LESSON 3

Basic Soil Properties for Foundation Design

BASIC SOIL PROPERTIES FOR FOUNDATION DESIGN

Lesson 3

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BASIC SOIL PROPERTIES FOR FOUNDATION DESIGN

1. List Main Soil Groups and Basic Engineering Uses

2. Differentiate between Identification, Description and Classification

ACTIVITIES: ***Soil Description***
Local Lab Tour
Geo-Quiz

Slide 3-2

Definition of Soil

Naturally occurring mineral particles which are fairly readily separated into relatively small pieces and in which the mass may contain air, water, or organic materials.

Mineral particles of the soil mass are formed from decomposition of the rock by weathering (by air, ice, wind and water) and chemical processes.

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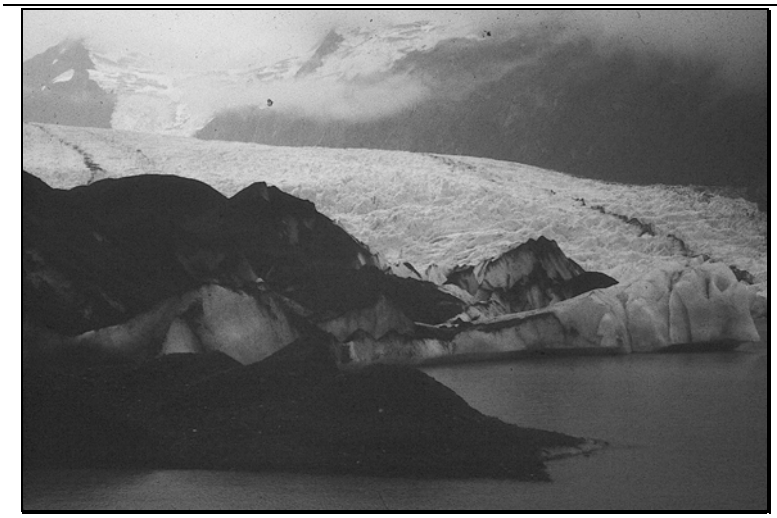

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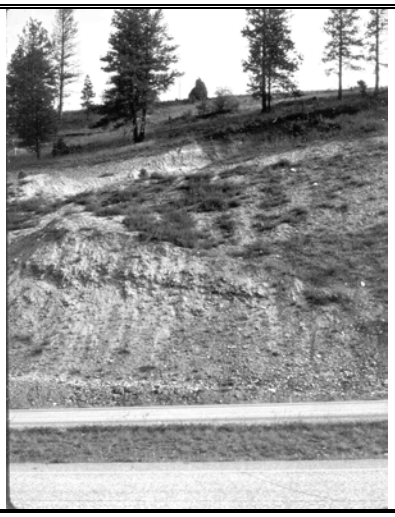

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Main Soil Groups

- ***Granular Soils***
  - ***Sands and Gravels***
- ***Fine-Grained Soils***
  - ***Silts and Clays***
- ***Organic Soils***
  - ***Organic Silts and Clays, Peats, Mucks***

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Granular Soils

Sands and Gravels

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Identify by Grain Size

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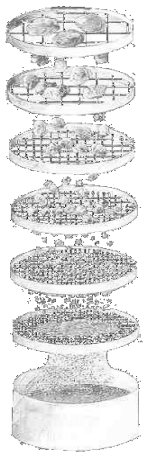
Gradation Test



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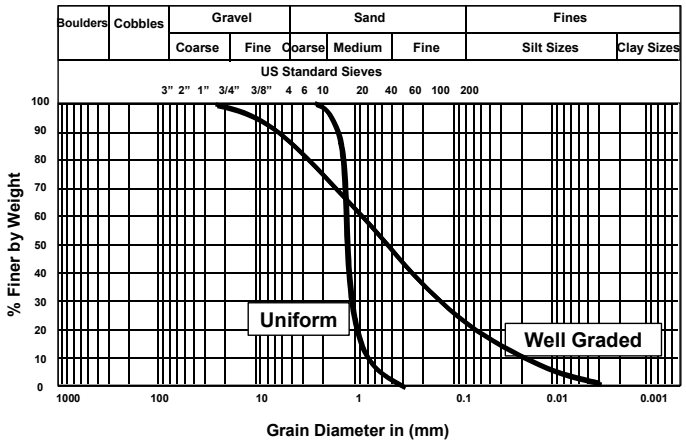

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Engineering Properties of Granular Soils

- ***Excellent Foundation Material***
- ***The Best Embankment Material***
- ***The Best Backfill Material***
- ***Possibly Susceptible to Vibratory Forces***
- ***Dewatering is Quite Difficult***
- ***Not Frost Susceptible if Free Draining***

