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Qno # 1

(A)

Forces 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 forces.

1) 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 stored on the upstream side of the dam can be estimated from rule of hydrostatic pressure distribution

2) Uplift 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 force and must be accounted for in all Calculations.

Silt pressure

It has been explained under 'Reservoir Sedimentation' that Silt gets deposited, againt the upstream face of a dam. 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 Rankine's formula as

$$P_{silt} = \frac{1}{2} \gamma \ Sub_w \ h^2 \ Ka$$

Wave pressure

Waves are generated on the Surface of the reservoir by the blowing winds, which causes a pressure towards the downstream Side. Wave pressure depends upon the wave height. Wave height may be given by the equation.

$$\Rightarrow H_w = 0.032\sqrt{V \cdot F} + 0.763 - 0.271(F)^{3/4}$$

for $F < 32$ Km.

Ice Pressure

The Ice pressure which may be formed on the Surface of the reservios in cold Countries, may Sometimes melt and 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 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 value of 500 KN/m^2 may be allowed under ordinary condition.

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Qno# 01 Part - (B)

Define the following terms

1) Liquification of Soil 2) Butress dam 3) Infinite slope

4) Pier foundation 5) Dynamic load.

1) Liquification of Soil

effective stresses are the Stresses which keep the Soil particles in Contact with eachother if the effective Stresses decrease the soil loose its strength. when the effective stresses become zero then soil will change to liquified state.

The liquification of soil can be prevented by

* Densification
* Stabilization of Soil
* Drainage from the Soil
* Prevent lateral flow by providing boffle wall.
* lowering the ground water table

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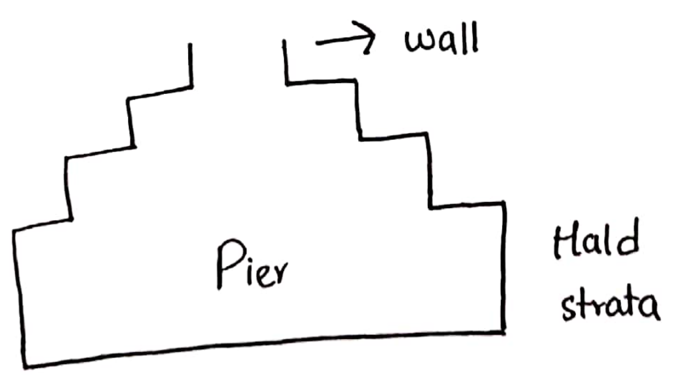
Infinite slope :-

The slope which have infinite area and finite depth Such a slope is called as infinite slope

example Natural Slope i.e Hills, mountains, desert etc.

Pier foundation :-

The vertical members ~~with~~ which have larger dia as Compared to pile and transmit the load of Structure to the underground Soil. They are Constructed by cast in-situ process

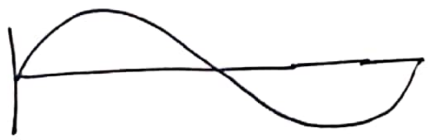


Dynamic load

When the Soil is exposed to dynamic load. Dynamic load may be in the form of.

* Earth quake
* Operation of heavy machinery
* Wave motion
* Wind.

Dynamanic load is in the form of



Butress Dam

A butress 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 supports. The Dam can be straight or Curved. They are made of reinforce Concrete.

Shallow foundation

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

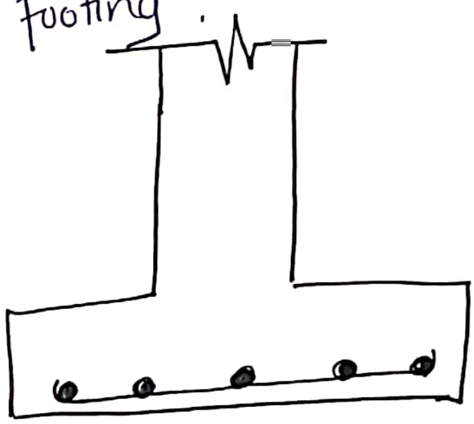
$$Df \leq B$$

Types of Shallow foundation

1) Wall / strip footing
2) Combined footing
3) Raft / Mat footing
4) Strapped footing
5) Column / Isolated footing
6) slopped 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.

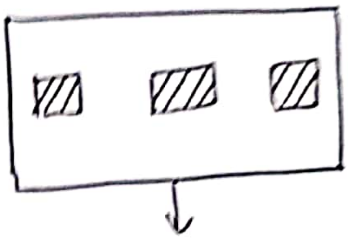


wall footing

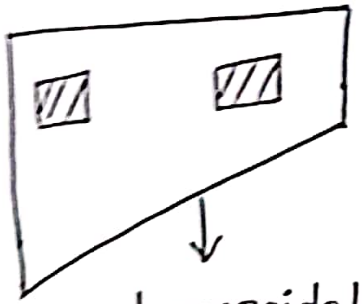
2) Combined footing.

