

# AUSTRALIAN GEOMECHANICS

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Front and Back Cover - The Briseis (Cascade) Dam failure - see page 19.

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## EDITOR'S NOTES

The Editorial Committee of Australian Geomechanics seeks technical 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 contributors may be willing to share with readers.
- Descriptions of geotechnical projects of special interest.
- Failures or 'partial successes'. Share your experience with others.

Submission of material in camera ready format is not absolutely necessary. However, so that justice can be done to contributors, it will be appreciated if the following guidelines are observed.

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  - \* Line spacing - single
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  - \* Main headings - numbered 1 to n, 10 characters per inch
  - \* Formulae - typed or clearly hand written
  - \* Lines per page - say 55 (editors will fit material to format)
- Diagrams: These should be sharp black on white and of the correct size for mounting on format sheets (ie 100 mm wide for single column or 220mm wide for double column layout). Please do not submit computer print out material because this does not reproduce to an acceptable standard. Original ink drawings may be submitted, these will be photographically reproduced and the originals will be returned if required. Photocopies of drawings are not acceptable.
- Photographs: These should preferably be good contrast black and white gloss prints and of the correct size for mounting on format sheets. However, negatives, colour prints and transparencies can be accepted. They must be clearly labelled to indicate their position in the paper.
- Tables: As for diagrams. Contributors are urged to use only standard size print characters.
- Responsibility: Authors will be responsible for the integrity of their material and for permission to publish.

Contributors are reminded that the deadlines for submission of material are 1 Nov. '89 for issue No. 18 and 1 May 1990 for issue No. 19. Contributions should be forwarded to the Editorial Committee, Australian Geomechanics, C/- H.E.C. G.P.O. Box 355D, HOBART, TAS 7001.

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# EDITORIAL

First a brief comment about the special edition of 'Australian Geomechanics' covering the 5th Australia New Zealand Geomechanics Conference. This edition was prepared by the conference organizing committee chaired by Prof. Harry Poulos and saved the current editorial committee many hours of painstaking work. Thank you Harry, John and Garry.

The task of drawing suitable material together for this issue of 'Australian Geomechanics' proved more difficult than anticipated. Striking a balance on what to publish is often complicated when material arrives which is considered borderline or which is not in accordance with our adopted 52 character column width. Even though the publication policy of 'Australian Geomechanics' has been enunciated regularly, submissions are still received which are too detailed and heavy - going for a 'news' type publication like this.

A request for more articles on mining and related matters is slowly starting to bear fruit. As our mining colleagues form a very significant proportion of our Society, their interests should be catered for more regularly.

The cover of this issue shows some aspects of the 'Briseis' (Cascade) Dam, in Northern Tasmania, which failed 60 years ago, resulting in the loss of fourteen lives. This dam failure provides a forceful reminder of the dangers associated with designing and building Geotechnical Structures. This is especially so when designs are, or have to be, based on 'insufficient' or 'limited' knowledge and understanding. This can often be the case when large structures such as dams are built in environments which can not be considered to be fully defined. Perhaps the only lower limit of a parameter that we can really be sure of is zero for the saturated cohesion intercept.

This brings us to the issue of professional liability which is currently being debated in many quarters. Dr Peter Miller, in his regular column in 'Engineers Australia' constantly reminds his readers of the implications of current legal 'opinion' on the application of the laws of liability. Many of his recent contributions to this debate should come as disturbing news to those engaged in the design, construction or maintenance of geotechnical structures. Miller concludes one of his recent columns "Engineers do not know it all" with the words: 'Engineering decision making is facing a crisis, and we are moving towards a dialogue which has been looming for some time. It will go to the root of the relationship between the profession and the community. Before we embark upon it, let's take a deep look at ourselves'.

The above words are most pertinent to Geomechanical experts, be they Engineers or Geologists, as we almost daily evaluate uncertainties of design and

probabilities of failure. Although advances in our knowledge and understanding of structural behaviour of materials may have led to considerable improvements in performance and safety, this does not mean that the risk of failure can be completely eliminated. This is of course generally recognized within the profession and is often expressed in concepts such as 'State of the Art' 'Failure Criteria' and 'Acceptable Risk'. Unfortunately such concepts are often difficult to quantify and are also subject to continual change. This is reflected for example in the fact that many water authorities both in Australia and overseas have during this decade been very much preoccupied with the issues of Dam Safety and spillway capacity. In this process many structures have now been identified which are considered to be unsafe and in particular to have inadequate spillway capacities. The process of bringing such structures to a currently 'acceptable' standard often requires considerable time in planning, design and construction. Any questions regarding liability in the event of a mishap occurring before the completion of an upgrading programme are likely to be complex.

News items and articles describing 'mishaps' and 'foul-ups' appear quite regularly in technical journals and form a constant reminder of how things can and do go seriously wrong. Some of these 'failures' such as Malpasset, Vajont and Teton, to name but a few, are permanently engrained in our minds. Many others may not be so well known but all form part of a pool of bitter experience. With the aid of hindsight the flaws in the original design decisions may be obvious. However in many instances the original design decisions appeared to be quite reasonable, when judged by the standards of the day. Then there are areas where the standards of design for some structures have changed to such an extent that it is hard to believe that those structures could have stood the test of time. In other cases disaster may appear to have been averted more by luck than good design.

Besides continually reminding ourselves of the 'failures' and 'incidents' in our specific fields of endeavour, we should perhaps also keep in mind the following dictums:

"Redundant structures can generally only accommodate one under-designed component" and "the expansion of liability is probable, for deep pockets attract litigation."

In closing this editorial we thank the Hydro-Electric Commission for its assistance in producing this issue.

Bram Knoop, Richard Barnett, Larry Polglase



# GUEST EDITORIAL

John K. Wilkins F.I.E. Aust., F.I.C.E.\*

## ROCKFILL - A BRIEF HISTORY

A well known quotation from Karl Terzaghi runs, "on a waterless planet the science of soil mechanics would not exist."

This could be taken as a warning to those aspiring to employment on the first moon colony, but actually reflects the enormous part that water plays in the properties of soils.

As grain sizes increase the importance of water decreases, which may account for the lack of interest in rockfill taken by soil mechanics experts for a long time. Indeed it was not until the late 1950's that anything really significant appeared in print on the subject.

Common sense in engineering is very useful as it is in all aspects of life, but it can be very misleading. We have all admired the immense piles of rocks forming the pyramids or the soaring walls of the great cathedrals. They have stayed there convincing us of their stability and permanence for hundreds of years. It was common sense, therefore, to assume that rock is a hard, virtually incompressible material and that when piled up in a heap to form a dam, would be stable for hundreds of years.

For dams up to 30m in height this was not far from the truth. Faith in it dominated the engineer's thinking right up to the mid 60's, but from 1930 onwards dam heights had been increasing rapidly. The Pacific Gas and Electricity Company (P.G. & E.) California embarked on the construction of a number of dams with heights of 100m or so, using a fill of large clean rocks dumped in great layers up to 60m high, confident that they would never move. Compaction was aided by water-sluicing the fines into the fill. The watertight membrane was constructed of reinforced concrete of a thickness equal to rather more than 1% of the water depth at any point. It was generally placed as the dam rose in height, on a bed of placed rock on the surface of the fill.

What happened is history. The P.G. & E. kept a record of variations in crest levels and movements of the faces of these dams which has proved of great value to other engineers. The movements were considerable and continued for a long time - so far as I know they are still going on. Although they did not affect the stability of the dams, the concrete faces were distorted and joints fractured, so that losses of water were both large and expensive. What was happening within the fill is quite clear. High contact stresses caused fracture of the rock points

and slight movements of individual stones, which redistributed the load to other points within the rock fabric. The process then repeated itself and continued indefinitely.

As a result of these troubles the Hydro Electric Commission (H.E.C.) of Tasmania decided to restrict the height of dams of this type at 30m. This decision became a challenge and we set to work to find a solution.

The solution was not a stroke of genius on our part but rather an accumulation of the correct processes.

Casagrande said in 1965 in a lecture delivered in Vienna that "Prof. Terzaghi many years ago half jokingly stated that an ideal rockfill shall consist of rock material crushed to the size of a well graded stone of maximum size 3 inches (75mm) after which it should be strongly compacted in thin layers." This was really the basis of the solution. The number of contacts between stone and stone increases as the void ratio decreases. The more contacts there are, the more stable is the stone, and the lower is the load on each contact.

A maximum density mix of crushed rock compacted by vibration rollers was what was required. As one cannot compact effectively a layer deeper than 500mm, this dictated the ideal maximum rock size although in practice some latitude was taken with layer thickness and rock sizes. Luckily it proved quite easy to obtain a suitable mix, as it came almost naturally from a quarry run rock.

Confirmation of the correctness of this theory came from the records of settlements of the Quoich Dam in Scotland which was built in 1958 of crushed rock rolled in 2 foot (600mm) layers.

In 1966 I went on a tour for the H.E.C. to study rockfill dams, mainly in the United States and France, and on my return we set about assembling all the good features and discarding all the bad features of world practice. We backed this up with the development of a reasonable theory, with laboratory tests of materials and careful design of face joints. Construction techniques were as important as anything else and finally it all came together in the design and construction of Cethana Dam in Tasmania, a dam so successful that it served as a prototype for similar dams in many parts of the world.

The main differences between Cethana and P.G. and E. dams were the use of crushed rock in layers, the completion of virtually the full height of the dam before the concrete face was cast, and the smoothing of the face of the fill, by rolling the thin layer of crushed rock on it, before placing the concrete.

It was realised that the concrete thickness was only required to keep out water, so savings were made by reducing it to 0.3m + 0.002 times the head.

Joints in the face were improved and in particular the peripheral joints were made so that they could open a little and slide without waterstop fracture.

In 1973 I was invited to form part of the expert panel on 'Impervious elements and slope protection of earth and rockfill dams' for the Large Dams Congress (ICOLD) in Madrid.

I spoke enthusiastically of the 'decked' rockfill dams and in my address said that "whenever I went onto the construction site I felt that this was the way to build a dam." In the discussion that followed I was heavily criticised by a young engineer who mistakenly thought that I was advocating the exclusion of all other types of dam. Moreover, in the panel meeting to prepare our report, I found that I was the only engineer in favour of this type of dam. All the others were sceptical.

The years have proved concrete decked rockfill dams even more successful than I had expected and in Tasmania they have almost taken over from all other types. Even at sites in the Pieman schemes where the depth of overburden required the removal of large volumes of material from the river bed before the rockfill placing could commence, they have proved more economical than earth fill and at one site which looked a natural concrete arch damsite the rockfill won.

Not all rockfill is suitable for dam construction. Scotts Peak Dam, with a maximum height of only 34m, was constructed at the upstream end of Lake Pedder to close off the Huon River. It was constructed of hard mudstone quarried in the vicinity, sources of other better types of rock having proved illusory. Although laboratory tests showed that the argillite would give settlements almost an order higher than would have been expected from Cethana's rock, it was decided to go ahead using a flexible bituminous concrete face. The dam was also given a camber of some 250mm to allow for crest settlement.

Despite all our care in construction, the dam sprang a leak about a year after filling. The bituminous concrete may be more flexible than cement but it still fractures in tension and this is what happened. The leakage rose to about 4.5 cusecs (130 l/s) and the water accelerated the settlement as it does with all such rockfill. Despite some public alarm over safety, which was partly whipped up by ardent conservationists who had objected to the flooding of the lake, we knew there was no danger. The sealing of the leak is a story of its own, but eventually it was achieved by placing a blanket of impervious gravel over part of the face, which has permanently cut off the leakage flow.

Although Scotts Peak Dam has taught us a lesson which should not be forgotten, I think that Karl Terzaghi would be very pleased if he could see how well his advice on rolled rock has worked.

John K. Wilkins

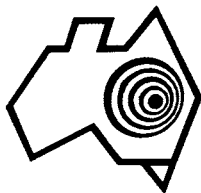
\*John Wilkins is a former Chief Civil Engineer of the Hydro-Electric Commission of Tasmania. He is a fellow of both the Institution of Civil Engineers and the Institution of Engineers, Australia.

During his time with the H.E.C. he has published eight papers dealing with various aspects of rock mechanics and the design of large dams.

In 1968 he was awarded the Warren Prize and the Chapman Medal for his paper "Decked Rockfill Dams" which was presented at the I.E. Aust. Engineering Conference in Brisbane that year.

This paper was recently re-published in the Australian Geomechanics Society's Commemorative Volume marking the Golden Jubilee of the International Society for Soil Mechanics and Foundation Engineering (1985).

