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HINDUSTAN College of Science & Technology

Hindustan College of Science and Technology , Farah

Department of Civil Engineering

ONLINE VIDEO LECTURE

Subject

Geotechnical Engineering

Sub code - KCE 501

By

ROHIT MAURYA
Assistant Professor

Subject – Geotechnical Engineering

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Geotechnical Engineering

Code – KCE 501

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Course Outcomes:

CO-1 Classify the soil and determine its Index properties.

CO-2 Evaluate permeability and seepage properties of soil.

CO-3 Interpret the compaction and consolidation characteristics & effective stress concept of soil.

CO-4 Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.

CO-5 Interpret the earth pressure and related slope failures.

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Subject Introduction

- This is a prime subject for all the Civil Engineer to study as of, it is based on soil which is major component of civil engineering.
- There are basically three fields related to study the soil as Soil Mechanics, Rock Mechanics and Soil Engineering.
- But just soil engineering consist of three as soil mechanics, geology, structural engineering of soil and soil dynamics.
- And as civil engineer we have to study the soil mechanics primarily.
- Later on a new term came across Geotechnical Engineering which consist almost all the relatable subject as mentioned above.

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Syllabus in short

Unit -1 First Unit is about soil origin and type, structure, basic properties.

Unit -2 This unit is about the soil hydraulics and seepage, soil water interaction.

Unit -3 This is about the soil compaction and consolidation properties in soil mass.

Unit -4 This unit is configure about the stresses in soil mass at different conditions.

Unit -5 This is about analysis of earth pressure and slope stability in soil.

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GEOTECHNICAL ENGINEERING SYLLABUS

Unit 1

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system.

Unit 2

Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping.

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Unit 3

Soil compaction, water content - dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method. Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation.

Unit 4

Stress Distribution in soil: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure. Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients, and Soil liquefaction.

Unit 5

Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and c-φ soils, inclined backfill, Graphical methods of earth pressure determination. Stability of slopes - finite and infinite slopes, types of slope failure, Culmann's method & Method of slices, Stability number & chart, Bishop's method.

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Text & References Books

K.R. Arora – Soil Mechanics and Foundation Engineering

Alam Singh – Modern Geotechnical Engineering

Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning

C. Venkataramaiah – Geotechnical Engineering

Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics

Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd., Noida.

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Civil Engineering concerns about soil problem

- As civil engineer we construct building, bridges, roads, tower, embankment, railway, tunnel, dams and hydraulic structures but the key point is they all are build on soil.
- This is done by building a foundation into the soil to transfer the dead and live loads of structure to the soil properly.
- But the problems occurs due to variety of the soil deposit on earth's geology, which makes soil a little vast and complex.
- Although, soil mechanics gives a methodology to study soil as being a civil engineer.
- But it is also necessary to have little knowledge about the geology, soil structure and foundation, that's why is called Geotechnical Engineering.

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Unit – 1 Origin and Classification

- Preview of Geotechnical field problems in Civil Engineering
- Soil formation,
- transport and deposit,
- Soil composition,
- Basic definitions,
- Weight volume relationships,
- Clay minerals,
- Soil structure,
- Index properties,
- sensitivity and thixotropy,
- Particle size analysis,
- Unified and Indian standard soil classification system.

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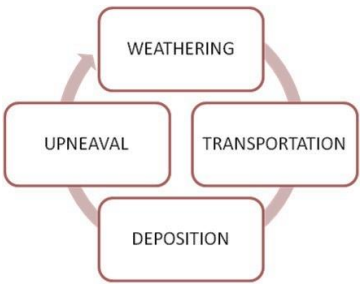
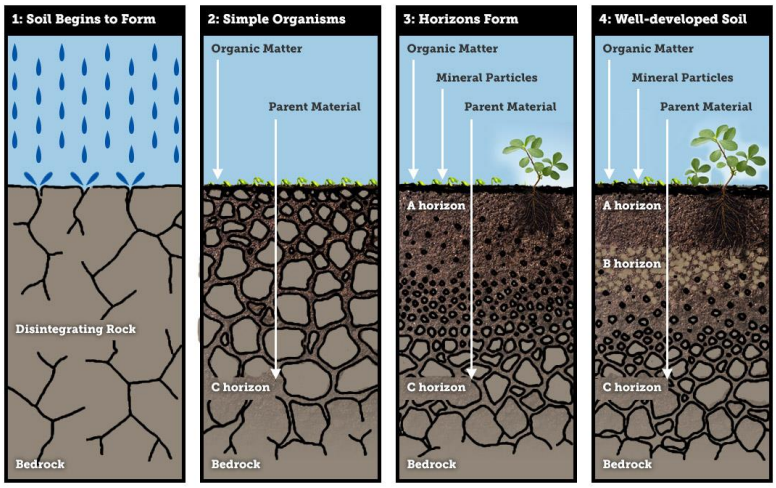
Origin and classification





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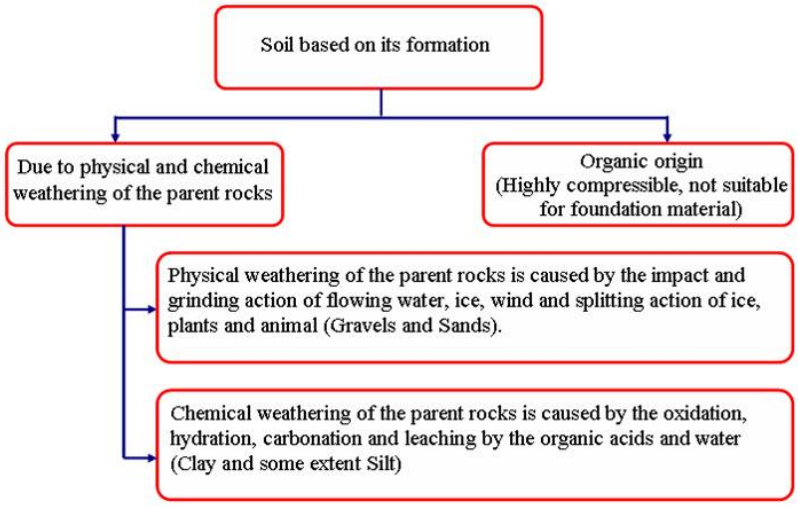
Origin and classification



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Origin and classification

If the rock weathering are still located at the place where they originated, they called residual soils.

