DECEMBER 2008 issue 76

NZ GEOMECHANICS NEWS

Newsletter of the New Zealand Geotechnical Society Inc. ISSN 0111–6851

NZGS CELEBRATING 50 YEARS

NEW ZEALAND GEOMECHANICS NEWS

CONTENTS

DECEMBER 2008, ISSUE 76

Cover image: Geomechanics News, through the years
Design: Karryn Muschamp

CHAIRMAN'S CORNER

2008 has been a very full year both for the society and for our members as workloads have been strong. Recent events in the world economy will affect the geotechnical community and the challenge will be for us to respond by adapting our skills and resources to this changed environment.

Management Secretary

Imrana Azimullah has resigned from her role as Management Secretary, following almost 5 years working with us. I have enjoyed her energetic and cheerful disposition and this has also done good things for our advertising sales! We are fortunate to be able to welcome Amanda Blakey into the role. Amanda has a planning background (she has Bachelor of Science and Master of Planning degrees), two young children and is on the Auckland branch committee of the Cystic Fibrosis Association. Imrana is supporting Amanda in a "hand-over" role over the remainder of the year.

Regions

Our branch co-ordinators have been active in 2008 and have facilitated regular meetings in most centres. I would like in particular to recognise the efforts of David Stewart in both re-establishing regular meetings in Wellington and attracting significant attendances.

Events

Dr Sergio Mora (ex-Inter American Development Bank and now consultant to the World Bank) lead a 3-day short course in Disaster Risk Management held in Auckland and Christchurch in late April/ early May, particularly relevant in a year that saw repeat flooding in New Zealand, the devastating Wenchuan earthquake, and a series of hurricanes coming onshore in Latin America with severe consequences in Haiti in particular, and evacuation of New Orleans.

Professors Paul Marinos (National Technical University of Athens) and Giovanni Barla (Torino) gave evening presentations in Auckland and Christchurch, with Giovanni giving a superb talk on the Beauregard deep-seated gravity deformation and its interaction with an arch gravity dam and Paul condensing a lifetime's experience on issues in tunnelling throughout the world into a couple of hours (sprinkled with subtle humour).

Dr David Petley returned to NZ and again gave stimulating presentations on earthquakes and landslides (Kashmir and Taiwan) to audiences in Auckland and Wellington – the scale of effects was disconcerting! Jeff Bryant of Queenstown headed around the northern branches to spread the 'real' story of the Young Valley landslide dam and action on the shot-over rock slide.

The 18th NZ Geotechnical Society Symposium, "Soil Structure Interaction – From Rules of Thumb to Reality" was held in Auckland over the 4th and 5th September. Unfortunately I had to miss the conference as I headed to Madrid to present progress on planning for IAEG2010 to the IAEG Executive, the Council and the Annual General Meeting at 'Euroengeo'. However I would like to take this opportunity to thank the symposium committee, convened by Gavin Alexander, for taking on and executing what has been reported to be another outstanding national symposium. In celebration of our 50th anniversary, the Symposium committee invited our life members and other key 'personalities' from the society's history to join us at the Symposium dinner. The pre-symposium workshop presented a draft seismic guideline prepared by Kevin McManus and his working group (in particular Misko Cubrinovski and Mick Pender) with financial support from the DBH. Professor John Atkinson from the UK was an enthusiastic key-note speaker at the Symposium; he will return to NZ in November to give presentations to regional branch meetings throughout the country.

The 8th ANZ Young Geotechnical Professionals (YGP) Conference is underway in Wellington, (5th – 8th November). Many thanks to the convenor, Lis Bowman, and her team for organising this event, that had met all it's sponsorship and registration objectives many months ago.

Preparations for our hosting of the 11th IAEG Congress in Auckland, September 2010 are progressing strongly; look out for the call for abstracts in February 2009.

All of the abstracts submitted by our members to be considered for inclusion in the 17th ISSMGE Conference to be held in Alexandria, Egypt in 2009 have been accepted.

Our Society

Kate Williams, supported by Imrana Azimullah and Karryn Muschamp, put together a superb 75th edition of our flagship magazine, Geomechanics News. Kate, building on the style set for the magazine by her predecessors, continues to give a significant amount of her own time to the magazine; Paul Salter has agreed to join her in preparing for the next edition.

The committee plans to continue our initiatives to host expert-led short courses, expose our members to a mix of local and international speakers and give access to conferences targeted at the different groups within our membership. We anticipate hosting short-courses in field mapping (to be lead by Dr Warwick Prebble) and in piled foundations (lead by Bengt Fellenius) in 2009.

The NZGS has made available a number of awards to encourage young professionals (8 EQC/NZGS awards have been made toward travel and accommodation costs of young professionals attending the ANZ YGP conference and an award will be made to the best judged NZ YGP, based both on their paper and presentation of it, to support attendance of a New Zealander at the world YGP conference to be held in Egypt in 2009.

However no nominations were received for the 2008 Geomechanics Award; the deadline will be extended to late February. The Geomechanics award is made to the author/s of the paper considered to have made a significant contribution to the geotechnical field in New Zealand over the last 3 years. Please consider making a nomination by emailing Amanda at nzgeotechnicalsociety@xtra.co.nz.

The committee is considering options for development of a suitable 'registration' mechanism for engineering geologists in New Zealand. I am interested to know members thoughts on the role of the Society in the development of guidelines. Are there particular areas that should be addressed in a guideline style document? I look forward to hearing from you on these and other relevant issues.

Ann Williams
Chairman, NZGS
Email: Ann.Williams@beca.com

Above: President, Fred Baynes with Prof Wang, recipient of the 2008 Hans Cloos medal.

EDITORIAL

Where did 2008 go?

Welcome to the December issue of the Geomechanics News and the final in our series of celebrating 50 years of the Society in this very busy commemorative year.

We have included some more historical recollections from some of our 'senior' members and in this edition, we introduce a new section "Member's Past Contributions" reprinting past newsletter contributions which current members should still find relevant to their thinking. This issue's selection is made by Bruce Riddolls and is by John Hawley, from 1981, on the respective roles of geologists ("literates") and engineers ("numerates") in predicting the stability of slopes in natural ground. I invite members to suggest articles for reprinting in future issues; they may also be from other sources.

There are some particularly interesting technical articles and project news items in this issue that should keep you all busy reading into the holiday period.

Our abstract award winners from the Young Geotechnical Professionals (YGP) Conference, reprinted in this issue, show we have some real talent out there across our profession and we look forward to seeing the winners present their papers in the coming year to selected branches. We also congratulate Hayden Bowen for his paper judged to be the best paper for the inaugural New Zealand Geotechnical Society Young Geotechnical Professionals Fellowship.

Congratulations to our Photo Competition winner David McKay for his "Spring Loading" photos and thank you to all that entered.

Next year will bring on some interesting changes with the recent newly elected government, the country officially in a recession and subsequent decreases in prospective workloads. However these changes bring about new challenges and opportunities for organisations and personal growth for individuals. Perhaps it is a time for us to reflect, and step up to the new challenges that arise.

Thank you to all our contributors for this issue. We welcome and encourage all members to consider writing articles and supplying project news information for the upcoming issues.

Finally from the editorial team, Amanda, Karryn and I, would like to wish you all a happy and restful Christmas – New Year holiday period.

Merry Christmas.

Kate Williams
Editor: kwilliams@tonkin.co.nz

THE SECRETARY'S NEWS

As many of you know by now, Imrana Azimullah has decided to move on from the position of NZGS – Management Secretary. It is apparent to me that Imrana's skills and talents will be sorely missed. Imrana continues to be extremely helpful, especially with her expert assistance while I am becoming acquainted with my new responsibilities.

My role of Management Secretary appears varied and exciting - my first task was to assist Professor John Atkinson finalise his itinerary for a recent New Zealand lecture tour. Professor Atkinson has informed me that everything went very smoothly, that attendances were generally good, and that everyone was very kind and helpful. He also mentioned that he thoroughly enjoyed meeting new people, and to pass on his thanks to all concerned – so thank you to everyone who assisted with this tour.

My background is in town planning; however I haven't worked as a planner now for about four years. I am finding the return to environmental management, albeit through geotechnical engineering, very interesting. I look forward to supporting you all and meeting more members as occasions permit.

New Members

Membership is thriving at 692 members and it is a pleasure to welcome the following new members since 1 April 2008:

STUDENTS

JDF Simpson; RC Roberts; AC Colson; JL Calleja; S Dupre; AB Humphries.

MEMBERS

SME Roberts; A Clifford; R McCully; S Ranson; RE Poole; HY Enright; AK Riman; ST McColl; JR Wech; M Mills; M Hanz; JT O'Dea; HJ Bowen; C McPherson; JA Wedgwood; DJ Veale; B Simms; TU Ganiron Jr; SD Rees; R Sabison; TH Bunny; A bin Ibrahim; K Walker; RP Wrigley; TP Palmer; A Hitchon; MJ Allis; J Power; H Aboel-Naga; G Maxwell; C Kaiser; GE Frost; Z Vilgevac; JG Watson; P Durney; RA Phillips; CW Ashby; MP Dawson; CR Gibbons; A van Dusschoten; CD Lyons; TT Tang; A Blakey; NW Egan; G Bailey; D Prasad; C Everett

Please do contact me for any assistance you might require or any queries you might have.

Amanda Blakey
Management Secretary
nzgeotechnicalsociety@xtra.co.nz

Imrana's Final Report

Well, now the time has come for me to say goodbye. I must say after approximately 4½ years as the NZGS Management Secretary it has definitely being an interesting journey (especially when you come from a sales and training background). I have not only learned a lot about the Geotechnical environment but have met some wonderful individuals. The greatest joy for me was watching the membership numbers increasing every year and is still continuing to do so and has virtually doubled since I took on the role 4 years ago.

Please take this opportunity with me to welcome our new Management Secretary Amanda Blakey whom I'm sure all of you will be seeing and hearing from on a regular basis. Please give her your support and I'm sure Amanda will do her best to provide assistance to you all anyway she can.

EDITORIAL POLICY

NZ Geomechanics News is a biannual newsletter issued to members of the NZ Geotechnical Society Inc. It is designed to keep members in touch with matters of interest within the Geo-Professions both locally and internationally. The statements made or opinions expressed do not necessarily reflect the views of the New Zealand Geotechnical Society Inc. The editorial team is happy to receive submissions of any sort for future editions of *NZ Geomechanics News*. The following comments are offered to assist potential contributors. Technical contributions can include any of the following:

- technical papers which may, but need not necessarily be, of a standard which would be required by international journals and conferences.
- technical notes
- comments on papers published in *NZ Geomechanics News*
- descriptions of geotechnical projects of special interest.

General articles for publication may include:

- letters to the NZ Geotechnical Society
- letters to the Editor
- articles and news of personalities
- news of current projects
- industry news.

Submission of text material in Microsoft Word is encouraged, particularly via email to the Editor or on CD. We can receive and handle file types of almost any format. Contact us if you have a query about format or content.

Diagrams and tables should be of a size and quality appropriate for direct reproduction. Photographs should be good contrast, black and white gloss prints or high resolution digital images. Diagrams and photos should be supplied with the article, but also saved seperately as 300 dpi JPGs. Articles need to be set up so that they can be reproduced in black and white, as colour is limited.

NZ Geomechanics News is a newsletter for Society members and articles and papers are not necessarily refereed. Authors and other contributors must be responsible for the integrity of their material and for permission to publish. Letters to the Editor about articles and papers submitted by members will be forwarded to the contributing member for a right of reply.

Persons interested in applying for membership of the Society are invited to complete the application form in the back of the newsletter. Members of the Society are required to affiliate to at least one International Society and the rates are included with the membership information details.

INTERNATIONAL SOCIETY REPORTS

ISSMGE Australiasia VPs Report: October 2008

ISSMGE Board Meeting

The most recent meeting of the Board of ISSMGE was held at the Renaissance Hotel, St Petersburg, Russia on 15th June 2008. Robert Holtz was welcomed as a new Board member, replacing John Christian who had resigned from the Board on health grounds. Subsequent to the meeting, it transpired that John Seychuk, Vice-President for North America, has had to resign from the Board for private reasons. The position of North American VP has been assumed by Dennis Becker of Canada.

Following is a summary of some of the issues discussed.

Membership

The Secretary General provided a summary report of ISSMGE membership. Currently, there are 78 Member Societies with 18,064 individual members. Five member societies, Azerbaijan, Kenya, Morocco, Peru and Vietnam, having a total of about 89 members, are shown as being suspended due to non-payment of subscription fees for a number of years.

The issue of suspension of membership was discussed and the following possible amendments to the Statutes and Bylaws were considered:

4H A Member Society shall fulfil its obligations to the International Society which include: active engagement in the aims of ISSMGE payment of the annual subscriptions, keeping the Secretary General regularly informed about changes of its statutes, address of its Secretariat, names of its officers, and names and addresses of designated Individual Members of the International Society. (4H.1, 4H.2, 4H.3)

4H.3 Activity reports that show engagement of the Member Society in the aims of ISSMGE are due to regional Vice-Presidents three months before each Council Meeting.

4I A Member Society which has failed to abide by Statute 4H and its Bylaws shall automatically cease to receive the benefits of membership of the International Society and its membership shall be deemed to be suspended (4I.1)

4I.1 A Member Society may be reinstated on conditions agreed by the Regional Vice-President and the Secretary General, which shall include a reinstatement fee of no less than three years of subscription.

After prolonged discussion, the President suggested that the proposal provided above should be considered further at the next Board Meeting for possible inclusion at the Alexandria Council Meeting. Meanwhile, the Vice Presidents should attempt to contact the Member Societies with fees in arrears with a view to finding a resolution.

The Secretary General commented briefly on Membership Lists and Membership Cards. There was a wide variety in responses from Member Societies, some producing detailed lists of members, others just a list of names, some societies sent incomplete lists because of data protection issues, some had lists of members where the numbers did not correspond precisely to the fees paid, and some sent no information at all. It remained the intention of the Secretariat to produce a CD with known lists of members at the time of the Alexandria Conference.

Technical Committees

The President reported on the activities of the 22 Technical Committees. Most Committees were engaged in agreed activities such as organising workshops and conferences, and some were cooperating in joint organisation of conferences. The President was concerned with the lack of progress of TC37 – Interactive Geotechnical Design. The President also commented briefly on the involvement of Technical Committees in the Alexandria Conference. It was hoped to be able to agree with the Conference Organisers a means by which Technical Committees would have the opportunity to organise either a committee meeting or a small workshop prior to the main conference. It was also noted that Technical Committees would need to produce a report on their activities during the period 2005-2009.

Regional Reports

Reports were received from Vice Presidents for Africa, Asia, Australasia, Europe, and South America. A brief summary of major issues and events is provided as follows.

Africa

Overall there is reasonable activity within the African societies. South Africa remains the biggest and most active society.

Asia

The region continued to be active and a number of regional and local events had been organised. There was a possibility of Kyrgyzstan joining as a new member society in the near future.

Australasia

Australia and New Zealand continued to have active Member Societies. It was reported to the Board that at the ANZ Conference in Brisbane, one of the keynote lectures was delivered by video link from the USA. This turned out to be a very successful lecture and this format should be a possibility to be considered for future occasions, should the need arise. It was also noted that the Liaison Officer for New Zealand, Stephen Crawford, was stepping down, and Michael Davies had been appointed to the role.

Europe

It was reported that John Burland had given an excellent lecture "Reflections on Victor de Mello, friend, engineer and philosopher" at the XI Congresso National de Geotecnia and IV Congresso Luso-Brasileiro de Geotecnia (Coimbra, Portugal). The Swiss geotechnical society seemed to be participating less in ISSMGE activities and had not sent a representative to the meeting of the European societies in Madrid. It was noted that the Danube and Baltic Sea conferences seemed to be making good progress.

North America

A formal report was not received but the following comments had been sent by the VP.

"I do not have much to report on the North American National Geo-Societies, except that they are, as usual, operating at "full-steam-ahead" with their Activities and Annual Agenda. For information in this regard, reference can be made to their Websites."

South America

It was noted that communication with Bolivia continued to prove difficult though there seemed to be various activities organised. The Colombian Geotechnical Society had hosted a Committee on Mass Movements. It had been suggested that this become a regional Technical Committee. However this would require Colombian Geotechnical Society to acknowledge that it could not be the permanent secretariat of the committee.

Federation of International Geo-engineering Societies

The President reported on meetings, correspondence, and progress with the Federation since the last formal meeting of the Board in Tunisia in March 2007. The Councils of IAEG, ISRM, and ISSMGE had agreed to form the federation, and the first meeting was held on 25th January 2008. William Van Impe had been elected subsequently as first President of the Federation in February 2008. At a meeting of the Board in June 2008, it had been agreed that the federation should have the acronym FedIGS.

Task Force: Geo-Engineering Resources/ Education

The Secretariat had now made keynote lectures from the Istanbul and Osaka conferences available via the restricted area on the Website with individual Member Society login. Permission has been obtained from publishers to allow keynote lectures from earlier international conferences to be made available, but for this professional help would be needed to facilitate the necessary scanning from bound copies of the proceedings. The generation of a database of case histories was also being considered. The President asked the Vice Presidents to make a survey of their region, and see what books, manuals, etc., can be made available via the website, either through links or via the internet.

Task Force: Role and Format of International Conferences

Page Allocations

The President addressed the issue of allocation to Member Societies of pages in the proceedings of the International Conference. At present this follows recommendations made by Professor Kerisel made in 1977 (see Appendix 8). That formula gives 4% of the total pages available to the Host Society organising the conference and 10% of the total pages is given to the President for distribution to Member Societies. The remaining 86% of pages available are allocated to Member Societies generally according to their relative financial contribution to the society in a 4-year period prior to the International Conference. For the conference in Alexandria the organisers had deliberately chosen to have hard copy proceedings of which approximately 2,700 pages were available for papers from Member Societies. The President went on to explain that he was keen to maximise contributions from Member Societies and had generally agreed to requests from member societies for increased page allocation, and had not paid too much concern to keeping within the 10% limit suggested by the Kerisel formula. John Carter and Roger Frank were asked to review the situation regarding page allocation for the international conferences, and to report back to the Board at its next meeting.

Use of ISSMGE Logo

The President of the International Geosynthetics Society (IGS) had written to the ISSMGE President regarding the use of the ISSMGE logo for IGS conferences. It was agreed that the IGS should be given permission to use the ISSMGE logo, and that it should be stated in publicity that their conferences are organised "in association with ISSMGE". Also, the ISSMGE Conference Manual will be amended with the sentence "Alternative and special arrangements may be made for conferences organised in conjunction with the Sister Societies ISRM and IAEG" replaced by "Alternative and special arrangements may be made for conferences organised in conjunction with other societies including ISRM, IAEG and IGS."

Task Force: Communications Information, and Information Technologies

Bulletin

To date, six issues of the ISSMGE Bulletin had been prepared and circulated to Member Societies. The general feedback was that the style and content were very good, and the Bulletin had been very well received. Young members are needed from the Regions to contribute to the Bulletin. More Case Histories are required, as are suggestions for the "Reminiscences"section.

Website

The Secretary General agreed to contact Webforum to see if it would be possible to implement a searchable database for the Lexicon within the ISSMGE website.

Journal

It was noted that the present editors of the International Journal of Case Histories in Geotechnical Engineering (IJCHGE) had asked if ISSMGE wished it to become their official journal. The Board felt that this was premature but that they would agree to it being labelled "a journal of ISSMGE". It was agreed that the IJCHGE be a journal of ISSMGE for a period of 2-3 years and after that the situation should be re-evaluated; other proposals could be considered in due course. Also, it was agreed that there could be a link on the ISSMGE website to the journal.

