ADMINISTRATIVE REPORT OF TC-34 ON PREDICTION AND SIMULATION METHODS IN GEOMECHANICS

F. Oka
Chairman of TC-34, Graduate School of Engineering, Kyoto University, Japan
A. Murakami
Secretary of TC-34, Graduate School of Environmental Science, Okayama University, Japan

ABSTRACT: This note contains the information concerning the activities of TC34 on the Prediction and Simulation methods in Geomechanics in the period 2005-2009 in form of an administrative report to the secretary general of the ISSMGE.

1. INTRODUCTION

In the last two decades prediction methods for the behavior of geomaterials have been greatly developed based on the ongoing research on constitutive models, numerical analysis methods and recent advances on calibration, verification and validation by experiments and of field data measurements. Nowadays computational methods are indispensable tools in geotechnical engineering although more use is expected by practitioners.

There are several issues, which are related to large deformation and failure in geomechancis, such as: a) Modeling (constitutive modeling and calibration; modeling of mechanical instabilities, strain localization and progressive failure; modeling of chemo-thermo-hydro -mechanically coupled phenomena). b) Verification and validation of the used methods. c) Development of more stable and accurate numerical methods. d) The promotion of exchange between academic and practicing engineers, members of the Society.

The importance of these developments were recognized by the Technical Committee 34 of ISSMGE on 'Prediction and simulation methods in geomechanics' which was established 2005 after the Osaka conference as a continuation of the previous one on Prediction methods in large strain geomechanics.

This is an administrative report on TC-34 of ISSMGE activities for the period 2005-2009. First of all, the objective and terms of reference, and the members of TC-34 including those of Japanese supporting committee are introduced. Then, the activities by TC-34 during this period are summarized. Finally, the future prospects for TC-34 including their topics and activities are presented.

2 TERMS OF REFERENCE

Terms of reference for the TC-34 are shown as follows:

1) Prediction of mechanical and thermo-hydro-mechanical instabilities: Large deformations, strain localization, progressive failure, liquefaction, ground water flow analysis with contamination, temperature dependency, erosion and rapid flow of complex geo-fluids.
2) Advanced and comprehensive constitutive modeling of Geomaterials including: elasto-plasticity, viscoplasticity, hypo-plasticity and cyclic plasticity, soil degradation, strain softening, rate dependency and anisotropy.
3) Development of advanced prediction methods based on new numerical and analytical techniques, such as the Mesh-free Method, BEM, SPH and MPM etc.
4) Numerical implementations and constitutive parameter determination using laboratory and field test results. Inverse analysis and upscaling, homogenization of the inherent local heterogeneity of Geomaterials.
5) Critical evaluation of existing prediction methods such as empirical methods, elastic, simplified elasto-plastic analysis and limit analysis etc., by comprehensive numerical analysis methods.
6) Transfer of knowledge and training activities; Promotion of technology transfer including new findings to the practicing engineers of the Society, that address important issues, including natural hazards. Promotion of exchanges between academic and practical members (i.e. industry second mends of young academic researchers on practical issues and continued education and training of experienced engineers on existing applicable and comprehensive methods and new findings).

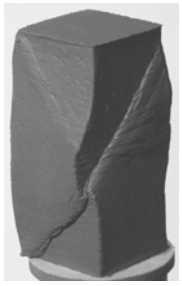

Photo 1. Picture of shear bands after CIU test and breaching of river embankment due to heavy rains.

3 MEMBERS AND SUPPORTING COMMITTEE

A well-selected international group of experts were appointed as responsible members of this committee based on the candidates recommended by ISSMGE member's societies, presided from 2001 to 2005 by Prof. F. Oka of Kyoto University as the Chairman and Prof. A. Murakami of Okayama University as the Secretary, who were finalized by the ISSMGE President. List of members are shown in the APPENDIX. TC-34 has also set up the supporting committee in the framework of the Japanese Geotechnical Society (JGS) in order to enhance the activities of TC-34. The members of Japanese Supporting Committee are also listed in the APPENDIX.

Proceedings of the 17th International Conference on Soil Mechanics and Geotechnical Engineering
M. Hamza et al. (Eds.)

doi:10.3233/978-1-60750-031-5-3781

4 REVIEW OF ACTIVITIES

4.1 TC-34 Website and Newsletters

TC-34 homepage has been constructed at the site below and all the formal information and the activities have been updated in this website.
http://nakisuna2.kuciv.kyoto-u.ac.jp/tc34/index.htm

Newsletters have been issued via e-mail. During the period of 2005-2009, a total of 12 newsletters were published.

