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Technical session 5a: Engineering practice and education

Séances techniques 5a: Pratique professionelle et enseignement

V.V.S. Rao
Nagadi Consultants (P) Ltd., India
O. Kusakabe
Tokyo Institute of Technology, Japan
Y. Honjo
Gifu University, Japan

1 INTRODUCTION

Technical Session 5a was held in Special Conference Room on 12th floor of Ground Cube Osaka from 15:30 to 17:30 on September 12, 2005.

The session was chaired by V.V.S. Rao (India). The general reporter was O. Kusakabe (Japan), and Y. Honjo (Japan) the secretary. The session started by introduction by the chairman followed by the general report, which altogether took 30minites.

The general report covered all 24 papers, which was classified into three groups, namely

(1) Geotechnical Risk and Risk Management (11 papers).
(2) Geotechnical Design (11 papers).
(3) Education in Geotechnical Engineering (2 papers).

Then the session was divided into 5 sections. Each panelist made 10 minutes presentations. The title of the sections and names of the panelists are listed as follows;

Section 5.1: Design and Codes (T. Orr)
Section 5.2: Management, Monitoring and Evaluation (F. Nadim and F. Kulhawy)
Section 5.3: Geotechnical Engineering and Law (J.E. Hellings)
Section 5.4: Education (J.P.Magnan.)
Section 5.5: Georisk (K.K.Phoon)

2 PANELISTS' PRESENTATIONS

The content of presentation by each panelist is summarized briefly as following.

T. Orr (Ireland) made presentation on Design Codes. He focused the problem into two core engineering issues: (1) how to make decisions under uncertain situations, and (2) how to transfer accumulated knowledge from generation to generation. Education and Design codes are considered to be very important elements in this respect. The panelist has emphasized role of a new design code, and summarized characteristics of Eurocode 7 and issues encountered in developing and implementing this new code, such as the design philosophy and the limit state design concept in comparison to the traditional design codes. He concluded that it is important the new code should clearly be superior to the existing codes and up to date. This implies the new code should be based on "well winnowed experience", provide sound design principles based on the accumulated knowledge of the profession, and be useful in making decisions under uncertain situations.

We had two panelists on topic 'Management, Monitoring and Evaluation', namely F. Nadim (Norway) and F. Kulhawy (USA).

F. Nadim made presentation on Geotechnical Engineers in Risk assessment. He fist introduced the definition of the important key words in risk assessment. It is based on Glossary of Risk Assessment Terms for ICG (International Center for Geo-hazards) published by NGI(2004):

- Danger (Threat): The natural phenomenon described in terms of its geometry, mechanical and other characteristics. The danger can be an existing one such as creeping slope or a potential one (such as a rockfall). The characterization of a danger or threat does not include any forecasting.
- Hazard: Probability that a particular danger (threat) occurs within a given period of time.
- Risk: Risk=Hazard x potential worth of loss. This can be also expressed as "Probability of an event times the consequences if the event occurs".

Thus, Risk is defined here as hazard times consequence (i.e. potential worth of loss.

He then classified risk management process into five phases:

(1) Danger characterization: what are the physical characteristics of the event.
(2) Hazard analysis: how often does the destructive event occur?
(3) Risk analysis: what are the expected losses if the event happens.
(4) Risk evaluation: Social demands, risk acceptance criteria regulations and judgment.
(5) Risk mitigation and control: political aspirations, costs and budget etc.

After referring to some of acceptance/tolerable risk criteria, he concluded his presentation by raising three challenging questions concerning risk mitigation:

- "Zero times infinity" problem: how to deal with very low hazard & extremely high consequences?
- How can we verify our calculated/estimated hazard and risk?Can we distinguish between "actual risk" and "perceived risk"?

F. Kulhawy made presentation on the same topic. He emphasized the importance of defining objectives of management, monitoring and evaluation in activities related to geotechnical engineering. This procedure includes setting entities to be assed, document tools to be used, set methodologies in detail, and assess personnel skills and economics. He cited the words of Aristotle to stress this point: "*it is the mark of an educated man to look for precision in each class of things just so far as the nature of the subject admits*".

Client	Models	Subjects	Contents	Teachers
Geotech	BSc (3)	Soils	Facts	Teachers
com-	MSc (5)	Calculation	Concepts	Engineers
panies	MSc (5) +	Techniques	Theories	Education?
Education	practice	Design	Experience&	research
MSc +PhD				

Fig. 1 Expectations and possibilities in geotechnical education

Nature		Ground	Structure	
		model	Geotech.	RC-Steel
Geology				
Site	Tests	Site	Conception	Concept.
investi-		model	Justification	Justific.
gations				

Fig. 2 Geotechnical engineering and geotechnical workers

The points was explained further by taking load test planning as an example and geotechnical design.

The issues related to limit states evaluation were described in this context. The assessments, especially on serviceability limit state, must be realistically done taking into account the current technological limitations as well as subjective issues in criteria.

