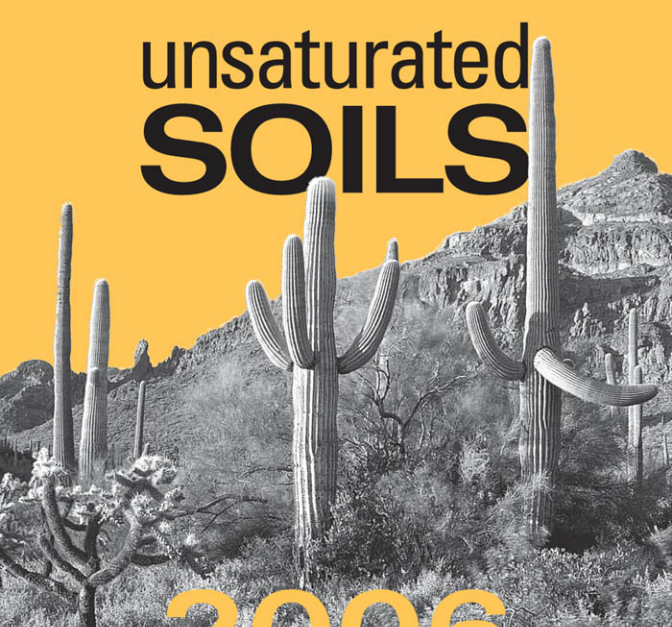
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Preface

Classical soil mechanics emerged in 1943 with the publishing of Karl Terzaghi's book entitled, "Theoretical Soil Mechanics". In 1948, the book titled "Fundamentals of Soil Mechanics" was written by Donald Taylor. These two books defined the context for classical saturated soil mechanics. These books focused on providing geotechnical engineers with the fundamental theories and formulations for three areas of application; namely, saturated flow through porous media, shear strength and its application to earth pressures, bearing capacity and slope stability, and volume change or settlement experienced when loading soft clay soils.

The scope of the application of soil mechanics was largely limited to saturated soils. In addition, moisture flux boundary conditions were not taken into consideration. In most cases an attempt was made to derive closed form solutions for either one-dimensional or two-dimensional characterization of the real world. Volume change problems were considered as a one-dimensional analysis with soil properties obtained from a one-dimensional consolidation test.

The original framework for soil mechanics served well for several decades but it gradually it became obvious that there were important "missing links" that remained outside the scope of soil mechanics. For example, the boundary conditions for a seepage analysis were limited to either a head boundary (i.e., such as water in a reservoir), or a zero flux boundary condition (i.e., such as an impervious soil). These boundary conditions have dominated the theory taught in soil mechanics at universities for many decades. There is a problem with such a limited scope of boundary conditions because we live in a "real world" with a moisture flux boundary condition at the ground surface. The moisture flux is controlled by climatic conditions at the site. Moisture flux boundary conditions become the primary forcing factor for many serious hazard related soil mechanics problems. Consequently, it is necessary to characterize the water balance conditions at the ground surface as well as modeling the infiltration of water into the soil.

Problems associated with expansive soils were the first class of unsaturated soil mechanics problems to be given serious research attention by geotechnical engineers. A series of international conferences were commenced to exchange ideas on how best to deal with expansive soils problems in 1965 at Texas A&M University. A series of conferences followed at approximately 4 year intervals. In the early 1990s it was realized that there would be merit in expanding the scope of problems addressed to include all types of unsaturated soils problems. Environmental engineering problems involving contaminant transport were also of paramount interest and concern. The first International Conference on Unsaturated Soils was held in Paris, France in 1995. This was followed by the Second International Conference on Unsaturated Soils in Beijing, China in 1998 and the Third International Conference on Unsaturated Soils in Recife, Brazil in 2002.

Historically, it is possible to look back and note that several major hindrances lay in the way of an early understanding of how best to formulate a science for unsaturated soil behavior. Most of these hindrances have now been thoroughly researched with the result that practical

engineering solutions have been proposed. It would now appear that it is time to force ahead with a full scale implementation of unsaturated soil mechanics into routine geotechnical engineering practice. The original hindrances that appear to have been sufficiently resolved can be stated as follows:

1.) the theories and formulations associated with unsaturated soil behavior for the classical subject areas have been proposed and verified,

2.) techniques and procedures have been developed for the estimation of nonlinear unsaturated soil property functions,

3.) the central role and importance of the soil-water characteristic curve (SWCC), or the water retention curve, has been realized,

4.) devices for the measurement of soil suction have been developed,

5.) new procedures for the solution of highly nonlinear partial differential equations have been discovered, and

6.) the teaching of unsaturated soil mechanics concepts, principles and solutions is increasingly becoming a part of the undergraduate and graduate teaching curriculum.

The Fourth International Conference on Unsaturated Soils held in Carefree, Arizona, provides yet one more opportunity to bring together researchers and practitioners in unsaturated soil mechanics from around the world. Significant strides have been made in the research of unsaturated soils problems and it is imperative that researchers be provided with a forum for the interchange of research findings and ideas. This is the primary purpose of the Fourth International Conference on Unsaturated Soils.

Each of the papers included in the proceedings received at least one positive peer review. All of the papers are eligible for discussion in the ASCE/G-I *Journal of Geotechnical and Geoenvironmental Engineering*, and all of the papers are eligible for ASCE Awards. Nearly eighty reviewers from around the world participated in the peer review process for abstracts and papers; the editors are sincerely appreciative for the efforts of all the anonymous reviewers. Special thanks go to the following persons for organizing and coordinating paper reviews for the following tracks:

- Evapotranspiration Cover Systems - Craig Benson, Charles Shackelford and Beth Gross (on behalf of the G-I Geoenvironmental Engineering Committee)
- Dynamic Soil Properties and Liquefaction Strength of Unsaturated Soils– Mishac Yegian (on behalf of the G-I Earthquake Engineering and Soil Dynamics Committee)
- Geophysical Methods for Unsaturated Soils – Soheil Nazarian and Michael Rucker (G-I Geophysical Engineering Committee)
- Determination/Estimation of Unsaturated Soil Properties – Claudia Zapata and Sandra Houston (on behalf of the G-I Soil Properties and Modeling Committee).

Delwyn G. Fredlund
Sandra L. Houston
Gerald A. Miller
Claudia E. Zapata

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