FINAL PAPER

SUBJECT : GEOTECHNICAL ENGINEERING

SECTION : B

MODULE : 6th

SUBMITTED BY : AQIB ULLAH , 7857

SUBMITTED TO : ENGR. LIAQAT ALI

DATE : 27 JUNE 2020.

7857

QUESTION 01 (A)

Name the forces acting on dam. Explain any five of them in detail?

FORCES ACTING ON DAMS:

Following are the forces that acts on Dams.

1) Water pressure
2) Uplift pressure
3) Wave pressure
4) Silt pressure
5) Ice pressure
6) Self weight of dam
7) Seismic forces.

1. WATER PRESSURE:

Water pressure is one of the mass major external forces acting on gravity dam. The horizontal water pressure exerted by the water stored upstream side of dam can be collected from hydrostatic pressure distribution.

7857

2. ICE PRESSURE:

The ice which may be formed on the water surface of the reseevior. in cold contries may sometimes melt and expand. The dam fac then has to resist force exerted by the expanding ice. The force acts lineaely along the length of the dam at the reservior level. The magnitude of this force varies from 250-1500 kn/m²

3. Weight of Dam:

The weight of dam and its foundation is the major resisting force. In two dimensional analysis of the gravity dam, unit length of the dam is considered.

4. WAVE PRESSURE:

Waves are generated on the surface of the reservoir by the blowing winds, which can cause a pressure and it depends upon the wave heigh.

5. Uplift Pressure:

Water seeping through the pores and fissures of the foundation material and water seeping through the dames of the body and there to the bottom through the joints.

7857

b/w the body of the dams and its foundation at the base, exeets an uplift pressure on the base of the dam.

QUESTION 01 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 decreases the soil loose its strength when the effective stresses become zero then soil will change to liquified state.

2) Butress Dam:

The butress dam is a dam with a solid, water tight upstream side that is supported at interval on the downstream side by a series of butress.

- It is basically a derivation of a gravity dam with introduction of intermediate side

3) Infinite Slope:

The slope which have infinite area and finite depth such as slope is called Infinite slope

Example: Natural slope.

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

4. Pier Foundation:

A piee foundation is a collection of large diameter cylindrical column to support the super structure and transfer large super imposed loads to the firm strata below.

5. Dynamic Load:

The load which acts on ground by the movement of subjects and sometimes the load due to earthquake can be classified as dynamic load.

Question 02 A

Define shallow foundation. Explain types of shallow foundation with appropriate sketch?

Shallow Foundation:

It is define as

According to Dr. Karl Terzaghi:

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

According to Skempton:

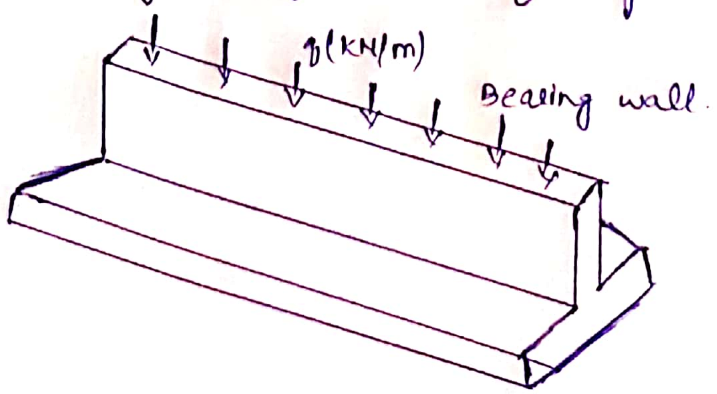
The foundation in D_f/B ratio is less than 2.5 such foundation is termed as shallow foundation.

Types Of Shallow Foundation:

Shallow foundation is divided into the following main types.