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 trapezoidal.



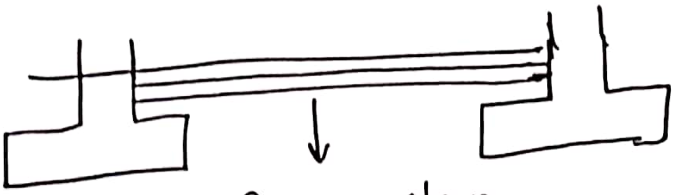
Rectangular



trapezoidal

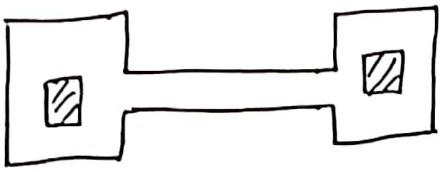
Raft /MAT footing

The footing which covers the whole area of the ~~Struggle~~ 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.



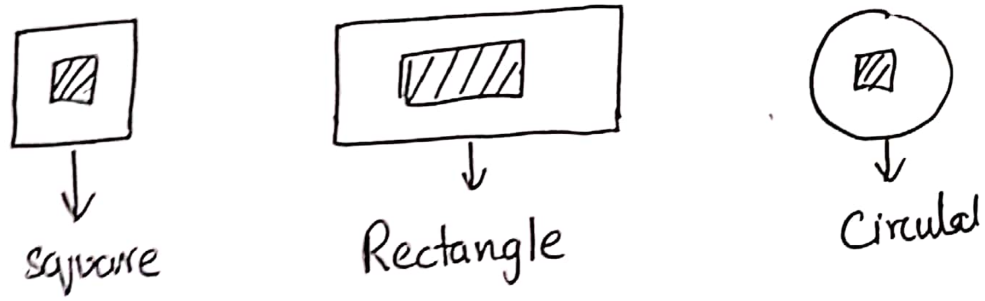
Strapped footing

The footing in which the outer Coolumn is connected with the inner column by means of the beam or strap is called Strapped footing.



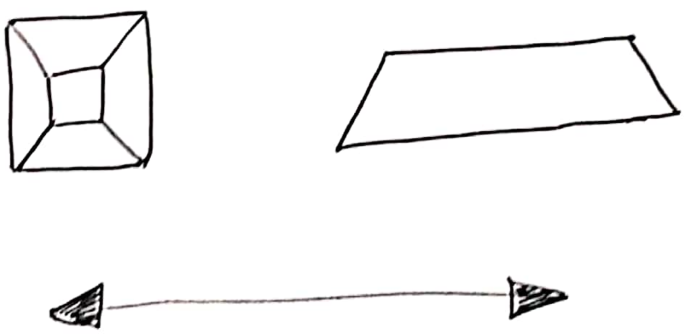
Column / isolated footing

The footing which is constructed for a Single Column and transmit its load to the Soil Safely. It may be circular, square, rectangular in shape.



Slopped footing

The footing which have Slope in all direction or in all Sides is called as slopped footing.



Qno #2 part (B)

Importance of ground Improvement techniques

The Soil in which volometric 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 Sanatory dump places also required ground improvement techniques

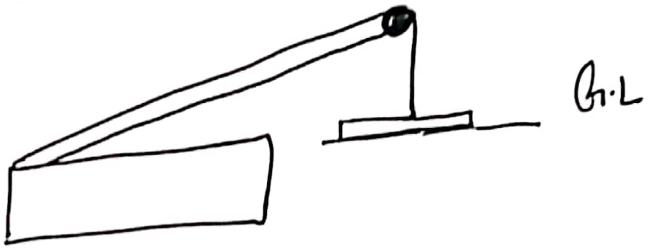
Methods of Ground Improvement techniques.

Removal and replacement of Soil.

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

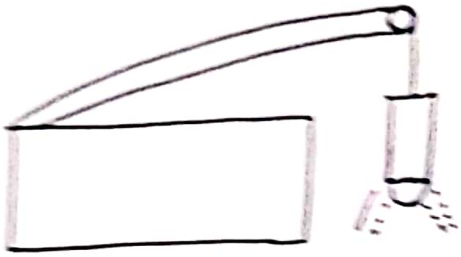
In this method the unsuitable Soil

is replaced with compacted fill.
In this method the same soil is used to refill the higher Compaction and better engineering properties.
This method is applicable above the ground water table.