During his career he has taken an active interest in the affairs of professional bodies such as the I.E. Aust., the A.G.S. and ANCOLD.



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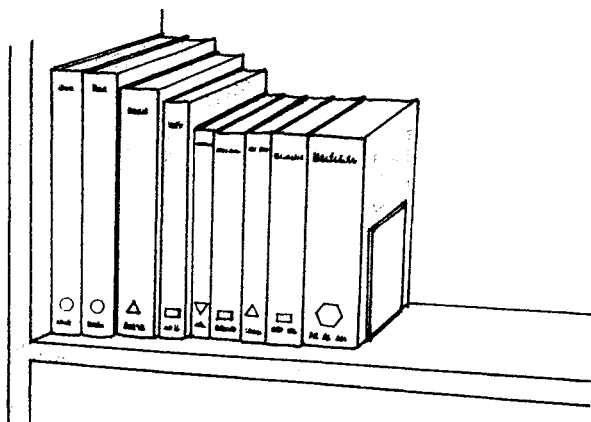
The Australian Underground Construction and Tunnelling Association was formed in 1972 and is jointly sponsored by The Institution of Engineers, Australia and the Australasian Institute of Mining and Metallurgy. It is a non-profit making organisation uniting engineers, tunnellers and miners in its membership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

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- \* 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 both the engineering and mining fraternities and extends to contractors, consultants, owners, public authorities, town planners, equipment and material suppliers and all individuals interested in tunnelling and underground construction.

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



## BOOK REVIEWS

### "Guide to Rock and Soil Descriptions"

Geoguide 3 - Geotechnical Control Office,  
Civil Engineering Services Department.  
First Published July 1988.  
HONG KONG.

189 pages, Price in Hong Kong: HK \$40.00  
Price overseas : US \$ 9.00  
(Including surface postage).

This guide is a companion volume to Geoguide 2 which was reviewed by Tom Bowling in Australian Geomechanics issue no. 15. This document is aimed primarily at the practising civil and/or geotechnical engineer and associated professionals working in the earth sciences field.

The structure of the guide is based on Section 8 of the British Code of Practice for site Investigations, BS5930:1981, and emphasises geological conditions pertaining to Hong Kong and its immediate surrounding territories.

The geoguide was prepared in the Geotechnical Control Office, Hong Kong, under the direction of Mr. J.B. Massey. The main contributors included Drs. R.P. Martin and R.L. Langford.

The contents of the guide are arranged in five main sections i.e. introduction, description of rocks, description of soils, engineering classification of rocks and soils and legend for maps, plans and diagrams. Also included are references, tables, figures, colour plates, an appendix and a glossary.

The sections on descriptions of rocks and soils are well set out. The evaluation of specific rock and soil parameters are dealt with in a concise manner. In general this geoguide provides advise and numerous hints on how the task of describing rocks and soils should be approached.

This volume should be a useful source document for geotechnical engineers and geologists especially those who are involved in projects in and around Hong Kong.

### "GUIDELINES FOR THE FIELD DESCRIPTION OF SOILS AND ROCKS IN ENGINEERING USE".

First published November 1988.  
New Zealand Geomechanics Society, Wellington.

42 Pages, Price not stated.

This guideline is the result of an extensive process of evaluation of a series of draft documents. The

original guideline was produced by the Geomechanics Society in 1980. A revised draft document, completed in 1985, was circulated to all society members for comment. The current document can be said to represent the collective thoughts of a wide range of geotechnical practitioners in New Zealand. The committee responsible for putting this guideline together, i.e. Messrs. S.A.L. Read, P.J. Millar, N.S. Luxford and A.J. Olsen, have produced a brief loose leaf manual which should provide a ready reference on how to describe soils and rocks in situ.

The document is in four parts, introduction, description of soils, description of rock and abbreviated charts and example logs, plus a bibliography.

The description of soils is largely based on the USBR "Earth Manual" and includes a (reduced in size) copy of its unified soil classification chart. The guideline for the description of rock is based mainly on the method originally put forward in the 1972 Report of the Engineering Group of the Geological Society Working Party.

Part four provides several examples of abbreviated charts obtained from various New Zealand organizations.

The guideline provides a concise office reference and can be obtained from the Institution of Professional Engineers, New Zealand, P.O. Box 12241, Wellington North, New Zealand.

Ed.

### ROCK ENGINEERING

By John A. Franklin and Maurice B. Dusseault.  
Published by McGraw-Hill Publishing Company.  
600 pages (hard back), price A\$150.00

This book was received recently from McGraw-Hill Australia. The book follows the rock engineering syllabus taught to fourth-year civil engineering and earth sciences undergraduates at the University of Waterloo in Ontario, Canada. A comprehensive review will be published in the next issue of Australian Geomechanics.

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PO Box 1, Kensington NSW 2033

## Access to the best

**T**he HEC Enterprises Corporation has been created to market the facilities and expertise of Tasmania's highly-credentialed Hydro-Electric Commission.

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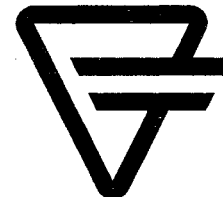
From the drawing boards to commissioning have come 26 individual hydro power schemes including all the civil and electrical engineering structures and installations: More than 800km of roads have been built, mostly in ruggedly remote terrain, 34 major dams and 172km of tunnels and pipelines.

In 1987 the Hydro-Electric Commission finished the massive Pieman River Power Development, resulting in the Commission receiving the Australian award for Engineering Excellence.

The wealth of accumulated skill and knowledge and a depth of modern engineering equipment and facilities is available through the HEC Enterprises Corporation.

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### HEC ENTERPRISES CORPORATION



*Manager : Mr Alan Davison*

*Postal Address:*

*HEC Enterprises Corporation  
GPO Box 355D*

*HOBART TAS AUST 7001*

*Telephone : (002) 305174*

*Telex : 58091*

*Facsimile : (002) 305823*

# GEONEWS, PEOPLE & ORGANISATIONS

## DRAFT CODE OF PRACTICE FOR EARTHWORKS

Committee CE27 of the Standards Association has now agreed a draft of the proposed Code of Practice for Earthworks for Residential and Commercial Development. This Standard is being prepared to provide guidance and recommendations with respect to the performance and control testing of earthworks for residential, industrial and commercial development, and associated site preparation works. It is intended to provide a basis upon which site works for such projects can be specified and to provide guidance in interpretation and applications of the test procedures presented in AS 1289.

This draft is currently being prepared in SAA format and is expected to be available for public review in August 1989. The Committee would welcome constructive review and comment and urges all with an interest in this important and often controversial issue to obtain a copy of the draft from their local SAA office when it becomes available.

Max Ervin

## RECENT APPOINTMENTS

Dr Ian W. Johnston has been appointed as an Associate Professor in the Department of Civil Engineering at Monash University. Dr Johnston is currently Vice-President for the Australasian region of the International Society for Rock Mechanics.

Professor Harry Poulos of Sydney University has joined Coffey Partners International in Sydney whilst retaining a part time commitment with Sydney University.

## ERRATA

In the last issue of Australian Geomechanics (Special Issue - 5th ANZ Conference on Geomechanics) some errors occurred in the Session Summary for Session B1. The text 6 lines from the top of page 115 which says "Rock mass indices are" should be replaced by "RQD alone is" and on pages 113 to 116 "Mr Barrett" should be replaced by "Dr Barrett".

As editor of the issue I offer my apologies to Dr John Barrett for these mistakes.

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John Small

## NEW GEOMECHANICS GROUP IS FORMED

A new international group has been formed to foster research in geomechanics, an interdisciplinary area that involves the study of natural and man-made systems with emphasis on the mechanics of various interacting phenomena. To be known as the Association for Computer Methods and Advances in Geomechanics, the group springs from a series of highly successful international conferences on the subject that began in 1976 and is held every three years.

In addition to encouraging and seeking funds for basic and applied research, the new group will also advocate industrial applications related to computer methods and other advances in geomechanics. It will also undertake efforts to introduce the subject into undergraduate and post graduate engineering curricula. A major avenue of communications will continue to be through its conferences, the next of which is set for 1991 in Australia. For more information contact: Secretariat, International Association for Computer Methods and Advances in Geomechanics, Dept of Civil Engineering and Engineering Mechanics, University of Arizona, Tucson, AZ 857 21 USA.

## ISRM COMMISSION OF TESTING METHODS

SUGGESTED METHODS FOR SEISMIC TESTING WITHIN AND BETWEEN BOREHOLES.

This document has been received recently and will be available from the CSIRO Library.

The document is in four parts and comprises 25 pages. It was co-ordinated by K. Sassa of Japan.

The topics covered in the document are: seismic testing within bore holes, seismic testing between bore holes and seismic tomography.

The document contains a number of illustrations including some computer generated graphics in colour, and concludes with a list of 21 references.

The quoted price is \$3 from Pergamon Press Plc. Great Britain.

## THE AUSTRALIAN GEOSCIENCE COUNCIL

The following article describing the structure and activities of the Australian Geoscience Council was published in the AusIMM Bulletin and Proceedings, Vol. 294, No. 4, June 1989. It is reproduced by kind permission of the Australasian Institute of Mining and Metallurgy. The Australasian Geomechanics Society is also a member of the Australian Geoscience Council. The author, Eric Best, is a longstanding member of the Australian Geomechanics Society.

# Structure and recent activities of the Australian Geoscience Council

by ERIC BEST

The AusIMM's Representative on AGC  
and AGC Treasurer  
Canberra College of Advanced Education  
PO Box 1 Belconnen ACT 2616

**The Australian Geoscience Council (AGC) is a forum of representatives of Australian geoscientific societies and organisations, co-operatively working together to encourage the development of the earth sciences in the best interests of the Nation and of the members of the geoscientific profession**

Collectively the Council represents over 7000 professional members of the geoscientific community including geologists, geophysicists, geochemists, palaeontologists, soil scientists, geographers and many other specialists in earth science involved in the exploration, development and conservation of national resources, and in teaching and research in earth science disciplines.

The Council consists of the Member Societies, whose nominated Representatives elect six of their number to form the Executive Committee. Additionally, the constitution provides for related geoscientific organisations (eg Governmental bodies, Research Institutes) to be invited to join the Council as non-voting Associate Members and Observers.

The composition of the AGC is currently as follows:

**Council Members:** Association of Exploration Geochemists, The Australasian Institute of Mining and Metallurgy, Australian Geomechanics Society, Australian Society of Exploration Geophysicists, Australian Society of Soil Science, Geological Society of Australia, Institute of Australian Geographers, and Petroleum Exploration Society of Australia.

**Associate Members:** Australian Clay Minerals Society, Australian Council of Chairmen of Earth Science Departments, Australian Geoscience Information Association, Australian Institute of Geoscientists, Australian Mineral Foundation, Australian Mining and Petroleum Law Association Ltd, Bureau of Mineral Resources, Commonwealth Scientific & Industrial Research Organisation, Consortium of Ocean Geosciences, Government Geologists' Conference, International Association of Hydrogeologists, Soil Conservation Service of NSW, and Statistical Society of Australia.

**Observers:** Australian Academy of Science, Australian Academy of Technological Sciences and Engineering, and Australian Mineral Industries Research Association.

## OBJECTIVES

The objectives of the Council are as follows:

- 1 To promote co-ordination and co-operation in the activities of Australian geoscientific societies.
- 2 To develop and disseminate to governments, industry and other bodies informed and collective opinions on matters of science policy involving earth sciences and their practical application, without political or industrial bias.
- 3 To promote the development of earth science education in Australia at all levels.
- 4 To provide an informed opinion to the people of Australia on matters of public concern relating to the earth sciences by developing channels of communication with the news and other information services.

- 5 To provide liaison with other scientific and professional societies in Australia and internationally.
- 6 To serve the community of earth scientists in Australia in whatever other ways the Council shall determine to be expedient, but excluding regulatory roles.

## RELATIONSHIP WITH THE FEDERATION OF AUSTRALIAN SCIENTIFIC AND TECHNOLOGICAL SOCIETIES (FASTS)

FASTS was formed in 1985, following an attack on science and technology funding in the preceding Commonwealth Budget. It has a full-time executive Director (David Widdup) and a Council and a Board made up of representatives from member Societies. FASTS has about 70 Member Societies, representing 60,000 scientists and technologists working in industry, government, research, administration and education. It has become a fully operational lobby for science and technology, and has been doing a tremendous job, both behind the scenes and in the media, in trying to counter the science and research bashing that has been so evident in the political environment in recent years.

