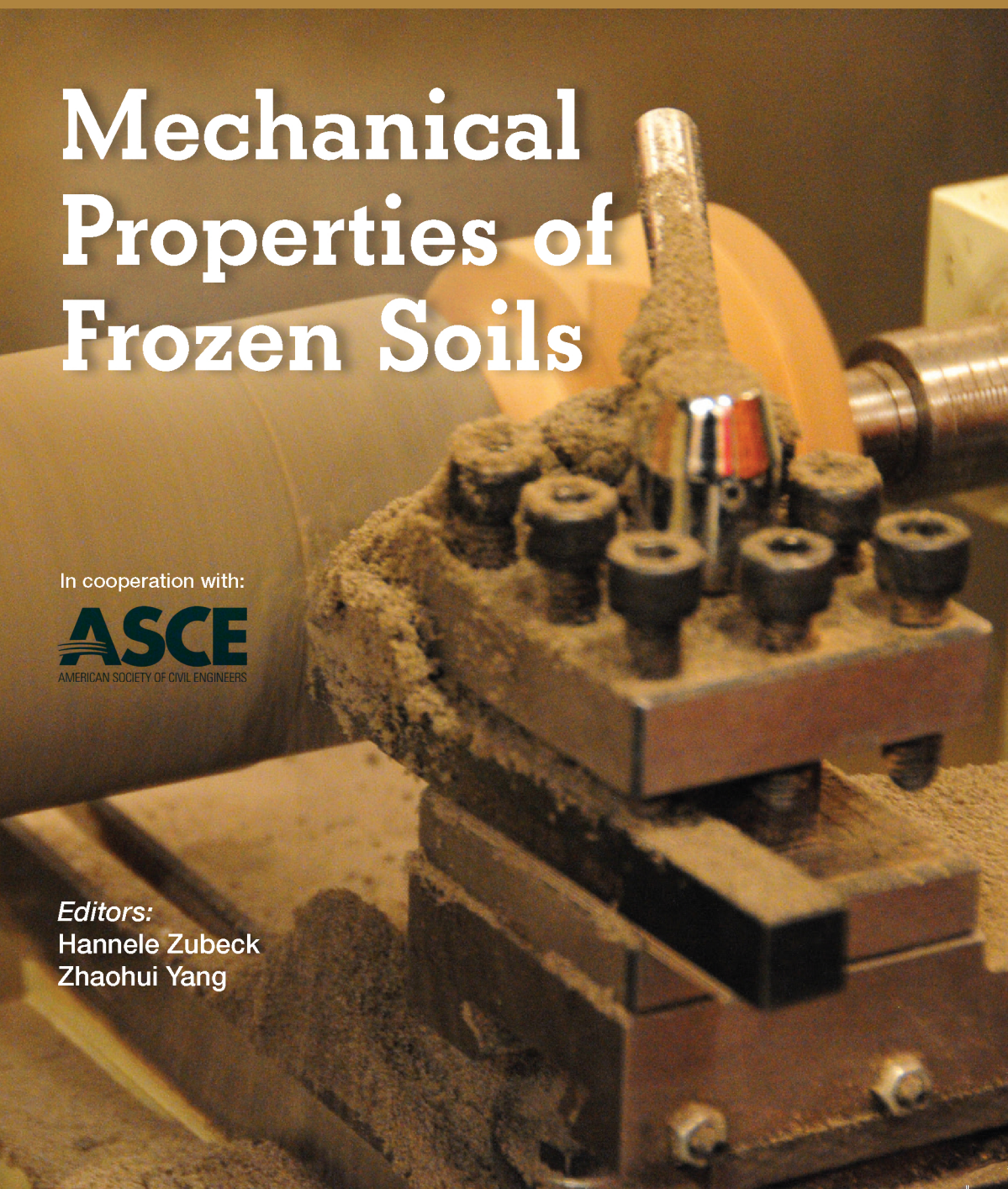
Selected Technical Papers

STP 1568

Mechanical Properties of Frozen Soils



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Foreword

THIS COMPILATION OF *Selected Technical Papers,* STP1568, on *Mechanical Properties of Frozen Soils,* contains peer-reviewed papers that were presented at a symposium held January 31, 2013 in Jacksonville, FL. The symposium was sponsored by ASTM International Committee D18 on Soil and Rock and Subcommittee D18.19 on Frozen Soils and Rock.

The Symposium Co-Chairpersons and STP Co-Editors are Hannele Zubeck and Zhaohui Yang, University of Alaska Anchorage, Anchorage, AK, USA.

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Overview

The ASTM International Committee D18.19 has jurisdiction over seven frozen soil standards, and is considering whether more standards are needed; especially in the area of frozen soil mechanical properties. The symposium offered a forum for the exchange of ideas on current research (nationally and internationally) as it relates to testing of mechanical properties of frozen ground; it also provided a rationale for the various details within new standards for testing of frozen soils.

Thirteen selected technical papers (STP) were submitted for publication and presented at the symposium. These papers portray ideas of authors from Canada, China, Norway, South Korea, Sweden and U.S.A. The papers are divided into four topics: Freeze-thaw Effects on Mechanical Properties, Testing of Mechanical Properties, Mechanical Properties, and Classification and Effects of Mechanical Properties on Performance. In addition, the symposium provided a round table meeting where future needs in the area of frozen soil research were proposed and discussed.

The success of the symposium was due to a large group of ASTM personnel including Mary Mikolajewski, ASTM International Manager, Symposia Operations; Hannah Sparks, ASTM International Administrative Assistant, Symposia Operations; Heather Blasco, Editorial Office, and numerous volunteers who devoted many hours in the planning, implementation and execution of the symposium. The volunteers behind the symposium were D18.96 Symposia Chair Joe Richey, and a large number of paper reviewers from the following volunteer groups: D18.19 members, American Society of Civil Engineer's Technical Council on Cold Regions Engineering, TRB AFP50 Seasonal Climatic Effects on Transportation Infrastructure, International Society on Soil Mechanics and Geotechnical Engineering - Technical Committee on Frost, TC 8, and International Permafrost Association's Permafrost Engineering Working Group. Sincere appreciation is extended to the authors, speakers and moderators for their contributions.

Hannele Zubeck and
Zhaohui Joey Yang

Discussion

Participants of the ASTM International *Symposium on Mechanical Properties of Frozen Soil* discussed two issues during the symposium: the research needs in frozen soil related engineering and frozen soil standard development needs.

One of the pressing problems presented by Chinese researchers is related to the high-speed railway (HSR). In Northeastern China, fine grained soils exist extensively and frost heaving poses a serious threat to the safe operation of newly constructed HSR. In fact, HSR speed has to be reduced from 300 km/h to 200 km/h due to uneven roadbed caused by frost heaving. In Northwestern China, the Qinghai-Tibet railroad was completed in 2005 and has been operating since July 2006. The railroad crosses 630 km of warm permafrost. There are already clear signs (ponds and subsidence of roadbed, etc.) showing degradation of the warm permafrost along the railway. Participants agree that more studies are needed regarding the effectiveness of geophysical methods in detecting permafrost distribution and properties. In addition, participants also felt that engineering practice guidelines are lacking in dealing with warm permafrost and that more research is needed regarding the engineering properties of warm permafrost.

The following standard development needs were listed and the participants recommend that D18.19 considers developing the following standards: Thaw consolidation test, shear stress test, triaxial compression test, unfrozen water content test, segregation potential test, handling-transportation-storage of frozen samples for laboratory testing, and sample preparation for laboratory testing.

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