ISSMGE – 75 Years Celebration

The President reminded the Board that the International Society had its origins at the 1936 International Conference held in Cambridge, Massachusetts. Thus, the 75th Anniversary would be in 2011. It was agreed that Vice Presidents should enquire of their Member Societies how they would like to celebrate the 75th Anniversary at the time of their regional conference.

Dates of next Board meetings

- Bangalore – 19th December 2008
- Orlando – 14th March 2009
- Alexandria – 3rd October 2009

OTHER NEWS

- The 8th ANZ Young Geotechnical Professionals (YGP) Conference was held in Wellington on 5th-8th November 2008 (for ISSMGE, ISRM and IAEG members). The organising committee is led by Dr Elisabeth Bowman, Lecturer in Geotechnical Engineering at Canterbury University. The support of ISSMGE for this conference is gratefully acknowledged, as is the support of the numerous sponsors (see http://www.nzgeotechsoc.org.nz/anz-ygp-conference.cfm).
- The 17th International Conference of ISSMGE, to be held in Alexandria, Egypt, from 5-9 October, 2009, has attracted much interest of ISSMGE members from Australia and New Zealand. NZ authors have submitted abstracts for 9 papers through NZGS, while Australian authors have submitted abstracts for 24 papers (from 28 submitted) through AGS, just exceeding Australia's formal full page allocation.

John Carter
ISSMGE VP Australasia
October 2008

ISRM Australasia VP Report: October 2008

1. SURVEY

The results from the recent survey of members have been analysed. They provide the Society with the first insight into who its members are and what they would like from the Society. A total of 396 responses were received which represents a 7.5% response rate.

The survey comprised 34 questions, 26 of which were for members, the others being for non-members. The members were asked to answer 23 multiple choice and 3 short answer questions. A total of 1716 comments were obtained for the latter questions. The responses, and the implications of them for the future direction of the Society, are now being reviewed by the Board. Members will be issued with more details when the review is completed. A snapshot of some of the results is as follows.

- Europe and South America, with the greatest and least numbers of members respectively, generated the greatest and least numbers of responses respectively. This result was expected. However, while approximately 16% of members from South America completed the survey, only 5% of members from Europe did so.
- Over 55% of the respondents are aged between 30 and 50 with the age distribution being skewed significantly towards the older ages. A characteristic which will, over the next decade, likely increase the shortage of rock mechanics practitioners even if the recent level of economic development decreases. The shortage must be addressed.
- Most respondents are highly experienced with over 61% having worked in rock mechanics for over 11 years and 32% having greater than 20 years of experience.
- 93% of the respondents were male. The disproportionate number of men is not unexpected; it reflects the general international statistics indicating a lack of woman in engineering and geo-sciences.
- 78% of respondents have a postgraduate qualification (i.e. a qualification other than their first degree).
- 93% of the responders carry out projects in civil construction and tunnelling; areas traditionally associated with rock mechanics. 43% of the projects carried out by respondents involve the mining industry. A smaller, yet still significant proportion (3%) of projects, are involved within the nuclear and energy generation industries.
- The most significant reasons why members join and remain in the Society are:
  - The ability to establish contacts within the discipline.
  - The ability to obtain benefits not available to non-members.
  - Members find it useful to participate in ISRM activities.

Members where asked what they believed to be the big questions in rock mechanics still to be answered. Of the 23 general themes into which the respondents 880 “questions” fell, almost half fell into these 5 themes:

- Further developments in statistically valid rock mass characterisation methods.
- Developments in the understanding of the affects of time on the characteristics and performance of excavations in rock;
- Development and validation of rock mass failure criteria; particularly criteria valid for very high stress and/or very low strength conditions;
- Development and validation of 3D numerical models that realistically model the rockmass geology and structure, crack development and deformation mechanisms; and
- Developments in theories relating to fluid flow and hydro-thermal-mechanical coupling.

2. CONFERENCE SUMMARY

1st Southern Hemisphere International Rock Mechanics Symposium
16 - 19 September 2008
Perth, Western Australia

The First Southern Hemisphere International Rock Mechanics Symposium (SHIRMS) was organised by The Australian Centre for Geomechanics (ACG). It was co-chaired by the Director of the Centre, Yves Potvin, Arcady Dyskin (University of Western Australia), John Carter (University of Newcastle) and Rob Jeffrey (CSIRO Petroleum) and sponsored by The Australian Centre for Geomechanics, CSIRO, The University of Newcastle and The University of Western Australia. It was supported by the International Society for Rock Mechanics (ISRM) as a Regional Symposium.

The event was attended by over 240 Rock Mechanics practitioners from the Mining, Petroleum and Civil disciplines. Attendees included industry practitioners, consultants, suppliers, academics, researchers and students. 27% of the attendees came from overseas including Canada, Chile, China, Croatia, Germany, Indonesia, Iran, Ireland, Japan, Kazakhstan, Malaysia, Netherlands, New Zealand, Norway, Poland, Russia, Singapore, South Africa, Thailand, Turkey, UK and USA.

According to Yves Potvin, “SHIRMS was a new initiative and its success was the result of an active involvement and outstanding contribution from a world wide authorship.” Its aim was to “bring together rock mechanics researchers and practitioners from the main areas of earth sciences to exchange ideas and lessons learnt and to develop further collaboration and synergies. It aimed to set the agenda for future research and operational directions and to ensure the ongoing viability of the mining and civil industries".

The Sheraton Hotel provided high standard facilities, which included a main ballroom for the keynote presentations, two smaller rooms for parallel sessions and a room where the high standard meals were served and the booths for the sponsors were laid out.

The sponsors were RioTinto, BHPBilliton, Geovert, Adam Technology, BOSFA, Coffey, CSIRO, Datgel Data Solutions, Geobrugg, Geofabrics Australasia, Geotechnical Systems Australia, Geomechanics International, Inflatable Packers International, Maccaferri and Rock Australia. Their generous support of this and other events was greatly appreciated; without it professional development in the Rock Mechanics discipline would be significantly stifled.

Two well attended pre-conference events were held prior to the main event "From Rock Mass to Rock Model" provided a forum for discussing the issue of modelling rock mass behaviour for the purpose of design. It provided a platform to critically examine the current state of practice and highlight shortcomings in the state of the art. The workshop involved introductory presentations and open floor discussions. Presenters included

- Peter Kaiser, Centre for Excellence in Mining Innovation, Sudbury, Canada,
- Peter Cundall, Itasca Consulting Group, Inc., USA
- David Beck, Beck Arndt Engineering, Australia
- Garry Mostyn, Pells Sullivan Meynink, Australia
- Philip Pells, Pells Sullivan Meynink and the University of New South Wales, Australia
- Steve Spottiswoode, CSIR, South Africa
- Doug Stead, Simon Fraser University, Canada

The two-day "Petroleum Geomechanics in the Value Chain" course was presented by Maurice Dusseault, Earth Sciences Department, University of Waterloo. It was intended for engineers, geoscientists and technologists involved in reservoir exploitation, drilling, exploration and other upstream activities. It provided an introduction to typical geomechanics issues arising in oil and gas development. The basic aspects of rock mechanics processes on reservoir development and management were presented in a clear manner and case histories from around the world were used to illustrate the discussions.

The main SHIRMS event was opened by Yves Potvin and Tony Meyers, Vice President (Australasia) of the ISRM who summarised the current Australian and International Rock Mechanics scenes, welcomed delegates to Perth and encouraged them to benefit from networking opportunities and the interdisciplinary spread of presentations.

Eight excellent keynote presentations were given and/or prepared by

- Ted Brown (Australia) presented by David Starr;

New Acquisitions

- John Deere 3720 Drilling rig with dual speed head for efficient fast drilling.
- Drilling capacity of 100m HQ core but in a small compact rig.
- Self contained support vehicle and transporter to enable easy movement between sites.

- Our second 200 kN Cone Penetrometer Crawler rig to complement our first.
- Similar specifications as our first with a host of minor upgrades for ease of operation.
- Capable of 50m plus metres of sounding and also has the ability to conduct seismic CPT's as our first rig does.

- The lastest complement to our comprehensive range of equipment. The MPP 150 (Modular Portable Penetrometer 150 kN).
- Has conducted CPT's to 40m depth, currently on assignment in PNG.
- Has the capacity to conduct electrical vane testing with the Electrical Vane Tester FFL 100 communicating with a PLC and interacting with the user by an Excel spread sheet.

CALL FOR ABSTRACTS

CONFERENCE THEMES AND SUB-THEMES

1 Geohazards at the Leading Edge
- 1.1 Seismic Hazards
- 1.2 Volcanic Hazards
- 1.3 Gravitational Hazards
- 1.4 Climatic Hazards

2 Managing Geological Risk
- 2.1 Hazard and Risk
- 2.2 Disaster Risk Management
- 2.3 Living with Geohazards
- 2.4 Planning for Climate Change

3 Advances in Engineering Geology
- 3.1 Developments in Site Investigation
- 3.2 In the Laboratory
- 3.3 Mapping and Remote Sensing
- 3.4 Field Measurement
- 3.5 The Geological Model
- 3.6 Geodata Management

4 Applied Engineering Geology
- 4.1 The Mechanics of Rock
- 4.2 Underground
- 4.3 Filling with Earth
- 4.4 Supporting our Structures
- 4.5 Water and Structures
- 4.6 Analysis in Engineering Geology

5 Evolving Engineering Geology
- 5.1 Engineering Geology in the Global Economy
- 5.2 A Resource Hungry World
- 5.3 Appropriate Technology in the Developing World
- 5.4 Sustainable Geotechnics
- 5.5 The Geotechnical Response to Global Warming
- 5.6 Litigation and Geotechnics
- 5.7 Professional Development
- 5.8 Education and Training

CRC Press / Balkema
Taylor & Francis Group

KEY-NOTE SPEAKERS

DR HAMISH CAMPBELL
A senior research scientist with GNS Science based in Wellington, NZ, he and his colleagues have recently advanced the controversial idea that New Zealand may have been totally submerged 23 million years ago. He has recently published a popular book that embraces this idea, 'In Search of Ancient New Zealand'.

DR SIMON LOEW (LÖW)
is Professor of Engineering Geology at the ETH Zurich. He has lead several large interdisciplinary projects related to the final storage of nuclear and toxic wastes, large traffic tunnels (NEAT, AlpTransit) and natural hazards. He leads research in deep tunnelling (settlements above tunnels), hydro-mechanical processes, geological waste disposal and slope instability.

DR SERGIO MORA
Originally from Costa Rica, Dr Mora is an international leader in Disaster Risk Management, with a background in rock mechanics, dams and tunnelling. He draws his DRM experience from his work as Environmental, Natural Resources and Risk Management Specialist at the Inter American Development Bank and as consultant to the World Bank.

TIM SULLIVAN
is Adjunct Professor at the School of Geo-technical Engineering, University of New South Wales, Australia and a Director and Principal Consultant of Pells Sullivan Meynink Pty Ltd, the firm he established in 1993. He has particular interest in the fields of mine stability and design; landslides, and engineering geological/geotechnical models .

DR SUSUMU YASUDA
Originally from Hiroshima, Dr Yasuda is Professor of Civil and Environmental Engineering at Tokyo Denki University. His main research interest is in soil liquefaction during earthquakes and he has visited many countries to investigate the damage due to liquefaction in the post-disaster period. Dr Yasuda chairs the Asian TC No.3 on Geotechnology formed by the ISSMGE.

IAEG CONGRESS 2010

GEOLOGICALLY *ACTIVE*

5-10 SEPTEMBER 2010

11th IAEG Congress Auckland, New Zealand 2010

Active, Auckland, Aotearoa

Hosted by the New Zealand Geotechnical Society **www.iaeg2010.com**

Estimating the Mechanical Properties of Rock Masses

- Peter Cundall (USA); Quantifying the size effect of rock mass strength.
- Maurice Dusseault (Canada); Geomechanics and Transport Process in Petroleum Engineering
- Peter Kaiser (Canada); Rock Mechanics Challenges in Underground Construction and Mining
- Alex Mendecki (South Africa); Forecasting Seismic Hazards in Mines
- Philip Pells (Australia); Assessing Parameters for Computations in Rock Mechanics
- Sergei Stranchits (Germany); Acoustic Emission Analysis of Initiation and Propagation of Faults in Brittle Rock and Compaction Bands in Porous Rocks
- Boris Tarasov (Australia); New Insights into the Nature of Shear Rupture in Pristine Rocks and Pre-Existing Faults

102 papers were accepted for inclusion and these were presented in two glossy volumes; Volume 1: mining and civil and Volume 2: fundamental and petroleum. The presentations fell into the categories:

- Petroleum reservoir mechanics, injection, production, fractures and wellbore mechanics (14 presentations)
- Numerical modelling (11 presentations)
- Constitutive relationships and effective characteristics (9 presentations)
- Rock mechanics data (8 presentations)
- Slopes (8 presentations)
- Underground mining rock mechanics including seismicity (10 presentations)
- Risk, rockfall and ground support (6 presentations)
- Fracture, damage and yielding of rocks (5 presentations)
- Caving (5 presentations)
- Civil tunnelling (4 presentations)
- Rock foundations and subsidence (4 presentations)
- Seismicity in mining (4 presentations)

The diverse collection of papers and presentations covered a wide variety of aspects of Rock Mechanics. Their overall quality was excellent and many were enthusiastically received and generated lively discussion.

Thank you goes to the organisers of the event, the staff of the Australian Centre for Geomechanics, the presenters, authors, reviewers, sponsors and everyone who contributed to the successful event.

3. ISRM SPONSORED EVENTS

19 - 22 May 2009, Hong Kong, China – SINOROCK 2009:

International Symposium on Rock Characterization, Modelling, and Engineering Design Methods, 2009 ISRM International Symposium, www.hku.hk/sinorock/

29 - 31 October 2009 Dubrovnik Croatia – EUROCK'2009

– Rock Engineering in Difficult Ground Conditions – Soft Rocks and Karst, an ISRM-Sponsored Regional Symposium, http://www.eurock2009.hr

4. CERTIFICATES

Members were informed in August by email that a certificate of ISRM membership was available on request. Six of 316 members requested certificates. Individual certificates were produced by the VP in MS Paint and saved as copy protected PDF files. Files were then emailed to the members. If you would like a certificate please contact me and I'll send one to you.

5. Mine Closure Commission report

The final report of the Commission On Mine Closure has now been completed and is available to members of the ISRM.

Several countries have a legacy of old, closed mines that now pose certain problems and in extreme cases, even danger to the public. The commission was set up to study the problem in international context and to propose a uniform method of handling the problem.

This work concentrated on the physical rock related aspects of mine closure and did not for instance include the social aspects in depth. The main problems arising from the closed mines relate to time dependant failure of old pillars or even overburdens spanning old works, resulting in surface subsidence.

The subsidence problems can be severe in certain cases, like the unexpected and sudden appearance of sinkholes on the surface. In other cases, the subsidence occurs over large areas over long periods of time and is easier to manage.

The report describes the mine closure situation in several countries, including ones not commonly associated with problems arising from the failure of abandoned mines like Japan and Korea. It is a reference work that describes different methods of handling the problem in different countries, including the legislative aspects.

Direct and indirect monitoring methods are described, as are technical methods of stabilizing old workings or protecting the public against the reopening of old mine shafts.

The report recommends a comprehensive risk management approach to handle the problem. Differentiation is made between gradual subsidence and sudden events. Depending on the nature of the expected effects, different reactions can be identified, ranging from doing nothing except to handle minor effects as they appear, to back filling old mines or even evacuation of villages in extreme cases.

The commission is currently in dialogue with the ISRM Board to extend the work of the first report, mainly to include countries that did not participate in the first commission.

7. ROCHA MEDAL

Since 1982 a bronze medal and a cash prize have been awarded annually by the ISRM for an outstanding doctoral thesis in Rock Mechanics or Rock Engineering.

An invitation has been extended to the Rock Mechanics community, and especially to Faculty members, for nominations for the Rocha Medal 2010. Full details on the Rocha Medal are provided in ISRM By-law No. 7.

To be considered for an award the candidate must be nominated within two years of the date of the official doctorate degree certification. Nomination shall be by the nominee, or by the nominee´s National Group, or by some other person or organization acquainted with the nominee´s work. Nominations shall be addressed to the Secretary General and shall contain:

- a one page curriculum vitae, which is to include the name, nationality, place and date of birth of the nominee, together with position held, postal address, telephone number and electronic mail address;
- a written confirmation by the candidate's National Group that he is a member of the ISRM;
- a thesis summary in paper and digital formats, written in English, of about 5,000 words, detailed enough to convey the full impact of the thesis and accompanied by selected tables and figures, with headings and captions also presented in English;
- one copy of the complete thesis and one copy of the doctorate degree certificate;
- a letter of copyright release, allowing the ISRM to copy the thesis for purposes of review and selection only;
- an undertaking by the nominee to submit an article describing the work, for publication in the ISRM News Journal, to be submitted at least one month before the Award Ceremony.

The nomination shall be sent electronically or by registered mail to be received by the ISRM Secretary General not later than 31 December 2008.

8. MEMBER COMMUNICATIONS

Over the year I've attempted to email any ISRM related material directly to the members of the ISRM rather than have it sent out by the Secretaries of the NGs. From the comments I've received, Members have seemed to appreciate the direct line of communication between the ISRM and them. It's also given them a direct link to the ISRM which has sped up any issues that have needed to be sorted out. Examples of the issues have been:

- Inability to access the website. I've managed to act as an intermediary between the ISRM secretariat and the member to ensure login details were provided.
- Dissatisfaction with the lack of hard copy News Journal or other forms of communication.
- Procedures necessary to become a member of the ISRM.
- Lack of recognition by the Secretariat that membership of the ISRM had been accepted.
- Procedures necessary to submit abstracts to various ISRM supported events.
- Misunderstanding as to the benefits accruing to non-ISRM members that are employed by companies that are corporate members. e.g. Inability to access various Suggested Methods.

If you are an ISRM member but have never received an email from me, it's probably because I have not been notified that you're a member or emails to you have bounced back as I don't have your correct email address. In either case, email me and I'll add you to the list.

Tony Meyers
ISRM VP Australasia
October 2008

IAEG Australasia VP Report: October 2008

The annual IAEG Executive and Council meetings were held in Madrid on 13 and 14 September 2008. The meetings were followed by the second European IAEG conference (EUROENGEO).

Overall the IAEG is in a sound financial position. As far as services are concerned the IAEG Bulletin is doing well. It now publishes more than 60 papers a year from many different countries on a wide range of topics. However, it was recognised that the IAEG website can be improved and more funds and effort will be put into the website in the coming year. IAEG also wants to establish a full database of all its members.

From January next year Sebastien Dupray will replace Michel Deveughele as Secretary General. Sebastien has been deputy for the past two years. Sebastien is young and enthusiastic and has contributed very positively to recent meetings.

The next annual IAEG executive and council meetings will be held in Chengdu, China in September next year. The meetings will be followed by an international symposium on geological engineering problems in major construction projects, which will be held in conjunction with the 7th Asian Regional Conference of the IAEG (www.iaeg2009.com). Post symposium tours include visits to the epicentre of the Magnitude 8 Wenchuan Earthquake (which occurred on 12 May this year) and the Three Gorges on the Yangtze River.

The IAEG Congress (which is held every four years) is the biggest international event in the IAEG calendar and there is already a lot of international interest in the Auckland congress (September 2010). Ann Williams gave reports to both IAEG meetings in Madrid which were very well received and also promoted the congress at EUROENGEO (see separate report by Ann).

