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Semester : 6th

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SUBJECT :- GEOTECNICAL - ENGENEERING

DATE :- 27-06-2020

QUESTION No 01:-

Name the forces acting on dam. Explain any five of them in detail:

Answer No 01:-

FORCES ACTING ON.

The various external forces acting on Gravity Dam may be.

- Water pressure
- Up lift pressure
- Pressure Due to Earthquake forces
- Slit pressure
- wave pressure
- Ice pressure
- The stabilizing forces is the weight of the dam itself.

1) UP LIGHT PRESSURE:-

Water seeping through the Pores, cracks and fissures of the foundation material and water seeping through dam body and then to the bottom through the Joint between the body of the dam.

It is the second major external forces and must be accounted for in all calculations. Such an uplight force virtually reduces the downword weight of the body of the dam and hence act against the dam stability.

EARTHQUAKE FORCE:-

- If the dam is to be design is to be located in a region which is susceptible to earthquakes, allowance must be made for stresses generated by the earthquakes.
- An earthquake produces waves which are capable of shaking the Earth upon which the dam is resting in every possible direction.

If h is the height of silt deposited, then the force exerted by this silt in addition to external water pressure. can be represented by Rankines formula as:

- Psilt - $\frac{1}{2}$ r sub$_w$ h^2 ka and it acts at h/3 from base
- where, ka is the coefficient of Active Earth Pressure of silt.
- $ka = \frac{1 - \sin\theta}{1 + \sin\theta}$
- where θ is the angle of internal friction of soil, and cohesion is neglected.
- rsubw - submerged unit weight of silt material
- h - height of silt deposited.

WAVE PRESSURE :-

- Waves are generated on the surface of the reservoir by the blowing winds, which cause a pressure towards the downstream side, wave pressure depend upon the wave height. wave height may be given by the equation

- $Hw - 0032\sqrt{V \cdot F} + 0.763 - 0271(F)^{3/4}$

for $F < 32$ km And.

- $Hw - 0.032\sqrt{V \cdot F}$ for $F > 32$ km

- Where hw - height of water from top of crest and bottom of tough in meter.
- V - wind velocity in km/hr.

WATER PRESSURE:-

D is the depth of water in reservior. P is the hydrostatic Pressure Per unit area acting on the vertical force of a concrete dam. assumed to behave as a rigid (in the Y direction) in given by $dp/d_1^2 lg$ in which P is the density of water and S is the accelercition due to gravity.

Question No 1 "B"

Define the following terms:

1) LIQUIFICATION of SOIL:-

Soil liquification occur when a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress such as shaking during an earthquake or other sudden change in stress condition, in which material that is ordinarily a solid behaves like a liquid.

Buttress Dam:-

A buttress dam or hollow dam is a dam with a solid, water-tight upstream side that is supported at intervals on the downstream side by a series of buttress or supports. The dam will may be

Straight & curved. Most buttress dam are made of rainforce concrete and are heavy, Pushing the dam into the ground.

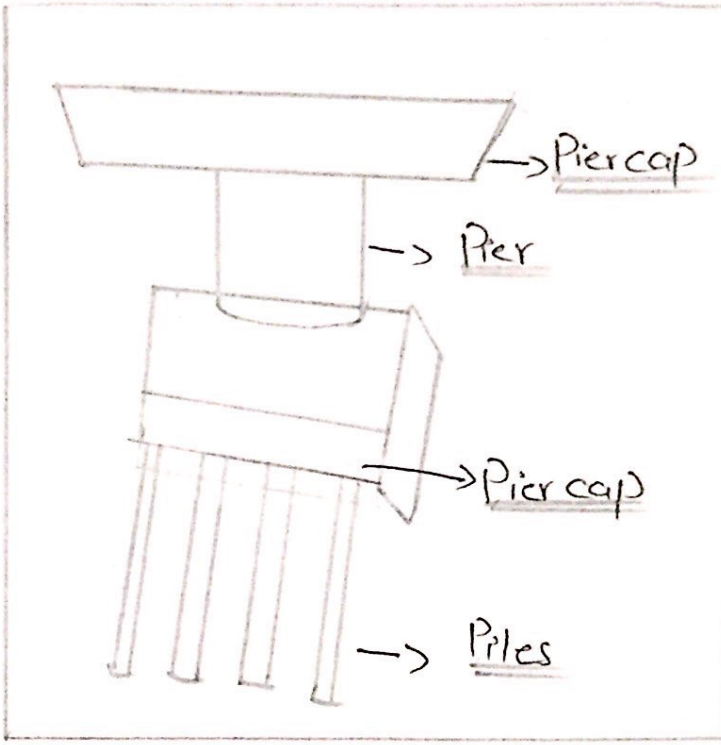
3) INFINITE SLOPE:-

The type of slope extending boundries or up to an extent whose boundries are not well defined. for this type of slope the soil properties for all identical depths below the surface are same. In the making of natural slopes, their is no contribution from our side.

