

Introduction

Luis Zambrano-Cruzatty, Ph.D.

Fall 2022

08/29/2022

1

CONTENTS

-
- 1. Objectives and challenges of soil sampling and testing
 - 2. Review: Units and dimensions
 - 3. Review: Phase relationships
 - 4. Review: Grain size distribution and consistency
 - 5. Review: State of stress and shear strength
 - 6. Anatomy of a ASTM standard

2

OBJECTIVES OF TESTING

- Soils are **complex** and multiphase material.
- Soils are **everywhere**.
- Soils are **non-prescribed** natural materials.

Through testing we want determine:

- Soil formation
- Mineralogy
- Composition and fabric
- **Mechanical properties**
- Volume change behavior
- Stress-strain behavior
- Hydraulic properties
- Time effects
- ...

3

CHALLENGES WITH SAMPLING AND TESTING

4

REVIEW: UNITS AND DIMENSIONS

Dimension: Are physical quantities that can be measured

Unit: An arbitrary scale that is used to measure a dimension based upon a definition

5

REVIEW: PHASE RELATIONSHIPS

6

Typical soil unit weight. Modified from Holtz et al. 2013

S. type	γ_{sat} kN/m ³	pcf	γ_d kN/m ³	pcf	γ' kN/m ³	pcf
Sands and gravels	19-24	119-150	15-23	94-144	9-14	62-81
Silts and clay	14-21	87-131	6-18	37-112	4-11	25-69
Glacial tills	21-24	131-150	17-23	106-144	11-14	69-87
Crushed rock	19-22	119-137	15-20	94-125	9-12	56-75
Peats	10-11	60-69	1-3	6-19	0-1	0-6
Organinics silt and clay	13-18	81-112	5-15	31-94	3-8	19-50

7

REVIEW: GRAIN SIZE

8

REVIEW: CONSISTENCY LIMITS

9

THE PLASTICITY CHART

10

REVIEW: STATE OF STRESS

11

REVIEW: SHEAR STRENGTH

12

ABOUT ASTM

FACTS about ASTM

- Over 12,500 standards
- Over 140 participating countries
- 80+ volumes of ASTM book of standards
- Manages the **Geotechnical Testing Journal**



PARTS OF THE ASTM STANDARD

- Title
- Designation
- Introduction
- Scope
- Terminology
- Summary of test method
- Significance and use
- Interferences
- Apparatus
- Reagents materials
- Hazards
- Sampling, t. specimens, t. units
- Preparation of apparatus
- Calibration and standardization
- Conditioning
- Procedure
- Calculation and results interpretation
- Precision and Bias
- Measurement of uncertainty
- Keywords
- Annexes and Appendixes
- References
- Summary of changes

LABORATORY VALIDATION

- Required for all government and several private jobs.
- Validation uses either ASTM or AASHTO standards.
- Doesn't ensure a good job. It ensures the lab follows standards.

15



Questions or comments?

16