AUSTRALIAN GEOMECHANICS

Issue No. 22 **July 1992**

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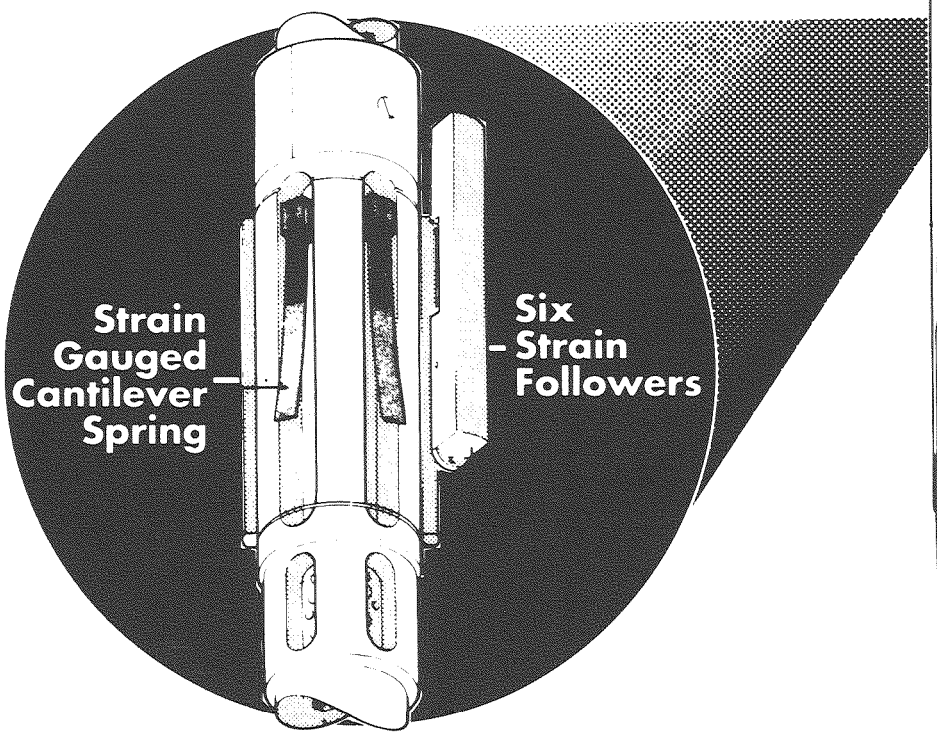

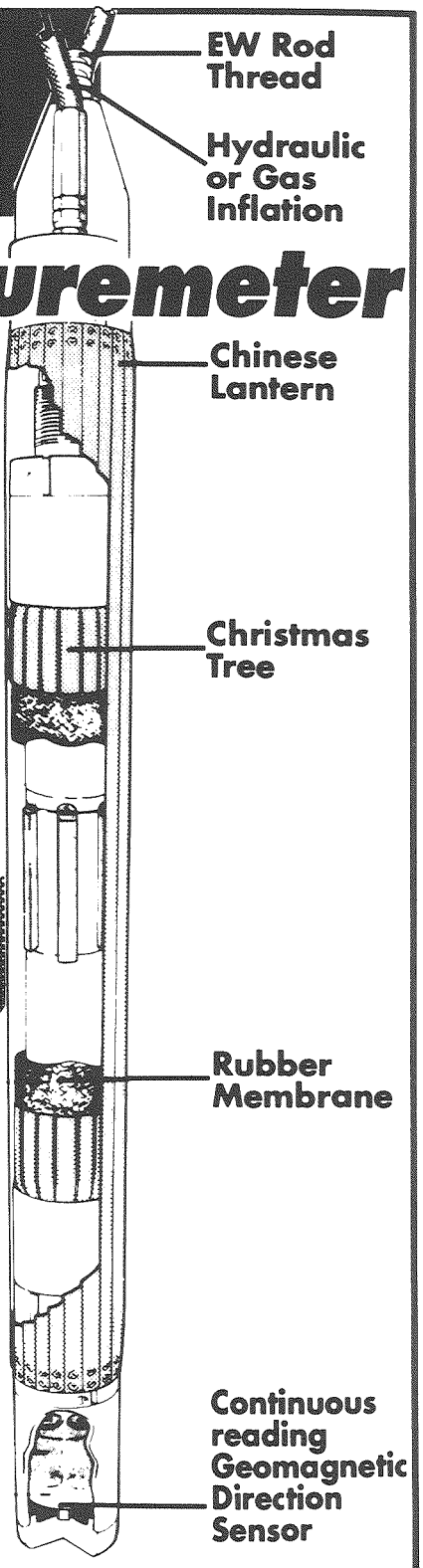

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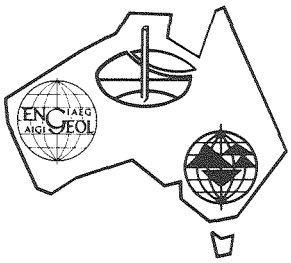

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News Journal of the Australian Geomechanics Society

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EDITOR'S NOTES

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

Technical contributions can include any of the following:-

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

Technical notes.

Comments on papers published in Australian Geomechanics.

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

Descriptions of geotechnical projects of special interest.

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

Contributions for the various regular columns and features.

Letters to the Editorial Panel.

Australian Geomechanics is now being produced in electronic format using Pagemaker 4 on IBM compatible hardware. Contributions are therefore preferred in computer format.

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

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

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

- Character quality - double density letter quality.
- Character size - 12 pts (10 pts on A4)
- Column width - 110mm (85mm on A4)
- Line spacing - single
- Paragraph spacing - double
- Main headings - numbered 1 to n, 10 cpi
- Formulae - typed or clearly hand written
- Lines per page - 55

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

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

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

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

Contributors are reminded that the deadlines for submission of material are 1 May for the June edition and 1 Nov for the December edition. Contributions should be forwarded to the Editorial Panel, Australian Geomechanics, c/- Department of Civil Engineering, Monash University, CLAYTON, VICTORIA 3168. Telephone (03)565 4982 or facsimile (03) 565 4944.

Editorial Panel for future edititions: Chris Haberfield, Julian Siedel and Peter Thornton.

Editorial Panel July 1992: Charles Waterton, Colin Bradbury, Trevor Osborne.

Advertising: Peter May

C/- I.E.Aust, 11 National Circuit, BARTON, ACT 2600

Ph: (06)270 6555.

LIBRARY FACILITIES

All publications received by the Society are soon to be transferred to IEAust National Headquarters in Canberra. State Secretaries are to hold a full listing of items held. Enquiries regarding access to this library should be addressed to Peter May.

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The Australian Geomechnics Society gratefully acknowledges the contribution made by its Supporting Members, who are listed below. To become a supporting member complete the appropiate section of the membership application form which is published elsewhere in this journal or contact Peter May in Canberra or your local group secretary.

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SUPPORTING MEMBERS' PROFILES

As announced in the last issue of Australian Geomechanics, we are intending to publish profiles of Supporting Members of the Australian Geomechanics Society. These will be published on an 'as received' basis and we reserve our editorial rights to limit extreme self aggrandisement! So, if you would like to see your organisation's profile published here, send the details to the Editorial Panel (after checking that you have paid your Supporting Member's subscription!).

GFWA

GFWA are specialist geotechnical and foundation contractors and engineers serving all areas of construction in Western Australia including the mining, commercial, industrial, civil engineering, environmental control and domestic sectors. With the support of SIF Entreprise Bachy of France, GFWA is able to provide a comprehensive range of geotechnical techniques backed by extensive worldwide and unparalleled local experience. For the last twenty years, GFWA has worked all over Western Australia developing, designing and constructing economical engineering solutions.

Areas of expertise include foundation and lateral retention piles, all types of grouting, ground anchors, underpinning, vibroflotation, diaphragm walls, slurry trenches, guniting, soil nailing and dynamic consolidation. In addition, GFWA operates a site investigation service with an Electric Friction Cone Penetrometer truck, a variety of drilling rigs and equipment capable of recovering bulk samples.

For more information and technical advice, contact (09) 410 2311 (phone) and (09) 410 1297 (fax). Mel Birkinshaw, Simon Breen and Martin Fielder will be pleased to help you with your enquiry.

HOLLINGSWORTH DAMES & MOORE

Hollingsworth Dames & Moore, a division of Dames & Moore, provides a range of professional services in the specialist fields of geotechnical engineering, mining engineering and geomechanics, hazardous waste management, environmental and earth sciences, town and regional planning and hydrogeology. The firm operates principally throughout Queensland and Papua New Guinea with offices in Brisbane and Townsville, managed by Mike Marley, and offices in Cairns and Port Moresby managed by Geoff Byrne. Doug Ryan and Terry O'Keefe manage Earthtech (soils and materials) laboratories in Brisbane and Cairns.

The Geotechnical Engineering Group in Brisbane is managed by David Starr and the Mining Group by Doug Maconochie. The Hazardous Waste Management Group is headed by Rod Williams and the Hydrogeology Group by Yin Foong. The Terrain Analysis & Graphical Information Systems Group is headed by Gavin Renfrew. According to Peter Hollingsworth, Senior Consultant in the Brisbane Office, the range and quality of the in-house skills and depth of experience offered by Hollingsworth Dames & Moore in these specialist areas is aimed at providing clients with services which match engineering excellence with environmental responsibility.

WESTERN GEOTECHNICS

Western Geotechnics are entering their sixth year of operation in the soil, rock and construction material testing industry in Western Australia, and are looking to expand activities both technically and geographically. They will soon be offering an extended service in the area of geotechnical instrumentation. As well as being the WA agent for the Australian made range of GSA equipment, they will also be offering an instrumentation installation and monitoring service. They also offer an inclinometer data reduction service and a hire service for more expensive specialised equipment, such as inclinometer sondes. They are currently also installing a Casagrande style rock direct shear testing machine, which will also handle large size gravel samples. Other new equipment includes high pressure triaxial testing equipment and a Shimadzu universal tensile and compressive testing machine.

Western Geotechnics employ about 25 staff with Mr Ralph Newton as Managing Director and Mr Ron Hoffmann as Commercial Director. In addition to their laboratory in Rivervale, Perth, they opened a lab in Kalgoorlie two years ago and they have just opened other permanent labs in Mandurah and Port Hedland. The laboratories of Western Geotechnics can offer the full range of tests for soil, rock, aggregate, concrete and other building materials.

EDITORIAL

Since this is our last editorial before handing over the reins to the Victorian Group, we're inclined to be a little self indulgent and reflect briefly on some of the wins and losses of our spell on the Editorial Panel.

Almost inevitably, the last four issues of Australian Geomechanics have seen more than their fair share of news, views and papers from WA - however we must correct the impression that all geotechnical activity in WA revolves round the UWA centrifuge!! Not so, but the rotating editorship does give individual states the opportunity to do a bit of grandstanding, to push issues of particular concern and to throw the spotlight on geotechnical activity within their state. We would like to think that we've succeeded in all three areas.

From the outset, we attempted to standardise the journal format by computerising its production using desk top publishing software. This was not without its headaches, however when it was successful, we believe the result was very pleasing. The Journal was intended to be a half yearly publication however problems of work commitments, software incompatibilty and unfamiliarity, late copy and last but not least, poorly developed keyboard skills(two digit variety), all contributed to delay publication beyond the deadlines. For this we apologise and wish Victoria, 'the very best of luck'.

Thanks to Peter May, IEAust Canberra, advertising is now a regular feature in each issue and brings in important revenue, offsetting journal publishing costs.

Our intention to narrow the gap between geotechnical people in the mining and civil engineering areas has met with only limited success if measured in terms of published articles and papers of common interest. However on the local scene, the formation of a separate WA AGS Group in the gold mining town of Kalgoorlie is interpreted as a positive step towards bringing the two disciplines together. So too is the formation of the WA Centre for Geomechanics which will provide an important link between the resource industries and major research institutions in WA. Either initiative could in turn prove to be an important source of technical papers and talks for the wider geotechnical community.

This special issue is devoted almost entirely to Waste Management, fulfilling a commitment we made on first taking over the editorial hot seat. The very existence of this issue is a reflection of the growing concern within and outside the profession about the subject of waste and its safe disposal.

Too often in the past, the waste products of society have been poorly managed and have exerted a heavy toll on the environment. A growing awareness of the problem has lead in recent times to concepts of minimising and recycling waste. and where these are not possible, disposing of waste safely, i.e. in such a way that is within the capacity of the environment to absorb it. This is consistent with the idea of ecologically sustainable development which forms the subject of our guest editorial from WA-EPA's Browne-Cooper. His article is particularly timely as it follows closely on the heels of IEAust's release of its "Environmental Principles for Engineers". According to one of its authors, the main purpose of the Principles is to get across the importance of ethics in sustainable development and as such it largely complements the previously issued IEAust's Environmental Code of Practice, first published in 1987.

Whilst in recent years there has been a shift in emphasis of production strategies away from waste treatment to waste prevention, management of waste whether from the past, present or future, will continue to remain a significant problem facing society (sic engineers).

Of the various options for disposal of waste, sea outfalls - dumping at sea, incineration and disposal on land, all have their inherent problems for the environment and their critics. Even recently constructed sea outfalls whose designs are based ostensibly on studies of the assimilative capacity of the receiving environment, are showing signs of harmful impacts. Incineration is expensive , frequently produces unacceptable gas emissions and typically encounters its own brand of "nimby" type opposition. Disposal on land is no better off, carrying with it the potential for pollution of surface or groundwater resources and sterilising tracts of land.

In some cases however, disposal on land can be beneficial:

> The more benign waste such as digested sewage sludge can have value as a fertiliser in agricultural spreading however leaching of nutrients to water courses and soil contamination must be avoided.
>
> Red mud - bauxite residue - has been used to benefit to decrease the permeability of poor agricultural sandy soils making them better able to retain applications of fertilisers.

Other land disposal options of the more ecologically damaging waste rely on containment to prevent surface or groundwater contamination by leaching. This aspect of waste management is relatively familiar territory to the geotechnical profession and one which sees increasing application of the use of geomembranes. A review of their use in Australia is provided in the paper by Parker and Sadleir.

A companion paper entitled "Geosynthetic Containments in Environmental Protection" by Sadleir discusses the use of both membranes and geotextiles, alone or in conjunction with

clay fill, as liners or caps, to provide landfill leachate containment.

Site investigations for proposed waste disposal sites and more particularly, for existing contaminated sites have their own characteristic problems. For contaminated sites, historical site records can give all important clues to likely contaminants and therefore which analytical tests to perform - you need to know what you are looking for to arrive at the correct test for finding it !! Again a prior knowledge of the site can be all important in knowing where to drill to locate any buried contamination.

These and other aspects of site investigation of contaminated land are addressed in "Auditing of Contaminated Land", a very useful paper by David Parker. Reasons for auditing are given together with key steps and pitfalls in the processes of field investigation, testing and assessing contaminated sites. Answers to 'What are acceptable levels of contamination for a particular site ??' are discussed and mention is made of Victoria's statutory audits. One wonders how long it will be before other states follow suit!!

Leachates from waste deposits contain chemicals which may adversely affect the sealing properties of clay liners or foundations. This type of chemical interaction was examined in the comprehensive investigations carried out for a landfill disposal site for aluminium smelter waste - the subject of an interesting paper by Sullivan and Knight. Fortunately in this particular case, batch tests identified good absorbtive capacity in the clay.