4) PER FOUNDATION:-

A pier foundation is a collection of large diameter cylindrical columns to support the super structure and transfer large super-imposed load to the firm strata below. It is also

known as "Post foundation."



DYNAMIC LOAD:-

Soil dynamic deals with the engineering behaviour of soils subjected to time varying loads and load applied very rapidly.
In soil dynamic applied loads vary with time. This implies that the stress and strain induced in the soil are also function of time.

Question No 02:- PART A:-

FOUNDATION:-

The lowest part of the structure which transmit the load of super structure safely to the soil surface

Types of FOUNDATION:-

There are two types of foundation.

1) Shallow foundation
2) Deep foundation

1) SHALLOW FOUNDATION:-

ACCORDING TO TERZAGHI:-

The foundation in which depth of the foundation is less as equal to width of the foundation is called shallow foundation.

$$Df \leq B$$

- ACCORDING TO SKEMPTON:-

The foundation in which DF/B ratio is less than or equal to 2-5 than the foundation is called shallow foundation.

TYPE of SHALLOW FOUNDATION:-

1) wall footing
2) Combined footing
3) Raft / Mat footing
4) Strapped footing
5) column / Isolated footing
6) Slopped footing.

WALL / STRIP FOOTING:-

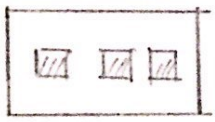
The footing which runs across the length of the wall and transfer the load of the wall to the soil safely. It is called wall or strip.

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 traperoidal.



Rectangular

Traperaidal

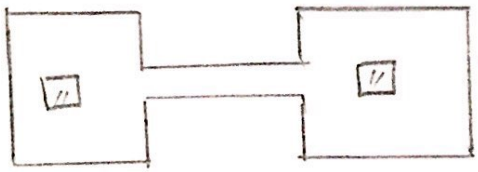
3) RAFT/MAT FOOTING:-

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 bealing capacity.

This is also provided when the load of soper structure is heavy.

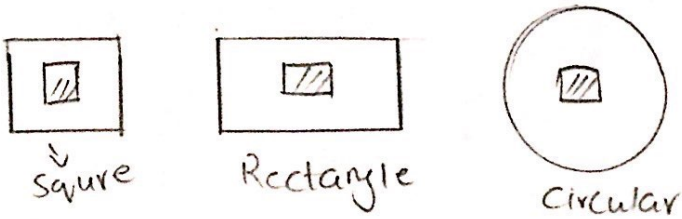
4) STRAPED FOOTING:-

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



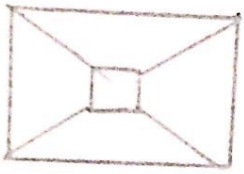
5) Column / ISOLATED FOOTING:-

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



SLOOPED FOOTING:-

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



QUESTION No 02:- Part B

GROUND IMPROVEMENT TECHNIQUES:-

Ground improvement techniques are the techniques which are used to enhance the engineering property of soil in order to beal heavy structual load. The main properties are sheal strength, permeability, bealing capacity and stiffress etc.

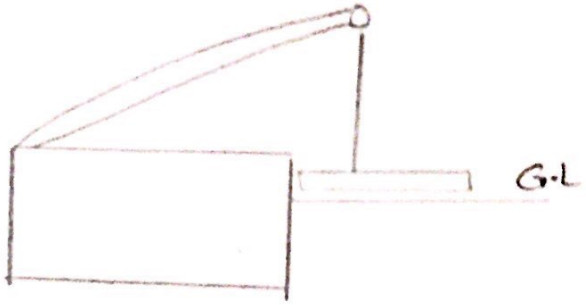
METHODS OF GROUND IMPROVEMENT TECHNIQES:-

1) REMOVAL AND REPCACEMENT OF SOIL:-

This is an oldest and simple method. This method is performed on loose soil. In this method the unsuitiable soil is replaced with compacted fill. In this method the same soil is used to refill the higher compaction and setler engineering properties. This method is applicable above the ground water table.