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Fine-Grained Soils

Soil Mineral Types Control Behavior of Silts and Clays More Than Grain Size

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Cohesive Soils (Clays)

Strength Largely Derived From Cohesion

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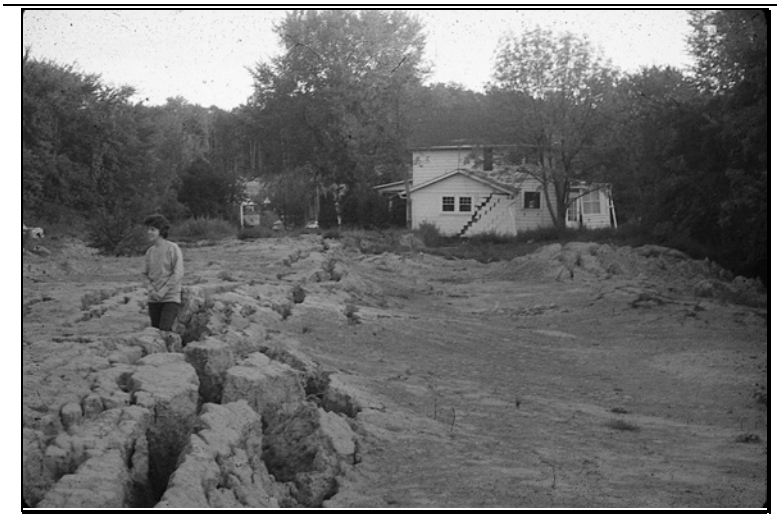

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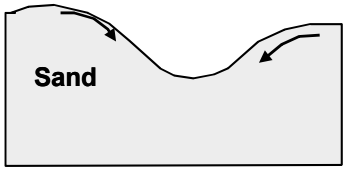
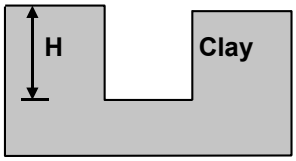
Cohesion

Excavations In Dry Sand Slopes WON'T Stand

Excavations In Stiff Clay Slopes WILL Stand if H<HC



No Cohesion



Cohesion

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Cohesive Soils (Clays)

Identify by Plasticity

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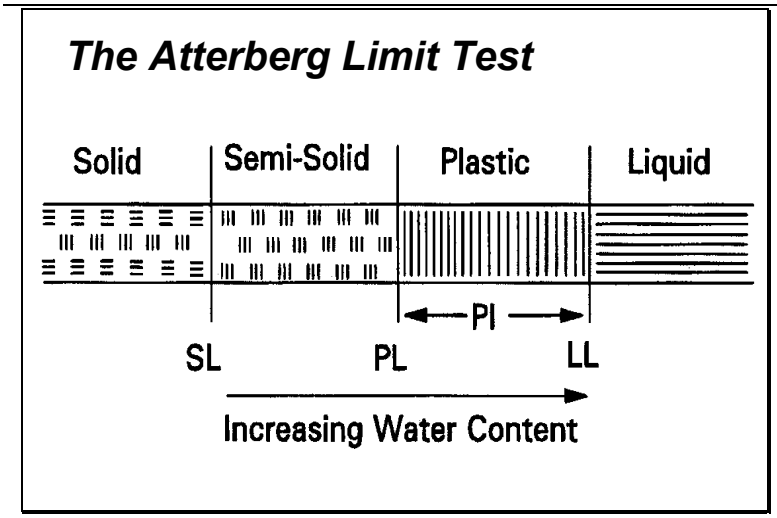

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Engineering Properties of Cohesive Soils

- ***Often Possess Low Shear Strength***
- ***Plastic and Compressible***
- ***Shear Strength Reduced by Wetting or Disturbance***

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Engineering Properties of Cohesive Soils (Cont'd)

- ***Shrink- Swell Potential***
- ***Poor Material for Backfill or Embankments***
- ***Practically Impervious***
- ***Clay Slopes Prone to Landslides***

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Silts

Similar to Clays but Exhibit No Cohesion

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Differences Between Silts and Clays

- ***Air-Dried Strength***
- ***Appearance When Shaken***
- ***Roll into Thin Threads***

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Engineering Properties of Silts

- ***Relatively Low Shear Strength***
- ***High Capillarity and Frost Susceptibility***
- ***Relatively Low Permeability***

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Engineering Properties of Silts Compared to Clays

Silts Characteristically Have:

- ***Better Load Sustaining Qualities***
- ***Less Compressibility***
- ***More Permeability***
- ***Less Volume Change***

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Organic Soils

Peat, Muck, Organic Silts and Clays Contain Decayed Animal and/or Vegetative Matter (Organic Matter).