Gaining an understanding of the likely migration of contaminant plumes was achieved by Hensley and Savidou in experimental work using geotechnical centrifuge modelling. Results of the physical modelling according to their paper, compared favourably with numerical modelling and demonstrate yet again the versatility of the centrifuge in engineering investigations.

Mine tailings - the water borne fine waste product from mining activity deposited traditionally in characteristic and frequently unattractive waste dumps - has its own brand of environmental engineering problems:

> Traditional tailings disposal involving thickening and pumping the slurried tailings to dams/lagoons, presents problems for rehabilitation. The deposited tailings have initial high water content, correspondingly weak shear strength and occupy large areas of land which are susceptible to erosion.

A promising alternative disposal technique which overcomes many of these problems, involves mixing the tailings with 'coarse reject'. The combination of materials has improved engineering properties and behaviour, is easier to rehabilitate and has better future land use capabilities. The technique has been trialled successfully in the NSW coal mining industry and forms the subject of a paper by Williams.

One of the key imponderables in the management of tailings disposal is the question of how quickly the waste material will consolidate and therefore improve in its properties. Fahey and Toh in their paper have developed a technique for examining and predicting consolidation behaviour of slurried tailings under various filling rates and boundary drainage conditions. For this they used a combination of numerical modelling based on large strain consolidation theory with input consolidation parameters obtained from geotechnical centrifuge modelling.

By its very nature, waste management frequently requires a multidisciplinary approach. This presents geotechnical engineers with a unique challenge in which they have to work with and have an understanding of many other disciplines. The latter can be achieved not only by training but by encouraging interdisciplinary debate in technical journals and in speciality conferences. One such conference is the forthcoming Conference on Geotechnical Management of Waste and Contamination due to be held in Sydney in March 1993.

The Editorial Panel strongly recommend anyone with an interest in waste management to take up the challenge and contribute to what we are sure will be a very successful conference.

Colin Bradbury, Trevor Osborne, Charles Waterton.

PETER BROWNE-COOPER —GUEST EDITOR

Peter Browne-Cooper is very well known in the environmental and waste management industries in Western Australia and indeed throughout Australia. In addition, he has come into public prominence here in the West through his previous position as Director of the Pollution Control division of the Environmental Protection Authority.

He graduated from the University of WA in 1964 with a B.Sc, majoring in physics and mathematics. He was with the 1965 Australian National Antarctic Research Expedition, specialising in geomagnetics and seismology. After a year with the Bureau of Mineral Research doing airborne geomagnetic surveys, he worked with the firm Geotechnics during the WA nickel boom.

Peter joined the Department of Environmental Protection (forerunner of the Department of Conservation and Environment) in March 1972 and, except for a secondment to the Australian Overseas Projects Corporation during which he worked in Jedda, Saudi Arabia, he has been with the EPA (and its antecedents) ever since.

He is currently A/Assistant Chief Executive Officer of the Environmental Protection Authority.

ECOLOGICALLY SUSTAINABLE DEVELOPMENT

IDEALISTIC MYTH OR A PRACTICAL APPROACH TO OUR FUTURE

Almost everyone - even the odd Geotechnical Engineer - has been exposed at some time recently to the term "ecologically sustainable development" (ESD): its the current environmental buzzword. A few of us may even have thought about what the term means. I suspect that very few indeed recognise the extent to which the concept can, and must, be applied to every aspect of human endeavour.

So what is ESD and why is it so important?

It is perhaps relatively easy to grasp the ESD concept in the context of forest or fishery management: one can see, at least theoretically, how the volume of timber removed can be limited to the growth volume each year, or the number of fish caught can be limited to the natural population growth. But is this true ecological sustainability - the action of removing trees or fish must change the ecological balance.

The practical implementation of ESD requires an understanding of two more "jargon" terms - *beneficial use and assimilative capacity*.

The *beneficial us* of a portion of the environment is the use assigned to it by society. The use of one piece of bush may be for protection of flora, another may be set aside for future residential development and another used for logging and regrowth; one estuary may be reserved as a shipping harbour, another for swimming, another for oyster culture; or there may be desire for a mixture of all these activities.

The ecology that we aim to sustain in those different areas of bush or those different estuaries may vary considerably:

- For the residential development we need to ensure that removal of vegetation will not produce flooding; perhaps that drainage will not adversely affect the beneficial use of the adjoining National Park; that air quality standards can be maintained; that groundwater uses are protected - very little of the pre-existing ecological diversity is necessary to sustain this beneficial use.

- For the flora protection reserve we need to ensure against introduced weeds and grazing animals; fire management may be necessary; flower picking may need to be controlled; a diverse range of insects and animals may need to be maintained for pollination; water quality and quantity in a wetland and depth to groundwater may be critical - a substantial amount, but perhaps not all, of the pre-existing ecological diversity may be necessary to sustain this beneficial use.

- For the logging area, removal of "weed" trees may be desirable to encourage commercial species; fire protection may be required; insect and animal pests may need control - if the only beneficial use to be sustained is timber production, some but not a lot, of the pre-existing ecological diversity may be necessary. If, on the other hand, multiple beneficial uses of timber production and wildlife conservation are desired, a far greater range of ecological diversity will be necessary.

The *assimilative capacity* of a portion of the environment is its ability to maintain a quality acceptable for the beneficial use or uses assigned to it or traditionally made of it, despite being subjected to some level of continuing interference.

Assimilative capacity is expressed as the quantity of a substance or intensity of an activity, alone or in combination with other substances or activities, which that portion of the environment can accept without jeopardising the beneficial use or uses assigned to it or traditionally made of it.

Looking again at the examples we have above:

- The residential area has a very large capacity to assimilate human trespass; being a low lying area with no wind it may have a very low capacity to assimilate smoke from domestic fires; the capacity to assimilate lawn fertiliser may be high if groundwater will only be used for garden irrigation but if there is a groundwater connection to wetlands in the adjacent National Park this beneficial use will dictate a lower assimilative capacity in order to avoid wetland damage.

- The flora reserve may be able to assimilate some human trespass, perhaps along designated tracks; smoke may not be problem but the plants may be highly susceptible to hydrogen fluoride for which the assimilative capacity will be virtually zero; a slightly elevated level of nutrients in the groundwater may be an asset but too much will kill the plants.

- The logging area may tolerate a quite high level of human trespass in the area of mature trees but seedling areas may have a very low assimilative capacity; smoke and some other air contaminants may only need to be controlled to levels appropriate to protect forest workers and casual visitors; quite high levels of nutrients in the groundwater might be able to be tolerated.

So different beneficial uses require different environmental management for their maintenance and may imply very different assimilative capacities. it follows that pollution or degradation of the environment only occurs when its assimilative capacity for the specified beneficial use is exceeded; conversely if the stresses placed on the environment are kept within its assimilative capacity they can continue indefinitely - ie we have ecological sustainability.

These concepts can be applied to virtually everything we propose to do - opening up land for housing or agriculture, building a factory, establishing a mine, disposing of wastes, creating a National Park, fishing for rock lobsters etc. We can test the sustainability of our proposal by following these steps:

1. Determine the present and likely future beneficial uses of, and surrounding, the site of the proposal;

2. Determine that environmental characteristics, which are likely to be impacted by some aspect of the proposal, are necessary to maintain those beneficial uses;

3. Determine for each of those aspects, the assimilative capacity in relation to the most sensitive beneficial use;

4. Measure the pre-existing load of each of those aspects;

5. Add the proposed load to the pre-existing load and compare the total to the assimilative capacity.

All this may look like an environmental consultant's dream come true - the trick is to make sure investigations are only done to the level of detail necessary to demonstrate that our proposal meets the requirements. If we want to dispose of large quantities of saline water to our tailings dam near the town water supply, we may need to do very detailed hydrogeological and engineering studies. If we are a long way from town in an area of known hypersaline groundwater very little investigation may be necessary.

If our proposal can be implemented and managed so that all the stresses placed on the environment are within its assimilative capacity our proposal will be *ecologically sustainable* and therefore:

- Our factory would be able to operate indefinitely without unacceptable environmental effect;

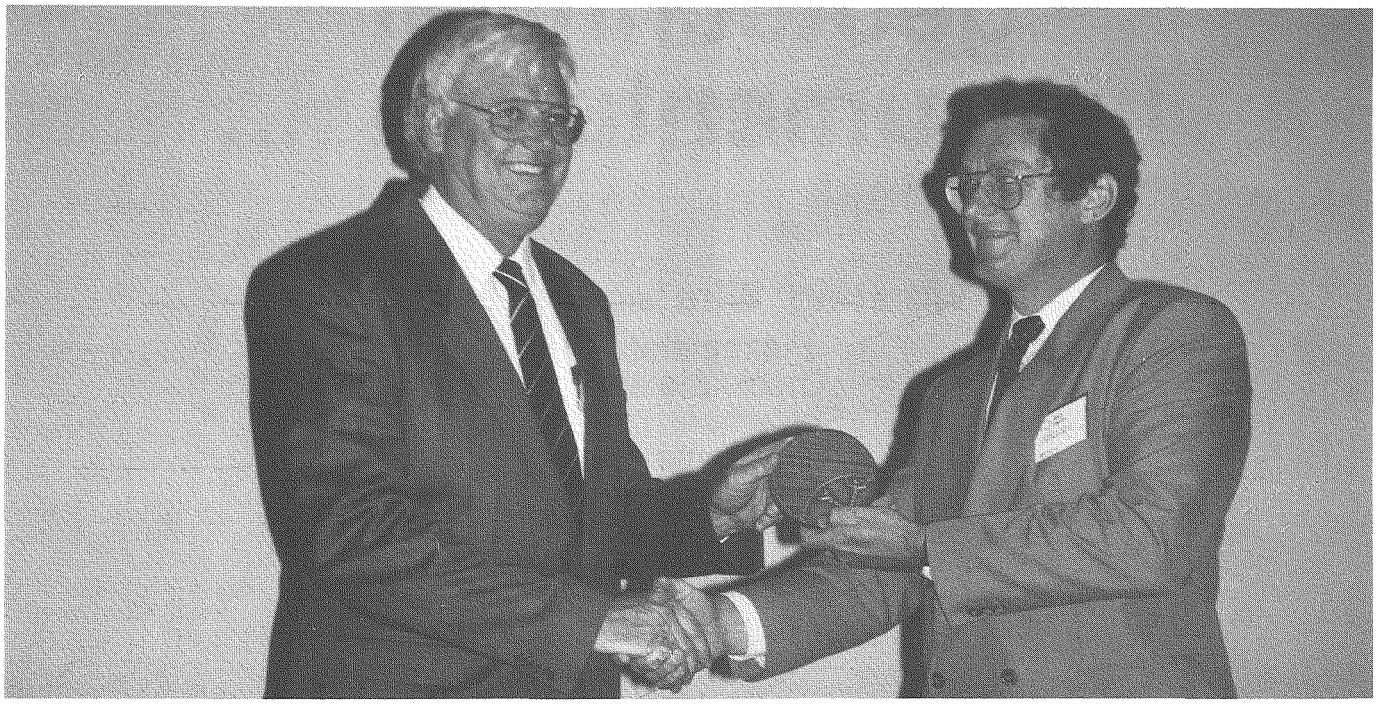
- We should be able to walk away from our mine and its tailings dam or the foundations of our offshore oil platform, confident that no unacceptable environmental hazard will arise in the future; and

- Our housing development will remain a pleasant place to live without adversely affecting the adjacent National Park which, in turn, should be able to continue to support its wildlife conservation and tourism functions indefinitely.

This is what ecologically sustainable development is all about - a sensible and essential approach to human activity.

Peter Browne-Cooper

1992 JOHN JAEGER MEDAL WINNER — Dr BRIAN RICHARDS



Dr Brian Richards receiving the John Jaeger Memorial Medal from AGS Chairman Max Ervin

The 1992 John Jaeger Medal winner is Dr Brian Richards. It was awarded to Dr Richards at a special ceremony at the 7th ANZ Geomechanics Conference in Christchurch, New Zealand in February 1992. Dr Richards then presented his paper "Modelling Interactive Load Deformation and Flow Processes in Soils" to the conference delegates.

Brian Richards was born in 1934 and obtained a First Class honours degree in Civil Engineering from the University of Adelaide in 1956. After a period with the Highways Department of SA, he joined the CSIRO Division of Geomechanics in Melbourne in 1959. Apart from a few changes in title and divisions, he has been with CSIRO ever since and has recently moved to Brisbane with the Division of Geomechanics.

During his 32 year stint with CSIRO, Brian Richards has developed an international reputation in the field of the physical behaviour of soils of the semi-arid to arid environment, and particularly unsaturated and expansive soils. His early work was pioneering research in a field in which very few workers at the time had made significant advances. This mainly fundamental research led to the development of new techniques for the definition, measurement and prediction of soil suction for geotechnical applications in the unsaturated soils of Australia.

Following on from this early work, he applied his knowledge and techniques to a wide range of applied problems, including road pavements in dry climates, foundations on expansive soils, retaining walls, slope stability in open cut mines, landslides in tropical areas, embankments constructed with expansive soils, compaction of agricultural soils, root penetration problems in compacted soils and, in recent times, water and contaminant transfer in rehabilitated mine sites. He is now considered a world authority in the use of unsaturated and expansive soils in agriculture and in civil, mining and environmental engineering.

His work and achievements clearly make Dr Brian Richards a very worthy and deserving winner of the 1992 John Jaeger Memorial Medal, which was instituted by the Australian Geomechanics Society in 1979 in memory of the late Professor John Jaeger. It is awarded every four years to coincide with the ANZ Conference. Jaeger was born in Sydney in 1907, graduating from the University of Sydney in Mathematics and Physics in 1928. After a period at Cambridge, he returned to Australia in 1935 to take a lectureship at the University of Tasmania where he subsequently became Professor of Applied Mathematics. In 1953 he moved to the Australian National University in Canberra as Professor of Geophysics. Although mathematics was probably Jaeger's main field of endeavour, he is well known for his work in Rock Mechanics, being a pioneer in the field. He wrote 6 books and published over 120 papers.

The John Jaeger Medal is awarded to an individual, or group of individuals, considered to have made a significant contribution to Australian geomechanics over recent years. The medal comprises a bronze casting, mounted on a piece of Wombeyan marble, this being the material with which Jaeger did much of his work.

