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Soil Type Determination of Remolded Soil Samples from Indang, Amadeo, and Naic, Cavite by Performing Direct Shear Test

Roberto E. Tabal

Faculty, College of Agriculture, South Cotabato State College, Isulan-Banga Rd, Surallah, South Cotabato

INTRODUCTION

Soil type is a technical term of soil classification, the science that deals with the systematic categorization of soils. Most soil in the Philippines is composed of a combination of clay, silt, sand, and humus at different ratios.

The direct shear test is the oldest test method for determining soil shear strength at a given normal stress. It is based on forcing the sample to fail along a predefined plane while being subjected to nor-mal load. This gives a direct measure of the shear force capacity at specific conditions and enables determination of the angle of internal friction and cohesion.

Since we can compute for the angle of internal friction by plotting the normal stress vs the shear stress, hence the direct shear test can be used as a method to determine the type of soil based on the angle of internal friction characteristics of a particular soil type.

OBJECTIVES

- To measure the shear strength of the Clay soils from Indang, Amadeo, and Naic, Cavite
- To Plot the Normal Stress vs the Shear stress and compute for the Angle of Internal Friction.
- To determine the soil type of the samples by considering its Angle of Internal Friction.

MATERIALS AND METHODS

- Soil samples from Indang, Amadeo, and Naic, Cavite were used in the Study.
- Prepare the selected soils to be use in the test.
- Assemble the shear box and connect the load cell to the amplifier with multi-tester meter.
- Place the sample in the shear box and insert the block on top of the box.
- Apply normal load to the sample on top of the box.
- Apply shear force by manual cranking slowly the device until failure occurs.
- Record the data displayed on the multi-tester meter.
- Compute the gathered data. Find the nominal normal stress

- Compute for maximum horizontal shear force, then solve for maximum shear stress, τ (kPa)
- Plot the normal stress & shear stress then measure the slope of the line to read the angle of internal friction (φ)

Fig. 1 Soil Samples from Indang, Amadeo, and Naic, Cavite

Fig. 2 Direct Sheer Apparatus for Experiment

RESULTS

Table 1. Normal and Shear Stress reading of Soil Samples for every Normal Load/stress setting.

Soil Sample	Normal Stress	Shear Stress
	(kPa)	(kPa)
Indang	16	95
	31	117
	59	129
	86	106
Amadeo	16	98
	31	157
	59	122
	86	148
Naic a	31	75
	86	101
Naic b	31	111
	86	150

The maximum shear stress reading for Indang, Amadeo, Naic a, and Naic b samples were 129, 157, 101, and 150 kPa respectively. All of which have normal stress setting of 59, 31, 86, and 86 kPa respectively.

As we observed, the Normal stress required to attain a maximum shear stress varies significantly for clay soils due to its physical components of the soil such as the silt-clay-loam ratios.

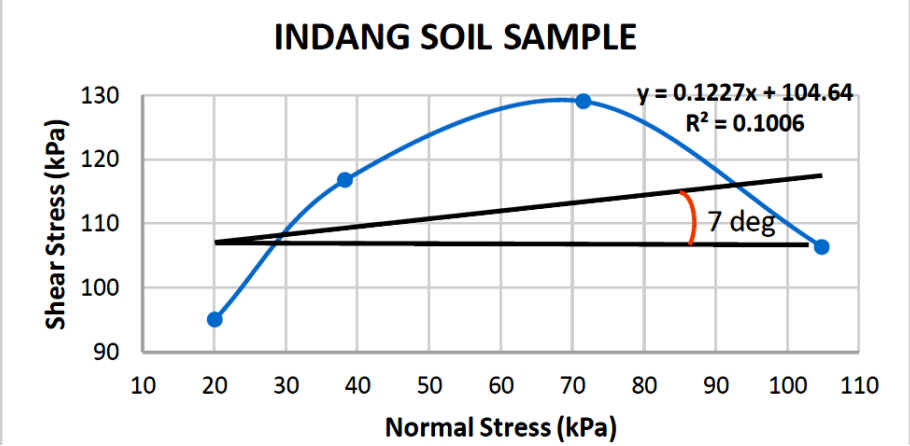

Fig. 3 Slope of the internal friction through the relationship of normal and shear stress of Indang Soil sample.

