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Administrative report of TC6 – Unsaturated soils

Compte rendu technique de la No. CT 6 – Sols non saturés

D.G.Fredlund – *University of Saskatchewan, Canada*

S.L.Houston – *Arizona State University, USA*

1 INTRODUCTION

The vast majority of foundations for structures, dams, pavements, tunnels, and other infrastructure are situated in the vadose zone, whether construction occurs in humid or arid climatic regions. The reason for this is that construction processes below the groundwater table are more complicated and costly, and are therefore avoided when possible. In arid climates construction in the vadose zone is highly dominant, and arid region soils are often characterized by their moisture sensitivity, such as collapsible soils and expansive soils. There is evidence that the design changes between doing typical and doing extensive geotechnical testing and analysis on unsaturated soils can be extremely significant. Therefore, the motivation for implementation of unsaturated soil mechanics into geotechnical practice is great.

Performance of unsaturated soil as an engineering material is strongly related to the changes in moisture content that occur over the life of the structure. Some of these soil moisture content changes occur incidentally (e.g. the filling of a reservoir behind an earth dam) or through natural processes such as precipitation. Other changes in moisture content result from more direct human intervention. Urbanization brings about changes in both surface and groundwater flow. In the last decade a consensus has coalesced around the use of two stress state variables to serve as the key elements in unsaturated soil constitutive equations: net normal stress, $\sigma_n - u_a$, and matric soil suction, $u_a - u_w$. The soil water characteristic curve (SWCC) relates $u_a - u_w$ to the water content or some function of the water content and is thus key to the implementation of unsaturated soil mechanics theory. The importance of the SWCC in estimating unsaturated flow properties as well as shear strength and compressibility of unsaturated soils has been demonstrated.

The international geotechnical community has made substantial recent advances in understanding of the general fundamental aspects of unsaturated soil behavior. The TC6 committee promotes cooperation and exchange of knowledge in the area of mechanics of unsaturated soils, including, as examples, expansive, collapsible, residual, and arid soils, and its relevance to the solution of engineering problems. TC6 activities focus on cooperation with other professional organizations and other technical committees of ISSMGE in dissemination of information about testing of flow, volume change, and shear strength properties for unsaturated soils.

2 COMMITTEE ACTIVITIES

This report on the TC6 begins with the Committee meeting held in Hamburg, Germany, on September 9, 1997, in conjunction with the XIV International Conference on Soil Mechanics and Foundation Engineering. During the Fall of 1997 and the Spring of 1998 a great deal of the energy of TC6 members was focused on the Second International Conference on Unsaturated Soils,

UNSAT'98, which was held at the China Hall of Science and Technology, Beijing, China, August 27 – 30, 1998. This Second International Conference was highly successful and was well attended by the international unsaturated soils community. The TC6 held a committee meeting in Beijing to plan future activities for exchange of knowledge on the mechanics of unsaturated soils.

The recent TC6 Committee activities have been focused on cooperation with other organizations interested in dissemination of information on modern sampling, testing, and modeling methods for unsaturated soils. The committee has been involved in sponsorship and co-sponsorship of several conferences and workshops of interest to researchers and practitioners dealing with unsaturated soil issues.

Conferences and workshops on unsaturated soils developed in cooperation with the TC6 subcommittee during 1999 and 2001 included the following.

1. Short Course on From Theory to Practice of Unsaturated Soil Mechanics, given at the Canadian Geotechnical Conference, Regina, Saskatchewan, Canada, October 23 – 24, 1999.
2. Unsaturated Soils sessions at the XI Panamerican Conference on Soil Mechanics and Geotechnical Engineering, August, 1999, Iguazu Falls, Brazil.
3. NSAT 2000, Fourth International Conference on Unsaturated Soils, September 25 – 27, 2000, Porte Alegre, Brazil.
4. International Workshop on Unsaturated Soils for young researchers, April 1 – 12, 2000, Italy.
5. UNSAT – Asia 2000, May 18 – 19, 2000, Singapore.
6. Seminar on Rainfall Induced Landslides at UNSAT Asia 2000, Singapore.
7. Seminar on Collapsible Soils at UNSAT Asia 2000, Singapore.
8. GeoDenver 2000 Conference, Sessions on Unsaturated Soils, Expansive Clays, and Geoenvironmental Applications of Unsaturated Soils Theory, August 2 – 8, 2000, Denver, Colorado, USA.
9. GeoDenver 2000 pre-conference Short Course on Unsaturated Soils in Engineering Practice USA.
10. NSAT2001, Brazil, March 22-24, 2001.

The 3rd International Conference on Unsaturated Soils is actively in preparation and will be held in Recife, Brazil, March 10 – 13, 2002. This International Conference is a major activity of the TC6 for the years 2000, 2001, and 2002.

In addition to conference and short course activities, significant enhancement of communication amongst those studying unsaturated soils is being promoted through the TC6 web site. The Unsaturated Soils web site can be accessed at www.dur.ac.uk/~des0www4/unsaturated/. The style of the web site is consistent with that of the ISSMGE site. The web site includes information on upcoming events, publications, and communications of interest to those in the field of unsaturated soil mechanics. The activities of the TC6 and minutes from recent

meetings of the committee are posted on the site. The web site is used extensively for timely and meaningful interchange of ideas amongst unsaturated soils researchers. In addition, outreach to other geo-professional is facilitated through the web page.

The TC6 committee will meet in conjunction with the XVth International Conference on Soil Mechanics and Geotechnical Engineering. Also, a discussion session on Recent Developments in Laboratory Techniques for Unsaturated Soils will be held at the XVth ICSMGE, Istanbul, Turkey, August 27 – 31, 2001.

3 TERMS OF REFERENCE

The terms of reference for the TC6 committee were recently modified at a meeting of the TC6 held August 7, 2000, in conjunction with the GeoDenver 2000 Conference, Denver, Colorado, USA. The current terms of references are listed below.

1. To promote cooperation and exchange of knowledge in the area of mechanics of unsaturated soils including, as examples, expansive, collapsible, residual, and arid soils, and its relevance to the solution of engineering problems.
2. To participate actively in the technical program of the next International Conference on Unsaturated Soils.
3. To cooperate actively with other technical committees whose field of activity involves important questions related to unsaturated soils, for example, TC5 on the Geoenvironment, TC25 on Residual Soils, TC11 on Landslides, and TC7 on Tailings.
4. To promote the exchange of information about testing of flow, volume change, and shear strength properties for unsaturated soils.
5. Promote TC6-sponsored sessions on unsaturated soils at ISSMGE International Conferences on Soil Mechanics and Foundation Engineering.

4 SUMMARY

The importance of unsaturated soil behavior has been recognized for decades, but only recently has the theory and testing of unsaturated soils become sufficiently developed to allow implementation of theory to engineering practice. The solution to important problems from contaminant transport to foundation design must take into consideration unsaturated soils. The TC6 committee exists to promote exchange of knowledge in the area of mechanics of unsaturated soils through cooperative activities with other professional organizations and technical committees of ISSMGE. The committee has many successful accomplishments for the past 4 years as well as many exciting future challenges and endeavors.