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IQRA NATIONAL UNIVERSITY;

Q NO #01 (a) :- Name the force acting on a dam. Explain Any Five of them in detail:

Answer :- Following are the force acting on dam.

* Self weight of the dam.
* Silt pressure.
* water pressure.
* uplift pressure.
* Wave pressure.
* ice pressure.
* Seismic pressure.

i) Self weight of the dam :-

⇒ the weight of the dam by its foundation is a major resulting force.

⇒ It can be Computed using the following equation.

⇒ $W = \gamma_w$ volume.

Where !

γ_m = unit weight of the dam material.

P.T.O

ii) Silt pressure :- It is the pressure that is caused by the deposition of the silt in the bed of the dam causing at b/3 from the base & can be computed using equation.

$$\Rightarrow P_{silt} = 0.5 \gamma_s K_a .$$

Where :-

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

$$\Rightarrow \frac{1 - \sin\theta}{1 + \sin\theta}$$

$\Rightarrow \theta$ = angle of internal friction of soil, Cohesion etc

$\Rightarrow \gamma_s$ = Submerged unit weight of silt material.

$\Rightarrow h$ = height of silt deposited.

iii) 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

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$P_w = 2.4 \gamma_w h_w$

Wave pressure depends upon wave height is given by the.

$\Rightarrow F < 32$ km.

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

$\Rightarrow h_w = 0.32\sqrt{VF}$

Where;

$\Rightarrow h_w$ = height of water from the Top of Crusts from the bottom of Trough in meter.

$\Rightarrow V$ = wind velocity in K/hr.

$\Rightarrow R$ = Fetch or Straight length of water expanse in Km.

$\Rightarrow$ the max pressure intensity due to wave actim acts when it's acts at 0.5.

$\Rightarrow$ Total force due to water wave actim is given by.

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

4) ice pressure:-

the ice which may be formed on the water surface of the reservoir in cold countries

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may sometimes melt by Expanding. The dam face is subjected to the thrust by exerted by the expanding ice. this force acting linearly along the length of the dam by the reservoir level.

(v) Seismic Forces:-

Dynamic loads created due to earth quacke must be considered in the design of all major dam located in high risk seismic regions. Earthquake produces waves in every possible direction. However, it has to be resolved into vertical & horizontal components for the design purpose. the horizontal Component had greater effect. Seismic vibration influence both dam & the generated dynamic loads are due to the interaction by dam by hydrodynamic force by the water in the reservoir.

Part (B):- Define the following Terms.

i) Liquification of Soils:-

Effective stress are the stresses which keep the soil particles in contacts with each other if the effective

P.T.O

Stresses decrease the soil loose it strength When the effective stresses with each other if the effective stresses decrease the soil loose it strength.

2) Buttress Dam :-

A buttress dam is a dam with a solid, water tight upstreams side that is supported at intervals on the downstreams side by a fence of buttresses or supports. The dam wall may be straight or curved Most buttress dams are made of reinforcemat concrete by are heavy pushing the dam into ground.

3) Infinite Slope :-

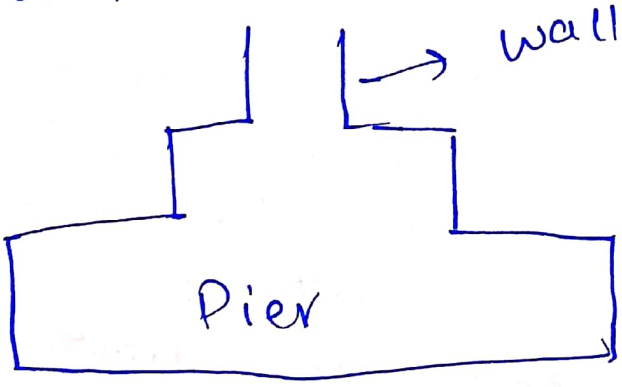
the slope which have infinite area by finite depth such a slope is called infinite slope.

Examples Natural slope i.e Hills, mountain deserts, etc.