4.2 TC34 meeting and workshop during the 14th ECSMGE, Sep. 2007 in Madrid

TC34 Meeting and workshop was held from 14:15 to 16:00 on September 26, 2007 at Room #9 bis, the Palacio de Congresos y Exposiciones - Madrid, Spain.

PRESENTATIONS:

1) 'Beyond failure in geomaterials: flow of fluidized geomaterials. Applications to wave generated by landslides': M. Pastor (CEDEX, Spain)
2) 'Modelling of Trevoux and Petacciato landslides by the second order work criterion': F. Prunier, S. Lignon and F. Darve (Laboratoire 3S, France)
3) 'The influence of faulting on existing underground excavation': A.Cividini (Politecnico di Milano, Italy)
4) 'Monitoring system and remiedial works for the large scale slope failure in Gifu, Japan': K. Sawada and A. Yashima (Gifu University, Japan)
5) 'Bearing capacity and displacements on non rotating surface footing on a layered medium': K. Papantonopoulos and G. Moulious (University of Patras, Greece)

DISCUSSIONS on the presentations and ' Future activity of TC34': F. Oka (Kyoto University, TC chair)

Details of the above workshop can be seen in ISSMGE Bulletin, Vol.1, Issue 4 published December, 2007.

4.3 Meeting during the 8th IWBIDG

THEME: Future activities
DATE: May 28-31, 2008
PLACE: Lake Louise Canada
ATTENDEE: F. Oka, R. Nova, F. Darve, H.-B. Muhlhaus, I. Vardoulakis, R. Wan, K.T. Chau, J.F. Labuz

4.4 International Symposium (IS-Kyoto2009)

The International Symposium on Prediction and Simulation Methods for Geohazard Mitigation was held in Kyoto on May 25-27, 2009 by the third term activity of TC-34 under the sponsorship of the ISSMGE, the Japanese Geotechnical Society, Kansai branch of JGS.

The proceeding of the international symposium on prediction and simulation methods for geohazard mitigation (IS-Kyoto2009) edited by F. Oka, A. Murakami and S. Kimoto was published papers by CRC press Taylor & Francis Group, A Balkema Book, ISBN: 987-0-415-80482-0. The proceedings includes 89 papers.

The organization of the Workshop is done by the members of the organizing committee with the aid of the international advisory committee as listed below.

- Organizing Committee
Chairmen:
F. Oka (Chair, Kyoto Univ., Japan)
K. Tokida (Vice Chair, Osaka Univ., Japan)
A. Murakami (Vice Chair, Okayama Univ., Japan)
H. Kusumi (Vice Chair, Kansai Univ., Japan)
Organizing members (26 members)
International Advisory Committee (33 members)

Objectives of the symposium:

Mitigation of geo-hazards is an important problem in geotechnical engineering. Heavy rain, typhoon and earthquake are the main causes of geo-hazards. Due to the climate change and the extreme weather, geo-hazard occurs in all of the worlds. The understanding of mechanism of geo-hazard due to various causes is critical for the mitigation. Due to the limitation of experimental techniques available, simulation-based prediction, monitoring and analysis of case records are playing an increasingly important role.

The Kansai branch of JGS established the technical committee on mitigation of geo-hazard in river basin 2006 and has been doing site investigation on the geo-hazard due to heavy rain and typhoon. On the other hand, TC34 of ISSMGE has been working on the prediction and simulation methods for in geomechanics, in particular, TC34 focuses on the analysis of unstable behavior of ground such as strain localization which is a precursor of the failure of ground, liquefaction, landslides, seepage failure etc.

The Kansai branch of JGS and TC34 of ISSMGE decided to organize an international symposium on the prediction and simulation methods for mitigation of geo-hazard. The symposium provides a forum to discuss new prediction and simulation methods of geo-hazard and exchange ideas and mutually interested information etc. This symposium is sponsored by the Japanese Geotechnical Society (Kansai branch), the TC34 of ISSMGE and TC34 supporting committee of JGS.

Main themes of the symposium are:

1) Mechanism of geo-hazards; heavy rain, floods, typhoon, earthquake, landslides, slope and snow slides, tsunamis, land subsidence and coastal erosion etc..
2) Numerical and analytical simulation methods for geo-hazards: conventional and advanced methods, FDM, FEM, Extended FEM, DEM, SPH and MPM
3) Advanced constitutive modeling of geomaterials and numerical implementations and constitutive parameter determination using laboratory and field test results including cyclic plasticity, nonlinear incremental plasticity, viscoplasticity etc.
4) Thermo-hydro-mechanical instabilities: large deformation, strain localization, progressive failure, liquefaction, ground water flow analysis, rapid flows of complex geo-fluids such as mud flow etc.
5) Monitoring methods of geo-structures during flood, earthquake and heavy rain etc and design methods.
6) Evaluation of existing prediction methods, performance based design method aided by advanced numerical modeling, Risk analysis and management of mitigation programs.
7) Case records of geo-hazards and mitigation projects