The geoscience community are members of FASTS through the Australian Geoscience Council, rather than through the individual Member Societies. Membership of FASTS currently costs \$3.50 per individual member. However, because the geoscience community is represented through the AGC, rather than the individual Societies, and because of the significant overlap of membership of the individual geoscience Societies, the AGC subscription to FASTS is based on an estimated total of 3,000 geoscientists to be represented. The FASTS subscription is then divided up proportionately among the AGC Member Societies. This means that the individual Societies are paying for FASTS membership, through AGC, at a rate of about \$1.50 per geoscience member.

In the early days of FASTS, there were some concerns about its operation being too political, but these were just teething problems. An earlier criticism that FASTS was not responsive to geoscience needs is certainly not true now. For the past two years David Widdup has attended all AGC Executive and Council meetings, with great benefit to both parties. The last AGC Council meeting was unanimous in its support of FASTS, as the geoscience community has a responsibility to support the only body which exists solely to promote the essential value of science and technology research and education to Australia's present and future wellbeing.

## ACTIVITIES OF AGC DURING 1988

### Murray Basin Conference

The AGC gave financial and organisational support to the Murray Basin Conference held in Canberra 23-26 May 1988. The co-sponsor was the Groundwater Working Group of the Murray-Darling Basin Ministerial Group of the Murray-Darling Basin Ministerial Council. Representatives of government agencies from Victoria, New South Wales and South Australia as well as the Commonwealth were all actively involved. The wide representation of organisations and disciplines ensured that the problems of water quality and soil degradation were examined from the widest possible perspective. About 170 delegates attended the Conference, a report of which has been published as Bureau of Mineral Resources Record 1988/43.

The Executive has set aside \$4000 to support future broadly-based ventures that will bring together geoscientists and other scientists to examine problems of wider community interest. Advances from this fund will be in the nature of seed money, and would normally be reimbursed from the proceeds of the meeting.

Member organisations of the AGC are invited to apply for assistance for similar ventures.

## ANZAAS

The ANZAAS Committee requested the Executive of the AGC to organise a half day Symposium on 'The contribution of geoscience to the national economy'. Dr Neville Markham of the NSW Geological Survey convened the Symposium on behalf of the Council. The program was greatly appreciated by those who attended but numbers were smaller than expected.

The AGC Executive seeks views on whether or not if its efforts would be better rewarded by supporting specific inter-disciplinary projects such as the Murray Basin Conference mentioned above, rather than generalist ones at ANZAAS. The Executive would welcome your comments.

## BMR Review

Because of its size and breadth, BMR must play a leading role in Australian geoscience. With the present Government's record of reducing the resources available to science through funding cuts in the CSIRO and tertiary education sectors, Council felt it was important to make a submission to the BMR Review. The members of the Executive who are not directly associated with BMR, undertook the task of informing the Minister for Resources, Senator Cook, and the reviewer, Mr Alan Woods AO, of the importance of BMR, the means by which it fulfils its role, and some ways in which its scientific effort could be improved.

A submission was written, and discussions were held with Senator Cook's staff. After the report of the review was published, the AGC took advantage of the opportunity to comment by preparing a response, which was sent to both Senator Cook and Mr Kerin.

## Ocean Drilling Program

The AGC has given its support to the raising of Australian funds to join the ODP through a consortium arrangement with Canada. A sum of \$1.15 million has been obtained from BMR, the Australian Research Council, the Australian Vice-Chancellors' Committee, and the Antarctic Division. A national ODP committee has been set up, and it has selected the University of Tasmania to be the site of the Program office.

## 'Green Paper' on Tertiary Education

The Green Paper's recommendations and its special implications for geoscience were summarised. This summary was circulated at the Geological Society of Australia Convention in Brisbane in February, and it also received wide circulation through FASTS. A submission to the Minister, Mr Dawkins, was acknowledged, but led to no recognisable changes in government policy as set out in the final 'White Paper'.

## FASTS

The AGC maintains membership of FASTS for a number of reasons:

- At a time of persistent attack on the funding and the character of science done in this country, it is necessary for scientists to present a united front. Our input is needed to support science as a whole;

- Earth scientists form a relatively small group in comparison with biologists, chemists and physicists, and our interests are better secured if we form part of a large body;
- FASTS has established a strong lobbying role with the Federal government and has succeeded in having scientists appointed to bodies previously dominated by economists, lawyers or trade unionists;
- FASTS is acting as a focus for submission on secondary teacher training in science and mathematics, and geoscience must be well represented in that effort.

It is the view of the AGC Executive that any reduction of support for FASTS activities would leave Australian science weaker, and geoscience exposed to attack by an unsympathetic and largely uninformed community and government.

## Geoscience Awareness Program (GAP)

This program was founded by Professor Bob Carter of James Cook University, and is centrally administered from the Earth Resources Foundation by Ms Robyn Stutchbury. It has set itself the task of informing the community of the importance of geoscience for understanding the environment and the economy of the country. It seeks to do this by influencing teachers, lobbying for changes in school curricula, and issuing press releases on issues of public concern.

AGC has agreed to support GAP wherever possible, and the AGC Executive is collaborating with Ms Stutchbury as opportunity offers. She attends AGC Council meetings as an observer.

## Overseas Shares of Skilled Immigrants

The Department of Employment, Education and Training prepares recommendations to government on the need to recruit personnel overseas for various professions and skilled trades. The Executive has offered advice to that department on the geoscience profession. It has stressed the need for more secure employment for geologists and geophysicists in certain areas of industry, and has pointed out the effects on tertiary educational institutions of fluctuations in employment.

## Creation Science

In response to requests from several quarters, the Executive wrote to all Ministers for Education pointing out the disastrous effects of teaching 'creation science' as an alternative to real science in schools. Responses supporting the Council's view were received from all States except Queensland. A second letter was then sent to the minister in that State who has sent a more subtle, casuistic reply. It has been decided to let the matter drop. Invincible ignorance is invincible ignorance.

## Research Priorities

The profession will soon be asked by the Australian Research Council (ARC) to indicate two or three areas of geoscience research which are considered to be major national priorities. These may be broadly defined, as demonstrated by the biological sciences where genetics and molecular biology, and Australian ecosystems have been suggested as its priority areas.

The Executive of AGC intends responding to this request by the ARC and seeks input from member societies. This could be through the holding of a workshop to identify research priorities. Please send your thoughts on this suggestion, or any other ideas, to Peter Smith, Secretary, AGC, c/-Bureau of Mineral Resources.

It is important to note that marine geoscience has been declared a national priority for 1989, and the Ocean Drilling Program benefited by a grant of \$600,000 from ARC as a result. This field may not be so considered in 1990 and beyond. Clearly it is important that we respond imaginatively and responsibly.

(Continued on page 16)



# SEVENTH AUSTRALIAN TUNNELLING CONFERENCE AND TRADE EXHIBITION

11-13 SEPTEMBER 1990

"THE UNDERGROUND DOMAIN"

SYDNEY.

The Seventh Australian Tunnelling Conference continues a series of regular conferences for those persons interested in the productive or creative use of underground space. The Conference is organised by the Australian Underground Construction and Tunnelling Association and by The Institution of Engineers, Australia in co-operation with the Australasian Institute of Mining and Metallurgy.

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, perhaps for the first time, interested entrepreneurial, urban planning, technical, construction, regulatory and environmental specialists.

Contributions addressing the aims of this Conference are invited from engineering personnel, researchers, equipment suppliers, architects and property owners or developers who are interested in underground space. Papers are invited in the following broad areas of interest:

- The financing of underground projects
- Urban planning and commercial development of underground space
- Innovative use of underground space
- Environmental and regulatory aspects of underground activity
- Industrial relations and industry matters
- Permanent and temporary services for underground structures

- Case studies
- Recent research
- Ground support
- Equipment development
- Project Management
- Underground construction in mining
- Investigation, planning and design
- Contractual issues

## DEADLINES

Receipt of synopses **25 September 1989**  
 Notification of acceptance of synopses **11 December 1989**  
 Receipt of papers for final review **12 March 1990**

## ENQUIRIES

The Conference Manager,  
 The Institution of Engineers, Australia  
 11 National Circuit, BARTON ACT 2600

Telephone: (062) 70 6549

Facsimile: (062) 70 6530

## MINE GEOLOGISTS' CONFERENCE

MOUNT ISA QUEENSLAND

2 - 5 OCTOBER 1990



The North West Queensland Branch of The Australasian Institute of Mining and Metallurgy is to conduct a conference designed specifically for mine geologists. It is the first of its kind to be held in Australia.

The Conference will provide the venue for the presentation and discussion of practical aspects of mining geology. It is anticipated that the following categories will provide the majority of interest:

- Collection and Manipulation of Raw Data;
- Geology Input into Mine Planning, Drilling and Blasting;
- Ore Reserve Estimation (Computerised and Manual);
- Diamond Drilling;
- Computer Applications;
- Grade Control;
- Ground Conditions and Support;
- Ore Accounting.

Particular emphasis on recent development, innovative ideas and cost reduction methods is desirable. Papers with a bias towards practical aspects of mining geology are preferred. The Conference is expected to attract mining geologists from underground and open-cut operations worldwide.

### UNDERGROUND TOURS

Half-day tours to the mining operations in the Mount Isa region will be conducted during the Conference. These tours will include visits to the underground operations at the Mount Isa and Hilton Mines.

### VENUE

The venue for the Conference will be the Mount Isa Civic Centre which is ideally situated in the centre of the city on the east bank of the Leichhardt River. The Civic Centre is suitably designed and equipped for technical sessions with a large auditorium, extensive balconies and a main entrance foyer.

### TRADE EXHIBITIONS

It is proposed to hold trade exhibitions in the Civic Centre foyer featuring suppliers, services and equipment. Intended exhibitors are invited to indicate their interest so that space can be allocated and guidelines established.

### CONFERENCE VOLUME

Papers to be presented will be published in a Conference volume. Copies will be distributed at the Conference.

### LANGUAGE

Please note the language of the Conference is English.

### CALL FOR PAPERS

Interested contributors interested in submitting papers are requested to forward a one page abstract to the Organising Committee by 30 September 1989. Advice of acceptance will be given by the end of November 1989. Final manuscripts will be required by 31 May 1990.

### MOUNT ISA

Mount Isa city is located in North West Queensland, Australia. It has a population of approximately 25 000 people. The city has developed primarily due to the operation of Mount Isa Mines Limited which currently produces 5.4 million tonnes of copper ore and 4.6 million tonnes of lead-zinc ore per year from the Isa and Hilton Mines.

### ORGANISER

The Conference is being organised by the North West Queensland Branch of The Australasian Institute of Mining and Metallurgy.



## THE AusIMM 1990 ANNUAL CONFERENCE

New Zealand 1990

Sheraton Hotel, Rotorua New Zealand

18-21 March 1990

1990 is the 150th Anniversary of New Zealand and this makes it very appropriate that the 1990 Annual Conference of The Institute is to be held there. New Zealand has a long history of mining activity commencing with the gold rush of the 1860's. While major gold dredging and more recently iron sand operations are well known most operations both surface and underground have been small in scale. These include the recovery not only of gold but of a wide variety of minerals for example many industrials and energy related resources.

### Conference Topics

While papers are invited on exploration, mining, mineral processing, economics, new technology, environmental controls, rehabilitation and resource management papers more specifically addressing the topics outlined below would be preferred.

The conference will place emphasis on these topics - of particular interest in New Zealand - and field visits and conference tours both technical and scenic will highlight both past and current operations in these general areas.

#### Small Scale Mining

Operations producing less than 500 tonnes per day contribute significantly to the mineral output of most countries. Small scale mining has always been a feature of mineral production in New Zealand and Australia. Papers are expected to cover the special features pertaining to the assessment, development and technology of smaller mineral deposits.

#### Alluvial Mining

The sustained gold price has resulted in a major growth in the number of alluvial gold operations worldwide. These together with sand mining involve unique technology and papers will include aspects of resource evaluation, mining and associated processing and recovery where many innovative developments have recently been demonstrated.

#### Industrial Minerals

While attracting less attention the industrial minerals industry yields substantial tonnages of products for the construction,

agricultural, manufacturing and metallurgical industries. These commodities represent a branch of the mineral industry which has distinctive evaluation, beneficiation and marketing characteristics and which provides the opportunity for sophisticated added value processing.

