Final Term Paper

Name Shahid Bilal

I.D 7224

Paper Geo-Technical & Foundation

Module 2012 Batch

Date 27/06/2020

Q1, Part(A) Name of Force acting on dam. Explain any Five of them in detail.

Part(A) **Name of Factors Acting on Dam**

Ans 1) water pressure:- water pressure is one of the most major external Force acting on gravity dam. The horizontal water pressure exerted by the water stored on upstream side on dam be collected from hydrostatic pressure distribution.

2) uplift pressure:- water seeping through the pores and Fissures of the Foundation material and water seeping through the dam of the body thereof to the bottom through the joints b/w the body of the dam and its Foundation at the base exerts an uplift pressure on the base of the dam.

This kind of uplift pressure virtually reduced the downward weight of the body of the dam & hence acts against the dam stability. It is assumed that uplift pressure are not affected by the earth quake Force.

3) **Earthquake Force:-** An earth-quake produce waves which are capable of ~~[illegible]~~ shaking the dams in every possible direction the effect of Earthquake is equivalent to imparting an acceleration to the Foundation of the dam in the direction in which the waves is travelling to the moment acceleration can be splitted into 2 components.

Horizontal Acceleration (a_h) = ~~[illegible]~~
$= K_h \times g$.

vertical Acceleration $(a_v) = K \times g$

4) **silt Pressure:-** If h is height of silt deposited then Force exerted by the silt in addition to external water pressure can be represent by Rankine's Formula.

$P_{silt} = \frac{1}{2} \gamma_{sub} h^2 K_a$ and its acts at $h/3$ From base.

where $K_a = 1 - \sin\theta / 1 + \sin\theta$.

5) **Wave pressure:-**

Where waves are generated on the surface of the reservoir by the blowing winds which can cause a pressure towards the downstream side wave pressure and it depends upon the wave height waves height may be given by the following equation.

$$h_w = 0.032\sqrt{vF} + 0.763 - 0.271 F^{3/4} \text{ for } F < 32.$$

Where
hw = height of water from top of crest to bottom of through in meters.

v = wind velocity in km/h.

f = fetch or straight length of water expanse in km.

6) **Ice pressure:-**

The ice which may be formed on the water surface of the reservior in cold countries may some times melt and expand. The dam from

Q1 part B

Define the Following term:

Ans (i) **Liquification of Soil:-** A phenomenon where by a saturated or partially saturated soil substantially losses strength and stiffness is reponse to an applied stress. usually earth quake shaking or other sudden change in stress condition causing at the behave like liquid.

2) **Butress Dam:-**

A butress dam or hollow dam is basically a derivation of a gravity dam with the introduction to intermediate space.

With a buttress dam the force of the dam is helb by a series of supports or butresses that are placed at intervals on the downstream sides.

The butresses work to combat the force of reservior water from trying the push the dam water.

3) **Infinite Slope:-** An infinite slope is simply a vertical line where you plot it on a line graph an infinite slope is any line where runs parallel to Y-axis you can also describe this is any line that does not move along the x-axis but stays fixed at one constant x-axis coordinate. making the change along the x-axis 0.

4) **Pier Foundation:-** A pier foundation is a collection of large diameter cylinderical coloumn to support the super structure and transfer large super imposed to load to the from strete below. It stood several feet above the ground.

5) **Dynamic Load:-** Dynamic load very in Their magnitude direction or position with time.

The types of Dynamic load is soil the Foundation of a structure depend upon on the nature of the source producing it.

x——x——x——x——x

Q2 (a) Part A

Define Shallow Foundation. Explain types of Shallow Foundation in detail with appropriate Sketch.

Ans

Shallow Foundation:-

According To TERZAGHI:-

The Foundation in depth of ~~water~~ the Foundation is less as equal to width of the Foundation is called Shallow Foundation.

According to SKempton:- The Foundation in which Df/B ratio is less then as equal to 2.5 then Foundation is called Shallow Foundation.

~~Types of Foundation~~

Types of Shallow Foundation:-

1) wall 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 to the Soil sofely. It is Called wall or Strip Footing

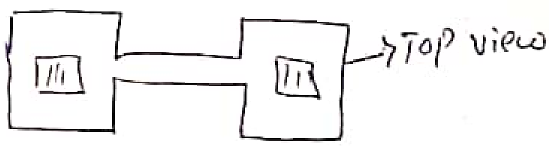
2) **Combined Footing:-** The Footing which is contructed For two or more columns and transfer the load to the two or more Column to the Soil Sofelly then it is Called Combined Footing.