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

4) pier foundation:

the vertical members which have greater dia as compared to pile cy transmit the load of structure to the underground soil. they are Constructed by cast in-situ proces.



Dynamic load:

Dynamic load occur when loading conditions are changing with time. It may be in the form of earthquake operation of heavy machinery, wave motion, wind etc. Due to dynamic load the settlement change increase.

Q NO#02:-

(a) According to Terzaghi:-

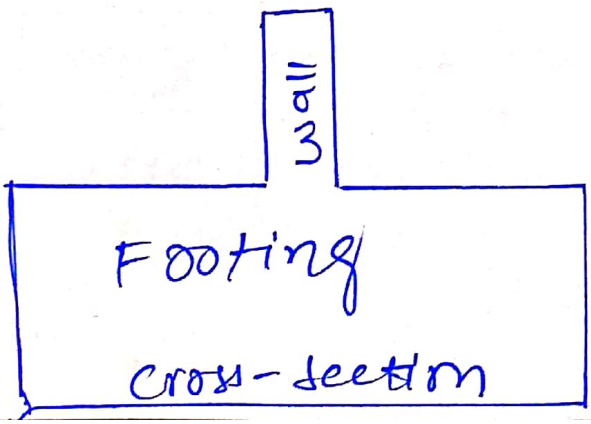
the foundation in which depth of the foundation is less are equal to width of the foundation is called shallow foundation $Df \leq B$.

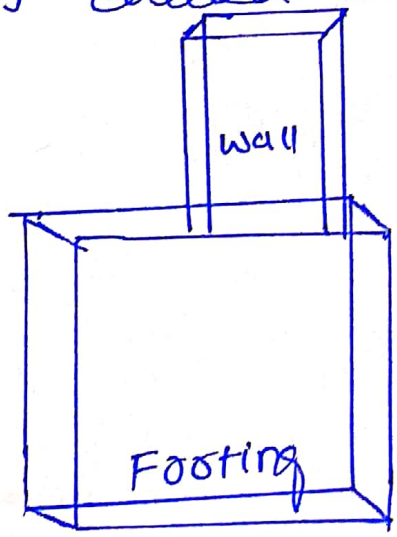
According to SKEMTON:-

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

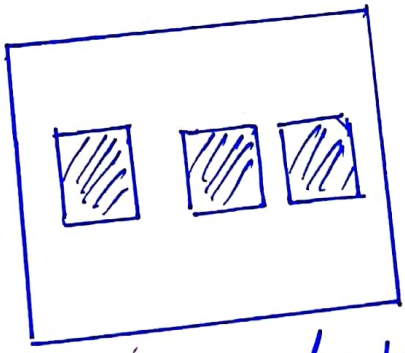
Following are the types of shallow foundation.

1) WALL footing:- the footing which run across the length of the wall to transfer the load of the wall to soil safely. It is called wall or strip footing.

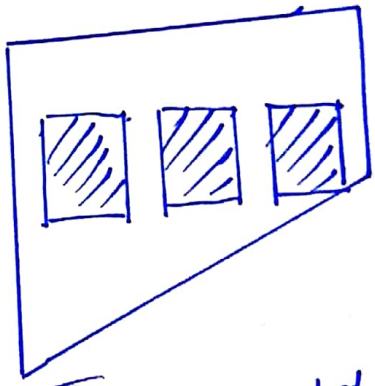




2) Combined footing:- the footing which is constructed for two or more column to transfer the load of the two or more column to the soil safely than it is called Combined footing. if the load of column is uniform then the Combined footing will be rectangular shape by if the load is not uniform then the shape of footing will be trapezoidal.



Rectangular footing



Trapezoidal footing.

3) Raft/mat footing:- the footing which Covers the whole area of the structure is called raft or mat footing. this type of footing is proposed in area which have soft weak in bearing Capacity. this is also provided when the load of super structure are heavy.

