PAVEMENT MATERIALS

LECTURE 3

ENGR. SHABIR AHMAD
LECTURER CED, INU

COURSE HEADS

- SUBGRADE
  - NATURAL
  - STABILIZED
- SUBBASE
- BASE COURSE
  - UNBOUND
  - BOUND
- SURFACE COURSES

SEQUENCE

- SUBGRADE

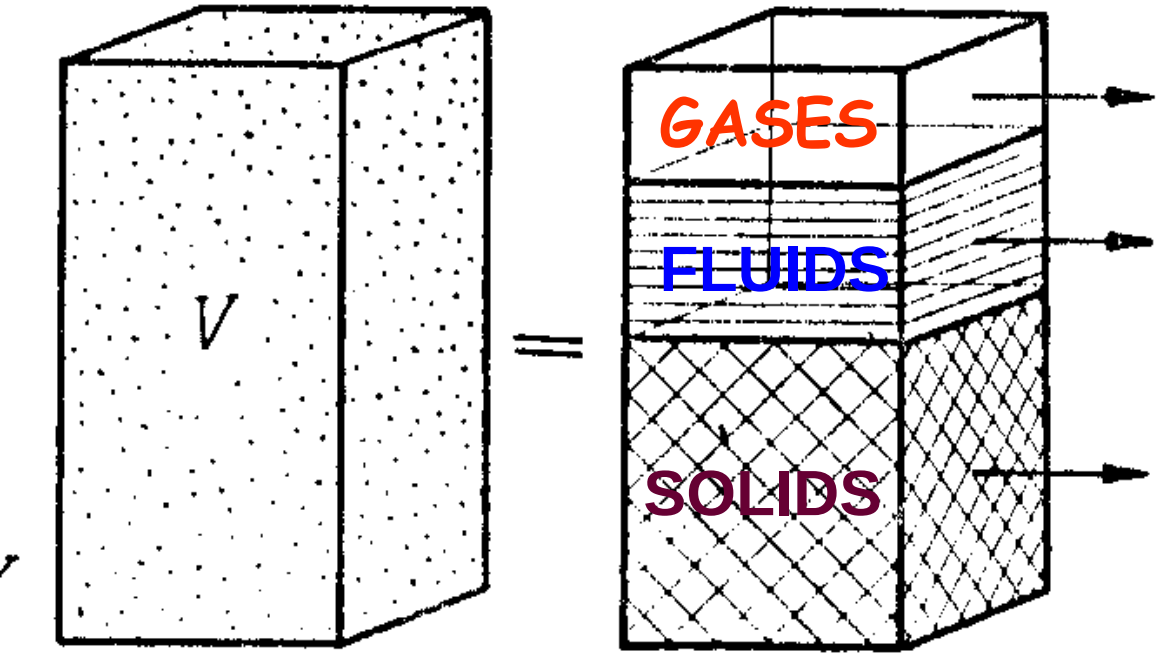
- INVESTIGATION
- MATERIAL CLASSIFICATION/IDENTIFICATION
- MATERIAL EVALUATION
- MATERIAL SELECTION
- CONSTRUCTION OF SUBGRADE
- QA/QC
- POST CONSTRUCTION INVESTIGATION

USE OF SOILS IN HIGHWAYS!

- IN HIGHWAY CONSTRUCTION, SOIL IS USED BOTH IN THE ROAD STRUCTURE (I.E. EMBANKMENTS, CUT SLOPES, ROADBED IN BOTH CUTS AND FILLS) AND AS A FOUNDATION TO SUPPORT THE EMBANKMENTS, CULVERTS, AND BRIDGES.

- SOIL IS, THEREFORE, A BASIC ELEMENT OF THE HIGHWAY, AND AS SUCH IT IS NECESSARY THAT THE PERSONS WHO WORK WITH IT AND USE IT BE ABLE TO IDENTIFY THE SOIL TYPES.

SOILS AND ROCKS



Unit weight	Volume	Void ratio	
$\gamma_g = 0$	V_g	e_g	e
γ_w	V_m	e_m	
γ_s	V_s	1	

SUBGRADE SOILS AND ROCKS

- BEHAVIOR (??)