Another important way that IAEG promotes engineering geology is through its commissions (technical working groups). The range of subjects covered by existing and planned commissions is illustrated below.

Existing IAEG commissions

C1 – Engineering geological characterization and visualization
C10 – Building stones and ornamental rocks
C14 – Engineering geology and waste disposal
C17 – Aggregates
C18 – Problematic soils
C19 – 3D terrestrial laser scanning technology in the geosciences
C20 – Risk based contaminated land management
C21 – Engineering geology of permafrost regions
C22 – Landscape evolution and engineering geology
C23 – Practical guide to engineering geological logging
C24 – Active tectonics and environmental hazards

Proposed IAEG commissions

C25 – Use of engineering geological models
C27 – Dimension stone heritage register

Some possible future commissions

- GIS methods
- Innovative geophysics
- Environmental aspects of construction materials extraction

There is also the Joint European Working Group on professional tasks, responsibilities and cooperation in ground engineering and IAEG members are also contributing to the joint technical commissions (JTCs) with the sister societies.

Anybody who is interested in contributing to these commissions should contact the chair of the commission (details on the website www.iaeg.info) or the President of IAEG, Fred Baynes (fredb@iinet.net.au). If anybody wishes to develop a new commission they are welcome to contact Fred Baynes to discuss the matter.

Alan Moon
IAEG VP Australasia
October 2008

LETTERS TO EDITOR

The Editor,
Geomechanics News,
C/o Tonkin & Taylor.

Dear Kate & Ann,
I found your special 50 year celebration issue fascinating. I was deeply involved in geotechnical matters myself in 1958, in the Engineering Department at Auckland University, then at Ardmore. I was lecturing in what we then called "Soil Mechanics", and had developed a geotechnical laboratory, in which I took great pride. It was something very new in those days.

Leafing through Geomechanics News caused me to ponder on the changes that had taken place since then. In some ways, the changes have been great, yet in others not much is different.

Some changes have indeed been major. The specialist geotechnical processes then available were very few. Now a large number of firms offer their expert services for a great variety.

Enormous changes have taken place in the engineering profession. It is now much more 'professional', in that it is conscious of its public image. Membership fees have escalated. It holds many more short courses and mini-conferences in expensive places. My memories go back beyond the days when it was the NZIE, and tended to be run by 'the old guard'.

There has been an enormous increase in the number of small conferences at luxury locations with colossal fees and also in the number of small groups or "sub-societies" with their own restricted range of expertise.

On the other hand, questions being raised in correspondence seem to be much he same as they used to be.

Keep up the good work! Regards from
Peter W Taylor
20 June 2008

Hello Kate,
Thank you for the lovely and very complimentary article in Geomechanics News about me and the life membership Award. I am indeed very honoured and very fortunate to have received such wonderful recognition from the Geotechnical Society.

May I take this opportunity to congratulate you on the excellent 75th issue of NZ Geomechanics News. It is terrific and a real testament to your hard work and skill.

May I also compliment you on the Soil and Rock field guide sheet. I shall be looking to obtain a whole bundle of them for use in my summer mapping class and to possibly give to the 3rd year elective class.

Best wishes,
Cheers,
Warwick Prebble
25 August 2008

Disaster Risk Management Short Course
With Dr Sergio Mora – Auckland, April 30th – May 2nd

Dear Ann,
Attached below are my thoughts (more a reflection) on Dr Sergio Mora's DRM course held in Auckland. The short course was very interesting and I particularly enjoyed the discussions we had as a group – I find these kinds of discussions hugely stimulating and valuable, especially for me all the way over here in the Hawkes Bay. To comment on the entire course would take pages so I have merely included a particular point that provided 'food for thought'. I look forward to the upcoming NZGS conference!
Here are my thoughts:

While attending this course I was struck immediately by the differences between Risk and Hazard management in New Zealand and in South America, principally the reasons WHY we insist on creating vulnerability for ourselves and how these reasons differ. I was again reminded in early June when the headline "19 Die in Columbian Landslide" appeared in my RSS feed, I went on to read "…An avalanche of mud and rubble in a poor hillside neighbourhood in the northern Colombian city of Medellin has killed 19 people, while up to eight more were missing…".

In New Zealand it seems that the greater the potential for the creation of vulnerability, the more desirable the site - hill sides, coastal cliffs, and beach front land are all prized possessions in NZ. Perhaps the article might read "…An avalanche of mud and rubble in a wealthy hillside neighbourhood in a Hawkes Bay town has killed 19 people, while up to eight more were missing…".

In South America the poor build vulnerability in their communities because they have nowhere else to go.

In New Zealand we build vulnerability in our communities because, if you can afford it, why go anywhere else?

Kind Regards,
Joy Hoverd, Engineering Geologist
23 July 2008

NZGS BRANCH ACTIVITIES

Auckland Branch Activity Report

Rodney Hutchison
Auckland Branch Coordinator
KGA Geotechnical Ltd
Work: 09 478 6655
Email: Rodney@kga.co.nz

Rodney Hutchison is Principal with KGA Geotechnical Ltd - a small specialist geotechnical practice on Auckland's North Shore. They provide general geotechnical consulting services to a wide range of clients ranging from Territorial Authorities, other consultants, land developers to individual house builders. He is a geotechnical engineer who studied in London and then worked in Hong Kong and the UK before returning to NZ.

Yan Chan
Auckland Branch Coordinator
KGA Geotechnical Ltd
Work: 09 478 6655
Email: yan@kga.co.nz

Yan Chan is a Director at KGA Geotechnical based in Albany, Auckland. Yan graduated from Auckland University before working in UK and Malaysia, ultimately returning to NZ in 2000.

Our programme has continued storming through the second half of the year, following on from the earlier presentations and site visits.

In April, Dr Sergio Mora-Casro gave his presentation on '*Reflections on the Causes and Consequences of Disasters in Latin America and the Caribbean*'. This highlighted the lack of planning and slow adoption of preventive measures to reduce the risks. The costs of losses attributable to disasters in the Latin American countries was put at approx. US$3.5bn per year. Over the period 1975 to 2006 close to 300 000 deaths occurred and 151 million people were affected. Dr Mora advocated a more proactive attitude in fostering integrated risk management strategies.

June saw a presentation from Alan Moon of Coffey Geotechnics Pty on '*Reducing slope risk on a coastal road in Australia*'. The presentation dealt with the geotechnical aspects of the reconstruction of the coastal section of the Lawrence Hargrave Drive north of Woollongong. This included hazard investigation, risk assessment and adopted solutions, including bridges, extensive slope stabilisation and protection works.

Another of our special lectures took place on 2 July, when Prof Paul Marinos spoke on '*Underground construction in urban areas*', followed by Prof Giovanni Barla speaking on '*The Beauregard deep-seated gravity deformation and its interaction with an arch gravity dam*'. Both presentations provided good insight into major geotechnical challenges that had been successfully addressed.

At the beginning of August, Geoff Bryant gave his presentation on '*The North Young rockslide at Mt Aspiring National Park*'. The rock slide occurred in September 2007 and dammed the river to a height of approximately 90m and impounded a lake containing approximately 20m cubic metres of water. Geoff highlighted the ongoing efforts including regular inspections in conjunction with automated monitoring of rainfall and river levels. He then outlined potential modes of dam failure and their likelihood together with an assessment of overflow channel erodibility.

On 27 August, we had a return presentation from Prof David Petley of the International Landslide Centre at Durham. His presentation entitled '*Earthquake induced landslides – lessons from Taiwan and Pakistan*' examined the occurrence of landslides following the 1999 Chi-Chi earthquake in Taiwan and the 2005 Cashmere earthquake in Pakistan. In particular, the presentation pointed out the increased occurrence of landslides in the aftermath of seismic events and that these landslides release large volumes of sediment into the river systems. He also referred us to his blog site daveslandslideblog.blogspot.com.

September was occupied by the symposium and so the next presentation was on 14 October when Craig Moritz of Keystone Retaining Wall Systems, USA spoke on 'MSE Wall – Design aspects and case studies'. This included the latest aspects of MSE wall designs, including seismic design, geogrid types and water applications.

At the time of going to press, the final presentation of the year is to be given by Mark Ballard of Beca, discussing the geotechnical investigations and pile load test that were undertaken by the Manukau Harbour Crossing Alliance (see paper in this Geomechnaics News).

The year is then scheduled to be rounded off with the annual drinks party at Old Government House and a coordination meeting to map out the programme for next year.

As always, we thank the presenters for all the effort that they put into their presentations. Without them, we would have no programme. We also thank the various organisations that support us by providing refreshments before meetings and the University of Auckland for their support in providing meeting venues.

Bay of Plenty/Waikato Branch Activity Report

Sally Hargraves
Bay of Plenty Branch Coordinator
Terrane Consultants Ltd, Tauranga
Work: 07 579 9708
Email: sallyh@terrane.co.nz

Sally is an Engineering Geologist and director of Terrane Consultants Ltd, Tauranga. She studied geology in the UK, and gained her PhD in slope stability modelling before moving to New Zealand. She has spent the last eight years in Tauranga and more recently co-founded Terrane Consultants Ltd, a geotechnical consultancy, which started up in March 2005.

Summary of events held since July 2008

1. Jeff Bryant's roadshow talk on the landslide dam formed in the Young Valley near Wanaka. A fascinating talk with some fabulous slides, unfortunately very poorly attended.
2. Professor Atkinson's talk on failures and why they occur. Local IPENZ members also invited. Good turnout and much appreciated by all. Well presented talk with some great anecdotes.

We will try and fit in a social occasion in downtown Tauranga one evening in late November before the Christmas rush kicks in – so keep a look out in your email in-box for details.

Upcoming in 2009 - (dates to be confirmed)

- Tour of Devan Blue facilities with presentation relating to their proprietary on-site wastewater treatment systems.
- Presentation by Marianne O'Halloran relating to the stopbanks on the Rangitaiki Plains.

For those located outside of Tauranga, e.g. Waikato, Rotorua, Whakatane, please feel free to suggest tours or presentations on local projects. We're always keen to visit other parts of the local area.

Wellington Branch Activity Report

David Stewart
Wellington Branch Coordinator
Opus International Consultants Ltd
Work: 04 471 7155
Email: david.stewart@opus.co.nz

David Stewart is a Senior Geotechnical Engineer / Engineering Geologist with Opus International Consultants in Wellington. David initially worked in site investigations in the UK, returning to NZ to work as an engineering geologist in the Otago area – initially with the Cromwell Gorge Landslides project, followed by GNS Dunedin and Macraes Gold Mine. After completing a BE he has spent the last 6 years based in Wellington.

We have had meetings at approximately monthly intervals through the year. Many of these have been travelling talks that have also been presented at other centres. The venue has been the Opus boardroom in the Majestic Centre, except for the last talk which was held in the larger recently constructed Opus Architecture Meeting Space just off the Majestic Centre foyer which is likely to be the main venue from now on. Typically around 25 - 30 people have attended each talk.

Details of activities since the last issue are given below.

On 13 May, Katherine Butterfield presented aspects of her PhD thesis research in a talk titled "*Seismic Liquefaction Trigger Mechanisms*". The talk was well received with a number of Earthquake Society (NZSEE) members also coming along, and provided a good opportunity to have some cross-over from research to a more consulting-based audience.

On 18 June, Chris Massey gave his talk "*Monitoring landslide movement and triggering factors in near real-time - an example from Taihape*". This talk outlined the history of movement and monitoring at this large landslide within Taihape township. A feature of the current monitoring is the radio transmission of monitoring data to GNS which allows near real time data to be viewed by GNS (and the public) over the internet.

On 16 July, Richard Justice presented a talk titled "*Geotechnical and Design Aspects of the Tunnel 4 Bypass, Kai Iwi*". Richard provided a very useful case history of engineering geological investigations and geotechnical design aspects for a new railway cutting. The realignment bypassed the existing undersized tunnel, just north of Wanganui. The talk covered the observations and geological model developed for the site during initial site investigations, subsequent prediction of ground conditions for the cutting, and the comparisons with actual conditions during earthworks, together with lessons learnt.

On 7 August, Jeff Bryant presented his very interesting 'road show' talk on the *Young River Landslide*; and while on the theme of landslide dams, also briefly covered the recent Shotover River rockslide near Queenstown and earthquake landslide dams in China.

On 26 August, Professor David Petley presented his talk "*Earthquake Induced Landslides - lessons from Taiwan and Pakistan*" to an audience of NZ Geotechnical Society and NZ Society of Earthquake Engineering members. The talk gave plenty of food for thought; including (a) how to predict the location of earthquake-induced landslides and (b) consideration of the impact of ongoing landsliding on earthquake-destabilised slopes in the years following the earthquake - usually in periods of heavy rain. The presentation is available on the internet on Dave's Blog (google "Dave's landslides").

On 4 November, Professor John Atkinson will have presented his talk "*What is failure and why do failures occur?*"

Upcoming Activities:

Possible activities for 2009 include – a talk on Transmission Gully site investigations, talks from some of the local branch members who presented at the September NZ Geotechnical Society Symposium and talks from local recipients of the Young Geotechnical Professionals Conference award winners. Feedback from members on ideas for activities or offers to present or organise these would be much appreciated.

Nelson Branch Activity Report

Professor John Atkinson presented his 'Failures' lecture at the Nelson Club on the 3rd November. The lecture was greatly appreciated by a very good turnout of 21 engineers. John's lecture was well pitched with the right mix of case studies, technical content, anecdotes, failure pictures and general humorous banter. Very entertaining. We were all 'gently' reminded that mistakes should not be repeated and that there are various basic principles that we engineers must know. If in doubt go back to the beach and do some sand engineering with a bucket and spade both above and below the water table!

Tim Coote
Nelson Branch Coordinator
Tonkin and Taylor Ltd
Work: 03 5466339
Email: tcoote@tonkin.co.nz

Tim Coote is an Engineering Geologist for Tonkin & Taylor in Nelson.

Canterbury Branch Activity Report

We've had a bumper year of meetings this year and I have several already lined up for next year. Thank you to all the presenters and attendees who have provided the Canterbury Branch a rich suite of topics and discussion. We are all mindful of financial issues unfolding across the globe but so far in New Zealand we appear to be insulated from the worst effects with Opus and my contacts in many other organisations reporting busy workloads ahead*. I wish all members a happy and fruitful New Year.

* at time of writing (October 2008)

Nick Harwood
Canterbury Branch Coordinator
Opus International Consultants Ltd
Work: 03 363 5400
Email: Nick.Harwood@opus.co.nz

Nick is a consulting Geotechnical Engineer who leads the geotechnical group of the Opus Christchurch office, and also oversees the Opus' Christchurch materials testing laboratory. He graduated in 1990 with a BEng (Hons) degree in Engineering Geology & Geotechnics, followed by a MSc in Soil Mechanics & Engineering Seismology from Imperial College in 1994. Nick started out as a graduate working for British Waterways before moving onto Brown & Root (London) and Buro Happold (Bath) before finally escaping to New Zealand in 2002. He has worked for Opus International Consultants for five years with the last two based in Christchurch.

Otago Branch Activity Report

Markus Hanz and Shane Greene of Opus International Consultants in Dunedin have recently stepped into the position of Otago Branch Coordinator. They are still learning the ropes of this role and are hoping for a get together and a presentation on geotechnical projects in Otago shortly after the Christmas break and would welcome any volunteers, suggestions or ideas for meetings, field trips or presentations.

Markus Hanz
Otago Branch Coordinator
Opus International Consultants Ltd
Work: 03 471 5548
Email: markus.hanz@opus.co.nz

Markus is a consulting Geotechnical Engineer with Opus International Consultants in Dunedin. Markus came to New Zealand from Germany in December 2006 and has extensive experience as a consulting engineer in a wide range of geotechnical projects. Markus also managed a soils testing laboratory in Germany for a number of years. Markus is the Geotechnical Workgroup Leader in Dunedin and has been kept busy designing retaining walls and pile foundations, assessing rock slope instability and holding the reins for the Opus Dunedin Geotechnical Team since October 2007. Markus is an outdoor enthusiast and loves the small town feeling of Dunedin.

Shane Greene
Otago Branch Coordinator
Opus International Consultants Ltd
Work: 03 471 5509
Email: shane.greene@opus.co.nz

Shane is an Engineering Geologist with Opus International Consultants in Dunedin. Shane came to New Zealand from Canada in January 2006 and has been working with the Opus Geotechnical Team since that time. Shane has specialisations in Hydrogeology and Contaminated Land Assessment however since coming to New Zealand has turned his hand to everything from foundations to slope stability investigations. Shane enjoys being a "field geologist" as it puts him out in the elements and gives him a chance to see the place that he is quickly learning to call home.

BOOK NEWS RELEASE

Cores and Core Logging for Geoscientists – Graham Blackbourn

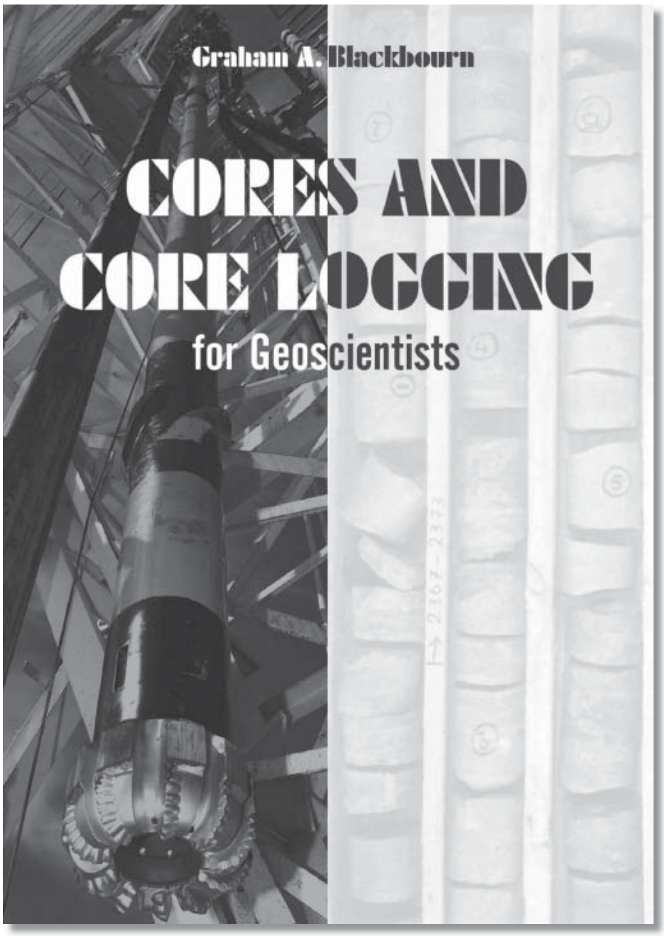
An invaluable companion for the geoscientist

The new edition of Cores and Core Logging for Geoscientists by Graham Blackbourn brings the subject of the earlier successful edition right up-to-date. Although the book is set to a great extent in the field of petroleum geology, the book will also be also of interest to a wide circle of geoscientists working in economic, mining and geotechnical disciplines.

The book acts as a guide for the trained geologist who needs to apply accumulated knowledge and experience to the description and interpretation of rock sequences recovered by the coring of subsurface boreholes. By describing the limitations and weaknesses, in addition to the advantages, of core in providing geological information, the book will also be of value to those who use data derived from cores, but have not undertaken the logging themselves.

Geologists involved with cores and coring work in a wide range of industries, in which widely differing techniques and terminologies are used. So far as possible, this book seeks to cater for geologists working in any of these spheres, and to concentrate on aspects common to coring, irrespective of the final purpose of the exercise.

