Final term

Name : Atif ali

ID : 7886

Section : B

Submitted to : Engr-Liaqat Bacha

Subject : Geotechnical

Q 1
Part (A) Forces acting on Dam:-

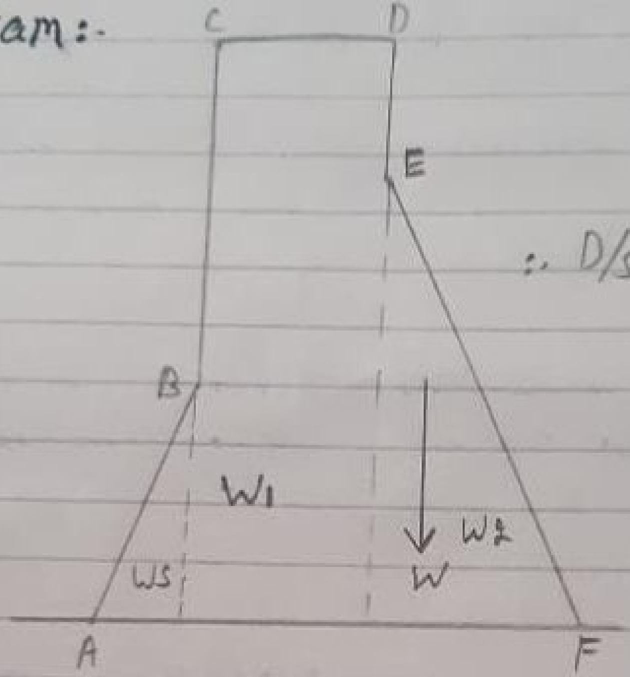
(1) Weight of Dam
(2) Water pressure
(3) Uplift pressure
(4) Wave pressure
(5) Earth and silt pressure
(6) Earthquake pressure
(7) Ice pressure
(8) Wind pressure
(9) Thermal pressure

1) Weight of Dam:- This is the ~~mg~~ major resisting force.
(1) Generally unit length of dam is considered.
(2) The cross section of dam may be divided into several triangles and rectangles and weights W_1, W_2, W_3 e.t.c may be computed.
(3) The total weight of the dam acts at C.G of its section.

Mathematical form:-

Weight = Vol per unit length x Density of material

Diagram:-



(2) Water pressure:-
These are the major external force acting on dam.

- pressure components on both upstream and down stream are
(1) Vertical Component
(2) Horizontal Component

:- Formula,
$P = \frac{1}{2} \gamma w h^2$

- Unit weight of Water
  - $\gamma_w = 1000\ Kg/m^3$

(3) Wave pressure:-
- When very high wind flow over the water surface of the reservior. Wave are formed Which exert pressure on the upstream part of the dam.
- The magnitude of Wave depend upon

- Velocity of Wind
- Depth of ~~Res~~ Reservior
- Area of water Surface.

. It is Calculated by the following formula.

$$P_v = 2.4 \gamma_w \times h_w$$

4) Uplift pressure:- . The Water stored on the upstream side of the dam has a tendency to seep ~~thro~~ though the soil below foundation
- While seeping, the water exerts a uplift ~~form~~ force on the base of the dam depending upon the head of water

(5) Ice pressure:- . The Ice pressure Which may be formed on the surface of Reservior cold Countries, may Sometimes melt & expend.
- The dam face has then to exists the thrust exerted by the expanding Ice.
- This force acts linearly along the length of the dam and at the reservior level.
- The magnitude of this force depending upon the temperature variation.
- These magnitude varies from 250 to 1500 kN/m².

Q 1

Part (B) Liquification of Soil:-

Soil liquification occure when a saturated or partially saturated soil substantially losses strength and stiffness in response to an applied stress such as shaking during an earthquake or other change in stress condition, in which material - that is ordinarilly a soil behaves like a liquid.

(2) Butress Dam:-

A Butress dam is a dam with a solid, water tight upstream side that is supported at interval on the down stream side by series of Butress or supports. The dam wall may be straight or curved. Most butress dams are made of reinforced concrete and are heavy.

(3) Infinite slope:

An inifinite slope is a simply vertical line. When you plot it on a line graph. an any line which runs parallel to the y-axis. The line that does not move along the axis but stay fixed at one constant x-axis co-ordinate.

(4) Pier foundation:-

A deep foundation is a type of foundation that transfers building load to the earth farther down from the surface than a shallow foundation does to a Subsurface layer or a range depth.

(5) Dynamic load:- Dynamic load is the load Which is non-static such as wind load live load.

Q 2 Part A

Shallow foundation:-

According to terzaghi, The foundation in Which depth of the foundation is less or equal to width of the founding is called shallow foundation.

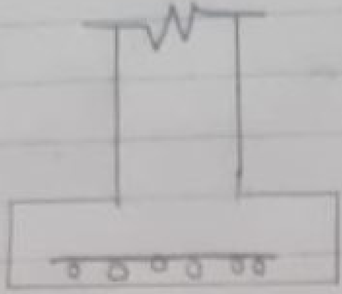
$$Df \leq B$$

Types of Shallow foundation

(1) Wall/strip footing
(2) Combined footing
(3) Raft/Mat footing
(4) Strapped footing
(5) Column/Isolated footing
(6) Slopped footing.

