Q1 Name the force acting on dam. Explain any five of them in detail.

Ans : There are seven types of force which are acting on dam. They are the following.

1. Water pressure.
2. Uplift Pressure.
3. Wave pressure.
4. Silt pressure.
5. Ice pressure
6. Self weight of the dam
7. Siesmic forces.

(1) Water pressure:

This is the major external force acting on dam

Pressure component on both upstream and downward are

1. Vertical component
2. Horizontal component

Unit weight of water, $\gamma_w = 1000\ kg/m^3$

(2) Weight of dam :-

This is the major resisting force

- Generally unit length of dam is considered
- The cross section of dam may be divided into several triangles and rectangles and weight W1, W2, W3 etc. may be computed.
- The total weight W of the dam acts at the C.G of its section.

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(3) Wave Pressure:

Wave Pressure $P_w = 2w h_w^2$

and it acts at a distance of $3h_w/8$ above the reservoir surface

(4) Silt Pressure:

According to IS: 6512-1972 the silt pressure and water pressure exist together in submerged silt.

The following are recommended for calculating forces.

$P_{sh} = 1360 \ kg/m^3$

$P_{sv} = 1925 \ kg/m^3$

(5) Wind pressure:

- It is the minor force acting on dam
- ~~Aact~~ Act on Super structure of the dam
- Normally, wind pressure is taken as 1 to 1.5 KN/m^2.

Q7 1048
Part B

Define the Following

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 each other, if the effective stresses ~~decrease~~ decrease the soil base it strength when the effective stresses become zero then soil will change to liquified state.

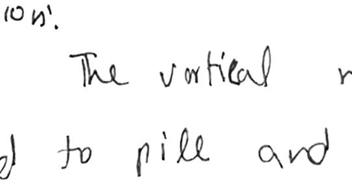
③ Infinite slope.

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

Example:
Natural slope i.e, Hills, Mountains, deserts etc.

④ Pier foundation:

The vertical member which have large dia as compared to pile and transmit the load of structure to the underground soil. They are constructed by cast in-situ process.



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(5) Dynamic loads.

Dynamic load 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 source producing it.

(2) Buttress dam.

Buttress dams are dam in which the face is held up by a series of supports.
Buttress dam can make many forms - the face may be flat or curved.

Q2

Shallow foundation:

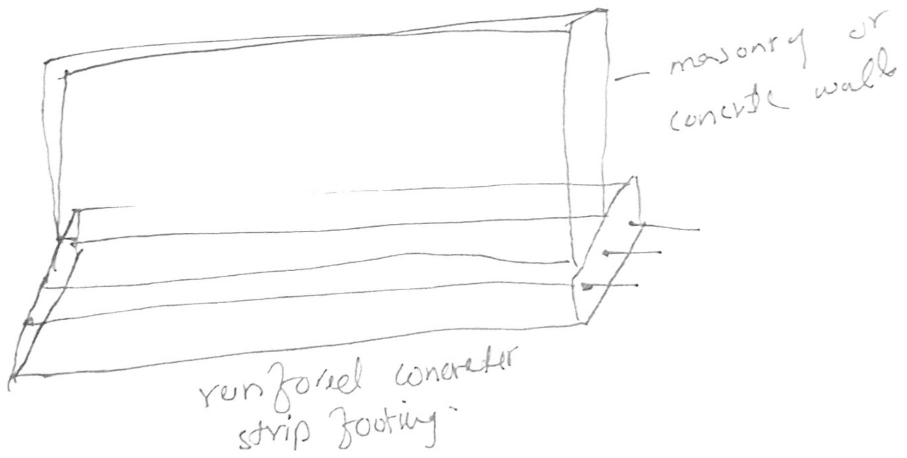
Ans:- According to Terzaghi. The foundation in which depth of the foundation is less or equal to width of the foundation is called shallow foundation.

Type of shallow foundation:

1. Wall footing
2. Combined footing
3. Raft footing
4. Strapped footing
5. Colom footing
6. Slapped footing.

1. Wall footing:

The footing which run across the length of the wall and transfer the load of the wall to the soil saftey. it is called wall footing or strap footing



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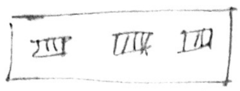
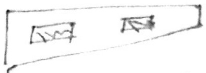
(2) Combined footing:
The footing which is constructed for two or more column and tranfer the load of the two or more column to the soil saftey then it is called combined footing

If the load of the column is uniform the the combined footing will be rectanguler in shap

If the load of the column is not uniform Then shape of combined footing will be traprozoidal.



