

# AUSTRALIAN GEOMECHANICS

Issue No. 19

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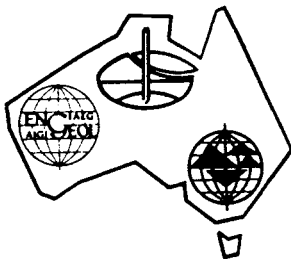
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# AUSTRALIAN GEOMECHANICS

News Journal of the Australian Geomechanics Society

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## EDITOR'S NOTES

The Editorial Panel of Australian Geomechanics seeks contributions for future editions. The following comments are offered to assist would-be contributors.

Technical contributions can include any of the following:-

-Papers, not necessarily of standard or content required for acceptance in, say, the Transactions of the I.E.Aust. State groups might consider submitting selected addresses.

-Technical notes.

-Comments on papers published in Australian Geomechanics.

-Brief notes on "wrinkles" encountered in the practice of geotechnical engineering which a contributor may be prepared to share with readers.

-Descriptions of geotechnical projects of special interest.

-Failures or "partial successes". Share your experiences with others.

-Contributions for the various regular columns and features.

Australian Geomechanics is now being produced in electronic format using Pagemaker 3 on IBM compatible hardware. Contributions are therefore preferred in computer format.

The ideal is, of course, as a Pagemaker document, however a variety of word-processing formats are acceptable. Wordperfect to version 5.1, Wordstar and Multimate can all be accepted. Text submitted as an ASCII file is also acceptable as are documents generated on Macintosh hardware. Please specify with your submission the format used to generate the file and include a hard copy. If the submission includes figures or photographs, these may be incorporated directly into Pagemaker documents submitted. If submission is in word-processing format, please submit camera ready copies of all figures and photographs.

Contributors may still present camera ready material which should either A4 size if prepared on a laser printer or A3 for lesser quality of print. The following guidelines will assist with maintaining some uniformity of style and production (applies in the main to production on other than laser printers):-

**Text:** The material should be submitted in typed form and preferably in the following format:

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- \* Character size - 12 cpi (10 pts)
- \* Column width - 110mm
- \* Line spacing - single
- \* Paragraph spacing - double
- \* Main headings - numbered 1 to n, 10 cpi
- \* Formulae - typed or clearly hand written
- \* Lines per page - 55

**Diagrams and tables:** These should be sharp black on white and of the correct size for incorporation into finished document (ie 100mm wide for single column or 220mm wide for double column). Original ink drawings should be submitted if possible and can be returned if required.

**Photographs:** These should preferably be good contrast black and white gloss prints and of the correct size for incorporation.

**Position:** Please ensure that all such items are clearly marked to indicate position in paper.

Authors will remain responsible for the integrity of their material and for permission to publish.

Contributors are reminded that the deadlines for submission of material are 1 May for the June edition and 1 Nov for the December edition. Contributions should be forwarded to the Editorial Panel, Australian Geomechanics, C/- Dames and Moore, 26 Lyall St, SOUTH PERTH WA 6151.

**CONTRIBUTIONS FOR THE DECEMBER 1990 EDITION WILL BE ACCEPTED UP TO 16th JANUARY 1991.**

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# EDITORIAL

This is the first edition of Australian Geomechanics to be edited by the Western Australian Group. We have of course approached the task with much journalistic zeal, aiming to at least emulate the high standards set by our predecessors in the editorial chair.

In this edition you will note a few changes of format. In the future you may see more, hopefully for the better, as we develop the a fore mentioned journalistic zeal.

One of the principal objectives of the new Editorial Panel is to narrow the gap that seems to exist between geotechnical people in the mining and civil engineering areas. Whilst recognising that such a gap is purely artificial, it is nevertheless there. This was underlined when the AGS WA Chairman only knew, *even by sight*, approximately half of the audience at a recent meeting addressed by Prof Barry Whittaker, whose special areas of interest include mining subsidence and slope stability.

The WA Group proposes to try to strengthen the bonds between the two groups and, to this end, we are scheduling several talks of mining interest. We are also investigating the possibility of setting up an AGS group in Kalgoorlie, where there is currently a great deal of interest in geotechnical matters, probably because of the recent open pit slope failures and the subsequent interest now being directed onto mining geotechnics by the Department of Mines!

It is in the interests of all of us to promote liaison between the "miners" and the "civil engineers" to overcome the perception that "the AGS is just for civil engineers" (heard during recent discussions with a group of mining people.) Will potential mining topic authors please take it on notice that their contributions will be gratefully received (and may even get "special consideration"!).

In 1991, we will embark on something of a first as we produce an edition containing a special feature dealing with "Waste Management". This topic appears to be an ideal vehicle to provide for this greater level of interchange between *the miners and the civil engineers*.

To support an expanded edition, we will be actively canvassing advertisers. This in itself will result in a somewhat changed format. Your comments in due course would be welcome.

These changes may be considered as representing something of the changes within Geotechnical Engineering in Australia as we see people like Professor Mark Randolph bringing a fresh approach to many aspects of the profession. This issue of Australian Geomechanics brings together some of these new developments as we present a major article on the UWA centrifuge and a guest editorial prepared by Mark Randolph.

Also in this issue we feature the 1989 E.H. Davis Memorial Lecture. This is particularly fitting as the award is a memorial to one of the pioneers of geomechanics in Australia whilst this lecture presents a new generation pioneering a new era. The subject of the lecture, "Geotechnical Aspects of the North West Shelf Project", represents the catalyst which proved to be so much a part of the development of the new facilities and faces which are now a part of our profession particularly in Western Australia.

It would be difficult to overestimate the part played by Dr Khorshid and Woodside Offshore Petroleum along with its joint venturers in developing local engineering and geotechnical skills through the foundations project for the North Rankin A platform.

The research and investigation associated with the project has significantly advanced our understanding of calcareous soils and elevated Australia to an eminent position in this area. To this, the success of the Calcareous Soils Conference in 1988 is ample testament.

Notwithstanding this position, we must remain forward thinking and move to meet the new challenges of this, the last decade of the twentieth century.

One of these major challenges must surely be the management of waste. In this generation we are presented with a two pronged challenge as we set about to manage the "mistakes" of the past as well as managing the mass of environmentally threatening products which are generated by our industrialised lifestyle. The whole style and quality of life which will be enjoyed by our children and other generations to follow may well depend upon how successfully we meet this challenge today.

Another challenge confronting all professions including geotechnical practitioners is the vexing question of legal liability. The "era" of waste management can only elevate the importance of this challenge as the consuming public seeks to place higher and higher levels of responsibility upon the shoulders of all professionals.

In this regard there are some promising signs that we may avoid the legal morass that seems to beset the professions in the United States. The Institution of Engineers, Australia has recently conducted a series of seminars around the country to bring engineers up to date with the present position and canvass the views of those directly involved. This exercise will be followed by the publication of a discussion paper later in the year. Hopefully this may present further light at the end of the tunnel.

Charles Waterton, Colin Bradbury, Trevor Osborne, Martin Press and Denis Smith.  
Editorial Panel 1990

## GUEST EDITORIAL

# POSTGRADUATE EDUCATION OF GEOTECHNICAL ENGINEERS

**Professor M. F. Randolph, Department of Civil & Environmental Engineering  
The University of Western Australia**

I was very pleased to be invited to contribute this Guest Editorial. It comes at an exciting and challenging time, both for me personally, and for engineers and teachers in the geotechnical profession throughout Australia.

There have been a number of initiatives in recent months in connection with the education of engineers, particularly at postgraduate level. A key element of the planned Co-operative Research Centres, which are discussed further below, will be postgraduate research training. This is intended to redress the current paucity of scientists and technologists educated to Masters or PhD level. A parallel move has come from the Institution of Engineers, with the proposed requirements for Continuing Education of graduate engineers. This initiative, although it appears to undervalue the longer term role of higher degrees, clearly acknowledges the insufficiency of even a four year Bachelor degree in today's specialist and changing engineering world.

Somewhat at odds with the perceived needs for postgraduate training referred to above, the Institution has also recently introduced a requirement for a minimum quantity of 'management' topics within undergraduate degree courses. Initially, the interpretation of management topics is to be relatively broad, including any elements of a course that address communication and design skills. However, there appears to be a background trend towards explicit management courses, such as those more usually encountered in postgraduate MBA courses. These courses would be feasible in a five year engineering course, such as the double degrees in Engineering and Management or Commerce that are currently available, but would inevitably dilute the technical content of standard four year degrees.

Rather than stipulating a minimum level of management content in undergraduate engineering courses, the Institution of Engineers should judge individual courses on the overall quality of the graduates produced. Courses that produce highly skilled technical engineers who, if they so wish, may proceed to higher level specialist education, should not be penalised in the interests of uniform mediocrity.

Continuing education is essential for engineers, both to acquire formal management skills and to update technical skills. Higher degrees should play a major role in this area. In Europe and the North American continent, a Masters or PhD degree is considered essential in order to specialise in geotechnical work. The Australian Geomechanics Society should be lobbying for a similar standard. In the past, potential postgraduate students have been deterred by the lack of support from government, in terms of the level of scholarships, and from industry, in terms of salary levels that reflect the additional training. The situation is now changing. Recent increases in

the value of postgraduate scholarships, and the introduction of industry-linked awards, have improved the terms under which higher degrees may be earned. The industry should now seize this opportunity to encourage graduates of 2 - 5 years experience to return to university for further specialist education.

The Federal Government has recently launched a scheme for Commonwealth funded Co-operative Research Centres. The principal goal of these centres, which will concentrate on science and engineering, is to provide further links between industry and research groups. Particular emphasis has been placed on postgraduate training through higher degrees, with direct involvement of postgraduate students in industry.

It is interesting to contrast the role of geotechnical specialists in two key industries in Australia - offshore engineering and mining. This issue of Australian Geomechanics contains Dr Khorshid's E.H.Davis Lecture, which describes the geotechnical experience on the North West Shelf. The early design for the North Rankin 'A' foundations was dominated by European and American consultants. The need for remedial treatment of the foundations initiated a major programme of research on calcareous soils throughout the world, but with a high percentage of that research being carried out in Australia. As a result, world expertise on calcareous soils now rests in Australia and foundation design for the subsequent Goodwyn platform was performed primarily by Australian engineers. The programme of research underwrote many PhD theses and there is now an appropriate pool of specialists within the industry.

By contrast, the mining industry has a woefully low presence of geotechnical engineers. In Western Australia, a large percentage of gold mines are designed with no specialist geotechnical input and suffer accordingly from high rates of failure. There has also been a recent spate of failures of open-pit slopes. The financial consequences of these failures dwarf the remedial measures of North Rankin. There is an urgent need for a major re-assessment of geotechnical design in the mining industry, and for an increased level of postgraduate research training.

To summarise, geotechnical engineers have a major role to play in Australian society, particularly in the development of natural resources. As a body that has close connections with the Institution of Engineers, the Australian Geomechanics Society should lobby for increased training of geotechnical engineers. We should resist any reduction of technical content at the undergraduate level, and push for greater recognition of higher degrees in the realm of continuing education.

# E.H. DAVIS MEMORIAL LECTURES

The E.H. Davis Memorial Lecture was established in 1983 by the Australian Geomechanics Society to honour a man who was one of the pioneers of geomechanics in Australia.

Ted Davis came to Australia from England in 1952. He joined the University of Sydney as a Senior Lecturer in Civil Engineering and began to develop lectures and laboratory classes in soil mechanics for undergraduate students. He proceeded to put the subject of soil mechanics on a sound theoretical basis.

He perceived that progress and understanding would only come if consistent, theoretically sound but simple models of soil behaviour were used. He proceeded to apply the theory of elasticity to foundation deformation problems and the theory of plasticity to stability problems. These two topics remained the central focus of his research interests during his career, and both were advanced significantly by his work. He also integrated into his sound analytical framework, the theory of consolidation of clay soils and again made a major contribution in this area.

Ted was always extremely conscious of the link between theory and practice, the relationship between the idealised and real material, and the engineering significance of his work. He was particularly conscious of the need to present theoretical results in a manner which could readily be understood

and applied by the practicing engineer. Consequently, he was widely sought as a consultant.

He was instrumental in the formation of the Australian Geomechanics Society in 1970, and served as its Chairman and also represented the Australasian Region as Vice President of the International Society of Soil Mechanics and Foundation Engineering between 1969 and 1973.

Two highlights of Ted's career came in 1980, towards the end of his life:

- \* he was elected to the Australian Academy of Sciences; and
- \* he was selected as the inaugural John Jaeger Memorial Medallist.

Following Ted's untimely death in 1981, it was decided that the E.H. Davis Memorial Lecture would be established and that it would be delivered every two years by a person who had made "distinguished recent contributions to the theory and practice of geomechanics in Australia".

*-Reprinted from "Civil Engineering Transactions" Vol.,CE30, No.3, October 1988. Published by The Institution of Engineers, Australia.*

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Previous E.H.Davis Memorial Lectures have been delivered by Dr. Barry K. McMahon and Prof.. Harry G. Poulos.

These lectures:

- \* Geotechnical Design in the Face of Uncertainty; and
- \* From Theory to Practice in Pile Design:

have previously been published in "Australian Geomechanics" and appear in the issue of "Civil Engineering Transactions", referenced above.

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# **IMPORTANT NOTE FOR POTENTIAL AUTHORS**

## **6TH AUSTRALIA - NEW ZEALAND CONFERENCE ON GEOMECHANICS**

Note that although this conference has been announced to have the theme "Geotechnical Risk - Identification, Evaluation and Solutions", it will not be exclusively on this theme, and papers are invited on the full range of Geomechanics topics, as has been the case for previous ANZ conferences.

Because of the late distribution of the Call for Abstracts (the pink brochure mailed to you recently) and the misunderstanding about the range of subject matter to be covered, we have requested the Conference Committee to extend the date for the receipt of abstracts to February 1, 1991.

# DR. M. KHORSHID

## - 1989 E.H. DAVIS MEMORIAL LECTURER

The 1989 E.H. Davis Memorial Lecture was delivered in Sydney on 8th November 1989 by Dr. Mohamed Khorshid. His lecture presented the highlights of the North Rankin "A" foundations project which has spread over seven years and become this country's most significant and costly geotechnical project.

The project has won wide acclaim and is recognised as being the catalyst for much of the recent development of geotechnical research facilities throughout Australia.

Earlier this year, the project was awarded "The Sir William Hudson Award" by the Institution of Engineers, Australia. This is the Institution's highest engineering excellence award.

The appointment of Dr. Khorshid as the 1989 E.H. Davis

Memorial Lecturer is a fitting testimony to the very significant part that he played in the successful realisation of the project.

Dr. Khorshid graduated with a B.Sc. in Civil Engineering from Ain Shams University, Cairo in 1968. In 1972 he obtained a M.Sc. in Civil Engineering from Kings College in London and was subsequently awarded a Ph.D., also from Kings College.

After three years as a research scientist in the CSIRO Division of Applied Geomechanics; two years as Project Manager on a major industrial development in Saudi Arabia and two years with Soil Surveys Pty Ltd, Dr. Khorshid joined Woodside Offshore Petroleum in 1981 as Chief Geotechnical Engineer. He currently holds the position of Manager for Civil Engineering with Woodside Offshore Petroleum.