This book forms an invaluable companion for the geoscientist and will no doubt reach an even wider readership than its predecessor.



Author	G. Blackbourn
Publisher	Whittles Publishing, Scotland
Year Published	2008
Hardback	144 pp
ISBN	978-1904445-39-5
Web shopping	http://moo.whittlespublishing.com/whittles/item/4237
Price	37.50 pounds

This book has not been reviewed by an NZGS member. Please contact the Editor if you are interested in reviewing this publication. kwilliams@tonkin.co.nz

MEMBER'S PAST CONTRIBUTIONS

Reprinted from NZ Geomechanics News – no 23, 1981, p 3-6

THE *LITERATES* AND THE *NUMERATES*

J.G. Hawley

It may be suggested that the membership of the Society may be divided into two groups - the *literates* and the *numerates*. The first is dominated by geologists, who are supported by pedologists, and earth scientists. They think in words - words like "Quaternary", "loessial" and "entisol" - and are seldom stuck for something to say (usually lots) about any piece of land anywhere. The second group (the *numerates*) is dominated by civil engineers, gingered up by a sprinkling of applied mathematicians and classical physicists. They like to measure things and do sums.

Between these two main groups lie the physical geographers. They speak the languages of both main groups while adding a flavouring of statistics - correlation coefficients and standard deviations.

One of the most worthwhile functions of the Society has been to bring these groups together, and this it has done quite regularly. However, the discussions at conferences, symposia, local group meetings, and in this newsletter have often been less than satisfying. The heterogeneous nature of the membership is probably the principal reason for this. This example of the gap between the "two cultures" is, I believe, a very real one. The *literates* keep silent and concentrate on nodding wisely when discussion is of principal planes or integrations: the *numerates* do likewise when the subject changes to stratigraphy or soil profiles.

The real fun starts when members of both groups (or cultures) find themselves called upon to give professional opinions on the same issue. A recurring example is the prediction of the stability of slopes in natural ground.

The stability of slopes in natural ground - a matter for the *literates* or the *numerates?*

In an attempt to avoid drifting into making unhelpful generalisations I will be referring to three different scales of investigation:

(a) rural slope instability, i.e. soil conservation. In this situation the "site" is usually at least a few hundred km^2 in area, commonly thousands and occasionally tens of thousands,

(b) urban capability surveys. These usually cover areas of the order of tens of km^2 - a few hundred at most,

(c) the investigation of sites for individual structures. For buildings, bridges and for problem areas on roads and railways, the site is commonly a thousandth and rarely greater than a few hundredths of a km^2, though investigations may need to be made of the broader geological setting - over say one to ten km^2.

From the individual building site of .001 km^2 to the soil conservation problem covering 10,000 km^2 there is then a span of seven orders of magnitude!

A facile follow-on from this would be an unhelpful general comment that for the 'large area problems' the *literates* will dominate, and for the small area, site specific situations the *numerates* will play the key role.

This is a generalisation which I do not buy. My present view is that the *literates* have as important role to play on the small site as in a regional study, and that the *numerates* may yet have as significant a role to play in soil conservation studies (from detailed studies of the typical site) as they have in investigations of small sites for structures.

One part of the *numerates'* armoury which the *literates* are fond of picking up is the slope stability calculation - based on values of cohesion and internal friction and leading to calculations of factors of safety. (They were given a few lectures on it in their geology or geography courses at university, and since then have heard the *numerates* talking about such calculations being done for dams and embankments.)

Do calculations of factors of safety ever have any relevance to the stability of natural slopes?

Before considering natural slopes it is of interest to look at the procedures for 'unnatural' slopes - dams and embankments. In these structures the soil is recompacted to a known density, and checks are made during construction to see that density standards laid down in the design are being met. Laboratory samples of the same soil are compacted to that same density and value of cohesion (c) and internal friction (ϕ)* are obtained from triaxial tests. Factors of safety are then calculated using one or more of the sophisticated analyses, several of which are now widely available on computers. The influence of possible variations in ground water levels from those assumed in the design may be calculated, and the actual variations checked in the field during and after construction.

This is really a very sound procedure - for recompacted structures. In natural slopes by contrast there is a variability (commonly large and often unknown) in material properties with depth, and a layering of the different materials generally parallel to the slope surface. In recompacted structures, unsuitable (low strength) regolith materials are excluded (carted to waste) and the layering is all horizontal - between the different "approved" soils being used, and within each soil as a result of it having been recompacted in thin horizontal layers.

Arising from this commonly large but unknown variability of soil properties (particularly permeability and strength) in natural slopes is the very real possibility that a very low strength layer exists which may be too thin to sample - i.e. it does not survive even the most careful borehole sampling operation and is only detectable in the walls of inspection shafts. The stability in such situations is determined by the strength and disposition of this "defect". (It is worth remembering the Euclidean definition - "a surface has area but no thickness"). The defect may be a weak surface rather than a weak layer - as could occur at the boundary between two different materials.

Any variability in soil properties is likely to include significant changes in permeability which may lead to anomalous pore water pressures. Specifically, the pore water pressure in a highly permeable layer may relate to infiltration much higher up the slope. Furthermore the structural defects which occur in virtually every rock type have been known to transit anomalous pore water pressures over large distances. This makes the assignment of meaningful values to ground water levels in the factor of safety calculations virtually impossible - without field measurement over several months.

* or c' and ϕ'

The considerations outlined above, together with difficulties of obtaining good "undisturbed" samples from even the more homogeneous natural slopes, leads me to the view that it is not generally practicable to assign meaningful values of c and ϕ to slopes in natural ground.

Expressed in another way I am confident that for most natural slopes even the best sampling and testing operation would lead to a scatter of values of c and ϕ which would be more than sufficient to span the range between "should have failed" and "stable". The more thorough the investigation, the greater is the range likely to be.

To these reservations about the values of c and ϕ must be added reservations about the validity of assumptions built into the different methods of using them, i.e. the assumptions adopted in deriving the different formulae for factor of safety.

During the 1950's and 60's a large number of papers appeared in which the results of investigations into slope failures in natural ground were presented. In many of these the investigations stated that they had measured values of c and ϕ, and on calculating the factor of safety found that, indeed it would have been unity so the slope should have failed. The world was thereby invited (by implication) to believe that the problem was understood and that man was in control. For the reasons outlined above, such papers tend to be unconvincing. They appear less often now.

What are the legitimate roles of the *literates* and the *numerates* in studies of slope instability in natural ground? My present views are:

For (a) above - soil conservation - by which in this context I refer to the control of mass movement erosion in pastoral hill country:

The real question is not "What are the soil strengths?" but "By what processes and what rates will the soil strengths change, daily and seasonally, under different styles of land use/management?"

We may hope that the *numerates* will answer this question by recording and analysing the daily and seasonal patterns of pore water pressure and strength within the soil - at "type sites" under different styles of land use/management. The role of the *literates* will include

(i) selection of the "type sites" and

(ii) the extrapolation of understandings developed by the *numerates* to areas which are similar in relevant properties.

For (b) above, I believe that the *literates* must prevail at the urban capability survey stage, in the preparation of the geotechnical input to district schemes and even up to the concept plan stage. Only when likely areas for commercial buildings, bridges, major road cuts or fills have been identified is it appropriate for the *numerates* to get involved. In other words the soil mechanics must be site specific.

The work done by the *literates* in preparing an urban capability survey includes

(i) gathering together onto one map and one legend all relevant information on geology, engineering geology and soils

(ii) remapping these as necessary and adding slope, vegetation, present and potential fluvial and mass movement erosion, drainage characteristics (including flooding) and a terrain component description

(iii) presenting all of the above "factual" or "inventory" information in the form of homogeneous unit areas on one map

(iv) making an interpretation, i.e. an integrated appraisal, of the above information relating to each unit area, from an urban development viewpoint. This interpretation is called "urban capability".

For (c) above - the site investigations.

These should always begin with the *literates* describing the geological setting and indicating what types of problem could be expected. The *numerates* plan their investigations accordingly and after making their measurements and doing their sums confer with the *literates* again to confirm/revise and finalise the evaluation of the site.

In summary

Slope stability calculation methods have been developed for and are valid for recompacted structures (dams, embankments etc). To have any validity for natural slope such calculations would need to be supported by good field measurements of the daily and seasonal patterns of pore pressure changes, and density/strength changes.

The Society membership may be divided into the literates and the numerates, and a good deal of interest (and benefit) may be derived from the interaction of these two groups.

STANDARDS, LAW AND INDUSTRY NEWS

Disaster Risk Management Short Course

The New Zealand Geotechnical Society hosted two 3-day short courses, one in Auckland and one in Christchurch, in late April and early May 2008. The courses were lead by Dr Sergio Mora, an international leader in Disaster Risk Management, with a background in rock mechanics, dams and tunneling, he draws his DRM experience from some 10 years as Environmental, Natural Resources and Risk Management Specialist at the Inter-American Development Bank, with assigned duties in Dominican Republic, Haiti, El Salvador and Bolivia, and most recently as consultant to the World Bank.

His thesis is that disasters are not 'natural' and that with appropriate planning we can avoid constructing vulnerability.

> "Even *if natural hazards - volcanism, seismicity, mass movements and hydro-meteorological processes - continue to become manifest, it is human vulnerability that actually defines the degree of intensity of the damage associated socially, economically or environmentally with their impact –i.e. disasters.*
>
> *In most countries worldwide, irrespective of their geographical location, wealth and degree of development, the occurrence of significant losses is becoming commonplace.*
>
> *Disasters have a significant bearing on the development prospects of most countries in Latin America and the Caribbean (LAC). During the past 30 years disasters in the region have annually affected 4 million people, causing some 5,000 deaths and about US$3.2 billion in physical losses (IADB, 2004).*
>
> *Despite rising awareness and recent progress, insufficient planning and slow adoption of preventive measures exacerbate this risk. Under hazards exposure and when vulnerability is high, progress in poverty reduction, improving social equity and sustainable economic growth may be seriously jeopardized. In absolute numbers, the total cost of losses attributable to disasters in LAC has been estimated at about US$ 125 billion (approx. US$ 3.5 billon/year) over the period 1975-2006. During the same period, close to 300,000 human deaths occurred and 151 million people were affected.*
>
> *Although available resources for post-disaster assistance rise, those dedicated to integrated preventive risk management lag behind. Investments in risk reduction focused on ex-ante actions to reduce vulnerability and thus to reduce losses still do not meet the real needs and are not proactive but reactive.*
>
> *A good part of this inaction is certainly caused by the lack of stamina from the scientific and engineering communities, which having the finest arguments to support the efforts, unfortunately are not persuasive and convincing enough to managerial and political decision-makers, who are not yet convinced about the priority of reducing risk and do not support a more proactive attitude in fostering integrated preventive risk management strategies.*
>
> *Our societies need urgent, sustainable and effective actions leading to the incorporation of preventive risk management.*
>
> *Territorial planning, watershed, natural resource and environmental management, based upon sound incentives, regulations and procedures, can reduce vulnerability and thus the probabilities of damage, particularly in densely populated urban areas and in productive rural areas.*
>
> *Resources for post-disaster assistance must of course be available, but not in detriment to those that should be destined for integrated preventive risk management. Investments in risk reduction, focused on ex-ante actions to reduce vulnerability and losses, must address the causes and consequences (hazards, vulnerability, potential losses) of disasters, as well as orienting proactive initiatives and strategies for their retention and/or transfer, considering adequate levels of "accepted" and "acceptable" risk."*
>
> *Sergio Mora*

The course was attended by 31 delegates in Auckland and 10 in Christchurch and addressed the following topics:

- Disasters are not natural: The perception of risk
- Introduction to the basics of the risk evaluation
- Social, political, economic and environmental aspects of disasters in Latin America
- Social, economic and environmental impact assessments of disasters
- Earthquake hazards analysis: Application to Disaster Risk Management

- Estimating earthquake hazards for Disaster Risk Management
- Case histories of earthquake disasters in Latin America and the Caribbean
- Volcanic hazards analysis: Application to Disaster Risk Management
- Volcanic hazards in Latin America and the Caribbean
- Hydrometeorological hazards
- El Niño is neither a phenomenon nor a "natural" disaster: Its causes and the way it affects countries
- Natural hazards and climate change
- Hazards derived from external geodynamic processes: Mass movements and debris flows
- Macrozonation methodology for landslide hazard determination
- Slope instability: Decision making for mitigation
- Natural hazards, vulnerability and the construction of risk scenarios
- Public policy and institutionality for Disaster Risk Management
- Alert and alarm systems
- Indicators for Disaster Risk Management
- Risk Management a tool for development.

All course material as well as a wide selection of references, short video clips etc, was provided on a CD to course delegates, and delegates received a certificate on course conclusion. The course was very well received (scoring 7 to 10 out of 10, and on average 8, in course evaluation).

"*Awesome presentations, fantastic photos, very engaging presentation style..*" Jo Horrocks

"*I enjoyed this course and found it very informative, with ideas that are easily applied in practice.*" Joy Hoverd

"*...enjoyed presentation style and range of examples..*" Michele Daly

"*This seminar has provided me with additional information and factors to consider and use when assessing the risk to projects that my company undertakes. The seminar has been thought provoking in many areas. The presentation by Sergio Mora was great.*" Leigh Dooley

"*Very grateful for the opportunity to attend with such an experienced authority on this very important subject. Excellent contribution to public/industry debate on geotechnical risk started by the Society for Construction Law's lectures last year.*" Roelant Dewerse

"*Very good to get a broad overview of the topic not confined to geological or engineering aspects.*" Marianne O'Halloran

"*All sessions informative and of relevance to a variety of projects I am involved in.*" Anna Kirschberg

"*I really enjoyed Dr Mora's approach to presenting the information he has gathered over the years in Central America. Both the lessons and images were thought provoking, challenging our role as a geotechnical community in minimising if not mitigating unacceptable risk to humandkind and the environment.*" Amy Macdonald

"*The course has provided me with new views/ insights surrounding risk and vulnerability that I previously hadn't considered.*" Sarah Williams

"*Well done; short course and the discussion that resulted are highly valuable*" Peter Faulham

"*Sergio was an excellent communicator with amazing depth of knowledge and experience.*" Eugene Crestanello

"*Very interesting with a lot of information. The amount of additional material provided is astounding when compared to courses I have previously been on.*" Anon

"*Really enjoyed Sergio's presentation style and good humour. Was excellent to become mindful of.... where we as consultants fit in and what we need to be doing better.*" Anon

I believe the course has added value to our members and consideration should be given to running an advanced level follow-up course in the future that provides practical examples in the operation of many of the tools discussed.

Ann Williams
Short Course Organiser

IAEG Congress Report

IAEG2010 promises to be a unique event in New Zealand. It is the 10th anniversary of GeoEng 2000 and the Congress will likewise cross the boundaries between engineering and science; it will incorporate the national Symposium of the New Zealand Geotechnical Society, and it will be talked about and add value long after it has passed. Plan now to be in Auckland in September 2010 for Geologically Active. Abstracts will be received from February 2009.

Website:

Keep your eyes on our webpage: **www.iaeg2010.com**
Key Contacts:

- Congress Co-ordinator, The Conference Company: Clare Wilton **clw@tcc.co.nz**;
- Day Sponsorship: Tim McMorran **Tim_Mcmorran@URSCorp.com** or Ann Williams, **ann.williams@beca.com**
- Sponsorship and Exhibition: Sally Hargraves **sallyh@terrane.co.nz**

Key Dates:

- February 2009 call for abstracts
- Mid September 2009 abstract deadline; registrations open
- End November 2009 abstracts accepted or rejected
- Mid March 2010 paper deadline
- End June 2010 early bird registrations close.

Venue:

Sky City, Auckland, completed in 2005. Sky has associated with it a substantial 5-star hotel, theatre, restaurants etc.

Sponsorship:

Discussions are underway with Principal and day sponsors. We expect to advertise our key sponsors very soon.

Above: the executive committee of IAEG at Madrid (and partners = females)

Promotions:

Quality IAEG 2010 vests made by Earth Sea Sky are available for purchase via the website.

Key Note Speakers:

Key note speakers have been confirmed (see advertisement):

- Dr Hamish Campbell (New Zealand)
- Dr Simon Löw (Switzerland)
- Dr Sergio Mora (Argentina)
- Dr Tim Sullivan (Australia)
- Dr Susumu Yasuda (Japan).

Ann Williams
Co-convenor IAEG2010


GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS
RESULT DRIVEN
GEOTECHNICAL SPECIALISTS
Telarc sai registered
Q-BASE
Tel 04 5277 346 | info@griffithsdrilling.co.nz | www.griffithsdrilling.co.nz

Membrane Interface Probe

For in situ detection of volatile organic compounds (VOCs) in the subsurface.

How it works

A heated probe carrying a permeable membrane is advanced to a recorded depth in the soil by our GEOPROBE 7720DT Direct Push probing rig. VOCs in the subsurface which cross the membrane enter into a carrier gas stream and are swept to gas phase detectors at ground surface for measurement.

Detectors

The ability to detect a contaminant is determined by the type of detectors being used. Detectors include:

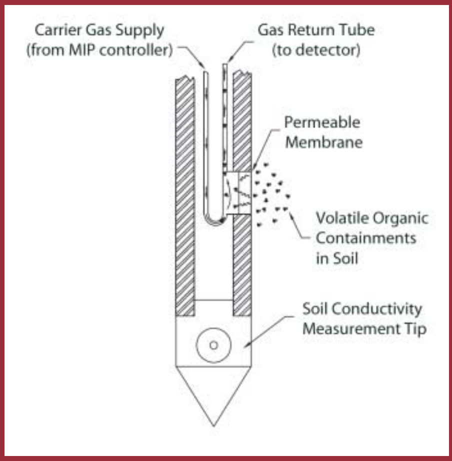
- PID - photo ionization detector used for the detection of aromatic hydrocarbons
- FID – flame ionization detector used for the detection of straight chained hydrocarbons (methane, butane)
- ECD – electron capture detector used for chlorinated (TCE, PCE) contamination detection.

Lithology

Electrical Conductivity is used to define zones of lower conductivity, equivalent to coarser grained, more permeable sediments, which will allow the movement of contaminants in the subsurface. The lithological information gathered with the EC in conjunction with the MIP data can be used to aid the investigator in understanding the movement and location of contamination in the subsurface. This information will also assist in the proper placement of monitor or extraction wells.

Self contained mobile laboratory trailer


HP Gas Chromotograph



Probe diagram and flow path

Features of MIP

- Operates in both saturated or unsaturated materials.
- Detects volatile compounds in gaseous, sorbed, dissolved, or free phase.
- Applicable to both chlorinated and non-chlorinated species.
- Provides simultaneous log of soil electrical conductivity (EC) via the dipole electrode on the probe.

What the MIP can tell you

- Where the contaminant is encountered at depth.
- Where the contaminant is absent at depth (below the detection limit).
- How the concentration of contaminants at this location compares to the concentration at other locations
- Where the contaminant occurs in relation to lithology.

Save Time and Money

- Reducing the number of unnecessary drilled sample holes and monitor wells.
- Reducing the number of samples taken and associated laboratory costs.
- Reduced on-going monitor well sampling.
- Less time on site .