- DEPENDS ON

- TYPE, NATURE, RELATIVE ARRANGEMENT.. OF SOLID(S)
- TYPE, NATURE, QUANTITY OF FLUID(S)
- INTERACTION OF SOLIDS AND FLUIDS *(SHORT AND LONG TERM)*
- QUANTITY OF GAS(ES)

CLASSIFICATION OF SOILS

- THE FIRST OBJECTIVE SHOULD BE TO IDENTIFY AND DESCRIBE SOILS IN SUCH A WAY THAT OTHERS WILL UNDERSTAND EXACTLY WHAT IS MEANT; THAT IS, IF A SILT LOAM IS MENTIONED, THAT NAME SHOULD CONVEY ESSENTIALLY THE SAME MEANING TO EACH PERSON.
- OTHER TERMS MAY ELABORATE ON IT AND DESCRIBE IT MORE FULLY. THE COMPLETE DESCRIPTION WOULD THEN CONVEY A VERY DEFINITE PICTURE OF THAT PARTICULAR SOIL.

- AN UNDERSTANDING OF THE CLASSIFICATION PROCEDURES WILL AID THE ENGINEER AND INSPECTOR IN THE FIELD
- *IN IDENTIFYING SOILS*
- *IN EVALUATING THE ENGINEERING PROPERTIES*
- *IN APPLYING BETTER SOIL SELECTION AND*
- *IN PERFORMING THE FIELD TEST MORE ACCURATELY.*

CLASSIFICATION SYSTEMS

- TEXTURAL
- AASHTO
- USCS (ASTM)
- *LOCAL/INTERNATIONAL NAMES/NOMENCLATURE*

CLASSIFICATION

- THE MORE COMMON CHARACTERISTICS OF SOILS BY WHICH THEY MAY BE DESCRIBED INCLUDE THE FOLLOWING:
- TEXTURE
- CONSISTENCY
- COLOR
- COMPACTNESS
- STRUCTURE
- CEMENTATION
- THESE CHARACTERISTICS ARE DISCERNIBLE IN THE FIELD, AND, EXCEPT FOR THE EXACT TEXTURE, THEY DO NOT HAVE TO BE DETERMINED BY LABORATORY ANALYSIS. THEY DO NOT DESCRIBE THE ENGINEERING PROPERTIES AS SUCH, BUT THEY ARE RELATED TO SUCH PROPERTIES AS CAPILLARITY, COMPATIBILITY, EXPANSION, ELASTICITY, DENSITY, SUPPORTING POWER, AND OTHERS.

TEXTURAL CLASSIFICATION

- TEXTURE

- TEXTURE IS A TERM USED TO INDICATE THE SIZE OF INDIVIDUAL PARTICLES IN A GIVEN SOIL MASS AND THE PROPORTIONS OF EACH SIZE PRESENT. MOST NATURAL SOIL MASSES CONSIST OF A COMBINATION OF MANY GRAIN OR PARTICLE SIZES. THE DISTRIBUTION OF PARTICLE SIZES AND THE RELATIVE PREDOMINANCE OF FINE OR COARSE GRAINS IMPARTS TO THE SOIL A DISTINCTIVE APPEARANCE AND "FEEL", WHICH IS CALLED TEXTURE.

- THE TEXTURAL TERMS USED TO DESCRIBE SOILS EXPRESS THE AVERAGE EFFECT OF ALL THE GRAIN SIZES OR THE EFFECT OF THE PREDOMINANT GROUP OF PARTICLES. TEXTURE IS THE MOST COMMON TERM USED TO IDENTIFY SOILS.

