

**A Study on Measuring Methodologies and Critical Parameters  
Influencing Soil Suction-Water Content Relationship**

*Thesis*  
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by

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## Abstract

The knowledge of unsaturated soil behavior is indispensable for many of the field situations such as compacted pavements, swelling clays, slopes, embankments, shallow waste disposal facilities etc. One of the important attributes of unsaturated soil is the negative pore water pressure or soil suction existing in it. The study of unsaturated soil behavior is dependent on the basic relationship between soil suction and water content (either, gravimetric or volumetric) or soil saturation. Such a relationship, in general, is termed as suction-water content relationship (SWR) or specifically soil-water characteristic curve (SWCC). Last few decades have witnessed a tremendous development in soil suction measurement methodologies, which are based on different measuring principles. There is a possibility that the inherent features and measuring procedures of these methodologies may influence the uniqueness of SWR/ SWCC. Apart from the measuring methodologies, there are physical, chemical and mechanical parameters of soil influencing the SWR. Reviewed literature indicates some contrasting observations and anomalies related to unsaturated soil characterization, which needs to be understood in detail.

A systematic experimental work has been conducted in this study to evaluate the influence of suction measuring methodologies, different procedures adopted, and critical soil parameters affecting the uniqueness of SWR. The implication of non-uniqueness of SWR on unsaturated soil behavior is investigated by taking unsaturated soil hydraulic conductivity as an example. For this purpose, the unsaturated soil hydraulic conductivity estimated by using different measured SWRs for a particular soil has been compared and evaluated. Another important issue related to the implementation of unsaturated soil mechanics into routine geotechnical engineering practice is the excessive costs, time and complexities associated with the measurement of high soil suction. To take this into account, the present study attempts to investigate the possibility of standardizing a cost-effective, less time consuming and simple methodology for measuring high range of soil suction greater than 1000 kPa. Moreover, most of the reported studies discuss about drying SWCC due to the simplicity of its measurement. But it must be noted that wetting SWCC is also equally important for situations like seepage through unsaturated soil.

However, it is challenging to experimentally obtain the wetting SWCC. A simple column set up has been used in this study to determine the wetting SWCC.

**Key words:** unsaturated soil, suction, suction-water content relationship, measurement methodology, parameter, unique, unsaturated hydraulic conductivity.