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Q No :: 1

(A): Name the force acting on a dam. Explain any Five of Them in detail :

Ans : Following are the force acting on daw.

* Self weight of the dam.
* Silt Pressure.
* Water Pressure.
* uplift Pressure.
* Wave Pressure.
* ice Pressure.
* Seismic forces.

i: **Self weight of the dam:**

⇒ The weight of the dam & its foundation is a major resulting force.

⇒ It can be computed using the following equ.

⇒ $W = \gamma_m$ Volume.

Where :

γ_m = Unit weight of the dam material.

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(ii) Silt Pressure :

⇒ It is the pressure that is caused by the deposition of the silt in the bed of the dam causing at h/3 from the base & can be computed using equation.

$$\Rightarrow \quad P_{silt} = 0.5\,\gamma_s\,h^2\,K_a$$

Where :

K_a = cofficient of active earth pressure of silt which is equal to :

$$\Rightarrow \quad \frac{1 - \sin\phi}{1 + \sin\phi}$$

⇒ ϕ = angle of internal friction of soil, cohesion etc.

⇒ γ_s = Submerged unit weight of silt material.

⇒ h = height of silt deposited.

(iii) Wave Pressure :

Waves are generated on the surface of the reservoir by the blowing winds, which exerts a pressure on the upper part of the dam above the water level. This is calculated by the following formula:

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$$P_{wl} = 2.4\ \gamma_w h_w$$

Wave Pressure depends Upon wave height is given by the :

⇒ F < 32 Km.

⇒ $h_w = 0.32\sqrt{PV} + 0.763 - 0.271 \times F^{1/4}$

⇒ $h_w = 0.32\sqrt{VF}$

Where :

⇒ h_w = height of water from the top of crusts from the bottom of trough in meter.

⇒ V = Wind velocity in k/hr

⇒ F = Fetch or straight lenght of water expanse in km.

⇒ The max Pressure intensity due to wave action accurs when it acts at 0.S.

⇒ Total force due to water wave action is given by

⇒ $P_{wl} = 0.5\,(2.4\ \gamma_w h_w)\ 3/8\ h_w.$

(4) Ice Pressure :

The ice which may be formed on the water surface of the reservoir in cold countries may sometime melt and expanding. The dam face is subjected to the thrust and ~~extert~~ exerted by the expanding ice.

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This force acting linearly along the length of the dam and at the reservoir level. The magnitude of these force varies from 250 to 1500 kN/m^2 depending upon the temperature.

(5) Seismic Force :

Dynamic load created due to earth quake must be considered in the design of all major dams located in high risk seismim regions. Earthquaks Produces waves in every possiable direction. However, it has to be resolved into vertical and Horizontal component. For all the design Purpose. The Horizontal component had ~~component~~ greater effect. Seismic vibration influence both dam body and water in the reservoir of dam.

① Part B

Define the following terms:

i ⇒ Liquification of Soils :

Effective stress are the stresses which keep the soil particles in contects. With each other if the effective stresses decrease the soil loose it strength. When the effective stresses become zero then Soil will change to liquification state.

(ii) Buttress Dam:

A buttress dam is dam with a solid, water tight upstream side that is supported at intervals on the downstream side by a series of buttresses or support. The daw wall be straight or cureved.

⇒ Most buttress dams are made of rainforced concrete and are heavy, pushing the dam into ground.

(3) Infinit Slope:

The slope which have infinite area and finite depth such a slope is called infinite slope.

Examples:

Natural slope i.e Hill, mountain, & deserts etc

⇒ In infinite slope the failure will be in the form of Sliding.

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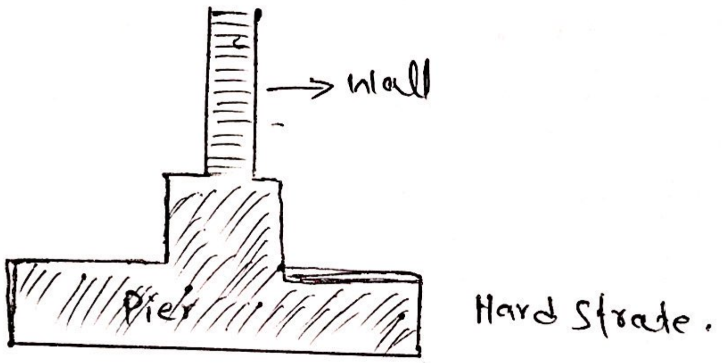
(4) Pier Foundation :

The vertical member which have larger dia as compared to pile & transmit the load of structure to the underground soil. They are constructed by cost in-situ Process.