TEXTURAL CLASSIFICATION

- TEXTURE
- THE PRINCIPAL PARTICLE SIZES OF SOIL ARE:
- 1. GRAVEL
- 2. SAND
- 3. SILT
- 4. CLAY

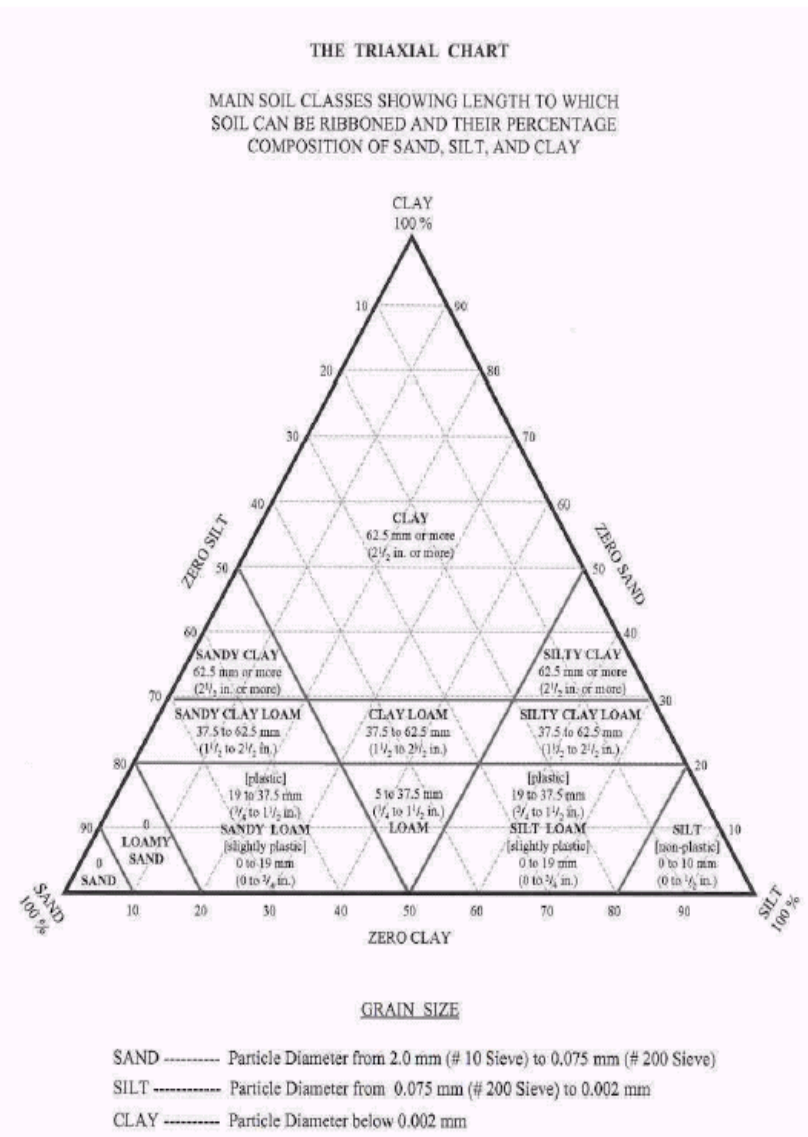
The grain size ranges for the above soil components are described in the following table:

Particle Size	Diameter in Millimeters	Corresponding U.S. Standard Sieve Sizes	
		Passing	Retained On
Gravel	75 to 2.0	75 mm (3")	2 mm (No. 10)
Coarse Sand	2.0 to 0.425	2 mm (No. 10)	425 • m (No. 40)
Fine Sand	0.425 to 0.075	425 • m (No. 40)	75 • m (No. 200)
Silt	0.075 to 0.002	Cannot be separated by sieving. Determined by settling velocity in soil-water suspension	
Clay	Smaller than 0.002		
Colloidal Clay	Smaller than 0.001		

TEXTURAL CLASSIFICATION

- THE TRIAXIAL CHART PLACES THE SOIL TEXTURES INTO THREE MAIN GROUPS ON THE BASIS OF CLAY CONTENT. THE THREE MAIN GROUPS ARE THEN SUBDIVIDED FURTHER.

- 1. SOILS CONTAINING LESS THAN 20% CLAY.
  - SAND
  - LOAMY SAND
  - SANDY LOAM
  - LOAM
  - SILT LOAM
  - SILT
- 2. SOILS CONTAINING FROM 20% TO 30% CLAY.
  - SANDY CLAY LOAM
  - CLAY LOAM
  - SILTY CLAY LOAM
- 3. SOILS CONTAINING 30% OR MORE CLAY.
  - SANDY CLAY
  - CLAY
  - SILTY CLAY