BROWN BROS (NZ) LTD

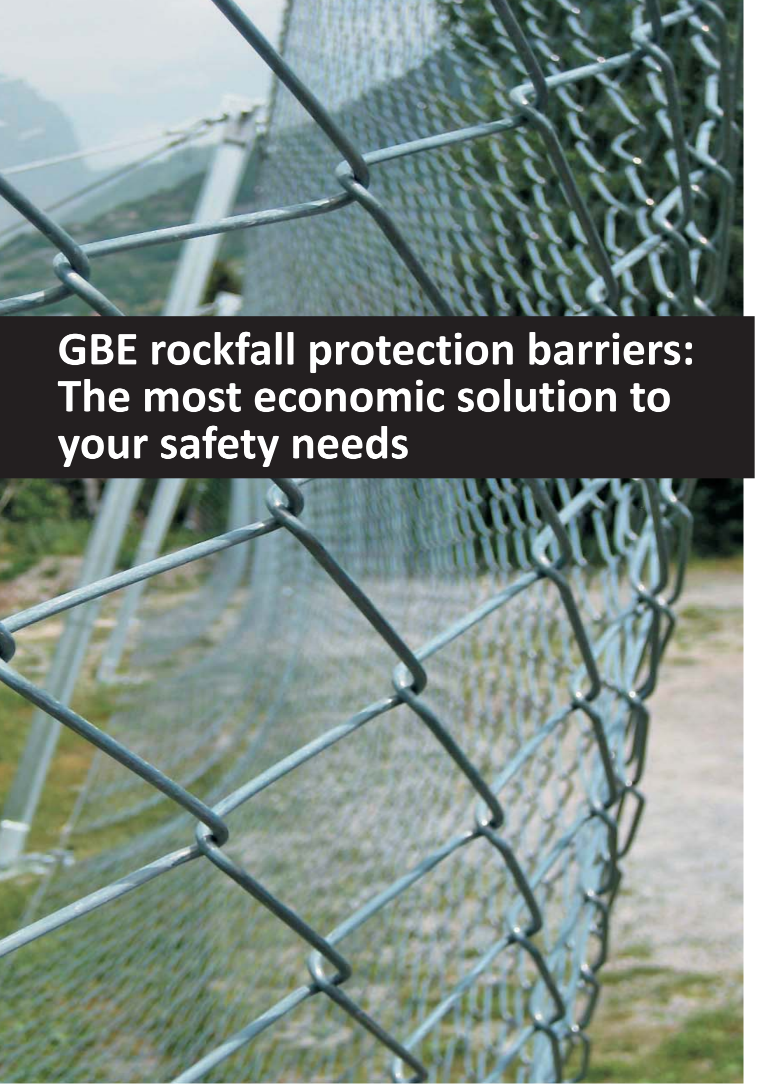
AUCKLAND
(09) 298 0449

HAMILTON
(07) 849 2919

EMAIL
mip@brownbro.co.nz

www.brownbro.co.nz


Congratulations
to the
NZ Geotechnical Society
celebrating 50 years
from
MACCAFERRI
also celebrating 20 years
geosynthetic support services
to the industry
0800 60 60 20
sales@maccaferri.co.nz
www.maccaferri.co.nz
MACCAFERRI
Engineered Environmental Solutions



GBE rockfall protection barriers: The most economic solution to your safety needs

GEOBRUGG®

Geobrugg NZ is excited to announce the new Geobrugg GBE rockfall protection barriers providing:

- **protection against impact energies up to 1000kJ**
- **over 50% residual useful height in the impact section**
- **no secondary mesh required**
- **rapid installation through modular design, using lightweight components**
- **simple anchorage thanks to lower force transmission**

This new cost effective rockfall protection barrier system provides a solution that is functionally and logically planned as a whole and is exceptionally installation friendly without compromise.

The system is fully certified, and satisfies the most strigent requirements of ETAG 27 category A, meaning these barriers are tested under the very toughest conditions.

Call or email us now for more information on this exciting new solution.

GEOBRUGG® protects people and infrastructure

We develop and produce technologically mature protection systems from steel wire nets, that are now installed worldwide. Our dynamic and static protective structures provide proven protection against:

- rockfall
- avalaches
- mud flows
- slope failures

They help to protect people as well as infrastructure from the forces of nature.

Slope Stabilisation Savings with TECCO Mesh

Because of the high tensile strength of the TECCO (≥ 1770Nmm2) mesh system compared to that of standard mesh (4-500Nmm2) you can achieve a much greater nail spacing, no matter what nailing system you chose. As can be seen from the Pie Chart comparisons at left, the bulk of stabilisation/remediation cost is in nailing - particularly when the access is difficult for production machinery.

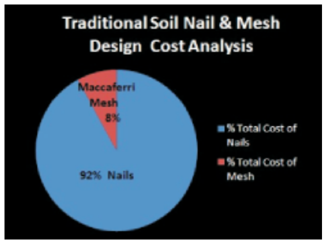
The increased nail spacing is a function of:

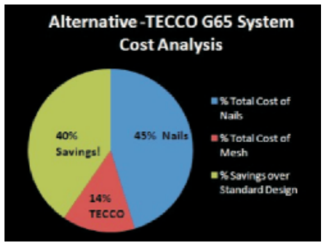
- the increased resistance of the high strength TECCO mesh to shearing off at the upper edge of the spike plate (standardised washer for the G65 system)
- the increased resistance of the high strength TECCO mesh to breaking from loading in shear against the nail

The resistance forces for these basic performance functions of the system as described above have been produced from test results in independent laboratories - this provides measurable data for **soundly engineered** solutions.

These specific resistance forces for the TECCO G65 system are fixed variables inside the RUVOLUM software.

The resistance force for mesh shearing against the washer and or the nail are not available for standard mesh because the testing has not be done by the manufacturers and because the washers for other systems have not been standardised in size and shape.





GEOBRUGG®

Geobrugg New Zealand Ltd. PO Box 4627, Christchurch 8140, NZ
Phone +64 3 968 2667 Fax +64 3 968 2668 info@geobruggnz.co.nz
www.geobruggnz.co.nz

CONFERENCE REPORT

New Zealand Geotechnical Society Symposium 2008 – Soil Structure Interaction – From Rules of Thumb to Reality

The 18th Geotechnical Symposium was held at the new Business School at the University of Auckland in early September 2008. A total of 212 registrants enjoyed a broad technical programme that commenced with a keynote lecture by Professor John Atkinson of City University, London. His lecture on common geotechnical rules of thumb and how to classify them neatly set the scene for the two days of technical sessions. Associate Professor Misko Cubrinovski from the University of Canterbury commenced the second day with an invited lecture on assessment of the seismic performance of soil-structure systems.

A total of 30 technical papers were delivered with several more presented as posters. Professor Mick Pender and Associate Professor John Butterworth received the Maunsell Best Paper award for their paper on classical soil-structure interaction and the NZ structural design actions standard. Merrick Taylor of Arup Geotechnics, London, won the KGA Geotechnical Best Paper (under 35) award for his paper on performance based design of retaining structures.

The evening of the first day saw 140 symposium attendees and invited guests gather at the Royal New Zealand Yacht Squadron to celebrate the 50th anniversary of our society. Peter Riley performed an admirable job as MC for the evening, during which we heard from Rodney Hutchinson and Geoff Farquhar on behalf of the Management Committee, Peter Geddes on behalf of IPENZ and Professor Pender on the past and future of geotechnical engineering in New Zealand. Colin James, a social and political commentator, delivered a timely and enjoyable after dinner speech during which he accurately predicted the forthcoming election date.

The Symposium concluded with a trip to the Northern Gateway project, where we got to see first hand the huge cuts, fills, bridges and tunnels of this world class project. The highlight for many was the walk through the southbound Johnstones Hill tunnel, and the NGA team, led by Neil Korte, is to be thanked for giving up their Saturday for us.

Some 60 people attended a pre-symposium workshop on the draft Geotechnical Seismic Design Guidelines, which was chaired by Dr Kevin McManus. Some lively debate occurred at times, and valuable insights were given into the origin of some of the tools we use, and into the different language of geotechnical and structural engineers.

I would like to acknowledge the Symposium sponsors for their generous support: Coffey Geotechnics; Tonkin & Taylor; Beca Geotechnical; Opus; Maunsell AECOM; Babbage Consultants; KGA Geotechnical; Riley Consultants; Reinforced Earth; and Geotechnical Jobs. These sponsors and the trade exhibitors are a vital part of a successful event.

Finally, I would like to thank our conference organizers, Tomas Pernecky and Tessa Hagemann from the Centre for Continuing Education, and my organizing committee, CY Chin of Maunsell AECOM, Yan Chan of KGA Geotechnical and Terry McCarthy of Soil and Rock Consultants, for their efforts in making the 2008 Symposium a great success.

Reported by:
Gavin Alexander
Conference Convener

Young Geotechnical Professionals Conference Report

Above: The 8YGPC gang on the Wellington Fault Scarp

After about 17months in the organising the 8YGPC was held in the Copthorne Hotel, Oriental Parade, Wellington on the 5th – 8th November 2008. The organising committee had high hopes for the conference and it went off with a bang, quite literally, fireworks in Wellington Harbour. Ok they might not have been for us technically, but thanks for Guy Fawkes all the same.

The conference was attended by 45 delegates, 6 committee members – 2 of whom were multi-tasking as mentors (Lis Bowman of UoC & Ross Kendrick of Maunsell AECOM), 2 mentors (Gavin Alexander of Beca & Bruce Symmans of Tonkin & Taylor), and with keynote speaker John Atkinson of Coffeys & City University, London. One third of the delegates came from over the sea in Oz, and 38% of the delegates were females – I wonder, is the field of Geotechnics leading the way in gender equality?

One rule of the conference was that every one of the delegates must present their paper, in 10mins. Some had issues keeping to the time limit, but the water pistol dealt with those overrunning. The general consensus is that we all learnt something from all of the presentations, and the proceedings will be well thumbed.

The conference started with welcome drinks (and those fireworks) on the evening of the 5th, with a full day of presentations on the 6th followed by the conference dinner, which included a trip up the Wellington cable car, a quiz, and a talk by John Atkinson. The 7th was a half day of presentations with the afternoon comprising of a gourmet BBQ lunch on the Wellington fault line with a field trip along the fault line. Unfortunately the field trip day was the worst day weatherwise but luckily the worst of it held off till after lunch when we were all safely on the bus. Another fabulous dinner on the evening of the 7th after which the committee showed the delegates the best spots along Courtney Place! The final presentations were held on the morning of the 8th with winners of the awards announced after lunch.

Two awards were up for grabs, judged by the mentors; one for the New Zealand delegates (sponsored by the NZGS), the Young Geotechnical Professionals Award (YGP), and one for the Australian delegates (sponsored by the AGS), the Don Douglas Youth Fellowship Award. The winner of the YGP award was Hayden Bowen from Tonkin & Taylor for his paper and presentation on *Pile foundations in liquefiable soil – A case study of a bridge foundation*. The Don Douglas award winner was Joel Gniel from Monash University for his paper and presentation on *Predicted site behaviour of geogrid encased stone columns*. The mentors also felt that special mentions for their presentations should go to: Cary Everett, Sian France, Tariq Rahiman, Chris Soutar, Owen Woodland & Carol Yan.

Enough from me, here are some "sound-bites" from the delegates & mentors on the 8YGPC;

- It was very good to meet other professionals with similar amounts of experience. I liked the informal

Above: A team hard at work during the conference dinner quiz**. Right:** John Atkinson & Ross Kendrick

nature of the conference and enjoyed the field trip, learnt lots.

- A very well organised and informative conference. I had high expectations and it exceeded them.
- After attending a few conferences as part of my research, this is probably the best organised, friendly and especially interactive of all.
- Fantastic conference, well organised and set up to ensure delegates felt comfortable meeting and presenting in front of their peers. Great atmosphere, fun people and highly recommended for those that haven't attended a conference before.
- The 8YGPC has been a very rewarding experience for me. The informal nature of the conference encourages dialogue & discussion between the delegates and it provides a relaxed atmosphere in which to present. I will definitely be recommending this to my colleagues.
- Awesome experience so much learned and gained. Great people and contacts for life.
- Very good environment in which to present papers. A thoroughly informative and entertaining event.
- The 8YGPC provided an interesting cross-section of activities of professional consulting engineers and research students. A thoroughly enjoyable event with great networking.
- Great conference where I almost lost my wedding ring!
- Fun filled, great variety in activities and presentations, definitely worth coming to.
- Very well organised, fantastic opportunity to present among peers.
- Fantastic conference, really enjoyable. I learnt a lot from a varied few days.
- Fantastic conference, great for meeting people. Well organised. John Atkinson was great!
- I was very impressed with the wide range of project experience and academic research presented by the delegates at the 8YGPC. The presentations were extremely well delivered, and stimulated thoughtful and insightful debate. I greatly enjoyed the camaraderie and the open sharing of knowledge – Gavin Alexander

Above: NZ prize winner Hayden Bowen (second from left) & delegates who deserved a special mention for their presentations

On behalf of the 8YGPC committee we would like to thank all the delegates for their papers, presentations & enthusiasm, the mentors for the time & feedback, John Atkinson for his insight, our companies for allowing us the time to organise the conference, and finally to our generous sponsors, Thank You. See you all at the 9YGPC.

Reported by: Bev Curley
beverley.curley@opus.co.nz
Opus International Consultants

Committee Members:
Lis Bowman, University of Canterbury
Lucy Coe, Beca Geotechnical
Paul Fletcher, Coffey Geotechnics
Andrew Kennedy, Tonkin & Taylor
Ross Kendrick, Maunsell.

AWARDS

Young Geotechnical Professionals Conference Awards

A total of eight awards were made this year for young New Zealanders to attend the YGP Conference held in Wellington during November. Abstracts of the award recipients are presented below. The awards consisted of funding provided by both the New Zealand Geotechnical Society and the Earthquake Commission Research Foundation. Award winners are expected to present their paper at the local branch meeting in New Zealand during the coming year. So you can expect to catch up with these presentations in your area.

Pile foundations in liquefiable soil – A case study of a bridge foundation

Hayden Bowen
Tonkin & Taylor Ltd., Christchurch

Soil liquefaction has caused major damage to pile foundations in previous earthquakes, particularly during the 1964 Niigata and 1995 Kobe events. Since pile foundations are primarily designed to transfer vertical loads from the superstructure to the bearing stratum, they are relatively vulnerable to lateral loads, such as those imposed by ground shaking during earthquakes. In the case of soil liquefaction, this vulnerability is particularly pronounced since the loss of strength and stiffness in the liquefied soil results in a near complete loss of lateral support for the embedded piles.

In this paper the seismic assessment of a bridge founded on piles in liquefiable soils is presented. The effects of liquefaction, lateral spreading and soil-structure interaction on the bridge during a predicted future earthquake are examined using two different analytical approaches. First, a simplified, pseudo-static beam-spring method is used. This analysis can be performed using common site investigation data such as the SPT blow count, yet it captures the essential features of pile behaviour. Secondly, a detailed finite element time-history analysis based on the effective stress principle is conducted. This analysis can simulate the process of pore pressure build up and the associated stress-strain behaviour of soils in great detail, giving a rigorous evaluation of pile performance.

The Cutter Soil Mixer Method for Ground Improvement

Heather Enright
Coffey Geotechnics (NZ) Limited, Auckland

The Cutter Soil Mixer (CSM) Method for ground improvement is new to New Zealand, and brings with it new construction possibilities for retaining walls, cut-off walls, building foundations and slope stabilisation.

The CSM method involves the formation of a vertical panel in the ground by using rotary cutting heads to break up the soil and intermix it with a cement slurry.

Recently the CSM method was used to construct a temporary retaining wall to facilitate a single level basement excavation in downtown Auckland. The panels were successfully constructed to 9 metres depth through four distinct lithologies, including reclamation fill, marine sediments, residual Waitemata Group soils and Waitemata Group bedrock.

A CSM slope stabilisation method has also been proposed for a future residential subdivision in Northcote where conventional shear key construction and bulk earthworks are difficult due to access, limited available area for fill conditioning and material handling, and silt control constraints. The CSM method offers solutions to these issues, with the added benefit of speed in a season-driven industry.

The CSM method is showing success in a range of applications across several different soil types. This paper outlines the CSM method and machinery, using case studies to illustrate some of its capabilities and efficiency.

Silverstream "Class A" landfill: Lining solutions for leachate control

Carys Everett
Tonkin & Taylor Ltd., Wellington

The engineering design and construction of modern landfills to meet environmental requirements, particularly at steep or challenging sites, is complex. The growing awareness regarding environmental protection means the prevention of contamination leaching from refuse and entering surface or ground water is a critical element in modern landfill design. Silverstream landfill Stage 2 upgrade involves a 23 hectare extension in a steep sided valley downstream from the existing landfill. The Stage 2 upgrade is planned to be constructed in five phases over a period of thirty to forty years. The geology and geometry of the site and the objective to optimise capacity resulted in new and innovative lining methods for steep slopes. This paper summarises the construction challenges of installation of both standard lining components and the use of "no fines" concrete in the liner system on steep slopes.

Cut and Cover Tunnelling: Drawdown, Damming and Contaminant Migration

Sian France
Beca Infrastructure Ltd, Auckland

The Vic Park Tunnel project will see the construction of a new 460 m long, northbound 3-lane tunnel beneath Victoria Park, downtown Auckland, to meet objectives for upgrading the motorway between the Auckland Harbour Bridge and the Central Motorway Junction.

The tunnel, to be constructed by cut and cover techniques, will cross low-lying reclaimed land. Reclamation was constructed progressively from the early 1900's and comprises variable materials to depths of up to 10 m, locally containing hydrocarbons in the near surface. The fill overlies compressible clayey silts and interbedded weak sandstone and siltstone.

Long term the tunnel will be lined to limit groundwater seepage, but the excavation will need to be dewatered during construction. The dewatering period is expected to be 6 months.

Both 2D seepage and 3D groundwater flow modelling were undertaken to assess the extent and magnitude of drawdown (up to 4.0 m adjacent to the tunnel), the potential for contaminant migration to be induced by dewatering, and in the longer term, the extent to which the tunnel might act as a 'dam' to groundwater flow. Classical 1D consolidation settlement analyses were used together with reviews of foundation records to identify the likely impact of settlement on existing structures.

Stress relaxation during K_O compression of pumice sand

Naotaka Kikkawa
Faculty of Engineering, University of Auckland

Previous research had shown that q_c values from cone penetration tests (CPT) on pumice sands were only marginally influenced by the density of the material. In this paper, data from K_O compression tests on dry pumice sand are presented. K_O triaxial compression tests on loose and dense specimens of pumice sand at various displacement rates were conducted to obtain further insight into the properties of this material. After compression, the maximum displacement was held constant for some time and relaxation of axial and lateral stresses were monitored with time. During testing, measurement of air permeability was conducted to monitor the temporal change in void ratio and the amount of particle crushing. Results indicated substantial decrease in air permeability. Moreover, stress relaxation increased with increasing displacement rate and the values for loose sample were generally larger than that for dense sample.

Rock socketed pile foundations - design methods for evaluating axial capacity

Paul McClean
Maunsell Limited, Auckland

Methods for determining the axial capacity of rock socketed pile foundations yield vastly varied results. While the theoretical basis for analysis is widely understood in terms of the mechanisms that govern rock-structure interaction, the methods of design are geologically dependent and widely dispersed throughout the literature relating to the subject. The application of this knowledge to design depends primarily on the structural characteristics of the rock mass. Design methods must consider all possible failure modes and this paper outlines the range of approaches that may be employed to ensure a rock socketed foundation design is compatible with geological conditions. Each method has limitations based on its underlying assumptions and perceived application. A sound design process will incorporate both a thorough geological investigation and field testing to ensure that the assumptions of the analysis reflect the practical constraints of the physical problem.