#### Gold Geology and Technology

Considerable attention has been focused on the history of gold mining and on the future potential for discovery in New Zealand as part of the Pacific Rim system. Interesting research and exploration developments will be addressed together with an update on the application of processing technology.

#### Energy - Oil, Natural Gas, Coal and Geothermal

The planned development and utilization of energy resources is of great national importance. The definition of resources and strategies for future use with particular reference to coal will form the basis for technical sessions in this broad area.

#### KEYNOTE ADDRESSES

It is expected in Keynote Lectures will address the role of the Mineral Industry in New Zealand, and its development and closer association with Australia.

#### EXHIBITION

A trade exhibition will be held in conjunction with the Annual Conference. Potential exhibitors are asked to contact those person

#### FOR FURTHER INFORMATION

M H Buckenham or W E Vance  
 Department of Mining Engineering  
 University of Auckland  
 Private Bag AUCKLAND  
 NEW ZEALAND  
 Telephone: +64 9 73 7804  
 Telex: UNILIB 21480  
 Facsimile: +64 9 366 0702

#### PRE AND POST CONFERENCE TOURS

Pre and Post Conference tours will be arranged in both the North and South Islands of New Zealand covering areas of mining, historical and scenic attraction

#### ACCOMPANYING PERSONS PROGRAM

A full and interesting program will be arranged for persons accompanying delegates to the Conference

Mrs J M Webber  
 Conventions & Marketing Coordinator  
 The Australasian Institute of Mining and Metallurgy  
 PO Box 122 Parkville Victoria 3052  
 Telephone: +61 3 347 3166  
 Facsimile: +61 3 347 8525

**AUSTRALIAN GEOMECHANICS SOCIETY  
DRAFT FIVE YEAR PLAN, 1990-1994.**

Dr. Neil Mattes, the current Chairman of the Society, has released a draft report which was prepared by a three man sub-committee consisting of Max Ervin, Charles Waterton and Garry Mostyn.

The sub-committee's draft report as shown below is set out in two parts, "Aims and Objectives" and "Suggested Action Plan".

The report has been forwarded to all local groups of the Society for consideration so that National Committee delegates will be able to discuss this matter at the next National Committee meeting in October.

**AIMS AND OBJECTIVES**

The aims and objectives of the Society during the period 1990-1994 will be as follows:-

1. To work with its sponsoring bodies, the Institution of Engineers, Australia and the Australasian Institute of Mining and Metallurgy, to create greater public awareness of the Geomechanics profession and its contribution to society.
2. To maintain and improve standards and to promote professional conduct in the practice of Geomechanics.
3. To promote (i) the evaluation and consolidation of existing knowledge and its relevance to practical geomechanics, (ii) the assessment of the reliability of various analytical and design procedures, and (iii) research and investigation into geotechnical problems which are relevant to Australian conditions.
4. To increase membership of the Society and, in particular, to encourage wider participation in the Society by persons involved in the Mining, Construction and Engineering Geology sectors.
5. To increase the numbers of organizations involved in the Society as Supporting Members.
6. To promote Australian Geomechanics by hosting appropriate local and international seminars and conferences.

**SUGGESTED ACTION PLAN**

Many of the proposed actions address more than one of the aims of the Society.

1. Each of the Society's Groups should hold regular meetings with invited speakers addressing topics of interest to geomechanics. At least some of these meetings should be targetted at non geotechnical personnel; thus other engineers, architects, planners, etc should be invited to attend.  
Continuing.
2. Where appropriate the content of the above meetings should be more widely disseminated by publication in general civil engineering and other broader based publications. Technical meetings should be recorded, where possible, for wider distribution and speakers encouraged to submit short technical notes or papers to Australian Geomechanics.  
Continuing.

3. Articles regarding broad based geotechnical issues should be submitted to the sponsoring bodies annual conferences. At each such conference the Chairman should organize an invited paper addresssing a topic of wider interest which would increase awareness of geomechanics. Society members should be encouraged to attend these conferences.  
Annually.

4. The Institution's Code of Ethics and Dr. Peter Mitchell's notes should be published at least once every two years in Australian Geomechanics, members attention should be drawn to these documents. Guest editorials on ethics and liability issues should be published in Australian Geomechanics.  
Two Yearly.

5. The Society should, as national body, hold a National Conference every four years, and organization for this conference should be rotated between State and New Zealand groups, as appropriate. The organizing committee for the A.N.Z. Conference should ensure that at least some sessions are targetted at the Mining and Engineering Geology sectors. The Regional Vice-Presidents of the I.S.R.M. and the I.A.E.G. should work actively to ensure that these sectors are involved in the Society's activities and that there is no conflict of themes between conferences nationally and internationally.  
1992.

6. The Regional Vice-president of the I.A.E.G. should investigate the current situation of the Engineering Specialty Group of the Geological Society of Australia and see if any headway can be made in ensuring a unified voice for engineering geologists.  
1990.

7. Supporting membership should be promoted by a general mailing of the publicity dodger and accompanying invitation to join. The chairman to follow up selected targets or delegate such targets to committee members.  
1990.

8. The National Committee and each State Group should formally report on specific issues relevant to aim 3(iii). This may best be achieved by each group reporting every two years on progress with respect to these aims and objectives; the National Committee should then consolidate this into a short position paper to be published in Australian Geomechanics.  
1990.

9. Government and private organizations should be encouraged to contribute, support or undertake research in geomechanics. Local participation should be encouraged.  
Continuing.

10. Depending on its size each Group should endeavour to organize, say every two to three years, a workshop/seminar on an issue of local geotechnical interest.  
Continuing.

12. Each group should encourage the active participation of young professionals in its activities. Thus young members should be encouraged to address technical meetings and to nominate for group committees.  
Continuing.

13. Every committee and sub-committee should report annually to its parent regarding its past and future performance. The membership of all committees should also be reviewed annually.  
Continuing.

# GLADSTONE'S BAG



## CHINESE GEOLOGICAL ABSTRACTS AND LITERATURE.

The abstracts are published quarterly by the National Geological Library of the People's Republic of China with the aim to provide bibliographic information on Chinese geological literature. Each issue may contain up to approximately 500 citations. References to more than one hundred Chinese magazines on geology and related sciences are quoted. An index of authors and magazines, appropriately indexed, is included with each issue.

The English edition of the quarterly comprises approximately 100 pages and costs:-

US\$ 20.00 per issue,  
US\$ 60.00 per year,  
US\$104.00 per 2 years.

Postage per copy costs US\$ 6.70 surface mail,  
US\$19.00 airmail.

The distributors are:

Export Department of China National Publications  
Import and Export Co.  
P.O. Box 88,  
137 Chao Nei Street,  
BEIJING, CHINA.  
Telephone: 444625,  
Telex: 22313 CPC CN.

Some typical titles quoted in the geological literature catalogue (G) 88-1 and 89-1 include:

### GE-17

Stratigraphy and Palaeontology of Systemic Boundaries in China, Cambrian - Ordovician Boundary (1) - (2).  
18 papers, 36 authors, 840 pages, 114 plates, English  
US\$56.00 (surface mail), US\$70.00 (airmail).

### GE-18

A Research on Cenozoic Tectonology of the Longjing Structural Area in the Shelf Basin of the East China Sea Region.  
209 pages, 55 plates, English ed. 1985.  
US\$14.00 (surface mail), US\$20.00 (airmail).

### GE-22

Developments in Geoscience.  
63 papers, 677 pages, 200 figures, English ed. 1984.  
US\$53.00 (paperback) plus US\$5.80 (surface mail) or  
US\$23.69 (airmail).

### GE-25

Engineering Geological Problems in Asia.  
30 papers, 500 pages, 150 figures, English ed. 1986.  
US\$48.00 (paperback) plus US\$5.80 (surface mail) or  
US\$18.52 (airmail).

### GE-27

Introduction to Geomechanics.  
234 pages, 50 figures, 9 plates, 1984 ed.  
US\$60.00 (paperback) (includes surfacemail).

### GE-28

Cambrian Trilobites of North China.  
459 pages, 125 plates, 1987 ed.  
US\$74.00 (paperback) plus US\$5.80 (surface mail) or  
US\$22.62 (airmail).

### GE-36

The Reconstruction of Climate in China for Historical Times.  
174 pages, 1988 English ed.  
US\$56.00 (paperback) plus US\$3.40 (surface mail) or  
US\$13.13 (airmail).

For further details please check with the CSIRO Geomechanics Library.

The Australasian Institute of Mining and Metallurgy has announced the publication of:

## GEOLOGY OF THE MINERAL DEPOSITS OF AUSTRALIA AND PAPUA NEW GUINEA (Two Volume Set)

This publication has been edited by Frank Hughes, a successful exploration geologist and a group of specialist advisers and will be available in the third quarter of 1989. This Monograph will cover the major mines and mineral prospects of this area and comprises 240 papers set out on 1400 pages and is illustrated with colour plates. Two folded geological maps are included with the publication.

Contents include:

General papers;  
Precambrian Orogenic Domains and Cover Sequences of Western, Northern and Southern Australia;  
Late Proterozoic and Phanerozoic Epicratonic Sedimentary Basins;  
The East Australian Orogenic Province;  
The New Guinea Orogenic Province;  
Surficial Deposits.

Price \$150.00 (Members).  
Enquiries: The A.I.M.M.  
P.O. Box 122  
Parkville,  
VIC. 3052.

## SOIL SLOPE STABILITY PROGRAMS REVIEW

An ACADS meeting was held in Melbourne during April to discuss the findings of the ACADS-Monash University Review of Slope Stability Computer Programs. The organizers of this project, Professor Ian Donald and Mr. Peter Giam, had arranged for a series of slope stability problems to be solved by various organizations each using their own slope stability computer program packages. The aim of the review was to test the different computer programs in use rather than the experts who normally operate such facilities.

The results obtained from participants in the review were compared against referee solutions which had been prepared by five different experts, three from overseas, using different methods of analysis.

Except for a few discrepancies the referee solutions agreed closely and were adopted as the correct solutions for the review.

The review covered five typical slope stability problems and called for solutions to ten distinct load cases. In the review 42 computer programs are listed and 236 solutions are summarised.

The findings surprised the organizers in that the spread of results obtained varied considerably more than had been anticipated. Considering that the slope stability problems used in the review had been fairly tightly defined, one would have expected that the results obtained for the minimum factor of safety,  $F$ , should have been within  $\pm 0.05$  of the referee value in each case. However the variations for the values of  $F$  obtained were found to range from  $-0.06$  to  $+0.04$  for the first case to  $-0.37$  to  $+0.51$  for one of the last cases examined. Generally there were also considerable differences in the plotted positions of the critical failure surfaces. The authors indicate that some of the slope stability programs still in use are based on fairly simple analysis and employ poor searching techniques to find minimum value solutions. They conclude '...that the local state-of-the-art is not as good as it could or should be...'

## GWEDGEM

Professor Ian Donald and Mr. Peter Giam have also released three civil engineering research reports dealing with various aspects of slope stability analysis. The reports are;

Report No.1/1989.  
IMPROVED COMPREHENSIVE LIMIT EQUILIBRIUM STABILITY ANALYSIS.

Report No.2/1989.  
SOIL STABILITY ANALYSIS BY AN UPPER BOUND PLASTICITY METHOD.

Report No.4/1989.  
EQUIVALENCE OF LIMIT EQUILIBRIUM AND UPPER BOUND PLASTICITY METHODS IN SOIL STABILITY ANALYSIS.

In these reports the authors set out details of the Generalised Wedge Method (GWEDGEM) for stability analysis.

For further information regarding these publications one should contact the authors at Monash University, Clayton, Vic. 3168.

## INTERNATIONAL SOCIETY FOR ROCK MECHANICS

The I.S.R.M. will be producing an annual directory which is planned as a major reference book for all those who are involved in the field of geomechanics. An important feature of the directory will be advertisements for professional services. It is anticipated that the directory will be published by Pergamon Press. Persons or organisations requiring detailed information on the I.S.R.M. Directory are advised to contact the I.S.R.M. Secretariat:

c/o Laboratorio Nacional de Engenharia Civil  
101 Ave. Brasil,  
P-1799 LISBOA Codex, PORTUGAL.  
Phone: 351 1 882131 - Ext 2419.  
Fax: 351 1 897698.  
Telex: 16760 LNEC P.

or Dr. Ian W. Johnston,

c/o Department of Civil Engineering,  
Monash University,  
CLAYTON, VIC. 3168, AUSTRALIA.  
Phone: 03 565 4963.  
Fax: 03 565 3409.  
Telex: AA 32691.