CLASSIFICATION

- COLOR

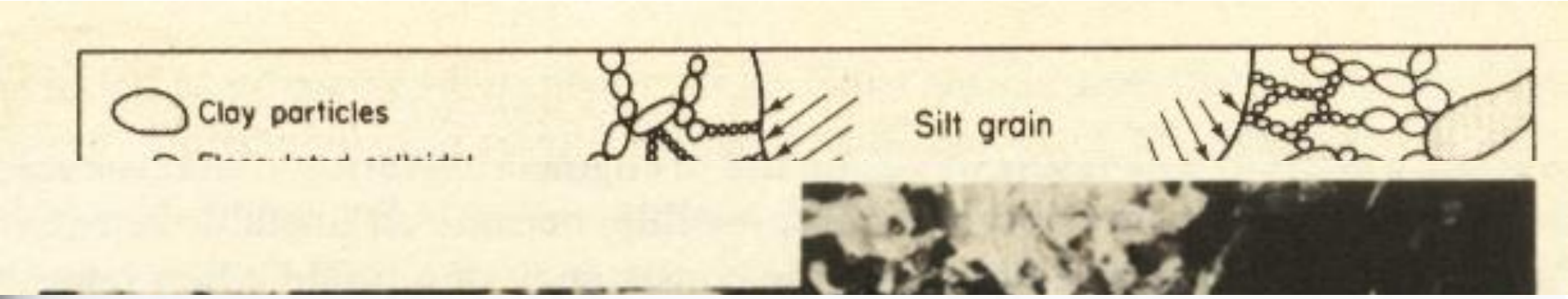
- IN DESCRIBING SOILS, COLOR PROVIDES A FIRST AND QUICK MEANS OF IDENTIFYING SOIL LAYERS AND THE OCCURRENCE OF SIMILAR SOILS IN OTHER LOCALITIES. COLOR ALONE IS NOT SUFFICIENT FOR IDENTIFICATION, YET IT CAN SERVE A USEFUL PURPOSE. TO INSURE UNIFORMITY OF DESCRIPTION, SOIL COLORS ARE DETERMINED ONLY WHEN THE SOIL CONTAINS MOISTURE.
- COLORS FOUND IN SOILS VARY FROM TAN, YELLOW OR RED TO BROWN, DARK GRAY OR BLACK.
- COLOR COMBINATIONS ARE OFTEN USED TO MAKE DESCRIPTIONS MORE COMPLETE, FOR EXAMPLE, A BROWNISH-GRAY SOIL IS A GRAY SOIL WITH A BROWNISH CAST.

