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SEMSTER :

"6th"

SUBBMITTED TO :

"Engr. LIAQAT SIR"

SUBJECT :

GeoTecnical Engineering

DATE

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Q.No.1: NAME The forces acting on dam. ExPlain any five of them in detail.

Following are the forces acting on dams:

- → Water Pressure
- → uPlift Pressure
- → wave Pressure
- → Silt Pressure
- → Ice Pressure
- → Self ~~Pressure~~ weight of the dam.
- → Sismic forces

1) Self weight of DAM:

The weight of the dam and it's foundation is a major resisting force. It can be computed using the following equation

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

where, γ_m: unit weight of dam material.

Silt Pressure:

It is the Pressure that caused by the deposition of the silt in the bed of the dam causing at h/3 from the base and can computed using equation:

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

where Ka = coffeicent of active earth Pressure of silt which is equal to $\frac{1-\sin\phi}{1+\sin\phi}$

ϕ = have internal friction of soil cohesive neglected.

γ = submerged unit weight of silt material

h = height of silt deposited

WAVE PRESSURE:-

waves are generted on the surface of the reservoir by by the blowing winds, which exert the pressure on the upper part of the dam above the water level. This pressure is calculated by the following formula:

$P_w = 2.4 \ \gamma_w \ h_w$

waves pressure depends upon wave height which is given by

For $F < 32$ km:

$h_w = 0.32 \sqrt{FV} + 0.763 - 0.27 \times F^{1/4}$

For $F > 32$ km:

$h_w = 0.32 \sqrt{VF}$

where,

h_w = height of water of crust to bottom of trough in meters.

V = wind velocity in km/hours

F = fetch or straight length of water expense in km.

The maximum Pressure intensity due to water action occours when it acts at 0.5

Total force due to action is given by: ~~Pw = 0.5(2.4)~~

$$P_w = 0.5(2.4\gamma_w h_w)\, 3/8\, h_w$$

ICE PRESSURE:

the ice which may be formed on the water surface of reservoir in cold. The dam face is subjected on the thurst & exerted by expanding ice. This force acts lineraly along the length of the dam ~~and~~ at the reservoir level. The magnitude of these force are varies from 250 to 150 KN/sq.m depending the temperature.

Sesimic forces: Dynmic load due to earth quick must be considered in in the design of all major dam locted in high risk sesimic region. Earth quake pressure waves in every Possible direction However, It has be resolved into verticle and horizntal component had greater effect. Sesimic viberations infulence both dam body and water in the ~~sesi~~ reservoir of the dam, so the generted dynmic load are due to inertia of the dam and hydro dynmic 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 decreases the soil lose its strength when the effective stresses becomes zero then soil will be changed into liquified state.

2) Buttress DAM:

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

3) Infinte Slope:

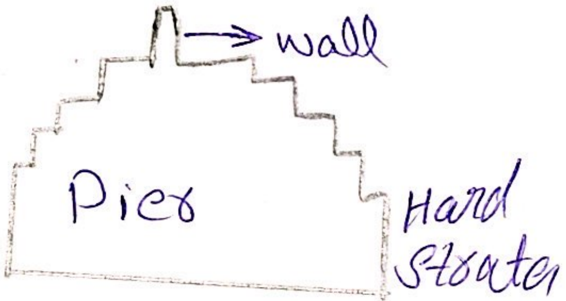
The slope which have infinte area and finte depth such a slope is called infinte slope.

Example: Natural slope i-e Hills, Mountains desert etc.

It is infinte slope the failure will be inform of sliding

4) **"Pier Foundation":**

The verticle member which have larger dia as compared to Pile and transmitt the loads of Structure to the underground Soil. They are constructed by cast in-situ Process.



5) **"Dynamic Load":**

Dynamic load Occours when loading conditions are changing with time. It may be in the form of waves motion, earth-quake, Opertion of heavy machinery, wind etc. Dynmic load causes settlement.

Q No. 2: Define shallow. . . .
. . . . apparatus.

ACCORDING TO TARZAGHI:

~~The depth of~~

The Foundation in which the depth of the foundation is less or equal to width of the foundation is called shallow foundation, $D_f \leq B$

ACCORDING TO SKEMPTION:

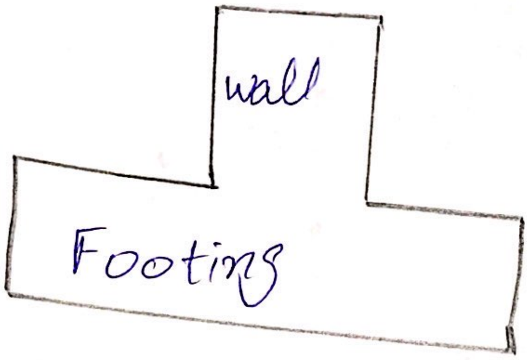
The foundation in which D_f/B ratio is less than or equal to 2.5 than foundation is called shallow foundation.