(5) Dynamic load :

Dynamic load accur when loading condition are changing with time. It may be in the form of earthquake operation of heavy machinery, waves motion, wind etc. Due to dynamic load settlement change increase.

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Q NO # 2.

Part A.

Define shallow foundation. Explain types?

Ans: **According to Terzaghi :**

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

$$\Rightarrow D_f \leq B.$$

Types :

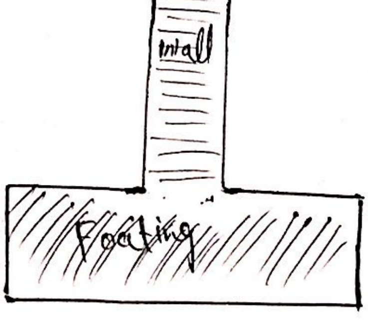
Types of shallow foundation are following.

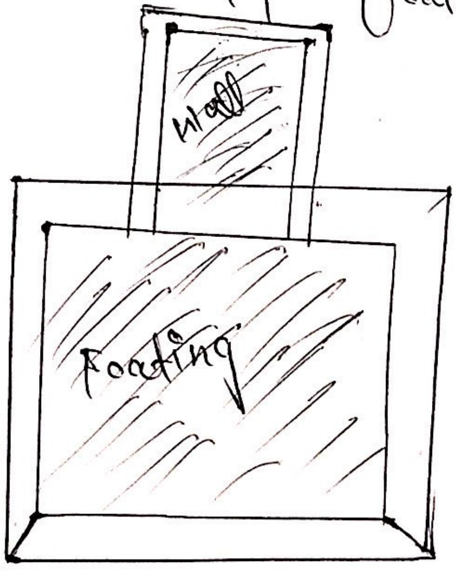
i: Wall footing :

⇒ The footing which runs across the length of the wall & transfer the load of the wall to the soil safty.

⇒ It is called wall or strip footing.

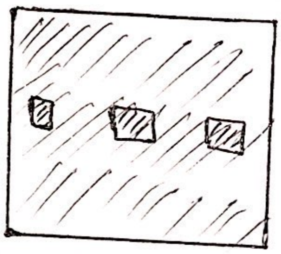
⇒ Diagram :



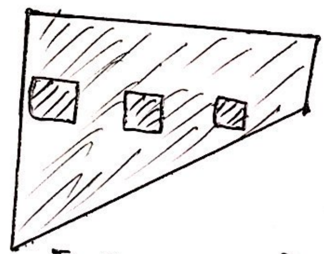


(2) Combined footing:

The footing which is constructed for two or more column & transfer the load of the two or more column to the soil safety then it is called combined footing. If the load of column is uniform then the combined footing will be rectangular shape & if the load is not uniform then the shape of footing will be trapozaidal.



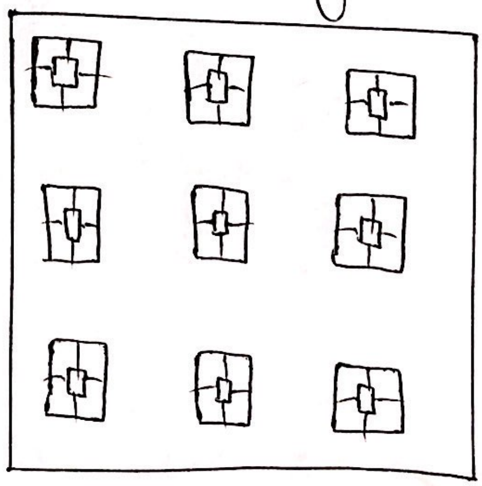
"Rectangular footing".



