Suction Kinetics in Compacted Soils Using a Tensiometer

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Abstract: In this study, relationship between the soil suction and time in compacted clay soils (standard proctor) with 90% of optimum moisture content was were investigated. The Suction pressure reached a stable value in 24 hours. The soil suction kinetics was represented using a hyperbolic model.

1. Introduction

Prediction of moisture suction in the unsaturated soil zone located near the ground surface is essential for numerous problems in geotechnical, geoenvironmental, and transportation engineering. The movement of moisture in soil is fundamentally governed by flow in response to a gradient in hydraulic head. In the case of unsaturated soils, this gradient is described in terms of soil suction, which is in turn dependent on the moisture content of the soil through the soil-water characteristic curve (SWCC). Therefore studying the behavior of the soil in the active zone based on the suction pressure gives better understandings of the soil behavior (Bulut, 1996). Many studies have used tensiometer suction measurement to monitor the soil suction at various sites (Cui et al. 2007).

2.Objectives

The objective of this study was to investigate the soil suction pressure in the compacted clay soils at 90% of OMC% using a 2100F Soilmoisture Tensiometer probe. Also modeling the suction change with the time in compacted clay soils was modeled.

3. Methods and Materials

The 2100F Soilmoisture probes were calibrated before using for suction measurements. Two compacted soil samples of Bentonite and Kaolinite at 90% of OMC% on standard compaction curve were tested. Fig. (1). the soilmoisture probes were installed horizontally in the middle of the compacted samples which were placed and sealed in plastic bags. Suction pressures are measured at room temperature with time for over two days.

4. Analysis

Hyperbolic relationship model between soil suction versus time was investigated. Based on the inspection of the test data following relationship is proposed. The model parameters in (Eqn.1) and the coefficient of correlation (R) for relationship are summarized in Table 1.

$$\text{Suction (kPa)} = \left(\frac{\text{Time}}{A + B * \text{Time}}\right) \quad \text{..................} \ (1)$$

Table 1. Index Properties, Compacted Properties and Model Parameters for Soils

Soil Type	LL %	PL%	Gs	OMC%	γ_{dmax}, (kN/m^3)	A	B	R
Bentonite	324	43	2.66	38.1	11.5	1.9	0.03	0.99
Kaolinite	47.7	32	2.6	27.4	13.9	0.6	0.02	0.98

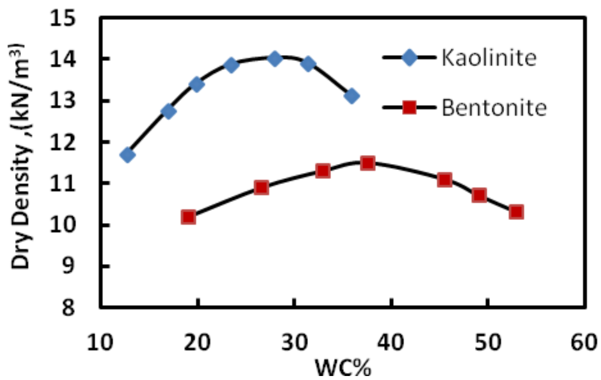

Figure 1. Water Content versus Dry Density

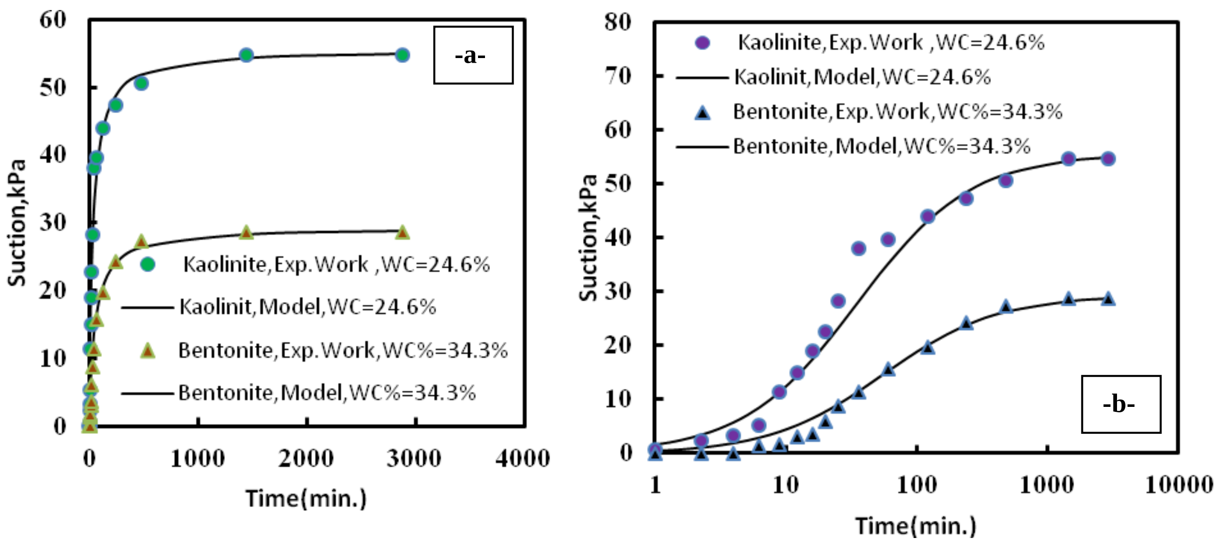

Figure 2.Suction Pressure vs. Time: (a) Normal Axis (b) Logarithmic x-Axis

5. Conclusions

Based on this study on a Bentonite and Kaolinite soil, the soil suction pressure decreased with increasing amount of water content. Also the soil suction pressure stabilized at the end of 24 hours by using 2100F Soilmoisture Tensiometer. A hyperbolic model between soil suction with time was represented.

6. Acknowledgements

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7. References

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