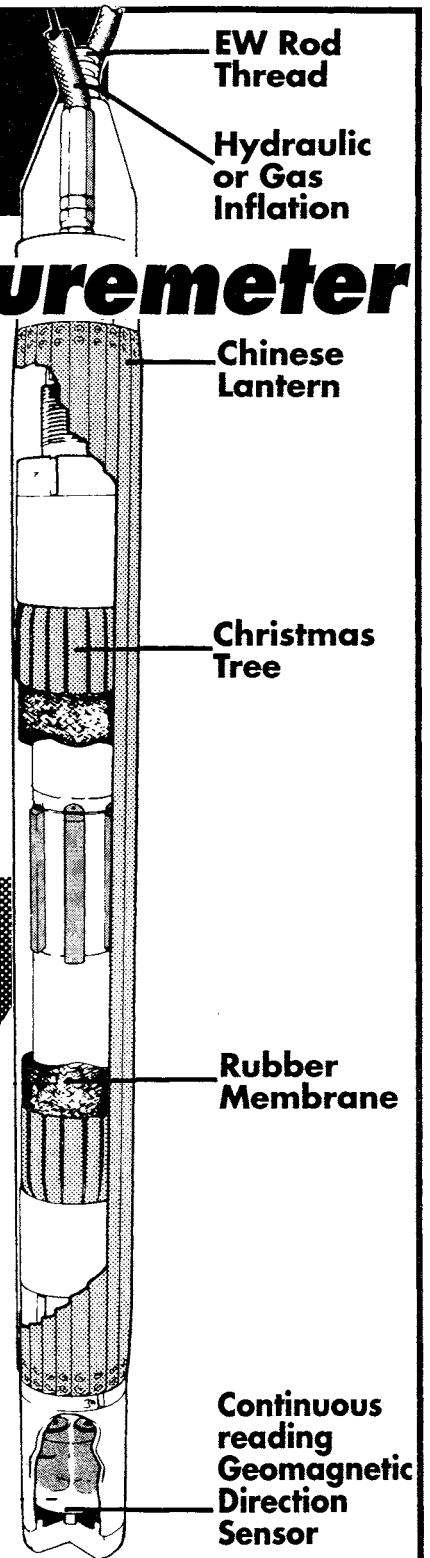
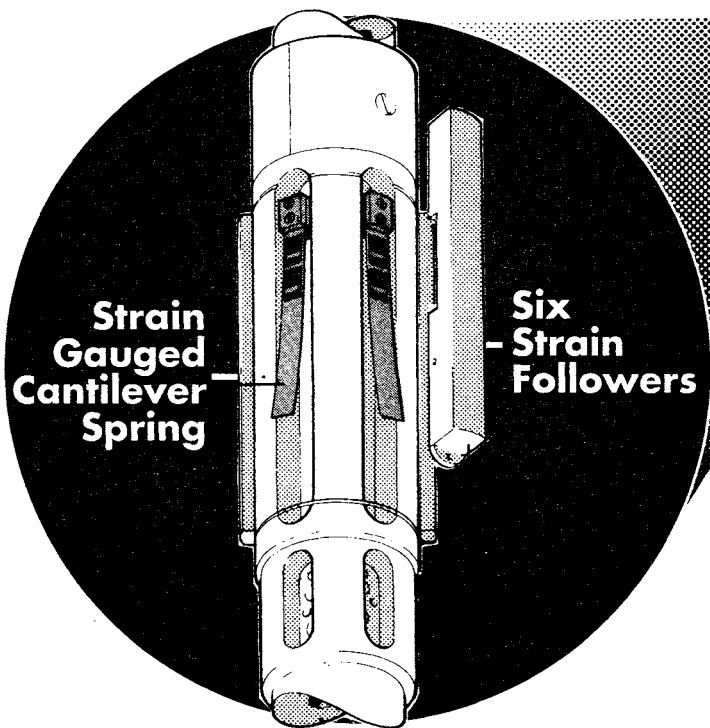


*Dr Khorshid (left) is seen here at the presentation with Mrs K Davis and Dr N Mattes.*

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# AUSTRALIAN STANDARDS

## ARE WE BEING SERVED?

In the course of their everyday work, most practising engineers rely in one way or another on the Standards and Codes published by Standards Australia (SA). The reason these documents are relied upon will vary according to the nature of the problem being addressed and on the individual or firm undertaking the task at hand. These reasons probably include:-

- a belief that the requirements of the Standard are mandatory
- comfort is gained from the belief that if the guidelines of the Standard or Code are followed, accepted reasonable practice is being adopted
- the recipe-book approach presented is convenient.

However, few of the users of our Standards and Codes are aware of the background to the documents, or even the process by which they evolve and are published. Over recent years concern has been expressed at various times by the Australian Geomechanics Society and elsewhere, that the process by which our Standards are produced may not always adequately reflect good practice, consistent with that which is or should be applied across our country. Australia is a large sparsely populated country with widely varying climatic and geological requirements to be addressed and accommodated in design. It therefore is essential that any document purporting to be an Australian Standard is genuinely applicable in all parts of the country, or at least recognises those areas to which it may not be applicable.

Where design processes are straightforward 'recipe-book' matters (if such things exist), this may not be a problem. However, in geotechnical engineering, judgement and local experience play a significant part in any design process. To try to incorporate such matters into a Code or Standard would be very difficult, if not impossible. It therefore is considered we have to be very circumspect about how codified we allow ourselves to become. Even more so, we must be conscious of the variable conditions with which we have to deal and avoid/prevent the publication of Codes or Standards which fail to recognise the diversity of conditions on our continent. The converse of this is ensuring we do not end up with Codes or Standards which are sufficiently general as to be of little value to anyone except the legal profession when a dispute has arisen.

From involvement in several committees of Standards Australia, the writer has some concern that the existing process is flawed by the funding policies of Standards Australia. Under present SA guidelines, no funding at all is provided for committee members, so that not only do active participants to SA

committees have to forgo considerable amounts of time (which may translate to income) they also have to meet direct costs of participation such as travelling expenses, accommodation and the like.

The result of this policy is that committees tend to be dominated by members from Sydney and Melbourne, due to their large population bases and relative proximity to each other. In this way if meetings alternate between Sydney and Melbourne, the costs of attending meetings are curtailed. Even so, there are many committee members who find themselves in the invidious position of not being able to attend "out-of-town" meetings because they or their organisation are unwilling to meet the direct costs involved.

The consequence of this is that continuity of committee participation often is restricted. Furthermore, it is believed there are many in the wider engineering community who have both the experience and time to be positive contributors to SA committees, but due to retirement or other financial restrictions, are unable to offer their direct services. On the Australia-wide scene, rarely does Western Australia, northern Queensland or the Northern Territory have the opportunity to contribute actively because of the distances and associated costs involved. However, these areas have geotechnical problems not encountered in south-east Australia, but which may not be incorporated in a prospective Standard through ignorance on the part of the authors of the document.

An additional disadvantage of this policy of non-funding of committees is that a number of committees end up being dominated by self interest groups whose committee members are fully funded to attend all committee meetings and "push" their particular barrow. Not only does this have the potential to result in a biased Standard, but technical merit may be compromised in order to satisfy the (perhaps conflicting) demands or requirements of these interest groups. As demands on our time increase and the costs of travel continue to rise, it is suspected the dominance of self interested parties in the preparation of Standards may increase, and technically "poor" Standards may result. Regrettably the content of many Standards is often made mandatory, and if we are not careful we may find we end up with mediocrity which has become compulsory.

Balanced against this view that the present system does not encourage Australia wide participation, by those most suited to the preparation of a technically relevant document, the view of Standards Australia should be put. It is understood Standards Australia is a Secretariat incorporated by Royal Charter to maintain an unbiased position in the market place. Its funding is principally from publication sales and membership

subscriptions with only nominal funding from the Federal Government.

It is further understood that Standards Australia takes the view that Standards are written by industry for themselves, and therefore those who will "benefit" most from the Standards should pay for, or at least contribute significantly to their preparation. The Committee process established by Standards Australia is designed to allow affected industry bodies to be represented, and with representatives who are able to both reflect the technical expertise required and the relevant interests of that body. Unfortunately, this is too altruistic in our real world, and it is considered many committees end up not having a fair representation of the community's interests and technical expertise.

No immediate solution to this perceived problem is apparent. However, it is considered the Australian Geomechanics Society and more generally the Institution, should periodically reflect on the way in which our Standards are produced. If we as a profession are united in wanting reform of this system, some rationalisation of it may be possible.

N. de Plume

M.AGS

#### Ed. Note

An issue not raised in the above letter is the current Standards Australia practice in respect to Public Review of Draft Standards. No longer does SA automatically forward copies of public review drafts to interested subscribing members, but rather the availability of a Public Review Draft is published in "The Australian Standard", the monthly publication of SA, and a charge is made for the supply of a draft (the draft site investigation code costs \$20). An obvious consequence of this state of affairs is that only a limited number of people become aware of the existence of a draft and even less go to the trouble of paying for a copy to review. This could easily result in a limited public review process, with the subsequently published Standards inadequately reflecting the views of the profession. This is particularly pertinent, given the concerns raised by Mr de Plume regarding representation on committees.

We would welcome any letters from interested readers on their experiences, good or bad, in relation to Australian Standards.

## Access to the best

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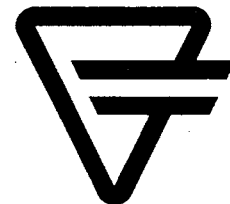
From the drawing boards to commissioning have come 26 individual hydro power schemes including all the civil and electrical engineering structures and installations: More than 800km of roads have been built, mostly in ruggedly remote terrain, 34 major dams and 172km of tunnels and pipelines.

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# Engineering Principles of Ground Modification

by Dr Manfred R. Hausmann

Published by McGraw-Hill Book Company

This new book by Dr Manfred Hausmann, of the University of Technology, Sydney, deals broadly with the topic of ground modification and covers such topics as compaction, hydraulic modification, dewatering, physical and chemical modification (including stabilization and grouting) and modification by inclusions and confinement.

The more conventional topics, such as compaction, dewatering and preloading are given a thoroughly modern and comprehensive treatment, however I felt that the real strength of the book was that it broke new ground by dealing with a wide range of specialist topics and modern ground modification techniques. Such topics include soil reinforcement, the use of geosynthetics for drainage and the reinforcement of embankments, pavements and railway foundations, soil nailing, thermal modification, ground freezing, electrokinetic dewatering, and the design of crib and gabion walls. Today, geotechnical engineering covers a wide range of disciplines, and it is becoming increasingly important for engineers and engineering geologists to have access to specialist texts and for this reason alone, I am most pleased to have a copy of this book on my bookshelf.

Although written for an international readership, one pleasing aspect of the book is that it has an Australian flavour, with

references to Australian Standards, case studies and experience. Where Australian experience is lacking, examples are given from overseas and this is often helpful when deciding which of the new technologies may be successfully introduced into Australia.

At the end of each chapter, there are numerous example questions and problems (with answers) so that the reader can test his knowledge of the preceding material. I have had experience of the use of the book with students, and having had to work out the solutions myself, have found this a most useful way of learning new design techniques.

In summary, I found this a most useful and interesting book, and at the price of \$123.95 for the hardback edition, I would recommend it to any practicing engineer. At over \$100, it is unfortunately out of the price range of most students, however if it appeared in a softback edition, it would make an excellent text for assisting them with their studies and would be a book that they would want to keep after graduation.

**John Small**

**The University of Sydney**

## NEXT ISSUE

# MORE PAPERS - MORE FEATURES

The next issue of "AUSTRALIAN GEOMECHANICS" shall include feature papers on embankments on soft clay, expert systems in geotechnical engineering, side resistance on piles and pile design by authors such as Poulos, Lee, Small, Goh, Tan and Johnston.

We will also feature a review of the issues raised by the "Coledale Case" as well as the regular features:

- \* GEONEWS
- \* BOOK REVIEWS
- \* GRAVEL RASH
- \* PRESS INTERFACE
- \* GEODIARY
- \* NATIONAL COMMITTEE REPORT
- \* GROUP REPORTS

## CONTRIBUTIONS

Contributions are welcomed to any of these regular features. Please try to meet the deadline and format details set out on page 2.

## LETTERS TO THE EDITOR

The editorial panel will welcome contributions in the form of letters on any topic related to the practice of geotechnical engineering. Many topics evoke much private discussion and complaint. Avail yourselves of a much wider audience and set out to change or incite by jotting down a few lines in time for the next edition. If you really don't have anything else to write about then just tell us what you think of *Australian Geomechanics*.

## WASTE MANAGEMENT FEATURE

The June 1991 issue of Australian Geomechanics will include a feature on waste management and related aspects of environmental engineering.

This area of geotechnical engineering is growing in Australia as we discover the legacies of some of the mistakes of the past and set out to better control the products of our present industrialisation.

These aspects present a major challenge for our generation and the life style of future generations may well depend upon just how well we handle this challenge.

Articles, papers, views, case histories and general comments are sought for this special edition on the technical, legal and liability aspects of this very significant topic.

Anyone wishing to submit a major article is asked to forward a brief abstract to the Editorial Panel by 28 February 1991 so that the panel may ensure that a wide range of aspects of the topic is presented.

## ADVERTISING

To ensure that Australian Geomechanics may maintain a high standard of production we are actively seeking the support of advertisers. If you are involved in the general geotechnical scene, support "Australian Geomechanics" and get your message across to MOST of the geotechnical practitioners in Australia.

For rates and other details please contact Peter May c/- I.E.Aust, 11 National Circuit, BARTON, ACT. 2600. Telephone:(06) 270 6555 or Facsimile:(06) 273 1488

# BOOK REVIEWS

## **Geotechnical Engineering Techniques and Practices**

by Roy E Hunt

Published by McGraw-Hill Book Company, 729pp.

Also titled **Geotechnical Engineering Analysis and Evaluation**

Recently, I was asked the following question:

“If you had to go to a deserted tropical isle and you could only take one reference book on geotechnical engineering, what reference would you select?”

Books like Winterkorn and Fang (1975), Tomlinson (1980) or even Bowles (1982) immediately spring to mind. A more recent candidate is a book published in 1986, written by Roy E Hunt entitled ‘Geotechnical Engineering Techniques and Practices’.

The author, Roy Hunt, received his B.Sc. in Geology from Upsala College in 1952 and his M.A. in Soil Mechanics and Foundation Engineering from Columbia University in 1956. He has worked variously as a project geologist, chief of a soil mechanics laboratory, project engineer, and the principal of a firm. His work experience has encompassed such diverse projects as dams, roads, foundations, tunnels, large land area development, environmental conservation, retaining structures, and slope failures.

His book, published by McGraw-Hill, is divided into three major sections covering (1) engineering properties of geological materials, (2) site planning, ground improvement, earth structures, and foundations, and (3) slopes, retaining structures, and excavations. The book’s strength lies in its elucidation of the techniques and practices applicable to the many scenarios and problems likely to be encountered in geotechnical engineering. The book contains a wealth of information within its 800 odd pages on many aspects of geotechnical design and evaluation. The person expecting to find a “cookbook” approach to engineering design may be disappointed.