Trapezadial footing.

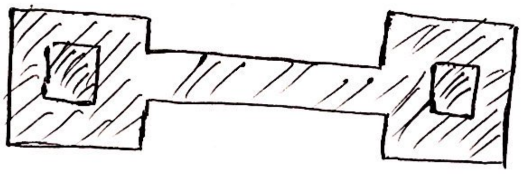
(3) Raft/mat footing:

The footing which covers the whales area of the structure is called raft or mat footing. This types of footing is proposed in area which have soft weak in bearing capcity in area. which This is also provided when the load of super structure are heavy.



④ Strapped Footing :

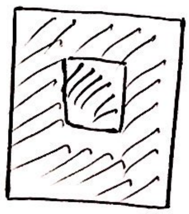
The Footing in which the Outer column is connected with the inner column by means of the beam or strap is called stropped Footing.



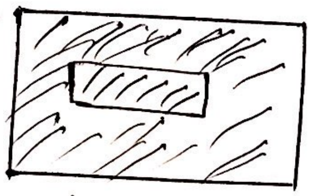
Top view.

⑤ Column / Isolated Footing :

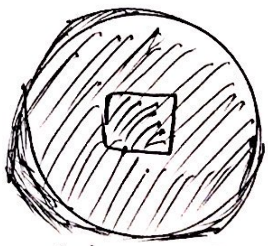
The Footing which is constructed for a single column and transmit it is load to the soil safety. It may be circular, square footing rectangular in shape.



square footing.



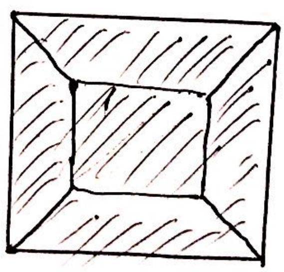
rectangular footing.



column footing.

⑥ Slopped Footing.

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



slopped footing.

(2). Part B.

Why ground improvement techniques are .... Explain Five method ....?

Ans: The Soil in which Volumeter changes takes 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 improvements tech.

⇒ The soil which is Sandy & Gravely.

⇒ The foundation is sanatery dump places also required ground improvement techniques.

Following are the Method of ground imprevements techniques:

① **Removel & Replacement of soil:**

This is an oldest & simple method. This method is Performed on loose Soil. In this methed the Unsuitable is replaced with compacted fill. In this Method the Same Soil is used to refill. The heigher compection & better engineering Propertities.

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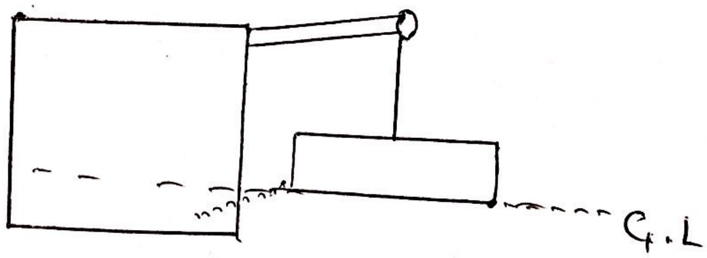
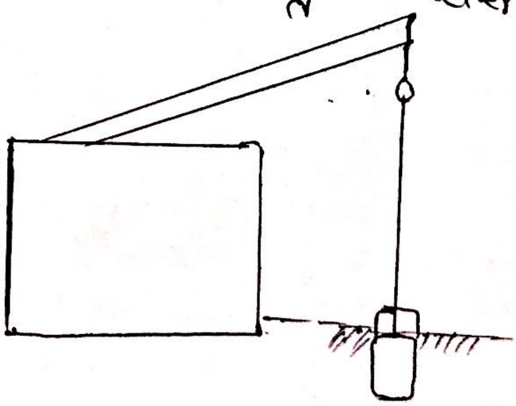
② Dynamic computation:

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. in This Method actually densification of soil Ta Ke ~~fess~~, Place.



③ Vibro compaction:

It is also called vibro densification. In This method compaction take place at a certain depth in grinular soil through vibratory Probs. This vibratory ~~soill through~~ is run by an electrical motor. The Penetration of Probs is enhance by ejecting water at the tip of Probe.



