Annual Report of IAEG Commission IAEG C 21 Engineering Geology for Development in Permafrost Regions

The INTERNATIONAL ASSOCIATION FOR ENGINEERING GEOLOGY AND THE ENVIRONMENT

1) Chair persons

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2) Aims and key objectives of the Commission

Aim of this IAEG Commission:
To develop new methodologies for risk assessment and geohazard evaluation in permafrost regions.

Key objectives of the Commission :
1. Review and collect examples of risk assessment and geohazard evaluation in permafrost regions.
2. Develop new methodologies for risk assessment and geohazard evaluation in relation with permafrost change.
3. Document new methodologies and guidelines for permafrost mapping related to engineering geology goals.
4. Network with practitioners and academics with an interest in permafrost problems world-wide.
5. Develop and maintain a dedicated area within the IAEG web site.
6. Present a comprehensive report at 2010 IAEG Congress.

3) Most recent meeting of the Commission

In 2008 and 2009, the Commission held the following meeting :
Ninth International Conference on Permafrost, Fairbanks, Alaska USA June 29 – July 3, 2008 (The special plenary session "Engineering Challenges in the 21st Century" (Chair: Kaare Flaate) consolidated reports about rationalizing climate change for design of structures on permafrost (D.W. Hayley and B. Horne), recent advances in permafrost geotechnics (S. Springman and L.U. Arenson), russian approaches to permafrost engineering (G. Perlshtein) and innovative designs for warm permafrost construction exemplified by the Qinghai-Tibet Railway (C. Guodong, M. Wei, and W. Quinbai)).
The joint initiative "Engineering geology for development in permafrost regions": Commission 21 in IAEG jointed with IPA subcommission was established.

4) On going research

Reviewing and collecting examples of risk assessment and geohazard evaluation in permafrost regions

5) Output and publications

Proceedings of the Ninth International Conference on Permafrost
University of Alaska Fairbanks, June 29–July 3, 2008
Edited by Douglas L. Kane and Kenneth M. Hinkel
Volume 1, 2
Institute of Northern Engineering
University of Alaska Fairbanks
2008

p.p.279-284

A Multi-Disciplinary Approach to Assess the Impact of Global Climate Change on Infrastructure in Cold Regions (Jim Clarke, BP Exploration, Sunbury, UK; Clark Fenton, Imperial College, London, UK; Antonio Gens, Universitat Politecnica de Catalunya, Barcelona, Spain; Richard Jardine, Chris Martin, David Nethercot, Imperial College, London, UK; Satoshi Nishimura, Port and Airport Research Institute, Yokosuka, Japan, formerly Imperial College, London, UK; Sebastia Olivella, Universitat Politecnica de Catalunya, Barcelona, Spain; Catherine Reifen, Paul Rutter, Fleur Strasser, Ralf Toumi, Imperial College, London, UK).

Imperial College London is researching with BP some potential impacts of future climate change. BP has a significant number of facilities in cold high-latitude regions, where global climate models predict significant rises in air and ground surface temperature. This could impact on the state and extent of permafrost, potentially posing risks to facilities, infrastructure, and operations (ACIA 2005). The paper reviews the research, focusing on an exemplar study region in eastern Siberia. The key elements included: (1) Developing an approach to provide a best estimate of future
climate change. (2) An engineering geological appraisal of the ground conditions in the study region. (3) Performing a parametric study of geothermal conditions in the study region using finite element thermal analyses. (4) Developing a Thermal-Hydraulic-Mechanical modeling approach for assessment of climate change impact on specific engineering facilities. (5) Developing a methodology for incorporating potential climate change considerations into engineering decision-making and design.

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p.p.445-450

Permafrost in Marine Deposits at Ilulissat Airport in Greenland, Revisited (Niels Foged Arctic Technology Centre, Department of Civil Engineering, Technical University of Denmark, DK-2800; Kgs. Lyngby, Denmark; Thomas Ingeman-Nielsen, Arctic Technology Centre, Department of Civil Engineering, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark).

Ilulissat Airport was constructed in 1982 to 1984 after detailed geotechnical investigations as the construction site included up to 12 m thick basins of marine clay deposits. Despite soil temperatures of approximately -3°C the soil appeared unfrozen from 4 m to 5 m below ground surface due to a high residual salt content in the porewater. However, in the less saline top zone massive ice layers were found constituting up to 30% by volume. These formations, representing a typical example of saline permafrost, caused the planned position of the runway to be shifted towards the northwest and the layers to be removed and replaced with compacted blasted rock fill. However, a test fill of 2.5 m of rock fill and coarse gravel was constructed in the abandoned area in order to establish experiences for future constructions. Background, previous findings, and present activities are also topics in an accompanying paper, Ingeman-Nielsen et al. (2007).