Vibro Compaction

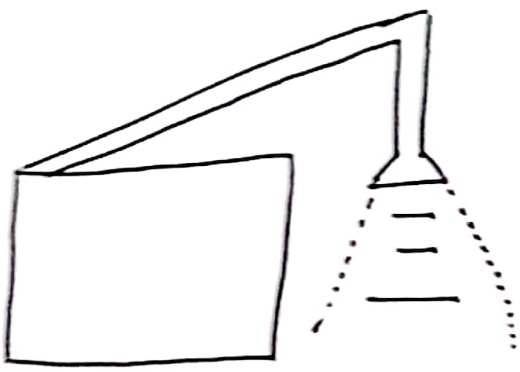
It is also called vibro densification.
In this method Compaction take place at a Certain depth in granural Soil through vibratory probe.
This vibratory probe is run by an electric motor. The penetration of probe is entrance by ejecting water at the tip of probe.



Rapid Impact Compaction

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

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



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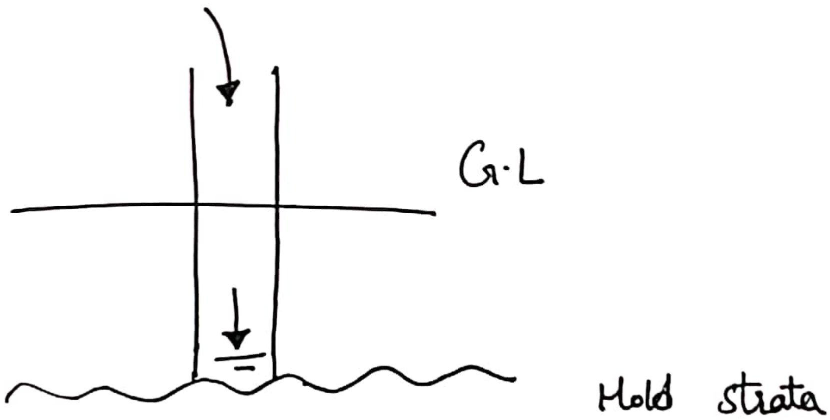
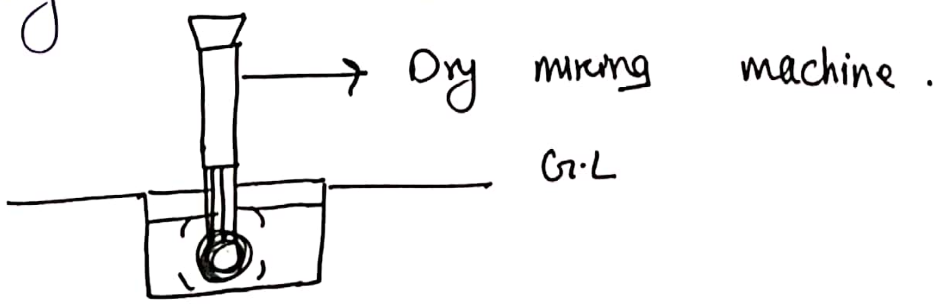
Vibro Concrete Column

Vibro concrete Columns is a ground improvement technique which transfes the load from weak strata to the hold strata by using strength Concrete



Dry Mixing of Soil.

Dry Soil mixing is ground improvement technique by which the characteristics of weak soil are impoved by using dry cementitious binder.



Q no# 3

Given data

$c = 25\ kN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.50$

To find

Fc (F.os) when soil is dry.

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

Solution

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

$$\gamma d = \frac{G_s \times \gamma_w}{1+e} = \frac{2.72 \times 9.8}{1 + 0.5}$$

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$\gamma d = 17.8 \ kN/m^3$

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

$$\boxed{Fc = 1.18}$$

When there is Seepage of water

$$Fc = \frac{c}{\gamma \times H \times \sin_i \times \cos_i} * \frac{\gamma'}{\gamma} \times \frac{\tan \phi}{\tan_i}$$

$\gamma' = \gamma - \gamma_w$

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

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

$\gamma' = \gamma - \gamma_w$

$\gamma' = 21.04 - 9.8$

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

Now

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

$$F_c = 0.816$$

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Qno #04

(Part - A)

Given data

$H = 10m$

$C = 18.8 kN/m^2$

$\gamma = 17 kN/m^3$

$\phi = 20°$

$F.O.S = 1.5$

$F\phi = 1.0$

Required

Inclination = ?

Solution,

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

$$S_N = \frac{18.8}{(1.5)(17)(10)}$$

$$S_N = 0.073$$

Using taylor chart for

$\phi = 20^\circ$

$S_N = 0.073$

$i = 44$

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Q4 (Par -b)

Given data

Height of water on upstream side = 15m

Bottom, width = 12m

Top width = 6m

γ_{water} = 1000 kg/m²

$\gamma_{concrete}$ = 1450

γ_{silt} = 1330 kg/m³

θ = 35°

Free board = 3.5m

H = 2.5

Required

Silt, pressure (P_s) = ?

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Solution:-

As we know

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

$$= 1330 \times 2.5^2 \times 0.27$$

$$= 4156.25 \times 0.27$$

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