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Q No 1
Part A)

Ans Following are the forces acting on dam.

- water Pressure
- uplift Pressure
- wave Pressure
- silt Pressure
- Ice Pressure
- self weight of the dam
- Seismic forces

(i) Self weight of Dam
The weight of the dam and its foundation is a Major resting force. It can be computed using the following equation.

$W = \gamma_m$ volume

where
γ_m = unit weight of dam Material

ii) Silt Pressure
It is the Pressure that is caused by the deposition of the silt in the bed of the dam

cousing 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.

(iv) Wave pressure:

Waves are generated on the surface of the reservoir by the blowing winds which exerts a pressure on the upper part of the dam above the water level. This is calculated by the following formula

$P_w = 2.4 \gamma_w h_w$

Wave pressure depends upon wave height is given by:

for $F < 32$ km

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

$h_w = 0.32\sqrt{VF}$

where h_w = height of water from the top of crest to botton of throughs in meters.

V = wind velocity in K/hr

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

The max pressure intensity due to wave action accurs when it acts at 0.5 Total force due to water action is given by

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

iv) Ice Pressure:

The ice which may be formed on the weter surface of the reservir 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 KN/m² depending upon the temperature.

v Seismic forces:

Dynamic loads created due to earthquake must to 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 resolved into vertical and horizontal componests for the design Purpose. The horizantal component had greater effect. Seismic vibration in fluence both dam body and water in the reservoir of dam so the generted dynamic loads are due to the ~~int~~ inertia of the dam and hydrodynamic forces by the water in the reservoir.

Part b

Define the following terms

① Liquification of soil:

Effictive stresses are the stresses which keep the soil particles in contact with each other if the effective stresses deercose the soil loose its stregth when the effective stresses become zero then soil will change to liquified state:

2) Butress Dam:-

A buttress dam is a dam with a solid, water tight upstrem side that is supported at interval on the downstream side by a serice of buttresses or support. The dam wall may be straight or curved. Most buttress dams are made of reinforced concrete and are heavy. Pushing the dam into ground.

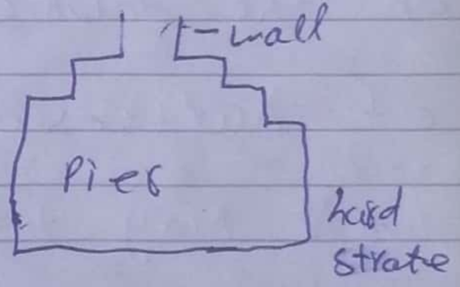
③ infinite slope:

The slope which have infinite area and finite depth such a slope is called infinite slope.

Ex: Natural slope i.e Hills, Mountains, deserts etc.

Q Pier Foundation..

The vertical Member which have larger dia as compared to Pile and transmit the land of structure to the underground soil. They are constructed by cost in situ Process.



Dynamic Load:

Dynamic load acuur when loading conditions are changing with time It may be in the form of earth quake operation of heavy Machinery wave motion ~~wide~~ wind etc Due to dynamic load the settlement chances may increse.

Q2 Define shallow foundation.
A) Explain types of shallow foundation.

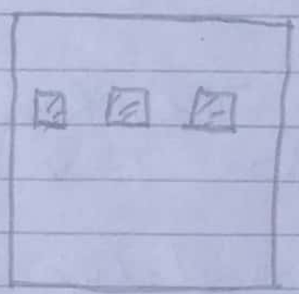
Ans According to Terzaghi: The foundation in which depth of the foundation is less or equal to width of the foundation is called shallow foundation

$D_f = B$

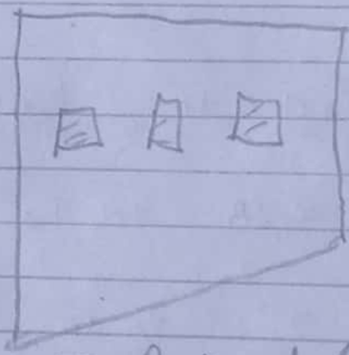
According to skemption. The foundation in which D_f/B ratio is less than or equal to 2.5 than the foundation is called shallow ~~fon~~ foundation.