1. Wall Footing:

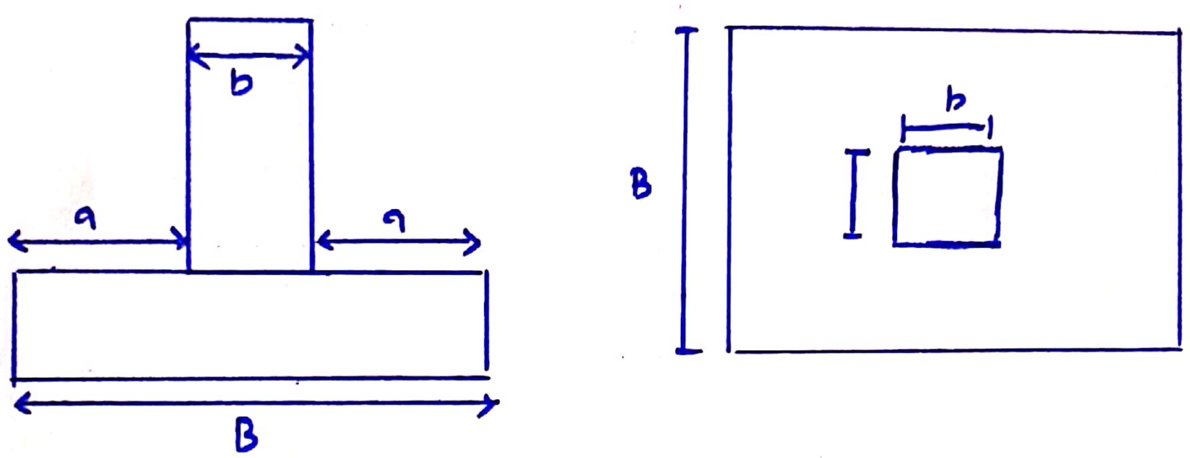
Wall footing is a footing which run across the length of the footing



4. ISOLATED 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 in shape



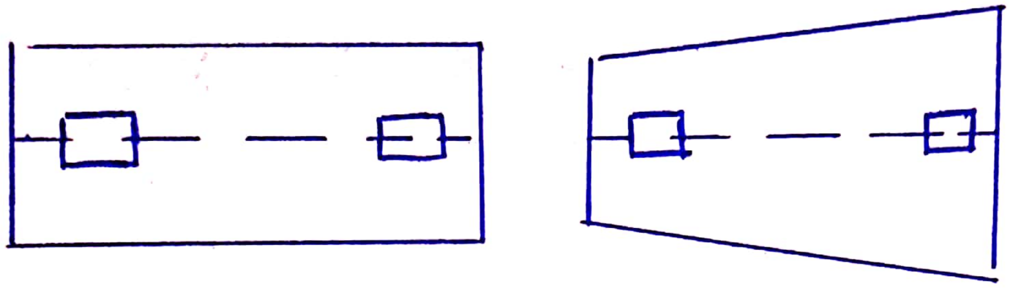
Square Footing.

RAFT FOOTING:

Footing which is constructed and covers the area of the entire structure this type of footing is provided when the soil is weak in bearing capacity.

2. COMBINED FOOTING:

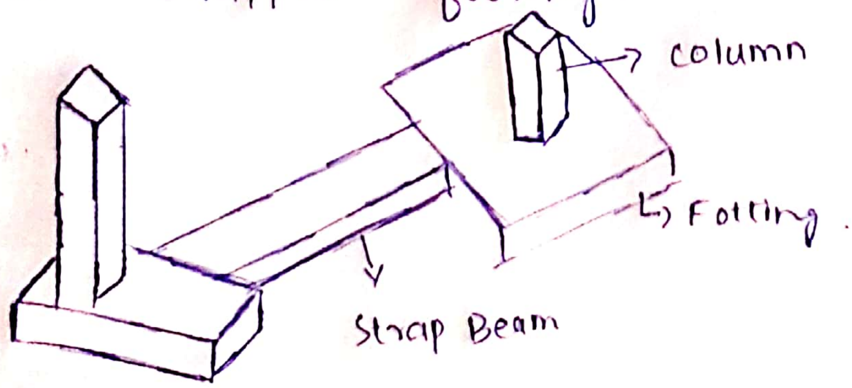
Footing which constructed combined for two or more columns to transfer the load of these columns safely to the soil then such footing is called combined footing.



- If the load of the columns are uniform mean equal in magnitude then the shape of combined footing will rectangular.
- If the load of the columns are not uniform mean not equal in magnitude then the shape of combined footing will trapeziodle.

3. 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.



QUESTION 02 (B)

Why ground improvement techniques are ~~improvement~~ important. Explain five methods of ground improvement in detail along with appropriate sketch?

Importance Of Ground Improvement Techniques:

The soil in which volumetric changes take place due to shrinkage and swelling such soil needs ground improvement techniques.

- The soil which is organic in nature.
- The soft soil also required ground improvement techniques.
- The soil which is sandy and gravely.

Methods Of Ground Improvement Techniques:

1. Removal And Replacement Of Soil:

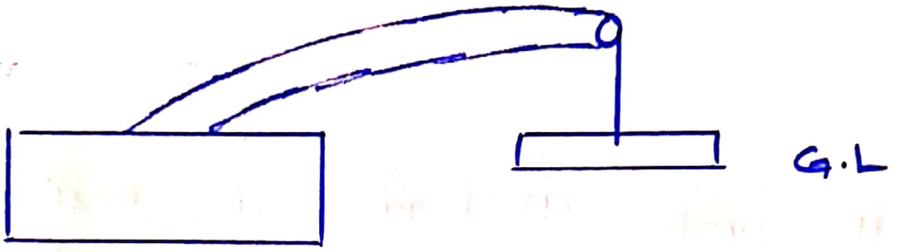
This is an oldest and simple method. This method is performed on loose soil.