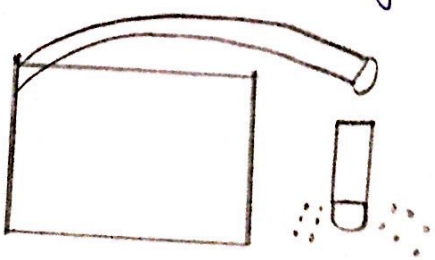
2) DYNAMIC COMPACTION:-

This method is used to increase the bealing capacity of soil. This also increase the consdidation rate. This method also increase the density of soil In this method actually dentification of soil take place.



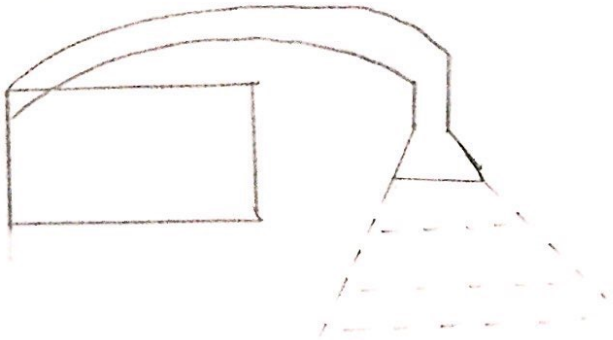
3) VIBRO COMPACTION:-

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 on electric motor. The penetration of probe is entance by ejecting water at the tip of probe.



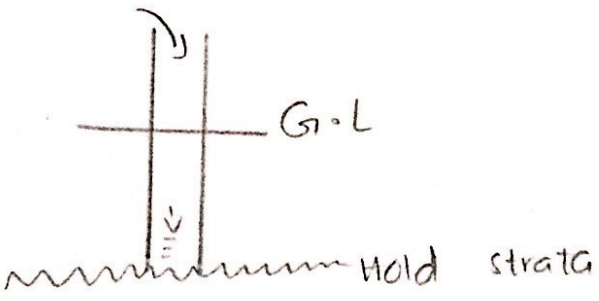
RAPID IMPACT COMPACTION:-

Impact energy is applied to surface of ground as a result of which densification of soil take place upto at depth of 15 feet. This impact energy is actually applied through hydralic ramp. The hydralic ramp weight vales from 4-8 tons.



VIBRO CONCRETE COLUMN:-

Vibro concrete columns is a ground improvement technique which transfer the load from weak strata to hold strata by using streyth concrete.



Question No 03:-

GIVEN DATA:-

$C = 25 kN/m^2$

$\phi = 16°$

$G_s = 2.72$

$e = 0.50$

REQUIRED:-

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

F c (F.O.S) when there is seepage in soil

SOLUTION:-

$$Fc = \frac{C}{rd \times H \times \sin i \times \cos i} + \frac{\tan \phi}{\tan i}$$

$$rd = \frac{G_s \times r_w}{1+e} = \frac{2.72 \times 9.8}{1+0.5}$$

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

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

$$Fc = 1.18$$

when there is seepage of water

$$FC = \frac{C}{r.H \times \sin i \times \cos i} + \frac{r'}{r} \times \frac{\tan\theta}{\tan i}$$

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

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

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

$$\gamma = 21.04 \ \text{KN/m3}$$

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

$$= 21.04 \ \text{KN/m}^3 - 9.8$$

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

$$Fc = \frac{25}{21.04 \times 6 \times \sin(26°) \times (\cos(26°)} + \frac{11.24}{21.04} \times \frac{\tan(16)}{\tan(26)}$$

$$\boxed{Fc = 0.836.}$$

Question No 04 Part (A)

GIVEN:

Height = 10m

$C = 18.8\ KN/m^2$

$\gamma = 17\ KN/m^2$

$\phi = 20°$

F.O.S = 1.5

$F\phi = 1.0$

REQUIRED:

Inclination, $i = ?$

SOLUTION:-

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

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

$$\boxed{SN = 0.073}$$

Using taylar chart for

$\phi = 20°$

$SN = 0.073$

$$\boxed{i = 44°}$$

Question No 04:- Part B

GIVEN:-

Height of water on upstream side = 10m

Bottom, width = 12m

Top width = 6m

$\gamma_{water} = 1000 kg/m^2$

$\gamma_{concrete} = 1450$

$\gamma_{silt} = 1330 kg/m^3$

$\phi = 35°$

Free Board = 3.5 m

$H = 20.5$ m

REQUIRED:-

Silt, pressure P_s = ?

SOLUTION:-

As we know

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

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

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

$$= 4156.25 \times 0.27$$

$$\boxed{P_s = 1122.18 \text{ kg/m}}$$