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The paper was published in the proceedings of the 7th Australia New Zealand Conference on Geomechanics and was edited by M.B. Jaksa, W.S. Kaggwa and D.A. Cameron. The conference was held in Adelaide, Australia, 1-5 July 1996.
Professional Issues - General Report

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Summary

The paper reviews the six papers submitted to the Session on Professional Issues, which fall into three groups: Codes and Standards, Professional Practice, and Geotechnical Education. It concludes by raising a number of points for discussion within each of these subjects.

1. INTRODUCTION

The papers in this session fall naturally into three categories:

1. Codes and Standards
2. Professional Practice
3. Geotechnical education.

This report aims to review the submitted papers, and then to raise a number of issues which may be deserving of further consideration.

2. CODES AND STANDARDS

2.1 Review of Papers

2.1.1 “Emerging Trends in the Application of Geomechanics Codes of Practice to Residential Development in Western New South Wales, Australia”

Barnett and Kingsland give an overview of the application of codes of practice for footings and for on-site disposal of effluent for residential development. They present the results of a survey of Western New South Wales councils in which the application of these codes of practice is assessed.

With respect to the Site Classification code AS2870 (1988), the application of the code is stated to be “mature”, but a number of issues have still emerged. In particular, the authors suggest that Councils should stipulate that Development Applications should require classification of residential allotments at the subdivision construction stage.

With respect to on-site effluent disposal, code AS1547-1973 “Disposal of Effluent from Small Septic Tanks” is said to be largely ignored. The authors contend that there is a need to achieve better implementation of this code by adopting mandatory land capability assessments prior to approval of the proposed residential developments, incorporating on-site effluent disposal.

The paper provides a useful revelation of common practices in country areas in Australia, and the relationship between practice and codes. It would appear that there is scope for a greater degree of effort in encouraging more extensive adoption of relevant codes, especially in relation to residential developments.

2.1.2 “New Draft AS - Earth Retaining Structures (Including Reinforced Soils)”

Hausmann, Shirley and Boyd describe the development of a new standard for earth retaining structures and outline the contents of the draft code. Design requirements are discussed and the background to the design philosophy is set out. The design approach is based on the Limit State concept, and in this code, the soil parameters are factored, thus adopting what is sometimes called the “European approach” to Limit State design. This contrasts with the “American approach” in which reduction factors are applied to the computed ultimate resistances; this latter approach is adopted in the Australian Piling Code AS2159-1995.

The authors extol the virtues of the Load and Resistance Factored Design (LRFD) philosophy in geotechnical engineering. They claim that “a more rigorous managerial control of geotechnical projects initiated by the LRFD framework should go a long way towards avoiding failures which are not simply caused by inadequacies in existing methods of design, but are caused by:

1. non-recognition of a failure state
2. unexpected loads or environmental influences
3. inappropriate geological/geotechnical model
4. unexpected variability of loads and material properties
5. mistakes in the calculation
6. inappropriate construction techniques or supervision.”

It is perhaps debatable whether the LRFD philosophy, or any other design philosophy, can compensate for the last four of the above factors.
Indeed, the authors realize that "it is still possible that nature will outwit us on occasions".

A useful discussion is given on the choice of design values, and the distinction between mean and characteristic values. In the end, the designer still has to exercise considerable judgment in the assessment of design parameters, even if more elaborate statistical methods may be available.

It would be interesting to canvass the authors' views on the use of partial safety factors when carrying out advanced analyses of the serviceability limit state i.e. computing movements, using a nonlinear numerical analysis such as FLAC. The use of reduced soil strength parameters in such a case may lead to an over-estimate of deformations, especially if the soil stiffness characteristics are chosen conservatively.

3. PROFESSIONAL PRACTICE

3.1 Review of Papers

3.1.1 "Management of a Suburban Landslide"

Baynes describes the technical management of damage to pavements, services and houses resulting from a landslide in a Hobart suburb. The circumstances and development of the landslide are presented briefly, and then the management plan is described in some detail. Refreshingly, the overall aim of the plan was to minimize the social and financial cost to all the parties concerned. Included in the overall plan was an emergency plan for the case of extreme rainfall, a drainage scheme to stabilize the landslide, and a program of monitoring to measure surface movements and groundwater levels so that the effectiveness of the stabilization scheme could be assessed.

Interesting aspects of the management plan included:

1. establishment of a protocol for all the investigation information to be shared by those involved
2. the installation of alarms to detect and warn of large sudden movements of the landslide mass
3. close liaison among the parties involved
4. successful application of communication and management skills by those involved, which proved to be even more important than the technical aspects of the problem.

This is a very interesting paper which combines technical aspects, including an understanding of the mechanisms causing the problem, the development of a plan to alleviate the problems, and a plan to cope with any possible future problems. It is an excellent example of the application of common-sense to the solution and resolution of a technical problem, and may well serve as a possible model for handling similar problems in the future. Finally, it is interesting and gratifying to note that the Australian Geomechanics Society guidelines for members involved in litigation were invoked successfully, thus reducing the potential for an adversarial approach.

3.1.2 "Managing for Tomorrow Geotechnical Engineering in the Public Service"

Herraman, Walker and Collingham discuss the role of public sector engineering in South Australia over the last few decades, with particular reference to geotechnical engineering. They review the development of geotechnical engineering in various South Australian Government departments and conclude that all have played a crucial role in the development of the state's economy. The public service has also played important roles in the promotion of research and development, the provision of professional career paths, and in the education and training of university undergraduates.

