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QNo1A

Ans Forces acting on dam :-

Forces acting on the dam are the following:

* Water pressur
* Weight of the dam.
* Ice pressure
* Wave pressure
* Earth quick pressure
* Silt pressure
* uplift pressure
* Thermal loads

Water pressure ⇒ Water pressure (P) is the most major external force acting on the dam. The horizontal water pressure exerted by the weigh of the water stored on the upstream side of the dam.

* The water pressure can be calculated by hydrostatic pressure distribution. $P = wH^2/2$

⇒ This act at a height of $h/3$ from base of a dam.

Uplift Pressure ⇒ It is almost Impossible to make a dam. impervious structure. It is the second major external force and must be actually for all

Calculation Such an uplift force virtually of the body of the dam and hence act against the down stability

Wave Pressure

Wave pressure are generated on the surface of water. Which causes a pressure toward the downstream side wave pressure depend upon the wave height.

Silt pressure

It has been explained under reservoir Sedimentation, that silt gets deposited against the upstream face the dam. height of silt deposited, than the force exerted by this silt in addition to external water pressure can be represented by Rankin's formula as,

$P_{silt} = \frac{1}{2} \gamma_{sub}\, b_y\, h^2\, k$ and it act at $h/3$ from base

Ice Pressure

The ice pressure which may be formed on the surface of the reservoir is cold countries may sometimes melt and expand the dam face has then to resist the thrust exted by the expending ice. This force act linearly along the length of the dam and at the reservoir level. The magnitude of this force varies from 250 to 1500 kN/m^2 depending upon the temperature variations. On an average, a valve of 500 kN/m^2 may be allowed under ordinary conditions.

Question# 1 B

Ans ⇒ Define the Following terms

1: **Liquification** ⇒ A phenomenon whereby a saturated or partially saturated soil substantially less strength and stiffness in responce to an applied stress, usually earthquake shaking or other sudden change in stress condition, causing it to behave like a liquid is called Soil liquefication.

2) **Butress Dam** A buttress dam or hollow dam is basically a derivation of a gravity dam with the introduction of intermediate space.

With a buttres dam, the face of the dam is held by series of supports or buttreses that are placed at intervals on downstream side. Force of reservoir water from trying to push the dam over.

The advantage of buttress dam is that it typically require less concrete to concrete than a gravity dam.

3) **Infinite Slope:-**

The Slop which have Infinite area and Finite depth Such a Slop is Called as Infinite Slope.

example

Natural Slop i-e Hills, deserts etc.

4) **Pier Foundation:-**

The vertical member which have larger dia as Compaled to pile and transmit the load of Structure to the underground soil. They are constructed by cost in Situ process.

5) **Dynamic load:-**

Dynamic loads vary in their magnitude, direction or position with time. The type of dynamic loading in soil or the Foundation of a Structure depends on the nature of the Source ponching it.

Dynamic load may be in Form of

① Earthquick ② Operation of heavy Machinary

3) Wave motion ④ Wind.

Qrlo # 02 A

Ans

Shallow Foundation

According To Terzaghi:

The Foundation width depth of the Foundation is less as equal to width of the Foundation is called Shallow Foundation:

$D_f \leq B$

⇒ According To Skempton

The Foundation in which Df/B ratio is less than as equal to 2.5 than the Foundation is Called Shallow Foundation.

Types of Shallow Foundation

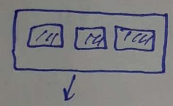
1: Wall Footing
2: Combined Footing
3) Raft /Mat Footing
4) Strapped Footing
5) Column/Isolated Footing
6) Stepped Footing:

1 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.

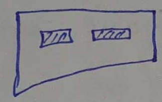
2) Combined Footing

The Footing which is constructed for two or more column and transfere the load of the ~~wall~~ 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 trapezoidal.