The book more correctly serves as a convenient starting point for design and supplies a useful reference list should further detailed information be required.

This is one of the few books that I have come across where rock and soil are treated as equals in geomechanics. So many texts that claim to be GEOtechnical mainly concentrate on one, usually soil, and pay lip service to the other. This is symptomatic of, firstly, the general division of geomechanics

into the two related sciences of rock and soil mechanics, and secondly, the fact that most geomechanists (and hence potential authors of geomechanics texts) become experts in only one of the two sciences. Perhaps, the engineering geology background of the author (Roy Hunt) and his varied work experience have provided a more balanced view of geomechanics. Such an outlook is to be commended and encouraged amongst all practitioners.

The figures and illustrations throughout the book are full of information; perhaps too detailed in some cases as the author seeks to convey as much information as possible in the available space. I like the section on lateral pile analysis, a convenient and useful summary, and the section on retaining walls is a good one. The description on laboratory testing of soil and rock is informative although I found that this section made for dull reading unfortunately.

One aspect that annoyed me throughout the book, is the different units used (e.g. tsf, ksf, kPa, kg/cm<sup>2</sup>, psi for stress), which appear to be derived from whatever reference source it was that the original information was obtained. I know that we live in a world where different systems of units are used, and tolerance is a virtue to be admired in an individual. That being stated, it may have shown foresight to have standardised the units, as in SI units (Pa, kPa, MPa) and American Imperial (either tsf or psi, not both). Adoption of SI units is recommended as it is a recognised international standard. American Imperial should be used only to ensure sales of one’s book in the U.S., since it serves no other useful purpose. This last statement shows that humility and tact are other virtues to be admired in an individual.

I wonder why the book has two different titles. The dust jacket gives the title as ‘Geotechnical Engineering Techniques and Practices’. The inside cover page has ‘Geotechnical Engineering Analysis and Evaluation’ as the title. Both titles accurately describe the book’s content. Perhaps that’s something for Mr or Ms McGraw-Hill to explain.

The book is a useful one to have, for both the young graduate and the ‘not-so-youthful’ experienced practitioner. Published by McGraw-Hill Book Company, the book is available from all discerning bookstores. EA Books price as of 19/4/90 is A\$155 plus \$6 postage. It’s a bit pricy for a personal copy (???), so get the office to buy one (but then again you get a book with two titles for the price of one). It may not be THE geotechnical text to take with you onto a deserted tropical isle, but then again I haven’t come across too many recent texts either.

Elio Novello.

# PROFESSIONALS IN THE DOCK

## THE COLEDALE EXPERIENCE TO BE REVIEWED

The legal aspects of the "Coledale case" ended when the four accused employees of the NSW State Rail Authority (SRA) were found not guilty of a variety of criminal charges. The charges arose from a 1988 mudslide in which a railway embankment collapsed onto a house and killed two people.

Among those acquitted was Mr David Christie, the principal geotechnical engineer with the SRA. The case has therefore created more than a little interest among geotechnical engineers across the country. The premature end to the case has been welcomed, but the principal questions regarding the reasons why Mr Christie was charged in the first place have still not

been answered.

The case has come at a time of increasing awareness and concern throughout the engineering profession in relation to professional liability. Many geotechnical engineers are acutely concerned about the issues raised by this case and the increasing responsibilities which society is pressing onto professionals.

So that the issues may be better understood, we have solicited an in depth analysis of this case from prominent practitioners who have followed the saga closely. This analysis will appear in a future issue of "Australian Geomechanics".

## GEODATA

### GEOmechanics Data Acquisition & Test Analysis

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# GEONEWS, PEOPLE AND ORGANISATIONS

## RECENT APPOINTMENTS

Keith Seddon has joined consulting geotechnical engineers M.P.A. Williams and Associates Pty Ltd, based in their Melbourne office. He will work in the areas of mine waste disposal and groundwater, as well as more conventional geotechnics. Keith was previously employed by Pak-Poyand Kneebone Pty Ltd.

Queensland Group extends its congratulations to two members:

Peter Hollingsworth on his election as Vice President of the Institution of Engineers, Australia.

and

Professor Ted Brown on his appointment as Deputy Vice-Chancellor at the University of Queensland.

Professor Harry Poulos has this year become ISSMFE's Vice-President for Australasia. He takes over from John H.H. Galloway who held the position from 1985 to 1989.

Professor Poulos was appointed Professor of Civil Engineering at the University of Sydney in 1982, filling the chair made vacant by the death of Professor E.H.Davis. In 1984, he became Head of the School of Civil and Mining Engineering and Director of the Centre for Geotechnical Research at the University of Sydney. In 1989, he joined consultants, Coffey Partners International, as Director of Advanced Technology, whilst still retaining a Chair of Civil Engineering at Sydney.

He has written over a hundred papers and three books and is a world authority on the behaviour of piles and piled foundations. In 1987 he was selected to present the E.H.Davis Memorial Lecture by the Australian Geomechanics Society. In 1988 he received the same society's quadrennial John Jaeger Memorial Award. In 1989 he was invited to give the 29th Rankine Lecture for the British Geotechnical Society.

## AUSTRALIAN GEOMECHANICS INDEX

A cumulative index 1971-1990 for Aust. Geomechanics Journal, Aust. Geomechanics News and Aust. Geomechanics is now available on DBase III. Copies can be obtained from Robert Smith, Senior Geotechnical Engineer, Australian Construction Services, Tivoli Court, 239-241 Bourke Street, Melbourne, Victoria 3000. Telephone (03) 652 8282. .

## AS 3725 - LOADS ON BURIED CONCRETE PIPES

The new Australian Standard AS 3725 was introduced at a series of seminars held throughout the country in June and July. The seminars were jointly sponsored by Standards Australia and the Concrete Pipe Association. Changes introduced in the new standard include higher bedding factors which permit the use of higher fills and larger diameter pipes.

## CHANGE OF ADDRESS

Members are requested to notify the Australian Geomechanics Society, as well as the Institution, of any changes of address.

## CONFERENCE WATCH

Details of forthcoming conferences etc are given under the GEODIARY heading, but a few conferences of note are worthy of special comment.

The conference with the most appeal for some will surely be the International Seminar on Soil Mechanics and Foundation Engineering of Iran to be held in November 1990. The theme covers the usual range of good soil mechanics topics but the attraction lies in the fact that the seminar organisers undertake the travel and accommodation expenses of individuals whose papers are accepted for oral presentation. This should surely ensure a major task for the reviewing committee. Unfortunately the due date is now past.

The award for the conference with the most unlikely topic for the particular venue must go to the May 1991 Conference on Computer Methods and Advances in Geomechanics. One of the topics for discussion is Ice Engineering which should provide a pleasant diversion from the sunshine of the Cairns coast.

The 'BIGGEST' award goes to The Second International Symposium on Mine Planning and Equipment Selection in Calgary, Canada. The advertising lists 25 distinct topics on almost every conceivable aspect of mining and geotechnical engineering. If you miss out on a free ticket to Tehran you could hardly miss acceptance here on the grounds of non-conformity with the theme.

For a trip nearer to home, the Ninth Asian Regional Conference on Soil Mechanics and Foundation Engineering to be held in Bangkok on 9-13 December 1991 may be attractive. However, for anyone wanting to present a paper at the conference, abstracts had to be submitted not later than October 1990!

Australian Geomechanics - December 1990

For those who must limit the conference round to Australian shores, don't forget the conference on Engineering in Coral Reef Regions to be held on Magnetic Island (4-7 November 1990). The latter definitely seems to have a certain attraction.

We anticipate that the next issue will include reports from one or other of the Australian delegates to the Retaining Wall conference in New York held in June and the Glasgow conference on Reinforced Soil to be held in September. Brief (or not so brief) notes on conferences will be welcomed for inclusion in future issues.

## **LIBRARY FACILITIES**

All publications received by the Society are placed in the CSIRO Division of the Geomechanics Library, PO Box, Mt Waverly, Vic 3149. Tel:(03) 881 1355, Fax:(03) 803 2052 . Copies of the library accession lists are sent periodically to the secretaries of Geomechanics Society groups in each state. Books are available for loan to Society members and photocopies of papers or extracts may be obtained on request for a fee.

# NATIONAL COMMITTEE MATTERS?

As I trust all of you are aware, the affairs of the Australian Geomechanics Society are organised and co-ordinated, on a national basis, by the so-called National Committee. This committee is composed of one ex-officio and 19 elected members, and its membership is currently as follows:

Chairman <sup>1</sup>	Dr Neil Mattes
Deputy Chairman <sup>1</sup>	Max Ervin
Immediate Past Chairman	Dr Peter Mitchell
A'asian Vice President ISRM	Prof Ian Johnston
A'asian Vice President IAEG	John Braybrooke
A'asian Vice President ISSMFE	Prof Harry Poulos
AusIMM Nominee #1	Denis McMahon
AusIMM Nominee #2	Frank Kaeshagen
IEAust Nominee #1	Garry Mostyn
IEAust Nominee #2	Mike Thom
Victorian & O'seas Members' Reps	Tom Flintoff Marc Kurzeme
NSW & ACT Members' Reps	Bob Carr Dr Tony Phillips
Queensland Members' Rep	Paul Wallis
SA & NT Members' Rep	Brian Richards
Tasmanian Members' Rep	Tom Bowling
WA Members' Rep	Charles Waterton
Secretary (ex-officio)	Peter May.

The National Committee meets twice a year, usually alternating between Melbourne and Sydney. The matters discussed by the committee are wide ranging and the meeting lasts an entire day. (Even then, some matters receive less than the airing they deserve, particularly after lunch!). In view of the important, but generally unseen role of the National Committee, the Editorial Panel has decided to include a regular column in Australian Geomechanics with discussions, outlines, etc. of those items raised at the previous National Committee meeting. Matters to be raised will be those that may be of interest to the general readership of this magazine or, alternatively, may require an airing that is more widespread than is generally available through the medium of the National Committee

meeting minutes! A typical example of such a matter would be discussions relating to Australian Standards. The article on this subject in this issue indicates the relevance of this particular topic.

## Matters Arising from National Committee Meeting on 6 April 1990

o Membership of the AGS is currently 730 and initiatives to attract new members are under consideration.

o A Five Year Plan setting out the objectives and future directions of AGS has been prepared and distributed to State Groups.

o John Braybrooke (Regional VP, IAEG) will undertake to foster unification of engineering geologists, who currently are variously represented by AusIMM, AGS, Geological Society of Australia, Assoc. of Engineering Geologists, etc.

o Nominations have been called for the 1991 W H Warren Medal and for the 1991 E H Davis Lecturer.

o The AGS will continue to provide its membership list (for a fee) to "appropriate" organisation for direct mailing purposes.

o A Bid Document is now being prepared for Melbourne's bid for the XIV ICSMFE in 1997. The committee agreed that the theme of the Australian bid should include "The Decade of Disaster Reduction". The bid Coordinator, Max Ervin, welcomes any input or suggestions for format of the bid, which should be ready by November 1990.

o Planning for the joint AGS/Structures Panel conference "Structures in the Ocean", which is currently scheduled to be held in Perth in 1992, has lost a good deal of momentum and the conference appears to be in danger of becoming a "non event".

o Tentative bookings have been made in Adelaide for the staging of the Sixth ANZ Geomechanics Conference in Adelaide in 1996.

o Next National Committee meeting will be in Sydney on 5 October 1990.

Should anyone have any comments/queries on the matters reported above or if there are any matters that you would like brought up at the next meeting, please contact your state representative or the National Secretary.

<sup>1</sup> Elected by last year's National Committee

# PRESS INTERFACE

The Engineering profession, along with the other professions associated with the Geosciences, suffers from a lack of public awareness of significance of the role we play in society. This is reflected by the status which is afforded those dabbling in the "earth sciences", compared to that afforded to Doctors, Accountants and Lawyers for example.

Various and continuing efforts are being made by professional bodies to rectify this situation with apparently limited success. One such effort on the part of the Western Australian Division of the Institution of Engineers involves informing the media about forthcoming technical meetings and other events.

In the latter months of last year, this particular project at least resulted in a response from the press. Len Findlay's regular column in The West Australian bore the headline "**ENGINEERS GET THE URGE TO INTERFACE**". Len then led into a "very tongue in cheek" article by referring to Engineers' apparent need to be loved and understood being demonstrated by the fact that the local "Institute" (He didn't even get the name right) of Engineers had deigned to send to the press "flyers" advertising forthcoming meetings. The Structures Panel's - "*Mr Trevor Osborne's delightful The Interface of Structures With Ground With Particular Regard to Retaining Methods*" and Geomechanics Society's - "*Professor C.P. Wroth's snappy address on Control of Ground Movements Around a Large Excavation in London*" both rated special comment.

Mr Findlay did go on to say "*For my part, I think it would be a shame to miss either.*" However he did not appear to be in the audience for either performance.

This article was followed up a week or so later, by another article written in response to a mass of letters which Mr Findlay received. This time we Engineers again bore the brunt of Mr Findlay's wit. We are acknowledged as being "*wonderful, imaginative, talented, hard working, skilful and, for all I know, underpaid.*" (We don't disagree with Mr Findlay on any of these points.) However by this stage our columnist had concluded that Engineers are also "*thin skinned.*"

In all of this Mr Findlay appears to deny that there is a need for journalists to be better informed about our professions. It has therefore been interesting watching the press in recent times for clues to suggest that the nation's "journos" are really so well informed that they have nothing to learn from geotechnical practitioners.

This isn't all that rewarding. About the only time matters to do with geomechanics make the press, is when there is a problem. The NSW State Rail Authority employees' court case gained quite wide coverage, as has a series of mine failures in recent times.

One such item published in The West Australian recently reported upon a slope failure in a gold mine in Kalgoorlie.

Under the headline "**MEN DASH CLEAR OF PIT LANDSLIDE**" we are informed of the lucky escape for a *serviceman* and a *driller* as about a million tonnes of ore collapsed onto a drill rig.

The article concluded by reporting that "a rock mechanic" was on his way to the scene. This description conjures up a delightful picture of our man in grease stained overalls, spanner in hand, rushing to the site to put the pieces of rock back together and hopefully getting the "darned thing going again" before too long.

The news isn't all bad of course, as evidenced by Carmelo Amalfi's recent article, also in the West Australian, under the headline "**ROUND ABOUT WAY TO MAKE BUILDING SAFER**". Carmelo has presented a well written and informative few paragraphs about the newly installed geotechnical centrifuge at the University of Western Australia.

The article was informative even for those of us "in the trade" particularly to learn that the demand for centrifuge modelling is so high that "*it had been booked out for the next eight months at a daily charge of \$1000 to \$2000.*" With this revenue (\$258,000 calculated), the unit certainly represents an excellent investment for the hallowed halls of UWA.