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p.p.845-850

Identification and Mitigation of Frost Hazards Along the China-Russia Oil Pipeline (Huijun Jin, Jianming Zhang, QihaoYu, Yu Sheng, Zhi Wei, Guoyu Li, Yanjun Ji, Ruixia He, Lanzhi Lu, State Key Laboratory of Frozen Soils Engineering, 326 W. Donggang Rd., Lanzhou, China 730000; Jiaqian Hao, Youchang Chen, Wei Wu, Yimin Zhao, Daqing Oilfield Engineering Company, PetroChina Corporation Limited, Daqing, China 163712).

The China-Russia oil pipeline is designed to transport 603,000 barrels of Siberian crude oil per day using a buried pipeline 914 mm in diameter across 1030 km of permafrost and seasonally frozen ground. Construction was scheduled to be between March 2008 and August 2009. The design was significantly challenged by differential frost heaving and thaw settlement. About 500 boreholes to depths of 5 to 20 m were drilled and cored for analyses, and frozen ground conditions were evaluated. Conventional burial construction modes were adopted after detailed surveys and analyses of permafrost conditions along the pipeline route. Permafrost forecasts, thermal and strain/stress analyses, measures to mitigate frost hazards, and a design for long-term monitoring and early detection of developing frost hazards were conducted. Mitigative measures using excavation and backfill of non-frost-susceptible soils, insulation, and drainage control were proposed and adopted. A review of the engineering activities and measures undertaken to address these concerns is presented herein.

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Ninth International Conference on Permafrost
Extended Abstracts
Edited by Douglas L. Kane and Kenneth M. Hinkel
Institute of Northern Engineering, University of Alaska Fairbanks, 2008

Low-Frequency Sounding During the Gas Line Engineering Investigations in the Area of the Transition Through Baidaratskaya Bay. A.V. Koshurnikov, Yu.D. Zykov, and Yu.V. Kulehsov

Preservation of the Alaska Highway. Eva Stephani, Daniel Fortier, Yuri Shur, Guy Dore, Bill Stanley.

Engineering Effect on the Thermal Status of Shallow Ground in Permafrost Regions. Zhi Wen, Yu Sheng, Wei Ma, Qingbai Wu, Bo Huang.

6) Future plans of the Commission

Tasks	Type of product	Deadline	Presentations	Responsible persons
Review and collect examples of risk assessment and geohazard evaluation in permafrost regions.	Oral report (literature review) Illustrated list of geocryological risk assessment examples	June 2009 "Active report" (eventually expanded)	International Symposium: Geological Engineering Problems, Sep 9-11, 2009 Chengdu, China IAEG Web-page	Each national representative
Develop new methodologies for risk assessment and geohazard evaluation in relation with permafrost change	List of Geocryological Hazards in connection with type of engineering structure List of current Master and PhD references (developed methods and actual investigators)	"Active report" (eventually expanded) "Active report" (eventually expanded)	IAEG Web-page IAEG Web-page	Each national representative Each national representative
Document new methodologies and guidelines for permafrost mapping related to engineering geology goals	Review of actual norms and guidelines for permafrost mapping	2012 Tyumen, Russia	The 10th International Conference on Permafrost	Each national representative
Develop and maintain a dedicated area within the IAEG web site	Put on the Web-page the files: 090309-IAEG-C21-ToR.doc Comm21-Minutes-Fairbanks2008.doc Comm21-Minutes-Fairbanks2008.doc	June 2009	—	D.Sergeev
Present a progress report at 2010 IAEG Congress	Electronic and paper report	June 2010	The 11th Congress of the International Association for Engineering	D. Sergeev

			Geology and the Environment. (IAEG2010)	
Participation in preparation of the next version of CAPS CD's	High-level list of the type of data our commission/working subgroup might contribute	2012 Tyumen Russia	The 10th International Conference on Permafrost	Each national representative
Present a report at 2012 IPA Conference	Electronic and paper report with reference of subgroup related items (literature and Internet-links)	2012 Tyumen Russia	The 10th International Conference on Permafrost	D. Sergeev K. Flaate

7) Other relevant information

8) Contact details of other members of the IAEG Commission

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