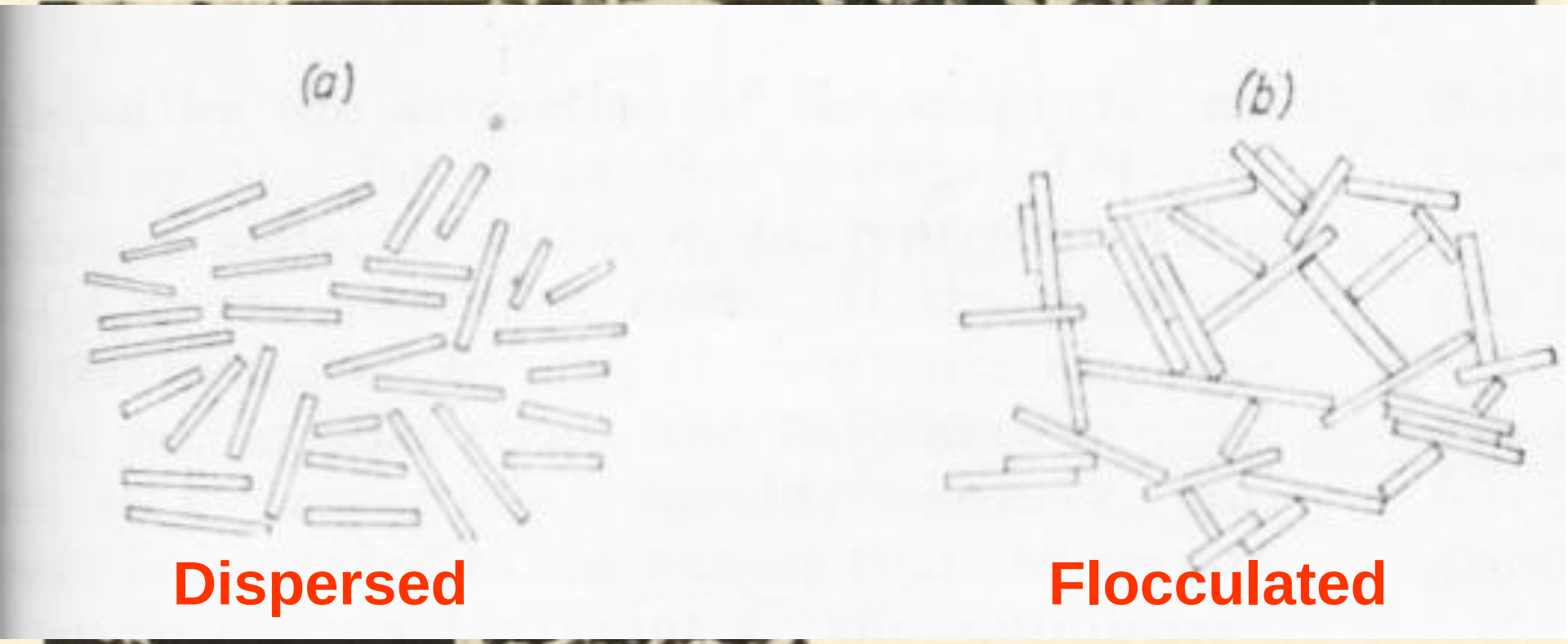
CLASSIFICATION

- FABRIC / STRUCTURE

- FABRIC DESCRIBES THE ARRANGEMENT OF INDIVIDUAL SOIL GRAINS INTO SOIL AGGREGATIONS WHICH MAKE UP THE SOIL MASS. IT MAY REFER TO THE NATURAL ARRANGEMENT OF THE SOIL WHEN IN PLACE AND UNDISTURBED OR TO THE SOIL AT ANY DEGREE OF DISTURBANCE. THE TERMS USED BELOW INDICATE THE CHARACTER OF THE ARRANGEMENT AND THE GENERAL SHAPE AND SIZE OF AGGREGATIONS.

- STRUCTURE IS THE FABRIC AND THE INTERACTIONS AMONG THE VARIOUS PARTICLES.





(a)

CLASSIFICATION

- CONSISTENCY
- THE STRENGTH OF COHESIVE SOILS IS QUANTIFIED BY THEIR CONSISTENCY.
- TERMS UTILIZED TO DESCRIBE CONSISTENCY ARE VERY SOFT, SOFT, FIRM (SOMETIMES REFERRED TO AS MEDIUM STIFF), STIFF, VERY STIFF, AND HARD.
- CONSISTENCY IS OFTEN THOUGHT OF AS RELATING TO PLASTICITY, SINCE IN CLAYS SHORT TERM STRENGTH IS BASED ON COHESION; HOWEVER, IT IS POSSIBLE TO HAVE A VERY PLASTIC SOIL (HIGH COHESION) APPEAR VERY SOFT.

- COMPACTNESS
- THE STRENGTH OF GRANULAR SOILS IS QUANTIFIED BY THEIR COMPACTNESS.
- IT IS DESCRIBED AS VERY LOOSE, LOOSE, MEDIUM DENSE (SOMETIMES REFERRED TO AS MEDIUM), DENSE, OR VERY DENSE. AGAIN, A SAND WITH A HIGH INTERNAL FRICTION ANGLE (INDICATIVE OF HIGH STRENGTH) MAY BE ENCOUNTERED IN A VERY LOOSE CONDITION, SO ASSOCIATING STRENGTH, PER SE, WITH COMPACTNESS IS NOT NECESSARILY CORRECT.

- *SPT, CPT, …..*

CLASSIFICATION

- CONSISTENCY

- THE STRENGTH OF COHESIVE SOILS IS QUANTIFIED BY THEIR CONSISTENCY.

- CONSISTENCY IS OFTEN THOUGHT OF AS RELATING TO PLASTICITY, SINCE IN CLAYS SHORT TERM STRENGTH IS BASED ON COHESION; HOWEVER, IT IS POSSIBLE TO HAVE A VERY PLASTIC SOIL (HIGH COHESION) APPEAR VERY SOFT.

- THE FOLLOWING DESCRIPTIVE TERMS ARE OFFERED TO MAKE THIS CLASSIFICATION AND IDENTIFICATION A UNIFORM SYSTEM
- *VERY SOFT, SOFT, FIRM, STIFF, VERY STIFF AND HARD.*

CLASSIFICATION

- COMPACTNESS

- THE STRENGTH OF GRANULAR SOILS IS QUANTIFIED BY THEIR COMPACTNESS.
- IT IS DESCRIBED AS VERY LOOSE, LOOSE, MEDIUM DENSE (SOMETIMES REFERRED TO AS MEDIUM), DENSE, OR VERY DENSE.
- AGAIN, A SAND WITH A HIGH INTERNAL FRICTION ANGLE (INDICATIVE OF HIGH STRENGTH) MAY BE ENCOUNTERED IN A VERY LOOSE CONDITION, SO ASSOCIATING STRENGTH, PER SE, WITH COMPACTNESS IS NOT NECESSARILY CORRECT.
- THE (SPT) STANDARD PENETRATION TEST IS WIDELY USED TO EVALUATE THE COMPACTNESS OF GRANULAR SOILS.
- IN THE CASE OF SILTS, IT IS PROBABLY BETTER TO ASSOCIATE TERMS OF CONSISTENCY RATHER THAN COMPACTNESS, SINCE SILTS ARE DIFFICULT TO COMPACT AND BEHAVE, UNDER MANY CIRCUMSTANCES, SIMILARLY TO LOW-PLASTICITY CLAYS.

