Report To

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Materials II
CIVIL 1356

Lab Report # 1
3 Part Lab- Classifications of a Soil Sample Using the Unified Soil Classification System Based on Field and Lab Techniques

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Summary

In this lab , a soil sample was obtained and classified using the unified classification system, using field and lab techniques.

In the first part of this lab moisture content, density, dry density, unit weight and dry unit weight of the soil sample was determined in the Lab.

In the second part of this lab , the liquid limit, plastic limit, and the plasticity index were determined. Field techniques were used in this determination. It was determined by using the unified soil classification system and field techniques that this soil sample is a “OL”. The “OL” indicates that the soil classification is an organic silts and organic silt-clays of low plasticity.

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Introduction

Part 1:

The objective of this part of the lab is to collect a soil sample off-site from the Niagara College campus. The in-place moisture content, density, dry density, unit weight and dry unit weight of the soil sample will be determined in the Lab using lab techniques.

Part 2:

The objective of this part of the lab is to classify the soil using field techniques. This technique is used quite often in the field as a quick classification method . This method is not as accurate as lab techniques. This method can be performed without any equipment and will give a good indication if further testing is necessary.

Theory

In this lab we classified the soil using the unified soil sample classification charts. There are many different classes in the charts, for instance when picking the soil types to classify it, the soil would go under many categories to find how coarse-grained it is or how fine-grained, the size of the soil particulates, and how clean or graded the soil is.

Coarse-grained soils have more than half of material finer than 3-inch sieve, and is larger than a No. 200 sieve size and more than 50% distinguishable by eye. While fine-grained soils have more than half of material is smaller than the No. 200 sieve size. Visually more than half of the particles are so fine that they cannot be seen by the naked eye, this would classify a fine-grained soil. Sieves are tools used for separating lumps from powdered material, straining liquids and grading particles. Sieves consists of mesh perforated bottom through which the material is shaken or poured. Sizes of the soils are determined by the type of soil for instance gravel is more than half of the coarse soils and larger than the No. 4 sieve, about ¼ inch. Clean gravels have less than 5% of the material smaller than the No. 200 sieve size. Well graded gravel have a wide range in the grade size and substantial amounts of all intermediate particle sizes while poorly graded gravel is predominantly one size with some intermediate sizes missing. Sands are more than half of the coarse fraction is smaller than the No. 4 sieve, while clean sands has less than 5% of the material is smaller than the No. 200 sieve. Well graded sands range in grain sizes with little or no fines, while poorly graded sands are gravelly sands and predominantly one size with some intermediate sizes.

Field classification using the Unified System should lead to the same results as laboratory classifications. For coarse soils the percentage sizes are simply estimated for field classifications. The coarse soil should be spread on a flat surface, the coarse soil will be seen with the naked eye without any magnification. Subsequently a fine soil will be identified in the field by 50% of the weight is visually indistinguishable by the particles found in it. It is important to know that aggregates are often classified as sands or gravels in the field, because of they are fine particle sizes. Coarse soils are easily distinguished between sand and gravel by the passage percentage on the No. 4 sieve, for field classification, ¼-inch particle seizes are generally used. Clean sands and gravels have less than 12% fines have a graduation designation W or P assigned, depending on whether a wide range of particle sizes is represented by one or two sizes predominant.

Procedure

Refer to Materials II Civil 1356, Lab 1 – Soil Collection Lab

Refer to Materials II Civil 1356, Lab 2 – Field Classification of Soils

Observations for lab 1

The 8873.6 cubic centimeter sample has a mass of 19.68 Kg. including the mass of the bag (123.7g) was obtained from 4920 Lister Rd, Beamsville, ON.

Figure 1-01 – Dig Area

Table # 1: Summary of Calculations

Moisture Content	**13.0884 %**
Wet Density	**0.2204 kg/m**
Wet Unit Weight	**137.5 lb/ft^3**
Dry Density	**1949 Kg/m^3**
Dry Unit Weight	**121.6 lb/ft^3**

Table #2: Data from Field Testing

Visual Test	**Fine Grained**
Organic Smell Test	Organic
Grittiness Test	Clay-Silt
Stroke/Shine Test	Dry/None Shine
Toughness Test	Does not roll into 3mm
Dry Strength Test	Difficult to break

Unified classification chart

Fine-grained soils. (More than half of material is smaller than No. 200 sieve size.) (Visual: more than half of particles are so fine that they cannot be seen by naked eye.)	Silts and clays. (Liquid limit less than 50.)	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.	Atterberg limits below "A" line, or PI less than 4.	Atterberg limits above "A" line with PI between 4 and 7 is borderline case ML-CL.	None to slight	Quick to slow	None
	... do ...	CL	Inorganic clays of low to medium plasticity; gravelly clays, silty clays, sandy clays, lean clays.	Atterberg limits above "A" line, with PI greater than 7.		Medium to high	None to very slow	Medium
	... do ...	OL	Organic silts and organic silt-clays of low plasticity.	Atterberg limits below "A" line.		Slight to medium	Slow	Slight

Figure 4.3 Unified Classification System, Fine-Grained Soils (after NAVFAC DM)

Table 3

Pictures of hole were soil sample was taken

Figure 2-01 – Measurement of un-dug hole

Figure 2-02 – Measurement of Topsoil Dug

Figure 2-03 – Full Depth Measurement

Figure 2-04 – Above Full Depth Measurement

Observations for lab 2

- Coarse soil fraction: 0% coarse found
- The vast majority of the soil particles were smaller than ¼" or 6mm, thus classified as a sand.
- 3 test results
    - 1 was reaction to shaking
    - 2 was rolling test
    - 3 dry test and try to break

1. Result for reaction to shaking was quick to slow. This means that while shaking the sample the water came to the surface quite quickly .

2. Result for the rolling test was slight. The sample was not able to be rolled, and did not make the 3 mm diameter thickness that is required for this test.

3. Result for the dry strength test was medium to high. These particular samples were very strong and difficult to break. At times the samples were mistaken for aggregate.

Discussion of Results

During this lab experiment two techniques were used lab and field to classify a soil sample. Using field techniques a grain size was obtained, a stroke/shine test, a grittiness test, dilatancy, toughness, dry strength were performed. Using these test results and the unified soil classification system charts the soil was classified. It was observed visually that the soil was almost 100% fine. It had the smell of an organic soil, and with the grittiness test it felt silty-clay, The stroke shine test resulted in no shine, and in the dilatancy test resulted with the water appearing quickly on the soils surface. This data was previously reported in the unified soil collection chart (see table 3.) The soil was classified as “ol” meaning it met all conditions for an organic silt.

Conclusion

From these labs the following may be concluded:

1. For field techniques, the soil has been studied and concluded that it is type “OL” organic silt. Taken from 4920 Lister Rd, Beamsville.
    a. “OL” indicates that the soil is organic silt, meaning the soil contains silty-clay of low plasticity. The soil has high strength in its dry state, yet brittle in a wet form.

Submitted by: _____