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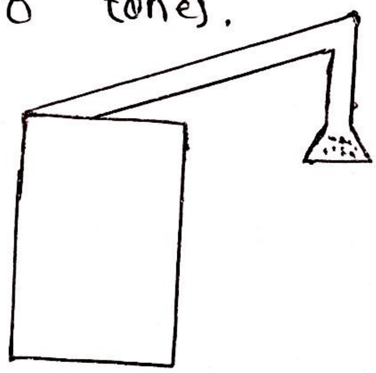
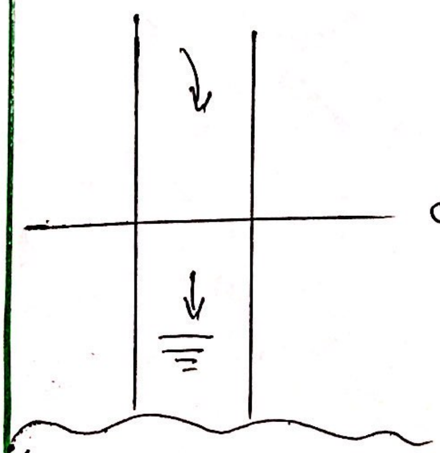
4: Rapid Impact compaction :

⇒ Impact energy is applied to surface of ground. as a result of which densification of soil take place upto a depth of (15′). This impact Energy actully applied through Hydraulic ramp. hydraulic ramp weight various from 4-8 tones.



⑤ Concrete column :

⇒ Vibro concrete is a ground improvement techniques which trasfer the load from weak strata to hard strata by using strength concrete.



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Q No # 3

Problem !

given Data !

$c = 25\ Nm/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.5$

required :

⇒ Fe (F.O.S) when soil is dry.

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

Solution:

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

$$\Rightarrow \gamma_d = \frac{G_s \times \gamma_w}{1+e} = \frac{2.72 \times 9.8}{1-10.5}$$

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

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

$$\Rightarrow \boxed{F_c = 1.18}$$

When the seepage of water then !

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

where :

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

$$\gamma = \frac{4+e}{1+e} \times \gamma_w$$

= Put the value.

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

γ = ~~$\frac{21.72 + 0.5}{1 + 0.5}$~~ 21.04 kN/m^3

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

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

$$= 21.04 - 9.8$$

$\Rightarrow \boxed{\gamma' = 11.24 \; kN/m^3}$

where :

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

$\Rightarrow \boxed{F_c = 0.836}$

Ans :

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Q No# 4 Part A.

It is Proposed to construct a 10.

given data:

$c = 18.8 \ kN/m^2$

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

$\phi = 20^\circ$

$F.O.S = 1.5$

$F_o = 1.0$

$H = 10m$

Requried:

Inclination = ?

Solution:

$$\Rightarrow S_N = \frac{c}{F.O.S \times \gamma \times H}$$

Put value:

$$= \frac{18.8}{1.5 \times 17 \times 16}$$

$$\Rightarrow \boxed{S_N = 0.073}$$

⇒ By using taylor chart or.

⇒ $\phi = 20^\circ$

$$\boxed{S_N = 0.073}$$

⇒ Thus; inclination; $i = 44^\circ$.

Ans:

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4. Part B

given data:

* Height of water on upstream side = 15 m.
* Bottom width of the dam = 12
* Top width = 6 m
* Unit weight of water = 1000 kg/m^2
* Unit weight of concrete = 1450 kg/m^3
* Unit weight of silt = 1330 kg/m^3
* Angle of friction for the silt = ϕ_1 = 35°
* silt deposite height = 2.5 m
* Free Board = 3.5 m.

Requried data:

silt Pressure = ?

Solution:

⇒ Silt Pressure:

$$\Rightarrow P_s = \frac{\gamma_s \times H_1^2}{2} \times \frac{1 - \sin\theta}{1 + \sin\theta}$$

Put value.

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

$$\Rightarrow \boxed{P_s = 1126.31 \ kg/m}$$

Ans:

The End!

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