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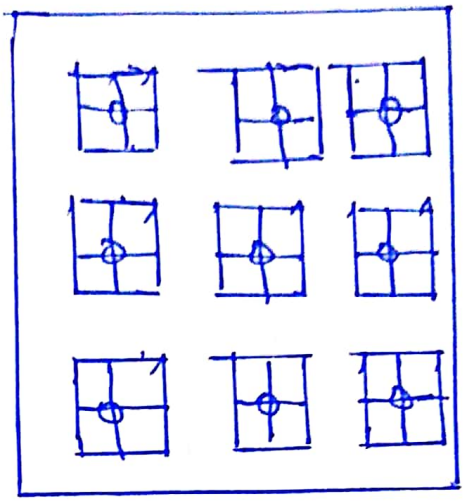
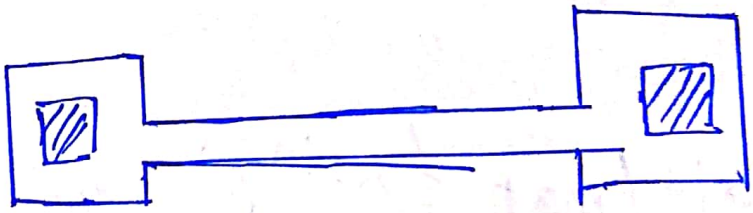
Diagram:-



4) Strapped footing:- the footing in which the outer column is connected with the inner column by means of the beam or strap is called strapped footing

Diagram:



Top view.

5) Column/Isolated footing:-

the footing which is constructed for a single column to transmit its load to the soil safely. It may be circular, square rectangular in shape

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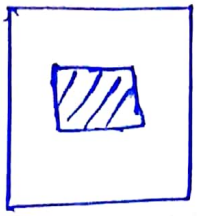
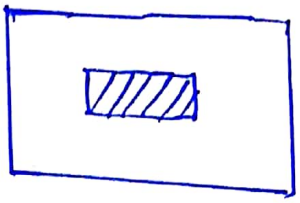
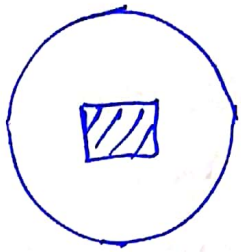


Square footing.



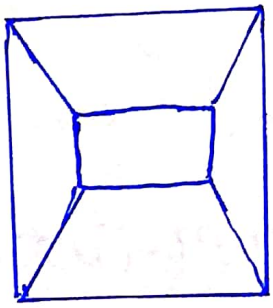
Rectangular Footing.



Column FOOTING.

b) Slopped Footing:-

the footing which have slope in all direction or in all sides is called as slopped footing.



Q NO #02:

Part (B):- the soil in which volumetric changes Take place due to shrinkage by swelling such soil needs ground improvement techniques.

⇒ the soil which is organic in nature

⇒ the soft soil also required ground improvement Techniques.

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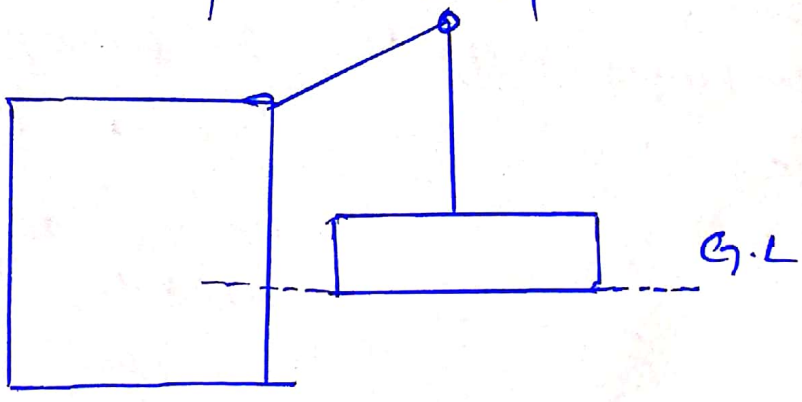
Following are the methods of ground improvement techniques.