CLASSIFICATION

- CEMENTATION

- A CONDITION OCCURRING WHEN THE SOIL GRAINS OR AGGREGATES ARE CAUSED TO ADHERE FIRMLY AND ARE BOUND TOGETHER BY SOME MATERIAL THAT ACTS AS A CEMENTING AGENT (AS COLLOIDAL CLAY, IRON OR ALUMINUM HYDRATES, LIME CARBONATE, ETC.).

- THE DEGREE OF CEMENTATION WHEN THE SOIL IS WETTED SHOULD BE STATED. SOME TERMS INDICATE THE PERMANENCE AS “INDURATED,” “HARDPAN,” ETC. TERMS USED TO DESCRIBE CEMENTATION ARE: FIRMLY CEMENTED, INDURATED (ROCK-LIKE), WEAKLY CEMENTED, SOFTLY CEMENTED.

CLASSIFICATION

- *ORGANIC SOILS*

- SOILS CONTAINING GREATER THAN 5 PERCENT ORGANIC MATERIAL BY WEIGHT ARE DEFINED AS ORGANIC SOILS. ORGANIC SOILS INCLUDE PLANT MATERIAL IN VARIOUS STAGES OF DECAY FROM A CONDITION WHERE THE STEM AND LEAF STRUCTURES CAN STILL BE DETECTED TO A STATE WHERE THE PLANT TISSUE HAS LOST ITS IDENTITY AND AN INDEFINITE MASS OF ORGANIC MATERIAL EXISTS.

Classification	Organic Content by weight %
Non-organic	<2
slightly organic*	2 - 5
organic*	6 - 10
highly organic*	11 - 25
Peat-woody, fibrous, decomposed, etc.	>25

SOIL CLASSIFICATION SYSTEM

- UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
- *OR CASAGRANDE CLASSIFICATION*
- *OR ASTM CLASSIFICATION*

SOILS AND ROCKS

- PAKISTANI SOILS (SURFACE)
    - COLLUVIUMS (HILL SLOPE SOILS)
    - ALLUVIUMS (SILTY IN NATURE)
    - ‘BAR’ SOILS (CLAYEY IN NATURE)
    - DESERT SANDS (FINE IN NATURE)
    - COASTAL ALLUVIUMS
- PAKISTANI ROCKS ?

AASHTO CLASSIFICATION

- THE AASHTO SYSTEM IS AN ENGINEERING PROPERTY CLASSIFICATION BASED UPON FIELD PERFORMANCE OF SUBGRADE SOILS UNDER HIGHWAY PAVEMENTS. SUBGRADE SOIL MATERIALS ARE CLASSIFIED INTO SEVEN MAJOR GROUPS DESIGNATED A-1 THROUGH A-7.

- THE SOILS OF EACH GROUP HAVE SIMILAR BROAD CHARACTERISTICS IN COMMON AND PHYSICALLY REACT ALIKE WHEN SUBJECTED TO LOADS.

- THIS SYSTEM WAS DEVELOPED SO THAT A SOIL COULD BE GIVEN A STANDARD CLASSIFICATION, NO MATTER IN WHAT LOCALITY, COUNTY OR PART OF THE WORLD IT IS FOUND. THIS ENABLED ENGINEERS ANYWHERE TO TALK THE SAME LANGUAGE.

AASHTO CLASSIFICATION

- BASED UPON THEIR FIELD PERFORMANCE, SOILS ARE CLASSIFIED BY THIS PROCEDURE INTO SEVEN GROUPS WHICH ARE DESIGNATED AS A-1, A-2, A-3, A-4, A-5, A-6, AND A-7.
- THE RESULTS OF TESTS MADE IN ACCORDANCE WITH THE METHODS SPECIFIED, INDICATE THE PHYSICAL PROPERTIES OF THE SOILS AND SERVE TO IDENTIFY THEM WITH RESPECT TO GROUPING.
- EVALUATION OF SOILS WITHIN EACH GROUP IS MADE BY MEANS OF A "GROUP INDEX" WHICH IS A VALUE CALCULATED BY MEANS OF AN EMPIRICAL FORMULA DERIVED FROM OBSERVATIONS OF THE BEHAVIOR OF SOIL AND SOIL MATERIALS IN EMBANKMENTS, SUBGRADES, AND SUBBASES.