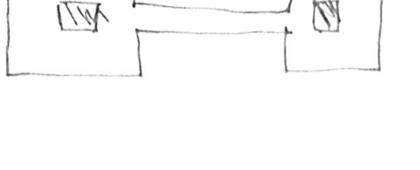
Rectanguler



Traprozeodial

(3) Raft footing.
The footing which cover the whole area of the struture is called raft footing. This type of footing is provided in area which which have soil weak in bearing capacity. This is also provided when the load of super structure is heavy.

(4) Strapped footing:
The footing in which the outer colum is connected with the inner column by mean of the beem or strap is called strapped footing.



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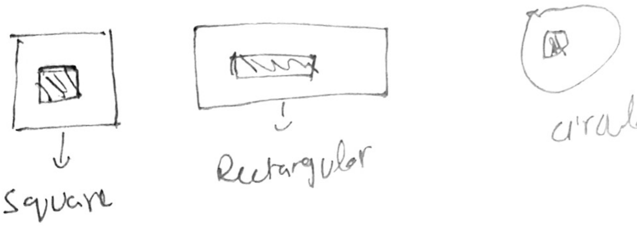
Column / Isolated footing:

The footing which is constructed for a single column and transmit it load to the soil safety. it may be circular, space, 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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Q2
Part B

Why ground improvement techniques are important. Explain Give method of ground improvement in detail along with appropriate sketch.

Ans

The soil in which volumetric change take place due to shrinkage and swelling such soil needs ground imporement techniques.

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

The foundation in sanatory dump places also required ground improvement.

Method of Ground improvement of soil:

① Removal and Replacment of soil :- This is an oldest and simple

This method is perfomed on losses soil.. In this method the unsuitable soil is replaced with compacted Fill. In This method the soil is used to refill the higher compaction and better engineering properties

This methoqd is applicable above the ground water table

② Dynamic compaction: This medood 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 take place.

③ VIBRO COMPACTION: It is also called vibro densification. In this method compaction takes 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.

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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 up to a depth of 15 feet. This impact energy is actually applied through hydraulic ramp. The hydraulic ramp weight varies from 4-8 tons.

(5) VIBRO CONCRETE COLUMN:
Vibro concrete columns is a ground improvement technique which transfer the load from weak starta to hold starta by using strength concrete.

(6) 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 charatoristics of weak soil by using cementitious binder slurry.

(7) Dry Mixing of soil.
Dry soil mixing is ground improvement technique by which the characturistics of weak soil are improved by using dry cementitious binder.

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Q.3 Given data,

$c = 25\ kN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.5$

Required:

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

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

Sol)

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

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

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

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

$F_c = 1.18$

when ther is seepage

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

$\gamma' = \gamma - \gamma_w$

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

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

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

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$\gamma' = \gamma - \gamma_w$

$= 21.04 - 9.8$

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

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

$F_c = 0.816$

Q4.
Part A

Given data

Height = H = 10 m

$c = 18.8\ kN/m^2$

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

$\phi = 20^\circ$

FOS = 1.5

$F_\phi = 1.0$

Required

inclination = ?

Sol

As we know that

$$S_n = \frac{c}{FOS \times \gamma \times H}$$

$$S_n = \frac{18.8}{1.5 \cdot 17 \times 10}$$

$S_n = 0.073$

Using taylor chart for

$\phi = 20^\circ$

$S_n = 0.073$

then

$i = 45$ (from Taylor chart.

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Q4
Part B

Given data.

Height of water on upstream side = 15 mm

Bottom width of dam = 12m

Top width = 6m

Unit wt of water = 1000 kg/m^3

" " " concrete = 1450 kg/m^3

" " " silt = 1330 kg/m^3

Angle of friction for silt = $\phi_s = 35°$

Free board = 3.5m

silt deposite height = 2.5 m

* Required

silt pressure = ?

* Sol

As we know that

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

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

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