If the load of column is uniform then the Combined Footing will be rectangular in Shape.

If the load of the column is not uniformly then shape of Combined Footing will be trapezoidal.

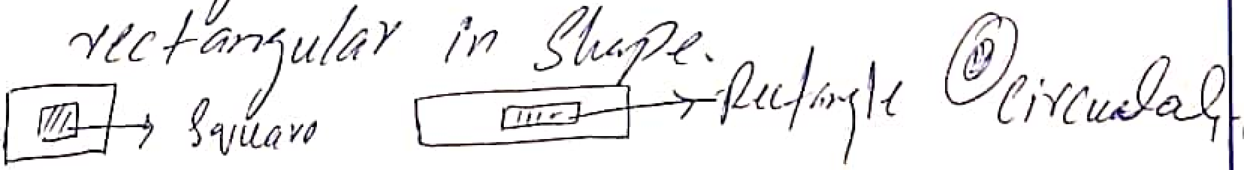
3) **Raft / MAT FOOTING:-** The footing which covers the whole area of the structure is called raft footing. This types of footing is proposed in area which have soil weak in bearing capacity. This is also provided when the load of super structure is heavy.

4 **Strapped Footing:-** The footing in which the outer column is connected with the inner column by mean of the beam or strap is called strapped footing.



5 **Column / Isolated Footing:-** The footing which is constructed for a single column and transmitt. Its load to the soil safely.

It may be circular square rectangular in shape.



6) **Slopped Footing :-** The Footing which have slopped in all direction as in all sides is called as slopped Footing.

Q

Q2 Part B why ground improvement techniques are important. Explain five method of ground improvement in detail along with appropriate sketch.

Ans

Ground Improvement Techniques:-

Ground improvement techniques are the techniques which are used to enhance the 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 Tech.-

The soil in which volumetric change take place due ~~ground~~ to shrinkage & 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 is ~~st~~ sanatory dump place
also required ground improvement techniques.

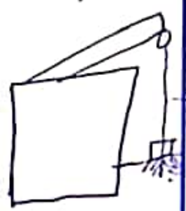
METHODS of Ground Improvement Techniques:-

1 1 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.

2 DYNAMIC COMPACTION:- 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 take place.

3 **VIBRO COMPACTION:-** It is also called vibro densification. In this method the compaction take place at a certain depth in granular soil through vibratory probe. This motor. the penetration of probe. is entance by ejecting water at the tip of probe.

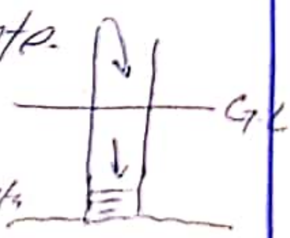


4 **RAPID IMPACT COMPACTION:-** Impact energy is applied to surface of ground as a result of which densification of soil take place upto a depth of 15 feet.

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

5 **VIBRO CONCRETE COLOUMN:-**

vibro concrete columns is a ground improvement technique which transfer the load from weak strata to hard strata by using strength concrete.



Q3

An infinitely long slop having an inclination of 26° in an area is underlain by firm choesive soil. (G=2.72, e=0.50) There is a thin weak layer of soil 6m below and parallel to the slop surface is C = 25 KN/m², Φ = 16°. Compute the factor of safety when the slope on the g is dry. if ground water flow could occure parallel to the slope on the ground surface. what factor of safety would result.

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 there is seepage in soil

Solution

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

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

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

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

$$FC = 1.18$$

where there is seepage of water.

$$FC = \frac{C}{\gamma \cdot H \times \sin i \times \cos i} + \frac{\gamma'}{\gamma} \times \frac{\tan \phi}{\tan i}$$

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

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

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

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

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

$$= 21.04 - 9.8$$

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

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

$$FC = 0.816$$

Q4 part (A) It is proposed to construct a 10m highway embankment with the following soil properties:

$C = 18.8\ KN/m^2$

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

$\phi = 20°$

what is the inclination required for the embankment if the design FOS = 1.5 & $F_\phi = 1.0$

Given Data:

Height = H = 10 m

$C = 18.8\ KN/m^2$

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

$\phi = 20°$

FOS = 1.5

$F_\phi = 1.0$

Required = Inclination i = ?

