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IES MASTER

Civil Engineering

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SOIL MECHANICS

- Theory BY-KANCHAN SIR
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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04-06-23

1. ORIGIN OF SOIL





- Soil is defined as unconsolidated material composed of solid particles produced by disintegration and transportation of rock (or) due to decomposition of organic matters.
- The soil obtained from disintegration of rock is called inorganic soil and that obtained from decomposition of organic matter like plants and vegetation is called organic soil.
- Inorganic soil is formed due to weathering of rock.
- Weathering of rock is classified as:
 - a) Physical weathering
 - b) Chemical weathering

AY PHYSICAL WEATHERING:

- It occurs due to erosion of rock due to wind, water, glaciers, disintegration of rock due to sudden change in temperature, due to unloading and subsequent cracking and due to freezing and thawing process.

* Soil particles obtained from physical weathering have the same mineralogical composition as that of the parent rocks.

→ Particles found are classified as sand and gravel (Bulky particles) and they can be indicated as:

- Angular →  → Surface roughness is more
Soil → Shear strength.
- Rounded → 
- Flat/ flaky →  → Like disc
- Elongated → 

→ Structural arrangement of these particles are describe as single grained structure. (i.e each particle is in direct contact with the adjoining particle without there being any bond b/w them.

* → Quartz, mica, feldspar are ^{non-clay mineral} the primary soil minerals in the soil formed during physical weathering.

B) CHEMICAL WEATHERING:

1. It occurs due to acid and alkalis in wind water or glaciers reaching with the rocks.
2. The mineralogical composition of soil obtain from chemical weathering will be entirely different from parent rock.

3. Chemical weathering leads to formation of clay minerals
(i.e. kaolinite, illite, mont-morillonite).

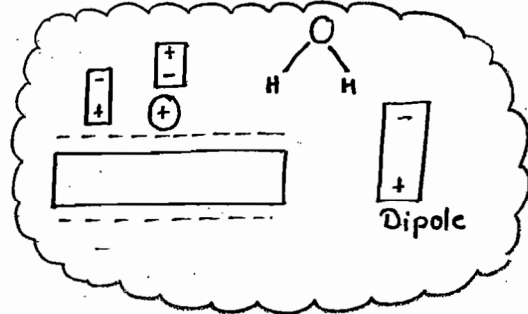
↳ kmm pani
bind hota h

↳ isme be jada pani
bind hota h soil ke sath.

more water bind

surface area bhut
jada hogga.

4. Most of the clay mineral particles have plate like form
having high sp. surface
(surface area / Volume).



Clay ke
upr kbhi koi
Struc. nhi
bna skte.

5. The result of these is that

properties of clay are significantly affected by the surface forces and water can significantly affect the behaviour with clay soil because water can bind with the surface of clay particles.

* RESIDUAL AND TRANSPORTED SOIL:-

- If the soil is still deposited at the location where it form these soil is called residual soil.

- Generally residual soil have angular particles, weak bonding b/w particles and have varying void ratio however its properties is better as compare to transported soil.

- If the soil is carried away from its position of formation and deposited at other location, it is called transported soil.

3//
- Mostly the transported soil have rounded grains.

- Depending upon the transporting agency soils are classified as:

a) Alluvial deposit:- Transported by running water (River)

b) Lacustrine deposit:- Soil deposited in lake.

c) Marine deposit:- Transported by sea water.

d) Aeolian deposit:- Transported by wind.

e) Glacial deposit:- Transported by glaciers.

Colluvial deposit:- Transported by gravity
except talus

* NAMES OF VARIOUS TYPES OF SOILS:

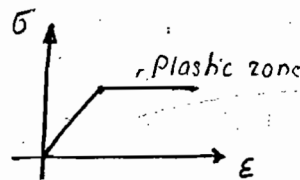
1. Bentonite:-

- Obtained by decomposition of volcanic ash, it have high water absorption prop. and hence have high swelling & shrinkage.

- The clay mineral present is mont-morillonite and it is a very plastic soil.

Plasticity represent deformability without volume change.

Soil which can bind more water will be more plastic.



2. Black Cotton Soil:

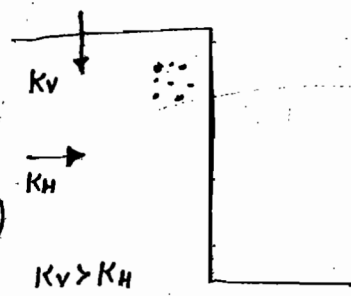
- It is a residual soil obtain from the decomposition of basalt rock.
- It is dark in color and good for growing cotton.
- It contains mont-morillonite clay minerals.
- It has greater swelling and shrinkage property.
- Bearing capacity of this soil is very less.
water binding cap. is less.
- It is stabilised by lime treatment.

Clay me jbb
lime krte h
h wo friable
ban jata h.

3* Loess:-

- Loess is a fine grained (silt size range), homogeneous, friable (easily crushable), air blown deposit.
- It has uniform grained size and high void ratio
- It can withstand deep vertical cut because of slight cemen-
-tation b/w particles due to CaCO₃ and mont-morillonite
- It is formed in arid and semi-arid region.
- It has high vertical permeability as compare to horizontal perme-
-bility due to deep root holes.
- It is highly compressible.

Compressibility means volume change per unit load.



- Soil grains are angular and composed of non-clay mineral.
- It is subjected to collapse when saturated.
- It has lower density and lower bearing capacity.

4. Till:

- It is an unstratified deposits formed by melting of glacier.
- It contains particle of almost all sizes and hence it is well graded and will have greater shearing strength.
- It is also called boulder clay.

5. Marl Soil:

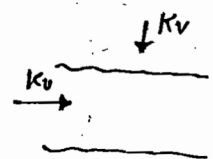
- It is stiff, marine, calcareous deposit of clay.

• Marine clay can have very high moisture content as great as even 400%.

* 6. Varved Clay:

- It is a sedimentary deposit consisting of alternate layers of clayey silt and silty clay with each layer approx. 1cm thick.

- It is formed in glacial lake.



- $K_H > K_V$ (Horizontal permability is greater than vertical permab.)

- Shear strength in horizontal plane is small.

* 7. Indurated Clay:

Soil Dbb krr rock bnn jsh h

- It is a very firm clay due to a process of lithification (conversion of unconsolidated sediment into sedimentary rock by porous destruction through compaction and cementation).
- It does not soften under prolonged wetting

8. Diatomaceous Earth:

- Diatomaceous earth is finest grain sedimentary deposits of silicious remains of skeleton of diatoms (unicellular marine organisms)

9. Lateritic Soil:

- It is a residual soil formed from basalt due to removal of bases and silica and accumulation of iron and aluminium oxides.
- It is reddish in color and have greater sp. gravity due to presence of iron oxide.

* 10. Marine deposits:

soil macro bodies present in water

- Marine deposits have greater amount of organic matter.
- It is soft and highly plastic.
- It has small shear strength and high compressibility.

11. Gravity deposited soil (Talus or Colluvial)

- It is deposited by gravity.
- It has irregular coarse particles.

* 12. Peat Soil:

- It is an organic soil formed from vegetative matter under excessive moisture condition like in swamps.
- It has fibrous grains it is highly compressible, dark in colour and have fongent odour, it is not suitable for foundation.

13. Muck Soil:-

- It is a mixture of fine particles and highly decomposed organic matter.

14. Loam Soil:

- It is a mixture of sand, silt and clay.
- It is also called garden soil.

15. Hard Pans:-

- It is very hard soil, has greater resistance to penetration and it does not disintegration or submergence.

↳ Job submerge krta hai
pani me