Rectangular

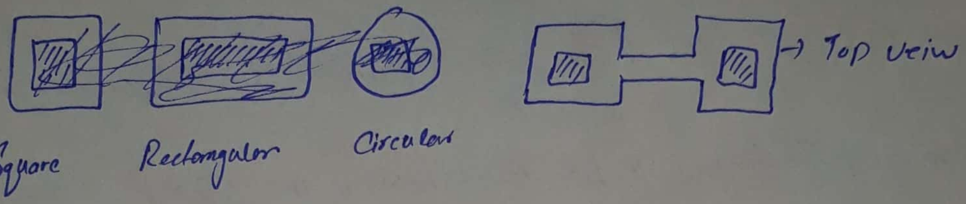


Trapezoidal.

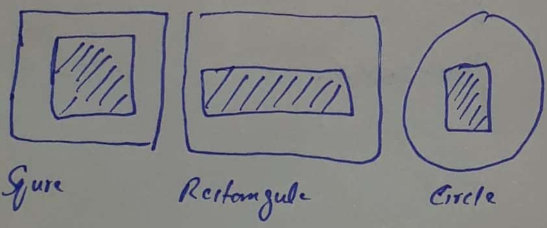
3) Raft / Mat Footing :-

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 bearing capacity. This is also provided when the load of super structure is heavy.

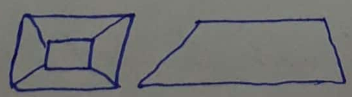
4) Strapped Footing => The Footing which is Constructed For a Single column and transmit its load to the Soil Safely. It may be Circular, Space, rectangular in Shape.



5) Column/Isolated Footing => The Footing which is constructed For a Single Column and transmit the load to the Soil Safely, It may be Circular, Square, rectangular in Shape.



6) Slopped Footing => The Footing which have Slope in all direction as in all Sides is Called as Slopped Footing



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QNo # 2 B

Ground Improvement Techniques:

Ground Improvement techniques are the techniques which are used to enhance to engineering property of soil in order to bear heavy structural load. The main properties are shear strength, permeability, bearing capacity and stiffness. etc.

Need of Ground Improvement Techniques:

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 Soil which is Sandy and gravely. The foundation in sanitary dump places also required ground Improvement technique.

Methods of Ground Improvement of ~~Soil~~: techniques.

1: Removal And Replacement of Soil:

~~In~~. this method is oldest and simple method. This method is perform on loose Soil.

In this method the unsuitabl soil is replaced with compacted fill. In this method the same soil is used to refill the higher compaction and better engineering properties.

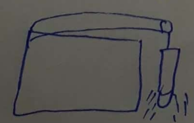
This method is applicable above the good water table.

2) Dynamic Compaction

This method is used to increase the bealing capacity of soil. This also increas the consoldition rate. This method actually densification of soil take place.

3) Vibro Compaction

It is also called vibro densification. In this method the compaction tames place at a certain depth in granable soil through vibratory proble. This vibratory probe is ran by an electric motor. The penetration of probe is entance by ejecting water at the tip of probe.

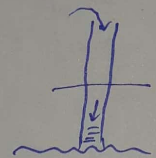


4) <u>Rapid Impact Compaction</u>

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 hydaulic ramp. The hydraulic ramp weight value from 4-8 tons.

5) <u>Vibro Concrete Column</u> =)

Vibro concrete columns is a ground improvement technique strata to hold strata by using strength concrete.



6) => <u>Wet Soil Mixing</u> =)

In this method of ground Improvement technique a paste of Cement is prepaled and inserted in the soil. This method is used to improve the charactions of weak soil by using cementitious binder slurry.

7) <u>Dry Mixing of Soil</u> =)

Dry soil mixing is chlocations of weak. Soil are improved by using dry cementitious binders.