TABLE A
CLASSIFICATION OF SOILS AND SOIL-AGGREGATE MIXTURES

General Classification	Granular Materials (35% or less passing 75µm) [No. 200]							Silt-Clay Materials (More than 35% passing 75µm) [No. 200]			
Group Classification	A-1		A-3*	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis:											
Percent passing:											
2mm (No. 10)	50 max.	---	---	---	---		---	---	---	---	---
425µm (No. 40)	30 max.	50 max.	51 min.	---	---	---	---	---	---	---	---
75µm (No. 200)	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of fraction passing No. 425µm (No. 40):											
Liquid Limit	---		---	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity Index	6 max.		N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min**
Usual Types of Significant Constituent Materials	Stone Fragments Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	
General Rating as Subgrade	Excellent to Good							Fair to Poor			

The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

**Plasticity Index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity Index of A-7-6 subgroup is greater than LL minus 30.

FIELD SOIL IDENTIFICATION

- *FIELD SOIL IDENTIFICATION*
- IF THE INFORMATION FURNISHED BY THE AASHTO CLASSIFICATION SYSTEM IS TO BE USED EFFECTIVELY BY THE INSPECTOR, IT IS NECESSARY TO PROVIDE A QUICK, SIMPLE METHOD OF IDENTIFYING SOILS IN THE FIELD HAVING THE SAME CHARACTERISTICS AS THOSE TESTED IN THE LABORATORY.
- COMPARISON OF LIKE TEXTURAL CLASSIFICATIONS CAN PROVIDE AN ESTIMATE OF THE AASHTO GROUP CLASSIFICATION. WITH PRACTICE, CONSIDERABLE PROFICIENCY CAN BE ATTAINED.
- BY COMPARISON WITH THE LABORATORY SAMPLES, AN ESTIMATE OF THE AASHTO GROUP CLASSIFICATION CAN BE OBTAINED AND THE TEXTURAL CLASSIFICATION CAN BE USED AS A GUIDE IN SELECTING EMBANKMENT SOILS.

FIELD SOIL IDENTIFICATION

- *FIELD SOIL IDENTIFICATION*

- THE FIELD METHOD FOR DETERMINING THE TEXTURAL CLASSIFICATION INVOLVES
- *DETERMINING THE COARSER GRAINS BY "SIEVE" AND "FEEL"*
- *"SUSPENSION" IN WATER AND*
- *THE EFFECT OF PLASTIC SOILS BY FORMING A CAST IN THE HAND AND BY PRESSING OR RUBBING A MOIST SAMPLE BETWEEN THE THUMB AND FOREFINGER TO FORM A THIN "RIBBON" UNTIL IT WILL BREAK UNDER ITS OWN WEIGHT WHEN HELD IN A HORIZONTAL POSITION.*