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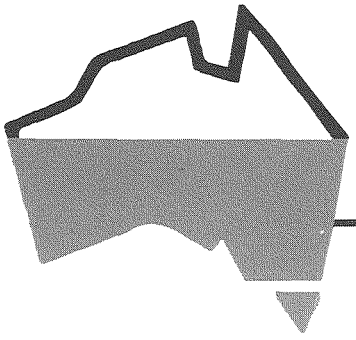

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TRANSISTOR PSYCHROMETER

This new instrument for Soil Suction Measurement was released in Dallas Texas at the 7th. International Conference on Expansive Clays

It is the result of a collaborative venture between CSIRO Division of Soils and Soil Mechanics Instrumentation and has many advantages over the older types of suction measuring equipment:

- high output voltage
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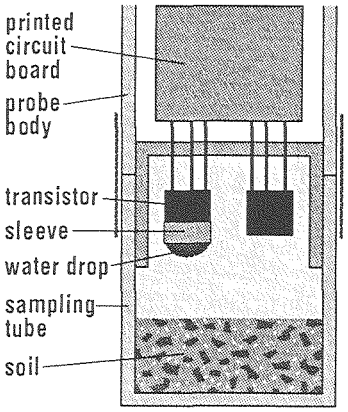
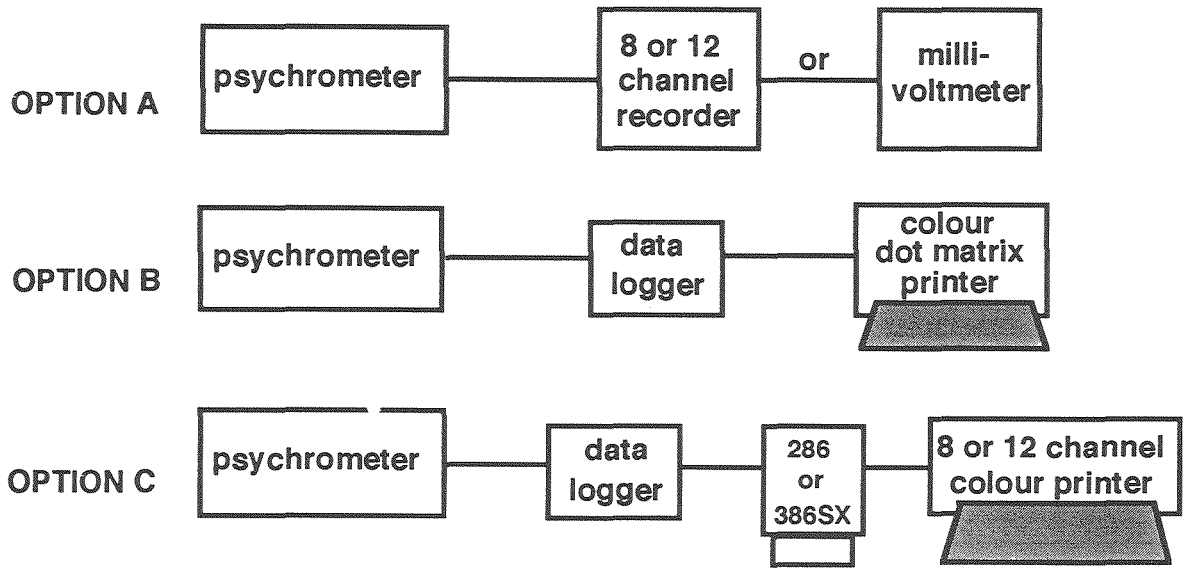


The psychrometer has been developed to fully utilise the trend in geotechnical laboratories for computer driven testing and recording.

Our data logger has an RS232 port for data extraction or it can send information in graphic or numeric form directly to a colour dot matrix printer.

The options for data recording, storage and manipulation are:



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Manufacturers of a range of instruments for measuring moisture reactive soil volume change and flow parameters

STANDARDS AUSTRALIA

The last two issues of Australian Geomechanics gave an update on the status of Standards and associated committees that were of relevence to members of the Society. They were:

AS3798—Guidelines on Earthworks for Commercial and Residential Development

AS1289—Testing of Soils for Engineering Purposes

AS1726—Site Investigation Code

AS2159—Australian Piling Code

AS2870—Residential Slabs and Footings

AS3706—Geotextiles—Methods of Testing

Committee CE/26 Precast Reinforced Concrete Box Culverts

Since then however there has been little to report. One new development is that AGS has been invited by Standards Australia to nominate a representative to the new committee responsible for developing a draft standard entitled:

CE 32—Reinforced Soils and Retaining Structures

[Ed comment: its reassuring to see Standards Australia are keeping up with new developments.]

In addition two draft standards were recently issued for public commment:

(i) DR 92090:R Methods of testing soils for engineering purposes: Method 2.1.6. Soil moisture content tests—determination of the moisture content of a soil—Hotplate drying method (subsidiary method). Closing date for comment was 31.07.92.

(ii) DR 92097: Piling—Design and Installation. This is the draft of the new Australian Standard Piling Code which will replace AS 2159—1978. The draft code has been formulated in limit state format, and comprises mandatory sections, and informative appendices which provide commentary to parts of the mandatory sections.

The draft code was originally issued for public comment until 30 September, 1992 but in view of the interest and debate generated, the deadline for comments was extended to the end of October 1992. Copies of the document can be obtained for $30.00 from:

Standards Australia Att . P. Walsh
Standards House 80 Arthur Street North Sydney NSW

Members with an involvement or interest in deep foundations are urged to obtain a copy and actively participate in the review process.

Since there is little to report from the SA committees in this issue, its worth reminding readers that this regular ` feature is also intended to provide a forum for members to comment on their experiences good or bad, in using the various geotechnical standards. Such 'open discussion' could provide important feedback to the Standards' Committees with the possibility of improvement in these all important reference documents.

NEXT ISSUE

Before telling you about the next issue, we would like to take this opportunity to say goodbye.
This is the last issue of Australian Geomechanics (for many years at least!) that will be produced by a Western Australian Editorial Panel. Whilst the task has sometimes seemed onerous, there is no doubt that it was all worthwhile. The pleasure of seeing the work completed might be compared with the joys of childbirth. There certainly was quite a lot of pushing, not a small amount of groaning but we can tell the Victorian Editors that breathing exercises are of no help whatsoever (although they do help to pass the time!)

We have all enjoyed the effort that was required and although we only managed to elicit one Letter to the Editor (despite attempts at being controversial), we do know that there are some people out there who read the magazine because, at long last, we have managed to extract a State Group report from SA (Loud cheering from offstage!)

For the next two years, Australian Geomechanics will be produced by an Editorial Panel nominated (conned?) by the Victorian Group and based at Monash University. The Panel will be led by Dr Chris Haberfield and we wish him and his co workers all the very best.

And now....the moment you have all been waiting for..... the next issue will centre around.....Research in Australian Geomechanics!

Over to you Chris!

GEONEWS

GEOTECHNICAL "GOINGS ON" IN THE WA GOLDFIELDS

In 1990 several mining and geotechnical engineers based in the Kalgoorlie area formed a group called the Goldfields Geotechnical Group (GGG). The purpose of the group was to promote geotechnical science and to provide a forum for the exchange of ideas in the field of Rock and Soil Mechanics. The group was lead by D Fotakis and P Loubser and, in 1991, organised seven meetings during which internal and external presenters lectured on new solutions and achievements in mining rock mechanics.

During the GGG meeting on 6 March 1992, members indicated their willingness to join the AGS as a local group. As a result, on 7 April 1992, a meeting of the group unanimously voted to transform the Goldfields Geotechnical Group into the Kalgoorlie Group of the Australian Geotechnical Society.

The group consists of eleven AGS members and twelve supporting members who are expected to join in the near future. Anyone interested in the activities of the group are invited to contact Trevor Little at the West Australian School of Mines Tel: (090) 805155.

Details of the 1992 Programme of the Kalgoorlie Group are given in the State Group Reports.

CENTRE FOR GEOMECHANICS IN WESTERN AUSTRALIA

A Centre for Geomechanics has been established in Western Australia in June 1992 for the purpose of servicing the technological and scientific needs of the state's mining and petroleum industries. As a co-operative venture, the Centre is able to draw upon the combined talents of its five primary participants, namely the UWA Geomechanics Group, CSIRO Division of Geomechanics, the WA School of Mines, the UWA Dept of Geology and the WA Dept of Mines.

The aim of the Centre is to promote a vigorous, world class, centre of research excellence and postgraduate education in geomechanics, with particular emphasis on its application to the mineral and energy extraction sections of Australia's resource industries. Expertise will be available across the full breadth of geomechanics from soil and rock mechanics, numerical and experimental modelling, structural and engineering geology, mining geomechanics and rock and groundwater chemistry. Close links with industry will be maintained through Dept of Mines and also through the Board of Management of the Centre, which has strong industry representation.

Companies who are affiliate members of the Centre will have priority access to research personnel, training facilities/courses as well as the Centre's reports, reference and data gathering systems.

Further information about the Centre may be obtained by contacting RJ Jewell, the Centre's Director, on tel. (09) 380 3300 or fax (09) 380 1130.

HOT OFF THE PRESS

'Embankment Dam Engineering' by Robin Fell, David Stapledon and Patrick Macgregor (AA Balkema Publishers) has recently hit the stalls and will hopefully be reviewed in a future issue of the Journal. The aim of the book according to pre-release publicity from publishers AA Balkema, is 'to present a "state-of-practice" on embankment dam engineering, particularly highlighting common problems, errors and omissions' - sounds interesting!

HONG KONG GCO PUBLICATIONS

Geotechnical Control Office, Hong Kong publish a series of relatively inexpensive and comprehensive geotechnical guides, manuals and reports which include titles such as :

Geotechnical Manual for Slopes
Guide to Retaining Wall Design
Guide to Site Investigation
Guide to Rock and Soil Descriptions
Model Specification for Prestressed Ground Anchors
Model Specification for Reinforced Fill Structures
Groundwater Lowering by Horizontal Drains
Review of Design Methods for Excavations

Further information on the publications available may be obtained by writing to:

Publications (Sales) Office
Information Services Department,
Battery Path,
Central,
Hong Kong.

CONFERENCE WATCH

In February of this year, the New Zealand Geomechanics Society and Christchurch, New Zealand were host to a unique 'double' on the conference circuit, namely the 6th Australian New Zealand Conference on Geomechanics and the 6th International Symposium on Landslides.

6th ANZ Geomechanics Conference

The Australian New Zealand Conference On Geomechanics ran from February 3 to 7, was attended by over 150 delegates and had as its overall theme "Geotechnical Risk - Identification, Evaluation and Solutions". Major Sponsor for the conference was the New Zealand Earthquake and War Damage Commission (EQC).

An excellent introduction to the conference was given by Professor J. K. Mitchell, University of California, Berkeley in his keynote address entitled "Mitigation of Ground Failure Risk - Some Lessons from the Loma Prieta Earthquake".

Aftermath of the 1989 Loma Prieta earthquake in California, displayed graphically in a series of colour slides, was used by Professor Mitchell to illustrate how geotechnical risk has been identified and evaluated in the Marina District of San Francisco. This was then used as a basis for recommendations for actions to prevent loss of life and massive damage in future large

earthquakes. The latter included site specific programmes of ground improvement to prevent liquefaction and lateral spreading in critical areas, seismic retrofitting of deficient structures, upgrading of utility systems and the development of emergency response plans.

The conference was also the venue for the John Jaeger Memorial Address which was given by Dr B.G. Richards, CSIRO, on the subject "Modelling Interactive Load-Deformation and Flow Processes in Soils, including Unsaturated and Swelling Soils." The concept model was developed over 25 years as a finite element computer program incorporating the theoretical and practical experience gained by the author in his widely acclaimed research work over the period. Of particular interest were the practical applications of the model which included back analysis of the Sau Mau Ping landslide in Hong Kong ,1972, in which 18 people were killed; prediction of pressures due to swelling soil on a retaining wall and hill-slope seepage in a soil with contrasting texture.

Over 90 papers were included in Conference proceedings and were discussed by Session Reporters under the following categories:

Session 1: Earth Structure,Dams, Soil Improvement and Geofabrics. 13 papers

Session 2: Foundations and Retaining Walls. 16 papers

Session 3: Mining, Tunnels and Excavations 13 papers

Session 4: Soil Properties and Testing. 23 papers

Session 5: Analyical and Probabilistic Methods 13 papers

Session 6: Slope Stability and Seismic Hazard. 13 papers

Session 7: Professional and Legal Issues. 4 papers including one by Peter James which really required a category of its own.

Of particular note was the Session Report from Prof John Carter who managed to present a very clear, informative and well balanced analysis of the 13 papers on Analytical and Probabilistic Methods - subject matter that potentially could be 'heavy going' for the uninitiated.

As might be expected the 90+ papers reflected a broad interpretation of the Conference theme of geotechnical risk. Having a specific theme however did focus conference discussion and as a result some key issues were identified and debated. Those requiring urgent consideration by the profession included:

a) the need for common understanding and consistent terminology for terms such as risk, hazard and uncertainty and

b) the need for education within and outside the profession in the concept of uncertainty and risk associated with engineering works.

Final day of the conference saw a polished presentation on the Clyde Power Project by M Gillon, Works Consultancy Services. This was followed by the NZGS Geomechanics Lecture, given by Professor G.R Martin, University of Southern California, on the subject "Geomechanics—The Art and The Science". By way of illustration in his talk, Professor Martin discussed recent developments in cone penetrometers, spectral analysis of surface waves, centrifuge modelling, instrumented pile load tests, finite element analysis and the future use of computers.

6th International Symposium on Landslides

The Symposium ran from February 10 to 14, 1992 and was attended by over 220 delegates, of whom about 90 were from either Australia or New Zealand. Major financial sponsors were EQC and Electricorp Production and the symposium was co-sponsored by ISRM, ISSMFE and IAEG. It is the first time the symposium has been held in the southern hemisphere and it attracted over 224 papers. The conference assumed a special significance in the context of the present United Nations International Decade for Natural Disaster Reduction Programme.

Technical sessions were introduced by general reports on the session themes from keynote speakers as follows:

General themes:

Landslide Investigations. Prof D H Stapledon (Australia)

Stability Analysis Techniques. Dr N R Morgenstern (Canada)

Stabilisation & Remedial Works. Dr R L Schuster (USA)

Landslide Hazard Assessment. Dr J N Hutchinson (United Kingdom)

Monitoring & Instrumentation. Mr J Dunnicliff (USA)

Specialist themes:

Seismicity & Landslides. Prof K Sassa (Japan)

Landslides & Reservoirs. Dr W Reimer (Germany)

Open-Pit Mine Slopes. Dr B K McMahon (Australia)

Slope Instability in Tropical Areas. Dr E W Brand (Hong Kong)

Landslides in Australasia. Prof R Fell (Australia) & Dr W M Prebble (New Zealand)

With such a wide range of themes and large number of papers it was impractical and probably inappropriate to mention individual contributions, suffice to say that there were some excellent presentations from keynote speakers and the interested reader is referred to the 3 volumes of Proceedings for further information.

Of particular interest to delegates was the massive landslide stabilisation programme nearing completion around the shoreline of the proposed Lake Dunstan, in southern New Zealand. This hydro-electric storage is to be impounded behind the completed Clyde Dam in the schist terrain of Central Otago, where large (<1000Mcu.m)ancient landslide complexes pose a potential threat to the long term operation of the scheme. Some 15 papers dealing with various aspects of landslide stabilisation programme on the Clyde Power Project were included in the conference proceedings. In addition delegates had the opportunity in a pre-symposium

study tour to visit the site and to gain an appreciation of the nature and scale of the remedial works. The landslide stabilisation programme is reputedly the largest known in the world and is costing NZ$400M (US$220M).

Keynote address "Landslide Hazards and their Mitigation in the Himalayan region" never materialised as at the eleventh hour, the speaker, Prof V D Choubey (India) was unable to attend.

Reports to the conference from the UNESCO Working Party on World Landslide Inventory included an update from Dr B Brown of US Geological Survey on current status of the inventory and a request for all available details of landslides to be submitted via national representatives (R Fell, Australia), to the USGS Landslide Centre.

Ed Note: I'm sure all conference delegates will wish to join with us in congratulating both the New Zealand Geomechanics Society and Guthreys Pacific Convention Planners on two excellently organised conferences.

