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Question #01 (a)

Forces Acting on dam:-

Following are The forces:

1) water pressure.
2) weight of dam.
3) Ice pressure.
4) wave pressure.
5) wind pressure.
6) Silt pressure.
7) uplift pressure
8) Thermal loads
9) Earth Quack pressure.

→ UPLIFT PRESSURE:-

→ It is almost impossible to make a dam on previous structure.

→ Many minute cracks and pores are left in the dam and the foundation body.

→ water is likely to find it ways into these minute opening Through Seepage and gradually

Fill Them up.

-> It exerts an upward pressure on the body of the dam.

=> water pressure:-

-> water pressure (P) is the most major external forces acting on a dam.

-> The horizontal water pressure exerted by the weight of the water stored on the upstream side of the dam.

=> EARTH QUACK FORCES:-

-> The disturbance in dam is highly dangerous because it store huge volume of water.

-> Dams built in those areas known to be seismically active must be designed to with stand additional forces that are likely to araise in future shock.

⇒ Wave Pressure:

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

→ The force and dimensions of waves depends mainly on the extent and configurations of the water surface, the velocity of wind.

⇒ Silt pressure:-

→ we also know that when water getting fill up in a dam it also brings silt in water by nature or natural.

→ These silt apply pressure against wall. Such pressure are known as Silt pressure.

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Question #01 (b)

1) Liquification Of Soil:-

A Phenomenon where by a saturated or partially saturated soil substantially losses strength and stiffness in responce to an applied stress, usually earthquake or shaking change in stress conditions, causing it to behave like a liquid is called soil liquification.

Liquification is a process that leads to a soil suddenly losing strength, most commonly as a result of ground shaking during earth quake.

2) Butress Dam:-

A dam consisting of a thin water supporting facing or dock supported by buttress generally in the form of equally spaced triangular walls or counter forts that transmit the water load and deck weight the the foundation.

3) Infinite slope:-

Slope which have great extent with uniform soil condition at any given depth below the surface and the soil stratum is not necessary.

4) Pier foundation:-

A pier foundation consists of a cylindrical column of large diameter to support and transfer large super-imposed loads to the firm strata below through pile-foundation transfer the load through bearing, pier foundation transfer the load only through bearing.

5) Dynamic Load:-

Dynamic load is any load that moves, changing magnitude or direction overtime. Load in a static system are constant and unchanging shock load, impact load and vibrating load can all considered dynamic in nature but are not the same.

Question # 2(a)

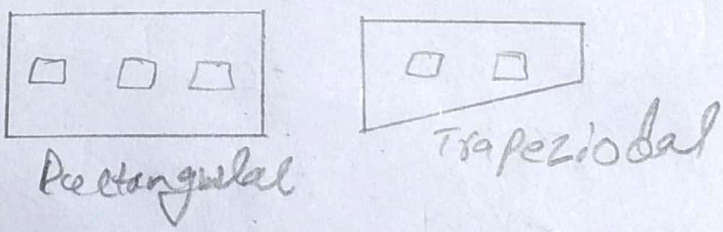
SHALLOW FOUNDATION:-

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

TYPES OF SHALLOW FOUNDATION:

1) Combined FOOTING:-

The footing which is constructed for more then two column and transfer the load of two or more column to the ground safely then it is called combined footing.



2) Wall footing:-

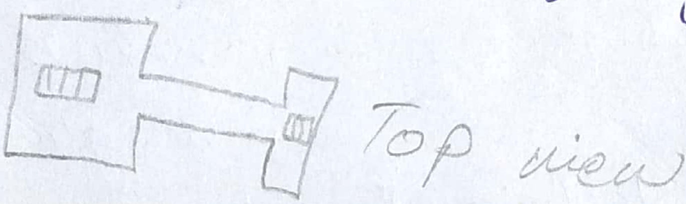
The footing which runs across the length of the wall and transfer load of the wall to the soil safely. It is called wall footing.

3) Raft footing:-

The footing which cover the area where the area of structure is called raft footing. This type of footing is proposed in area which have soil weak in bearing capacity. It is also provided when load of structure is heavy.

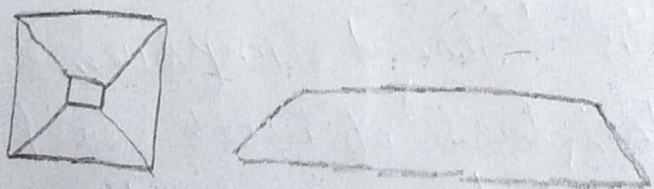
4) Strapped footing:-

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



5) Slopped footing:-

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



Question #02 (b)

Ground Improvement techniques Importance:

The Soil in which volumetric changes take place due to shrinkage and swelling such soil needs ground improvement techniques.