① wall footing:- The footing which runs across the length of the wall and transfer the land of wall to the soil safety. 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 safety than it is called combised footing.

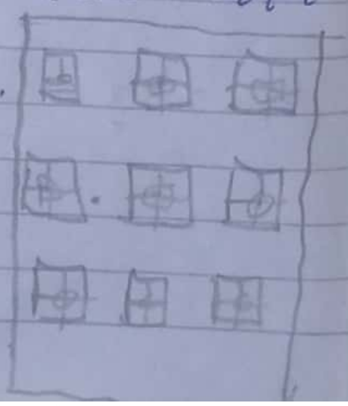


Rectangular Footing

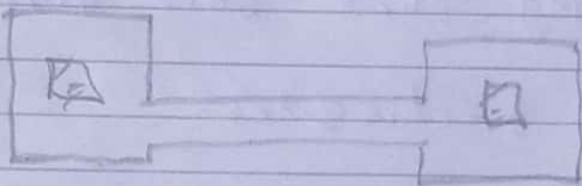


Tropezoidal footing

3, Raft / Mat Footing :- The Footing which covers the while area of the structure is called raft footing This type of footing is proposed in area which have soft ~~wa~~ weak in bearing capacity.



(4) strapped footing - The footing in which the outer column is connected with the inner column by mean of the beam or straf is called strofped footing.

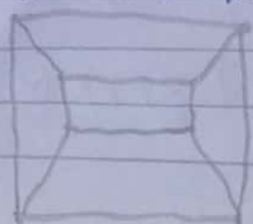


Top view

(5) column / isolated footing - The footing which is constructed for a single column and transmit it is land to the soil safety, It may be circular, Syuare, rectangular in shape.

Syure Vectangular column.

(6) sloPPed Footing ;; The footing ~~wit~~ which heve slape in all direction or in all side is called as sloPPed Footing.



Q2.
Part B
Ans:

The soil in which volumetric changes takes place due to shrinkage and swelling such soil need ground improvment techniques:

- The soil which is organ in Nature
- The soft soil also required ground improment techniques.
- The soil which is sandy and gravely

Following are Methods of ground imprment techniques:

1) Removal and Replacment of soil:

This is an aldest and simple method this method is performed on loose soil In this method the unsuitable soil is replaced with compacted fill.

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.

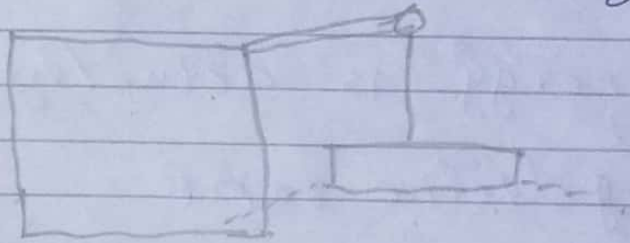
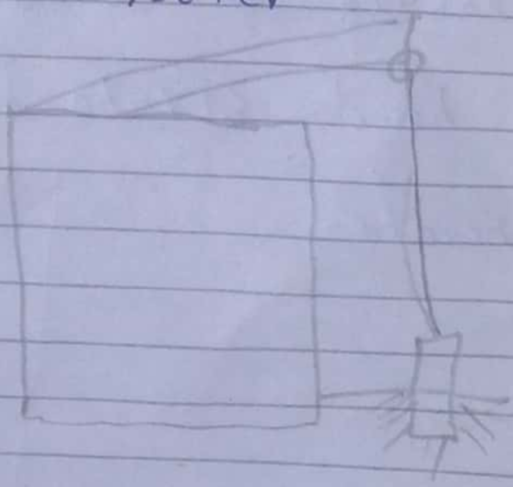