4.5 Special Issue on Prediction and Simulation Methods for Geohazard Mitigation of Soils and Foundations

Due the high quality of the presentations during this IS-Kyoto2009, it was decided, with the approval of the Japanese Geotechnical Society, to dedicate a special issue of *Soils and Foundation*s, where full length papers of the communications could be published. The rapid review of the editorial committee of *Soils and Foundations* made it possible to publish this special issue on the 'Prediction and Simulation Methods for Geohazard Mitigation,' which will be published August issue of 2009. It is

expected that a number of related papers will also be published in the coming issue.

The main aim in publishing this special issue of *Soils and Foundations* was to provide to researchers and engineers a forum of international exposure to present the recent advances on the subjects of 'Prediction and simulation methods for Geohazard Mitigation'.

4.6 Organizing Sessions in the Regional Conferences and Related Conferences

(1) Discussion Sessions at the Annual Conference of the Japanese Geotechnical Society: July 2006 through 2009.

THEME: New simulation methods in geomechanics –large deformation, multiphase coupled analysis, multi-physics analysis-
DATE: July 10, 2008
PLACE: Hiroshima, Japan
CONTENTS:
1) Opening address by F. Oka (Japan)
2) General report on the accepted papers (16 papers)
3) Discussion
Chairpersons: T. Noda (Japan) and K. Maeda (Japan)

THEME: Prediction and mitigation methods for geohazards in river basin
DATE: 2009 August 18 (to be held)
PLACE: Yokohama, Japan
CONTENTS:
1) Opening address by F. Oka (Japan)
2) General report on the accepted papers (18 papers)
3) Discussion
Chairpersons: F. Oka (Japan)

(2) Meeting and Workshop

Meeting during the IS-Kyoto2009
THEME: SOA report of TC34, Future activities, observer of TC34 (A. Puzrin, ETH, Swizerland)
DATE: May 26, 2009
PLACE: Kyoto Int. Conference center, Kyoto, Japan
ATTENDEE: F. Oka, K.T. Chau, A. Cividini, R. Michalowski, P. Lade, I. Vardoulakis, R. Wan, A. Murakami, T. Nakai, K. Sawada, J. Otani, T. Noda, K. Maeda, H. Zhang, T. Kodaka, S. Kimoto

Regional Symposium
THEME: Prediction and simulation methods for large deformation in geomechanics
DATE: October 26, 2007
PLACE: Kyoto, Japan
CONTENTS:
1) Opening address by F. Oka (Japan)
2) General report on the accepted papers (11 papers)
3) Discussion
4) Closing address by A. Murakami (Japan)
Chairpersons: T. Nakai, T. Noda, T. Tuneshi (Japan)

(3) Organization of the International Symposium on Prediction and Simulation Methods for Geohazard Mitigation (IS-Kyoto2009)

DATE: May 25-27, 2009
PLACE: Kyoto, Japan
CONTENTS:
1) Opening address by F. Oka (Japan)
2) Keynote lectures
Ioannis G. Vardoulakis (Core member of TC34, Greece)
/ Thermo-poro mechanical analysis of catastrophic landslides
Kam Tim Chau (Core member of TC34, Hong Kong)
/ Some geohazards associated with the 8.0 Wenchuan Earthquake on May 12, 2008
Chjeng-Lun Shieh (National Cheng Kung University, Taiwan)
/ Risk assessment for hydraulic design associated with the uncertainty of rainfall
Hajime Nakagawa (Kyoto University, Japan)
/ Recent flood disasters in Japan
3) General presentations (71 papers)
4) Discussion

Members of the Kansai branch of JGS and TC34 of ISSMGE organized an international symposium on Prediction and Simulation Methods for the Geohazard Mitigation. The symposium provides a forum for discussing new prediction and simulation methods for geohazards and for exchanging ideas and information on topics of mutual interest. A total of 188 participants contributed from 18 countries. The members of the Organizing Committee and the International Advisory Committee reviewed 116 papers.

(4) Co-sponsored Conferences and Workshops

1. 8th IWBIDG, Int. workshop on bifurcation and instability and degradation in geomaterials, May 28-31, 2008, Lake Louise, Canada
2. Support for GeoX2006, Oct. 5-7, 2006, Aussois, France

4.7 Publications

Following is the list of our publications:

(1) Prediction and simulation methods for large deformation in geomechanics, proceedings of the regional symposium, Kyoto, Japan, Oct. 26, 2007 (in Japanese).
(2) Proceedings of the International Symposium on Prediction and Simulation Methods for Geohazard Mitigation (IS-Kyoto2009), Kyoto, Japan, 25-27 May 2009.
(3) Special reports on the related topics on prediction and simulation methods in geomechanics (to be published).

