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Section : "A"

Subject : Geotechnical

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Q No # 01

(a) Nam of force acting on Dam:

1) water pressure
2) uplift pressure
3) wave pressure
4) silt pressure
5) Ice pressure
6) Self weight of the dam
7) Seismic force.

→ uplift pressure

It is an upward vertical pressure created due to the penetration of water into pore material of dam basement. it is the condition of great pore water pressure than the overburden pressure of structure. This hydraulic gradient is set up b/w the upstream and down stream side of dam.

2) Seismic force:-

The disturbance in dam is highly dangerous because they store huge volume of water. Dam built in the area known to be seismically active must be designed to with stand addional forces that are likely to arise in a future shock.

(3) Water pressure:-

water pressure (P) is the most major external forces acting on the dam. The horizontal water pressure exerted by the weight of the water store of the upstream side of the dam.

→ The water pressure can be calculated by Hydrostatic pressure ~~can~~ be distribution

→ Force due to water pressure

$$P = WH^2/2$$

→ This act at a height of because from base of a dam.

→ **Wave pressure:-**

→ The upper portion of the dam are subject to the Impact of waves.

→ Wave pressure against massive dam of appreciable hight is usually of little consequence.

→ The force and dimension of wave depends mainly in the extent and configuration of the water surface, the velocity of wind.

→ **Ice - Pressure:-**

The Ice pressure which may be formed on the surface of the reserviour in cold countries may some time melt & expand.

→ The dam face has then to resist the thrust exerted by the expanding ice. This force acts linearly along the length of the dam & at the reserviou level.

→ The magnitude of the force varies from 250 to 1500 KN/m² depending upon the temprature variation on an average, a value of 500 kN/m² may be allowed under ordinary condition.

Part "B" "Define the following term"

1) Liquefication of Soil:-

Liquefication is the phenomenon in which the strength and stiffness of a soil is reduced by earthquick shaking or other rapid loading. Liquefication and related phenomena have been responsable for tremendous amount of damage in historical earthquick in around the world.

Liquefication occure in saturated soils, that is, soils in which the space b/w individual particals is completely filled with water.

Earthquake shaking often triggers this increase in water pressure, but construction related activities such as blasting can also cause an increase in water pressure.

Buttress dam:-

A buttress 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 wall may be straingth or curved. most buttress dams are made of reinforced concrete and are heavy, pushing the dam into the ground. water pushes against the dam into but the buttresses are inflexible and prevent the dam from falling over.

Infinite slope

An Infinite slope is simply a vertical line. when you plot it on a line graph. an Infinite slope is any line graph friction and bearing, pier foundation transfer the load only through bearing.

QNo # 02

Shallow foundation:-

→ According to Terzaghi:-

The foundation in which depth of the foundation is less as equal to width of the foundation is called wall as strip footing.

→ According to ~~shallow~~ Skemption:-

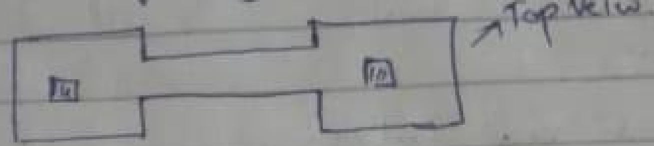
The foundation in which of Df/B ratio is less than as equal to 25 than foundation is called shallow foundation.

Type of shallow foundation:-

(1) wall footing
2) combined footing
3) Raft / Mat footing
4) strapped footing
5) colom / Isolated footing
6) slopped footing.

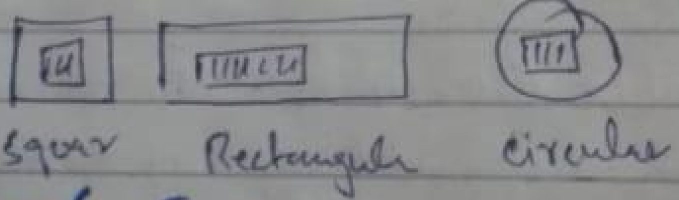
→ **Strapped footing:-**

The footing in which the outess column by mean of the beam as strap is called strapped footing.



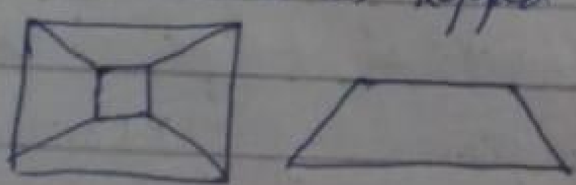
→ **Column / Isocated Footing:-**

The footing which is constructed for a sigle column and transmit its load to the soil safely it may be circular, square, reqtangular in shape.