- The soil which is organic in nature.
- The soft soil also required ground improvement techniques.
- The foundation which is sandy and gravely.

METHODS Of Ground Improvement technique:

1) **Dry Mixing Of Soil:**

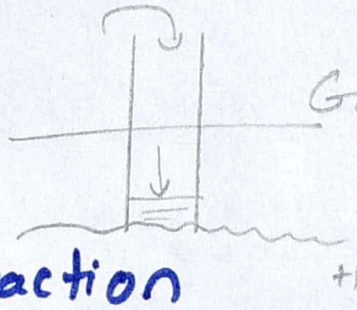
Dry soil mixing is Ground improvement technique by which characteristics of weak soil are improved by using dry cementitious binder

2) **WET Soil Mixing:**

In This method of ground improvement technique a paste of cement is prepared and inserted in the soil. This method is used to improve the characteristics of weak soil by using cementitious binder slurry.

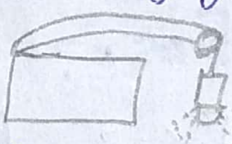
3) Vibro Concrete Column:-

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



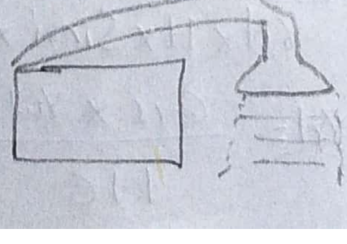
4) Vibro Compaction

It is also called vibro densification. In this method the compaction takes place at a certain depth in granular soil through vibratory probe. This vibrating probe run by a motor. The penetration of prob is enhance by ejecting water at the tip of probe.



5) Rapid Impact Compaction:-

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



Question #3

Given:

$i = 26^\circ$

$C = 25 KN/m^2$

$G.S\ 2.72$

$\phi = 16^\circ$

$e = 0.50$

$H = 6m$

Required:

Fos = ? (when the soil is dry)

Fos = ? (when there is seepage in soil)

Solution:-

As we have.

$$Fos = \frac{c}{\gamma \cdot H \cdot \sin i \cdot \cos i} + \left(\frac{\gamma'}{\gamma}\right)\frac{\tan\theta}{\tan i}$$

First we have to find dry density. (γd) by using formula.

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

where $\gamma d = \frac{G.s \times \gamma w}{1+e}$

Putting values in above formula.

$$\gamma_d = \frac{2.72 \times 9.8}{1 + 0.50} \Rightarrow 17.77 \approx \boxed{17.8\ kN/m^3}$$

Now from Fc $(\gamma_{soil} = 9.8\ kN/m^3)$

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

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

$$\boxed{F_c = 1.18}$$

For seepage of water Fos will be.

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

where:

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

Also

$$\gamma = \frac{G_s + e}{1+e} \times \gamma_w \Rightarrow \frac{2.72 + 0.50}{1 + 0.50} \times 9.8$$

$$= 21.037 \approx 21.04$$

$$\Rightarrow \boxed{\gamma = 21.04\ kN/m^3}$$

Now,

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$\gamma' = \gamma - \gamma_w$

$= 21.04 - 9.8 \Rightarrow \boxed{\gamma' = 11.24\ kN/m^3}$

Now putting all the values in FoS Formula

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

$\boxed{FoS = 0.816}$

Question # 4 (a)

Given Data:-

$H = 10m$

$C = 18.8 \, KN/m^2$

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

$FOS = 1.5$

$\phi = 20^\circ$

$F_\phi = 1.0$

Required:-

Inclination Angle for the embankment = ?

Solution:-

By using Taylor Stability Member formula.

$$S_N = \frac{c}{FOS \times \gamma \times H} = \frac{18.8}{1.5 \times 17 \times 10}$$

$$\boxed{SN = 0.073}$$

Now :, using taylor chart for the values.

$\phi = 20^\circ$, $SN = 0.073$

$i = 44^\circ$ ⟶ from taylor chart.

Question #4 (b):-

Given Data:-

H = 15m

Bottom width of Dam = 12m

Top width = 6m

unit weight of water = 1000 kg/m³.

unit weight of concrete = 1450 kg/m³

unit weight of Silt = 1330 kg/m³

Angle of friction for silt = (ϕs) = 35°

Free Board = 3.5m.

Silt Deposite height = 2.5.

Required:

Silt pressure (P_s) = ?

Solution:.

By using formula.

$$P_s = \frac{\gamma_s \times (H)^2}{2} \times \frac{1 - \sin\phi}{1 + \sin\phi}$$

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

$$\boxed{P_s = 1126.30 \text{ kg/m}}$$