Any soil that has been transported from its place of origin by wind, water, ice or any other agency and has been re-deposited, is call transported soil.

Residual soil	Transported soil
Stress history is not important for this soil	Stress history is very important because it make changes in the primary grain packing, which leads to the settlement of consolidation.
It includes very different grain strengths. Varying mineralogy and numerous weak grains are possible.	It contains the most unit form of particle strength, and weak grains in this soil are eradicated during transportation.
Residual bonds or cementing generates components of significant strength, produces the cohesion intercept and results in a yield stress, and can be smashed by disturbance.	Bonding with geologically aged deposits generates a cohesion intercept, yield stress, and can be eliminated by disruption.

Origin and classification

Transported Soils

Alluvial Deposit – soils that have been deposited from suspension in running water.
Lacustrine Deposit – soils that have been deposited from suspension in still, fresh water of lakes
Marine Deposit – soils that have deposited from suspension in sea water
Aeoline Deposit – soils that have been transported by wind
Glacial Deposit – deposits that have been transported by ice





Origin and classification

The common Indian soils are presented below:

(i) Marine deposits: These soils are found along the coast in narrow tidal plains. These are very soft with low shear strength and high compressibility. Construction of structures on these soils is very challenging due to low bearing capacity and excessive settlement.

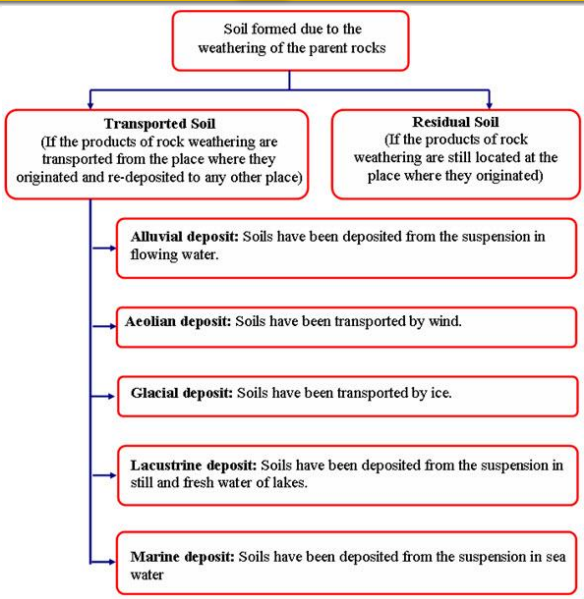
(ii) Laterites soils: These soils are found in Kerala, Karnataka, Maharashtra, Orissa, and West Bengal. These are formed due to the decomposition of rocks and reddish in colour.

(iii) Black cotton soils: These are expansive soils found in Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh and Uttar Pradesh.

(iv) Alluvial soils: These are found in Assam to Punjab covering a large part of northern India. These soils have alternating layers of sand, silt and clay.

(v) Desert soils: These are found in large parts of Rajasthan.

(vi) Boulder deposits: These are found in the sub-Himalayan regions of Himachal Pradesh and Uttar Pradesh.



Geotechnical Field Problems for Civil Engineer

There are following problems that has been faced by a Geotechnical or a Civil Engineers in Soil.

- Soils has a vast variety and characteristics due which it has a different properties.
- Soils has both chemical and biological components into it which changes its behavior.
- Soils has a long history of deposition due which it has variety of layer composition on earth surface.
- Soil consist water, vegetation, minerals, metals, rocks and gases into it, which comprises as a soil mass.
- Soil has to face seismic activity, seepage, compression, lateral and dynamic loads.
- Soil has no bounding property due which only works in compression in nature still shows some of the failures.

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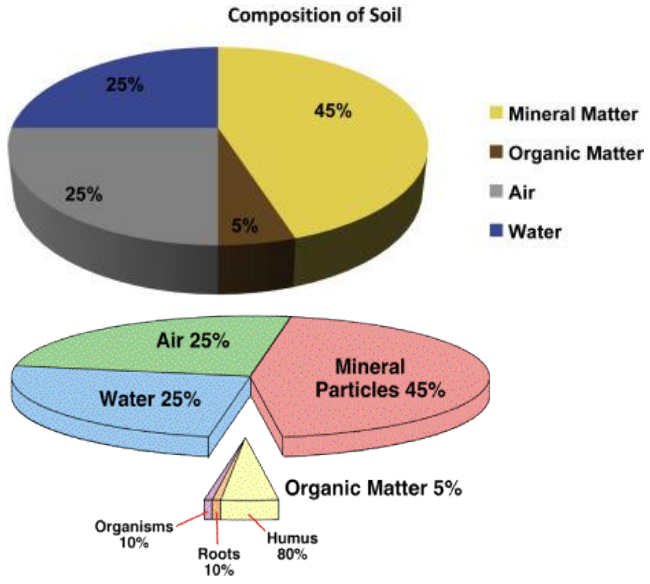
Soil Compositions

In soil mechanics the consideration of soil composition is only based on the there things (soil particles, water, air), leaving the minerals and organic compounds.

But the distribution of composition of soil mass are as shown in figure.



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THANK YOU

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