This leads to the point of this column and the fact that we invite submission of articles "of interest" concerning the geosciences which may be gleaned from the national press. Please forward your cuttings to the Australian Geomechanics Editorial Panel for inclusion in future editions.

"Fin Lendlay"

# GRAVEL RASH

All engineers would be aware that the status of the profession in the eyes of the public is not all that it could be. (However, there is an interesting contradiction between the dropping of engineers from the list of professions that can sign passport applications and the criticism that was levelled at Australia's immigration policy recently that we only take "engineers , doctors , etc." from Third World Countries - It would seem that Australians recognize the status of Third World engineers above those practicing here).

The Institution is currently endeavouring to raise the status of engineers and this involves, to a considerable extent, the improvement of the image of the professional engineer. A major component of this is the projection of the practice of engineering in a positive light, in a manner that can be appreciated by the general public.

Several different strategies have been implemented to carry this out and there has even been a suggestion that the IE Aust might produce a "soapie" tentatively called "The (Young?) Engineers"! This might seem a little over the top, but no one could argue that "Young Doctors" (which my daughter, who is a nurse, claims to watch for "educational reasons"! ) does anything but enhance the public profile of the medical profession. So maybe we can look forward to "living and loving" with the team at the sewage treatment plant, or even "real life human drama" in the core logging shed on a remote dam site!

Another measure of our public persona can be gauged by references to our profession in the literature. Medical doctors, architects, lawyers, teachers, accountants abound, but where are the geotechnical engineers? My only recollection of a geotechnical profession cropping up in a novel is a book called "Orange Wednesday", written by Leslie Thomas, who also wrote "Virgin Soldiers". There was an Israeli geotechnical engineer in this book, but the profession was hardly presented in the best light (imagewise) because his wife had an extended affair with the hero, with the engineer being portrayed as very boring, preferring to be scratching around in the desert rather than being with his wife!

All this notwithstanding, I believe that we in the geotechnical profession have a particular duty to "lift our game" and present our important, interesting and sometimes even exciting profession to the general public. I am sure we have all experienced the blank glazed look that comes over people's faces when the following drama is enacted:

GLVFLG<sup>1</sup>: (in response to EXTREMELY funny joke told to her by Witty, Sophisticated, Bright, Good Looking, Young Man ("WSBGLYM") )

"Ha - Ha - Ha - Ha - Ha" (+ tears rolling down her cheeks)

"Tell me, Pete/Bill/Fred/Ian/etc...." (Delete where appropriate)

".....What do you do for a living?"

WSBGLYM:(proudly) "Oh, I'm a geotechnical engineer"

GLVFLG:(with puzzlement) "What's that?"

WSBGLYM proceeds with explanation

GLVFLG:(with boredom) "Oh, that's nice...Must go now, Bruce has invited me to go and watch some paint dry!"

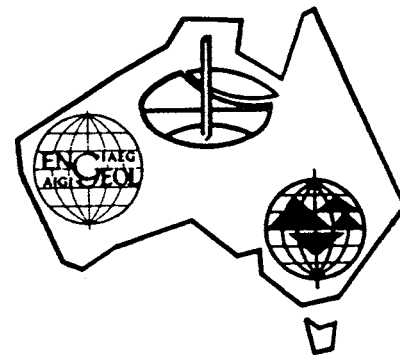
(Exit stage left, yawning).

So what are we going to do about it?

---

<sup>1</sup> "Gorgeous Looking, Vivacious, Fun Loving Girl"

# STATE GROUP REPORTS



## QUEENSLAND GROUP

### Report of the March Meeting

At a combined meeting with the Geological Society of Australia, Jenny Hacker and Peter Reman presented a paper on Recent Coastal Sediments and Climatic Changes. Recent development of the coastal plan has highlighted the variability of coastal sediments. The authors showed that much of this variability is due to sea level change resulting from climatic shift. The most recent shifts resulted in low sea levels at around 18 000 BP and 135 000 BP and high sea levels at the present time and 120 000 BP. Sediments deposited during the last inter-glacial when sea levels were high were subjected to sub-aerial weathering during the following period of low sea level. In contrast, those that were formed since the last low sea level have not undergone such substantial change. Sediments deposited 5 000 to 6 000 BP when sea levels were 1 - 2m higher than present show some significant differences compared to other recent sediments. The authors pointed out that knowledge of the details of recent coastal sedimentation in Queensland is still incomplete and that thorough investigation is desirable from both a geological and geotechnical point of view

### Future Meetings

#### MAY:

Mini Symposium - "Earthworks Compaction"

Thursday 17 at 4.30pm.

#### JUNE:

"Geomechanics Japanese Style"

Monday 25 at 6.15pm - Dr D Williams.

Venue: Hawken Auditorium.

#### JULY:

"The Geotechnical Engineer and the Law"

Thursday 19 at 6.15pm

Messrs J Doyle, D Starr.

Venue Hawken Auditorium.

#### AUGUST:

Dinner Meeting - Topic & Speaker TBA.

Thursday 16 at 7.00pm.

Venue Johnsonian Club.

#### OCTOBER:

Mini Symposium - "Geomechanics and the Environment"

Thursday 18 at 4.30pm.

Venue Hawken Auditorium.

#### NOVEMBER:

Annual General Meeting - Retiring Chairman's Address

Thursday 15 at 6.15pm.

Venue TBA.

#### DECEMBER:

End of Year Dinner

Thursday 6 at 7.00pm.

Venue TBA.

## VICTORIAN GROUP

### Report of Meetings

#### SAA Draft Earthworks Code

14 February 1990

M Ervin of Golder Associates outlined the provisions of the draft Australian Standard DR 89204 "Guidelines on Earthworks for Commercial & Residential Developments". The document includes guidance on testing procedure and frequency, minimum standards of compaction and documentation.

#### Recent Experiences with Rock Stress Measurements Throughout Australia

14 March 1990

The two stress measurement techniques most frequently used by CSIRO Division of Geomechanics, overcoring and hydraulic fracturing, were described by J Enever.

The recording of very high stresses in the Newcastle district and in the south-west of Western Australia before the 1989 earthquake was of interest. Other measurements for new tunnels beneath Sydney and in Tasmania were reported.

## **Stabilized Clay Grouting and Application to the Australian Environment**

11 April 1990.

S Hancock of Australian Groundwater Consultants outlined his Churchill Fellowship tour of the USSR and Eastern Europe where the technology is widely used. Mining examples from Australia were also described along with its potential application to waste containments.

## **Future Meetings**

9 May 4-8pm

### **Seminar on the Design & Construction of Pavements for Container Handling Depots and Airfield.**

(Date to be advised)

### **1989 E H Davis Memorial Lecture - M Khorshid**

18 July

### **Beyond the Theory of Landslides T McKinley & I Pedler.**

A joint meeting with graduates and students.

Venue Monash University

8 August

### **Draft SAA Piling Code - I Lee**

5 September

### **Cable Bolting Theory & Practice P Fuller**

10 October

### **Geomechanics Research from Monash University**

14 November

### **Seminar "Investigation and Assessment of Contaminated Sites" followed by the Annual Dinner**

Venue Melbourne University

## **TASMANIAN GROUP**

### **Reports on Recent Meetings**

#### **Toxic Waste Disposal Seminar**

12th March 1990

Speakers: Mr Frank Brown, Senior Chemist, Department of the Environment, Tasmania

Mr Alex Eadie, Engineering Geologist, Dames & Moore, Melbourne.

Mr Peter Stevenson, Engineering Geologist (recently retired) ex Department of Mines, Tasmania.

The Seminar was held at the Hydro-Electric Commission's Cafeteria and was attended by over 40 participants representing some quite diverse groups including waste disposal companies, councils and local environmentalists.

The speakers for the seminar had been briefed by Dr Fred Baynes in order that each would cover some fairly specific subject matter plus details of some distinct recent case histories after the buffet tea.

Frank Brown discussed the legal and political issues involved in the safe disposal of toxic wastes. He contrasted 'Toxic' wastes as a subset of 'Hazardous' wastes. In Tasmania these materials were covered in legislation in more than 60 acts which generally required updating to ensure consistency and the use of modern methods in dealing with these substances.

Frank presented details and examples of conflicts in the legislation which is currently in force. He outlined improvements which should be introduced and indicated that public involvement would demand the introduction of tighter controls on the disposal of toxic and hazardous substances.

Alex Eadie dealt with what he termed 'Hazardous Waste Clean-up Technology'. He described the sequence in which projects were handled, ie from 'investigation', to 'design', to 'tendering', to 'contract' and 'quality control and quality assurance'. In this process a range of different disciplines including engineers, geologists and chemists were involved.

Two options were generally available to treat a toxic waste disposal problem, ie insitu treatment or removal and treatment elsewhere. Insitu treatment options included 'volatilization', 'biodegradation' (usually with aeration to speed up the process, synthetic microbes were being used at times), 'leaching' and 'chemical reaction', (including soil washing), 'vitrification' (radiation wastes), 'passive remediation' (let nature run its course), and 'isolation and containment' (where water inflow was controlled and outflow barred). Non-insitu techniques were generally similar but provided more opportunities for solidification eg with cement, lime or other binding agents.

Practical problems associated with toxic waste disposal included the non-uniformity of contamination over an area, which often caused problems in 'representative' testing, and the concentration of toxicity which might be considered acceptable. The latter usually came down to a consensus of those involved including the 'owner', the 'workers' on the site, the 'government' and the 'public'.

Peter Stevenson briefly quoted some basic facts, ie the amount of waste generated by the metals industry in the U.S.A. currently comes to approximately 3m tonnes per year. He then detailed the geological requirements for a toxic waste disposal area saying that low permeability of the soil and rock mass was particularly important together with the hydrological aspects, ie low rainfall and little ground water (ie the converse of what is required for a water supply area). The disposal site should also be accessible, though secure, it should be on government controlled land in order that it can be readily managed and monitored for extended periods, possibly centuries. The site should also be aesthetically acceptable and its location should be well documented.

After the buffet tea break the three speakers presented details of case histories.

Frank Brown described the 5 B's of waste disposal:- Bury, ie storage in landfill, Burn, ie construction of a suitable incinerator which is currently being discussed for the disposal of medical wastes in Australia, Bog, ie disposal into the sewage treatment system, Barge, ie disposal at sea, and Bunker, ie establishing a storage facility such as is proposed for radioactive wastes. All the above disposal methods were being practiced to various degrees and all had their pros and cons.

Alex Eadie presented details of work at the former BP Oil Terminal site in Melbourne which was being developed as a canal residential area but was contaminated with hydrocarbons. He briefly described the investigation phase and the proposed method for cleaning and washing the sand to remove the hydrocarbons, the quality assurance system to be used and the acceptance criteria which were being specified.

Peter Stevenson described an investigation into suitable areas for disposing of toxic wastes in southern Tasmania. He stated that the tops of dolerite plateaus were generally considered good as they were capped with impermeable dolerite clay and were areas of low ground water movement. Deposits of similar clays at or near sea level also provided possible sites. Areas which had been assessed included the Styx River Area - deep dolerite clays but too far away, Snug Tiers, Mt Wellington and Mt Dromedary were too accessible to the public, Brown Mt was too far away, Margate tip - near sea level on deep dolerite clays, the University Farm near Richmond - below sea level with deep dolerite clay, and Sandfire Island in the Coal River Estuary.

Although the University Farm appeared to be one of the most suitable areas, and much of the toxic waste originated from the University, the NIMBY (not in my back yard) philosophy prevailed and the waste was being sent to Victoria for disposal, ie for the time being at least.

In the discussion which followed the presentations by the three speakers a number of issues were explored such as:-

**The safety of transporting toxic wastes;** not considered any more problematic than say the transport of substances like petrol and sulphuric acid.

**Treating the problem at its source;** ie required industry to reduce the amount of waste being produced or to recycle the waste products.

**Problems with the establishment of a central national incinerator facility somewhere in Australia;** ie would the 'nimby' syndrome tend defer such a project ad infinitum.

**Problems in quality assurance and quality control of ensuring that contaminated soil is sufficiently cleaned-up;** ie are a large number of samples required to satisfy clients and/or inspecting authorities.

**Education of the public in the need to establish clean-up strategies and to counter the 'nimby' syndrome;** it was noted that the public generally feared chemical names as

opposed to common names, eg paint thinners is quite an acceptable substance, xylene and toluene are suspect.

**Biological methods for treating toxic materials and the problems being investigated in this field.**

The seminar concluded after a vote of thanks to the speakers was moved by Dr Fred Baynes.

As a postscript to the above seminar the Group Committee has decided to hold a special committee meeting to follow up on some of the issues raised by the seminar. It was felt the Group should seek to raise awareness amongst its membership of the wide range of opportunities which could be provided by a general community requirement for higher standards of waste disposal and environmental control.

## CONCRETE FACED ROCKFILL DAMS

3 May 1990

Speaker: Mr Rick Boyle, Hydro-Electric Commission.

This meeting was held in conjunction with the Tasmanian Division of the Institution of Engineers and was chaired by Max Maynard, the current Division Chairman. The meeting was attended by approximately thirty members and visitors.

Mr Rick Boyle is the Commission's Construction Manager for the West Coast and is based at Queenstown. He has over twenty years experience in the construction of concrete faced rockfill dams in Tasmania.

In his lecture Rick Boyle presented an outline of the construction methods developed for C.F.R. dams within the Commission starting with the Wilmot, Cethana and Palooona Dams in the Mersey-Forth Power Development, and through to the Pieman River Power Development Dams onto the dams currently under construction on the King River at Crotty and in the Anthony-Henty Scheme.

He showed how construction methods for this type of dam had been improved during the last twenty years.

In the Mersey-Forth Scheme two types of concrete plinth design had been used, ie the 'Cethana' type and the 'Palooona' type plinth. In the first type the excavation for the plinth apron extends deeper into the foundation rock so that the top surface of the apron is normal to plinth reference line which enables grouting equipment to be positioned squarely onto the apron. In the second type the apron is parallel with the valley wall. This cuts down on foundation excavation but makes the positioning of grouting equipment much more complicated. From experience it was found that the 'Cethana' type plinth is more economical and is now used exclusively for C.F.R. type dams in the Commission.

In the placing and compacting of the rockfill a number of changes had been introduced. For the earlier dams the Commission had used a fleet of large capacity 'Haul-Pacs' which required haul roads at fairly flat grades. Currently the Commission was using a hire fleet of smaller articulated dump trucks which were much more manoeuvrable and could handle steeper grades. To compact the rockfill smaller self

propelled vibrating rollers (6 tonne) were now being used instead of 10 tonne towed units. Tests had shown that practically the same degree of compaction could be obtained with the self propelled rollers. The large 10 tonne rollers, which are nowadays no longer readily available, are still being used to compact the upstream and downstream faces of the rockfill. At Crotty dam glacial gravels were being used as fill instead of the customary shot rock. Although the gravels were required to be washed to enable placing in wet weather once in place they performed very well. Settlement measurements at Crotty dam indicated high rockfill modulus values for the gravels which formed the core of the dam. The upstream and downstream zones were being constructed using shot rock from the nearby power tunnel excavation.