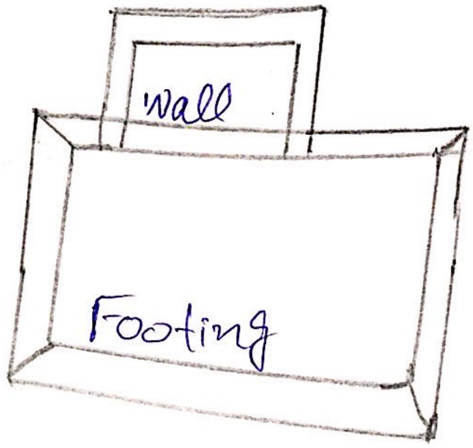
Types of Shallow Foundations:

1) wall footing
2) combined footing
3) Raft/Mat footing
4) Strapped footing
5) column/isolated footing
6) Slopped footing

Wall Footing :-

The footing which run across the length of wall and transfer the load of the wall to the soil safety. It is called wall footing.



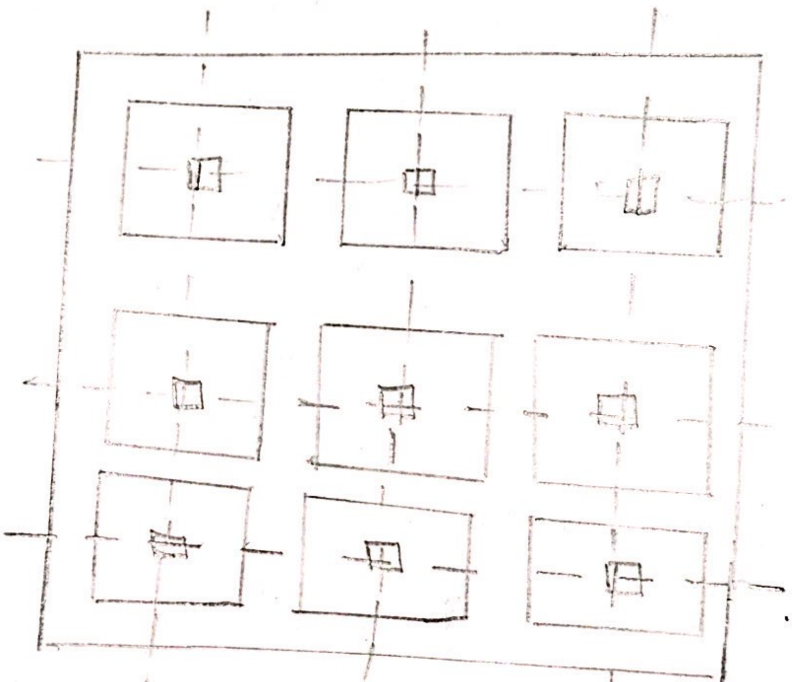


COMBINED FOOTING :

The Footing which is constructed for two or more column and transfer the load of the two or more column to the soil. Safty then it is called combined footing. If the load of the column is uniform then the combined footing will be ranctangular in shape. If the load of the column is not uniform then shape of combined footing will be trapezoidal.

Raft / Mat Footing :

The footing which covers the the whole ~~value~~ 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 the super structure is heavy.



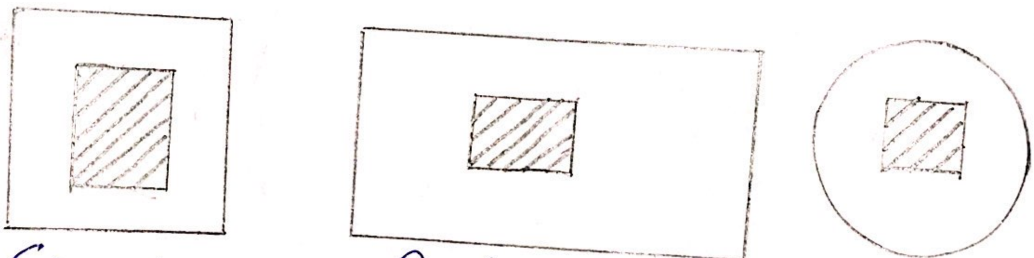
4) Strapped Footing :

The footing in which the outer column is connected with the inner column by means of the beam or Stop is called strapped footing.