→ **Stopped Footing:-**

The footing which have slope in all direction as in all side is called as stopped footing



Q 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 bear heavy structural load.

The main properties are shear strength, permeability, bearing capacity and stiffness etc.

Method of ground Improvement Techniques:

(1) Remove and replacement of Soil

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

In this method, the unsuitable soil is replaced with compacted fill. In this method the same soil is used to refill the higher compact and better engineering property

This method is applicable above the ground water table

(2) Dynamic compaction:-

The method K used to increase the bearing of the soil. This also increase the consolidation rate this method actually densification 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 an electric motor. the penetration of probe is enhance by ejecting water at the tip of probe

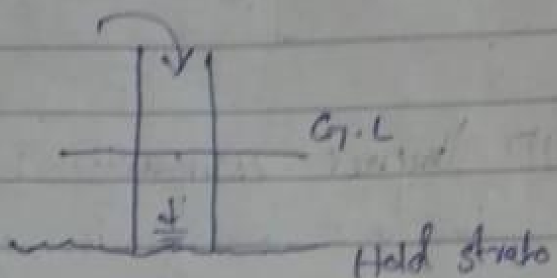
(4) RaPID Impact compaction:

Impact energy is applied to surface of ground as a result of which densification of soil take place upto a depth of 15 feet.

This impact energy is actually applied through hydraulic ramps. The hydraulic ramp weight values from 4-8 tons.

(5) VIBRO concrete column:-

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



(14)

Q No #03

Given Data:

$C = 25 kN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.50$

Required:

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

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

Solution:

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

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

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

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

$$FC = 1.18$$

When there is seepage of water.

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

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

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

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

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

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

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

$$\gamma = 21.04 - 9.8$$

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

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

$$\boxed{FC = 0.816} \text{ Ans}$$

's ... penetration

Result :-

FC when soil is dry = 1.18

FC when there is seapage = 0.816

Q No # 04

Part "A"

Given data:-

Height = H = 10m

$c = 18.8\ KN/m^2$

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

$\theta = 20°$

FOS = 1.5

$F\theta = 1.0$

Required:-

Inclination $i = ?$

Solution:-

As we know that

$$SN = \frac{c}{Fos \times \gamma \times H}$$

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

$$SN = 0.73$$

(18)

Solution:

As we know

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

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

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

$$= 4156.25 \times 0.27$$

$$PS = 1122.18 \, kg/m$$

using tayler chart for

$\theta = 20^\circ$

$SN = 0.073$

Then

$i = 44$ (from tayler chart)

Q No # 04

Part B

Given data

height of water on upstream side = 15m

Bottom width = 12 m

Top width = 6m

γ_{water} = 1000 Kg/m²

$\gamma_{concrete}$ = 1450

γ_{silt} = 1330 Kg/m³

$\theta = 35^\circ$

free board = 3.5

H = 2.5m

Required:-

Silt pressure = Ps = ?

penetration

ejecting

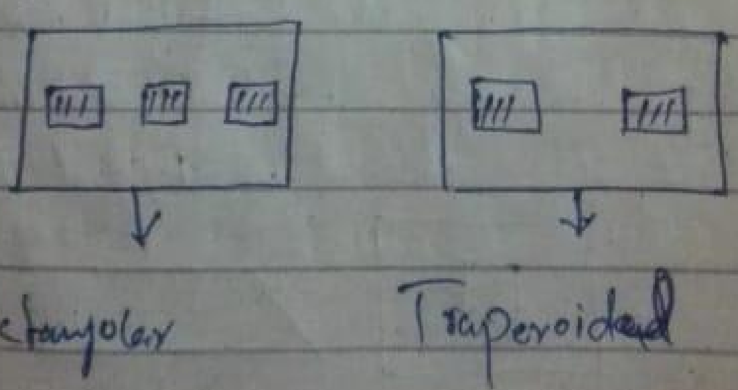
1) Wall / sTrip Footing:-

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

2) Combined footing:-

The footing which constructed for two or more column and transfer the load of the two as more column to the Soil safty than it is called combined footing will be rectangular in shape.

if the load of the column is not uniform than shap of combined footing will be trapezoidal.



which runs parallel to the y-axis. You can also describe This is any line that doesn't move along the x-axis but stays fixed at on constant x-axis coordinate, making the change along the x-axis 0.

Dynamic load:-

The load which act on ground by the movement of subject and sometime the load due to earthquick can be classified as dynamic load.

Pier Foundation:-

A pier foundation consists of cylindrical column of larg diameter to support and transfer large super-imposed loads to the firm strata below through pile foundition transfer the load through

side is cal