

# INTERNATIONAL SOCIETY FOR SOIL MECHANICS AND GEOTECHNICAL ENGINEERING



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# ISSMGE/ITC8 International Technical Committee on Frost, Period 2006-2009, Administrative Report

ISSMGE/ITC8 Comité technique international du gel, Période 2006-2009, Rapport administratif

Saarelainen Seppo M I

*Dr, Chairman*

Gustavsson Henry M

*MSc, secretary*

## 1 MEMBERS

Chairman: Dr Seppo Saarelainen, Finland  
Secretary: Mr Henry Gustavsson, Finland

Core Members:

Prof. Takashi. Ono, Japan  
Prof. Sven Knutsson, Sweden  
Prof. J.M. Konrad, Quebec, Canada  
Dr Karen Henry, USA  
Dr Arne Instanes, Norway  
Dr Mathias Vogler, Germany

Other members:

Dr Anne-Lise Berggren, Norway  
Tibor Boromisza, Hungary  
Dr. V.I. Grebenets; Russia  
William.T. (Bill) Horne, P. Eng., USA  
Patrick Lerat, France  
Dr. V.V. Shamov, Kazakhstan  
Prof. K. Skarzynska, Poland  
T. Ishizaki, Japan  
J.F. Thimus, Belgium  
J.I.G. Vardoulakis, Greece  
Sergei Kudryavtsev, Russian Federation

Active "co-members" (participating meetings etc.)

Ted S. Vinson, USA  
Dave Seago, Canada  
Jean Côté, Canada  
Doug Goering, USA  
Hannele Zubeck, USA  
Guy Dore, Canada

## 2 THE TERMS OF REFERENCE AND PLAN OF ACTIVITIES IN THE 6<sup>th</sup> PERIOD (2006-2009) OF ITC8

### 2.1 *Permanent deformations in thawing subgrades under traffic loading*

- Modelling and pre-estimating freeze-thaw
- permanent deformations on pavement during thaw
- investigations and design
- monitoring of freezing and thawing
- cooperation with ISSMGE/ITC 3 on Pavements

### 2.2 *Determination of frost susceptibility*

- frost susceptibility of earth materials
- frost susceptibility of coarse-grained aggregates

### 2.3 *Performance of insulation materials, by-products and waste materials in relation to frost action*

- impact of freeze-thaw on the permeability of soils
- impact of freeze-thaw on geotechnical characteristics of soil
- durability of soil materials in freeze-thaw
- cooperation with ISSMGE /ITC 5 on Environmental Geotechnics

### 2.4 *Influence of climate change on frost action*

- change of freezing index and frost penetration
- change of thaw index and thaw penetration
- length of thaw

### 2.5 *To co-operate with the working group on "Permafrost Engineering" of the International Permafrost Association (IPA) in terms of: "Theory to practice – pertinent to the design of frost heave, freezing and thawing and to construction measures"*

- to support the organising of the next Permafrost conference in Alaska 2008,
- to support the activities of IPA working group on Permafrost engineering

### 2.6 *To arrange the next International Symposium on Ground Freezing and Frost Action in Soils, together with the International Symposium on Ground Freezing (ISGF).*

- to organise together with ASCE and ISGF the next Symposium on Ground Freezing and Frost Action in Soils in Bangor, Maine in the year of 2006.
- to organise together with ISCORD the next International Symposium on Cold Region Research and development (ISCORD) in Tampere, Finland in the year of 2007.

## 2.7 To arrange session/workshop on frost geotechnics in the XVII ICSMFE, Egypt

- together with TC3 and/or TC5 on common themes (geotechnical engineering of pavements, application of waste materials and by-products in geotechnical engineering)

## 3 PLANNING OF ITC8 ACTIVITIES FOR 2006-2009 AND THE OUTCOMING TECHNICAL REPORTS

### 3.1 Mode of work

The International Frost Committee ITC8 was sponsored by the Finnish Geotechnical Society.