Top view

5) Column/isolated footing :

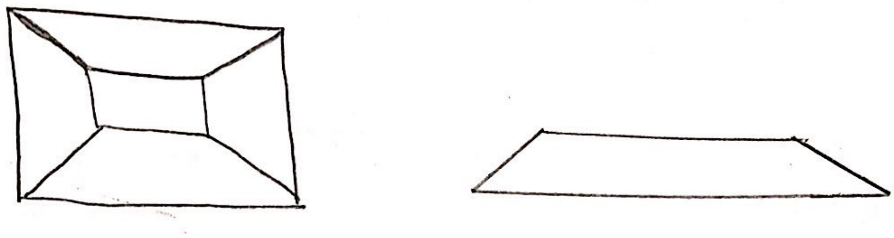
The footing which is constructed for a single column and transmit it's load to the soil safety. It may be circular, square, ractangular in shape.



Square Ractangular circular

Slopped Footing:

The Slope which have Slope in all direction or in all Side is called as Slopped.



PART B

Ans The Soil which is volumeteric changes takes Place due to sharinkage and swelling such Soil needs grounds improvment tecniques

→ The soil which is organic in nature

→ The Soft Soil also required ground improvment tecniques.

→ The soil which is sandy and gravely.

→ The foundation in sanatory dump Places also required ground improvment tecniques.

⇒ Following are the methods of ground improvement tecniques.

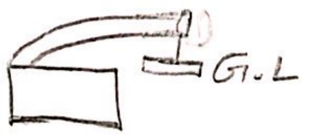
Removal & Replacment of Soil :-

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

In this ~~Soil~~ method the unstable 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 ~~surface~~ water table.

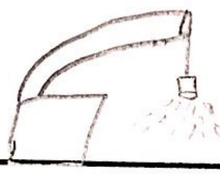
2) **Dynmic Compaction:**

This method is used and compaction takes place at certain depth granull soil, and increase the bearing capacity of soil. This also increase the consolidation rate and also increase the density of soil. In this method actully densification of soil take place.



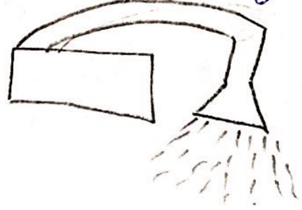
vibrating compaction:

In this method the compaction takes place at a certain depth in granulal soil through vibrating probe. This vibrating probe is run by electeric ~~probe~~ motor. This pentration of probe is enhance by ejecting water at the tip of probe.



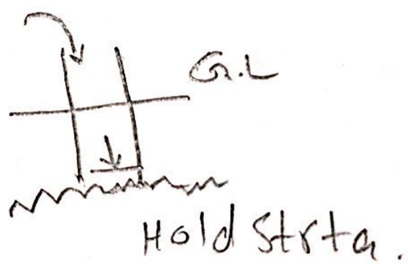
4) Rapid Impact Compaction:

Impact energy is applied to surface of ground as result of which densification of soil take place upto a depth of 15 feet. This impact energy is applied throug hydraulic ramp. The hydraulic ramp weight volume from 4-8 hours.



5) vibro Concrete column:

Vibro concrete column is ground improvment technique which transfer the load from weak strata to hold strata by using strength concrete.



QNo.3

[redacted]:

Given data

$C = 25 \ KN/m^2$

$\theta = 16^\circ$

$G = 2.79$

$e = 0.50$

Required :-

Fc (F.O.S) when Soil is dry

Fc (F.O.S) when Soil is seepage.

Sol :-

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

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

$\gamma d = 1.78 \ KN/m^2$

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

$F_c = 1.18$

when there is seepage of water

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

$\gamma' = \gamma - \gamma_w$

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

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

$\gamma = 21.04$ kN/m³

$\gamma' = \gamma - \gamma_w$

$= 21.04 - 9.8$

$\gamma' = 11.24$ kN/m³

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

$F_c = 0.816$

Q4

Part A

Given data:

$C = 18.8\ kN/m^2$

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

$\phi = 20$

$FDS = 1.5$

$F_o = 1.0$

$H = 10m$

Required:

Inclination

Sol:-

$$S_N = \frac{C}{F.D.S \times \gamma \times H} = \frac{18.8}{1.5 \times 17 \times 10}$$

$S_N = 0.073$

using tylor shart for

$\phi = 20°$

$S_N = 0.073$

$\Rightarrow$ Inclination, $i = 44°$

Q 4

PART B

Give DATA

→ Height of water upstream side = 15 m
→ Bottom width of the dam = 12 m
→ Top width = 6 m
→ 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 silt = $\theta_s = 35^\circ$
→ Free board = 35 m
→ Silt Deposite height = 2.5 m

Required:

Silt Pressure = ?

Sol:-

$$P_S = \frac{\gamma_s \times H^2}{2} \times \frac{1 - \sin\theta}{1 + \sin\theta}$$

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

$$P_S = 1126.31 \text{ Kg/m}$$

THE END