Page 1 ID= 7775

QNO 1:- part (a)

ANS:- **Forces acting on dam:-**

Forces acting on a dam are as follow

- Water pressure
- Weight of the dam
- Ice pressure
- Wave pressure
- Earth quack pressure
- Wind pressure
- Silt pressure
- Uplift pressure
- Thermal loads

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.
- The water pressure can be calculated by Hydrostatic pressure distribution.
- Force due to water pressure

$$P = WH^2/2$$

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

P.T.O

=) Water is likely to find its ways into these minute openings through seepage and gradually fill them up.

=) It exerts an upward pressure on the body of the dam

Earthquake forces:-

=) The disturbance in dam is highly dangerous because they store huge volume of water.

=) Dams built in the area known to be seismically active must be designed to withstand additional forces that are likely to arise in a future shock.

=) Wave pressure:-

=) The upper portions of dam are subject to the impact of waves.

=) Wave pressure against massive dams of appreciable height is usually of little consequence.

=) The force and dimension of waves depends mainly on the extend and configuration of the water surface, the velocity of wind.

Ice pressure:-

=) The ice pressure which may be formed on the surface of the reservior in cold countries may sometime melt and expand.

=) The magnitude of this forces varies from 250 to 1500 KN/m^2 depending upon the temperature variation. On an average a value of 500 KN/m^2 may be allowed under ordinary condition.

QNo 1 Part (2)

Ans: Define the following terms

=> Liquifiection of soil:-

=> A phenomenon where by a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition, 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 a large earthquake.

Buttress Dam:-

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

Infinite slope:-

=> slope which have great extent with uniform soil conditions at any given depth below the surface and the soil stratum is not necessary.

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. Though pile-foundation transfer the load through bearing, pier foundation transfer the load only through bearing.

Dynamic load:-

=) Dynamic load is any load that moves, changing magnitude or direction over time. and unchaning load in a static system are constant load, impact load and vibrating load shock load, all the considered dynamic in nature but are can not the same.

Q NO 3:-

Part A

SHALLOW FOUNDATION:-

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

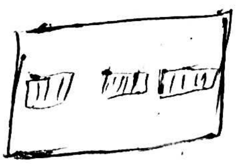
Types of shallow foundation:-

Wall / strip footing:-

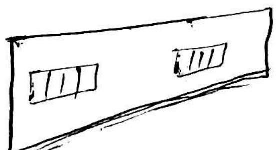
=) The footing which runs across the length of the wall and transfer the load of the wall to the soil safely. It is called wall footing.

Combined footing:-

=) The footing which is constructed for two or more column and tranfer the load of two or more column to the ground safely then it is called combined footing. If the load of column is uniform then it is rectangular in shape. If the load of column is not uniform then it is trapezoidal.



Rectangular



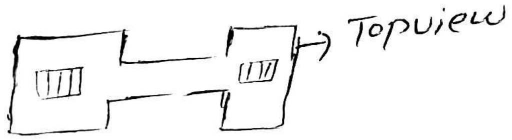
Trapezoidal.

Raft footing:-

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

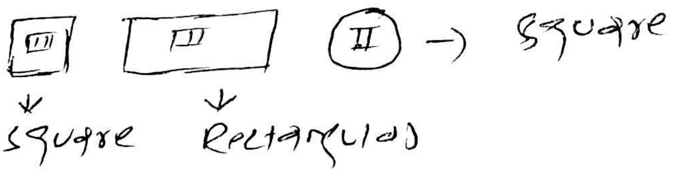
Strapped footing:-

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



Column footing:-

The footing which is constructed for a single column and transmit the load into the soil safely.
It may be circular, square or Rectangular in shape.



Slopped footing:-

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

Q No 2 Part (B)

Ans

Ground improvement techniques

⇒ Ground improvement technique are the technique which are used to enhance the engineering property of soil in order to deal heavy structure load.

⇒ The main properties are shear strength permeability, bearing capacity 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.

Method of ground improvement techniques

Wet soil mixing:-

⇒ In this method of ground improvement technique a paste of cement is placed prepared and inserted in the soil. This method is used to improve the characteristic of weak soil by using cementitious binders slurry.

Dry mixing of soil:-

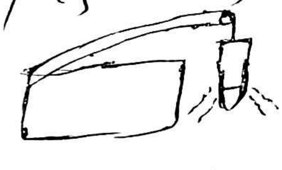
⇒ Dry soil mixing is ground improvement technique by which the characteristic of weak soil are improved by using dry cementitious binders.

Dynamic compaction:-

=) The method is used to increase the bearing capacity of soil. This method also increase the consolidation rate. This method also increase the density of soil. In this method actually densification of soil take place.

Vibro compaction:-

=) It is also called vibro densification. In this method the compaction takes place at a certain distance depth in granular soil through vibratory probe. This vibratory probe runs by a electric motor. The penetration of probe is enchance by ejecting water at the tip of probe.

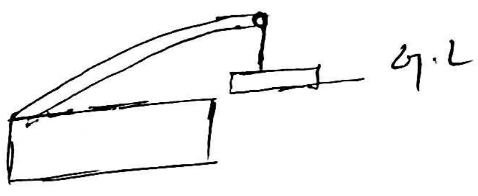


Removal and replacement of soil:-

=) 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.



QNo 3:-
Numerical 6:-

Given:-

$c = 35\ KN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.50$

Req:-

⇒ Fc (F.O.S) when soil is dry.

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

Sol:- As

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

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

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

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

$$\boxed{Fc = 1.18}$$

When there is seepage of water.

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

$\gamma' = \gamma - \gamma w$

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

P.T.O

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

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

$$\Rightarrow \gamma' = \gamma - \gamma_w$$
$$= 21.04 - 9.8$$

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

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

$$\boxed{FC = 0.816}$$

QNo 4 part (a)

Numerical:-

Given:-

Height = 10 cm

$c = 18.8\ kN/m^2$

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

$\phi = 20^\circ$

$F_{c} = 1.5$

$F_{\phi} = 1.0$

Req:-

Inclination $i = ?$

Sol:-

$$SN = \frac{c}{F_c \times \gamma \times H}$$

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

$SN = 0.073$

using taylor chart for

$\phi = 20^\circ$

$SN = 0.073$

$\boxed{i = 44}$.

Page (11)

Q No. Part (B)

Given:

- Height of water on upstream side = 15 m
- Bottom width of dam = 12 m
- Top width = 6 m
- unit weight of water = 1000 kg/m^3
- unit weight of concrete = 1450 kg/m^3
- unit weight of silt = 1300 kg/m^3
- Angle of friction for the silt = ϕ_s = 35°
- Free board = 3.5 m
- Silt deposite height = 2.5 m

Req: silt pressure = ?

Sol:

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

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

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