## FOREIGN PUBLICATIONS RECEIVED

Since the publication of the issue no 16 of Australian Geomechanics the editors have received three copies of the newsletter put out by the Dutch Engineering Geology Group.

Their November 1988 publication contains a summary of results of a doctoral-thesis on 'The Influence of Discontinuities with Respect to the Groundwater Flow in the Limestone Aquifers of South Limburg' by Ir. R.G. de Wit of Delft University. (in English).

The December 1988 issue contains articles on, engineering geology in Finland, the influence of natural discontinuities and material strength on the safety of calcarenite mine pillars, slope stability calculations, and a review on penetration testing.

The April 1989 issue contains reports on, the Sixth International Conference on Numerical Methods in Geomechanics, and the Conference on Underground Spaces and Earth Sheltered Buildings, Shanghai.

The above publications also contain book reviews and articles on topics of local interest plus conference notices. Ingeokring Nieuwsbrief is published approximately 50-50 in Dutch and English.

**TRANSPORTATION RESEARCH BOARD  
NATIONAL RESEARCH COUNCIL  
WASHINGTON, D.C., U.S.A.**

The following Transportation Research Records have been received by The Institution of Engineers, Aust. and are available from their Library in Canberra.

**RECORD 1153  
REINFORCED LAYERED SYSTEMS**

Contents:

- 1 Reinforced Elastic Layered Systems.  
C.A. Vokas, R.D. Stoll.
- 8 Geogrid Reinforcement of Ballasted Track.  
R.J. Bathurst, G.P. Raymond.
- 15 Design and Performance of a Reinforced Embankment for Mohicanville Dike No. 2 in Ohio.  
J.M. Duncan, V.R. Schaefer,  
L.W. Franks, S.A. Collins.
- 26 Design and Construction of Reinforced Embankments over Weak Foundations.  
R. Bonaparte, B.R. Christopher.
- 40 Model Tests for Strip Foundation on Clay Reinforced with Geotextile Layers  
J.P. Sakti, B.M. Das.

**RECORD 1169**

Contents:

**GEOTECHNICAL INSTRUMENTATION**

- 1 Deformation Measurements with Inclinometers.  
G.E. Green, P.E. Mikkelsen.
- 16 Dilatometer Experience in Washington DC and Vicinity.  
P.W. Mayne, D.D. Frost.
- 24 Ground Vibration Monitoring Instrumentation and Computerised Surveillance.  
C.H. Dowding, D. Jessen.
- 33 Instrumentation for Tests of Piles Subjected to Axial Loading.  
L.C. Reese, K.H. Stokoe II.

- 43 Use of the Wave Equation by the North Carolina Department of Transportation.  
J.F. Ledbetter, Jr.
- 49 NYSDOT's Construction Control of Pile Foundations with Dynamic Pile Testing.  
P.F. Bailey, S.E. Sweeney.
- 54 Discussion of Procedures for the Determination of Pile Capacity.  
R.L. Engel.
- 62 Modern Specification of Driven Pile Work.  
R.S. Cheney.
- 70 Analysis of Laterally Loaded Piles with Nonlinear Bending Behavior.  
S.L. Kramer, E.J. Heavey.
- 75 Unified Design of Piles and Pile Groups  
B.H. Fellenius.
- 83 LTBASE: A Computer Program for the Analysis of Laterally Loaded Piers Including Base and Slope Effects.  
M.A. Gabr, R.H. Borden.

**AUSTRALIAN GEOSCIENCE COUNCIL**

**GEOSCIENCE NEWS**

The Council for Earth Science Societies in Australia now produces a Newsletter for distribution to its member organisations.

The Editor for this publication is Paul Shelley who can be contacted;

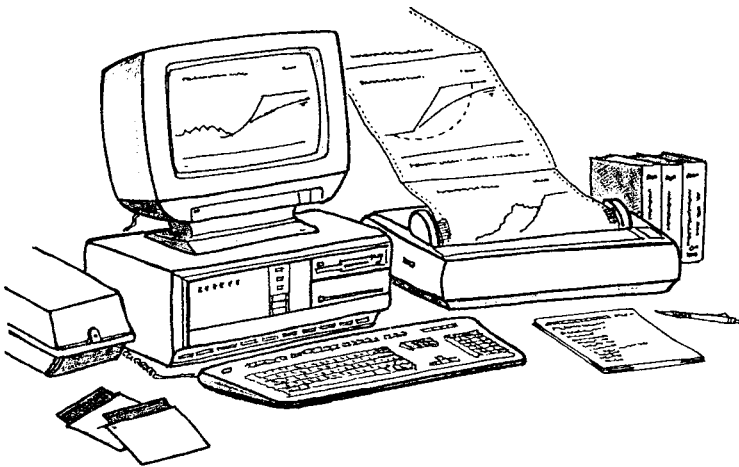
c/o Bureau of Mineral Resources,  
G.P.O. Box 378,  
CANBERRA CITY, ACT 2601.  
Phone: 062 499602.

Copies of Geoscience News are available from A.G.S. Group Secretaries.



**ISRM PUBLICATIONS AVAILABLE**

TITLE	Unit Price (USD)	No. of Copies
Characterization of Swelling Rock .....	\$ 5.00	630
Recommendations on Site Investigation Techniques .....	\$ 5.00	115
Report on ISRM Fields of Activities .....	\$ 5.00	725
Report on the Teaching of Rock Mechanics .....	\$ 5.00	120
SMS for Deformability Determination Using a Flexible Dilatometer .....	\$ 5.00	175
SMS for Deformability Determination Using a Large Flat Jack Technique .....	\$ 5.00	150
SMS for Determining Point Load Strength .....	\$ 5.00	197
SMS for Determining Shear Strength .....	\$ 5.00	188
SMS for Determining the Fracture Toughness of Rock .....	\$ 8.00	150
SMS for Rock Anchorage Testing .....	\$ 5.00	180
SMS for Rockbolt Testing .....	\$ 5.00	192
SMS for Rock Stress Determination .....	\$ 8.00	187
SMS for Seismic Testing within and between Boreholes .....	\$ 8.00	220
SMS for Surface Monitoring of Movements across Discontinuities .....	\$ 5.00	175
Terminology .....	\$ 5.00	100



# GRAVEL RASH

## GRAVELRASH & THE PC BLUES

Some time ago the topic of home computers raised its head at the dinner conversation. Our eldest, who has just started in her first year at university, mentioned that staff these days appreciated assignments produced on a word processor in preference to the hand written product. Number two, who is currently in his first year of a two year matriculation course, felt he could put a P.C. to everyday use producing school projects in physics and chemistry. My wife identified a need to model quilting patterns whilst I could use a home P.C. for editing issues of Australian Geomechanics and yachting material to mention but a few.

With four participants in the debate and four 'experts' the question as to what would be a suitable system was not likely to be answered overnight. However the price of office style P.C. equipment brought everyone quickly back to earth. So after protracted consultations with various experts at the office an I.B.M. P.C. clone was decided upon as appropriate to our needs.

Of course the equipment arrived just when the cut-and-paste work for Australian Geomechanics was getting into full swing. Although installing a P.C. may according to all the glossy pictures seem quite straight forward in actual practice there are many hurdles to be crossed before the system can be said to be fully functional.

In the office environment the P.C. is these days taken for granted, ie. it is part of the furniture which gets used if not daily at least once a week for either handling technical data or word processing. Under these conditions the P.C. system is usually maintained by the office computer whiz who is also available most hours of the day to advise on any curly problems should they arise.

At home this is quite an other matter. One can hardly ring up the supplier of the equipment late in the evening to question him about a compatability problem between the word processing software and the printer. However of necessity one soon learns to cope with the jargon in the various manuals and guides and after a period of time one starts to become quite familiar with the 'user friendly' messages which beam from the video screen.

With the system now generally operational I feel I can reflect more objectively on the pros and cons of presenting material for publication using a wordprocessing system. Having the equipment in the study at home is very helpful however it still takes a lot of time to prepare typed material in the appropriate format. Also with three other users, or potential users, the equipment is not always available on demand. Furthermore considerable time can be spent sorting out problems as they arise such as encouraging a physics program on satellite motion to function properly so that the device does not crash after half an orbit or flies off into outer space.

So on reflection it may be that expecting contributors to Australian Geomechanics to present their material in 'paste' ready format is a tall order. Hence in this issue some none format material from the Western Australians has been published more or less as is. No doubt they will find out exactly what I mean when they take on the task of publishing Australian Geomechanics next year.

For a closing comment it may be worth noting that computer systems appear to conform to WYSZKOWSKI'S SECOND LAW: which states that - Anything can be made to work if you fiddle with it long enough. This truism comes from that well known publication- 'MURPHY'S LAW and other reasons why things go W & O N G' - by Arthur Bloch. The copy I have was picked up at a School Fair and used to belong to the Officers of the 'ZINCMaster' a vessel which comes into Hobart from time to time.

Finally in respect of the suggestion that contributors should send their material on a floppy disk, so that the editors can format it to their specific requirements, please don't. The practicalities of reformatting material prepared with different wordprocessing packages is akin to the problems experienced with the building of the tower of Babel.

*Bram Kuort*



# GEODIARY

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

*Brief details of conferences, courses, seminars, symposia, workshops, etc will be entered in Geodiary without charge to the organiser 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.*

AUGUST 8-10 1989.  
FIRST SOUTH-AMERICAN SYMPOSIUM ON LANDSLIDES.  
Topics: Methods for detection, analysis, prevention and research of landslides.  
Bogota, COLUMBIA.  
Enquiries:  
Juan Montero Olarte, Sociedad Colombia de Geotecnia,  
Apartado Aereo 057045,  
BOGOTA, D.E. COLUMBIA.  
Telephone: 57 1 2223896, 2924695.  
Telex: 41263 SIKA.

AUGUST 13-18 1989.  
XII INTERNATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.  
Topics: include environmental impact in geotechnical engineering, offshore exploration and foundations, excavation in soft rock, environmental control of toxic wastes, earthquake geotechnical engineering, SPT, CPT pressure testing.  
Rio De Janeiro, BRAZIL.  
Enquiries:  
Mr. Francis Bogossian, Secretary General,  
C.P. 1559, BR-20001 RIO DE JANEIRO, RJ, BRAZIL.  
Telephone: 55-21-2246080.  
Telex: 2132891 CERT.

AUGUST 28-31 1989.  
INTERNATIONAL SYMPOSIUM - ROCK AT GREAT DEPTH.  
Rock mechanics and rock physics at great depth.  
Topics: include stability of excavations, role of fluids, properties of rock mass discontinuities, stress field evaluation.  
Pau, FRANCE.  
Enquiries:  
Vincent Maury, Honorary Chairman,  
Symposium 'Rock at Great Depth'  
Elf Aquitaine, CSTCS - Bat. L5,  
F-64018 PAU CEDEX, FRANCE.  
Telephone: 33 59 834318.

SEPTEMBER 3-9 1989.  
2<sup>nd</sup> INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY.  
Frankfurt am Main, GERMANY FR.  
Enquiries:  
Prof. Arno Semmel, Institut f. Physische Geographie,  
University Frankfurt, Senckenberganlage 36,  
Postfach 111932, D-6000 FRANKFURT/MAIN, GERMANY FR.

SEPTEMBER 4-7 1989.  
INTERNATIONAL CHALK SYMPOSIUM.  
Brighton, ENGLAND.  
Topics: General, Construction, Hydrogeology, Petroleum Engineering.  
Enquiries:  
Dr. R.N. Mortimore, Department of Civil Engineering,  
Brighton Polytechnic, Moulsecoomb,  
BRIGHTON BN2 4GJ, ENGLAND.

SEPTEMBER 4-8 1989.  
INTERNATIONAL CONFERENCE ON MICROMECHANICS OF GRANULAR MEDIA.  
Clermont-Ferrand, FRANCE.  
Topics: Geometry, Mechanical properties, Mechanics of grain assemblies, Fictive continuum, Relationship between fundamental approach and practical experience.  
Enquiries:  
Mr. P. Gourves, C.S.U.T., Laboratoire de Genie Civil,  
Universite Blaise Pascal de Clermont-Ferrand II,  
Rue des Meuniers,  
63170 AUBIERE, FRANCE.  
Telephone: 73 26 41 10.