- 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.

7857

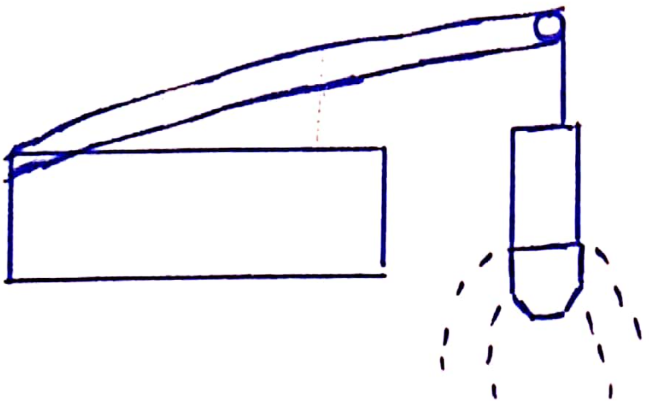
2. DYNAMIC COMPACTION:

This method is used to increase the bearing capacity of soil. This method also increase the density of soil. In this method actually densification of soil take place.



3. VIBRO COMPACTION:

It is also called vibro densification. In this method the compaction takes place at a certain depth in granular soil through vibratory probe. This vibratory probe is run by an electric motor. The pentration of probe is enhance by ejecting water at the tip of probe.

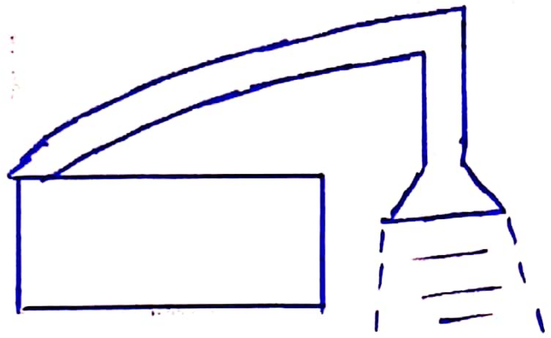


7857

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 feet.

This impact energy is actually applied through hydraulic ~~pump~~ ramp. The hydraulic ramp weight varies from 4-8 tons.



5. Dry Mixing Of Soil:

Dry mixing is a ground improvement technique by which the characteristics of weak soil are improved by using dry cementities binder

QUESTION 03

GIVEN DATA:

$C = 25 \ KN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.50$

REQUIRED:

- Fc (F.O.S) when soil is dry
- Fc (FOS) when there is seepage in soil

SOLUTION:

$$F_c = \frac{C}{\gamma_d \times H \times \sin i \times \cos i} + \frac{\tan \phi}{\tan i}$$

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

$$\gamma_d = 17.8 \ KN/m^3$$

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

$$F_c = 1.18$$

7857.

When there is seepage of water.

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

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

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

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

$\gamma = 21.04 \ kN/m^3$

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

$= 21.04 - 9.8$

$\gamma' = 11.24 \ kN/m^3$

- $F_c = \frac{25}{17.8 \times 6 \times \sin(26^\circ) \times \cos(26^\circ)} + \frac{11.24}{21.04} + \frac{\tan(16^\circ)}{\tan(26^\circ)}$

$F_c = 0.816$

7857

QUESTION 4 (A)

GIVEN DATA:

$C = 18.8\ kN/m^2$

$\gamma = 17\ kN/m^3$

$\phi = 20^\circ$

FOS = 1.5

$F_o = 1.0$

$H = 10\ m$

REQUIRED:

Inclination = ?

SOLUTION:

$$S_N = \frac{C}{F \cdot 0.5 \times \gamma \times H}$$

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

$$S_N = 0.073$$

Using tylor chart for.

$\phi = 20^\circ$

$S_N = 0.073$

$\Rightarrow$ inclination, $i = 44^\circ$

QUESTION 04 (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 for the silt = ϕ_s = 35°
- Free Board = 3.5m
- Silt Deposite height = 2.5m

REQUIRED:

Silt pressure = ?

SOLUTION:

Silt pressure ⇒

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

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

$$= 4156.25 \times 0.27.$$

$$\boxed{P_s = 1122.18 \text{ Kg/m.}}$$