Lastly, he described recent damages cursed by hurricane Katrina in New Orleans. Some questions are raised in the context of management, monitoring and evaluation on the roles of technical simulations, observational methods, GIS tools, judgment and role of the government bodies in this tragic event.

J. Hellings (UK) made a presentation on geotechnical engineering and law based on his practice as a practical geotechnical engineer. A general view on the issue was described.

It was emphasized first that it is always better to do good practice and avoid litigation. Selection of client, professional indemnity insurance, contract and use of qualified people are some of the most important elements to be considered. As for the technical aspects of the problem, one should recognize that large percentage of construction problems are related to the ground, i.e. geotechnical engineering related. Therefore, it is always important to carry out good site investigation. That is to say, careful desk study, well designed ground investigation, multi-phase if necessary, and good supervision.

If unfortunately some problem arises, and insures have notified this fact, they will appoint a lawyer, and the lawyer will appoint an expert who has no conflict of interests for the case. The duty of an expert is quite important. Followings are some of the pints that should be considered in expert's report:

- provide details of qualifications.
- provide details of literature/materials on which you have relied.
- contain a statement setting out the basis of instructions.
- state which facts are in the expert's knowledge.
- consider range of opinion.
- should be concluded with a clear statement.

He concluded the presentation by stating that it is always the best to do good geotechnical engineering with well qualified people and not to be getting sued. To keep good communication with clients are very important, and it is better to be involved throughout the project, not just the design stage. Select the expert carefully, and it is not easy to be an expert!

A presentation on Education and Geotechnical Engineering was given by J.P. Magnan (France). Fig.1 presents expectation and possibility of geotechnical engineering education. The client of this system may be geotechnical companies for BSc level, but more advanced demand are expected in the higher level. The education models may be 3 years BSc or totally 5 years MSc. It is possible to add PhD course on top of 5 years MSc. Also practical experience should be included. The subjects start from basic soil mechanics, calculation techniques and finally design, which need to integrate all the knowledge taught. This can also be viewed as start teaching the facts, then concepts and theories, and finally necessary experiences. It is thus understood from these explanations that teachers of geotechnical engineering should have appropriate expertise as well as experiences.

There are many challenging tasks in the each stage of education. For example, teaching facts, but what do we mean by this! Teaching facts about pure textbook soils or unpure more realistic soils? How many phases does soil consist of? Do we teach about saturated or unsaturated soils? As far as the calculations are concerned, how should we teach FEM? Do we have compiled sufficient experience for this method to be used in the practical applications? What do we expect from numerical modeling, failure, deformation or time dependent behavior? Should we better stick to traditional experience based methods?

Teaching '*experience*' in geotechnical engineering has quite substantial importance compared to other areas of engineering. Some of the thoughts in accordance with this line can be listed as follows:

- Soil mechanics are sometimes taught as a logical construction starting from the laboratory behavior of samples, then stress-strain(-time) relationships, equations and analytical or numerical solutions.
- Geotechnical engineering may be taught as lessons from experience: collective experience is the accumulated knowledge of the behavior of soils and structures in-situ. Most aspects of that behavior are well known and serve as a firm basis for the design of structures and more generally of geotechnical works.
- Personal experience is active for design and for the construction of the site geotechnical model.
- Collective experience may be taught.
- Personal experience must be gained from practice.

In conclusion, Magnan stressed the importance of the scope of geotechnical workers. Fig.2 presents the areas of geotechnical work. Geotechnical workers should have full scope of work including geological knowledge and design of a whole structure.

K.K. Phoon made presentation on 'Georisk'. He reported recent progress in three related areas on this topic, namely (1) geostatistics, (2) reliability analysis and design and (3) risk assessment and management.

Geostatics started by Georges Matheron of France in 1960's, which is based on correlation of physical variables over the space. The method was first applied to mining engineering and later applied in hydrology, petroleum, soil science etc. The method is know as Kriging in many areas. In geotechnical engineering, random filed theory introduced by E. Vanmark in 1970's uses same mathematical concept and tools as geostatistics. This method is now most actively applied in random field simulation and stochastic FEM.

Much motivated by development of limit state design concept codes in structural engineering filed, many geotechnical codes are now under the revision from the traditional ones to limit state design (or LRFD) based design codes. It goes without saying that structural Eurocodes had quite impact in this area. Relevance of reliability analysis, statistical properties of soil parameters, accuracy of geotechnical prediction and appropriate safety levels of structures are still under active debate.

The panelist also referred to problem of risk assessment and management especially in the context of geohazard, which shared much contents together with the prior presentation by Nadim.

3 FINAL REMARKS

There were some lively floor discussions for about 20 minutes. Due to relatively diverged topics that had been treated in this session, to summarize these discussion and coming to any conclusions were quite difficult task, and not attempted.

The session was closed on time by Y. Honjo by giving appreciations to the chairman, the general reporter, the panelists and staffs who had all contributed to the success of this session.

REFERENCES

NGI 2004, Glossary of Risk Assessment Terms for ICG (International Center for Geohazards).