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paper : Geotechnical & foundation Engineering

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Q#01:

a) name of force - - - - - detail:

Ans:- Name of

force Acting on Dam:

- Water Pressure
- Uplift Pressure
- Wave pressure
- Silt pressure
- Ice pressure
- Self weight of dam
- Seismic forces.

→ Silt Pressure:

→ According TO IS, Silt pressure and water pressure exist Together in Submerged silt.

→ The following are recommended for Calculating forces.

$P_{sh} = 1360 kg/m^3$

$P_{sv} = 1925 kg/m^3$

→ Wind Pressure:
→ It is a minor force acting.
→ Acts on superstructure of the dam.
→ Normally, wind pressure is taken as 1 to 1.5 kN/m^2

→ Ice Pressure:
→ The ice formed on water surface of the reservoir is subjected to expansion and contraction due to temperature variations.

→ Self weight of dam:
The weight of dam and it foundation is a major resisting force. It can be computed using the following equation, $W = \gamma_m$ Volume.
where,
γ_m = unit weight of dam material.

→ Wave Pressure:
Wave are generated on the Surface of the reservoir 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.

$P_w = 2.4\, \gamma_w h_w$

b) Define The Following Terms:

① Liquification Of Soil:
It is define as "The phenomenon which by a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake or other sudden change in stress condition causing it the behave like liquid.

2) Butress Dam:
It is define as a dam consisting of a relatively thin water supporting facing or deck supported by buttress generally in the form of equally spaced Triangular walls or counter forts that Transmit the water load and deck weight to the foundations

3) Infinite Slope:
. Slope which have great extent with uniform soil conditions at any given depth below the surface.
. The soil stratum is not neccessary homogenous with depth but the strata of different soils are parallel to the slope surface.

4) Pier foundation:

Pier foundation consists of a cylindrical column a large diameter to support and transfer large super-imposed loads to the firm strata below.

5) Dynamic load:

Dynamic load vary in their magnitude, direction or position with time.

→ The type of dynamic load in soil the foundation of the structure depend upon on the nature of source producing it.

Q#02.

a) Define - - - - appropriate Sketch:

Solution:

Shallow foundation:

"The foundation in which depth of the foundation is less or equal to the width of the foundation"

$$D_f \leq B$$

Types Of Shallow foundation:

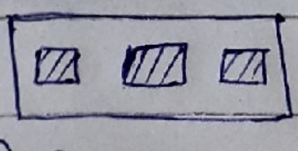
* Wall/Strip footing:

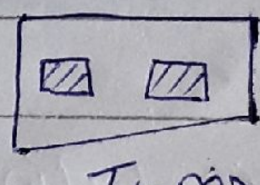
The footing which

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.

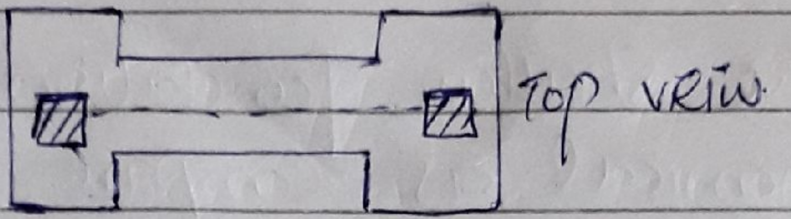




(3) Strapped footing:

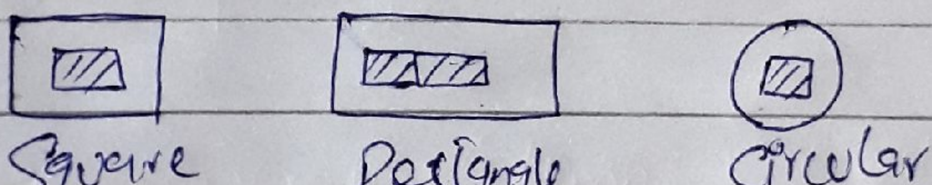
The footing in which the outer column is connected with the inner column by means of the beam or

Strap is called Strapped footing.



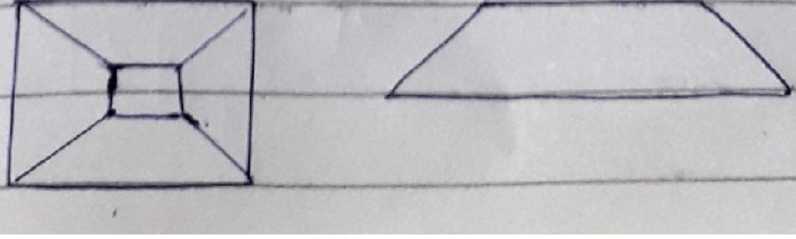
* Column footing:

The footing which is constructed for a single column and transmit its load to the soil safely.



