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Q No 1 (a)

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

ANSWER:

DAM:

A dam is a barrier that impounds water or underground stream; they serve the purpose of retaining water.

FORCES ACTING ON DAM:

the forces acting on Dam are

- Water Pressure
- Uplift Pressure
- Pressure due to Earth Quake forces
- Silt Pressure
- Wave Pressure
- Ice Pressure
- Weight of Dam

Water Pressure:

Water pressure (P) is the most major external force acting on such a dam. The horizontal water pressure exerted by weight of water stored on upstream side of the dam can be estimated from rule of hydrostatic Pressure distribution

$$P = \frac{1}{2} \gamma H^2, \text{ acting } H/3 \text{ from base.}$$

Uplift Pressure:

Water Seeping through the pores, Crack and fissures of foundation material and water seeping through dam body and then to the bottom through Joint between the body of dam. It is second major external force.

Earthquake forces:-

If the dam is to be designed, is to be located in a region which is susceptible to earthquake allowance must be made for stress generated by earthquakes

- An earthquake Produce wave which are capable of shaking the Earth upon which the dam is resting.

Water Pressure:

Waves are generated on surface of reserviour by blowing winds, which cause a pressure towards the downstream side. Wave pressure depends upon the wave height. Wave height may be given by

$H_w = 0.032\sqrt{V.F} + 0.763 - 0.271(F)^{3/4}$ for $F < 32$ KM

$H_w = 0.032\sqrt{V.F}$ for $F > 32$ km

H_w = height of water

V = wind velocity km/hr

ICE Pressure:

The Ice Pressure may be formed on the surface of reservior in cold countries, may somltimes melt and expand. The force act linerly along the length of the dam and reservior level. Magnitude of forces varies from 250 to 1500 KN/m².

Q No 1(b)

Define the following

Liquification of Soil:

Soil liquefication occur when a Saturated or partially saturated Soil Substantially Loss strength and Stiffness in response to an applied Stress such as Shaking during an earthquake or other Sudden change in stress condition, in which material that is ordinarily, a solid behave like liquid.

Butress Dam:

A buttress dam or hollow dam with a Solid water tight upstream Side that is supported at interval on downstream side by series of buttress or support. The dam wall may be straight or curved.

Infinite Slope:

The type of slope extending infinitely, or up to an extent whose boundries are not well definied. For this type of slope the soil properties for all depth below the surface are same

Pier Foundation:

A pier foundation is collection of large diameter cylinderical columns to support the superstructure and transfer large loads. It is also known as post foundation.

DYNAMIC LOAD:

A dynamic load is any force that changes with time, such as car tyres, people walking and wind gusts. Usually in structural engineering we treat there as static load.

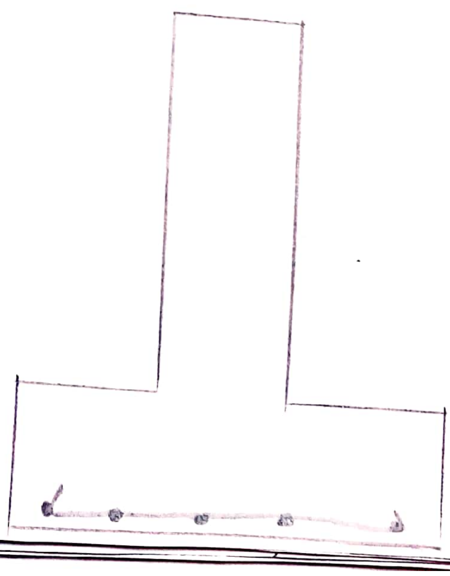
Question No 2

Define shallow foundation. Explain type of foundation

ANSWER:

SHALLOW FOUNDATION:

A shallow foundation is a type of building foundation that transfer building load to the earth very near to the surface