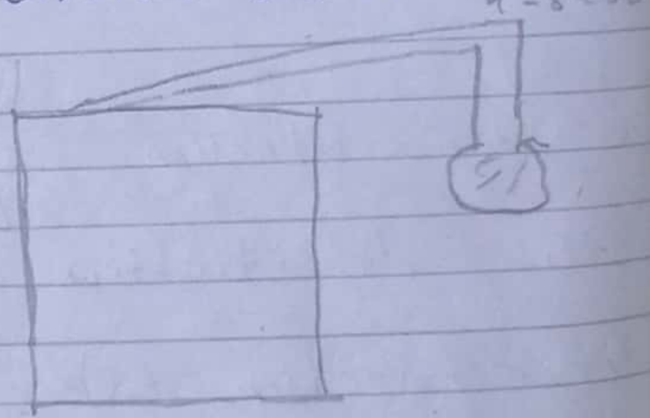
Fig 2

③ Vibro compaction.

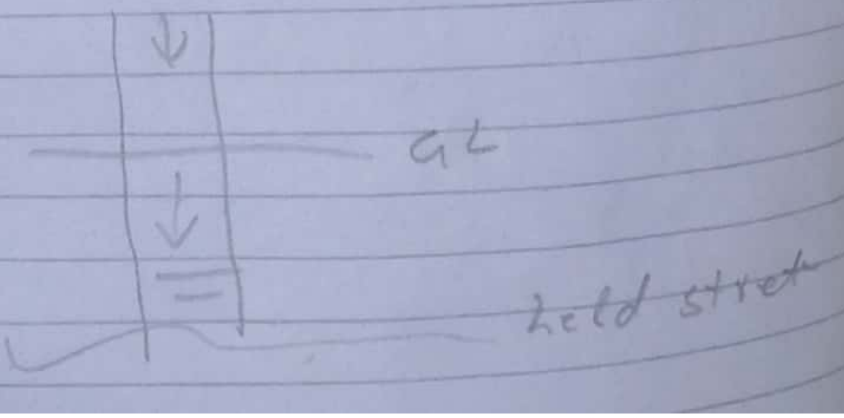
It is also called vibro densification In this method the compaction take place at a certain depth in granular soil through vibratory Probe. This vibratory Probe is run by an electric moter.



(4) Rapid impact
Impact energy is applied to surface of ground as a result of which densification of soil takes place upto a depth of 15'. This impact energy is actually applied through hydrolic ramp.



(5) concrete column
Vibre concrete is a ground improvment technique which transfer the load from weak strata to hard strato by using strength concrete.



Q3

Given data

$C = 25\ KN/m^2$

$\alpha = 16^\circ$

$G = 2.72$

$e = 0.50$

Req :

Fc (F.o.S) when soil is day
Fc (F.o.S) when is seepage in soil.

Sol :

$$Fc = \frac{C}{\gamma d - H, \sin i \cos i} + \frac{\tan \phi}{\tan}$$

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

$\gamma d = 17.8\ KN/m^3$

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

$Fc = 1.18$

when there is seepage of water.

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

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

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

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

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

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

$$= 21.04 - 9.8$$

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

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

$$\boxed{F_c = 0.836}$$

Q. No 4a.

Given data:

height = 10m

$c = 18.8\ KN/m^2$

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

$\phi = 20^\circ$

F.O.S = 1.5

$F\phi = 1.0$

Req.

Inclination $i = ?$

Sol:

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

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

SN = 0.073

using taylor chart for:

$\phi = 20^\circ$

SN = 0.073

$i = 44^\circ$

Q 4
Part b

Given data:

- height of water on upstreamside = 15m
- Bottom width of the dam = 12 m
- unit weight of water = 1000 Kg/m^3
- Top width = 6 m
- unit weight of concrete = 1450 Kg/m^3
- unit weight of solt = 1330 Kg/m
- Angle of friction = θ = 35°
- Free Board = 3.5m
- silt Depote height = 2.5 m

Req:
silt pressure = ?

Sol:
As we know that

$$Ps = \frac{\gamma s \times Hs^2}{2} \times \frac{1 - \sin\theta}{1 + \sin\theta}$$

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

$$Ps = 1126.30 \ Kg/m$$