SEPTEMBER 9-14 1989.  
INTERNATIONAL CONGRESS ON PROGRESS AND INNOVATION IN TUNNELLING.  
Topics: include investigation and testing, design and construction, seepage control, case histories, research and development, support, lining.  
Toronto, CANADA.  
Enquiries:  
Technical Secretariat,  
Prof. K.Y. Lo,  
Faculty of Engineering Science,  
University of Western Ontario,  
LONDON, ONTARIO, B6A 5B9, CANADA.  
Telephone: 1 519 6612125.  
Telex: 0647134.  
Organizing Secretariat,  
Mr. Laurier Forget,  
National Research Council Canada,  
OTTAWA, ONTARIO, K1A 0R6, CANADA.  
Telephone: 1 613 9939009.  
Telex: 0533145.

SEPTEMBER 10-14 1989.  
QUATERNARY ENGINEERING GEOLOGY.  
25<sup>th</sup> Annual Conference of the Geological Society  
Heriot-Watt University, Edinburgh SCOTLAND.  
Enquiries:  
Dr. J. A. Little,  
Department of Civil Engineering,  
Heriot-Watt University,  
EDINBURGH, EH14 4AS, SCOTLAND.

SEPTEMBER 11-13 1989  
SEMINAR ON ROCK FRAGMENTATION MECHANICS  
CSIRO Division of Geomechanics, Queensland  
Course Co-ordinator:  
Dr. G. Beer, CSIRO Div. of Geomechanics,  
Ritchie Building, Research Road, University  
of Queensland, St. Lucia, Qld. 4067.  
Tel (07) 377 7822; Fax (07) 371 7435

SEPTEMBER 17-21 1989  
NON-FERROUS SMELTING SYMPOSIUM  
Port Pirie, SA

Enquiries:  
The AusIMM, PO Box 122, PARKVILLE, VIC 3052  
Telephone (03) 347 3166; Fax (03) 347 8525

SEPTEMBER 25-29 1989.  
NEW AUSTRIAN TUNNELLING METHOD (NATM) SEMINAR.  
Topics: principles, tunnel geology, rockmechanics,  
excavation, support, design, numerical analysis,  
measurements.  
Technical University of Graz, AUSTRIA.  
Enquiries:  
Technische Univ. Graz,  
Rechbauerstrasse 12,  
A-8010 GRAZ, AUSTRIA.  
Telephone: 43 316 7061231.  
Telex: 311221.

SEPTEMBER 28-29 1989.  
SUOLOSOTTOSUOLO, INTERNATIONAL CONGRESS ON  
GEOENGINEERING.  
Topics: environment and land, non-energetic mineral  
resources, energetic mineral resources, underground  
water resources.  
Turin, ITALY.  
Enquiries:  
Associazione Mineraria Subalpina,  
c/- Dip. o di Georisorse e Territorio del Politecnico  
Corso Duca degli Abruzzi 24,  
I-10129 TORINO, ITALY.  
Telephone: 39 11 5567681.  
Telex: 220646 POLITO.

OCTOBER 2-4 1989.  
FOURTH INTERNATIONAL SYMPOSIUM ON MINING WITH  
BACKFILL.  
Inovations in Mining Backfill Technology.  
Topics: in-situ testing, laboratory testing, rock  
support, system design, economics.  
Montreal, CANADA.  
Enquiries:  
Dr. F.P. Hasani, Chairman, Organizing Committee,  
Department of Mining & Metallurgical Engineering,  
McGill University,  
3480 University Street,  
MONTREAL, PQ H3A 2A7, CANADA.  
Telephone: 1 514 3984377.  
Telex: 05268510.

OCTOBER 9-11 1989  
DEWATERING TECHNOLOGY AND PRACTICE CONFERENCE  
The Sheraton Hotel, Brisbane  
Enquiries:  
The AusIMM, PO Box 122, PARKVILLE, VIC 3052  
Telephone (03) 347 3166 Fax (03) 347 8525

OCTOBER 12-13 1989  
HARALD LAUFFER COLLOQUY  
(38th Geomechanics Colloquy 1989)  
Themes: Pressure tunnels and pressure shafts -  
recent developments; rock mechanics in mining  
practice; tests in geomechanics; control of high  
rock pressure in tunnelling.  
Languages: English and German  
Enquiries:  
Austrian Society for Geomechanics,  
Paracelsusstrasse 2, 5020 SALZBURG, AUSTRIA

OCTOBER 18-20 1989.  
IABSE COLLOQUIM ON EXPERT SYSTEMS IN CIVIL  
ENGINEERING.  
Bergamo, ITALY.  
Enquiries:  
ISMES,  
Viale Giulio Cesare 29,  
I-24100, BERGAMO, ITALY.  
Telephone: 035 358 301.

OCTOBER 23-26 1989.  
FOURTH INTERNATIONAL CONFERENCE ON SOIL DYNAMICS AND  
EARTHQUAKE ENGINEERING.  
Mexico City, MEXICO.  
Enquiries:  
Prof. A.S. Cakmak,  
Department of Civil Engineering,  
Princeton University,  
PRINCETON, NJ 08544, USA.  
Telephone: 609 452 4601.  
or  
Prof. I. Herrera,  
Instituto de Geofisica,  
Universidad Nacional,  
Autonomo de Mexico,  
Apartado Postal 22-582,  
14000 MEXICO, D.F.  
Telephone: 905 548 5892.

NOVEMBER 6-8 1989.  
INTERNATIONAL SYMPOSIUM ON TRIAL EMBANKMENTS ON  
MALAYSIAN MARINE CLAYS - PREDICTIONS AND  
PERFORMANCE.  
Kuala Lumpur, MALAYSIA.  
Enquiries:  
Ir. Chua Lee Boon,  
Hon. Secretary, International Symposium on Trial  
Embankments,  
c/- Institution of Engineers, Malaysia,  
Bangunan Insanieur, 60/62, Jalan 52/4,  
Peti Surat 223, 46720 Petaling Jaya,  
Seangor Darul Ehsan, MALAYSIA.  
Telephone: 03 7569173, 7569575.  
Telex: MA 37299 IEM.

APRIL 3-7 1990  
TUNNEL CONSTRUCTION '90 DRILLEX '90  
Wembley Stadium, London, England  
Enquiries:  
The Conference Office, The Institute of Mining  
and Metallurgy, 44 Portland Place  
London W1N 4BR, England Tel. 01-580-3802  
Fax 01-436 5388; Telex 261410 IMM

APRIL 16-20 1990.  
TENTH SOUTHEAST ASIAN CONFERENCE ON GEOTECHNICAL  
ENGINEERING.  
Topics: include tunnelling and underground  
construction, environmental geotechnology, mapping,  
slope stability, engineering geology, rock  
mechanics.  
Taipei, TAIWAN.  
Enquiries:  
Dr. C.D. Ou, Secretary-General,  
Organizing Committee, 10<sup>th</sup> SEAGC,  
c/- Ret-Ser Engineering Agency,  
11<sup>th</sup> Floor, No. 207, Sung-Chiang Rd.,  
TAIPEI, TAIWAN, REPUBLIC OF CHINA.  
Telephone: (02) 503-2233  
Facsimili: (02) 503-1113  
Telex: 21531 RSEA.

APRIL 18-20 1990.  
INTERNATIONAL CONFERENCE ON MECHANICS OF JOINTED AND  
FAULTED ROCK

Topics: include structural geology and formation of  
joints and faults, failure criteria, time dependent  
deformation, hydromechanics, performance and  
stability.

Vienna, AUSTRIA.

Call for papers. Abstracts required by 30-7-89.

Deadline for papers 31-1-90.

Enquiries:

Doz. Dr. H.P. Rossmannith,

Institute of Mechanics,

Technical University Vienna,

Wiedner Hauptstrasse 8-10/325,

A-1040 VIENNA, AUSTRIA.

Telephone: 0222 58801 5514, 5519.

Telex: 61 3222467 = TUW.

MAY 14-18 1990.

14<sup>th</sup> WORLD MINING CONGRESS AND EXHIBITION.

Beijing, CHINA.

Enquiries:

Chinese Organizing Committee of the 14<sup>th</sup> World

Mining Congress,

54 Sanlihe Road,

BEIJING, CHINA.

Telephone: 868981 Extension 264 or 863880

Telex: 222633 CSTEC.

MAY 28 - JUNE 1 1990.

FOURTH INTERNATIONAL CONFERENCE ON GEOTEXTILES AND  
GEOMEMBRANES.

Topics: include bank and bed protection, soil  
reinforcement, properties and testing, drainage,  
environmental control.

The Hague, THE NETHERLANDS.

Enquiries:

The Secretariat of the Fourth Geotextile Conference,

c/- Holland Organizing Centre,

16, Lange Voorhout,

NL 2514EE THE HAGUE, THE NETHERLANDS.

Telephone: 31 70 65 78 50

Telex: 33111 HOC NL

Facsimili: 31 70 65 58 07.

JUNE 4-6 1990.

ISRM REGIONAL SYMPOSIUM ON ROCK JOINTS.

Topics: characterization of joints, mechanical,  
hydraulic, dynamic and coupled behaviour,  
constitutive models.

Loen, NORWAY.

Abstracts: 300 (words max. + 3 fig.) by 1 10 1989,  
papers by 1 2 1990.

Enquiries:

Norwegian Geotechnical Institute,

Attention Dr. Nick Barton,

P.O. Box 40,

TAASEN, N-0801, OSLO 8, NORWAY.

JUNE 7-8 1990.

ISRM WORKSHOP ON SCALE EFFECTS IN ROCK MASSES.

Topics:

Loen, NORWAY.

Abstracts: 300 (words max. + 3 fig.) by 1 10 1989,  
papers by 1 2 1990..

Enquiries:

Mr. Antonio Pinta da Cunha,

Laboratorio Nacional de Engenharia Civil,

101 Av. do Brasil,

P-1799 LISBOA CODEX, PORTUGAL.

JUNE 10-13 1990.

SECOND SYMPOSIUM ON STRAIT CROSSINGS.

Topics:

Trondheim, NORWAY.

Abstracts: (200 words max.) by 1 10 1989, papers by  
1 3 1990.

Enquiries:

Vidar E. Storvik,

Norwegian Society of Chartered Engineers,

Kronprinsensgt 17,

N-0251 OSLO 2, NORWAY.

JUNE 12-15 1990.

FIRST INTERNATIONAL SYMPOSIUM ON UNIQUE UNDERGROUND  
STRUCTURES.

Denver, COLORADO, USA.

Abstracts: (500-1000 words) by 31 8 89.

Enquiries:

Abstracts and Papers.

Dr. R.S. Sinma,

U.S. Bureau of Reclamation,

D3120 P.O. Box 25007,

DENVER, COLORADO, 80225, USA.

Phone 303 236 3994.

Authors' Registration.

Dr. G.L. Braughman,

Director Office of Special Programs and Continuing

Education, Colorado School of Mines.

GOLDEN, COLORADO, 80401 USA.

Phone 303 273 3321.

JUNE 18-21 1990.

ASCE SPECIALTY CONFERENCE ON DESIGN AND PERFORMANCE  
OF EARTH RETAINING STRUCTURES.

Topics: wall selection and performance, mechanically  
stabilised systems, in-situ walls, waterfront  
retaining structures.

Ithaca, NY, USA.

Enquiries:

Dr. Phillip Lambe,

Department of Civil Engineering,

North Carolina State University,

Campus Box 7908,

RALEIGH, NC 27695, USA.

AUGUST 6-10 1990.

6<sup>th</sup> INTERNATIONAL CONGRESS OF THE IAEG.

Topics: include engineering geology mapping, site  
investigation, hydro engineering geology etc.

Amsterdam, NETHERLANDS.

Enquiries:

Dr. L. Primel, Secretary General IAEG,

LCPC, 58, Boulevard Lefebvre, F-75732

PARIS Cedex 15, FRANCE.

Telex: 200361 LCPARI.

AUGUST 26-31 1990

'FRAGBLAST 90'

Third international symposium on rock fragmentation  
by blasting

Brisbane, Queensland

State of the art in explosives and blasting  
technology

Enquiries:

The AusIMM, PO Box 122, PARKVILLE, VIC 3052

Telephone (03) 347 3166; Fax (03) 347 8525



SEPTEMBER 3-7 1990.  
INTERNATIONAL SYMPOSIUM - TUNNELS AND UNDERGROUND  
WORKS.  
Chengdu, CHINA.  
Enquiries:  
Secretariate CCES,  
P.O. Box 2500,  
Bai Wan Zhuang,  
FELJING, CHINA.