4.8 Meetings of Japanese Supporting Committee

The meetings were held by Japanese Supporting Committee for three or four times in each year and the discussion by this supporting committee was a guideline for the whole activities by TC-34. Meetings were held as following schedule:
/ 1st meeting: July 12, 2006, Kagoshima
/ 2nd meeting: November 27, 2006, Tokyo
/ 3rd meeting: March 29, 2007, Tokyo
/ 4th meeting: July 4, 2007, Nagoya
/ 5th meeting: March 31, 2008, Kyoto
/ 6th meeting: July 10, 2008, Hiroshima

The meeting of IS-Kyoto committee was held as following schedule.
/ 1st meeting: December 17, 2007, Osaka
/ 2st meeting: April 4, 2008, Osaka
/ 3st meeting: October 17, 2008, Osaka

/ 4st meeting: January30, 2009, Osaka
/ 5st meeting: March 30, 2009, Osaka

5 CONCLUDING REMARKS

5.1 Summary of Activities

TC-34 activities in the period 2006 to 2009 are summarized:
(1) Two organized sessions in the annual conferences of the JGS,
(2) Six meetings, workshops and related conferences,
(3) Eight meetings for the Japanese Supporting Committee, and
(4) Three publication

5.2 Planned Activities for

1. TC34 Workshop during the 17ICSMGE at Alexandrea, October 3, 2009
2. Strong support for the 17th ICSMGE in 2009 by members of TC34
3. Panelists in the Technical Sessions by core members.
4. Support for GeoX2010, Texas, USA, March 3-5, 2010

5.3 Next Host Member Society

The TC-34 has obtained good results in this period 2005-2009, providing successful contributions towards the development of prediction and simulation methods in geomechanics. A large number of the members of TC34 want to continue the TC. The expected Host member societies are Hong Kong society and the Japanese Geotechnical Society of TC-34 for the forthcoming term of 2009-2013.

APPENDIX : LIST OF MEMBERS

- TECHNICAL COMMITTEE #34
CHAIRMAN
Oka, F., Japan
SECRETARY
Murakami, A., Japan
CORE MEMBERS
Chau, K.T., Hong Kong
Darve, F., France
Muniz de Farias, M., Brazil
Lade, P.V., USA
Muir Wood, D., UK
Nova, R., Italy
Van den Berg, P., The Netherlands
Vardoulakis, I., Greeece
MEMBERS
Cividini, A., Italy
Charlier, R., Belgium
Gens, A., Spain
Gudehus, G., Germany
Kim, S.R., Korea
Kolymbas, D., Austria
Labuz, J.F., USA
Lámer, G., Hungary
Länsivaara, T., Finland
Michalowski, R.L., U.S.A.
Mühlhaus, H.B., Australia
Noorzad, A., Iran
Pastor, M., Spain
Serra, J.P.B., Portugal
Sulem, J., France
Tamagnini, C., Italy
Wan, R., Canada
OBSERVER
Puzrin, A., Switzerland

- JAPANESE SUPPORTING COMMITTEE
CHAIRMAN
Oka, F., Kyoto University
SECRETARY GENERAL
Murakami, A., Okayama University
SECRETARY
Kodaka, T., Meijo University
MEMBERS (27 members)
Asaoka, A., Nagoya University
Higo, Y. Kyoto University
Iizuka, A., Kobe University
Iwakuma, T., Tohoku University
Uzuoka, R., Tohoku University
Otani, J., Kumamoto University
Oda, M., Saitama University
Kishino, Y., Tohoku University
Kohgo, Y., Tokyo University of Agr. and Tech.
Komiya, K., Chiba Institute of Technology
Sakaguchi, H., Japan Marine Science & Technology Center
Sunami, S., Nikken Sekkei Ltd.
Sekiguchi, K., JFK R&D Corporation
Takahashi, A., Public Works Research Institute
Tatsuoka, F., Tokyo University of Science
Tamura, T., Kyoto University
Zhang, F., Nagoya Institute of Technology
Tobita, Y., Tohoku Gakuin University
Nakai, T., Nagoya Institute of Technology
Nakano, M., Nagoya University
Noda, T., Nagoya University
Hori, M., The University of Tokyo
Maeda, K., Nagoya Institute of Technology
Matsushima, T., Tsukuba University
Miyake, M., Toyo Construction Corporation
Yashima, A., Gifu University
Yoshida, N., Kobe University