Solution:

As we know that:

$$S_N = \frac{C}{FOS \times \gamma \times H}$$

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

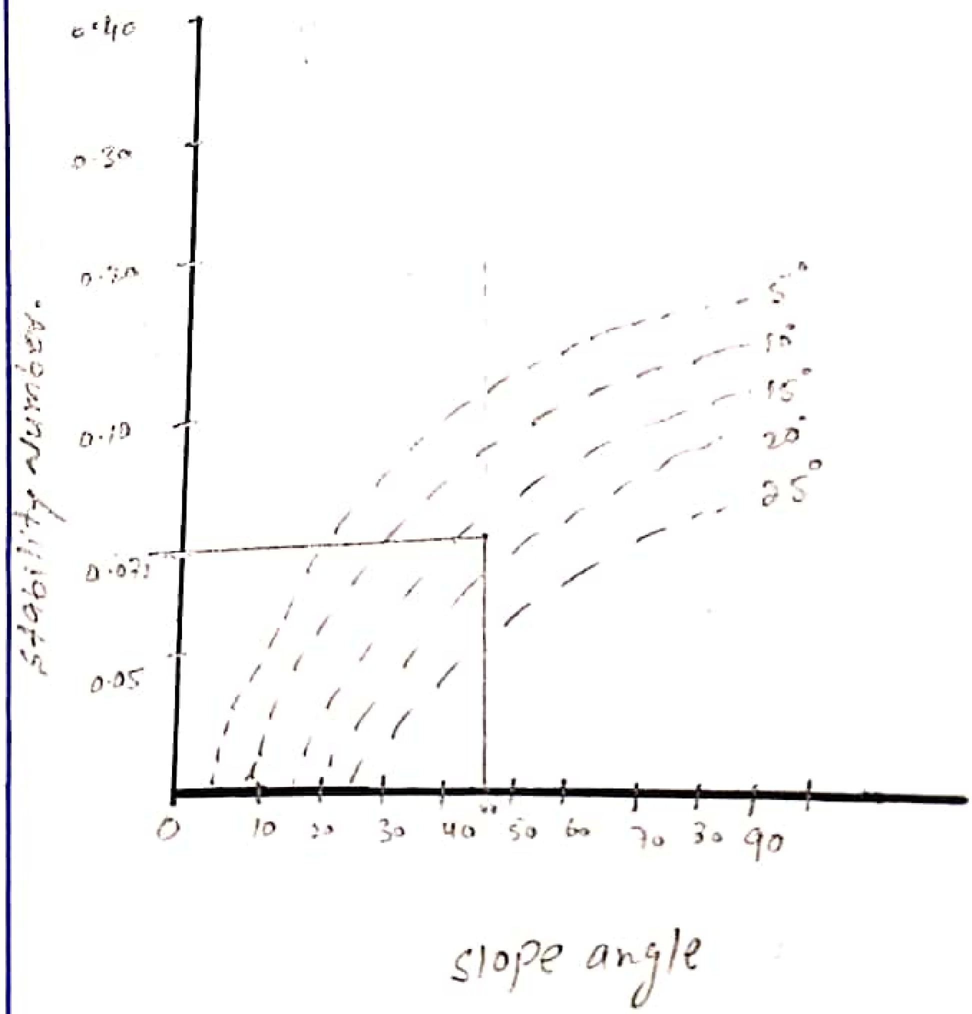
S_N = ~~0.1~~ 0.073.

using ~~T~~ Tayer charts for

$\phi = 20°$

$S_N = 0.073$

Then $i = 44$ (From Tayer charts).



Q4
part B

Considering the Following data Find silt pressure.

⇒ Height of water on upstream side = 15m
⇒ Bottom width of the dam = 12m
⇒ Top width = 6m
⇒ Unit weight of water = 1000 Kg/m³
⇒ unit weight of concrete = 1450 Kg/m³
⇒ unit wt of silt = 1330 Kg/m³
⇒ Angle of friction for the silt = θ = 35°
⇒ Free Board = 3.5m
⇒ slit Deposite heigh = 2.5m

Required :- Silt Pressure = ?

Solution

As we know that.

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

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

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