Engineering geology and debris flow hazards at Matata

Annette O'Leary
Maunsell Ltd, Auckland

On 18 May 2005, prolonged and intense rainfall triggered numerous landslides and debris flows throughout the steep terrain south of Matata. Flooding destroyed 27 homes, damaged a further 87 properties, washed away 100 m of railway, closed the state highway for 12 days, and cost in excess of $30 million in damages. Erosion associated with the debris flow events has created fresh exposures throughout the catchments which provide a unique opportunity to study the geological and geotechnical aspects of the area. The geology consists of weak/unconsolidated deposits which have created a landscape dominated by deeply incised stream valleys and debris. As a result the region is highly susceptible to landslides and streambeds are littered with boulders and debris. Further debris flows are possible whenever there is rainfall with high enough intensity to trigger landslides on the steep slopes.

Innovative Highway Stabilisation on Rimutaka Hill Road

Selvem Raman
Opus International Consultants, Wellington

A section of the SH2 Rimutaka Hill Road was affected by a dropout caused by storm events. Transit New Zealand let a "design and build" tender for the design and construction of a 70 m long retaining structure supporting the road formation to reinstate the affected traffic lane. The instructions for tendering indicated that the specimen design which was a contiguous bored pile wall does not meet the principal's requirements.

A cost effective design solution consisting of a combination of unanchored and anchored (rock anchors) soldier pile wall, and ground improvement piles was developed to provide the required performance. This considers the varying depth of bedrock level below existing ground. A shotcrete facing was provided to support the ground between the piles to transfer the load to the piles.

Trench cut-off drains, sub-horizontal drainage holes, additional sumps, discharge culverts with extended flexible hoses, weepholes and stripdrains were installed to reduce the groundwater pressures and improve stability.

The design considered the importance of the highway as a key arterial road and also Transit's desire for a 50 year design life and 0.2g peak ground acceleration earthquake design.

NEW ZEALAND GEOTECHNICAL SOCIETY inc

Nominations are now sought for consideration for the NZGS Geomechanics Award 2008.

The award shall be made to the Society member or members producing the adjudged "best" published paper during the three year period 31 July 2005 to 31 July 2008, in any publication at the discretion of the Management Committee.

The Geomechanics Award is bestowed on the author (s) of papers that are distinguished in their contribution to the development of geotechnical engineering and/ or engineering geology in New Zealand and that advances the objectives of the society.

All Society members who are authors of any paper published within the previous three years shall be eligible, provided that at least one author is a member and that another member nominates the paper in writing prior to 20 February 2009.

AWARD VALUE: $2000 plus certificate

Nominations must be made in writing and close 20 February 2009. Please provide author details, a brief comment on the contribution the paper makes and a hard copy of the paper to the NZGS Management Secretary.

Amanda Blakey, Management Secretary. Email: nzgeotechnicalsociety@xtra.co.nz

PROJECT NEWS

Geotechnical Investigations and Pile Load Test for the New Mangere Bridge

1. Introduction

This paper was written and presented at the Civil Engineering Testing Conference held in Auckland, September 2008 and is now being reproduced here in order to reach the wider geotechnical community.

The purpose of the paper is to present details relating to geotechnical investigation, test pile construction and the load test results that assisted in demonstrating the adequacy of the pile design and reduced the perceived risks with constructing large diameter bored piles across the Manukau Harbour for the duplicate Mangere Bridge.

The Manukau Harbour Crossing Alliance is widening the existing SH20 motorway over a 4.7km long transport corridor from the Walmsley Road Interchange to Queenstown Road Interchange. The project effectively duplicates the existing motorway and associated infrastructure and forms an important link to the Western Ring Route to increase the capacity of the network. This project is designed to reduce the travel time between Mt Roskill and Auckland International Airport during peak hours and is scheduled for completion prior to the 2011 Rugby World Cup.

The construction of the new Mangere Bridge represents the critical path for the project and is consequently viewed as a vital component to its success. To develop an effective pile design additional geotechnical investigations and a full scale pile load test were undertaken to assist in managing the construction risks associated with predicting the performance and constructing of these large diameter bored piles.

The Manukau Harbour Crossing Alliance comprises New Zealand Transport Agency, Fletcher Construction Company Ltd, Higgins Contractors Ltd and Beca Infrastructure Ltd.

2. Description of the Duplicate Mangere Bridge

The duplicated bridge is to be situated parallel and offset to the east of the existing bridge and will comprise of four lanes of traffic with two shoulders on a high level alignment that will solely carry southbound traffic.

The bridge comprises of seven piers and two abutments with the span arrangements almost symmetrical about the central Pier 4. Generally, the bridge comprises of 100m spans crossing the Manukau Harbour with 50m land spans between the abutments and the closest piers. The superstructure comprises of a cast in-situ twin box constructed using a balanced cantilever technique supported at pier positions by a pair of columns. Individual large diameter bored piles then support each column and found within the underlying Waitemata Group Formation.

3. Geotechnical Investigations

3.1 Geological Setting

The Auckland Geological Map (NZGS, 1992) indicates the geological units underlying the Mangere Bridge site as Miocene aged East Coast Bays Formation (ECBF), Pleistocene aged Tauranga Group (TG) sediments, volcanic deposits and within the Manukau Harbour, recent marine sediments. In addition reclamation of both coastal foreshores was undertaken in the late 1970s for the purpose of constructing the existing SH20 motorway.

3.2 Additional Geotechnical Investigations

Extensive geotechnical investigations were undertaken prior to constructing the existing 1970's Mangere Bridge this included laboratory testing comprising of unconfined compressive strength testing within the ECBF and this indicated it to be highly variable siltstones and sandstones. Additional geotechnical investigations were undertaken by the Alliance with the purpose of complementing the existing geotechnical data, confirming soil profile, obtaining geotechnical parameters upon which to base a pile design, and to develop a piling methodology that would assist in managing the geotechnical risk associated with the piling works.

The additional investigations comprised of rotary-drilled boreholes undertaken in two phases by Pro-Drill (Auckland). The first phase comprised of five land-based boreholes carried out in December 2007 and January 2008 and a second phase that comprised of three marine-based boreholes undertaken from the temporary staging that would assist in constructing the duplicate bridge in June 2008.

The machine-drilled boreholes ranged in depth from 45m to 60m and adopted both open (single) barrel and HQ triple tube drilling methods and included Standard Penetration Tests (SPT), hand-held Pilcon shear vane tests and laboratory unconfined compressive strength tests.

3.3 Soil Profile at Test Pile Location

The test pile was located 6m to the north of Pier One and the adjacent borehole located at the centre of Pier One revealed the following soil profile;

- 0.0 to 9.0m Fill material predominantly comprising

of scoria gravel
- 9.0 to 20.5m Tauranga Group Alluvium (firm to very stiff clayey, sandy silt with some organic layers)
- 20.5 to 25.5m Waitemata Group (extremely weak siltstone and sandstone SPT N values 60 to 70)
- 25.5 to 50.0m Waitemata Group (extremely weak and very weak siltstone and sandstone SPT N values >100)

Initially, the ECBF materials were extremely weak with SPT-N values between 50 and 70. Beneath this upper layer the strength of the siltstones and sandstones increased with SPT-N values consistently greater than 100 blows for a 300mm penetration. Unconfined compressive strength testing undertaken on retrieved core samples indicated a large degree of scatter with no general trends observed. The resulting unconfined compressive strengths ranged from 0.2 to 3MPa with the majority of the values between 0.7 and 2MPa.

4. Pile Load Test using an Osterberg Load Cell (O-Cell)

Following completion of the land based geotechnical investigation a full scale pile load test was designed with the following purposes:-
- Provide an opportunity to develop a piling methodology and to demonstrate that it was appropriate at this site;
- Provide direct comparison between the pile design and performance of large diameter piles and
- Increase confidence in the pile design, and then adopt an increased strength reduction factor in accordance with the Transit New Zealand Bridge Manual.

An 1800mm diameter test pile was designed by Alliance engineers this included determining founding depth, size and position of the O-Cell and extent of instrumentation. This diameter of the pile was considered representative of the range of the permanent pile sizes and scaling effects would not impede the interpretation of the results obtained.

Testing of the pile was undertaken using an Osterberg cell (O-Cell) as this offered an efficient method to undertake a test of this scale and would allow the simultaneous determination of both shaft and base resistances.

Strain gauges were used to assess the force distribution within the pile shaft above and below the O-Cell assembly. Traditional telltale casing and rod extensometers were placed at the top of the O-Cell and the pile toe to allow for measurement of the pile compression above and below the O-Cell assembly and provide actual pile toe displacements. The displacement of the O-Cell was directly measured by four 150mm stroke linear vibrating wire displacement transducers. The O-Cell and all instrumentation was provided by Loadtest, who also assisted in supervising the fabrication of the O-Cell assembly and carried out the load test. Calibration of the O-Cell was undertaken prior to shipping to New Zealand.

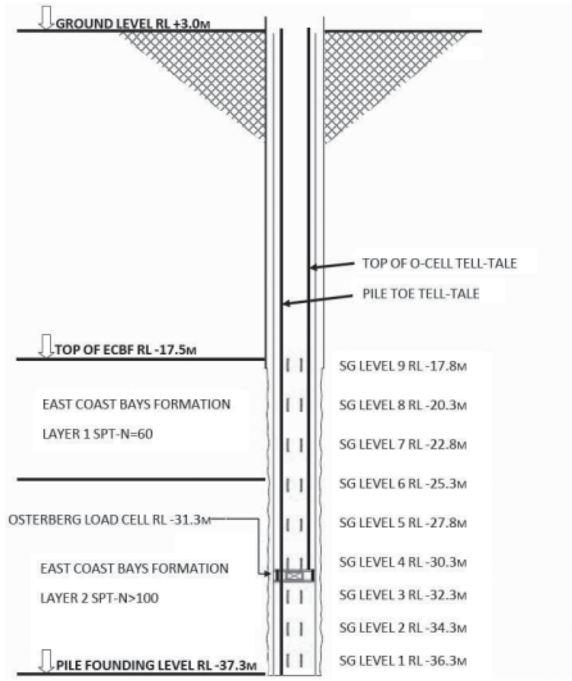


Figure 1: Arrangement of Test Pile Instrumentation

The test pile was designed with a 20m socket into ECBF from which an assessment of the fully mobilised shaft resistance and a proportion of the base resistance would be such that the upward and downward load was shared equally. The calculations predicted that the optimum position for the O-Cell was located 6m above the base of the pile. The upward and downward resistances were each calculated to be in the order of 24MN and a single 870mm O-Cell with a rated 45MN capacity was adopted for the test.

4.1 Piling Methodology for Test Pile

The construction techniques adopted Methodology for the test pile needed to replicate the permanent piles and grooving of the rock socket was considered too difficult to consistently reproduce in these large diameter piles. In order to maintain a simple and repeatable construction methodology the rock socket was bored and then reamed out to provide a roughened surface and remove the majority of the side wall smear. In addition, to represent the most detrimental conditions likely to be experienced whilst constructing the working piles, the test pile was filled with water for 24 hours prior to placing the concrete under water using tremmie techniques.

Based on the wide scatter of relatively low unconfined compressive strength test results obtained from the historical

Figure 2: Drilling 1800mm diameter MHX Test Pile

investigations, the formation of a stable pile bore within the extremely weak sandstones and siltstones was also considered to be a significant risk whilst constructing the piles. The geotechnical investigation identified that the ECBF could be split into two distinct layers based upon SPT-N values. The lower layer with SPT-N values greater than 100 was considered sufficient to allow a stable pile bore to be constructed without the need of any casing.

4.2 Construction of Test Pile

In February 2008, Brian Perry Civil constructed the 1800mm diameter 40m long cast in situ bored test pile using a self erecting R516 piling rig adjacent to Pier One within the southern Waterfront Reserve. The test pile was constructed based on the above methodology with permanent steel casing installed to a depth of 21m through fill, and TG materials before forming a seal 1m into the underlying extremely weak siltstones and sandstones.

The pile was excavated using a conventional bucket fitted with a reaming tool and the base cleaned using standard equipment. A video camera undertook a remote pile inspection prior to filling the pile bore with water that revealed the surface of the socket was suitably roughened. The light reinforcement cage was fabricated in two sections with all instrumentation and the O-Cell assembly attached. The final connections between the two cages and instrumentation were made as the cages were placed into the pile bore.

The time between excavating the pile and the commencement of the concreting operation was approximately 48 hours. Concrete samples were taken throughout the concreting operation and were tested to provide an indication of the concrete strength and stiffness.

4.3 Load Test Procedure

Loading the Test Pile was based on adopting an incremental load test as described within Australian Standard AS2159 (1995), *Piling-Design and Installation* based on a 12MN serviceability load and an incremental load test up to a maximum 18MN.

Following the application of each load increment, the load was sustained at a constant magnitude for the minimum specified load duration or until the rate of movement at the load cell was less than 0.5mm per 15min.

Following the completion of the above incremental load test an additional extended proof load test was undertaken that comprised of applying the 18000kN load in three equal steps and then increasing the load in

Figure 3: Installation of O-Cell within reinforcement cage of test pile.

2000kN increments until completion of the test. All of the instrumentation included within the test was connected through a data logger to a laptop computer that allowed data to be recorded and stored automatically at 30 second intervals.

The completion of an O-Cell test is when one of the following situations occurs:-

- The capacity of the O-Cell has been applied;
- The maximum travel of the O-Cell is reached (150mm) or
- The ultimate capacity of the pile above or below the O-Cell location has been reached.

5. Results from Manukau Harbour Crossing Test Pile

The pile load test was undertaken by Loadtest engineers 18 days after casting the pile at which time concrete strengths measured from test cylinders were all in excess of 45MPa. The testing continued over two days and the results are presented in Figure 4 and was concluded after the application of a maximum 30.21MN bi-directional load due to the O-Cell exceeding both its nominal rated capacity (22.5MN) and its maximum nominal 150mm stroke.

The maximum net upward load obtained from the test was 28.83MN (after subtracting the buoyant weight of the pile) and resulted in upward movement of the top of the O-Cell of 56.5mm whilst the maximum downward applied test load was 30.21MN and resulted in downward movement of the base of the O-Cell of 98.5mm.

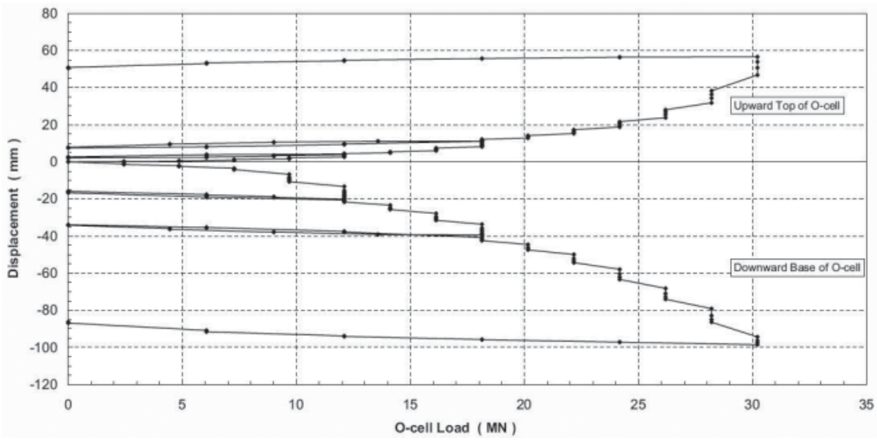


Figure 4: Measured displacements at each O-Cell load increment

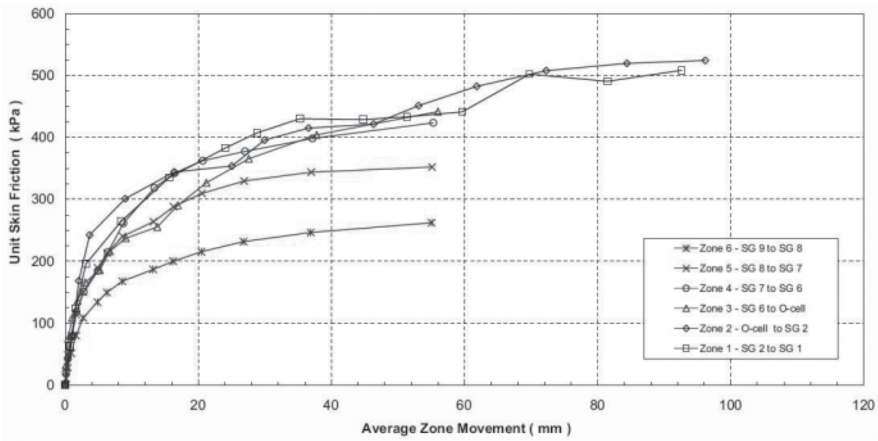


Figure 5: Measured Unit Shaft Resistance plotted against O-Cell displacement

5.1 Shaft Resistance Measured During Load Test

Mobilised unit shaft resistance curves are presented in Figure 5. These are based on the strain gauge data and estimated axial stiffness (AE) of 102,500MN and 86,300MN for the upper cased and lower uncased pile sections. This indicates that the unit skin friction continued to increase with no evidence of a pronounced peak despite pile movements in excess of 50mm.

The curve shapes indicate that all of the unit skin frictions are approaching their ultimate value. In addition, the maximum average unit skin frictions measured during the application of the maximum applied load are provided within Table 1.

The load transfer zones between strain gauges 9 to 8 and 8 to 7 were located within the upper layer of the ECBF where SPT-N values were measured to be approximately 60. All of the other load transfer zones were located within the lower ECBF layer in which extrapolated SPT-N values were measured as greater than 100 blows for a 300mm penetration.

The mobilized shaft resistances within the rock socket does not include data gathered from the strain gauges levels 3,4 & 5 closest to the O-Cell due to distortion of the results associated with bending the bearing plates upon which the O-Cell was attached.

Load Transfer Zone	Reduced Level (m)	Displacement (mm)	Unit Skin Friction (kPa)
Strain Gauge Level 9 to 8	-17.80 to -20.3	55.05 (up)	262
Strain Gauge Level 8 to 7	-20.3 to -22.80	55.14 (up)	352
Strain Gauge Level 7 to 6	-22.8 to -25.3	55.32 (up)	424
Strain Gauge Level 6 to O-Cell	-25.3 to –31.3	56.00 (up)	442
O-Cell Position			
O-Cell to Strain Gauge Level 2	-31.3 to -34.3	96.15 (down)	524
Strain Gauge Level 2 to 1	-34.3 to -36.3	92.64 (down)	508

Table 1: Average Unit Skin Friction Values measured during the Load Test

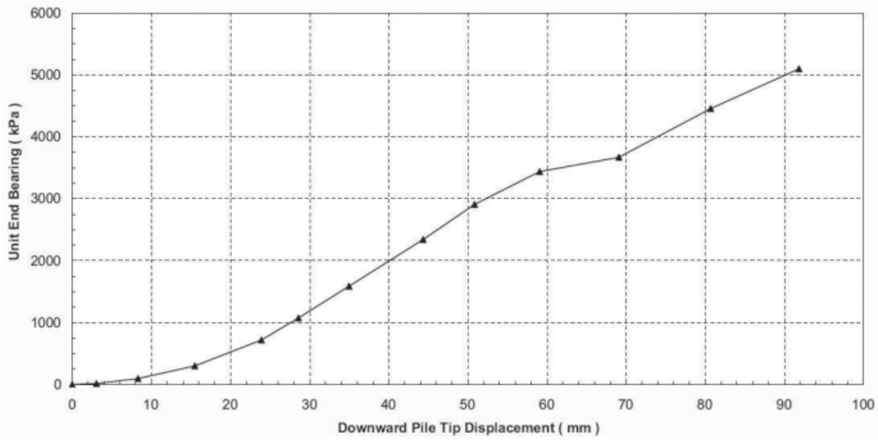


Figure 6: Measured Unit Base Resistance plotted against O cell displacement

5.2 Base Resistance Measured During Load Test

Simultaneously to the increase in unit skin friction, Figure 6 indicates that the unit end bearing resistance also increased and showed no signs of approaching its ultimate value. The maximum unit end bearing at the base of the pile was calculated to be 5100kN occurring at a pile displacement of 91.8mm.