PRESS INTERFACE

"TLC threat to ban export of WA waste"
"PM buckets poor waste strategies"
"Tonnes of waste to wait at Fremantle"
"Toxic waste exports to UK banned"
"Toxic waste plan under cloud"
"The political morass of intractable waste"
"More waste, less speed"
"Premier rises to smelly event"
"Do not rubbish the idea of efficiency"
"Once and Future Landfills".

This is just a selection of snappy headlines from various publications around the nation in recent time. Headlines over articles which focused readers on a rubbishy subject. Your esteemed journal - with this issue - has joined the throng pursuing journalistic zeal towards what is a rather consuming topic of the '90's.

In this endeavour we join rather august company, as evidenced by the last listed headline. It comes from none other than the National Geographic. This article published part way through last year, was sub-titled "Garbage Archaeology" and proved to be a fascinating look at the garbage industry in the USA. The introduction, printed alongside a photograph of a compactor, track deep in rubbish and surrounded by a flock of seagulls, set the scene by posing the question *"How will we dispose of our trash when dumps like this one in New York City are full? Discoveries by garbage archaeologists clarify our options."*

The photograph could have been taken at any one of a hundred locations in Australia and the question posed by the leader writer is just as relevant to Australia as it is to the USA.

The article was of course generously interleaved with high quality photography and neat graphics for which "NG" is famous. The article revealed that the "archaeological" work showed US garbage consists of about 50% paper. The picture in Oz is unlikely to be very different so it is obvious that the Nation's journalists must lift their standard so that the bulk of the written word is retained for its value to posterity otherwise we may be over-taken by a sea of waste.

I do hope that Issue No 22 of Australian Geomechanics does nothing to contribute to the problem.

On a different level, the problems of dealing with intractable wastes have also received a lot of press coverage. The biggest problems in this arena are of course political. Back in 1990 or so, the then Environment Minister, Barry Cohen wrote a couple of excellent articles published in The Australian and The Bulletin which provided a real insight into the political problems associated with disposing of the toxic by-products of our current age. Unfortunately the in-sight from these articles doesn't seem to have provided enough light for Mr Cohen's successors to make any real inroads into finding a solution. In this case the politicians can be assured that ignoring this problem will not see it go away.

More recent headlines bear testimony to the fact that the problem and the waste are both still very much with us.

Political progress is however being made in the landfill area with the WA Premier (that affable Lady dubbed *"Dr Feelgood"* by the local press) gaining some kudos by announcing the go-ahead for an ambitious methane gas collection facility. The gas is to be used to generate electricity for a sports centre with excess capacity sold to the SEC. The headline which accompanied the article may have dampened the *feel* of the event for the *good Doctor* as the West Australian lead with ***"Premier rises to smelly event"***

Back to things "Geographic" and a new direction all together. It was a pleasure to see the most recent issue of Dick Smith's "Australian Geographic" and the major article devoted to the Sydney Harbour Tunnel project. Liberally illustrated with great photography and a lift out poster, the article provides a very readable commemoration of a major engineering project.

Predictably, the significant geotechnical aspects of the work didn't rate a mention but it remains an excellent record of a major "geotechnical" project. By the way "The Australian Geographic Society" has once again opened its membership. If you are interested contact *Australian Geographic, PO Box 321, Terry Hills, NSW 2084. Tel:(02) 450 2300 or Fax:(02) 986 3517.*

NATIONAL COMMITTEE MATTERS?

The first National Committee meeting for 1992 was held in Sydney on 10 April 1992. As mentioned in the last issue, it had been planned to hold this meeting in Adelaide but, in the interests of economy, the venue was changed at the last minute. Nevertheless, also in the interests of economy, the meeting was held at the Holiday Inn, Coogee, rather than at the IEAust's facilities in North Sydney. This is not the place to examine why meeting facilities supplied by a commercial operation should be cheaper than those belonging to IEAust, but it does seem to this unenlightened individual that there is something wrong if IEAust cannot provide facilities for meetings at a competitive rate if, indeed, they must charge at all.

Over the past few National Committee meetings, those delegates who can have been getting together for dinner on the night before the meeting. Informal discussions held over a bottle or two of red wine seem to have enabled open discussion and sharing of ideas without the strictures that must be applied during formal meetings. They have also allowed your correspondent to identify those issues of particular interest or importance for the general reader. It is a curious, although perhaps not surprising fact that the interest in any particular topic is much more likely to be a function of the heat it generates during such informal discussions, rather than the space it occupies in the business paper.

The meeting opened at 10am with the (usual) full business paper. One of the first items discussed related to the matter of membership subscriptions and the related issue of IEAust subventions. For all non IEAust members and others who do not know, IEAust offered to pay a $15 subvention (= "grant of money in aid") to the technical society of choice for each IEAust member. Consequently, the subscription for such members was reduced accordingly. This created a nightmare, compounded for the AGS by:

1. significant numbers of non IEAust members;

2. a less than crystal clear IEAust subscription renewal notice, which actually did include an opportunity for payment of additional society subs if appropriate, and

3. the AGS sending all existing AGS members a separate AGS subscription renewal form which did not mention a reduced subscription payment for those nominating AGS as the recipient of the IEAust subvention. Since the AGS renewal forms were sent out BEFORE the IEAust forms, prompt payers had no chance of avoiding the confusion!

Of course all of this confusion was compounded by the usual application of the corollary of the First Law of Engineering "When all else fails, read the instructions". Since all else had not failed (". . . and anyway, I've renewed my subscription dozens of times before"), there was no need to read (decipher?) the accompanying documentation and the result was chaos. The effects of the resulting mess are still being felt, but we are assured that it will all be sorted out next year. We shall see!

Despite the problems, the National Committee welcomed the action of IEAust supporting Technical Societies like AGS in this manner. It gives recognition and support to our role in the Learned Society function of the IEAust.

It is pleasing to report that the National Committee accepted the proposal to form a Kalgoorlie Group of the AGS. At this time, it has a membership of approximately 20, most of whom work in the mining geotechnics area. Whilst there are a few technical problems to be resolved mostly concerned with setting up a working organisational relationship between the new group, the National Committee and the Perth based AGS Group, the National Committee and the Editorial Panel of "Australian Geomechanics" are very pleased to welcome the new group in Kalgoorlie and we all look forward to a long and fruitful relationship between all parties.

As foreshadowed in the previous issue of "Australian Geomechanics", considerable thought is being applied to the future directions that AGS should take. The National Committee agreed that more consideration needs to be given to this topic, particularly in light of the fact that both the IEAust and the AusIMM seem to be losing sight of their "Learned Society" function, even though it was their perception that most members expected that priority should be given to their professional needs, rather than to the needs of the engineering industry. [1] The matter of the future direction of AGS will continue to be actively considered and discussions with IEAust and AusIMM on this matter are planned.

It was reported in the last issue of "AG" that the Victorian Group were to purchase two videos featuring Prof Ralph Peck. Unfortunately, financial considerations prevented this but we are pleased to announce that National Office has stepped into the breach and bought them instead. Contact AGS National Secretary, Peter May, if you would like to see them.

In light of the success of a similar venture in Europe, it was proposed to hold a Young Geotechnical Professionals' Conference in Australasia. The National Committee accepted the idea and charged its Deputy Chairman, Mr Garry Mostyn to develop a specific draft proposal for the next National Committee meeting in October 1992.

[1] As a sidelight to this issue, the Editorial Panel is disappointed to report that, despite its importance, no correspondence or other communication has been received on this vital matter since the publication of the Editorial in the last issue of "AG". This matter WILL affect each and every AGS member, particularly if the AGS comes out from beneath the IEAust "umbrella" and becomes totally independent. We wonder how many AGS members would resign from IEAust/AusIMM if AGS subscription rates were trebled or quadrupled.

GRAVEL RASH

"THE CLAY FEAT"

BY STEPHEN R JONES

At the annual in-house technical seminar held by D J Douglas & Partners, a geotechnical guessing competition was held. It was dubbed the Clay Feat and we felt that the findings should be shared with the rest of the geotechnical world. An unidentified sample of clay was put on display, and entrants were asked to estimate (guess?) some basic soil properties, namely:

- maximum dry density (Standard)
- optimum moisture content (Standard)
- liquid limit
- plastic limit
- percent passing 75 um
- linear shrinkage

To add some spice, a $2 entry fee was charged. As a further incentive to enter, a $5 fee was charged for not entering. Not suprisingly, everyone entered. Only one person knew the official laboratory results, and although he was not permitted to enter, he did encourage bribery and corruption.. It is indeed a happy reflection on the integrity of our profession that the only act of bribery was perpetrated by the company accountant (A bit of a worry actually).

Scoring was based on a system of penalty points: one penalty point for each percentage point away from the official result. In the case of maximum dry density, entrants received one penalty point for each 0.01 t/m^3 away from the official result. The lowest score would win the handsome prize pool.

The estimation techniques used by entrants ranged from not bothering to look at the sample (relying on geo-psychic instinct), to extended caressing and remoulding of a sample, even dropping a chunk into the Perrier to check dispersive tendency. Most people, however, were satisfied to spend just 20 or 30 seconds peering and prodding the display before putting their reputation on the line.

That evening, during the Seminar Dinner, the ballot box was opened and the estimates entered into a prepared speadsheet. Self-appointed scrutineers ensured no shonky business, while still savouring the pepper steak washed down with Bin 444. Only after all results were 'locked in' were the official values entered; the scores were instantly calculated and sorted. The results were announced over profiteroles and coffee to the merriment of all.

The vital statistics of the sample were as follows:

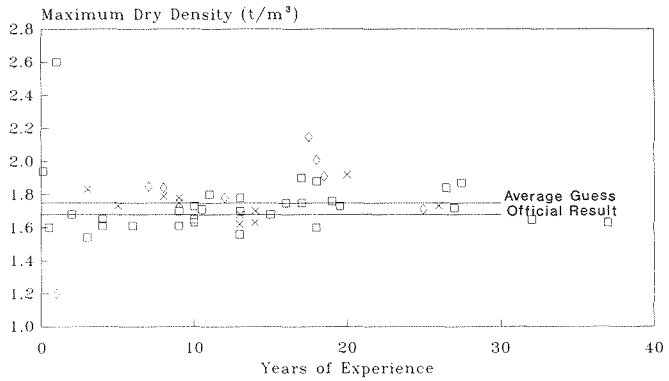
Description:	red-brown slightly silty clay, from Ashtonfield (near Maitland), NSW
Maximum Dry Density:	1.68 t/m^3
Optimum moisture content:	22.5%
Liquid Limit:	62%
Plastic Limit:	17%
Percent Passing 75 um:	92%
Linear Shrinkage:	15%

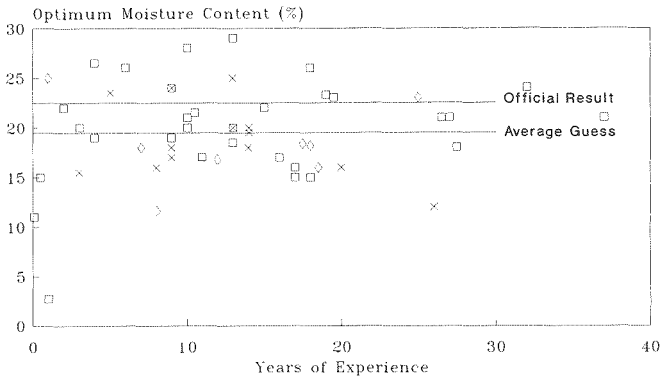
A total of 53 legitimate entries were received. A number of informal entries were received from some non dirt-oriented types who just wanted to save $3. The geochemists, for example, thought that the liquid limit was how much alcohol one could consume before passing out. The company accountant had successfully obtained the correct answers by graft, but not knowing what they meant, incorrectly filled out the entry form, scoring poorly as a result (proving once more that crime does not pay).

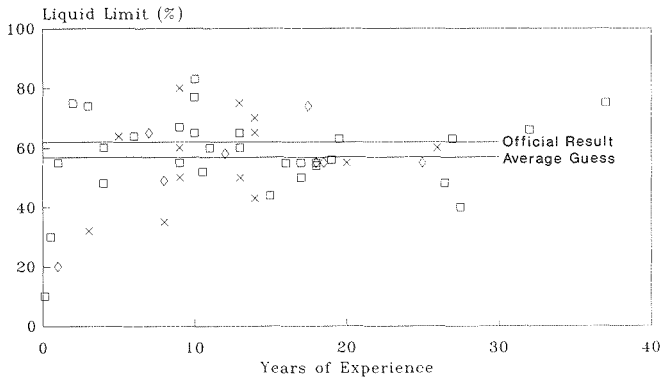
The winning score was 17.5, two experienced engineers tied on first place; their respective guesses were not identical. The highest (worst) legitimate score was 170.5, by a fresh graduate engineer who hadn't yet visited the soil laboratory.

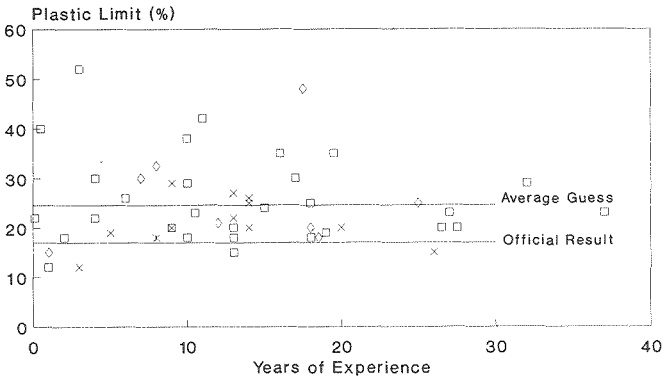
The results are shown plotted on the following graphs. Rather than naming names, the entrants have been placed in 3 broad classifications: Engineers, Geologists and Technicians (only Senior Technical Officers were at the Seminar).

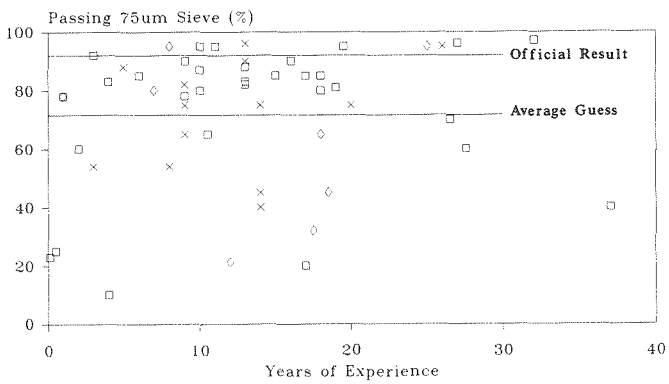
The final plot shows scores against years of experience. Despite the wide scatter, there is a general trend for improved scores with increasing years in the job. It would also appear that years in the job is not the only ingredient for experience, when you consider that 8 of the top 12 scorers are principals (Directors or Associate Directors) of the firm, some of whom are relatively young. While the early betting favoured the technicians who spend time in the lab getting their hands dirty, it would appear that, in general, there is no substitute for experience.