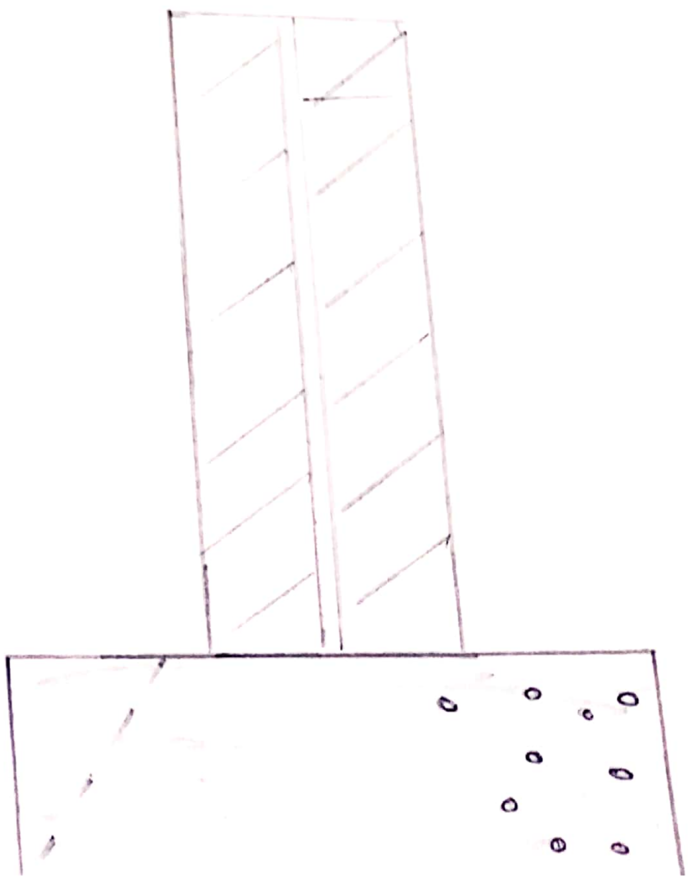


Types of ~~Fo~~ SHALLOW FOUNDATION:

Strip foundation
Raft foundation
Combined foudation

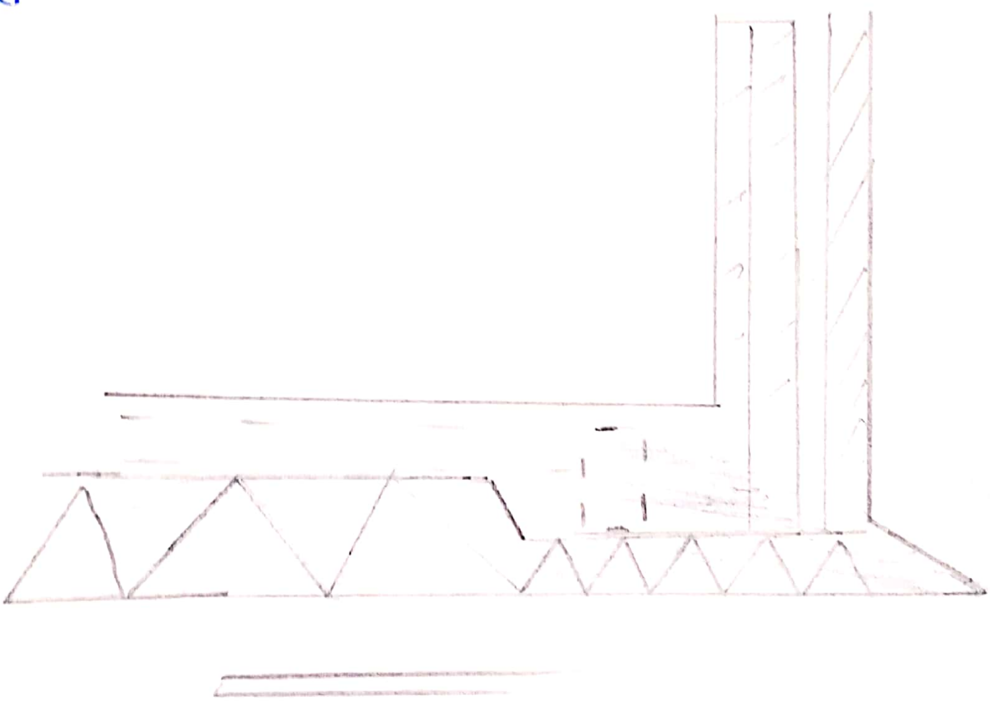
Stoip Foundation:

Stoip foundation are type of Shallow foundation that are used to provide a continuous, level Stoip of support to linear structure such as wall or closely-spaced row of column built centrally above them.



RAFT FOUNDATION:

A raft foundation, also called a mat foundation is essentially a continuous slab resting on the soil extend over the entire footprint of the building and transfering its weight to the ground



Question No 2(b)

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

ANSWER:

GROUND IMPROVEMENT TECHNIQUES:

Ground improvement

technique 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, healing capacity and stiffness etc.

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 in higher compaction and better engineering properties

DYNAMIC COMPACTION:

This method is used to increase bearing capacity of soil. This also increase consolidation rate.

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.

RAPID IMPACT COMPACTION:

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

DRY MIXING OF SOIL:

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

Q No 3

GIVEN DATA:

$C = 25 \, KN/m^2$

$\phi = 16°$

$G = 2.73$

$\theta = 0.50$

REQUIRED:

F.o.s when soil is dry = ?

F.o.s when there is seepage = ?

SOLUTION:

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

By relation

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

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

$$\gamma_d = 17.8 \, KN/m^3$$

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

$$F_c = 1.18$$

When there is seepage of water

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

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

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

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

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

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

$$= 21.04 - 9.8$$

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

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

$F_c = 0.816$

RESULT:

Fc when soil is dry = 1.18

Fc when there is seepage = 0.816

Q No 4(a) (14)

GIVEN:

Height = 10m

$C = 18.8 kN/m^2$

$\gamma = 17 kN/m^2$

$\phi = 20^\circ$

F.O.S = 1.5

$F\phi = 1.0$

REQUIRED:

Inclination, i = ?