QNo#3

Given data

$C = 25 kN/m^2$

$\phi = 16°$

$G = 2.72$

$e = 0.50$

Required

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

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

Solution

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

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

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

$$\boxed{\gamma_d = 17.8\ kN/m^3}$$

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

$$\boxed{F_c = 1.18}$$

When there is seepage of water

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

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

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

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

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

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

$$\gamma' = 21.04 - 9.8$$

$$\boxed{\gamma' = 11.24 \ kN/m^2}$$

$$Fc = \frac{25}{21.04 \times 6 \times \sin(26) \times (0.5)(26')} + \frac{11.24}{21.04} * \frac{\tan(16^{\circ})}{\tan(26)}$$

$$\boxed{Fc = 0.816}$$

QNO # 4 A

Given data

H = 10 m

C = 18.8 kN/m²

γ = 17 kN/m³

φ = 20°

F.O.S = 1.5

Fφ = 1.0

Required

Inclination i = ?

Solution

We know that

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

$$\boxed{S_N = 0.073}$$

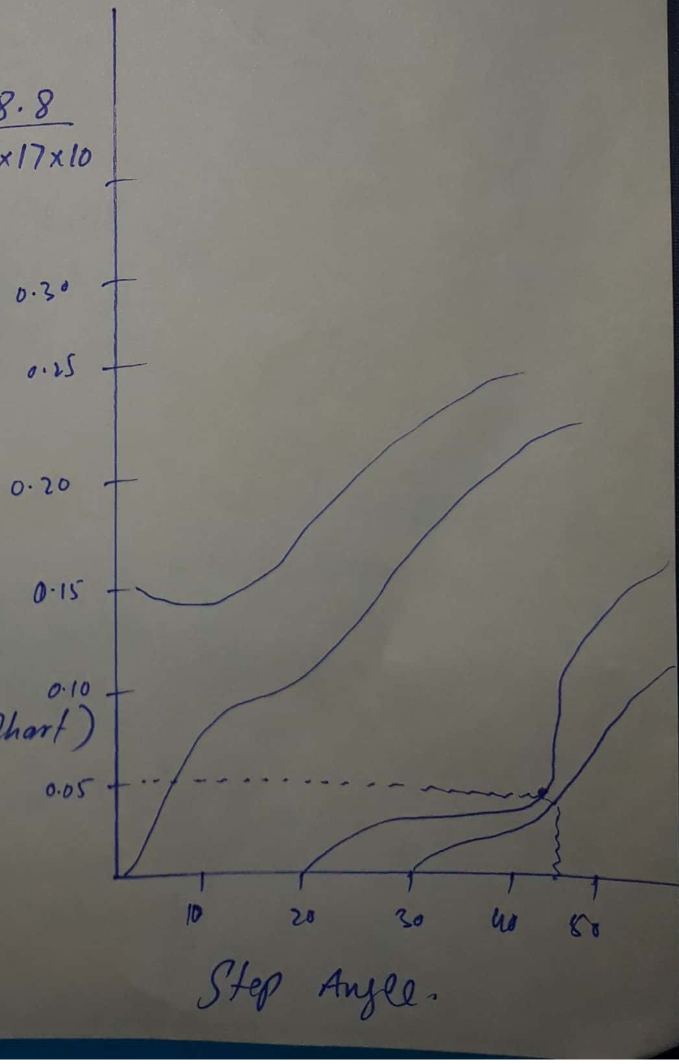
Using Taylor Chart

φ = 20°

$$\boxed{S_N = 0.073}$$

Then

i = 44 (From Taylor Chart)



Q.No4 # B

Given data

* Height of water on upstream side = 15m
* Bottom width of the dam = 12m
* Top width = 6m
* Unit weight of water = 1000 kg/m^2
* unit weight of concret = 1450 kg/m3
* Unit weight of Soil = 1330 kg/m^3
* Angle of Friction of silt = $\phi_s = 35°$
* Free Board = 3.5m
* Silt deposite height = 2.5m

Required ⇒ Silt pressure = ?

Solution As we know that

$$P_s = \frac{\gamma_s \times H_2^2}{2} \times \frac{1 - \sin\phi}{1 + \sin\phi}$$

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

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