SOIL IDENTIFICATION					
TEXTURAL CLASS	**IDENTIFICATION BY FEEL**	**RIBBON LENGTH**	**AASHTO GROUP (H.R.B. CLASS)**	**GROUP INDEX**	**RATING FOR UPPER EMB.**
Gravel (G)	Stones: Pass 75mm (3") sieve, Retained on 2mm (No. 10)	0	A-1-a	0	Excellent
Fine Gravel (FG)	Stones: Pass 9.5mm (3/8") sieve, Retained on 2mm (No. 10)	0	A-1-a	0	Excellent
Sand (S)	100% pass 2mm (No. 10). Less than 10% silt and clay	0	A-1-b	0	Excellent
Coarse Sand (CrS)	Pass 2mm (No. 10), Ret. 425µm (No. 40).	0	A-1-a or A-1-b	0	Excellent
Fine Sand (FS)	Most will pass 425µm (No. 40), Gritty, non-plastic	0	A-1-b or A-3	0	Excellent to Good
Loamy Sand (LS)	Grains can be felt. Forms a cast.	0	A-2-4 or A-2-5	0	Excellent to Good
Sandy Loam (SL) a. sightly plastic (slpl)	0-10% clay. Gritty.	0 - 19mm (0-3/4")	A-2-4, A-2-6 or A-2-7	0 - 4	Excellent to Good
b. plastic (pl)	10-20% clay. Gritty.	19mm (0-3/4") - 37.5mm (1 1/2")	A-4	1 - 13	Excellent to Good
Loam (L)	Gritty, but smoother than SL.	5mm (1/4") - 37.5mm (1 1/2")	A-4	1 - 13	Excellent to Good
Silt Loam (SiL) a. sightly plastic (slpl)	0-10% clay. Smooth, slippery or velvety. Little Resistance	0 - 19mm (3/4")	A-4	0-13	Fair to Poor
b. plastic (pl)	10-20% clay. Smooth, slippery or velvety. Little Resistance .	19mm (0-3/4") - 37.5mm (1 1/2")	A-4	1 - 13	Fair to Poor
Silt (Si)	>80% Silt. Small, slippery or velvety. Little Resitance.	0 - 15mm (0-1/2")	A-4	1 - 13	Poor
Clay Loam (CL)	Smooth, shiny, considerable resistance.	37.5mm (1 1/2") - 62..5mm (2 1/2")	A-6	1 - 40	Good to Fair
Silty Clay Loam (SiCL)	Dull appearance, slippery, less resistance.	37.5mm (1 1/2") - 62..5mm (2 1/2")	A-6 or A-5	1 - 40	Fair to Poor
Sandy Clay Loam(SCL)	Somewhat gritty. Considerable resistance.	37.5mm (1 1/2") - 62..5mm (2 1/2")	A-6 or A-5	1 - 40	Good to Fair
Clay (C)	Smooth, shiny, long thin ribbon.	> 62..5mm (2 1/2")	A-7	1 - 40	Fair to Poor
Silty Clay (SiC)	Buttery, smooth, slippery.	> 62..5mm (2 1/2")	A-7 or A-7-5	1 - 40	Poor

DEVELOPMENT OF SOIL PROFILE

- THE SOIL PROFILE IS COMPOSED OF A SERIES OF DISTINCT SOIL LAYERS, OR HORIZONS AS THEY ARE CALLED.
- THESE HORIZONS ARE THE RESULT OF WEATHERING ACTION OF THE ELEMENTS THROUGH CENTURIES OF TIME UPON THE PARENT MATERIAL OR ORIGINAL UNWEATHERED GEOLOGICAL FORMATION.
- THIS PARENT MATERIAL WHEN FIRST DEPOSITED BY GLACIERS, BY WIND, OR BY WATER WAS THE SAME AT THE SURFACE AS DOWN WITHIN THE DEPOSIT; THAT IS, THERE WERE NO HORIZONS OF WEATHERED SOIL AT THE SURFACE.
- THESE HORIZONS DEVELOPED LATER THROUGH THE ACTION OF WATER, WIND, SUN, FREEZING AND THAWING AND BACTERIOLOGICAL LIFE WHICH EVOLVED WITH GROWING AND DYING VEGETATION.

DEVELOPMENT OF SOIL PROFILE

- GRADUALLY, IN HUMID REGIONS, THESE PROCESSES RESULTED IN LEACHING OUT SOME OF THE WATER SOLUBLE MATERIALS IN THE UPPERMOST OR TOP ZONE. PERCOLATING WATER CARRIED WITH IT THE SOLUBLE MATTER TOGETHER WITH THE FINE SOIL MATERIAL IN SUSPENSION AS IT SEEPED DOWNWARD.

- AS THE RATE OF DOWNWARD FLOW SLOWED WITH DEPTH, THE SOLUBLE MATERIAL AND SOIL IN SUSPENSION WERE DEPOSITED AT A LOWER LEVEL, RESULTING IN A ZONE OF ACCUMULATION.

- AS A CONSEQUENCE, THE TOP SOIL HORIZON BECAME LIGHTER IN TEXTURE AS SOME OF THE FINER CLAY PARTICLES WERE CARRIED OUT OF IT. THE SECOND ZONE THEN BECAME HEAVIER TEXTURED DUE TO THE CLAY AND OTHER SUBSTANCES ADDED TO IT.

DEVELOPMENT OF SOIL PROFILE

- IN STANDARD SOIL TERMINOLOGY, THESE SOIL HORIZONS ARE DESIGNATED AS:

- "A" HORIZON
- ”B" HORIZON
- ”C" HORIZON
- ”D" HORIZON

- *SOURCE OF INFORMATION*
- SOIL SURVEY OF PAKISTAN

Thank You