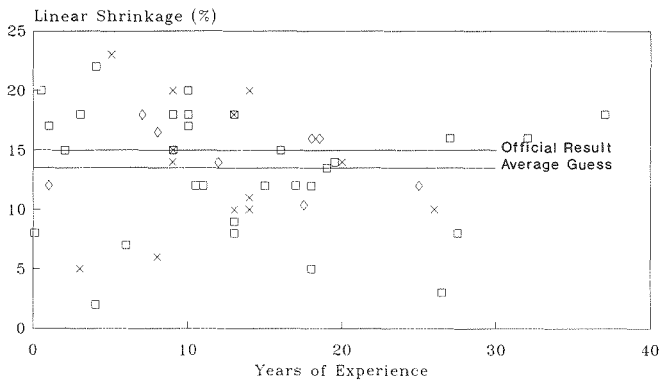




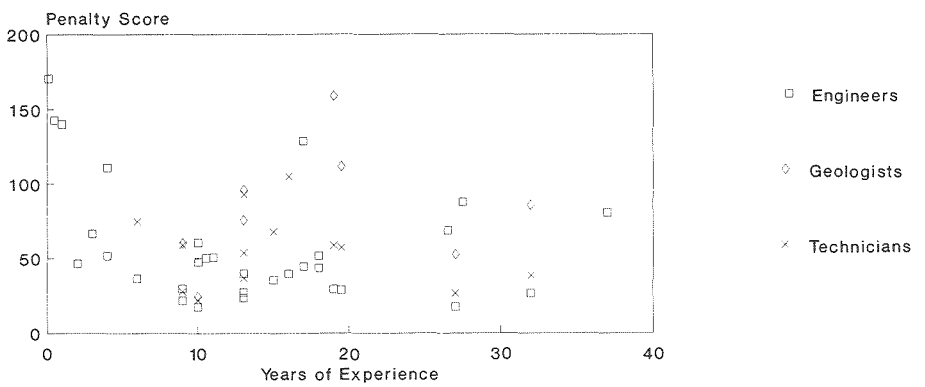








Scores
The Clay Feat



GRAVEL RASH - EDITOR'S NOTES

What an interesting exercise "The Clay Feat" was. I am sure that there are many learned practitioners who would not score as well as we lesser mortals would think...! Whilst there are many interesting points made in Stephen Jones' article, we would also like to add some comments on the data sets. Some of these are made in the blinding clarity of hindsight, others because we can do so without the risk of getting fired!

Estimate of Maximum Dry Density

(1) Professionals with limited experience can be very wide of the mark. Perhaps Don should have a chat with his junior engineers about the concept of void ratio.

(2) It would seem that people with 15 - 20 years experience get drunker more quickly, especially when they are geologists!

(3) Technicians tend not to have too many grey hairs, but they get the answers right anyway!

Estimate of Optimum Moisture Content

(1) There seems to have been an awful lot of guessing going on.

(2) Geologists don't seem to have any feeling for compaction, generally guessing too low.

(3) Perversely, there seems to have been a group of relatively senior engineers who guessed too high. They obviously need a prolonged spell at the wrong end of a compaction hammer. It's funny how doing compaction tests by hand seems to clear the mind (or were their minds on other things?)

Estimate of Plasticity Indices

1) Years ago Don Douglas introduced me to the concept of a "shotgun" plot - Well, here it is again.

(2) According to most criteria, this clay would not seem to be highly active. However, at least 25% of those surveyed would not agree (or was the whole world moving at the time - in which case we could conclude that engineers get drunk more quickly than geologists and technicians!)

(3) Did you spot the 25+ year engineer who had a material with a Linear Shrinkage value of 3% and a %fines of at least 60%. Mighty strange soils over there in the E.S. (Since this is our last issue we can make provocative statements like that - please send all your examples of expansive gravelly sands with a PI of 250 and a Linear Shrinkage of 0% to the new Editorial Panel in Victoria. We know they will be very interested!)

Estimate of Percent Fines

(1) Editorial Panel Law #1 - People really aren't used to materials without much sand in them unless they are very soft. This plot is the most interesting of all - 92% passing 75u is very high and somewhat unusual (Anyone that wants to dispute that statement, please contact Victorian Group as per above) - Nearly everyone was too low (and some far too low!)

(2) Has anyone asked D J Douglas & Partners most senior citizen how he got this one so wrong? Shame about this result really - If he hadn't done so badly on this estimate, he would have been amongst the front runners - or was he nobbled?

Statistical analysis of the overall scores would make very interesting reading. I hope there is going to be a paper presented on these data at the next year's conference in Canberra on Probabilities and Risk - I am sure the findings will be very interesting. In view of the imminent demise of lab testing after the seminal debate in Victoria earlier this year, these new data should form an excellent basis for the development of a new random number generator to produce quantified information to pass on to clients, students, etc. The mystery of soil mechanics lives on!

STATE GROUP REPORTS

VICTORIAN GROUP

The 1992 Committee comprises:

I Pedler, (Chairman)
Dr C Haberfield, (Secretary)
R Smith
Dr W Bamford
Dr A Bennet
P McDonald
I McKenzie
J Seidel
R Sanders
K Seddon
P Thorton
Dr W Power
D Raisbeck
B Chandler
D Jordan
Dr M Kurzeme, (ex-officio member)
M Ervin, (ditto)

REPORT ON RECENT MEETINGS

October 16, 1991—W Harrison, Kinhill Engineers, I Haustofer & C Broadhurst, Vic Roads

"SOIL NAILING"

The speakers presented a lecture on the theory, design, application and construction of Soil Nails. They illustrated their talk with two case studies; the Western Ring Road - Broadmeadows Section and the Bell-Banksia Link Road.

October 21, 1991—VISIT TO CSIRO DIVISION OF GEOMECHANICS AT SYNDAL

This was a joint meeting with AusIMM. The research activities of this division were described and the meeting discussed industry's needs and CSIRO's capabilities.

November 1991 — Professor I Johnston, Monash University

E.H.DAVIS MEMORIAL LECTURE —
"GEOMECHANICS AND THE EMERGENCE OF SOFT ROCK TECHNOLOGY"

Ass. Professor I Johnston presented a repeat of his 1991 E.H.Davis Memorial Lecture. The lecture covered a wide range of subjects concerned with soft, weak and weathered rocks and represented the results of many years of research into the behaviour of these materials.The Victoria Group's annual dinner followed the lecture.

February 1992—Professor Emeritus N Janbu, Norwegian Institute of Technology.

"DEFORMATION BEHAVIOUR OF SEDIMENTS"

Professor Janbu presented an informative lecture on the above topic. He described a novel method for estimating large consolidation settlements and presented a number of case studies to illustrate its application.

March 1992—IE Aust Civil College Eminent Speaker, 1991.Murray Gillon, Works Consultancy Services (NZ)

"ASPECTS OF THE CLYDE POWER PROJECT, NZ."

Mr Gillon presented an illuminating lecture on the geotechnical aspects of the Clyde project. He explained the design problems faced and the innovative methods used to overcome these problems.

April 1992 —The Great Debate on the proposition

"THAT LABORATORY TESTING IS A WASTE OF MONEY"

Two teams of local eminent geotechnical engineers argued for and against the proposition. The team arguing for the proposition consisted of Dr Jack Morgan (Golder Associates), Mr Peter Mcdonald (Vic Roads) and Mr Brian Chandler (Maunsell). The team arguing against the proposition consisted of Dr Ian Johnston (Monash University), Dr Gary Chapman (Wagstaff Piling) and Mr Brian Ims (DJ Douglas & Partners). Dr Peter Moore (Melbourne University) officiated as adjudicator. After a reasonably close contest and to the relief of most of the audience, the team arguing against the proposition emerged victorious.

May 1992—Professors Harry Poulos & Mark Randolph and Associate Professor Ian Johnston

ALL DAY SEMINAR — "PILING—MODERN METHODS"

The speakers presented an informative, comprehensive series of lectures on pile analyses. Current techniques were critically examined and in addition a substantial amount of material (as yet unpublished) was presented. The seminar was jointly sponsored by the AGS and ACADS and attracted over 90 participants.

June 1992 - Rick Willoughby, Pasminco Ltd.

"THE INTRODUCTION OF MM130 AT PASMINCO, BROKEN HILL"

Mr Willoughby presented an interesting lecture on the new Mobile miner MM130. He explained the design process used in the development of the MM130 and described some of the problems associated with installing these machines into underground mines. This meeting was a joint meeting between AusIMM and the AGS.

FUTURE MEETINGS

8 July 1992—"Landslides in China's Water Resources Development: Case studies and Analysis"Dr Zu Yu Chen, Chinese Institute of Water Conservancy and Hydro-Electric Power Research.

12 August 1992—Student meeting at Royal Melbourne Institute of Technology (RMIT). This lecture will describe the history of projects conducted by the MMBW around Melbourne.

16 September—Seminar to mark the release of the book "Engineering Geology of Melbourne"

14 October—This lecture will describe local experience with solving soft ground geotechnical problems.

SPECIAL PROJECTS AND PUBLICATIONS

a) Engineering Geology of Melbourne: The book on the Engineering Geology of the Melbourne region is almost complete. It is due for publication in September 1992.

b) Subcommittee on Groundwater Act: A subcommittee has been formed to investigate problems concerned with the Groundwater Act and the registration of boreholes used purely for geotechnical investigation purposes. The subcommittee is to be chaired by M Ervin.

c) The Foundations and Footings Society (Vic): This society has been formed as a separate entity from the AGS and is not affiliated with the Institution of Engineers, Australia. Membership comprises professional engineers, geologists and para-professionals including council building staff. The society provides a forum for discussion of footings for houses and other related matters. The Victoria Group of AGS has a representative on the Steering Committee. A publication 'Special Provisions for Site Investigations and the Design of Residential Slabs and Footings for Victorian Conditions' was prepared in February 1992. Further sub-committee work on geotechnical, footing and superstructure matters is in progress.

SYDNEY GROUP

The 1992 Sydney Group Committee is as follows:

Bruce Walker, Chmn,	Jeffery & Katauskas
Dr Charles Gerrard, V-Chmn,	Golder Associates
Peter Andrews,	D.J. Douglas & Partners Pty Ltd
John Braybrooke,	D.J. Douglas & Partners Pty Ltd
Prof. John Carter,	School of Civil & Mining Engineering, University of Sydney
Kim Chan,	Longmac Associates Pty Ltd
Prof. Robin Fell,	School of Civil Engineering, University of New South Wales
A.Prof.Manfred Hausmann,	School of Civil Eng'g University of Technology
Paul Hewitt,	Arup Geotechnics Pty Ltd
Jack Hodgson,	J.D. Hodgson Consultants
Andrew Leventhal,	Longmac Associates Pty Ltd
Mrs Margaret McMahon,	McMahon Associates
Dr Neil Mattes,	Coffey Partners International PtyLtd
Jim Millar,	J.A. Millar & Associates Pty Ltd
Garry Mostyn,	School of Civil Engineering, University of New South Wales
Dr Tony Phillips,	Arup Geotechnics Pty Ltd
Prof. Harry Poulos,	Coffey Partners International Pty Ltd
A.Prof. John Small,	School of Civil & Mining Engineering, University of Sydney
Michael Thom,	D.J. Douglas & Partners Pty Ltd
Patrick Wong,	Coffey Partners International Pty Ltd

PROGRAMME OF RECENT MEETINGS

March 1992—Murray Gillon, Group Engineer (Geotechnical), Works and Development Services Corporation (NZ) Ltd.
"Geotechnical Aspects Associated with Clyde Dam, N.Z."
Joint Meeting with Civils.

April 1992—Philip Pells, Coffey Partners International Pty Ltd
"Bennelong Point Car Park"

May 1992—Professor H. G. Poulos, Chairman, Coffey Partners International Pty Ltd and Professor of Civil Engineering, University of Sydney
"Geotechnical Aspects of the Newcastle Earthquake"

June 1992 — Richard Heggie, Richard Heggie Associates Pty Ltd
"Construction Vibrations in the Urban Environment"Joint Meeting with AUCTA.

July 1992—Andrew Leventhal, LongMac Associates Pty Ltd
"Malanjkhand Copper Project, India"

FUTURE MEETINGS

12 AUGUST—"ROCK BOLTING AND ANCHORS"
Charles Gerard, Golder Associates Pty Ltd, Ross Seedsman, Australian Coal Industry Research Laboratories, Bellambi

9 SEPTEMBER—"RESEARCH AT SYDNEY UNIVERSITY"
John Carter, Director, Centre for Geotechnical Research, University of Sydney

14 OCTOBER—"PREDICTION OF RIPPABILITY OF ROCK"
Ms Fiona McGregor, University of New South Wales

11 November—Chairman's Address "SIGNIFICANT CONTRIBUTIONS TO GEOTECHNICAL ENGINEERING IN RELATION TO LOCAL PRACTICE" Bruce Walker, Jeffery & Katauskas.

FUTURE CONFERENCES / SEMINARS

"Conference on Geotechnical Management of Waste and Contamination" to be held in Sydney, 22-23 March, 1993: "Call for Papers" has closed, meanwhile conference organisation progressing well. Sub-committee Chairman: Prof. Robin Fell

"Engineering Geology of Narrabeen Group and Coal Measure Rocks of the Central Coast and Newcastle Region" Seminar has been deferred until 1994.

SOUTH AUSTRALIAN GROUP

1992 Committee Members:

Chairman	Bob Newman
Dep Chmn	John Morris
Secretary	Dr Patrick Lunn
	Paul Peter
	Peter Bayetto
	Lindsay Ballantyne
	Don Cameron
	Richard Cavagnaro
	Ed Collingham
	Ian Hosking
	Dr Peter Mitchell
	Dr Maurice Arnold
	Dr William Kaggwa
	Charles Fitzhardinge

REPORT ON RECENT MEETINGS

As usual the South Australian Group held a full programme of technical meetings, on the third Monday of each month in Chapman Hall, Institution of Engineers, 11 Bagot Street, North Adelaide.

Meetings held in 1991 and early 1992 are listed below.

Meetings have generally been well attended, notably the July '91 meeting (about 75) and the September '91 annual seminar (about 65) and the March '92 meeting with Murray Gillon which attracted about 60.

February 18, 1991—Paul Moritz, Foundation Systems, "Small Diameter Driven Piles"

March 18, 1991 - Dr Patrick Lun, PPK Consultant Engineers, "Hydraulic Fracture"

April 15, 1991 - N Holmes, Kinhill Engineers, "Underwater Geomechanics"

June 17, 1991 - Bob Newman & Ed Collingham, E & WS Dept, "River Murray - Salt Interception Schemes"

July 15, 1991 - Don Cameron, University of South Australia "AS 2870 Residential Footings Code" (combined meeting with SA Footings Group and SA Structural Group)

August 19, 1991 - Dr Peter Mitchell, PPK Consultant Engineers, "The Collapsible Soil Problem"

September 19, 1991—ANNUAL SEMINAR—"PILED FOUNDATIONS"
Roman Washyn, Dept of Road Transport. Park Terrace Railway Overpass—Prediction Vs Performance
Ian Hosking, Coffey International. Pile Driving Vibration in Sands
Dr Peter Mitchell, PPK Consultants. Piled Raft Design
Slav Tchepak, Frankipile Australia. Recent Advances in Piling
Prof HG Poulos, Coffey Partners International. Piling in Shrinking and Swelling Soils
Copies of the Proceedings are available on enquiry.

