Lecture Notes in Civil Engineering

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Proceedings of the 5th International Conference on Geotechnics for Sustainable Infrastructure Development

GEOTEC2023; 14–15 Dec; Hanoi, Vietnam

Springer

Lecture Notes in Civil Engineering

Volume 395

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Use of SWC-050 for Measuring Soil–Water Characteristic Curves

Thi Phuong An Tran, Delwyn G. Fredlund, and Tran Thanh Nhan

Abstract The determination of the SWCC is pivotal to the estimation of unsaturated soil property functions. These functions can be used for numerical modeling of seepage and shear strength applications in geotechnical engineering. A recently developed SWC-050 pressure plate apparatus by GCTS is a welcomed laboratory apparatus that needs to be evaluated for its ability and efficiency in measuring the SWCC on a variety of soil types. This paper presents the results of an evaluation of the functionality of the SWC-050 apparatus. The unit consists of 3 pressure plate cells and 1 air pressure control system. The amount of water removed from the soil under each air pressure application is monitored by weighing each of the pressure plate cells once equilibrium conditions have been achieved. The features of the equipment are presented along with an example laboratory data set Measured on a loose sand.

Keywords Unsaturated soils · Matric suction · Soil–water characteristic curves · Air-entry value · Residual conditions · Pressure plate apparatus

1 Introduction

The determination of the drying branch of the soil–water characteristic curve (SWCC) has become the focal point for the implementation of unsaturated soil mechanics into geotechnical engineering practice. The most common steps have generally involved the laboratory measurement of the drying water content versus soil suction which is then converted to degree of saturation versus soil suction [2]. The degree of saturation

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P. Duc Long and N. T. Dung (eds.), *Proceedings of the 5th International Conference on Geotechnics for Sustainable Infrastructure Development*, Lecture Notes in Civil Engineering 395, https://doi.org/10.1007/978-981-99-9722-0_167

5 Conclusions

The SWC-050 pressure plate apparatus has advantages over devices that have been previously designed and manufactured with agricultural applied in consideration.

- It is advantageous to be able to test independent soil specimens and not need to remove the soil from the pressure plate device for weight measurements.
- The applied pressures in the pressure plate cells are maintained in each cell while it is detached for weighing.

6 Recommendation for Further Studies

The testing protocols when using the SWC-050 pressure plate for the measurement of clay soils will vary from the protocol for testing sand soils. Further studies need to be undertaken regarding testing undisturbed and/or compacted (or remolded) clay soils. It must also be recognized that the laboratory testing protocols used in agricultural applications also differ somewhat from those that are best suited for geotechnical engineering applications. For example, the degree of saturation SWCC (*S*-SWCC) should be used to determine the air-entry value and the residual conditions in geotechnical engineering applications.

- It is important to standardize laboratory testing protocol, particularly for establishing the initialization stress state condition.
- The time required for stress state equalization conditions is dependent on the soil type. It is possible that less than 2 days are required for equalization to be achieved for sand soils. On the other hand, more than 2 days may be required for equalization to be achieved for clay soils. Guidelines for testing protocol should be studied with the characteristic features of the SWC-050 device in mind.
- It is possible that an improved methodology could be devised for absorbing excess moisture from the base of the pressure plate cell prior to weighing the cell.

Acknowledgements The study is partial support from the Natural Sciences and Engineering Council of Canada, RGPIN 3787-2013 to the University of Saskatchewan, Saskatoon, for research into Implementation Techniques for Unsaturated Soil Mechanics. The first author acknowledges the partial support of Hue University under the Core Research Program, Grant No. NCM.DHH.2018.03.

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