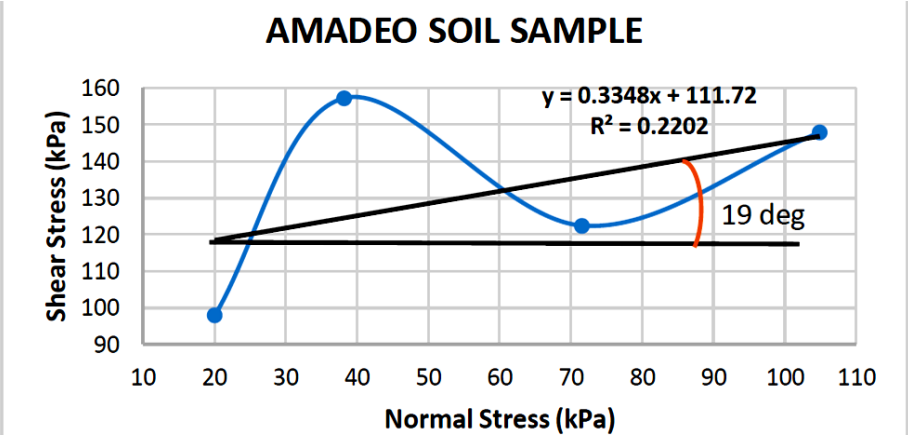

Fig. 4 Slope of the internal friction through the relationship of normal and shear stress of Amadeo Soil sample.

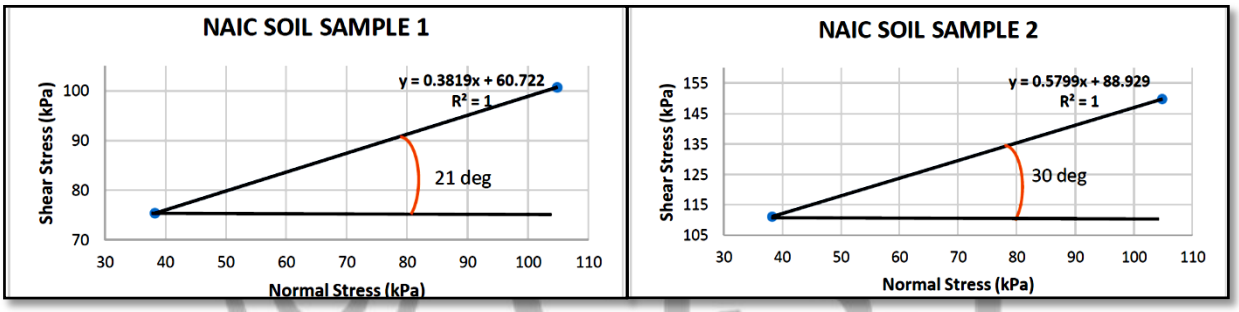

Fig. 5 Slope of the internal friction through the relationship of normal and shear stress of Naic a and Naic b Soil sample.

Table 3. Determination of the Soil type based on its Angle of internal friction φ.

Soil Sample	Angle of Internal Friction φ (deg)	φ Range (deg)	Source	Remarks
Indang	7	5 to 10	elibrary.asabe.org	Pure clay
Amadeo	19	15-30	(Lindeburg 2001; Koloski et al. 1989)	Silty Clay Loam
Naic a	21	20-30	(Lindeburg 2001; Koloski et al. 1989)	Clay
Naic b	30	20-30	(Lindeburg 2001; Koloski et al. 1989)	Clay

CONCLUSION

- The Direct Shear test can be used as an alternative method of de-termining the Soil type of soil samples.
- The Direct Shear test is an economical method of determining soil parameters since it can both determine the soil shear strength and the soil type compared to other existing methods that only yields the soil texture of soil sample (hydrometer method, The pi-pet method, Feel method, etc.).

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