highway embankment with the following soil properties.

$C = 18.8\ KN/m^2$

$\gamma = 17 KN/m^3$

$\phi = 20^\circ$

what is the inclination required for the embankment if the design FOS = 1.5 &

$F_\phi = 1.0$

Given:- Height = 10m

$C = 18.8 KN/m^2$

$\gamma = 17 KN/m^3$

$\alpha = 20^\circ$

$F.O.S = 1.5$

$F\phi = 1.0$

Required:- Inclination = i = ?

Solution:-

$$S_N = \frac{c}{F.O.S \times \gamma \times H}$$

$$S_N = \frac{18.8}{1.5 \times 17 \times 10}$$

SN = 0.073

using taylor chart for

$\phi = 20°$

SN = 0.073

$i = 44°$

(B). Given data:-

Height of water on upstream side = 15m

Bottom width of the dam = 12m

Top width = 6m

Unit weight of water = 1000 kg/m³

Unit weight of concrete = 1450 kg/m³

unit weight of silt = 1330 kg/m³

Angle of friction of silt = ϕ = 35°

Free Board = 3.5m

silt deposite height = 2.5m

Required: silt pressure = ?

As we know that

$$P_s = \frac{\gamma_s \times H_s^2}{2} \times \frac{1 - \sin\phi}{1 + \sin\phi}$$

$$P_s = \frac{1330 \times 2.5^2}{2} \times \frac{1 - \sin 35°}{1 + \sin 35°}$$

$P_s = 1126.30$ kg/m

The End