In the construction of the upstream concrete face slab numerous construction improvements had been developed over the years. These ranged from improved waterstop installation details, eg the use of stainless steel instead of copper, to the use of much lighter slipform equipment which improved construction efficiency considerably.

The lecture was well illustrated with diagrams and colour slides. At the conclusion of the lecture a fifteen minute video on the construction of the Reece dam on the Pieman River was shown.

Bram Knoop, A.G.S. Tasmanian Group.

## SYDNEY GROUP

Meetings during the first half of the year received good attendances, particularly the May 9 meeting on "Coledale Remedial Measures".

The April 11 meeting was changed to:

### **-PERFORMANCE VERSUS PREDICTION -**

#### **TRIAL HIGHWAY EMBANKMENT IN MALAYSIA**

Professor Harry Poulos - Coffey Partners International Pty Ltd.

Four geotechnical engineers were invited to predict the behaviour of a test embankment section in the Muar Valley south of Kuala Lumpur in Malaysia. The embankment was located on a deep deposit of alluvial clay and will eventually form part of the north-south highway which crosses Malaysia from the Thailand border to Singapore.

The predictors were asked to predict the following:

- i) embankment height at failure.
- ii) excess pore pressures in the clay
- iii) settlement profile at the soil surface
- iv) horizontal movement profiles

The lecture will describe the prediction approach adopted by the author and his two co-predictors at the University of Sydney. The other three predictions will also be summarised. The four predictions will then be compared with the measured

behaviour, which was revealed well after the predictions were made.

Total group members also submitted their Class A predictions with about the same scatter in values.

Although the talk to be given by Dr Arthur Penman on May 30 was postponed (to a date yet to be fixed) an additional meeting was held on 29th June 1990 by Dip. Ing. Leonhard Zanier from Austria, entitled "Dynamic Compaction and Dynamic Replacement". The presentation included a film showing the soil improvement works for runway, taxiways and aprons of the new Changi International Airport, Singapore.

## Future Meetings

Technical meetings scheduled for the last half of the year are as follows:

July 11, 1990

### **GEOTECHNICAL RESEARCH AT CSIRO**

Dr Bruce Hobbs - Commonwealth Scientific Industrial Research Organisation

The emphasis of this talk is on new instrumentation, techniques and services available to investigate, monitor and alter the in-situ mechanical properties of rock masses. Ten individual examples are presented. These techniques are important not only because of their intrinsic use in geotechnical investigations, but because they form the basis of a new industry in Australia.

The examples are:

- \* Ground probing radar
- \* Down hole nuclear techniques
- \* 20 vision systems for size analysis on conveyor belts and muck piles, and for RQD determination from surface exposures.
- \* Technology for methane drainage from coal seams.
- \* Grouting and artificial cementation techniques
- \* Rock reinforcement
- \* Rock stress and displacement monitoring, including stress monitoring using tomography
- \* Blast vibration monitoring with emphasis on transducer mount techniques
- \* Computer aided mine and tunnel design packages with emphasis on rock stability and support
- \* Automated and 'smart' mining and tunnelling machinery.

In each example, the aim is to demonstrate that it is now possible to determine and monitor specific geomechanical properties, often remotely and sometime in-situ, over greater volumes of rock than has been readily possible in the past. In addition, the potential is there to alter selectively some of these properties using techniques such as reinforcement or artificial cementation so that construction methods are facilitated.

These techniques, with others, form part of a package of technology that can be the basis for a new manufacturing industry in Australia built around automated and 'smart' mining and tunnelling machinery and services. A strategy for

developing this new industry is outlined.

August 8, 1990

## **WASTE MANAGEMENT AND GEOMECHANICS**

Mr William McClenney - Kinhill Engineers Pty Ltd

Environmental management has gradually become more involved over the past decade with geotechnical engineering and this trend can be expected to continue, and perhaps the largest overlap in these fields is in the waste management area. In the past, waste management strategies have often neglected the effects on the environment of fugitive releases of waste products.

With new environmental controls, there is a need for clean-up of continuing and disused operations and for design of improved waste management for new and continuing operations. In the design and implementation of the necessary measures, extensive geotechnical inventories of the soil, rock and groundwater conditions at the sites involved and their interaction with wastes are basic requirements.

The needs of these studies have demanded improved assessments of movement and contaminants through soil and rock by percolation and diffusion of the pore gas and water, and of the interaction of ground materials and wastes. These assessments involved traditional geotechnical disciplines, such as hydrogeology, together with chemical and allied disciplines.

As legislative controls become more strict, engineering controls for environmental management will become more exotic to deal with them effectively. Therein lies the challenge.

September 12, 1990

## **A GEOTECHNICAL ENGINEER'S CASEBOOK - PANEL DISCUSSION**

Chairman: Mr Don Douglas - D J Douglas & Partners Pty Ltd

Panelists:

Mr Colin Thorne - Coffey Partners International Pty Ltd  
Mr Jack Hodgson - J D Hodgson Consultants Pty Ltd

Three senior engineers will present brief case histories of several past projects that 'might have been done better', with specific reference to the lessons which can be learned from them.

October 10, 1990

## **TRIAL LOADING OF A FAILED SECTION OF RIVER BANK, FISHERMAN ISLAND WHARF, PORT OF BRISBANE**

Mr Colin Thorne - Coffey Partners International Pty Ltd

In the early hours of 30th November, 1985, 180 metres of the partially completed bank of the new Fisherman Island's No. 3 berth collapsed into the Brisbane River. At the time of the failure the natural bank had been dredged and a supporting wall of rock and sand fill had been placed. In the course of the failure shearing had occurred in the river deposits with

displacements of up to about 4 metres. At the toe, the dredging had resulted in over consolidated conditions and laboratory reversing shear box tests had shown low residual friction angles. Analyses for remedial measures showed that the costs of such measures were very dependent on whether residual strength behaviour would apply, on the extent of pore pressures remaining from the failure, and on pore pressures which would be developed during reconstruction. There were also indications that in the un-failed area there could be re-moulded conditions near the toe.

To provide information on these matters, it was decided to carry out two trials to near failure by loading two sections of the bank. Monitoring consisted of numerous piezometers, inclinometers and movement markers to track the deformation and pore pressure build-up as loading progressed. The major findings were that in the failed and disturbed areas the operational strength was essentially the critical state value, and that substantial pore pressures were developed near the toe because even at relatively high factors of safety against the overall failure, the area near the toe became highly stressed and experienced pore pressure increases approximating the maximum total principal stress increase, ie Skempton's 'A' = 1. Near the rear of the slope, the pore pressure increase approximated the increase in total bulk stress, ie Skempton's 'A' = 0.33.

November 14, 1990

## **CHAIRMAN'S ADDRESS**

Dr Tony Phillips

## **FAILURES AND THE GEOTECHNICAL ENGINEER**

The geotechnical engineer bases most of his designs on the results of limited site investigation and uses experience and judgement to interpret geology and test data. In addition his analysis normally relies on the application of simplified theoretical models of ground behaviour, which may or may not be appropriate to conditions on site.

Fortunately, the approach works more often than not, but factors can come into play which are not appreciated until problems arise. These may be a direct result of some feature of the geological history of the site, or of changes brought about by the development itself.

Lessons can be learnt from case histories involving failures. A number of examples will be given to illustrate some of the problems that can arise. The effectiveness of post failure investigations will also be considered to determine what information is needed to undertake effective back analysis.

All meetings are held in the Auditorium of the Institution of Engineers, Eagle House, 118 Alfred Street South, Milsons Point, between 6.00pm and 7.30pm. Light refreshments are available from 5.30pm.

A sub-committee of the Sydney Group has been formed to examine the problem of "Professional Liability". Any comments or suggestions may be forwarded to Colin Thorne, Coffey Partners International Pty Ltd.

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# WESTERN AUSTRALIAN GROUP

## Reports on Recent Meetings.

The airline strike restricted our programme in the latter half of 1989 with a number of meetings having to be cancelled or deferred when speakers' transport arrangements were disrupted. A brief review of meetings which did proceed, is presented below.

5 October 1989 - Dr M Khorshid

### **'GEOTECHNICAL EXPERIENCE ON THE NORTH WEST SHELF'**

The North Rankin 'A' platform was installed in 1982 on the north west shelf of Australia and is located in a water depth of 125 m. The platform was designed to resist cyclonic weather conditions. The proposed Goodwyn 'A' platform will be installed in 1992. It is located approximately 23 km to the south west of North Rankin 'A' in similar water depth and on similar foundation materials.

This presentation discussed the geotechnical programmes undertaken for both North Rankin 'A' and the proposed Goodwyn 'A' platforms. These included:

- the experience with the initial design of North Rankin 'A', including measures which were to be implemented if the design assumptions could not be verified during installation; the realisation that following the implementation of these remedial measures, the capacity was still insufficient; the development of an extensive field and laboratory test programme to enable the design of further primary and secondary remedial measures and the implementation of the selected option which consisted of an end bearing solution.
- the selection of drilled and grouted piles for the proposed Goodwyn 'A' platform foundations; the site investigations both offshore and onshore; the development and results of the large scale pile load testing programme and the modification to the design codes which included effects of long term cycling.

23 November 1989 - Professor CP Wroth

### **'CONTROL OF GROUND MOVEMENTS AROUND A LARGE EXCAVATION IN LONDON'**

One of the many developments taking place at present in London is the construction of a large office block to serve as headquarters in Europe for one of the leading American banks. Planning permission restricted the height of the building, so that in order to maximise the investment in the site, four basement levels are being constructed below existing ground level.

The resulting excavation is essentially rectangular in plan, with dimension 145 m x 45 m x 18.5 m deep. The method of construction is 'top-down' with initially a deep slurry trench diaphragm wall formed around the site; the ground floor slab

is cast and excavation proceeds under this slab to the next level. Each floor in turn acts as a stiff horizontal diaphragm to restrain the lateral movements of the retaining wall and minimise possible damage to neighbouring buildings.

The talk included description of the site investigation and soil testing (cone penetration testing, self-boring pressuremeter tests and special triaxial tests), the finite element calculations of the movement of the wall and the performance of the wall as monitored by accurate survey and inclinometers.

The 1990 programme has included the following technical meetings:

13 March 1990 - C Bradbury & C Potulski

### **'SLURRY TRENCH CUTOFF FOR THE HARRIS DAM'**

High labour costs and improved safety standards rule out traditional methods of constructing deep seated cutoffs in soil foundations of modern dams. The talk reviewed the selection of a cement bentonite slurry trench cutoff for the Harris Dam and discussed the problems encountered in mix design and cutoff construction.

15 May 1990 - D Smith (Joint meeting with Structures Panel)

### **'THE ENGINEERING PROPERTIES OF PERTH SANDS'**

Mr. D. Smith presented a paper which included the following topics:

- types of Perth Sands
- their strengths and densities
- settlement and bearing capacity
- effect of groundwater
- Perth Sand Penetrometer tests in sand
- Electric Friction Cone tests in sand.

21 June 1990 - C Windsor

### **'ROCK MECHANICS AND STRUCTURED SLOPES'**

In recent years a number of advances have been made in rock mechanics that have direct application to surface excavations in structured rock. These include investigation and analysis techniques in structural geology, design and analysis techniques for single block stability assessment, continuum and discontinuum computation techniques for analysing progressive collapse mechanisms and new reinforcement hardware. Individually, these advances are substantial but when integrated, yield a powerful methodology for the design and analysis of unreinforced and reinforced surficial excavations.

5 July 1990 - J Doyle

### **'THE APPLICATION OF CROSS HOLE SEISMICS IN THE CIVIL AND MINING INDUSTRIES'**

Mr John Doyle of BHP Engineering presented a paper to the W.A. Group of the Australian Geomechanics Society on The Application of Cross Hole Seismics in the Civil and Mining Industries. The main part of presentation concentrated on the use of cross-hole seismic techniques to obtain a complete

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two-dimensional picture of the ground conditions between a pair of boreholes. The speaker used the analogy of brain scanning using X-ray tomography to explain the process. In seismic tomography, a string of geophones is lowered into one borehole, and a string of charges lowered into another. Ideally, the string lengths are the same order as the borehole spacing. The charges are fired in sequence (usually starting from the bottom of the borehole), and each geophone records the arrival time of the compression wave from each explosion. Thus, if there are  $n$  geophones and  $n$  charges, an array of  $n \times n$  arrival time values are recorded in the whole test.

By dividing the area between the boreholes into a rectangular grid, the average compression wave velocity  $V_p$  of each cell can be uniquely determined, with the only limiting assumption being that the fastest travel path between source and geophone is a straight line. Having obtained values of  $V_p$  for each cell, contouring of  $V_p$  is carried out automatically by the computer software, and the results displayed in colour on the screen. This is the so-called tomograph of the area between the boreholes. The final stage is to interpret this contour plot to relate the contours to the geology of the area.

During subsequent discussion, questions from the audience related mainly to the effect of the assumption of straight-line travel (especially where the object was to search for cavities), to the cost of the process, and to the scale of operations in which it was most ideally used.

9 July 1990 - Professor B Whittaker

#### **ROCK SLOPE STABILITY AND MINING SUBSIDENCE**

Professor Barry Whittaker from the University of Nottingham addressed a well attended lunchtime meeting on subsidence and slope stability. He presented many examples and a fascinating array of slides to illustrate the dramatic affects of subsidence and slope failure. The topic obviously attracted a wider audience than usual with many new faces.

#### **Future Meetings**

30 August 1990 - C Orr (Luncheon Meeting with Mining Club)

#### **SUBJECT: OPEN PIT ABANDONMENT**

The recent increase in the open pit mining within the State will result in between 60 and 100 open pits being abandoned over the next few years. The talk will deal with the existing guidelines on safety bund walls around abandoned open pits, types of pit failures observed in a sample of approximately 70 pits and analytical techniques used to predict the long term stability of pit slopes.

4 September 1990 - Dr PJ Hensley

#### **SUBJECT: CENTRIFUGE MODELLING OF CONTAMINANT TRANSPORT IN SOILS**

Centrifuge modelling is an ideal tool for studying problems associated with transport of pollutants through soils. This talk will present work from a number of model tests completed

using the geotechnical centrifuge at the University of Western Australia to investigate a variety of subsurface contaminant transport problems. The principles of centrifuge modelling processes governing transport phenomena and scaling laws will be briefly discussed. Tests will be described and results presented including comparisons with theoretical data from existing numerical transport codes. Conclusions and an outline of future work will be presented.

#### **NEWSLETTER**

The group has continued its practice of circulating a non technical newsletter with 2 editions so far this year. Contributions should be forwarded to: G. Cocks c/- Coffey Partners International, P O Box 517, Subiaco WA.

### **'OSBORNE GEOTECHNICAL'**

**in the West**

We announce the formation of a new consulting practice based in Perth. The principal is Trevor Osborne and the firm trades under the banner of Osborne Geotechnical. Trevor has decided to change roles after over 20 years in the specialist contractor field with Grouting and Foundations and the Cementation Co (Aust) Ltd.

The practice is specialising in construction aspects of Geotechnical Engineering with particular emphasis on foundations, grouting, soil retention and soil stabilisation.