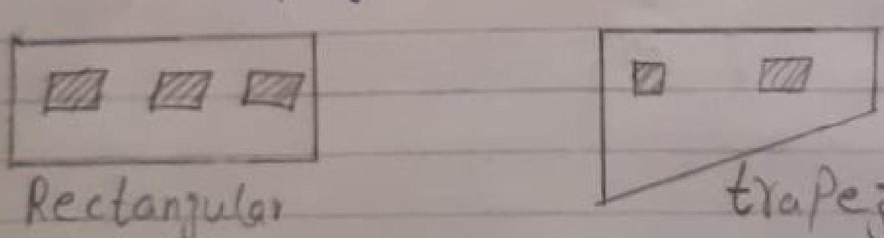
1) Wall/strip footing:- The footing Which runs across the length of the wall and transfer the load of the wall to

the soil Safely It is called Wall or strip footing.



2) Combined footing:- The footing Which is constructed for two or more Column and transfer the load of the two or more Column to the Soil Safely then It is called Combined footing. If the load of Column is uniform then the Combined footing will be rectangular in shape.

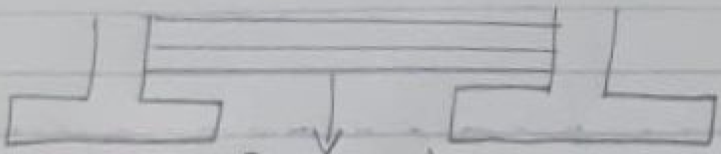
if the load of the Column is not uniform then Shape of Combined footing will be trapozaidal.



Raft / Mat footing:- The footing Which Covers the Whole area of the Structure is called raft footing. This type of footing is proposed in area Which have soil weak in bearing capacity. This is also provided When the load of Super

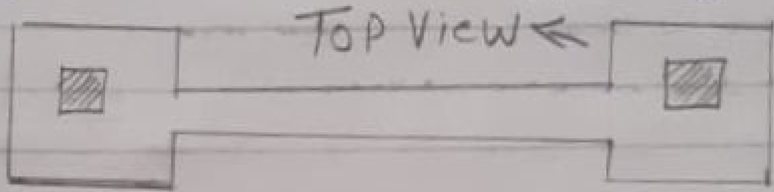
P-07 7886

structure is heavy.

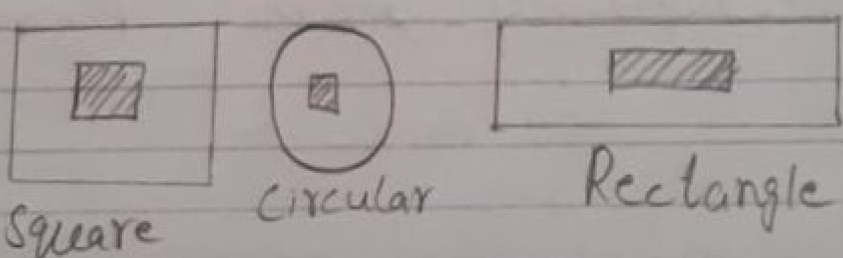


Beam strap

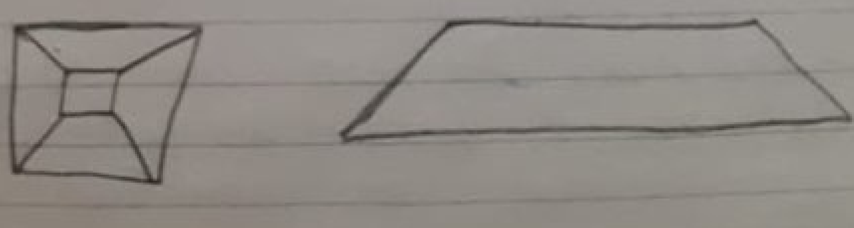
Strapped footing:- The footing in Which outer Column is Connected With the inner Column by means of the beam or strap is called Strapped footing.



Column/isolated footing:- The footing Which is constructed for a single Column and transmit It load to the soil safely. It may be circular, square, rectangular in Shape.



Slopped footing:- The footing Which have slope in all direction or in all sides is called slope footing.



Q 2 Part (B) Importance of ground improvement techniques:- The Soil in Which Volumetric changes take place due to shrinkage and swelling, such soil needs ground improvement techniques

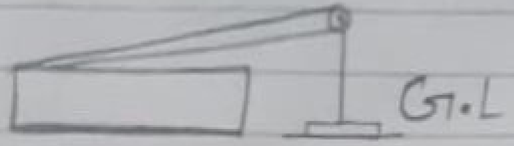
- The soil Which is organic in nature
- The soft soil also required ground improvement techniques.
- The soil Which is ~~slow~~ Sandy and gravely.

The foundation in sanatory dump places also required ground improvement techniques.