* Slopped footing:

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



* Priority To Shallow foundation:

↳ The Shallow foundation is economical as compare To deep foundation

↳ The Shallow foundation is easily construction.

Q#2

(b) Why ground improvement - - -
- - - - - - Sketch:

Ans:

Importance of Ground Improvement Techniques:

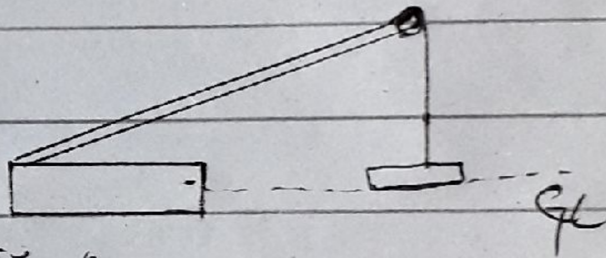
The Soil in which volumetric change Take place due To Shrinkage and Swelling such Soil needs the ground improvement Techniques.

- The Soil which organic in nature
- The Soft Soil also Required ground improvement Techniques.
- The other importance of Ground Improvement Techniques are that when the soil are Sandy and gravely also required ground improvement Techniques.

→ Method of Ground Improvement Techniques:

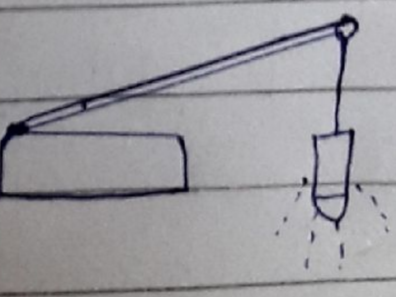
① Dynamic Compaction:

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. On This method actually densification of Soil Take place



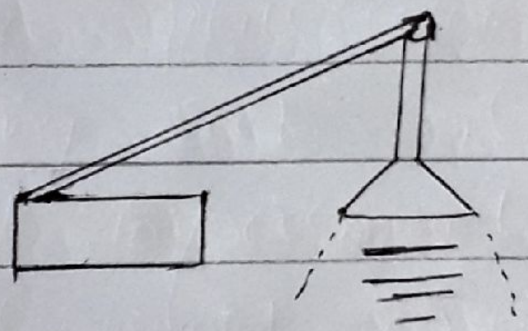
② Vibro Compaction:

It is also called vibro densification. On This method The Compaction Take place at a certain depth in ground Soil To vibratory probe. This vibratory probe is run by an Electric motor.



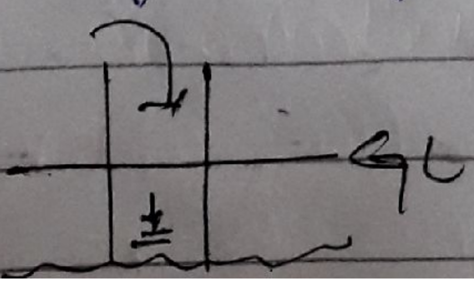
(3) Rapid Impact Compaction:

Impact Energy is applied to Surface of Ground as a Result of which densification of Soil take place upto a depth of 15 feet



(4) Vibro Concrete Column:

VCC is a ground improvement Technique which Transfer the load from weak strata to hold strata by using strength



(5) Dry Mixing Of Soil:

It is ground improvement Technique by which The Characteristi of weak soil are improved by using dry cementitious binder

Q#03:

An infinitely . . . .
- - - - would Result.

Given data:

values of

$G = 2.72$

$e = 0.52$

Slop Surface $C = 25 kN/m^2$

$\phi = 16°$

Required:

F_c → when soil is dry

F_c → when there is seepage in soil.

Solution:

We know that

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

Now find "γ_d"

$$\gamma_d = \frac{G_s \times \gamma_w}{1+e} = \frac{2.72 \times 9.8}{1+0.5} = 17.8 kN/m^3$$

→ from Eq(A), we get

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

$\Rightarrow F_c = 1.18$

⇒ When There is Seepage of water.

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

we know that

$\gamma' = \gamma - \gamma_w \rightarrow (i)$

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

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

Now put it in Eq(i)

$\Rightarrow \gamma' = \gamma - \gamma_w = 21.04 - 9.8 = 11.24\ kN/m^3$

→ Now put it in Eq(B)

we get

(17)

$$F_c = \frac{25}{21.04 \times 6 \times \sin(26^\circ) \times \cos(26^\circ)} + \frac{11.24}{21.04} + \frac{\tan(18^\circ)}{\tan(26^\circ)}$$

$$F_c = 0.816$$

Q#04

a) Cut is proposed To - - - -

- - - - $F\phi = 1.0$

Given data:

Height $= 10m$

$C = 18.8 kN/m^2$

$\gamma = 17 kN/m^3$

$\phi = 20°$ & $FOS = 1.5$ & $F\phi = 1.0$

Required:

Inclination, $i = ?$

Solution:

As we know that

$$S_n = \frac{C}{F.O.S \times \gamma \times H}$$

putting value.