October 21, 1991—Dr Peter Dillon, Dr Santo Ragusa, Centre of Groundwater Research SA, "Microbiological Clean up of Contaminated Sites.

November 18, 1991—Visitors Night Annual Dinner, "Environmental Geomechanics"

February 17, 1992—Dr Brian Richards, CSIRO, "John Jaeger Memorial Lecture" - a repeat of the award lecture first presented at the 6th ANZ Conference on Geomechanics, in Christchurch in February 1992.

March 16, 1992 - Murray Gillon, "Geotechnical Aspects associated with Clyde Dam, NZ."—joint meeting with HYDSOC.

April 27, 1992—Kevin Mills, University of SA, "Application of the Physical Chemistry of Swelling Soils to the Prediction of Movements."—Jae Li, University of SA, "Side Friction on Beams in Swelling Soils"

May 18, 1992—Ian Hosking, Coffey International "Geotechnical Investigation for Pt. Stanvac Single Buoy Mooring and Pipeline."

June 15, 1992—Lindsay Ballantyne, "Design and Testing of Piled Foundations—Port Augusta Power Station."

July 20, 1992—Bob Newman, E & WS Dept. "Chowilla Salinity Mitigation Proposals."

August 17, 1992—Dr Peter Mitchell, PPK Consultant Engineers, "Case Studies of Footing Failures"—a joint meeting with the Footings Group.

September 21, 1992—ANNUAL SEMINAR - "Environmental Geomechanics"

October 19, 1992—William Kaggwa, Don Cameron and students. Research at University of Adelaide & University of SA.

November 16, 1992—Dept of Road Transport, S.A., "Quality Management in Geotechnical Engineering."

QUEENSLAND GROUP

The Queensland Committee for 1992 includes a few new faces this year with good representation from the geological and geotechnical consulting community. The Committee comprises:

Robert Morphet (Chairman)	Golder Associates Pty. Ltd
Alan Moon (Vice-Chairman)	Coffey Partners International Pty. Ltd
Bruce White (Secretary)	D. J. Douglas & Partners Pty.Ltd
John Beal	Engineering Geology Services Pty. Ltd
Gavin Blakey	B.C.C. Materials Section
Bevan Boyce	Queensland University of Technology
Michael Brock	Blain Johnson Pty. Ltd
Scott Fidler	Golder Associates Pty. Ltd
Joe Gough	Insite Geology Pty. Ltd
Andrew Middleton	Hollingsworth Dames & Moore Pty.Ltd
John Simmons	BHP Engineering
Peter Stocker	Golder Associates Pty. Ltd
Paul Wallis	Arup Geotechnics Pty. Ltd
K.Y. Wong	University of Queensland
Michael Yau	Soil Surveys & Exploration Pty. Ltd

REPORT ON RECENT MEETINGS

February 1992—Scott Fidler, Golder Associates

"SOIL REINFORCEMENT"

Scott detailed results and conclusions drawn from research work carried out for his Masters degree. His presentation included a number of design philosophies for extensible reinforcements based on research at the Q.U.T.

March 1992—Murray Gillon

"CLYDE DAM"

I am sure that all State Groups were presented with a very interesting and informative talk on a problem emanating from the " The Shakey Isles".

April 1992—Maurie Philp, Coffey Partners International

"LITIGATION"

Maurie presented some recent litigation cases in which he had been involved and gave his wise and philosophical thoughts on "what went wrong". This talk was videoed for possible distribution after we "bleep" out a few of Maurie's colourful expletives.

MAY 1992—SYMPOSIUM— "SAFETY IN EXCAVATIONS"

A group of guest speakers presented various aspects on the necessity and requirements for shoring excavations. The speakers included representatives from the following organisations:

Division of Workplace Health & Safety
National Safety Council of Australia
Civic & Civic
MFM Trench Shoring Systems Pty. Ltd
Wreckair Pty. Ltd
Shorco Hire Pty. Ltd
Brisbane City Council
Golder Associates Pty. Ltd

The need for adequately designed shoring in all situations was stressed and backed up by dramatic videos of the dangers of entering unshored excavations.

June 1992—Russell Cuthbertson, Geological Survey of Queensland.

"FACTORS AFFECTING EARTHQUAKE INTENSITIES"

This was a joint meeting with the Queensland Division of the Australian Geological Society.

Russell presented background information on seismic (earthquake) theory and the relationship of earthquake events to variations in geology in particular sediments. Historical examples as well as current modelling were outlined and the generation of seismic risk maps discussed.

FUTURE MEETINGS

Technical presentations proposed for the remainder of 1992 include the following:

July 23, 1992

"DIAPHRAGM WALL/BARRETTE CONSTRUCTION"

Dr Tony Phillips, Arup Geotechnics Pty. Ltd Peter Openshaw, Bachy

Peter will describe construction procedures, on-site quality control and illustrate examples. Tony will present an overview of the design of the barrette foundations for the ARC Cement Silo at Newcastle.

August 20, 1992

DINNER MEETING

The venue, invited speaker and topic are still to be finalised. Hopefully a memorable occasion as all previous dinner meetings have been.

September 3, 1992

"CENTRIFUGE MODELLING IN GEOMECHANICS WITH APPLICATIONS IN MINING"

Professor Mark Randolph, University of Western Australia

Our knowledge of "fuging" in Queensland is quite limited, so hopefully Mark can enlighten us on what we are missing out on.

October 22, 1992

"E.H. DAVIS MEMORIAL LECTURE"

Professor Ian Johnston.

November 19, 1992

ANNUAL GENERAL MEETING

The Queensland Group welcomes suggestions from all Queensland members for topics for technical presentations in 1993. Please forward your thoughts to any members of the Committee.

TASMANIAN GROUP

REPORT ON RECENT MEETINGS

September 1991—Dr Ross Large, Director of the Key Centre for Ore Deposit and Exploration Studies—CODES, University of Tasmania.

"THE MINERAL POTENTIAL OF WESTERN TASMANIA."

Dr Large descibed the distribution of mining areas in Western Tasmania and the history of their development.

He identified two stages, i.e. the development of surface deposits between 1860 and 1930 and the development of sub-surface deposits between 1960 and 1990. The latter developments resulted from applying new sub-surface investigation techniques. He discussed the current value of ore deposits in the region and suggested that a new major mining project would be required every five years to maintain the current level of mining activity.

Dr Large presented details of the operation of CODES and its objectives. The organisation is generally financed by the mining industry. Its activities are spread throughout Australia. In Tasmania research is currently centred on the Mount Read vulcanics which contain significant metal sulphides.

Dr Large concluded his address with a discussion on the environmental impact of mining activity and showed how modern methods could reduce such impact to virtually insignificant levels.

November 1991—Ivan Hausdorfer, Vic Roads, Melbourne

"SOIL NAILING"

Mr Hausdorfer described soil nailing as a type of passive reinforcement of soil slopes which enabled the construction of steeper batters. This method of slope stabilisation had been developed in France during the 1970s and is now also used in other European countries. Large scale tests had been carried out in France, the UK and the USA and had identified three modes of failure, ie. breakage of the soil nails, slippage of the nails and failure due to excessive height.

In the design of soil nailed slopes, a number of factors had to be considered including external stability, internal stability, nail capacity, shotcrete failure, allowable displacement, drainage, etc. In the overall design aesthetics should also be considered.

Mr Hausdorfer concluded by presenting details of failure analysis carried out on soil nailed slopes. His address was illustrated with a series of slides showing the use of soil nailing techniques at two projects in Victoria.

February 1992—Dr John Hutchinson, Imperial College, London

"LANDSLIDES IN PERU"

Dr Hutchinson passed through Hobart on his way to New Zealand for the International Landslide Conference and kindly agreed to present a talk on his experiences in South America to members of the Society.

Dr Hutchinson presented an illustrated address covering aspects of two major landslide events in the Andes Mountains plus details of a slope stabilising project at the Tablachaca Dam on the Mantaro River. In one of the landslides, approximately 1500M cu.m of material, mainly Permian mudstone, had slid into the Mantaro River valley, 35km downstream of the Tablachaca Dam. The landslide created a temporary embankment that blocked the river for about 40 days. When the fill was eventually overtopped the flow downstream was estimated to have peaked at 10000 cu.m/s. The flood wave caused by this event was recorded well downstream along the Amazon River in Brazil. The slip material had been inspected prior to overtopping. It consisted mainly of gravels with little clay, c'=0, phi'(peak)~33 degrees, phi'(res)~25 degrees.

At the Tablachaca Dam it had been noticed that the right bank upstream and adjacent to the dam was being undercut due to the continuous operation of one of three bottom sluice gates in the dam. These gates had to be operated continuously to prevent siltation of the reservoir. The sluice flow caused the formation of a back eddy which destabilised the toe. Remedial works at the site included the construction of a stabilising berm plus soil anchors in the potential slide material.

March 1992 - Murray Gillon, Works Consultancy Services, Wellington, New Zealand

"GEOTECHNICAL PROBLEMS ASSOCIATED WITH THE CLYDE DAM"

Mr Gillon presented an overview of the reservoir stabilising works which are being carried out prior to the filling of the Clyde Dam reservoir. In his talk, Mr Gillon showed details of the investigation work which was carried out at the damsite and at a series of recent (in a geological sense) landslide areas above the new reservoir. Substantial stabilising works had been put in place at a number of sites to reduce the risk of failure to acceptable limits. An extensive network of instrumentation had been installed to monitor both the dam and the reservoir banks during the impounding operation.

May 1992—Dr Fred Baynes, Consulting Geologist, Hobart

"MANAGEMENT OF THE ROSETTA LANDSLIDE"

Dr Baynes presented a detailed assessment of the Rosetta Landslip area which is located in the Municipality of Glenorchy, north of Hobart. He showed details of the monitoring work which was being carried out to ascertain the nature and extent of the slip zone. Management of the slip zone was found to be costly. The landslip had had a profound effect on the local community not only in monetary terms but also socially. The need for effective communications of technical matters with the affected residents was stressed.

WESTERN AUSTRALIAN GROUP

The 1992 Western Australian Group Committee is as follows:

Ian Smith, Chairman
Prof. Mark Randolph, Secretary
Trevor Osborne
Martin Fahey
Peter Lilly
Colin Bradbury
Tony Abbs
Charles Waterton
Geoff Cocks
Peiter Zwaan
Andrew Cray
Steve Brice

PROGRAMME OF RECENT MEETINGS

13 February 1992—Prof. John Booker, Sydney University

'ANALYTICAL METHODS IN GEOMECHANICS'

The theme of Professor Booker's talk was the role which analytical methods can play in geomechanics. He showed that what may at first sight appear to be a very complex problem can often be simplified and idealised to the extent that an analytical solution can be found. This process is in itself of great value as it helps in identifying the essential features of the problem.

Having achieved this idealisation, some problems could then be completely solved analytically, though sometimes a combination of analytical and numerical methods were required.

The most powerful message which the speaker conveyed to the audience was that even with the ready availability of very powerful finite element or boundary element packages, some attempt should always be made to arrive at an analytical solution, no matter how much idealisation was required.

Even if finite element or similar analysis was still believed necessary, the amount of such analysis would be reduced, and very often this effort would be directed at further clarifying the areas of concerns highlighted by the analytical solution.

24 March 1992 - Murray Gillon, New Zealand Works Consultancy Services

'GEOTECHNICAL PROBLEMS ASSOCIATED WITH THE CLYDE DAM'

Murray Gillon was the IEAust Eminent Speaker for 1992. A report on his talk can be found elsewhere in this issue.

14 April 1992—Trevor Osborne, Osborne Geotechnical

'RESIDUE AREA GROUTING'

For a number of years Trevor Osborne has consulted to Alcoa of Australia Ltd and worked closely with Alcoa personnel on the reduction of losses of caustic liquor from tailings areas at Kwinana. Original residue areas were constructed on permeable sandy formations with containment provided by sand embankments and lined with clay blanket and an overlying sand under-drain. Residue placement has now proceeded to depths of 20 to 30 metres. Monitoring around the residue areas has detected some losses of caustic liquor from the facility and much effort has been put into locating and sealing the sources of the leakage.

The talk described the methods of leak location which now routinely include piezometric head survey of the underdrains, sampling and property analysis of liquor in vicinity of suspected leakage and the use of electrical conductivity measurement. Once leakage is located, sealing is achieved by injection of chemical grout into the sand blanket.

The speaker described the equipment and methods employed to realise this sealing under greater than 20 metres of residue deposits and showed a number of slides of the work in progress.

12 May 1992—Dr Martin Fahey, University of Western Australia.

'USE OF THE SEISMIC CONE AND PRESSUREMETER TESTS FOR SETTLEMENT ANALYSIS'

The starting point for the talk was that the stress-strain behaviour of practically all soils is highly non-linear, even in the 'elastic' range. This means that the appropriate value of

$$\frac{G}{G_0} = \left[1 - f\left(\frac{\tau}{\tau_{max}}\right)^g\right]$$

secant modulus to use in a deformation calculation depends upon the shear stress level at each location. Therefore, even for a homogeneous soil layer, the appropriate stiffness value will vary with location relative to the loaded area. Rather than attempting to define how to choose the appropriate secant stiffness value for each location, the speaker suggested that a more logical approach is to accept that the response is non-linear and to put effort into devising methods of defining the precise stress-strain curve for each site.

The speaker then went on to show how this was being done for sand. A non-linear elastic, Mohr-Coulomb plastic model was proposed. The 'elastic' part is similar to the usual hyperbolic model but with two additional parameters to allow the model to be matched with experimental data:

where G is the secant modulus, G_o is the 'small strain' shear modulus, τ and τ_{max} are the mobilised shear stress and the maximum shear stress (i.e. the current shear strength). The parameters f and g are empirical parameters — f dictates the strain to failure and g controls the shape of the curve up to failure.

The method proposed for calibrating the model consists of carrying out seismic cone tests to provide the value of G_o at the in situ stress state and the parameters f and g are obtained by using the model with a finite element cavity expansion program and varying f and g to match the shape of the unloading-reloading curves in self-boring pressuremeter tests. This process was demonstrated using data from a site in Perth. The talk finished with an outline of seismic cone testing,

a description of the equipment developed at UWA in conjunction with the Engineering Research Station (Water Authority of Western Australia) and a sample of the types of results being obtained.

A vote of thanks was proposed by Mr Chris Potulski.

9 June 1992— David Elias, Dames & Moore

'SEISMIC ANALYSIS OF EARTH STRUCTURES'

By world standards, Western Australia is not particularly seismically active. However, it is still necessary to assess the design and performance of earth structures particularly water and tailings dams - when subjected to seismic loading conditions.

David Elias pointed out that although a lot had been published on seismic analysis, there was not a concise approach applicable to earth structures. A procedure for the simple seismic analysis of such structures was presented which had been prepared by reviewing the literature. The procedure reflects the current state of practice in California but takes account of Australian conditions.

25 June 1992—Steve Brice, Geological Survey

GEOLOGICAL DATA BASE FOR THE PERTH CENTRAL BUSINESS DISTRICT'

The increase in building activity in the Central Business District (CBD) of Perth over the last decade had lead to a large volume of geological and geotechnical data being available from the numerous site investigation studies that had been carried out. The vast quantity of factual data available is not generally in a form that is useful to geotechnical engineers, structural or design engineers or town planners.