TC8 aimed to continue the work listed in Terms of Reference. The goal of TC8 was to promote technical knowledge of freezing, thawing and frost action in soils. Important part of the work also was to create contacts with researchers and institutions in many countries. Participating and arranging conferences handling problems of cold regions was one of the best ways to reach the goals. In these conferences, latest results of research were reported and the progress of the committee work was discussed in the TC-meetings.

ICT8 on Frost aimed to set a task to prepare and publish expert presentations on actual topics in the frost Engineering practice (terms of Reference, points 1-4). Work was organized in work groups that are lead by core members.

The draft presentations were discussed in the meetings of the Committee, and they were to be published in a special session/workshop in the 17th ICSMGE in Alexandria, Egypt 2009.

Committee meetings took place during conferences, which were connected to cold climate and frost, and also discussed on frost aspects in engineering practice. Thus, it was natural and probable that committee members also contributed to the conference program.

### 3.2 Preliminary schedule for ITC8 meetings

- XII International Conference on Cold Regions Engineering (together with American Society of Civil Engineering., International Society on Ground Freezing), July 23-26, 2006 in Bangor, Maine
- International Conference on Cold Regions Research and Development (ISCORD 2007) September 25-27, 2007 Tampere, Finland
- IX International Conference on Permafrost (NICOP), June 29-July 3, 2008 in Fairbanks, Alaska, U.S.A.
- XVII Int. Conf. on SMGE, Egypt 2009

### 3.3 Outcomes of the work

Committee wanted to encourage discussion on frost action in geotechnical engineering. We saw that the task of the committee was not to prepare manuals or standards for wide commercial distribution. We saw it proper to encourage developments in frost engineering and to offer occasions for informal and formal discussion and cooperative efforts to create better understanding on these important engineering issues. Committee aimed to present main findings in its reporting.

## 4 ACTIVITIES COMPLETED AND REPORTED

### 4.1 The meeting in Bangor, Maine

#### 4.1.1 Meeting of ITC8 on Frost

ITC8 organised one meeting in 2006 in Bangor, Maine, USA in July the 26th 2007 during the International Conference on Cold Regions Engineering, organised with The American Society of Civil Engineers (ASCE) and International Permafrost Association (IPA). The Committee meeting was attended by 13 persons, including 5 Committee Members.

#### 4.1.2 The Bangor Conference

The Bangor Conference, the XII ICCRE that took place in Bangor, July 23-26 2006; was attended by about 200 specialists on Cold regions engineering, on a wide professional variation of disciplines, anyhow concentrating mostly on physics of freezing and thawing, earthworks, road engineering, ground freezing and frost geotechnical engineering. The attendants came mostly from USA and Canada, with minor representation from North European countries and Asia.

The Conference was organised in three parallel sets of sessions, each 3-5 presentations. The proceedings was published in CD-format, including 110 professional papers. Members of ITC8 participated in the preparation, organisation and chairing of sessions. The main topics in the terms of reference of ITC8 were discussed in the sessions.

#### 4.1.3 The progress of main findings and the progress of the draft report

In the discussions on terms of reference of TC8 was suggested By Dore and Henry that a common standard description should be prepared to make more comparable the results from various, different procedures to carry out frost-heave tests in the laboratory. Thaw weakening, application and properties of frost insulation materials as well as the impacts of climate change on freezing and thawing were popular topics in the sessions, and discussions will be continued in the next meetings and conferences. It was seen no urgent need to organise "own" conferences, because almost every year international conferences, symposia and meetings are organised by the Cold Regions Engineering-group of ASCE and IPA. The committee meetings are organised in connection to these selected occasions.

### 4.2 The meeting in Tampere, Finland

#### 4.2.1 Meeting of ITC8 on Frost

ITC8 organised one meeting in 2007 in Tampere, Finland in Sept the 26th 2007 during the ISCORD 2007 The Committee meeting was attended by 13 persons, including 6 Committee Members. TC8 was gathered in its meeting in discussing draft texts prepared and further progress.