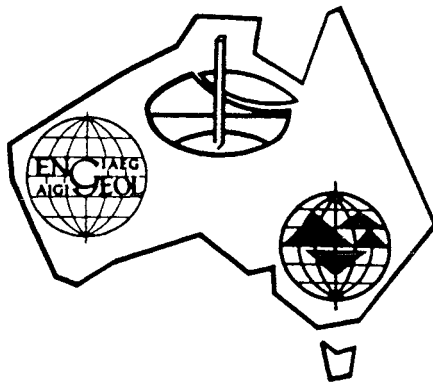
SEPTEMBER 11-13 1990  
SEVENTH AUSTRALIAN TUNNELLING CONFERENCE AND TRADE  
EXHIBITION  
"The Underground Domain"  
Hilton International Hotel, Sydney  
Enquiries:  
The Conference Manager, IEAust., 11 National Ct.,  
Barton, ACT 2600 Tel (062) 706 549; Fax (062)  
706530

OCTOBER 2-5 1990  
MINE GEOLOGISTS CONFERENCE  
Mount Isa, Queensland  
Enquiries:  
The AusIMM, PO Box 122, PARKVILLE, VIC 3052  
Telephone (03) 347 3166; Fax (03) 347 8525

OCTOBER 11-13 1990.  
IX NATIONAL CONFERENCE ON SOIL MECHANICS AND  
FOUNDATION ENGINEERING.  
Cracow, POLAND.  
Call for papers. 200 word abstracts by 15-7-89.  
Enquiries:  
Komitet Organizacyjny IX Krajowej Konferencji  
Mechanikow Gruntow i Fundamentowania.  
Biuro RW Not, Dzial Org. Prezydialny,  
ul Straszewskiego 28,  
31-113 KRAKOW, POLAND.

MARCH 11-15 1991.  
SECOND INTERNATIONAL CONFERENCE ON RECENT ADVANCES  
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Parameters and Constitutive Relations of Soils;  
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Liquifaction of Sands, Silts, Gravels, and Clays;  
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Retaining Structures; Soil Structure Interaction  
under Dynamic Loading; Earthquake Geotechnolgy in  
Off-shore Structures; Stability of Slopes and Earth  
Dams under Earthquakes; Soil Amplification during  
Earthquakes and Microzonation; Seismology,  
Predicting Strong Ground Motion for Design; Wave  
Propagation in Soils; and Dynamic Characteristics of  
Vibration Sources other than Earthquakes.  
Call for papers. Abstracts of 500 words by 1-11-1989  
Enquiries:  
Shamsher Prakash,  
Conference Chairman,  
Department of Civil Engineering,  
University of Missouri-Rolla,  
Rolla, MO 65401 U.S.A.  
Telephone: 314 341 4489 or 341 4461.  
Facsimili: 314 341 4729.

APRIL 14-18 1991  
TUNNELLING '91  
Sixth international symposium, London England  
Enquiries:  
The Conference Office, The Institute of Mining  
and Metallurgy, 44 Portland Place  
London WIN 4BR, England Tel. 01-580-3802  
Fax 01-436 5388; Telex 261410 IMM



# STATE GROUP REPORTS

## SYDNEY GROUP REPORT

The Sydney Group Committee for 1989 was elected at the Annual General Meeting in November 1988 and consists of the following members.

### CONTINUING MEMBERS

Mr Garry Mostyn Chairman	University of NSW 607 5038/810 5760
Dr Tony Phillips Secretary	Arup Geotechnics 261 1633
Dr John Small Past Chairman	University of Sydney 692 2128
Dr Neil Mattes National Comm.	Coffey and Partners 888 7444
Prof Harry Poulos National Comm.	University of Sydney 692 2109
Mr Bruce Walker	Jeffery & Kautaskas
Mr Jack Hodgson	J.D. Hodgson Consultants
Mr Michael Thom	D.J. Douglas & Partners
Mrs Margaret McMahon	McMahon Associates
Mr Malcolm Dale	Burgess & Associates
Mr John Braybrooke	D.J. Douglas & Partners
Prof Robin Fell	University of NSW
Mr Peter Burgess	Burgess & Associates
Mr Peter Andrews	D.J. Douglas & Partners
Mr Ian Hoskins	Coffey & Partners Resigned December 1988

### NEWLY ELECTED MEMBERS

Mr John Adamiec	Frankipile
Mr Colin Thorne	Coffey & Partners
Mr Geoff Young	Arup Geotechnics

### THE FOLLOWING MEMBERS OF THE OUTGOING COMMITTEE RETIRED

Dr Terry Wiesner, Mr Bruce Rodway, Mr Mike Adler, Mr Rod Jeffrey, Mr Slav Tchepak and Mr Ron Coleman.

### TECHNICAL MEETINGS

The February to May meetings advised in the last issue have been held with continuing good attendances.

Technical meetings programmed for the rest of 1989 are listed below.

#### June 14th 1989 DEEP EXCAVATIONS IN SYDNEY ROCK EXTENDED TECHNICAL MEETING

C.R. Windsor - CSIRO
P. Hilleard - State Rail Authority
P. Wong - Coffey & Partners
J Braybrooke - D.J. Douglas & Partners

Sydney is entering a particularly challenging phase of varied underground and deep foundation development. The extended meeting will cover developments in rock stress measurement, rock reinforcement, excavation design and analysis and performance monitoring. Current case studies will be used to illustrate the topics discussed.

#### July 12th 1989 NEW DEVELOPMENTS IN GEOSYNTHETICS

Dr Manfred Hausmann - University of Technology, Sydney

The growing number of books, conference papers, design manuals and testing standards on the use of synthetics in geotechnical engineering is evidence of the rapid advances made in this field. The functional approach to the design of soil-geosynthetic systems is now fairly well developed for solving problems with embankments, foundations, railways, steep slopes, pavements, landfills and more. Now types of fabrics and composites are widening the scope of applications. In Australia, interesting research results have become available on fabric reinforced clay walls, composites in railway tracks, fabrics and membranes as formwork, and more. Progress is also being made in standardizing basic test procedures for geotextiles.

#### August 9th 1989 DESIGN OF STRUCTURES FOR SUBSIDENCE

Dr Laurie de Ambrosis - Longworth & McKenzie

The issue of mining subsidence and its effect on surface structures has been receiving much attention in the recent past. The issue is particularly relevant to the Sydney Coal Measures where coal is largely mined by underground techniques. Increasingly, because of the limited extent to the allowable workable mining areas, underground mining is being forced into developed areas (urban as well as rural). The need to maximise extraction exacerbates the effects of subsidence.

Many structures which could previously be "protected" by sterilisation are now not capable of protection because of the increasing use of longwall mining techniques which involve the mining of large continuous panels of underground coal. In most instan-

ces provision now has to be made for such structures to withstand the effects of future subsidence and the geotechnical engineer is being asked to provide input information into the design of these structures.

This talk will aim to briefly describe the currently available methods for subsidence prediction which incorporate the results of monitoring to give relevant "local" subsidence parameters. Some time will also be given to reviewing some techniques which have been used in the design of a wide variety of structures to cater for subsidence. The talk will also be illustrated by case studies.

September 13th 1989  
EXPERIENCE WITH THE FOOTING CODE A.S.2870

L.D. Appleyard - Appleyard, Forrest & Assoc  
A Maltby - Sinclair, Knight & Partners

The "Residential Slabs and Footing Code" (AS 2870) was published in 1986 after much discussion of the draft document. Implementation of the code initially caused some "buyer resistance" but is now accepted and indeed required by most Councils. Within the Sydney area, further geotechnical research seems limited as a result of site classification, in many cases, by determination of the clay profile thickness. As a result, structural engineers have become the main users of the code, often with minimal input from geotechnical engineers.

The discussion will present comments on implementation of the code, primarily from the viewpoint of the structural engineer either when designing the footings or when checking building applications to Council. Contributions and discussion will be sought from the audience regarding problems with application of the code, adequacy of the designs nominated by the code, future developments in footing design and construction, and further geotechnical research in the Sydney area.

October 11th 1989  
THE GEOTECHNICAL INVESTIGATION AND  
CONSTRUCTION SUPERVISION OF THE BURWOOD  
BEACH SEWER OCEAN OUTFALL PROJECT

Margaret McMahon - Dames & Moore

This project involved the construction of a 90m deep shaft 4.5m in diameter, a 1.8km long 2.7m diameter TBM driven tunnel, 10 vertical 1m diameter diffuser shafts, and associated works. The excavations were completed in 1988. The project was complicated by the presence of old, water or gas filled coal mines which extend out under the sea over most of the site. This talk will describe the investigations to explore the subsurface geological and mine conditions for the contract documents, and throughout the project for design modifications which were made during construction. It also reviews the TBM performance.

November 8th 1989 - AGM  
GEOTECHNICAL EXPERIENCE ON THE NORTH WEST  
SHELF

## THE THIRD E.H. DAVIS MEMORIAL LECTURE

Dr Mohamid Khorshid - Woodside Offshore  
Petroleum

It is proposed that the lecture will present the following material. The North Rankine A Platform was installed in 1982 on the North West Shelf of Australia, is located in a water depth of 125m and was designed to resist cyclonic weather conditions. The proposed Goodwyn A Platform will be installed in 1992 and is 23km to the south west of North Rankin A but in a similar depth of water and over similar foundation materials.

This presentation will discuss the geotechnical programme undertaken for both North Rankin A and the proposed Goodwyn A platforms which will include:

1. 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 realization 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.
2. 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.

The presentation will conclude with the lessons learnt from these investigations and areas for possible future development.

## VICTORIA GROUP STATE REPORT

### Report of Meetings

#### The Lochiel Trial Pit

8 Feb 1989

Tim Sullivan of Coffey & Partners described the Trial Pit which was part of the evaluation of the mining efficiency of the Lochiel coal deposit. The pit project entailed site selection, investigation, design, instrumentation, monitoring, dewatering, depressurisation, excavation and trial dump construction. Intensive monitoring included 385 separate instruments.

The geotechnical & hydrogeological aspects described included

- \* depressurisation drains to improve mining condition in fine grained soil strength materials,
- \* vacuum dewatering of aquifers,
- \* evaluation of depressurisation of fine grained soils due to unloading,
- \* intensive monitoring of pit movements,
- \* large scale evaluation of the shear strength of loosely dumped soil and
- \* back analysis of planned failures.

#### Modulus of Subgrade Reaction - Its Use & Abuse

14 March 1989

A joint meeting with Institution of Engineers, Victoria Division Structural Branch. Speakers included Peter Moore of University of Melbourne outlining the background to the use of the Winkler method and the methods of correcting the modulus for width and depth effects.

Keith Seddon of Pak Poy & Kneebone described 3 case histories which showed how some engineers had misunderstood the correct use of the modulus in design of rafts.

Chris Tattersall of B J O'Neill & Partners presented examples of its successful use from a structural engineers viewpoint.

Chris Haberfield of Monash University described the use of elastic theory, and in particular CSIRO Division of Geomechanics FOCALS program to model raft footings.

A lively discussion followed. It would appear that geotechnical engineers prefer to use Youngs modulus while structural engineers frequently use modulus of subgrade reaction in programs for raft design. It is proposed to publish the proceedings in a forthcoming I E Aust Civil College Report as an insert in Engineers Aust.

#### Review of Slope Stability Programs.

19 April 1989.

Prof Ian Donald & Peter Giam of Monash University presented a review of slope stability programs carried out for ACADS based on contributions from various sources. The 5 basic problems with 5 variants were compared against 4 "referee" sources from a worldwide selection. The problems tested the ability of the programs and users to handle a full range of situations expected in practice including complex soil profiles and slope geometries, pore water pressures, seismic effects, earth and rock dams, surcharges and non-circular failure surfaces. Calculated safety factor and positions of critical surfaces were presented by 24 respondents using a total of 27 different programs. The results cover a surprisingly wide range with the mean sometimes agreeing with "referee" values.

Two programs GWEDGEM and EMU developed at Monash were described and are detailed in the University's Civil Eng Research Reports 1, 2 and 4 of 1989.

The ACADS report Soil Slope Stability Programs Review was launched and is available from ACADS, 576 St Kilda Road, Melbourne, 3004 for \$45 for ACADS members & \$90 for non-members.

#### Dam Surveillance and Safety in Victoria -

17 May 1989

Ranji Casinader, consulting engineer, described the history and present situation of the proposed Victorian Water Bill which includes provision for dam safety. The major issues included in the Bill are

- liability for dam failure
- limited legislative controls
- definition of applicable dams
- administrative arrangements

The main implication is the requirement of strict liability of dams owners for which reasonable care is not a defence in the

case of damage to third parties. This will have significance for dam owners, public service and consulting engineers and liability insurers.