Steve Brice outlined how the Geological Survey of Western Australia has established a trial database of geotechnical information as a pilot project for a larger scale database of this type. The pilot project involved the acquisition of a large volume of data from a variety of digital and non-digital sources. He described how a Geographic Information System (GIS) approach is being adopted to permit a thorough analytical investigation through interrogation and manipulation of the various stored datasets.

PROGRAMME FOR REMAINDER OF 1992

23 JULY—"MINING TECHNOLOGY" Speaker: Gary Lye, CRA, ATD

11 AUGUST— "LIQUEFACTION OF TAILINGS DAMS" Speaker: Prof. P.K.Robertson, University of Alberta, Canada

8 SEPTEMBER - "INVESTIGATION TECHNIQUES IN CONTAMINATION" Speakers: Mike Hillman, Coffey International Peiter Zwaan, Golder Associates

13 OCTOBER— "BLASTING" Speaker: Trevor Little, School of Mines

20 OCTOBER —"QV1 PROJECT—FOUNDATION SYSTEM" Speakers: John Ryan, Airey Ryan & Hill Denis Smith, Soil & Rock Engineering

10 NOVEMBER - "INSITU TESTING OF SOIL" Speaker: Prof. Peter Robertson

KALGOORLIE GROUP

In 1990 several mining and geotechnical engineers based in the Kalgoorlie area formed a group called the Goldfields Geotechnical Group (GGG). The purpose of the group was to promote geotechnical science and to provide a forum for the exchange of ideas in the field of Rock and Soil Mechanics. The group was lead by D Fotakis and P Loubser and in 1991 organised seven meetings during which internal and external presenters lectured on new solutions and achievements in mining rock mechanics.

During the GGG meeting on 6 March 1992 members of the GGG indicated their willingness to join the AGS as a local group. As a result on 7 April 1992 a meeting of the group unanimously voted to transform the Goldfields Geotechnical Group into the Kalgoorlie Group of the Australian Geotechnical Society. The following committee was elected:

T Szwedzicki, Chairman	WASM Tel:(090)805172 Fax:(090)805151
D Fotakis Co-Chairman	KCGM
TN Little,Secretary	WASM Tel:(090)805155 Fax:(090)805151
G Auld, Member	WMC
P Loubser, Member	WMC

The group consists of eleven AGS full paying members and twelve supporting members who are expected to join in the near future. Anyone interested in the activities of the group are invited to contact Trevor Little at the West Australian School of Mines Tel: (090) 80 5155.

PROGRAMME FOR 1992:

6 February—'WATER TABLE MEASUREMENT USING PIEZOMETERS IN OPEN PIT MINES' Speaker: Colin Visca, SINCO

7 March—'GEOTECHNICAL INSTRUMENTATION AND CABLE BOLTING' Speaker: Doug Minchin, Rock Engineering

8-10 June—'WESTERN AUSTRALIAN CONFERENCE ON MINING GEOMECHANICS' Organiser: Western Australian School of Mines

24 June— 'RADIO IMAGING IN MINING' Speaker: Scott Thompson, Mineral Exploration Technical Services

28 Sept-2 Oct—'SCHOOL ON NUMERICAL MODELLING IN MINING GEOMECHANICS' Organiser: WASM/CSIRO

GEODIARY

CONFERENCES, COURSES, SEMINARS, SYMPOSIA, WORKSHOPS, ETC.

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

NOV 2-5, 1992

Perth, Western Australia

INTERNATIONAL BAUXITE TAILINGS WORKSHOP

Topics: Classification, dewatering and washing processes; Slurry transportation and distribution techniques; Material properties and design of storage facilities; Operational practices; Environmental monitoring and management; & Alternative uses for bauxite residues and storage areas. This international workshop will provide an update on bauxite tailings management from the process to the final storage or alternative use.

Milena di Russo, Workshop Secretary, Bauxite Tailings Workshop, PO Box 265, Hamilton Hill, WA, 6163 Australia. Tel: (09) 434 2886. Fax: (09) 418 4980.

NOV 3-5, 1992

Rio de Janeiro, Brazil

1st BRAZILIAN CONFERENCE ON SLOPE STABILITY

Topics: Various topics with particular focus on the tropical and densely populated areas of Rio de Janeiro. **Language:** Portuguese.

ABMS/COBRAE-Av. Rio Branco 124-18oandar,CEP 20042-centro, Rio de Janeiro-RJ. Tel:(021) 221 6177-R.178 or 108. Fax: (021) 580 1026 or (021) 511 1546.

NOV 6-7, 1992

Tokyo, Japan.

INTERNATIONAL SYMPOSIUM ON RECENT CASE HISTORIES OF PERMANENT GEOSYNTHETIC-REINFORCED SOIL RETAINING WALLS

Prof. Fumio Tatsuōka, the Institute of Industrial Science, University of Tokyo, 22-1, Roppongi 7-chome, Minato-ku, Tokyo 106, Japan.

NOV 11-13, 1992

Fukuoka, Japan.

INTERNATIONAL SYMPOSIUM ON EARTH REINFORCEMENT PRACTICE. (IS Kyushu '92)

Topics: Materials; Analysis, design & testing methods; Construction practices; Monitoring systems. **Language:** English.

Secretariat of IS Kyushu '92, Prof. Hidetoshi Ochiai, Dept of Civil Engineering (Suiko), Kyushu University, Hakozaki, Fukuoka 812, Japan. Tel:(092) 641 1101 ex 5212 or 5232. Fax: (092) 641 5195.

NOV 17-22, 1992

Wahun, China.

INTERNATIONAL SYMPOSIUM ON HYDRAULIC RESEARCH IN NATURE AND LABORATORY.

Topics: River dynamics; Hydraulics for structures and hydromachines; Environmental hydraulics; Cooling water systems; Navigation hydraulics; Ground water hydraulics.

Prof. Liu Daming, Yangtze River Scientific Research Institute, 23 Huang Pu Road, Wuhan, 430010, China.

Nov-Dec, 1992

Bangkok, Thailand.

GEOTECH 1992

This year Geotech 92 includes workshops and courses as follows:

Nov 23-26,1992

Workshop on COMPUTER AIDED DESIGN IN GEOTECHNICAL ENGINEERING

Nov 30-Dec 4, 1992

Symposium on PREDICTION vs PERFORMANCE IN GEOTECHNICAL ENGINEERING and

Dec 7-11, 1992

Workshop on APPLIED GROUND IMPROVEMENT TECHNIQUES

Prof. A.S. Balasubramamiam, Geotechnical Engineering Division, Asian Institute of Technology, GPO Box 2754, Bangkok 10501, Thailand. Fax:(662) 524 5523.

DEC 7-11, 1992

New Delhi, India.

REGIONAL SYMPOSIUM ON ROCK SLOPES.

Themes: Geotechnical parameters, geological aspects, investigations and data interpretation; Drilling and blasting techniques - innovative approaches; Slope stability analysis; Rock anchoring, other stabilising methods and drainage; Slope monitoring and instrumentation; Special problems of opencast mining. **Abstracts:** Dec 31, 1991. **Papers:** May 31, 1992. **Language:** English.

C V J Varma, Organising Secretary, Regional Symposium on Rock Slopes - India, The Committee of the International Society for Rock Mechanics, Plot No 4, Institutional Area, Off Malcha Marg, Chanakyapuri, New Delhi - 110021, India. Tel:91 11 301 5984. Fax:91 11 301 6347.

FEB 10-12, 1993

Canberra, Australia.

CONFERENCE ON PROBABILISTIC METHODS IN GEOTECHNICAL ENGINEERING.

Topics: Probabilistic techniques in geotechnical engineering; Probabilistic design of slopes, foundations and other geotechnical structures; Modelling of soil properties; Other aspects of probabilistic methods in geomechanics. **Abstracts:** Mar 25, 1992. The conference will be preceded by a two day workshop on 8-9 Feb 1993 presented by invited speakers covering various aspects of geotechnical reliability.

Dr K.S. Li, Department of Civil & Maritime Engineering, University College, University of New South Wales, ADFA, Campbell, ACT 2600. Tel:(06) 268 8329. Fax:(06) 268 8337.

FEB 16-18, 1993

Wollongong, NSW, Australia.

INTERNATIONAL CONFERENCE ON ENVIRONMENTAL MANAGEMENT - GEO-WATER AND ENGINEERING ASPECTS.

Topics: Risk and reliability in geomechanics and water engineering; Water quality modelling of catchments, rivers, reservoirs and estuaries; Soil erosion and sediment transport; Water quality in water supply and resource management; Slope stability and landslide management including urban, riverbank and reservoir slope stability; Dams and reservoirs; Solid waste, urban storm water and waste water management; Mine water, mine drainage and rehabilitation; Urban hydrology; Flood management.

Dr M Sivakumar, Department of Civil & Mining Engineering, University of Wollongong, Locked Bag 8844, South Coast Mail Centre, NSW, 2521 Australia. Fax:61 42 213238. Tel: 61 42 213055.

MAR 22-23, 1993

Sydney, NSW, Australia.

CONFERENCE ON GEOTECHNICAL MANAGEMENT OF WASTE AND CONTAMINATION.

Topics: Site investigation and monitoring techniques for waste disposal and contaminated sites; Groundwater contaminant flow in soil and rock; Legislative controls and "safe" contaminant levels; Site remediation and chemical cleanup; Ground modification techniques, eg clay and geomembrane liners, dynamic compaction, vibroflotation, grouting; Foundations for reclaimed landfill sites; Design of landfills and their rehabilitation; Mine tailings disposal and rehabilitation, eg prediction of properties, impact of operation phase and long term seepage, safe contaminant levels, seepage minimisation techniques.

Conference organisation enquiries to: The Conference Manager, Conference on Geotechnical Management of Waste and Contamination, Tel:(06) 2706 559. Fax: (06)2732 918.

APR 5-7, 1993

Istanbul, Turkey.

INTERNATIONAL SYMPOSIUM - ASSESSMENT AND PREVENTION OF FAILURE PHENOMENA IN ROCK ENGINEERING.

Themes: Failure phenomena and there mechanisms -model tests -surface structures -underground openings; Theoretical Approaches -strain localisation -failure mechanics -damage mechanics - plastic and visco-plasticity theory; Numerical approaches -finite element -boundary element -other methods; Case studies - slope and open pit mines -foundations - dams -tunnels -underground caverns - underground mining.

Prof. Gunhan Pasamehmetoglu, Middle East Technical University (ODTU), Dept of Mining Engineering, 06531 Ankara, Turkey. Tel: 90 (4) 223 71 00 Extn 2654. Fax: 223 30 54.

APR 6-8, 1993

Paris, France

INTERNATIONAL CONFERENCE ON THE ENVIRONMENT AND GEOTECHNICS

Topics: Legislative and legal aspects; Ground water and sub-soil protection; Site decontamination, treatment and land reclamation; Recognition and construction in reclaimed areas.

Prof. F Schlosser, L'Ecole Nationale des Ponts et Chausees, Paris, France.

APR 19-22, 1993

Amsterdam, The Netherlands.

INTERNATIONAL CONGRESS "OPTIONS FOR TUNNELLING" 1993.

Topics: Research and new developments on site investigation; Design and construction of tunnels in soft ground and rock; Submerged floating tunnels. **Language:** English. **Abstracts:** Feb 1, 1992.

OPT 1993, c/- Congress Office KIVI, PO Box 30424, 2500 G.K. The Hague, The Netherlands. Tel:31 70 391 9890. Fax:31 70 391 9840.

MAY 2-6, 1993

Ontario, Canada

SIXTH CONFERENCE ON SHOTCRETE FOR UNDERGROUND SUPPORT

Topics: Design; Dry mix and wet mix processes; Additives; Reinforcement; Robotics and shotcreting; Soil nailing and shotcrete.

Prof. D.F. Wood, University of Toronto, Sudbury, Ontario, Canada. Fax: 705 673 6532.

May 4-8, 1993

Singapore

11th SOUTHEAST ASIAN GEOTECHNICAL CONFERENCE

Theme: Soft Ground Engineering. **Topics:** Soil Characterisation and testing; Engineering geology; Slope Stability and landslides; Ground improvement; Shallow and deep foundations; excavation and buried structures; environmental geotechnics. **Language:** English.

Conference Manager, 11 SEAGC, 150 Orchard Rd, #07-14 Orchard Plaza, Singapore. Tel: (65) 7332922. Fax:(65) 2353530.

MAY 26-28, 1993

Copenhagen, Denmark,

SPECIALIST SYMPOSIUM ON LIMIT STATE DESIGN IN GEOTECHNICAL ENGINEERING.

Topics: Existing practice in the use of LSD; Major problems in its use; Interaction between design in structural and geotechnical engineering.

Dr Niels Krebs Ovensen, Director, Danish Geotechnical Institute, 1 Maglebjergveg, PO Box 119, DK-2800, Lyngby, Denmark.

JUN 1-4, 1993

Ghent, Belgium

2nd INTERNATIONAL SEMINAR-DEEP FOUNDATIONS ON BORED AND AUGER PILES.

Topics: Design, installation and monitoring; In-situ testing; Pile-raft interaction; Settlement; Case studies.

Secretariat of B.A.P.I.I., Laboratory of Soil Mechanics, Prof. W.F. Van Impe, Grosteesteenweg-Noord 2, 9052 Zwijnaarde, Ghent, Belgium. Tel: 32 91 64 5723 Fax: 32 91 64 5849.

JUN 1-6, 1993

St Louis, Missouri, USA.

3rd INTERNATIONAL CONFERENCE ON CASE HISTORIES IN GEOTECHNICAL ENGINEERING.

Case History Themes: Foundations; Slopes, dams and embankment; Geotechnical earthquake engineering; Man-made vibrations; Retaining structures and deep excavations; Geological engineering and rock engineering; Soil improvement, grouting, geosynthetics, dynamic compaction, vibroflotation, blasting and other methods; Forensic engineering "Where things went wrong"; Geo-economy - adequate geotechnical solution; Geotechnical and hydrological management of solid, hazardous and low level radioactive wastes; Geotechnical and hydrological remediation of solid, hazardous and low level radioactive wastes; Liner and final cover for solid, hazardous and low level radioactive waste management facilities; New solutions to traditional geotechnical problems. Case histories dealing primarily with settlement prediction and performance will be referred to ASCE settlement conference, Spring 1994.

Shamsher Prakash, Chairman, Conference on Case Histories in Geotechnical Engineering, Civil Engineering Department, University of Missouri-Rolla, Rolla. MO 65401-0249, USA. Tel: 1 314 341 4489. Fax:1 314 341 4729.

JUN 2-8, 1993

Kobe, Japan.

KIGForum '93. 2nd KANSAI INTERNATIONAL GEOTECHNICAL FORUM ON COMPARATIVE GEOTECHNICAL ENGINEERING.

Topic: Excavation. Design, construction and performance of all types of excavation; Geotechnical problems with excavation in urban areas. **Language:** English.

Prof. Daizo Karube, Dept of Civil Engineering, Kobe University, Nada, Kobe, 657 Japan. Tel:81 78 881 1212 (ext 5178). Fax:81 78 861 0779.

JUN 9-11, 1993

Montpellier, France.

GEO CONFINE '93

Themes: Natural geological barriers; Improvement of containment with treated geomaterials; Cover and surface isolation for disposal sites; monitoring systems and safety of confinement; New confinement concepts. **Languages:** English and French.