#### 4.2.2 The 8th International Symposium on Cold Region Development ISCORD 2007

The ISCORD conference took place in September 25-27, 2007 in Tampere, Finland. The symposium was attended by 183 participants from 14 countries, presenting 113 papers from 12 countries in 23 sessions. The symposium was arranged by the Finnish Association of Civil Engineers (RIL) and sponsored by the ASCE, the International Polar Year, the Technical Research Centre of Finland VTT, the International Society of Soil Mechanics and the Geotechnical Engineering / International Technical Committee on Frost, ISSMGE/ITC8. In the symposium, a wide set of presentations dealt with various aspects of living in environments with seasonal frost and permafrost, such as construction and maintenance of

infrastructure, buildings, transport facilities, foundations, materials, as well as safety and environmental aspects, climate change, and education.

#### 4.3 *The meeting in Fairbanks, Alaska*

##### 4.3.1 *Meeting of ITC8 on Frost*

ITC8 organised one meeting in 2008 in Fairbanks, Alaska in June the 29th-July the 3rd 2007 during the Ninth International Conference on Permafrost (NICOP) organised by United States and International Permafrost Association (IPA) with The American Society of Civil Engineers (ASCE) and University of Alaska Fairbanks etc. The Committee meeting was attended by 10 persons, including 6 Committee Members.

The preparation of standards for frost heave tests in the laboratory had been started within CEN (Europe) and ASTM (America). A need and possibility of interaction was seen necessary between these activities. After discussion, the modified segregation potential concept was seen as a most appropriate and applicable model for interpretation of laboratory tests as well as field behaviour and frost heave design.

##### 4.3.2 *The IX International Conference on Permafrost, June 29- July 3, 2008*

From June 29 to July 3, 2008, approximately 700 participants representing 31 countries convened at the University of Alaska Fairbanks for the Ninth International Conference on Permafrost (NICOP). “Permafrost on a Warming Climate: Impacts on Ecosystems, Infrastructure and Climate” was the theme of the Conference. Five plenary sessions (20 presentations) and 40 concurrent oral sessions (approximately 200 presentations) and three, all-day poster sessions (306 posters formally scheduled) covering over 40 subject areas were presented during five days.

Publications included a two-volume set of 358 papers (2140 pages), an enclosed CD-Rom of the papers, and a volume of 187 extended abstracts and IPA reports (372 pages). A special issue of the journal *Permafrost and Periglacial Processes* (PPP) was produced for distribution at NICOP and contained eight summary papers, several of which were the topic of plenary reports. A DVD was produced and distributed to all participants that contained the proceedings of all nine International Conferences on Permafrost.

## 5 ACTIVITIES AT HAND AND TO BE COMPLETED

### 5.1 *Standard procedure for frost heave testing in the laboratory*

The CEN Task Group for preparing a proposal for the standard frost heave testing of bound and unbound aggregates discussed in the spring of 2009 in three meetings, and concluded that according to current national procedures cannot be harmonised. The basic reason was obviously the lack of commonly approved theory of ice lensing in the freezing soil, and the variability of application of test results in practice.

A similar working group was active within ASTM. It was obvious that a basic discussion on the theory and modelling of frost heaving was needed within the scientific community to create sound background for different national approaches, and for different technical applications, eg. frost durability, strength loss of materials in freezing, thaw weakening of frozen, frost-susceptible materials etc. This discussion could be continued within a new TC8 on Frost in ISSMGE

### 5.2 *The meeting in Alexandria, Egypt during ICSMGE, Oct 3th, 2009*

ITC 8 on Frost will organise the final meeting of period 2006-2009 in Alexandria, Egypt, during the XVII ICSMGE.

After the meeting, a special session on Frost Action on Soils will be organised. The discussion will be preceded with 4-5 presentations. Written papers will be published on the web-pages of the Committee after the conference.