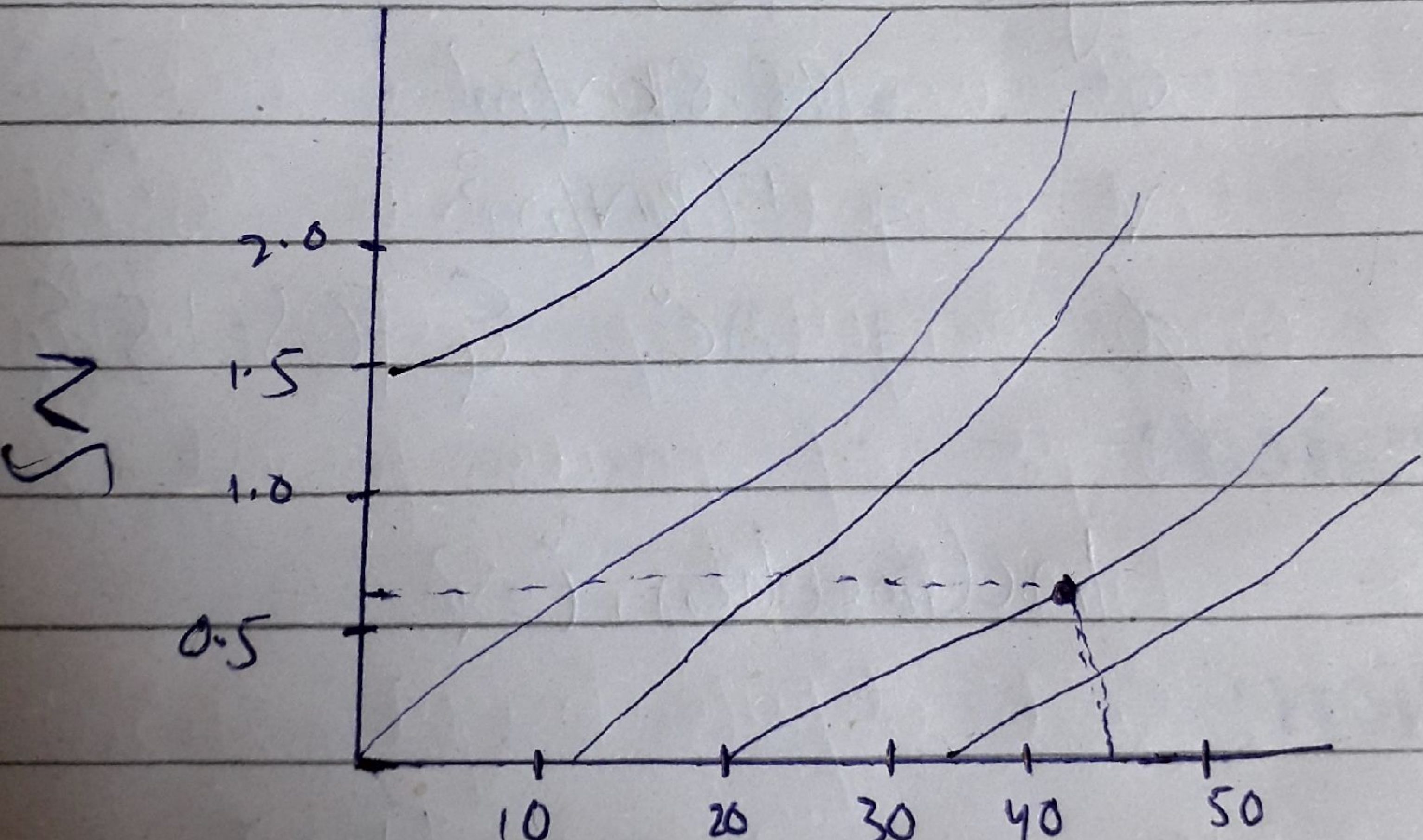
$$\Rightarrow S_n = \frac{18.8}{1.5 \times 17 \times 10} = 0.073$$

Using Taylor Chart for $\phi = 20^\circ$

→ value of $S_N = 0.073$

So,

$i = 44^\circ$



Slop Angle.

part (b) Consider - - - -.

Given data:

- → Height of water upstream side = 15m
- → Bottom width of dam = 12m
- → Top width = 6m
- → Unit weight of water = 1000 kg/m^3
- → Unit weight of Concrete = 1450 kg/m^3
- → Unit weight of Silt = 1330 kg/m^3
- → Angle of friction for Silt = $\phi_s = 35^\circ$
- → free Board = 3.5m
- → Silt deposite height = 2.5m

Required:

Silt pressure = ?

Solution:

As we know that

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

putting values

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

$$\Rightarrow P_s = 1126.30 \, kg/m$$