1) Removal cy Replacement of soil:-

this is an oldest cy simple method this method is performed on loose soil. An this method the unsuitable soil is replaced with Completed. soil is performed on loose soil. An this method the unsuitable soil is replaced with Compacted fill. An this method the soose soil is used to refill. the higher Compaction cy better engineering properties. this method is applicable above the ground water table.

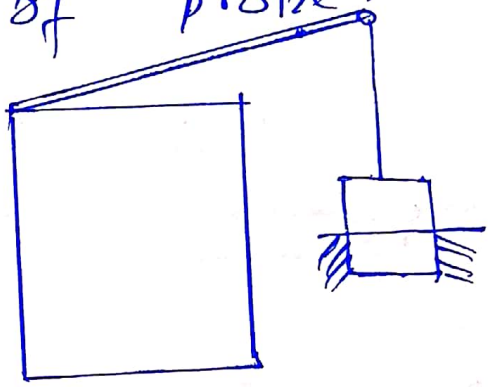
2) Dynamic Computation:-

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. An this method actualy densification of soil Takes place.



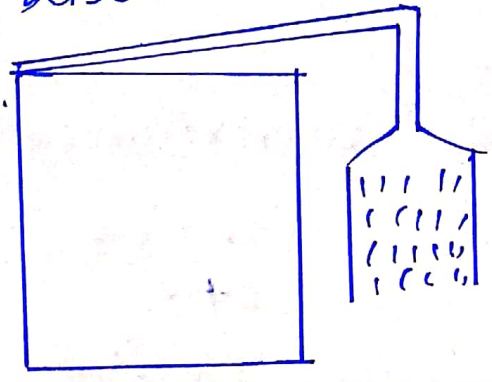
3) "Vibro Compactim":-

It is also called vibro densificatim An this method the Compaction take place at a Certain depth in granular soil through vibratory probe. this vibratory probe is run by an electric motor. the penetratim of probe is enhance by ejecting water at the tip of probe.



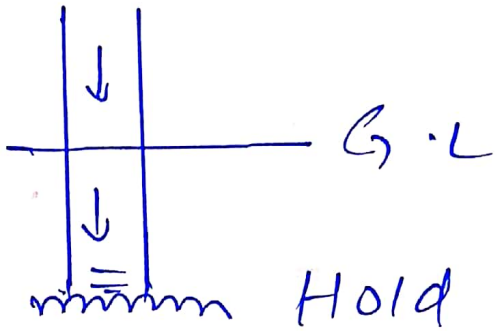
4) "Rapid Impact Compaction":-

Impact energy is applied to surface of ground as a result of which densificatim of soil Takes upto a depth of 15'. this method of impact energy is actually applied through hydraulic ramp. It is wt is round about 4-8 tons



"Concrete Column":-

Vibro Concrete is a ground improvement technique which transfer the load from weak strata to hard strata by using strength concrete.



QNO#03:

Sol:- Given Data:

$C = 25\ KN/m^2$.

$\phi = 18^\circ$.

$G_s = 2.72$.

$e = 0.50$

Required: F_c (F.O.S) When soil is dry

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

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

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

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

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

$$F_c = 1.18$$

When there seepage of water then

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

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

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

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

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

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

$$= 21.04 - 9.8$$

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

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

$$F_c = 0.836 \quad \text{Ans}$$

Q NO # 04

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 = ?

"Solution" :-

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

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

$$S_N = 0.073$$

using tylor chart for :-

$\phi = 20°$

$S_N = 0.073.$

$\Rightarrow$ inclination, $i = 44°.$

QNO# 04 :-
Part (B) Given Data:-

- Height of water 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
- Angle of friction for silt = $\theta_3 = 35°$.
- Unit weight of silt = 1330 kg/m³
- Free board = 3.5m.
- Silt deposite height = 2.5m.

"Required" :-

Silt pressure = ?

"Solution" :-

As we know that.

$$P_s = \frac{\gamma_s \times H_1^2}{2} \times \frac{1 - \sin\theta}{1 + \sin\theta}$$

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

$$P_s = 1126.31 \text{ kg/m.}$$ Ans