The aim of the legislation is to encourage dam surveillance by owners.

The technology of surveillance and monitoring was outlined.

#### Future meetings

Wed 21 June Nuclear Densometers in compaction control  
K York RCA

Wed 19 July Site Investigation in Practice  
R Olds of Coffey & Partners. A meeting with students & new graduate members

Wed 16 Aug Workshop - Update of Melbourne City Geology Map  
J Neilson Geological Survey

Wed 20 Sept Seminar on Lateral Earth Pressures 4 - 8 pm  
J Morgan, A Bridges, J Peyton

Wed 18 Oct Predicting Failure in Rock Mechanics E T Brown

Wed 9 Nov E H Davis Memorial Lecturer Dr M Khorshid

The Victoria Group, through Max Ervin, is continuing its bid for the XIV ICSMF in 1997. The next opportunity to present our case will be at the International Society's Council Meeting in August. The bid has been with the considerable support of I E Aust. An approach has been made to the Australian Tourist Commission.

#### TASMANIA

The Tasmanian Group have held two meetings so far this year. At the first meeting on the 20th March Mr Max Ervin presented the paper that he had presented at the fifth ANZ Conference on Geomechanics in 1988, a paper entitled "The Evaluation of Geotechnical Performance". The presentation was well received by the twenty members and guests who attended.

The second meeting was a combined meeting with the Tasmanian Division of the Institution of Engineers, Australia. Dr Patrick Quilty, Assistant Director Science with the Commonwealth Antarctic Division in Hobart, presented a talk on "Geotechnology in Antarctica". Although the area of exposed soil and rock in Antarctica is only a small fraction of the continent's total area, Dr Quilty described some of the problems associated with the foundations of buildings at Antarctic bases and excavations in frozen ground and also gave a fascinating account of the deep sea drilling operations with which he has recently been involved.

Three more meetings are planned for the remainder of this year. On the 10th July Mr Barry Weldon of the Tasmanian Mines Department will talk about his involvement with the recently resurrected gold mine at Beaconsfield in the North of Tasmania. On the 11th September a Workshop on "The Role of Personal Values in Geomechanics" will be held. This Workshop will investigate the effect of interpersonal relationships and attitudes on the transmission of geological and geotechnical information to the

design or construction engineer. The final meeting for the year will be the Group's Annual General Meeting to be held on Monday 20th November. At this meeting Mr Peter Bailey of the Tasmanian Mines Department will talk about "Geology and Hydrocarbon Potential of Tasmania's Offshore Areas".

The current membership of the Group is 23 with the following members forming the Committee:

Bram Knoop (Chairman)	H.E.C.
Brian Cousings (Deputy Chairman)	University
Tom Bowling (Secretary)	H.E.C.
Dick Barnett	H.E.C.
Fred Baynes	H.E.C.
David Brett	Consultant
Rick Donaldson	Mines
Larry Polglase	H.E.C.
Ralph Rallings	D.M.R.
Peter Stevenson	Ex Mines

Tom Bowling is the Group's representative on the AGS National Committee and Bram Knoop is the representative on the Committee of the Tasmanian Division of the IEAust.

## QUEENSLAND GROUP NEWS

Summary of meetings held so far.

### February

Engineering Evaluation of Compressible, Underslab Void Forms; presented by Miss Sue Henderson and Professor Keith Wallace. This paper was a review of research work undertaken by Sue Henderson into the behaviour of cardboard void formers used in certain circumstances under concrete floor slabs to relieve expansive uplift forces. The investigation considered the interaction of the soil expansion rate with the moisture uptake and the rate of strength loss of the void former under typical covered conditions.

### March

This was a joint meeting with the Geological Society at which Dr. Cliff Mallett, of the C.S.I.R.O. Division of Geomechanics, presented a paper on New Energy Sources and their Geotechnical Challenge. Two possible energy sources were discussed, coal seam methane extraction and thermal energy from deep artesian waters of western Queensland. Projects in the U.S.A. were compared with Australian possibilities. The major problems for methane extraction appeared to be finding suitable coal seams having sufficiently high permeabilities, and the availability of a pipeline infrastructure.

### April

A Mini Symposium was held on the Geotechnical Problems of Coastal Resort Developments which attracted a large audience to hear a panel of six speakers outlining problems such as, investigations for reclamation design, design and construction difficulties on dune sand, coastal protection structures, and finally the developers viewpoint.

### June

Mr. Jim Miller from Frankpile presented a talk on new techniques and equipment being applied to the design, installation and testing of piles, and on new types of piles such as the Atlas pile.

Meetings on the agenda include the July dinner meeting which will be addressed by the distinguished Austrian philosopher Dr. Friedrich Felskop on 'The Early Life and Times of Karl Terzaghi'; in September a Mini Symposium on Soil and Groundwater Pollution Control; and in October a field visit; and the Group's A.G.M. in November.

## SOUTH AUSTRALIAN GROUP

Office Bearers for 1989:

Brian Richards, Chairman,	CSIRO Soils Div SA	274 9283
John Morris, Deputy Chairman,	Department Mines and Energy	274 7688
Bob Newman, Honorary Secretary	E&S Department	226 2299

Committee:

Derek Avalle	212 5733
Lindsay Ballentyne	31 6356
Peter Bayetto	363 0022
Richard Cavagnaro	272 0777
Ed Collingham	226 2279
Michael Doherty	223 7011
Dr Peter Mitchell	212 5733
Paul Peter	274 9209
Dr Stephen Priest	228 5333
Ian Hosking	352 1744

The South Australian Group meets monthly at the Institution of Engineers Building, Chapman Hall, 11 Bagot Street, North Adelaide. Meetings are generally held on the third Monday of each month and commence with a light tea at 5.30 pm.

Technical meetings held in the first half of 1989 were:

### Feb 20 Void Formers for Footings on Expansive Sites

Sue Henderson of the CSIRO discussed the use and application of various compressible materials used to avoid the impact of soil movement beneath floor slabs.

### March 20 Overseas Study Leave Experience

Dr Neil Kay of the University of Adelaide presented his experience into research of static core testing, application of probability to geotechnical design which he gained during visits to Berkely California, Cornell and Hong Kong.

### April 17 Post Graduate Studies in Adelaide

Students from the University of Adelaide and the South Australian Institute of Technology, Richard Herriman, Mark Jaksa, Narajana Somaratne, Chris Rigg, Li Hong Yu and Tony Meyers presented the basis of their studies.

### June 19 The Sydney Harbour Tunnel

Ian Hosking of Coffey Partners International presented an address on the new road tunnel for Sydney Harbour.

Meetings for the remainder of the year include a Seminar on Earthworks: design construction and quality control which will be held on September 18.

To date this year our technical programme has been fairly busy with some eminent overseas visitors passing through Perth.

- \*\* On 7 March 1989 Dr. Guy Houlsby of Oxford University spoke on "Recent Developments in Cone and Pressuremeter Testing".

Guy was able to provide first hand reports of the recent developmental work underway at Oxford University in the fields of Insitu-Testing.

Of particular interest was the discussion based upon testing in relation to the influence of horizontal stress on the cone test and its interpretation.

Also of interest was the description of the cone pressuremeter which is presently under development.

- \*\* Our other Overseas visitor was Dr. Richard Jewell also of Oxford University who came to Perth to be part of the team presenting a short course at University of Western Australia on Soil Reinforcement.

On 20 April 1989 the final session of this course took the form of a technical meeting of the Geomechanics Society when Richard presented a talk entitled : "Reinforced Soil - Selected Developments Worldwide". This talk was amply illustrated by slides and descriptions and was well received by a large audience.

The interest shown in the topic and the course seems indicative of the current trend toward soil reinforcement be it for insitu soils by soil nailing techniques or for fill structures as in reinforced soil applications.

- \*\* On 8 April 1989 a small group of members visited the Harris Dam Site where construction is underway on a new dam to supplement the water supply to the Great Southern areas of W.A.

The dam is to be located on the Harris River, a few kilometres upstream from its confluence with the Collie River. The embankment will be earth fill and some 35 metres high.

Because the site is underlain by up to 25 metres of decomposed granitic materials (in places highly permeable) a slurry trench is required as part of the dam foundations.

Visitors were able to see the slurry trenching operation and the associated curtain grouting. Also of particular interest was the construction detail of the articulated outlet culvert which has been designed to accommodate the significant foundation settlement anticipated.

The spillway channel excavation had recently been completed mainly through rock so there was also something of interest for the "Geologists" in the group.

- \*\* Of special interest to country members was a joint meeting with the Geraldton Group of the Institution of Engineers of Australia held on 24 May 1989 when Geoff Cocks of the Main Roads Department spoke on "Laterite Gravel for Road Construction". Western Australia has an extensive network of lightly trafficked rural roads. The extent of this network and the sparsity of population has meant that low cost of construction is an important aspect in considering appropriate materials. In this regard Lateritic gravels have been used extensively and it has been found that performance has been some what better than may have been predicted on the basis of particle size distribution and plasticity tests alone.

Geoff presented details of characteristics of some lateritic materials which have been used.

One interesting feature which emerged from the talk is the realisation that very little research has gone into the selection of materials suitable for unsealed roads since the days of Macadam in the 19th Century. When one considers that Australia has more unsealed roads than sealed roads this becomes significant.

\*\* Not only was 4 July Independence Day but it was also the date upon which Doug McInnes of Golder Associates and Paul Foley of Main Roads Department presented a paper entitled "The Effects of Heavily Loaded Vehicles on Pavements".

The authors pointed out that vehicle and wheel loading are increasing as loads to be carried get heavier and tyre technology improves. Assessment of the effect of this on existing pavements and design for it on new pavements has required an extrapolation from the conventional methods of design based upon standard vehicle types and axle loads.

A review of methods of design was presented and a number of interesting case studies described.

\*\* A social side to our programme was provided on 9 June 1989 with a sampling of Thai Cuisine. This restaurant visit was thoroughly enjoyed by all who attended. However, the restaurant proprietor may never forgive us for the disruption caused when our Secretary decided we should all be photographed as a group. Hopefully a copy of the photograph may appear elsewhere in this publication. If anyone would like a print of the photograph for "posterity" or "evidence" please contact Charles Waterton.

\*\* For the remainder of 1989 we anticipate the following programme:-

- 20 September - Jointing Meeting with ACADS  
Soil Slope Stability Programme Review
- 3 October - Presentation by Dr Mohamed Khorshid of Woodside Offshore Petroleum Pty Ltd, who is the E.H. Davis Memorial Lecturer for 1989.
- 7 November - Presentation by Prof. Peter Wroth of Oxford University on a topic to be confirmed.

Committee Members for 1989 are as follows:-

CHAIRMAN

Charles Waterton                      Dames & Moore Pty Ltd

VICE CHAIRMAN

Ian Smith                                Golder Associates Pty Ltd

SECRETARY

Trevor Osborne                        GFWA Pty Ltd

COMMITTEE

Neil Daetwyler                        Dames & Moore Pty Ltd

Pieter Zwaan                            Golder Associates Pty Ltd

Geoff Cocks                            Main Roads Department

Martin Press                            Curtin University of Technology

Denis Smith                             Soil & Rock Engineering

Dr Mohamed Khorshid                Woodside Offshore Petroleum Pty Ltd

Joe Peuchln  
Resigned to Return overseas        Coffey & Partners Pty Ltd

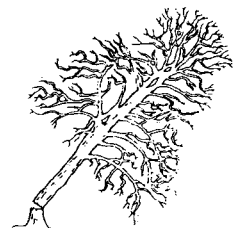
Dr Mark Randolph                     University of Western Australia

Dr Martin Fahey                        University of Western Australia

Colin Bradbury                        Water Authority of WA,

CO-OPTED MEMBER

Chris Swindells                        Australian Geological Survey



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The Secretary, Australian Geomechanics Society  
11 National Circuit  
BARTON ACT 2600

## GEODIARY

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The above photo shows some of the devastation downstream near the Briseis Mine. The flood wave actually cut through the ridge which ran from left to right as shown diagrammatically.

The photos are part of a set of about 11 taken by the late Fred Smithies and which are now kept in the Tasmanian Archives.

- 1 - Old river course ran around Ridge in the middle distance
- 2 - Flood from dam burst cut through the ridge here
- 3 - Devastation in the foreground