Trevor Osborne is also developing particular expertise in the field of soil reinforcement and the firm has established links with Dr Richard Jewell at Oxford University and Prof. Colin Jones at Newcastle upon Tyne. Richard and Colin are regarded as two of UK's leading practitioners in the field of reinforced soil design and construction. This field includes the use of reinforcing techniques for soil structures and embankment construction and the developing area of soilnailing.

The client base for the firm already includes representation from other specialist consulting firms, structural consultants, contractors, mining companies and government departments.

With the practice working within a very specialised area it is well placed to provide practical advice to compliment the services of other geotechnical consultants.

# GEODIARY

## CONFERENCES, COURSES, SEMINARS, SYMPOSIA, WORKSHOPS, ETC

*Brief details of conferences, courses, seminars, symposia, workshops, etc will be entered in Geodiary without charge as a service to members of the Society. Advertisements giving more prominence and carrying greater detail may be inserted in any issue of Australian Geomechanics.*

**AUG 6-10, 1990**

**Amsterdam, The Netherlands.**

6TH INTERNATIONAL CONFERENCE OF THE IAEG.

**Topics:** Engineering geological mapping; Remote sensing and geophysical techniques; Hydro-engineering geology; Surface engineering geology; Underground engineering geology; Engineering geology of land and marine hydraulic structures; construction materials. **Languages:** English and French.

Sixth International IAEG Conference, QLT/ CONGREX, Keizersgracht 782, 1017EC Amsterdam, The Netherlands.

**AUG 1990**

**Bucharest, Romania.**

INTERNATIONAL COLLOQUIUM ON VISCOPLASTICITY OF GEOMATERIALS.

**Topics:** Recent Developments in theory, experiment, computational methods and applications.

Chairman Organising Committee of Colloquium on Viscoplasticity of Geomaterials, Department of Mechanics, University of Bucharest, str Academiei 14, Bucharest Cod 70109, Romania.

**AUG 28-31, 1990**

**Beijing, China.**

INTERNATIONAL SYMPOSIUM ON ADVANCES IN GEOLOGICAL ENGINEERING.

**Themes:** Systematic evaluation of the engineering geological conditions for site selections; Processing of the geological information and establishment of the geomechanical models; Evaluation of the geomechanical parameters; Reliability analysis of the geological engineering and the optimum design; The monitoring system of the geological engineering and the back-analysis; Case histories with emphasis on integration of geology into engineering.

Dr Yang Zhifa, International Symposium on Geological Engineering Problems, Institute of Geology, Academia Sinica, Beijing, P.O. Box 634, China. Tel: 4014031 Fax:(86)(1) 4014031.

**SEP 3-5, 1990**

**Cranfield, UK.**

INTERNATIONAL CONFERENCE ON

MICROBIOLOGY IN CIVIL ENGINEERING.

**Topics:** include rock and groundwater environments and geotechnical engineering.

Mrs C. King/Dr P. Howsam, Silsoe College, Silsoe, Bedford, MK45 4DT. Tel:(0525) 60428. Fax:(0525) 61527.

**SEP 3-7, 1990**

**Glasgow, UK.**

3RD INT. SYMPOSIUM ON RECLAMATION TREATMENT AND UTILISATION OF COAL MINING WASTES.

Dr A.K.M. Rainbow, Head of Minestone Services, British Coal Corporation, Philadelphia, Houghton-le-Spring, Tyne and Wear, DH4 4TG, UK. Tel:091 584 3631

**SEP 3-7, 1990**

**Chengdu, Sichuan, China.**

INTERNATIONAL CONGRESS ON TUNNEL AND UNDERGROUND WORKS - TODAY AND FUTURE.

**Topics:** Design and construction of railway tunnels, urban tunnels and metros, hydro tunnels and rock caverns; Theoretical analysis and design of underground structures. **Languages:** English and Chinese.

Prof. Xu Wenhuan, Southwest Jiaotong University, Jiu Li Di 610031, Chengdu, Sichuan, China. Tlx: 600072 SWJU CN.

**SEP 9-13, 1990**

**Leeds, UK**

26TH ANNUAL CONFERENCE OF THE ENGINEERING GROUP OF THE GEOLOGICAL SOCIETY.

**Theme:** The Engineering Geology of Weak Rock.

**Topics:** Weak rock materials; Weak rock masses; Engineering in weak rocks.

Dr S.R. Hencher, Department of Earth Sciences, University of Leeds, LS2 9JT, UK.

**SEP 10-12, 1990**

**Glasgow, UK.**

INTERNATIONAL REINFORCED SOIL CONFERENCE.

**Sessions:** Theory and Design Related to the Performance of Reinforced Soil Structures; Construction Influences on the Performance; In-situ Techniques; Modelling and Laboratory Testing of Soil and Material Properties; Design, Construction and Performance of Reinforced Soil Structures over Soft and Difficult Foundations.

Conference Secretariat, Meeting Makers, 50 Richmond St., Glasgow, G1 1XP, UK. Tel:(041) 553 1930. Fax:(041)552 0511.

**SEP 10-12, 1990**

**Royal Swazispa, Swaziland.**

ISRM INTERNATIONAL SYMPOSIUM ON STATIC AND DYNAMIC CONSIDERATIONS IN ROCK ENGINEERING.

**Topics:** Excavation in rock, mechanical and explosive methods; Dynamic behavior of excavations in rock; Long term performance of excavations in rock susceptible to deterioration.

Mr M. Faure, ISRM Symposium, PO Box 5906 Johannesburg 2000, Republic of South Africa. Tel:(011) 399 4738. Fax:(011) 339 1281. Tlx: 9-450083 SA.

**SEP 11-13, 1990**

**Sydney.**

SEVENTH AUSTRALIAN TUNNELLING CONFERENCE AND TRADE EXHIBITION -THE UNDERGROUND DOMAIN.

**Objectives:** The aim of the conference is to provide a forum for discussion of the broad economic, social and technical factors that bear upon our community's use of underground space. This will be achieved by bringing together interested entrepreneurial, urban planning, technical, construction, regulatory and environmental specialists.

The Conference Manager, The Institution of Engineers, Australia, 11 Barton Circuit, BARTON, ACT 2600, Australia. Tel:(06) 270 6563 Fax:(06) 270 6530. Tlx:AA62758.

**SEP 12-15, 1990**

**Nottingham University, UK.**

BNCOLD'S 6TH CONFERENCE ON EMBANKMENT DAM.

**Topics:** State of the art of embankment dam; Tailings dams design and operation; Risk, hazard and safety; Research; Dams and the environment.

N.Tyler, The Institution of Civil Engineers, 1-7 Great George St, London SW1P 3AA, UK.

**SEP 17-20, 1990**

**Toronto, Ontario**

DAM SAFETY CONFERENCE OF THE CANADIAN DAM SAFETY ASSOCIATION.

**Topics:** Inspection and monitoring; Legislation and emergency planning; Dam safety assessment and Innovative case studies. A tour of various dams on the Niagara Peninsula is also planned.

Mr B. Hurndall, P.O. Box 4490, South Edmonton postal Station, Edmonton, Alberta, Canada T6E 4X7. Tel:(403)422-1359 or Grant Smith, Ontario Hydro, Tel:(416)590-2498.

SEP 18-20, 1990

**Santander, Spain.**

2ND EUROPEAN SPECIALTY CONFERENCE ON NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING.

**Theme:** Establishment of links between the development and practical application of numerical methods in Geotechnical Engineering and the enhancement of cooperation with other existing groups within the field of numerical methods in Geotechnical Engineering.

D.C.I.T.T.Y.M., Escuela de Ingenieros de Camerinos, Universidad de Cantabria, Avda. de Los Castros, s/n, 39005 Santander, Spain. Tel: 42-201822 Fax:42-275862.

OCT 1-5, 1990

**Kuala Lumpur, Malaysia.**

4TH INTERNATIONAL CONFERENCE ON SMALL HYDRO 1990.

**Topics:** Assessing the needs of developing countries; International cooperation; Implementing technology transfer and training; Environment impact studies; site selection; using indigenous technology.

Mr L. Maskell, Water Power & Dam Construction, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS, UK. Tel:44 1 661 3622. Fax 441 661 8904. Tlx: 892084 REEDBP G.

OCT 2-5, 1990

**Budapest, Hungary.**

9TH DANUBE-EUROPEAN CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.

**Theme:** Deep Geotechnical Works in Urban Areas.

Prof. G. Petrasovits, Geotechnical Department, Technical University, H-15212 Budapest, Muegyetem rkp.3. Tel:(36-1-)1666-42-42, Fax:(31-1-) 166 68-08. Tlx:225931 MUEGY.

OCT 10-12, 1990

**Sainte-Foy, Quebec.**

CONFERENCE, PREDICTION AND PERFORMANCE IN GEOTECHNIQUE.

**Topics:** Economic significance of landsliding in Canada; Static liquefaction in sand; Characteristics and properties of aggregates; Geotechnical aspects of earthquakes; soil and treatment.

Dr Jacques Locat, ing., President du C.O., Dept. de geologie (GREGI) Pavillon Pouliot, Universite Laval, Sainte-Foy, Quebec G1K 7P4. Tel: (418)656-2179.Fax:(418)656-2603.

OCT 11-13, 1990

**Cracow, Poland.**

9TH NATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.

**Topic:** Theoretical and experimental bases of geotechnics; Practical problems in geotechnics; Geotechnical aspects of

environmental control.

Komitet Organizacyjny IX Krajowej Konferencji, Mechanikow Gruntow i Fundamentowania, Biuro R W NOT, Dzial Org. Prezydialny, ul Straszewskiego 28, 31-113 Krakow.

OCT 11-13, 1990

**Indianapolis, Indiana.**

SPOTLIGHT '90. INDUSTRY, TRADE SHOW AND SYMPOSIUM SPONSORED BY THE INTERNATIONAL DRILLING FEDERATION.

International Drilling Federation, 3008 Millwood Av, Columbia, SC, USA 29205. Tel:(800)445-8629.

OCT 16-18, 1990

**Lille, France.**

INTERNATIONAL CONFERENCE ON UNDERGROUND CROSSINGS FOR EUROPE.

**Topics:** Geography; Design and work techniques; Economic and financial aspects; Operation of structures. **Languages:** English and French.

Journees d'Etudes A.F.T.E.S - Semaly, Mrs Jacqueline Boller, 25 cours Emile-Zola, 69625 VILLEURBANNE CEDEX.

Tel:78 94 86 00, Fax:78 94 86 00,

Tlx: 380801F.

OCT 17-20, 1990

**Caracas, Venezuela.**

3RD SOUTH AMERICAN CONGRESS ON ROCK MECHANICS.

**Topics:** Characterisation and properties of the rock mass; Slope stability for soft and for fractured rocks; Foundations on soft and fractures rocks; Tunnels in soft and fractured rocks; Open pit and underground mining; Rock mechanics applications to oil industry; Special topics.

Juan Francisco Lupini, Ap. Post 4074, Caracas 1010, Venezuela. Tel:(582) 7513824 / (582) 6625902. Fax:(582) 5628048. Tlx:29136 CEHVC.

OCT 30-31, 1990

**Singapore.**

CONFERENCE ON DEEP FOUNDATION PRACTICE.

**Topics:** Support and stability of deep foundations; Load bearing and settlement solutions; Strengthening of foundations of existing structures and industrial buildings; Soil-structure interaction; caisson design and construction; Piling economics, systems, design etc.; Piling installation, testing, interpretation; Stress wave measurements, load capacities; New development in micropiles; Deep raft foundations - construction method; Bored piles, tubular piles and applications; Case histories and practical examples. Keynote addresses by Prof. Bengt Broms and Mr William Loftus. **Abstracts:** 1 Jul 1990. **Papers:** 5 Sep.

CI Premier Pte Ltd, 150 Orchard Rd, #7-14 Orchard Plaza, Singapore 0923. Tel: 733 2922. Fax: 2353530.

NOV 4-7, 1990

**Magnetic Island, North Queensland.**

ENGINEERING IN CORAL REEF REGIONS.

A conference for Engineers and Scientists involved in the engineering activities in the Great Barrier Reef and similar regions.

**Purpose:** To provide engineers with an up-to-date scientific overview of the reef environment; To allow the exchange and publication of engineering experience in the Great Barrier Reef and similar regions; To identify research priorities for engineering activities in or associated with the Great Barrier Reef region.

Dr Michael Gourlay, Department of Civil Engineering, The University of Queensland, St Lucia, Qld. 4067.

Tel:(07)377 2543. Fax:(07)371 5863.

Tlx: AA40315 UNIVQLD.

NOV 7-9, 1990

**Calgary, Alberta, Canada.**

SECOND INTERNATIONAL CONFERENCE ON MINE PLANNING AND EQUIPMENT SELECTION.

**Theme:** Geotechnical Stability and Mine Equipment Selection for Surface Mines.

**Topics:** Pre-mining investigations; Slope stability predictions and monitoring techniques; In-situ instrumentation; Ground water; Slope stability analysis; Pit slope stabilisation techniques; Blasting and controlled blasting; Haulroad design and construction; Design and construction of waste dumps; Liquid storage and tailings ponds; Application of geotextiles; Remote sensing; Reclamation; Equipment selection procedures; Continuous mining systems; Change over to continuous mining systems; truck/shovel, draglines, conveyors, etc; In-pit crushing/conveying; Pipeline transporting; Drilling and blasting equipment; Dredging; Mine maintenance; Equipment health and performance; Monitoring systems; Case histories.

Dr Raj K. Singhal, Symposium Chairman, Faculty of Continuing Education, The University of Calgary, 2500 University Drive, N.W., Calgary, Alberta T2N 1N4. Tel:(403)220-6069, Fax:(403)282-7208.

NOV 19-21, 1990

**Tehran, Iran.**

FIRST INTERNATIONAL SEMINAR ON SOIL MECHANICS AND FOUNDATION ENGINEERING OF IRAN.

**Themes:** Exploration and Evaluation of Soil Properties; Design and Analysis in Geotechnical Engineering; Problems of Regional Soils; Underground Structures; Construction Control and Monitoring.

Organising Committee, Plan and Budget Organisation (Technical Research and Standards Bureau), Post Code: 15316, Dr Beheshti Ave., Pakistan St., 2nd Alley, No 7, 4th Floor, Tehran, Iran.

**NOV 26-30, 1990**

**Bangkok, Thailand.**

**GEOTECH' 1990. 14TH ANNUAL GEOTECHNICAL SYMPOSIUM.**

**Topics:** Model Tests in Relation to Traditional Laboratory and Field Tests.

Asian Institute of Technology, GPO Box 2754, Bangkok 10501, Thailand. Tel:(43)529004. Fax:(66-2)5290374.

**FEB 25-MAR 1, 1991**

**Atlanta, Georgia, USA.**

**GEOSYNTHETICS '91. - THE BIENNIAL NAGS-IFAI CONFERENCE.**

**Theme:** The conference will focus on current applications of geosynthetics and technical advancements.

**Topics:** Transportation; Waste management & other environmental applications; Commercial & industrial applications; Building and foundations; Heavy construction & earthworks projects; Geosynthetic durability; Future applications; Geosynthetic innovations; Technical advancements - research, testing, new design methods. There will also be pre and post conference courses and a special forum on failures and solutions to discuss lessons that can be learned from examples of misapplication.