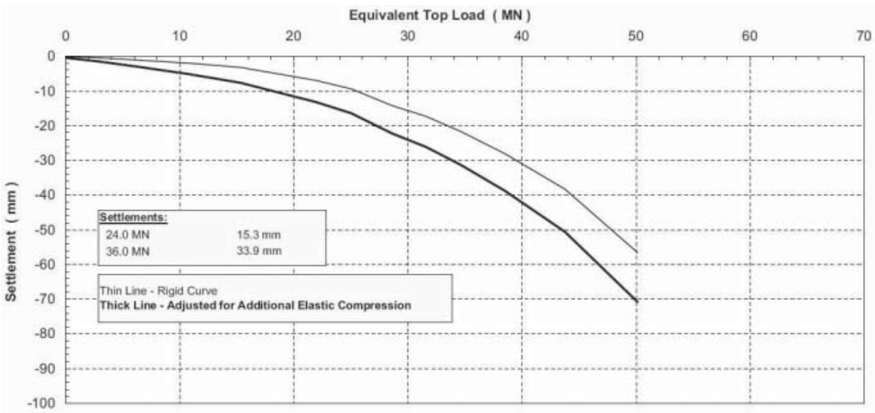


Figure 7: Equivalent top load verses settlement curve for a 1800mm diameter pile

6. Interpretation of Test Pile Results

In order to compare the O-Cell Load test results to those of an equivalent top loaded pile two equivalent top-loaded "Load –Settlement" curves were developed by Loadtest and are presented in Figure 7. The first thinner curve considers the movement of the O-Cell and is based on the pile acting as a free standing column with no resistance provided above the ECBF. The second thicker curve takes into consideration the additional elastic compression that would occur if the load was applied at the top of the pile.

In order to assist in controlling pile settlement particularly at working load, the adopted unit shaft and base resistances were based on the values associated with 40mm pile movement. These values were then considered to be ultimate geotechnical capacities to which strength reduction factors could be applied to make direct comparisons against required ultimate structural demands.

Unit skin frictions obtained from the load test (based on allowing a 40mm pile movement) over the upper 5m layer were 250kPa and 340kPa whilst within the lower second layer (SPT-N values >100) produced a relatively consistent 420kPa value. Similarly a 2000kPa value obtained from the test results was adopted for the ultimate base resistance of the pile.

7. Conclusions

The geotechnical investigation and pile load test have both successfully assisted in the development of both a construction methodology and preparation of a pile design that incorporated both shaft and base resistance.

The soil profile along the bridge alignment revealed by the geotechnical investigation and particularly the in-situ Standard Penetration Testing allowed the ECBF to be graded into two distinct layers. This assisted in providing an increased degree of certainty regarding the length of permanent casing required to reduce the risk of pile bore collapse and allow the piles to be constructed within the extremely weak and very weak sandstone and siltstone of the ECBF.

A construction methodology for the large diameter bored piles was developed based on the experience gained by constructing the test pile that include determining the casing length required to extend into the ECBF, excavation of a roughened rock socket using a reaming tool and concrete placement via tremmie techniques.

The test pile demonstrated the potential performance of a large 1800mm diameter bored pile that took 48 hours between commencement of excavation beyond the bottom of the casing and placing concrete in wet conditions.

The pile load test used an O-Cell situated 6m above the pile toe to effectively load the pile to 60MN and this provided sufficient upward and downward displacements from which to assess appropriate unit shaft and base resistances that could be incorporated into a pile design that would limit anticipated pile settlements at working load to less than 25mm.

8. Acknowledgement

The writer gratefully acknowledges the support received by colleagues from the Manukau Harbour Alliance.

9. References

1. *Institute of Geological & Nuclear Sciences Geological Map 2, Geology of the Auckland Urban Area*, scale 1:50,000 Les Kermode (1992)
2. *Auckland Structural Group Piling Specification* (March 2002)
3. AS 2159 – 1995, *Piling - Design and Installation*
4. Loadtest International Inc. Report on *Drilled Pile Load Testing (Osterberg Method) Test Pile – Manukau Harbour Crossing Auckland, NZ* (LT-2552) dated 04 March 2008.
5. *Transit New Zealand (2003).* Transit NZ Bridge Manual (SP/M/022) – 2nd Edition.

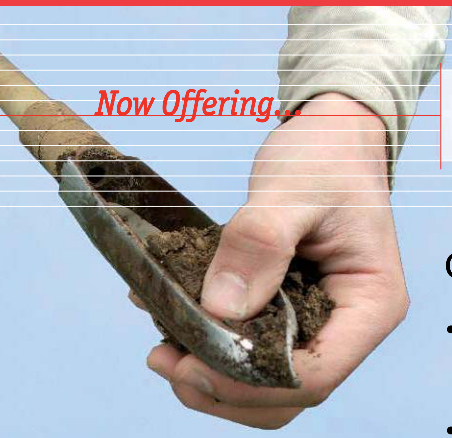
Reported by:
Mark Ballard
Manukau Harbour Crossing Alliance and Beca Infrastructure Ltd, Auckland, New Zealand

OPUS

Opus specialises in

GEOTECHNICAL TESTING & INVESTIGATIONS

throughout New Zealand



Now Offering...

Seismic Investigations and Analysis

Opus's services include:

- Cone Penetration Testing - electronic, manual and seismic
- Investigation drilling management and logging
- Triaxial - including Repeat Load Triaxials
- Consolidation and permeability testing
- Aggregates, Bitumen, Concrete and Soils Testing
- IANZ accredited
- Instrumentation
- Geophysical down hole logging
- Soil classifications

CONTACT

Gary Bentley
Central Laboratories
138 Hutt Park Rd
Lower Hutt 5610
Ph. 04 587 0600
Gary.Bentley@opus.co.nz

John Cunningham
Hamilton Laboratory
Fox Street
Hamilton 3216
Ph. 07 856 2870
John.Cunnningham@opus.co.nz

John Evans
Auckland Laboratory
Unit A, 7 Ride Way
Albany 0632
Ph. 09 415 4660
John.Evans@opus.co.nz

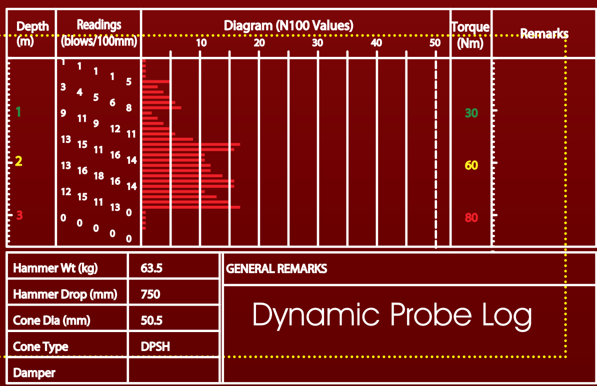
Denys Searls
Dunedin Laboratory
131 Main South Rd
Dunedin 9018
Ph. 03 488 0580
Denys.Searls@opus.co.nz

Geoff Jones
Christchurch Laboratory
52c Hayton Rd
Wigram
Christchurch 8042
Ph. 03 343 0739
Geoff.Jones@opus.co.nz

Geotechnical Sampling and Testing Rig

- Compact & manoeuvrable with a quick set up time
- 100mm Ø samples in clear plastic liner for easy logging & sub-sampling
- Ideal for sampling to depths of 5 to 8m
- Excellent sample recovery
- Stepped down sampling from 100mm Ø to 56mm Ø
- Sample catchers for loose material or soft soil
- Sampling in soils to very weak rock, N<35
- Concrete & Asphalt coring attachment

- Dynamic Probing (Fixed cone)
  - Dynamic probing to 30m in suitable ground
  - Excellent for locating voids, or obstructions
- Standard Penetration Test (SPT)
- Instrumentation installation – piezometers, gas & water wells



Dimensions	
Working height	2.85m
Width	0.8m
Overall height mast down	1.5m
Overall length	2.7m
Total weight	1300kg plus a 7000kg reaction load
Terrier Rig ground bearing pressure	33 kPa

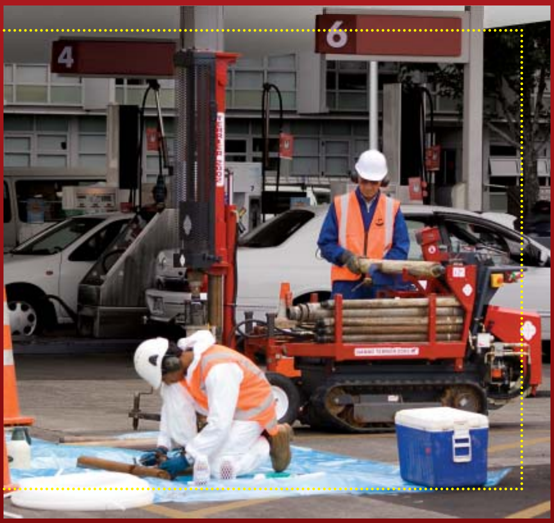
GEOTECHNICS LTD
23 Morgan Street, Newmarket, Auckland 1023
PO Box 9360
Newmarket, Auckland 1149, New Zealand

p. +64 9 356 3510
f. +64 9 356 3511
e. enquiries@geotechnics.co.nz
w. www.geotechnics.co.nz

GEOTECHNICS

Environmental Sampling Rig

- Compact & manoeuvrable with a quick set up time
- 100mm Ø samples in clear plastic liner for easy logging & sub-sampling
- Excellent sample recovery
- Spark arrestor enables work in petroleum installations
- Minimum disturbance to the environment
- Low mast height, therefore can work under forecourt canopies
- Cores through concrete & asphalt



- Simultaneous casing which minimises cross contamination between successive sampling runs

Dimensions	
Working height	2.85m
Width	0.8m
Overall height mast down	1.5m
Overall length	2.7m
Total weight	1300kg plus a 7000kg reaction load
Terrier Rig ground bearing pressure	33 kPa

GEOTECHNICS LTD
23 Morgan Street, Newmarket, Auckland 1023
PO Box 9360
Newmarket, Auckland 1149, New Zealand

p. +64 9 356 3510
f. +64 9 356 3511
e. enquiries@geotechnics.co.nz
w. www.geotechnics.co.nz

GEOTECHNICS

BUILD A ROCK SOLID CAREER WITH MWH

MWH is an established leader in the provision of water, wastewater, highways infrastructure, energy, environmental and building services throughout New Zealand and the wider Asia Pacific region. Our geotechnical engineers, who provide specialist support to the MWH project teams and expert services directly to clients, are vital for our continued success.

We're keen to maintain and build our geotech centres of excellence based in Wellington, Nelson, and Christchurch. These teams support and advise on small and large projects locally and throughout Asia and the Pacific so travel opportunities may arise. We also have vacancies in other offices.

We need skilled geotech specialists and leaders with design expertise to mentor and coach others and apply their expertise in a design and review capacity. We are also searching for staff with business development and client relationship aspirations and skills to shape the direction of this vital business line.

As an expert in your field, there is the potential to become a Technical Specialist. This is a nationally recognised role that contributes to technical design, project risk assessment and business development at the highest level. Showing technical excellence & proven leadership also has the potential to see you develop into a National Discipline Leader in the future.

When you join MWH you'll enjoy variety of work, technically challenging projects and a supportive and friendly team environment with national and global opportunities.

Plateau Hut Construction, Mt Cook 2005

For more information, please contact Megan Davey on 09 580 7681 or megan.davey@mwhglobal.com

MWH

BUILDING A BETTER WORLD

INFRASTRUCTURE AND ENVIRONMENT EXPERTS

World Cup Geology – Redevelopment of Eden Park South Stand

As part of New Zealand's preparation for the upcoming 2011 Rugby World Cup, the redevelopment of Eden Park South Stand is currently well underway. The main contractors for the redevelopment are Fletchers Construction with Connell Wagner providing the structural design for the new south stand.

An engineering geological assessment of the area around the South Stand was carried out as part of the structural design. This included a review of the geological literature, available historical geotechnical information and the results of a contemporary ground investigation, mainly comprising a combination of cored and percussion boreholes. In addition, in situ cross-hole shear wave velocity tests from ground level to 30m depth within a series of cased boreholes was carried out in order to classify the site in terms of the Site Hazard Spectra in accordance with NZS1170. The drilling contractor for the investigation was Boart Longyear and Sub Surface Imaging carried out the geophysical testing.

Geological assessment

The findings of the geological assessment were as expected, with the geology beneath the South Stand generally comprising around 1m of fill over scoria and rubbly vesicular basalt that becomes very strong, well jointed, crystalline basalt lava with depth. The source of the lava is the Mount Eden volcano (Kermode, 1992) and the total thickness of the basalt was found to be between 18m and 28m. Two distinct lava flows were identified from analysis of the intrusive investigation and these were separated by the presence of a water-bearing scoria layer. In some cases a 1m to 2m layer of soft to firm variably organic clay or silt further separated the lava flows. At the base of the flows, alluvial sediments of varying thickness was encountered, which lie directly upon East Coast Bays Formation rock. A thickness of between 1m and almost 12m of alluvial material was recorded within boreholes drilled in behind the South Stand, suggesting the presence of an old stream channel beneath.

Searle (1964) explained that the topography of the area around Eden Park resulted from Mount Eden lava flows moving westwards down a valley and becoming constrained by lava flows that originated from Mount Albert, resulting in the formation of a lava lake. He postulated that the lava lake suddenly broke free, resulting in the level of the lake quickly falling and the temporary solidified surface of the lake collapsing. A number of small sinkholes resulted, with water collecting to form ephemeral swampy lakes such as Cabbage Tree Swamp – the now infilled and developed Eden Park Stadium site.

Foundations

Foundations for the stadium comprise square pads varying in size between 800mm and 1.9m square. Depending upon the findings of the ground investigation and proof drilling, the pads are founded directly onto basalt rock or are embedded 500mm within the scoriaceous basalt material. At the construction phase of works, following demolition of the South Stand, rock head levels were found to vary considerably between foundation locations. Plate 3 shows

Above: Plate 1. Drilling on the hallowed turf, prior to demolition of the "old" South Stand.

Left: Plate 2. *in situ* cross-hole shear wave velocity tests

the southeastern corner of the site where a large amount of fill material was encountered; Plate 4 shows very strong basalt at relatively shallow depths some 60m to the west.

Proof drilling at each pad location was undertaken to determine the depth and thickness of competent basalt and preceded the foundation excavations. A minimum thickness of 5m of competent basalt was proven beneath each pad foundation by proof drilling.

Where an abundance of very strong basalt was encountered "near surface", controlled blasting was carried out on site in order to achieve excavations at the design foundation level.

Several cylindrical, vertical hollows were encountered within the basalt lava during foundation excavations. Searle (1964) suggests such features are tree moulds which are common in the Auckland region, especially to the north of Takapuna beach.

Above: Plate 3. Where's all the rock gone? **Below:** Plate 4. There it is!

Above left: Proof drilling at foundation excavations **Right:** Finished foundation excavation

Above: One of the large crane base excavations behind the South Stand

continue over page >

Above left and right: A deep, vertical hollow within the foundation excavation filled with water. This was pumped out and cleaned prior to the construction of the foundation itself.

Above: The circular hollow was approximately 2.5m deep


Above: Going, Going, Going…Gone! Eden Park South Stand demolition as recorded by the engineering geologist. (**clockwise from top left,** 21/08/2008, 26/08/2008, 03/09/2008, 12/09/2008)

Demolition of the South Stand

The "old" South Stand has been completely demolished and the groundwork for the new structure is well underway. Future work at Eden Park Stadium includes the redevelopment of the East Stand and West Stand with the delivery date for the completed Stadium expected late 2010 (www.eprb.co.nz).

Reported by:
BI Thomas and H Higham
Connell Wagner, Auckland

References

Kermode, L O (1992) *Geology of the Auckland Urban Area.* Sheet R11 Scale 1:50,000. Institute of Geological and Nuclear Sciences Geological Map 2, 1 sheet & 63p. ISBN 0-478-07000-4.

New Zealand Standards (2004). *NZS 1170 Structural Design Actions*, Part 5 Earthquake Actions – New Zealand. NZS 1170.5 Supp 1:2004

Searle, E.J. (1964) *City of Volcanoes. A Geology of Auckland.* Halstead Press, Sydney, Australia ISBN 0-582-71784-1

www.eprb.co.nz Eden Park Redevelopment
(October 2008)

An Unusual Contact – Whitford Quarry, Whitford

Introduction

The Whitford Quarry, located some 6km south of the Beachlands settlement in east Auckland, is operated by Fulton Hogan Ltd. Resource primarily in the form of 'greywacke' rock, is actively being extracted from the quarry, crushed and sold as aggregate.

The quarry is located in close proximity to a large fault (Waikopua) and has overlying younger sediments that mantle the resource rock.

Riley Consultants Ltd has been involved in stability assessment of existing and proposed cuts and excavations within the quarry. During our inspections of the cut faces the geological contact between the older 'greywacke' and considerably younger overlying sediments has been exposed at several locations.

This article presents a brief summary of the nature of the contact including cursory observations and stability characteristics of the geological units in proximity to the contact.

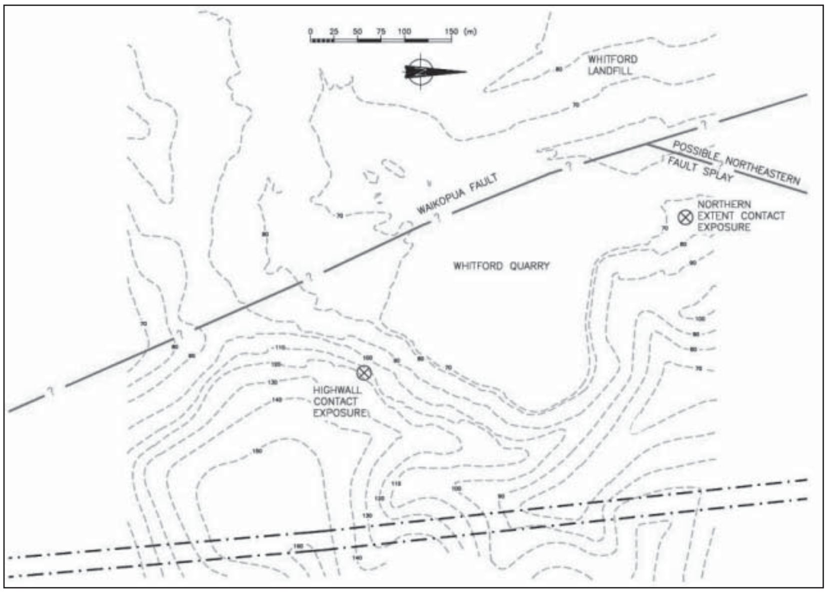


Figure 1: Plan of relevant features at Whitford Quarry

Geological Environment

The Whitford Quarry has been developed in sheared, argillite dominated rock of the Waipapa Group. This material at Whitford is typically referred to as 'greywacke', however this term is more accurately applied to coarser grained materials, such as indurated sandstones. For consistency with other publications and reports, the quarried material is referred to as greywacke within this article.

The quarry is generally being excavated eastward into relatively steep bush covered terrain. To the west is gentler terrain, including the artificial hill of the Whitford landfill (which will eventually backfill the quarry). Figure 1 shows the location of key elements.