SOLUTION:

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

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

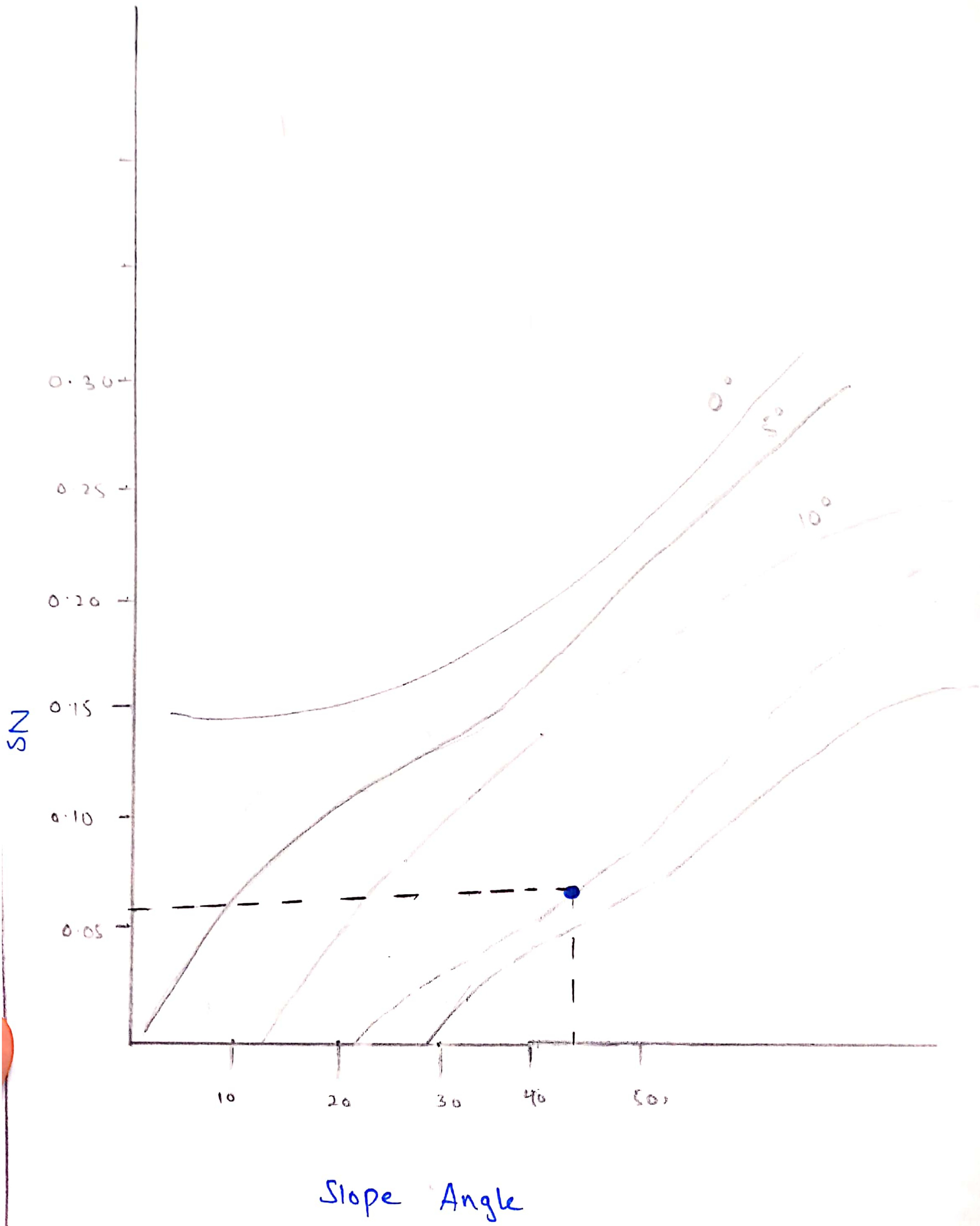
SN = 0.073

Using taylor chart for

$\phi = 20^\circ$

SN = 0.073

$i = 44^\circ$


0.30
0.25
0.20
0.15
0.10
0.05
0°
5°
10°
10
20
30
40
50
SN
Slope Angle

Q No 4(b)

GIVEN:

Height of water on upstream side = 15m

Bottom, width = 12m

Top width = 6m

$\gamma_{water} = 1000 kg/m^3$

$\gamma_{concrete} = 1450$

$\gamma_{silt} = 1330 kg/m^3$

$\theta = 35°$

Free Board = 3.5m

H = 2.5m

REQ:

Silt, Pressure $P_s = ?$

SOLUTION:

As we know

$$P_s = \frac{\gamma_{silt} \times H^2}{2} \times \frac{1 - \sin\theta}{1 + \sin\theta}$$

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

$$= \frac{1330 \times 2.5^2}{2} \times 0.27$$

$$= 4156.25 \times 0.27$$

$$P_s = 1122.18 \text{ Kg/m}$$

RESUT:

Silt Pressure, P_s = 1122.18 Kg/m

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