NAGS Secretary, Ms Laurie Honningford, Industrial Fabrics Association International, 345 Cedar St, Suite 800, St Paul, MN, USA, 55101. Tel:(800)225-4324 or (612)222-2508. Fax:(616)222-8215.

**MAR 11-14, 1991**

**Perth, Australia**

**ANCOLD 1990 CONFERENCE ON DAMS**

**Topics:** RCC and Earthfill dams; Tailings dams; Repairs and Rehabilitation; Catchment management.

C. Bradbury, 1990 ANCOLD Conference, Water Authority of Western Australia, PO Box 100, Leederville, WA 6001.

**MAR 11-15, 1991**

**St Louis, Missouri, USA**

**2ND INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS.**

Shamsher Prakash, Conference Chairman, Dept of Civil Engineering, University of Missouri-Rolla, Rolla, MO 65401, USA. Tel:(314)341-4489 or 341-4461. Fax:(314)341-4719.

**MAR 18-20, 1991**

**Milano, Italy.**

**EUROPEAN CONFERENCE ON "SOIL AND ROCK IMPROVEMENT IN UNDERGROUND WORKS".**

**Topics:** Ground reinforcement; Low pressure grouting; Very high pressure grouting; Drainage; Freezing; Preventative schemes.

Organising Secretariat, MGR S.r.l., Via Servio tullio 4, 20123 Milano, Italy. Tel:02/43007.1. Fax:02/4980723.

**MAR 19-21, 1991**

**Paris, France.**

**INTERNATIONAL CONFERENCE ON DEEP FOUNDATIONS. Topics:** New technologies; Behaviour and design; Control and load tests; Repetitive loads and dynamic stresses.

F.Schlosser, Tour Horizon, 52 quai de Dion Boulton, 92806 Puteaux Cedex, France. Tel:(1) 47.76.43.14. Fax:(1) 47.73.85.64. Tlx:610386F.

**APR 7-12, 1991**

**Stresa, Italy.**

**4TH INTERNATIONAL CONFERENCE ON PILING AND DEEP FOUNDATIONS.**

**Topics:** Technological developments in deep foundations with soil excavation; Pile installation equipment; Pile design; Pile testing.

J. M. Mitchell, Ove Arup and Partners, 13 Fitzroy St. London W10 6BQ, UK. Tel:01 636 1531. Fax:01 580 3924. Tlx: 295341 OVARPT G.

**APR 15-19, 1991**

**Canary Islands, Spain.**

**23RD INTERNATIONAL CONGRESS OF THE INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS. AQUIFER OVER-EXPLOITATION.**

**Topics:** Characterisation of over-exploitation. Hydrogeological and hydrochemical aspects; Environmental effects related to over-exploitation; Protective and corrective measures in cases of over-exploitation; Legal and socio economic problems related to aquifer over-exploitation; Over-exploited aquifers in water resources management.

Dr Fermin Villarroya, Dept. de Geodinamica, Facultad de Ciencias Geologicas, Universidad Complutense, 28040 Madrid, Spain. Tel:(34-1)449-73-91. Fax:(34-1)243-91-62.

**APR 15-19, 1991**

**Isle of Wight, UK**

**INTERNATIONAL CONFERENCE ON SLOPE STABILITY ENGINEERING.**

**Topics:** Mechanics of landslides; Environmental influences on slope stability; Planning aspects; Investigation techniques; Coastal slopes (including Isle of Wight studies); Remedial works.

Conference office, Institution of Civil Engineers, 1-7 Great George St, London SW1P 3AA, UK.

**MAY 6-10, 1991**

**Cairns, Queensland.**

**INTERNATIONAL CONFERENCE ON COMPUTER METHODS AND ADVANCES IN GEOMECHANICS.**

**Topics:** Constitutive modelling of geomaterials; Methods for solving problems in rock, soil and ice mechanics; Analytical methods in geomechanics; Hardware and software; Verification by field and laboratory measurement.

IACMAG 1991, GPO Box 853, Brisbane, Qld., 4001. Australia. Tel:(07) 21 2762. Fax:(07) 220 0231. Scientific enquiries to: Conference Chairman, Dr G. Beer, CSIRO., PO Box 63, St Lucia, Qld., 4067. Tel:(07)377 7822. Fax:(07)371 7435.

**MAY 12-18, 1991**

**Houston, Texas, USA.**

**FOURTH INTERNATIONAL SYMPOSIUM ON LAND SUBSIDENCE. Objects:** Provide a forum for presenting results of research and practice in the subject; Exchange experiences related to cause, effect, control and remediation of land subsidence; Promote technology transfer between the various disciplines and countries represented; Evaluate the advance of knowledge taking place on this subject since 1983 and develop guidelines for needed future research.

Ivan Johnston, Chairman, FISOLS, A.Ivan Johnston Inc, 7474 Upham Court, Arvada, CO 80003, USA.

**MAY 27-JUN 1, 1991**

**Florence, Italy.**

**10TH ISSMFE EUROPEAN REGIONAL CONFERENCE.**

**Topics:** Experimental determination of soil properties; Modelling stress-strain behaviour of natural soils; Displacements and soil-structure interaction, Specialty sessions on a range of associated topics.

The Organising Committee, X ECSMFE, C/ - Associazione Geotecnica Italiana, Via Bormida, 2, 00198 Rome, Italy. Tel: 39 6 856129.

Fax: 39 6 8842265.

**JUN 3-7, 1991**

**Mexico City.**

**6TH INTERNATIONAL CONFERENCE ON APPLICATIONS OF STATISTICS AND PROBABILITY IN CIVIL ENGINEERING.**

Instituto de Ingenieria, Unam, Ciudad Universitaria, Apartado Postal 70-472, Coyoacan 04510, Mexico, d.f.

**JUN 10-12, 1991**

**Boulder, Colorado, USA.**

**ASCE GEOTECHNICAL ENGINEERING CONGRESS.**

**Topics:** Broad scope with emphasis on examples from current practice and recent innovations for future practice.

Prof. Stein Sture, Department of Civil, Environmental and Architectural Engineering, University of Colorado, Boulder, Colorado 80309-0428 USA.

Tel:(303)492-7651.

Fax:(303)492-7317.

**JUN 13-14, 1991**

**Boulder, Colorado, USA.**

**INTERNATIONAL CONFERENCE - CENTRIFUGE 91.**

**Topics:** Design and operation of new facilities; Special instrumentation problems

and design of test packages; Studies of basic mechanics and gravity dependent phenomena; Application of centrifuge modelling to natural and manmade hazards reduction; Centrifuge studies related to engineering design and practice; Relations between centrifuge testing, full scale testing and numerical methods.

Prof. Hon-Yim Ko, Centrifuge 1991, Department of Civil, Environmental and Architectural Engineering, University of Colorado, Boulder, Colorado 80309-0428 USA. Tel:(303)492-6716 Fax:(303)492-7317

**AUG 26-30, 1991**

**Vina del Mar, Chile.**

**IX PAN-AMERICAN CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.**

**Topics:** Mass movement phenomena; geotechnical properties of soils in America; Geotechnical aspects of waste disposal; Foundations; Underground excavations in urban areas. **Languages:** English and Spanish.

Mr Luis Valenzuela, Secretary General - IX PCSMFE - Vina 1991, San Martin 352, Santiago, Chile. Tel:(56-2)2516527-2257861-498330-2616149. Fax:(56-2)4127. Tlx:240501 BOOTH CL.

**SEP 9-11, 1991**

**Oslo, Norway.**

**3RD INTERNATIONAL SYMPOSIUM ON FIELD MEASUREMENTS IN GEOMECHANICS.**

**Topics:** Instrumentation and measurement techniques; Data acquisition, processing and interpretation; Use of field measurements as an aid to problem solving. **Abstracts:** Mar 15, 1990. **Language:** English.

FMGM-91, Norwegian Geomechanical Institute, PO Box 40, Taasen, N-0801 Oslo 8, Norway. Tel:+47 223 0388. Fax:+47 223 04 48. Tlx:19787 NGIN

**SEP 10-12, 1991**

**Beijing, China.**

**SIXTH INTERNATIONAL SYMPOSIUM ON GROUND FREEZING.**

**Topics:** Heat and mass transfer; Mechanical properties; Engineering design; Case histories.

ISGF 91, Central Coal Mining Research Institute, Hepingli, Beijing 100013, PR China.

**SEP 16-20, 1991**

**Aachen, FRG.**

**7TH INTERNATIONAL CONGRESS ON ROCK MECHANICS.**

**Topics:** Rock mechanics and environmental protection; Rock mechanics based on reliable descriptions of geological conditions; Stability of rock slopes; Underground construction in rock. **Abstracts:** July 15, 1990. **Papers:** March 1, 1991. **Languages:** German, English and French.

Dr Ing. W. Wittke, ISRM-Kongresssekretariat Institut für Grundbau, Bodenmechanik, Felsmechanik und Verkehrswasserbau der RWTH Aachen, Mies-van-der-Rohe-Strasse 1, D-5100 Aachen, West Germany. Tel:02 41 80 52 47.

Fax:02 01 78 27 43. Tlx: 832704 THAC

**SEP 18-21, 1991**

**Cologne, FRG.**

**GEOTECHNICA - INTERNATIONAL TRADE FAIR AND CONGRESS FOR GEOSCIENCES AND TECHNOLOGY.**

**Theme:** Interdisciplinary event for all geosciences concentrating on the fields of earth, water, air and energy.

Koln Messe, Messe-und Ausstellungs-Ges.m.b.H. Koln, Messelplatz 1, Postfach 21 07 60, D-5000, KOLN 21 FRG. Tel:02 21 821 0. Fax:02 21 821 25 74. Tlx: 8873426 MUA D.

**SEP 23-27, 1991**

**Maseru, Lesotho.**

**10TH ISSMFE AFRICAN REGIONAL CONFERENCE.**

**Theme:** Geotechnics in the African Environment. **Topics:** Geological influences; Problem soils; Testing; Foundations; Roads; Dams; Waste disposal; Environmental aspects. **Languages:** English and French.

Mr M. Lephoma, Hon Secretary 10 ARC SMFE, PO Box 7737, Maseru 100, Lesotho.

**SEP 29- OCT 2, 1991**

**Calgary, Alberta, Canada.**

**44TH CANADIAN GEOTECHNICAL CONFERENCE.**

**Topics:** Soil mechanics and foundation engineering; Rock mechanics; Engineering geology; Cold region geotechnics; Oil sands engineering; Irrigation and water resources; Environmental engineering; Case histories.

Ken Been, Golder Associates, 7017 Farrell Road SE, Calgary, AB T2H 0T3, Canada. Tel:(403)259-3413. Fax:(403)252-4884.

**DEC 9-13, 1991**

**Bangkok, Thailand.**

**9TH ISSMFE ASIAN REGIONAL CONFERENCE.**

**Topics:** Development of the theory and practice in Geotechnical Engineering (including soil sampling, laboratory and field testing, design methods and construction works); Problematic soils and their engineering behaviour (including collapsible, expansive, dispersive and erosive soils as well as other problematic soils); Soil-structure interaction and foundations (including settlement and compressibility characteristics); Embankments, excavations and buried structures; Natural hazards and environmental engineering; Ground improvement techniques. **Language:** English. **Abstracts by Oct 1990, papers by Feb 1991**

Prof. A.S. Balasubramaniam, Secretary South East Asia Geotechnical Society, Asian Institute of Technology, PO Box 2754, Bangkok 10501, Thailand. Fax:66-2 529 0374. Tlx:842767H.

**FEB 3-7, 1992**

**Christchurch, New Zealand.**

**6TH ANZ CONFERENCE ON GEOMECHANICS.**

Dr D.McG.Elder, Convenor Organising Committee, C/- Soils and Foundations Ltd, PO Box 451, Christchurch, New Zealand. Tel:(3)798 432. Fax:(3)667 780.

**FEB 10-14, 1992**

**Christchurch, New Zealand.**

**6TH INT.SYMPOSIUM ON LANDSLIDES.**

Dr D.Bell, Geology Department, University of Canterbury, Christchurch, New Zealand.

**FEB 25-28, 1992**

**New Orleans, USA.**

**SPECIALTY CONFERENCE ON GROUTING, SOIL IMPROVEMENT AND GEOSYNTHETICS.**

**Topics:** Soil Reinforcement, densification and stabilisation; Application of geosynthetics; Grouting and grout materials; Environmental technology. **Abstracts:** Sep 1, 1990.

Dr Ilan Juran, Department of Civil Engineering, Louisiana State University, Baton Rouge, LA 70803, USA. Tel:(504)388 8699. Fax:(504)388 5990.

**MAY 10-16, 1992**

**Rostock, GDR.**

**3RD BALTIC CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.**

Prof. Dr Rattay, Kammer der Technik, Anschrift, Clara-Zetkin-Str. 115/117, PSF 1315, Berlin DDR. Tel:2 20 25 31. Tlx:011 4841 TECH KAMMER.

**MAY 28-31, 1992**

**Aalborg, Denmark.**

**XI Nordic Geotechnical Meeting.**

Prof. Jorgen Steenfelt, Danish Geotechnical Society, Maglebjergvej 1, DK-2800 Lyngby, Denmark.

**AUG 23-26, 1993**

**Kingston, Canada.**

**INTERNATIONAL CONGRESS ON MINE DESIGN.**

Peter Scott, Department of Mining and Engineering, Goodwin Hall. Tel:(613)545-2212.

Fax:(613)545-6597.

**JAN 5-10, 1994**

**New Delhi, India.**

**XIII INTERNATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.**

Prof.S.K. Gulhati, Organising Secretary General 13th ICSMFE, Indian Geotechnical Society, C/o Indian Institute of Technology, New Delhi, 110016, India.

# Introduction

Although Australia has a population of only 17 million people, it is a continent which is as large as Europe and the USA. The majority of the population live in large coastal cities around the east and south east edges of the continent. The major tunnelling works associated with water supply, sewerage and hydro-electric power are therefore of a scope greater than might be expected for a country with so small a population as a direct result of the concentration of habitation. Australia is also major mining country, specialising in hard-rock metalliferous and coal mining.

Over the last 20 years there has been a revolution in underground construction through the increasing use of mechanical excavation methods and developments in Australia have often played a leading role. This has affected investigation, design and ground support procedures and has demonstrated the ability to dramatically increase productivity. Nevertheless, efficient conventional methods such as drill and blast methods are still applicable and widely used.

## Australian Underground Construction and Tunnelling Association (AUCTA)

The Australian Underground Construction and Tunnelling Association was formed in 1972 and is jointly sponsored by The Institution of Engineers, Australia and the Australasian Institute of Mining and Metallurgy. It is a non profit organisation uniting engineers, tunnellers and miners in its membership with the aims of:

- \* encouraging the use of subsurface space to meet social, environmental and economic demands for facilities.
- \* promoting advances in research, investigation, design, construction and maintenance of tunnels and subsurface openings and structures.
- \* acting as a focal point for the collection and dissemination of information on all aspects of tunnelling and underground construction.