With the current narrow focus on economic efficiency, the authors feel that the above roles played by the public sector are likely to be overlooked. They conclude with a number of recommendations, among which is "the adoption of a cautious approach to de-construction of the public sector and the destabilization of public sector expertise, experience and infrastructure".

The South Australian experience appears to mirror the situation in most other states of Australia, and also in many other countries where economic rationalism and short-term financial objectives are dominating policy development.

4. GEOTECHNICAL EDUCATION

4.1 Review of Papers

4.1.1 "CATIGE for Windows - A Computer-Aided Teaching Suite for Geotechnical Engineering"

Jaksa, Kagwa, and Gamble describe a suite of 11 computer programs which have been written to assist with the teaching of elementary geotechnical engineering principles to university undergraduates. They describe the philosophy underlying the development of the programs, and outline the main principles they have attempted to follow. These principles include:

1. the software should be easy to use and user-friendly
2. the programs should have adequate Help facilities
3. the main aim is to enhance understanding of the fundamental geotechnical engineering principles, rather than to provide experience in computer-aided design
4. the software should be user-interactive.

The programs in the CATIGE Suite are as follows:

1. CLASS4W - Soil Classification
2. EFFECT4W - Vertical Effective Stress
3. MOHR4W - Mohr Circle of Stress
4. DSAND4W - Direct Shear Test in Sand
5. TRIAX4W - Triaxial Test
6. FALLINGW - Falling Head Test
7. CONSOL4W - Consolidation Processes
8. PROCTORW - Proctor Compaction Test
9. RETAIN4W - Sheet Pile retaining Wall Analysis
10. DAMS4W - 2D Seepage Analysis
11. EXPANSIV - Expansive Soil Heave.

The authors discuss the benefits of computer-aided teaching, but at the same time, recognize and point out the limitations. In particular, students do not see or handle real soils on the computer, nor do they become familiar with the equipment or apparatus involved. Therefore, computer-aided instruction is only an adjunct to a broader range of teaching methods, a fact that is clearly understood and stated by the authors.

This paper is a very constructive contribution to geotechnical engineering education. The authors generously offer the ability for dissemination of the programs, and this should be of great interest, both within Australasia, and also in other countries. It will certainly enhance the work of the ISSMFE Technical Committee 31, which is concerned with Geotechnical Education, and which doubtless will enthusiastically pursue discussions with the authors.

4.1.2 “Geotechnical - Computer Assisted Learning in Geotechnical Engineering”

The paper by Davison embodies similar principles and philosophy to those described in the paper by Jaksa et al. The software suite described in the paper has been developed by a consortium of 23 universities in the UK via a large grant from the Government Teaching and Learning Technology Programme.

There are 5 components or strands to the project, each addressing a different aspect of geotechnical teaching and learning. In summary, the 5 strands are as follows:

1. Geotutor - an exploration of some of the important concepts in geotechnical engineering by manipulating simple models and observing the effect. A total of 25 models have been produced to date, including strength, compression, permeability, walls, foundations and slopes.
2. Soil-Structure Interaction - illustrations of the dependence of soil-structure systems on the stiffness of the soil and the structure, as well as the applied loads. Examples include pile and slab foundations, tunnels, retaining walls and reinforced structures.
3. CONFOUND - a knowledge-based system for the preliminary conceptual design of foundations. It operates in two modes, browse mode and decision mode, and can offer the user a hierarchy of foundation types together with an indication of the circumstances for applicability.
4. Site Investigation - this comprises a game supported by a series of tutorial modules. It provides a simulation of a number of situations and enables the students to explore some of the consequences of decisions taken about costs, information assembly, and exploratory techniques.
5. LABSIM - computer simulation of the triaxial test, allowing students to carry out a “test” on the computer screen and observe the behaviour of soil types which can be user-defined.

Once again, it is emphasized that computer-aided instruction is a most valuable component of an overall teaching strategy. The paper represents another major contribution to Geotechnical engineering education, and it is to be hoped that it will be available to educators worldwide, and to the geotechnical community at large.

5. ISSUES FOR DISCUSSION

Although there are relatively few papers in this session, they raise or provoke a number of questions that appear to be deserving of discussion. Some of these are set out below:

5.1 Standards and Codes

1. Is it appropriate for all geotechnical codes to be mandatory or is there scope for at least some codes to be advisory?
2. Should codes involving geotechnical design include detailed methods of analysis and design, or should they outline only principles or guidelines for the methods to be used?
3. Is Limit State Design (LSD) appropriate for geotechnical engineering, or has the
4. In carrying out estimates of deformations under the serviceability limit state, how can nonlinear soil behaviour be incorporated without becoming over-conservative?

5. The introduction of the LSD concept has led to many more load cases having to be analyzed. Is it really necessary for a geotechnical designer to have to design for more than (say) 20 load cases now, whereas in the past, only a small number of load cases have been considered, apparently without a large number of failures?

5.3 Geotechnical Education

1. Should computer-aided instruction be available to the engineering community at large, as well as university students, to give practitioners the opportunity of self-instruction and of undertaking self-motivated refresher courses?

2. Is it important for engineering students to be taught computer programming skills in the traditional computer languages, or should more emphasis be placed on application of programs, and skills in spreadsheet and similar programs?

3. At what stage should students be exposed to the realities of geotechnical engineering, rather than just the theory and principles? Is premature exposure likely to confuse, rather than educate, an undergraduate student?

4. Given that there is a useful role for the consideration of case histories in geotechnical courses, how are case histories best handled in an educational environment?

5. How can the inevitable uncertainty associated with geotechnical engineering and geomechanics be conveyed to students who may have the impression that engineering necessarily implies precision?

6. To what extent should the provisions of geotechnical codes be taught in undergraduate courses?