Michel Barres, BRGM - Department "Environment", BP 6009, 45060 ORLEANS CEDEX, France. Tel:(33) 38 64 3414. Fax:(33) 38 64 3013.

JUN 21-22, 1993

Kalgoorlie, Western Australia.

AUSTRALIAN CONFERENCE AND WORKSHOP ON GEOTECHNICAL INSTRUMENTATION AND MONITORING IN OPEN PIT AND UNDERGROUND MINING

Topics: Stability of mining excavations; Geotechnical input into mine design; Prediction of rock mass failure; Interpretation of monitoring results; New solutions and equipment. **Abstracts:** Dec 15, 1992. **Papers:** April 1, 1993.

Contact: Dr Tad Szwedzicki, Department of Mining Engineering and Mine Surveying, Western Australian School of Mines, PO Box 597, Kalgoorlie, WA, 6430. Tel:(090) 805 172. Fax:(090) 805 151; or

Dr C.F. Swindells, Dept of Minerals and Energy, 100 Plain St, East Perth, WA, 6004. Tel:(09) 222 3597. Fax: 222 3633.

JUN 21-24, 1993

Lisbon, Portugal.

EUROCK '93 - ISRM INTERNATIONAL SYMPOSIUM

Themes: Modelling in safety evaluation; Influence of the environment in rock engineering; Stability of large underground structures; Contribution of failures and incidents to the progress of rock engineering. **Languages:** English, French and German. **Abstracts:** Sep 30, 1992. **Papers:** Feb 28, 1993.

Luis Ribeiro e Sousa, EUROCK '93, c/o LNEC, Av.do Brasil, 101, P-1799 Lisbon Codex, Portugal. Tel:(351) 1 8482131. Fax:(351) 1 897660.

JUN 25, 1993

Lisbon, Portugal.

INTERNATIONAL WORKSHOP - SCALE EFFECTS IN ROCK MASSES

Themes: Deformation and strength of rock masses; Internal stresses in rock masses; Hydraulic properties of rock masses. **Language:** English. **Abstracts:** Sep 30, 1992. **Papers:** Feb 28, 1993.

Antonio Pinto da Cunha, Int Workshop on Scale Effects, c/o LNEC, Av.do Brasil, 101, P-1799 Lisbon Codex, Portugal. Tel:(351) 1 8482131. Fax:(351) 1 897660.

JUN 26-JUL 1, 1993

St Johns, Newfoundland.

4th CANADIAN MARINE GEOTECHNICAL CONFERENCE

Topics: Foundation analysis; Case histories; Ice-seabed interaction; Soil properties; Centrifuge applications; Instrumentation; Codes and standards; In-situ measurements; International projects; Site investigations; Environmental geotechnics; Monitoring.

C-CORE, Memorial University of Newfoundland, St Johns, NF, A1B3X5. Tel:(709)737 8354. Fax:(709)737 4706.

JUN 28-JUL 1, 1993

Anchorage, Alaska.

INTERNATIONAL CONFERENCE ON FROST IN GEOTECHNICAL ENGINEERING

Topics: Theory pertaining to prediction of frost penetration and thermal degradation of frozen layer; Application to design and construction; Case histories.

Dr Arvind Phukan, Chairman Organising Committee, School of Engineering, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, AK 99508-8096, USA.

JUL 1993

Bolton, England.

EUROPEAN SYMPOSIUM ENVIRONMENTAL GEOTECHNOLOGY (ENGINE '93)

Theme: Waste disposal by landfill.

Prof. R.W. Sarsby, Bolton Institute of Higher Education, School of Civil Engineering, Dean Rd, Bolton, England. Tel: 0204 28851. Fax: 0204 399074.

JUL 1993

France.

INTERNATIONAL SYMPOSIUM ON STORAGE AND CONFINEMENT OF TOXIC WASTE IN GEOLOGICAL MEDIA.

Sponsored by IAEG.

JUL 12-16, 1993

Birmingham, UK.

2nd INTERNATIONAL CONFERENCE ON MICROMECHANICS OF GRANULAR MEDIA - "POWDERS AND GRAINS 93".

Topics: Particle assemblies; Particle interactions; Quasi-static deformation; Rapid granular flow; Aggregation/segregation; Fracture/fragmentation; Particle solids. **Abstracts:** Sep 1, 1992.

Dr Colin Thornton, Dept of Civil Engineering, Aston University, Aston Triangle, Birmingham B4 7ET, England. Tel:(44) 21 359 3611 ext 4364. Fax:(44) 21 333 3389.

Aug 11-15, 1993

Beijing, China.

INTERNATIONAL CONFERENCE ON GEOSCIENCE IN URBAN DEVELOPMENT (Landplan IV)

Themes: General review of geoscience in urban development; Instability in large cities - natural disasters; Instability in large cities - geo-environment change and induced geohazards; Problems in reconstruction of large cities; Pollution and hazardous waste disposal in large cities; Engineering geological and geo-environmental investigation for urban planning and construction; Chinese megacities; World megacities.

Prof. Wang Sijing, Chairman LANDPLAN IV, Institute of Geology, Academia Sinica, PO Box 634, Beijing, China 100029. Tel:86 1 202 7766. Fax:86 1 491 9140.

AUG 16-18, 1993

Kingston, Ontario, Canada.

3rd INTERNATIONAL SYMPOSIUM ON ROCKBURSTS AND SEISMICITY IN MINES.

Topics: Mechanics of seismic events and rockbursts; Monitoring of seismicity and seismic networks; Rock mass characterisation in seismically active mines; Rockburst hazard mitigation and ground control; Induced seismicity. **Abstracts:** JUL 1, 1992.

Dr R Paul Young, Dept of Geological Sciences, Queen's University, Kingston, Ontario, Canada K7L 3N6. Tel:6135456171. Fax:613 545 6512.

AUG 23-26, 1993

Kingston, Ontario, Canada.

INTERNATIONAL CONGRESS ON MINE DESIGN.

Theme: Mining into the 21st Century. **Topics:** Computer applications; Backfill technology; Microseismic technology; Mine automation and material handling; Blasting technology; Open pit technology; Underground support design; Mine sequencing; Mine ventilation; Mine dewatering; Instrumentation technology. **Language:** English and French.

Dr Peter Bawden, International Congress on Mine Design, Dept of Mining Engineering, Queen's University, Kingston, Ontario, Canada K7L 3N6. Tel:6135456553. Fax:613 545 6597.

AUG 24-26, 1993

Sydney, Australia.

VIII AUSTRALIAN TUNNELLING CONFERENCE - "FINDING COMMON GROUND".

Plenary Session Themes: Recent advances in excavation technology; Innovation in materials handling; Management of poor ground conditions; Contractual sharing of risk; Future exploitation of the underground domain. **Non-plenary Topics:** Contract mining for production operations; Major UG mine installations; Training people for the industries;

Improved public image of UG facilities; Major UG civil projects; The role of R & D in UG construction; Major capital works; UG occupational health and safety; Electrical and mechanical fit-outs; Minimising environmental impact. **Abstracts:** Jun 30, 1992. **Papers:** Mar 31, 1993.

The VIII Australian Tunnelling Conference Secretariat, The Australian Institute of Mining and Metallurgy, PO Box 122, Parkville, Victoria 3052. Tel:(03) 347 3166. Fax:(03) 347 8525; or

Terry Lanz, Conference Convener, Tel:(02) 979 5144. Fax:(02) 979 5239.

SEP 6-10, 1993

Krakow, Poland.

4th INTERNATIONAL SYMPOSIUM ON THE RECLAMATION, TREATMENT AND UTILIZATION OF COAL MINING WASTES.

Topics: Physical, chemical and geotechnical properties of coal mining wastes and fly ash; Deposition of waste materials; Ecological consequences; Use in civil engineering and hydraulic structures; Use as secondary materials; Reclamation of semi-derelict and derelict land; Frost susceptibility; Reclamation of spoil heaps. **Papers:** Jan 1993 to: Dr A.K.M. Rainbow, Head of Minestone Services, British Coal Corporation, Bedewell Park Suite, Victoria Rd, Hebburn, Tyne and Wear NE31 2HQ England. Fax (091)4890726. **Registration:** Dr Ing. Piotr Michalski, c/o Prof. Dr Drystyna M. Skarzynska, Dept of Soil Mechanics and Earth Structures, University of Agriculture, 24 Aleja Micheiwicza, 30-059 Krakow, Poland. Fax:(12) 33 6245.

Sep 13-17, 1993

Newcastle upon Tyne, UK.

INTERNATIONAL CONFERENCE ON ENGINEERED FILLS

Topics: Construction on, in and with engineered fills; Stabilisation and improvement of existing fills; Mechanical and physical properties of fills.

Dr B.G. Clarke, Department of Civil Engineering. The University, Newcastle upon Tyne, UK. Fax:(91) 222 6613. Tel:(91) 222 6419.

SEP 20-24, 1993

Athens, Greece.

INTERNATIONAL SYMPOSIUM ON HARD SOILS-SOFT ROCKS.

Topics: Geological feature; Mechanical properties and behaviour; Foundations, excavations and retaining structures; Slope stability and protection; Fills and embankments; Tunnelling and underground openings. **Language:** English and French. **Papers:** By Nov 1992.

Dr N. Kalteziotis, HS-SR Symposium, PO Box 20034 GR, 118 10 Athens, Greece. Tel:30 1 347 5830. Fax:30 1 346 7455.

OCT 19-21, 1993

Toulon, France.

INTERNATIONAL CONFERENCE ON UNDERGROUND TRANSPORT INFRASTRUCTURES.

Topics: Include site investigation for civil engineering projects. **Languages:** English and French.

Journees D'Etudes Aftes, c/o EDF Bureau 4/69, 22-30 avenue de Wagram, F-75008 Paris, France. Tel:33 1 47 6484. Fax:31 1 47 64 7588.

NOV 9-12, 1993

Tehran, Iran.

2nd INTERNATIONAL SEMINAR ON SOIL MECHANICS AND FOUNDATION ENGINEERING OF IRAN.

Themes: Problematic soils -swelling soils - collapsible soils -residual soils -dispersive soils -soils containing gypsum; Geotechnical design and construction -retaining structures -deep and shallow foundations -underground structures -soil improvement; In situ testing and measurements -penetration tests - stress-strain measurements -loading tests - soil behaviour monitoring. **Language:** Persian and English.

Organising Committee of 2nd International Seminar on Soil Mechanics and Foundation Engineering of Iran, Plan and Budget Organization (Technical Research and Standards Bureau), No 7 2nd Alley, Pakistan St, Dr Beshty Ave, Tehran (15316), Iran. Tel: 0098 021 624630/629368. Tlx:212642.

JAN 3, 1994

New Delhi, India.

INTERNATIONAL SYMPOSIUM ON UNDERGROUND CONSTRUCTION IN SOFT GROUND.

Topics: Earth and water pressure on braced walls and tunnel linings; Ground movements associated with underground construction. **Abstracts:** JUN 30, 1992. **Language:** English.

Prof. Keiichi Fujita, Dept of Civil Engineering, Science University of Tokyo, 2641 Yamazaki, Noda, Chiba 278, Japan. Tel:81 474 24 1501. Fax:81 471 239766.

JAN 5-10, 1994

New Delhi, India.

XIII INTERNATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.

Topics for Plenary Sessions: Soil properties; Foundations; Design and performance of retaining and buried structures; Embankment dams and dam foundations; Natural hazard mitigation. **Topics for Parallel Sessions:** Marine geotechnology; Computer application in geotechnical engineering; Construction instrumentation and real time management; Environmental geotechnology; Ground improvement; Foundations of old structures and monuments; Geotechnical engineering education; Professional practices; Arid climate soils; Liquefaction; Geophysical methods; Roads and tracks. Enquiries re papers from Australia to AGS Secretariat, Canberra.

Prof.Shashi K. Gulhati, Professor of Civil Engineering, Indian Institute of Technology, Organising Secretary General 13th ICSMFE, Post Bag No -28, Hauz Khas, New Delhi, 110016, India. Tel:91 11 6852540 or 653798. Fax:91 11 6852541.

JAN 27-28, 1994

Reno, Nevada, USA.

SYMPOSIUM ON DYNAMIC GEOTECHNICAL TESTING.

Topics: Field and laboratory test methods; Centrifuge testing.

ASTM, 1916 Race St, Philadelphia, PA 19103-1187, USA.

JUN 16-18, 1994

Texas A & M University, USA.

ASCE SPECIALTY CONFERENCE, SETTLEMENT 94.

Topics: Vertical and horizontal deformations for foundations and embankments.

Settlement 94, Geotechnical Engineering, Texas A & M University, College Station, Texas 77843-3136, USA. Tel:409 845 3735. Fax:409 845 6156.

SEP 5-9, 1994

Singapore.

5th INTERNATIONAL CONFERENCE ON GEOTEXTILES, GEO-MEMBRANES AND RELATED PRODUCTS.

Mr R S Douglas, Secretariat, 510 Thompson Rd No 0022-03 SLF Building, Singapore 1129, Tel: 3535511. Fax: (65)3532424

SEP 12-14, 1994

Sapporo, Japan.

INTERNATIONAL SYMPOSIUM ON PRE-FAILURE DEFORMATION OF GEOMATERIALS - MEASUREMENT AND APPLICATION (IS-Hokkaido).

Topics: Measurement and modelling of shear deformation properties of geomaterials (including those under dynamic and static loading conditions, but excluding purely theoretical work); Case study associated with shear deformation of ground and geostructures. **Abstracts:** Jul 31, 1993. **Language:** English.

Secretariat of IS-Hokkaido, Prof. Toshiyuki Mitachi, Department of Civil Engineering, Faculty of Engineering, Hokkiado University, North 13 West 8, Sapporo 060 Japan. Tel:011 716 211 ext 6192. Fax:011 726 2296.

SEP 21-23, 1994

Mamala, Romania

Xth DANUBE-EUROPEAN CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING FOR INFRASTRUCTURE.

Theme: Soil mechanics and foundation engineering for infrastructure.

Prof. I. Manoliu, C.P. 38-71, RO-72302I, Bucharest, Romania.

MAY 28-JUN 1, 1995

Copenhagen, Denmark.

11th EUROPEAN CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING.

Theme: The interplay between geotechnical engineering and engineering geology.

Dr Jorgen Steenfelt, c/o ICS International Conference Services, Strandvejen 171, DH-2900 Hellerup, Denmark. Tel: 45 31 61 2195. Fax:45 31 2068.

SEP 25-29, 1995

Nakase, Japan.

8th INTERNATIONAL CONGRESS ON ROCK MECHANICS

Themes: Geology, site exploration and testing; Physical properties and modelling of rock; Near surface excavations, stability of slopes and foundations; Excavation and stability of underground openings; Heat, water flow and chemical transport in rock masses; Information systems and artificial intelligence in rock mechanics. **Preliminary Registration:** NOV 30, 1992.

Secretariat for 8th International Congress on Rock Mechanics, c/o Conference and Event Department, Simul International Inc, Kowa Bldg No 9, 1-8-10, Akasaka, Minato-ku, Tokyo 107, Japan.

JUN 17-21, 1996

Trondheim, Norway.

7th INTERNATIONAL SYMPOSIUM ON LANDSLIDES

Norwegian Geotechnical Society, PO Box 40, Taasen, N-0801, Oslo 8, Norway.