The Association membership includes engineering and mining fraternities and extends to contractors, consultants, owners, public authorities, town planners, equipment and material suppliers and all individuals interested in tunnelling, underground construction and the utilisation of underground space.

## International Tunnelling Association (ITA)

AUCTA is one of the 35 member nations of the International Tunneling Association, which has its secretariat in France. ITA has a number of working groups: Maintenance and Repair of Underground Structures, Contractual Sharing of Risk, Subsurface Planning, Catalogue of Tunnels, Health and Safety in Work, Research, Immersed Tube Tunnels, Shotcrete Use and General Approaches to the Design of Tunnels. AUCTA has nominated corresponding representatives on all these groups.

ITA has an Annual General Assembly which is organised in one of the member nations countries. It also publishes the journal Tunnelling and Underground Space Technology (TUST); AUCTA membership qualifies for a heavily discounted subscription.

## AUCTA Activities

The Association encourages member participation in activities which include:

- \* organised talks on topics of interest to the members, usually in the form of lunchtime meetings
- \* tunnelling and underground excavation conferences, which are held triennially
- \* seminars on particular aspects of tunnelling and underground construction
- \* site visits to underground works
- \* presentation of the "Tunnelling Achievement Award" usually in conjunction with the triennial conference to an individual for outstanding achievements in the tunnelling industry.
- \* assisting with seminars and conference sessions organised by other mining and engineering groups.

## AUCTA also provides members with:

- \* a newsletter/journal "Australia Underground Construction and Tunnelling"
- \* copies of the United States National Committee on Tunnelling Technology newsletter (quarterly)
- \* contents abstracts (in English) from the Japan Tunneling Association newsletter "Tunnels and Underground"
- \* a price reduction on conferences and AUCTA publications
- \* reduced subscription rates to the International Society for trenchless Technology (ISTT)
- \* a regular list of references for recently published articles on tunnelling
- \* information on international underground construction
- \* a direct link to those interested in underground construction both nationally and internationally

## Membership

Four types of membership are available, Full (company or organisation), Affiliate (individual), Student (undertaking full time study at a tertiary institution) and Retired (wholly retired from a professional occupation)

- |                    |   |                 |                |   |                |
|--------------------|---|-----------------|----------------|---|----------------|
| * Full Member      | - | \$130 per annum | Student Member | - | \$10 per annum |
| * Affiliate Member | - | \$25 per annum  | Retired Member | - | \$10 per annum |

Full members receive a free copy of the AUCTA publication "Australasian Tunnelling Construction Index"

Any interested party can join and it is not necessary to be a member of either The Institution of Engineers, Australia or the Australasian Institute of Mining and Metallurgy>

## Committee

The Association is administered by a Committee which is elected and supported by members. Elections are held every odd numbered year and Committee Members usually hold office for a period of two years. The Chairman of the Association is elected in even numbered years by the Committee from its members and hold office for a period of two years. He is also Chairman of the Committee.

Any member of the Association is eligible for nomination for the Committee.

## Publications Available

From:  
The Australasian Institute of Mining and  
Metallurgy  
P.O. Box 122  
Parkville, Victoria 3052  
Tel: (03) 347 3166 Fax: (03) 347 8525

**Second Australian Tunnelling Conference**  
Melbourne, 1976, Design and Construction of  
Tunnels and Shafts. 234 pages

**Fourth Australian Tunnelling Conference,**  
Melbourne, 1981. 389 pages  
\$10.00 each or \$15.00 for both

**Sixth Australian Tunnelling Conference**  
Bore or Blast? 2 Vols, 358, 225 pages  
Melbourne 1987, \$80.00

From:  
E.A. Books, Engineers Australia  
P.O. Box 588  
Crows Nest, New South Wales 1065  
Tel: (02) 438 1533 Fax: (02) 438 5934

**Australasian Tunnelling Construction Index**  
A summary of tunnels constructed in Australia  
\$20.00

**Fifth Australian Tunnelling Conference**  
State of the Art in Underground Development and  
Construction, Sydney 1984, 212 pages - \$36.00

**Seventh Australian Tunnelling Conference**  
The Underground Domain, 316 pages  
Sydney 1990 - \$39

# Regulations

## Status

The Australian Underground Construction and Tunnelling Association is a non-profit making organisation with activities directed towards the learned society role. It is administered by the Australian Underground Construction and Tunnelling Committee.

The Association is affiliated with the Australian Geomechanics Society, which is a joint venture of The Institution of Engineers, Australia and The Australasian Institute of Mining and Metallurgy.

## Objects

The objects of the Association are to:

- advance knowledge of all the factors affecting the use of tunnels
- stimulate a better understanding of these factors by governments, planners and the general public, as well as by those directly concerned with the science and practice of tunnelling
- act as a focus for the collection and dissemination of information on all aspects of tunnelling, including social, economic, aesthetic, medical, industrial and legal, as well as technical aspects
- promote and review research and development and generally to advance knowledge of the socioeconomic, including environmental aspects, of tunnelling
- encourage the writing, presentation and publication of papers on all aspects of the field
- encourage the preparation of specialist technical manuals, data books, codes of practice, forms of contract, and other publications affecting tunnelling
- arrange conferences, symposia and meetings at suitable intervals and to collaborate with other agencies in arranging such functions
- correspond and act as a link with appropriate international bodies, and to participate in international activities concerned with the application, planning and practice of tunnelling
- review from time to time the adequacy of education and training of technologists in the field of tunnelling.

## Membership

Members include Commonwealth and State government departments and authorities, companies and other bodies active in the field.

Affiliates are individuals who support the objects of the Association.

Acceptance of a Member or of an Affiliate is subject to approval by the Committee and payment of the appropriate subscription.

## Australian Underground Construction and Tunnelling Committee

The Committee shall consist of a Chairman elected by the Committee who shall hold office for two years, and the following members:

- 1 person nominated by each of the I.E.Aust and the Aus.I.M.M.
- 4 persons elected by the Members, each candidate for election being the nominee of one of the Members, and on the staff of that Member. Each Member shall be entitled to make one nomination and cast one vote in the election for Members' representatives on the Committee
- 3 persons nominated from among Affiliates. Each Affiliate shall be entitled to cast one vote in the election for the Affiliates' representatives on the Committee
- Other members shall be
  - the immediate past-Chairman of the Association;
  - the Chairman of the Australian Geomechanics Society or his nominee; and
  - not more than 3 persons nominated by the Committee, to represent areas or disciplines considered to warrant increased representation.

In the event of there being fewer than 7 committee members elected, the Chairman may nominate persons to fill the vacancies, subject to confirmation by the Committee at its next meeting.

The Chairman may nominate replacements for elective members as appropriate to fill vacancies occurring between elections.

## Officers of the Association

The officers of the Association shall be a Chairman, a Deputy Chairman and a Secretary. The Chairman shall be elected every second year by the Committee from its own members at the second meeting in each even-numbered year and shall also be Chairman of the Committee.

The Deputy Chairman shall be elected at the first meeting of a newly elected Committee and shall also be Deputy Chairman of the Committee.

The Secretary shall be a joint nominee of the Chairman, the Chief Executive of The Institution of Engineers, Australia, and the Chief Executive Officer of the Australasian Institute of Mining and Metallurgy.

The venue of the Secretariat shall be agreed by the Chairman of the Association, the Chief Executive of The Institution of Engineers, Australia, and the Chief Executive Officer of the Australasian Institute of Mining and Metallurgy, and shall normally be the Organisation employing the Secretary.

## Tenure of office of the Committee

Elections shall be held in August of every odd-numbered year.

The new Committee shall take office on 30 September following an election.

## Meeting

The Committee shall normally meet twice in each calendar year at the discretion of the Chairman.

## Finances

Funds of the Association shall be handled by the Secretariat.

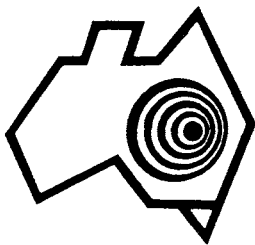
A financial statement shall be circulated to Members and Affiliates of the Association each year.

Funds may be used to pay for or contribute towards the activities of the Association including:

- Subscriptions to other appropriate bodies
- Secretarial and administrative expenses incurred by the Association
- Travelling and other expenses incurred in meetings of the Committee
- Publications approved by the Committee.

## Subscriptions

Subscriptions shall be fixed by the Committee from time to time.



**AUSTRALIAN  
UNDERGROUND  
CONSTRUCTION AND  
TUNNELLING  
ASSOCIATION**

**MEMBERSHIP APPLICATION FORM**

1. FULL MEMBER .....  
(Organisation name and  
Address) .....  
.....  
.....

2. AFFILIATE MEMBER .....  
STUDENT MEMBER\* .....  
RETIRED MEMBER# .....  
(delete as appropriate) .....

\*Student members please enter details of your course and the tertiary institution in  
Section 3 below.  
#Retired members please enter brief details of your previous professional occupation in  
section 3 below.

Member of: I.E.Aust YES/No Aus.I.M.M. YES/NO

3. STUDENT/RETIRED .....  
MEMBER .....  
further details .....  
.....  
.....

4. Name and address for .....  
mail, subscription renewal .....  
etc.if different from 1 or 2 .....  
above .....  
.....

I/we apply to join the Australian Underground Construction and Tunnelling Association as a  
full/affiliate/student/retired member and I/we agree to be bound by the Association Regulations.

Cheque/money order for \$.....is enclosed, OR  
BANKCARD/MASTERCARD authorisation overleaf completed.

Signature.....

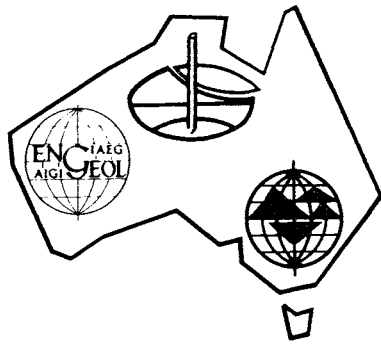
Date.....

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Secretariat: 11 National Circuit Tel: (062) 70 6555 Telex: AA 72 6548  
BARTON, ACT 2600 Fax: (062) 73 1488

Jointly sponsored by The Institution of Engineers, Australia and The Australasian Institute of Mining and Metallurgy





# Australian Geomechanics Society

## APPLICATION FOR SUPPORTING MEMBERSHIP (1991 Subscription \$300)

Name of Organisation .....

Address .....

.....

..... Postcode .....

Telephone ..... Facsimile ..... Telex .....

- Is your organisation
- A Commonwealth Government body or Department
  - A State Government body or Department
  - A private or public company or corporation
  - Other (please specify) .....

Supporting members may nominate two staff members to receive individual membership privileges, copies of all publications, etc.

Please provide details:

Title ..... Name ..... Brief Designation .....

(Dr/Mr/Mrs/Ms/etc.)

Address for mail .....

..... Postcode .....

Telephone ..... Facsimile ..... Telex .....

Title ..... Name ..... Brief Designation .....

(Dr/Mr/Mrs/Ms/etc.)

Address for mail .....

..... Postcode .....

Telephone ..... Facsimile ..... Telex .....

Occasionally, the Australian Geomechanics Society secretariat is asked by Australian and foreign organisations to supply lists of contractors, consultants and equipment suppliers in the geotechnical area. The Society provides the list of Supporting Members to meet such requests. Please indicate below the particular areas of interest of your organisation and state whether you have any objection to having your name included on such a list.

We do/do not object to having our name included in the list.

We apply for Supporting Membership of the Australian Geomechanics Society and agree to be bound by the Statutes of the Society as now in force or as amended from time to time.

Date ..... Signature .....

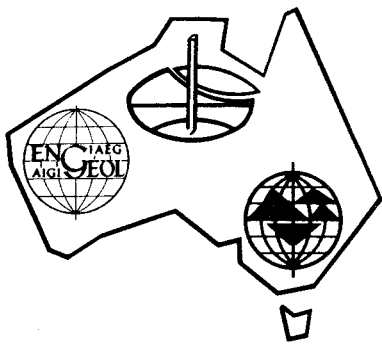
for .....  
(organisation)

### General areas of interest:

- Soil mechanics
- Foundation engineering
- Rock mechanics
- Engineering geology

### Specialised areas of interest:

- Foundations
- Slope stability
- Roads and pavements
- Earth dams
- Field testing
- Laboratory testing
- Site inspection
- Resource evaluation
- Underground openings
- Mining applications
- Other (please specify)



# Australian Geomechanics Society

## APPLICATION FOR MEMBERSHIP

Title ..... Surname ..... Other Names .....

Address ..... Postcode .....

Telephone ..... Facsimile ..... Telex ..... Brief Designation .....

### Membership qualifications

1. I am/am not a member of The IEAust (Grade) ..... or The AusIMM (Grade) .....

2. This section to be completed by those who are not members of AusIMM or IEAust.

Academic and Professional Qualifications .....

(Use recognised abbreviations. Documentary evidence may be required)

Employer .....

Position .....

Activities in Geomechanics .....

3. This section to be completed by persons applying for student membership

Are you a full time student at an Australian tertiary institution? Yes / No.

When are you due to finish your studies? .....

Name the Institution .....

If you are not a student member of The IEAust or The AusIMM, this application must be accompanied by a letter signed by the Head of Department of your tertiary institution stating that you are a full time student.

### International Societies and Subscription 1991

IEAust or AusIMM members ..... \$37.50 (Student and retired members \$19.00) \$ .....

Others ..... \$75.00 (Student and retired members \$38.00) \$ .....

The above annual fee entitles you to membership of one of the three International Societies listed below. If you wish to be a member of more than one society, you may do so by paying a fee of \$8 for each additional Society (maximum \$14).

Please circle the Societies you wish to join:

I.A.E.G.                      I.S.R.M.                      I.S.S.M.F.E.                      Additional charge \$ .....

If you elected to join the IAEG and wish to receive the IAEG Bulletin, please add \$8.00 to cover postage as the Bulletin is posted direct to individual members from France. You cannot subscribe to the Bulletin unless you elected to be a member of the IAEG

Bulletin \$8 \$ .....

**TOTAL** \$ .....

I declare that the information given above is correct. I hereby apply for membership of the Australian Geomechanics Society and I agree to be bound by the Statutes of the Society as now in force or as amended from time to time.

Date ..... Signature .....

So that we may provide a better service, please indicate your areas of interest by ticking the appropriate box(es).

#### GENERAL

- Soil mechanics
- Foundation engineering
- Rock mechanics
- Engineering geology

#### SPECIALISED

- Foundations
- Slope stability
- Roads & pavements
- Earth dams

- Field testing
- Laboratory testing
- Site inspection
- Resource evaluation

- Underground openings
- Mining applications
- Other (please specify)

## **OBITUARY**

Keith Grant, previously of the CSIRO Division of Applied Geomechanics in Melbourne, passed away this year in Canberra.

He will be remembered for his work on terrain evaluation and his contributions to pedogenic materials, (laterites, silcretes etc).

Our sympathies are extended to his family.