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Organic Soils

Organic Matter is Objectionable Because:

- ***Reduces Load Carrying Capacity***
- ***Increases Compressibility***
- ***Releases Toxic Gases During Excavations***

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Engineering Properties of Organic Soils

- ***Low Shear Strength***
- ***High Compressibility***
- ***Spongy Structure Which Deteriorates Rapidly***
- ***Acidity and Other Injurious Characteristics to Construction Materials***

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Soil Classification and Description

- ***Arrangement of Different Soils into Groups Having Similar Engineering Properties***
- ***Systems Most Used by Highway Agencies:***
  - ***AASHTO***
  - ***Unified***
  - ***ASTM***

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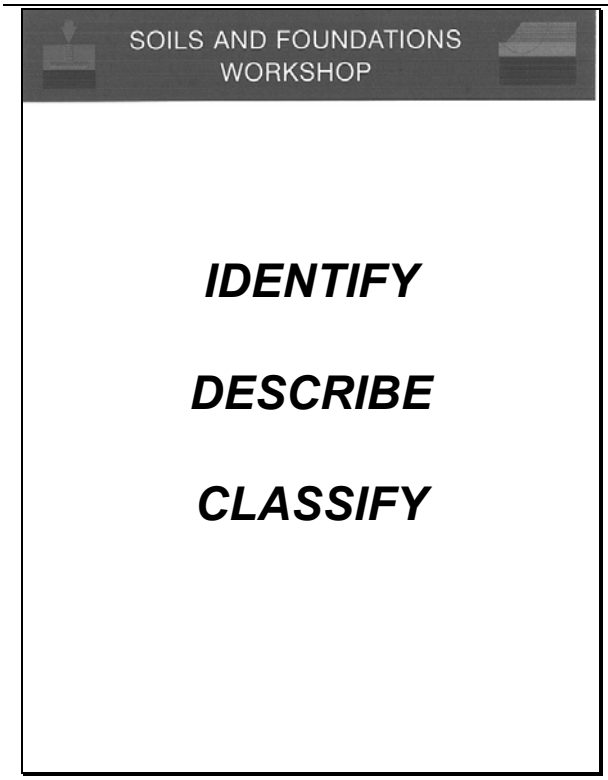
Slide 3-33



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SOILS AND FOUNDATIONS WORKSHOP

List the Typical Soil Tests that are Performed in Your Laboratory for a Highway Project

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SOILS AND FOUNDATIONS WORKSHOP

Lab. Exercise Begins

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SOILS AND FOUNDATIONS WORKSHOP

Return to Main Classroom

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SOILS AND FOUNDATIONS WORKSHOP

Geo-Fun: What Soil Types (Silt, Sand, Clay, Gravel, Etc.) Are Used For...

- ***Gardening***
- ***Unpaved Roads***
- ***Water Filter***
- ***Pottery***
- ***Ice Cream***
- ***Kaopectate***
- ***Kitty Litter***

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SOILS AND FOUNDATIONS WORKSHOP

Site Exploration

Basic Soil Properties

- ***Visual Description***
- ***Classification Tests***
- ***Soil Profile***

Laboratory Testing

Slope Stability

Embankment Settlement

Spread Footing Design

Pile Design

Construction Aspects

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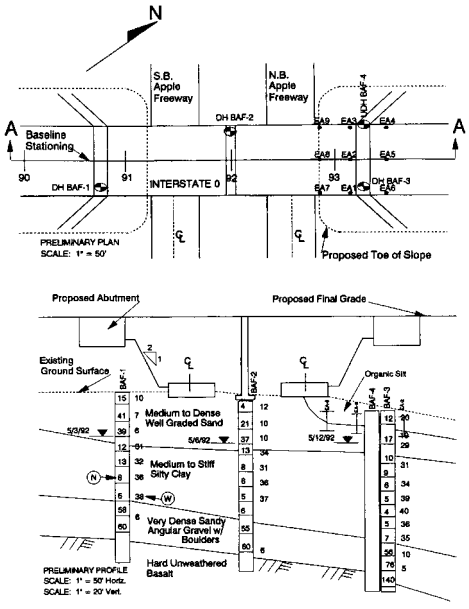
SOILS AND FOUNDATIONS WORKSHOP



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SOILS AND FOUNDATIONS WORKSHOP

Basic Soil Properties

- ***Visual Description***
  - ***Predominate Soil Types are Sand, Silty Clay and Sandy Gravel***
- ***Classification Tests***
  - ***Moisture Content and Unit Weight Determined***
- ***Soil Profile***
  - ***Subsurface Variation of Soil Layers and Ground Water Estimated***

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SOILS AND FOUNDATIONS WORKSHOP

BASIC SOIL PROPERTIES FOR FOUNDATION DESIGN

1. List Main Soil Groups and Basic Engineering Uses

2. Differentiate between Identification, Description and Classification

ACTIVITIES: ***Soil Description***
Local Lab Tour
Geo-Quiz

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