Methods of Grand improvement techniques:

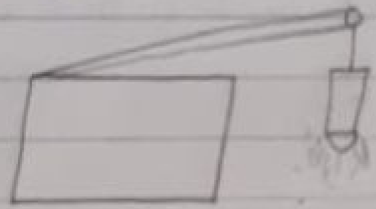
- Removal & replacement of soil:- This is an oldest and simple method. This method is performed on loose soil.

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 bettering engineering properties This method is applicable above the grand Water table.



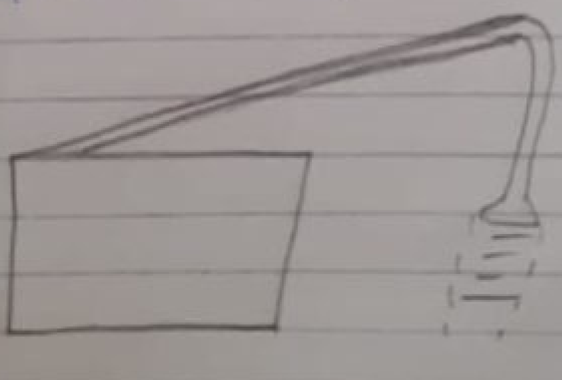
Vibro Compaction:-

It is also called Vibro densification In this Method Compaction take place at a Certain depth in granual soil through Vibratory probe.



Rapid Impact Compaction:-

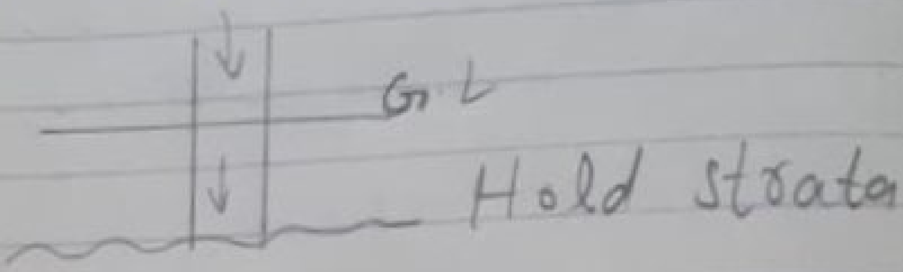
Impact energy is applied to surface of grand as a result of Which densification of soil take place upto a depth of 15 feet. The impact energy is actually applied through hydraulic ramp.



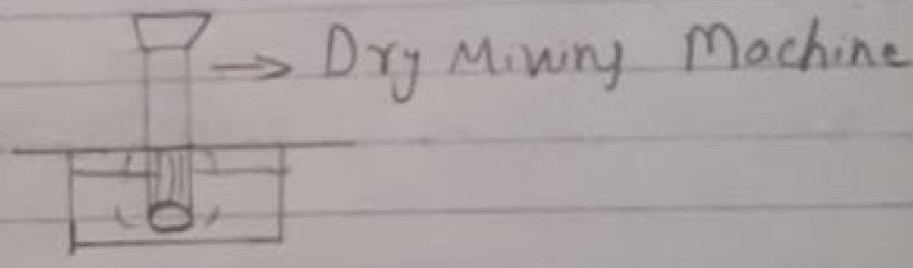
• Vibro Concrete Column:-

Vibro Concrete Columns is a grand

improvement technique Which transfer the load from Weak Strata to hold strata by using strength concrete.



Dry mixing of soil:- Dry mixing soil is ground improvement technique by Which the characteristics of weak soil are improved by using dry cementitious binder.



Q 3
Ans

Given data:-

$C = 25 \ kN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.50$

Required:- F_c (F.o.s) When Soil is dry

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

Solution:-

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

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

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

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

$$\boxed{F_c = 1.18}$$

=> When there is seepage of Water:-

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

$\gamma' = \gamma . \gamma_w$

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

-> $\boxed{\gamma = 21.04 \ kN/m^3}$

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

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

$$\frac{11.24}{21.04} \times \frac{\tan(16^\circ)}{\tan(26^\circ)}$$

=> $\boxed{F_c = 0.816}$ **Ans**

Q 4
Part A

Given data:-

Height = 10 m
c = 18.8 kN/m²
γ = 17 kN/m²
Ø = 20°
F.o.s = 1.5
FØ = 1.0

Required:- Inclination, i = ?

Solution:-

$$S_N = \frac{c}{F.o.s \times \gamma \times H}$$

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

$$S_N = 0.073$$

Using taylor chart for

$\phi = 20°$

$S_N = 0.073$

$$\boxed{i = 44°}$$ Ans

Q 4 Part (B)

Given data:-

Height of water on upstream side = 15m

Bottom width = 12m

Top width = 6m

γ_{water} = 1000 kg/m²

$\gamma_{concrete}$ = 1450

γ_{silt} = 1330 kg/m³

Free Board = 3.5m

H = 2.5 m

θ = 35°

Required:-

Silt Pressure, Ps = ?

Solution:-

As we know that

$$P_s = \frac{\gamma_{silt} \times H^2}{2} \times \frac{1 - \sin\theta}{1 + \sin\theta}$$

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

$$= \frac{1330 \times (2.5)^2}{2} \times 0.27$$

$= 4156.25 \times 0.27 \Rightarrow$ **Ps = 1122.18 kg/m**

Ans