At the quarry the rock has a cataclasite texture and primary bedding is difficult to discern. Where bedding is rarely discernable it is typically steeply dipping at 60°+.

The Waikopua Fault borders the uplifted greywacke of the Maraetai hills and defines the western extent of the quarry resource. The fault crosses the existing quarry floor and at the present time broadly divides the quarry from the adjacent landfill (which is developed on Waitemata Group deposits). Drilling results and geological mapping indicates there is a possible obscured fault zone passing northeast through the northern corner of the quarry, however this has not been directly observed.

Overlying the greywacke around the periphery of the quarry is younger Waitemata Group deposits, typically comprising alternating beds of sandstone and mudstone of the East Coast Bays Formation (ECBF). Separating the ECBF from the underlying greywacke at Whitford quarry is typically a variable thickness of highly weathered Cape Rodney Formation (CRF) consisting of a pebbly conglomerate in a silty sand matrix up to 4m-5m thick.

Greywacke/Waitemata Group Contacts

The contact between Waipapa Group (greywacke) and Waitemata Group is naturally exposed in several locations along the margins of the mainland and islands of the Hauraki Gulf. This includes Leigh and Tawharanui on the mainland, along with Kawau, Motatapu and Motuihe Islands. Other locations also exist. However, these contacts are not within an active quarry.

Although not studied in detail by the author, the contact between greywacke and basal Waitemata Group at the above listed sites typically comprises an undulating greywacke top, punctuated by old sea stacks, with depressions filled and overlain by pebbly in-fills (CRF). Overlying this is generally sandstones and mudstones of the ECBF or Pakiri Formation (a unit similar to ECBF).

At the Whitford quarry the contact between greywacke and overlying units has been observed at two locations (excluding drillholes). The first near the crest of the 60m tall highwall, whilst the other is at the quarry's northern end, adjacent to the Waikopua Fault, where stripping operations have been recently performed.

Figure 2: Exposure near crest of highwall in 2005. Geologist is picking at white chalky material whilst standing on highly weathered greywacke rock. Above is pebbly Cape Rodney Formation.

Figure 3: Exposure at northern extent of quarry showing dipping weathered greywacke, the top of which is marked by dark greenish colouration. This is overlain by mixed deposits including dark brown silt, which is apparently unconformably overlain by Cape Rodney Formation. The Waikopua Fault is some 90m to the west (left).

Highwall

At approximately RL120, near the highwall crest, highly to completely weathered greywacke rock is overlain by CRF. The contact is gently undulating, though would appear to have an overall gentle dip to the north (6° to 8° northward based on structural contouring).

Interestingly, during excavations in 2005 an unusual exposure was created of approximately 1m-3m of CRF overlying a unit of weathered sand. This lensoidal sand ranged in thickness from 0.0m to 0.6m and appeared to be infilling a palaeo erosion surface on the weathered greywacke below, but also possibly inter-fingering with the CRF at the extremities (although this is uncertain due to limited access). Within the sand were lenses of a white chalk like material up to 0.15m thick. The 'chalk' contained pockets of carbonaceous material up to 5cm thick and 30cm in length. These pockets contained unusual rounded pebbles, inferred to be weathered sandstone. This material extended some 20m laterally and is shown in figure 2.

Quarry Northern Extent

Recent excavations at the northern extent of the quarry have exposed the contact between the greywacke and overlying units as shown in figure 3. This can be compared against the limited exposure in the current highwall as discussed above. The greywacke has an undulating palaeo-surface with apparent channel infill and beds of dark brown (possibly carbonaceous) silt, similar to that observed in Waikato Coal Measures (Te Kuiti Group) seen in Papakura. Also included are apparent rounded greywacke gravels (often with a yellowish sulphur colouration). This sequence is no more than 1m thick over the exposed section with carbonaceous beds dipping sub-parallel with the greywacke interface. It appears to have an undulating, unconformable contact with the overlying CRF pebbly beds above, with an average interface dip of 22° to the northwest. Within the CRF were organic silt horizons with a bed dip of approximately 6° northwest.

The upper, completely weathered greywacke had a greenish colouration, which is unusual compared to other current Whitford Quarry exposures.

Te Kuiti Group?

Previous investigations at the quarry, e.g. GF Industrial Geology 2000, have speculated on the possible presence of isolated Te Kuiti Group deposits around the Whitford Quarry.

The materials recently encountered in the northern faces and highwall share similarities with some Te Kuiti Group deposits. The presence of Te Kuiti Group deposits is known in Papakura some 15km south of the quarry and also in deep coring under Auckland city isthmus and Ardmore, however the author is unaware of any occurrences recorded near-surface in the Whitford-Clevedon area.

It is also considered plausible the described deposits are constituent members of the CRF or the larger Kawau Subgroup as defined by Kermode 1992 and Edbrooke 2001.

The carbonaceous bedding dip within the subject material is sub-parallel with the eroded greywacke surface. That this dip is unconformable with the overlying sequence is another interesting aspect. The relative close proximity of the Waikopua Fault may have an influence, through drag effects, on the bedding angles. It should be noted however, judging bedding dip from organic rich layers may not always be reliable.

Massive ECBF sandstone units in the immediate vicinity of the CRF at the northern extent of the quarry have

Figure 4: Steeply cut Cape Rodney Formation at the northern extent of the quarry.

an unclear relationship to the CRF exposure. It has been previously postulated by others that a northeast striking fault is present in the area and this may somewhat explain the uncertainty.

It is unclear from published information whether Kawau Subgroup has internal unconformities that would give rise to such divergent bedding dips.

Geotechnical Properties

Whilst pondering over the geological relationships is all very interesting, the materials exposed have to be worked to form a quarry or landfill.

With respect to the highwall exposure limited tri-axial testing was performed on the weathered basal ECBF sandstone beds and also the underlying CRF recovered from core. For the ECBF results of c'=15kPa and ø'=32º were achieved, whilst for highly weathered CRF a single test gave c'=42kPa and ø'=31º. Such parameters are consistent with back-analysed numbers.

Stability

CRF can be battered at relatively steep angles of up to approximately 70º to heights of 3m-4m as shown in figure 4 and exhibit good stability. The batter at the quarry shown in figure 4 has shown relatively excellent stability for at least 5 years with one minor failure along an apparent major joint.

This excellent stability characteristic is thought to be primarily attributable to relatively high strength and superior drainage.

The contact between the greywacke and overlying materials could potentially act as a failure plane. In the Whitford Quarry this contact is typically undulating and rough. Also, the orientation of the contact has not yet been unfavourable to stability; however this could change with further highwall excavation.

Summary

The contact between basal Waitemata Group and underlying greywacke deposits is currently exposed at 2 locations within the Whitford Quarry. In both situations unusual deposits or structures have been observed adjacent to the interface. It is uncertain whether these deposits relate to Te Kuiti Group or perhaps Kawau Subgroup, of which Cape Rodney Formation is a member.

In cut, the highly weathered Cape Rodney Formation typically performs well due to relatively high strengths and a freer draining characteristic than adjacent materials. The Cape Rodney material would appear to be affected mildly by jointing.

References

Edbrooke, S; 2001: *Geology of the Auckland Area.* IGNS

GF Industrial Geology Ltd; 2000: *Assessment of Rock Quality at Whitford Quarry*. For GHD Ltd

Kermode, L: 1992: *Geology of the Auckland Urban Area. IGNS.*

Report by: Steven Price
Riley Consultants Ltd
sprice@riley.co.nz

HISTORICAL RECOLLECTIONS

Don K. Taylor

The Geotechnical Society

The changes in the name of our society mirror changes in the practice of geotechnics. First Soil Mechanics and Foundation Engineering then Geomechanics Society, now Geotechnical Society – the shift to include geology and rock mechanics in a much broader view of the physical environment in which civil engineering operates.

There has been a large proliferation in the sophistication of investigation, testing and analytical techniques available – one has only to look at the range of advertisements in NZ Geomechanics News. Much of this has been generated by ever larger infrastructure and building projects around the world.

Also there has been a shift to much more integration and continuity through investigation design, construction and operation.

Early Interest

My own interest in all this began, when as a cadet in the Public Works Department, I chanced upon Cotton's "Geomorphology" (1942 edition) which I was then able to read with other geology books during War Service in the Pacific. Back at university from 1947 I was able to combine "bread and butter" engineering studies with a degree in geology. At that stage Pip Alley must have been moving towards Soil Mechanics but the subject was not taught.

Contact with "running sands" in early suburban development at Porirua – Titahi Bay and with shifting rock in the Rimutaka Tunnel preceded a move to England for the big "OE" in 1952. I looked for Engineering Geology at Imperial College – I found that it appeared to be mainly palaeontology for Engineers. What was needed was a study of Engineering for Geologists. Almost by default then I secured a post-graduate scholarship to study "Soil Mechanics" under Skempton, Bishop and Heinkel in company with fellow kiwis Alan Watt doing an MSc and John Hollings and Peter Nissen who were filling in other studies.

Our lecturers were leading the world in the subject. Bishop in particular was intensely into effective stress mechanism.

New Zealand

Back in New Zealand I met Ralph Tonkin during the construction of the Auckland Harbour Bridge approaches where we indulged in some rudimentary earthworks and paving subgrade investigations as part of our supervisory duties.

Peter Taylor has recounted (in his memoirs) the beginning of Geotechnics Ltd and the practice of Tonkin & Taylor Ltd.

At that time (1960) the only other site investigation and testing laboratories were those of Roy Northey at DSIR, Ministry of Works Auckland (under Ken Odlin and Sam Cornwell) and R.G. Brickell (Brickell and Smith), the only other firm in private practice (University Labs at Auckland and Canterbury did some outside testing). There are many more firms now.

Tonkin & Taylor

It was soon apparent that soil mechanics tests had to be planned and interpreted in close relationship with experience in civil engineering. The earlier overseas practice of drilling, sampling and testing by contractors to a standard set of specifications was unsatisfactory and in any case such contractors did not exist in New Zealand.

While the practice (now Tonkin & Taylor Ltd) diversified in general civil engineering, earthworks, roading, earth dams, water resources, hydro electric and associated structures, and later into environmental work, there continued a heavy commitment to geotechnical specialisation. Its this aspect which is the focus of the following notes.

Investigation Objectives and Methods

In contrast with the more fragmented operations current overseas I believe that we can claim to have initiated (at least in New Zealand) the cohesive interactive operation of planning, drilling, sampling, testing and interpretation through design, construction and operation phases of projects, in the geotechnical phase. From a small number of available drillers a few were engaged on a time and expenses basis to work under the "hands-on" direction of engineers with sufficient experience to shape the process to address the particular engineering concerns of the project. The logs were written by the supervising engineers (and later by trained technicians with daily contact to the engineers) and the site and laboratory testing tailored to the project.

A growing incorporation of geomorphological and geological examination has contributed greatly to interpretation of spacial continuity and likely variation of ground conditions down, and between inevitably wide spaced boreholes and samples.

Penetrometer and other remote means of evaluation are, for me, infill supplements to direct examination of the foundation materials in extracted samples, in natural exposures, in open pits when this is practicable, "seeing is believing".

In one of our investigations for the Ministry of Works, designers of public buildings (in the 1960s), I had myself lowered below the bottom of a 24 inch (600 mm) diameter casing to inspect the broken mudstone, the founding material for bored piles. A pre-OSH adventure.

The unsung heroes were the technicians who had augered bores where drill rigs feared to tread. These holes gave us at least a visual appreciation of soil type and supplemented with dynamic penetrometers, a measure of consistency.

That the business succeeded was I think, due to several factors:

- The service was provided by civil engineers of some experience who had studied soil mechanics and geology.
- There were structural engineers who wanted reliable geotechnical investigations done by people who understood their problems
- And (least satisfactorily) once the service was there, anyone who didn't use it might risk being called negligent.

Some Projects of Geotechnical Significance

Spread Footings

The South Pacific Hotel (now the Hyatt) was one of the many building site investigations in central Auckland in the 1960s. With the assistance of samples in 4 inch BRS steel tubes airfreighted to New York, we persuaded Dames & Moore from their pre-occupation with "bed rock" under a layer of glacial fill, to accept compensated spread footings in weathered sediments. The building appears to be comfortable with the decision.

Similar pre-conception from our familiar environment dog our advances into new areas in all aspects of engineering.

Piled Foundations

The foundations of major industrial buildings are but a necessary precursor to the real business of erecting the superstructure and installing the plant that will earn money, and should not be delayed by sophisticated site investigations designed to optimise those foundations which relatively speaking are a minor part of the total cost anyway.

The New Zealand Steel Mill at Glenbrook occupied a large area underlain by volcanic rocks of heterogeneous composition with erratic variation of weathering.

A pattern of drill holes indicated that groups of piles would vary in length from 3 to 20 m. The pre-casting of concrete piles of that range of length was modified by driving pilot piles over the whole site. This saved time and resulted in few piles requiring lengthening in-situ and only a modest surplus. A constriction on piling practice in New Zealand is the absence of "Kentledge" to provide the test loading. In Kuala Lumpur for example hundreds of tonnes of concrete block Kentledge are available for hire.

Pile loads at NZ Steel are moderate and testing was done by cantilevering off stacks of the pre-cast piles, with tie downs to adjacent piles.

For the Huntly Power station, by contrast, piles were much longer and needed 600 tonnes of test load. This we did by anchoring a pile cap with pre-stressed cables to an annular concrete ring buried under a stack of sand.

Pumiceous Sands

A feature of the geomorphology of New Zealand from Taupo to Auckland is the deposits of pumiceous sand from the Taupo eruption and subsequent working by rivers. These sands have a high in-situ permeability (about 10^{-1} cm/sec) and submerged bulk density about half that of normal siliceous sands resulting in lowered resistance to hydraulic uplift and piping erosion.

The lower Waikato River Control Scheme includes some 74 km of stop banks close to the river channel on both sides and underlain by at least 15 m of the evil pumiceous sands, silts and some peat in erratic lensed deposits of the irresponsible meandering of the river over the flood plains.

Definitely gum boot country – or worse! I personally spent weeks paddling through flood water to drill rigs and a site lab (caravan).

Of necessity boreholes were widely spaced, difficult of access, and the soils hard to sample. Samples from BRS or Bishop sample tubes provided at least visual identification of strata and allowed remoulded permeability and grain size tests.

Analyses of seepage and hydraulic uplift had to be based upon very much idealised models supplemented by a large scale field test of a ring bank around a pond. The stop banks were then designed to take advantage of the common overflow silt layer at the surface, with a clay upstream section reinforced with pumped river sand extending downstream and perforated with a relief drain. Relative to the cost of the basic bank, the downstream sand berm and pumping from the relief drain were estimated to increase the cost by about 14% whereas even a shallow cut off below the bank would double the cost.

There comes a time when investigation has done all that it can, and a commitment to construction has to be made – or the project above abandoned.

The only subsequent sever testing of the banks resulted in some piping in vulnerable sections but no collapse.

Open Caisson

A very satisfactory collaboration between investigations and Ministry of Works designers prior to, and during construction, lead to modifications in procedure which resulted in the successful sinking of a huge open caisson, about the size of the Karapiro generator hall, forming the cooling water intake for the Huntly Power Station – in the dreaded pumiceous sands.

Landslips

Far removed from major projects justifying expensive investigations are the problems of house owners of modest means particularly on sites subject to slope movements. Tonkin & Taylor dealt with multiple slips in Auckland in 1965, 1979 (28 in 14 days) and 23 more in 1984.

The NZ Geotechnical Society has addressed the problem in symposia and publications in 1974, 1977 (DSIR information series publication Series No. 122), 1978 with the Council of Insurance Adjusters, 1980 (handbook), and 1981.

I have been sounding off about it all the time; why stop now!

In spite of all the talk, Local Authorities have moved only a little way towards preventing their rate payers from building on ground judged risky by simple geomorphological examination. More detailed investigation and analysis involves cost beyond owners' means if they are to advance the assessment by much.

For example, our protracted examination of six adjacent lots in a subdivision in Auckland exhibiting significant slope movement produced a comparison of costs in stages of increasingly complex investigations (in 1975 cost terms).

A superficial inspection of the site and of stereopairs of aerial photos clearly showed an ancient slump ($200) (Cost Factor 1). Drilling, sampling, testing defined the quality of soils but did not succeed in quantifying the forces acting (a further $7,900) (Cost Factor 38).

If samples could have been extracted from a thin failure zone, residual strength testing and analysis would have cost a further $2,000 (Cost Factor 100).

Stabilising measures and subsequent proof monitoring were estimated at a further $40,000 (Cost Factor 200). A total cost of $51,800 for six building lots and a questionable insurance remaining (Cost Factor 259).

Overseas

Following a Ministry of Foreign Affairs initiative in 1970 New Zealand engineering firms surged overseas to unknown places as widespread as Malaysia, Indonesia, Philippines, Solomon Islands, Fiji, Samoa, Kenya, Laos and Iraq.

Some projects involved significant geotechnical input in a physical and social environment different from New Zealand. Poorly developed infrastructure hampered transport, and communication limited drilling and test facilities.

Social differences in contractual arrangements, patronage and handling of money, and the approach to sharing out employment were a new experience and often frustrating. Have you ever tried to buy a pencil in the wilds of Fiji when biros would not write borelogs in the humidity?

Innocents abroad – but still learning.

In Laos I was introduced to the "two envelope" system of payment and to the idea that the locals would like the job to last long and be spread amongst their friends and relatives – regardless of my tight time constructions.

Sophistication

Since those early days, new and much more sophisticated equipment and facilities have developed including:

- Mobile radio and cell phone communication save time and frustration in the field.
- Aerial and satellite imaging and positioning invaluable on extended sites (try locating yourself on a 4,000 acre peat swamp).
- Computers! (Compose eight figure log tables in the surveying field.)
- Small, mobile specialist drill rigs ease the back of the handaugerer.
- Down the hole testing and logging of all sorts of soil properties; in-situ mobile TV inspection.
- Ground improvement work and monitoring
- In-situ pavement testing.

For all these advances shouldn't we remember that nature is oblivious of our ambitions? We can understand it, use it, abuse it, nudge a little but not really change it.

Don Taylor
NZGS Chairman 1974 – 1976
NZGS Life Member

Peter W. Taylor Looks Back

I found your special 50 year celebration issue fascinating. I was deeply involved in geotechnical matters myself fifty years ago, in the Engineering Department at Auckland University, then at Ardmore. I was lecturing in what we then called "Soil Mechanics", and was developing a geotechnical laboratory, in which I took great pride. It was something very new in those days.

Ralph Tonkin

I was rather sad that Ralph Tonkin was not mentioned in your special edition. He is one who deserves to be remembered, as being in at the very beginning of Tonkin & Taylor. The Harbour Bridge and its approaches had just been completed, resulting in several civil engineers looking for employment. As there was no such service available then in Auckland, I suggested to Ralph that we set up a geotechnical laboratory, and asked him to manage it. His reply was, "Yes, provided I can start a consulting practice alongside" to which I readily agreed. To finance the project, we contributed a small amount each, but the bulk of the money was provided by Nigel Smith, the importer of the equipment. I think there was 'import licensing' at that time so we were very dependent on him.

To prepare himself, Ralph regularly drove to Ardmore where he conscientiously performed all the geotechnical tests that our students did.

He had a remarkable combination of talents. He could size up an engineering project in a flash, and come up with a workable scheme. He could play golf with a prospective client and convince him of the soundness of the scheme and the expertise of the firm. Truly a man to be remembered.

The initial policy, of doing test work for any consultant that asked, came unstuck in the very first year, when an engineering failure was blamed on a test result when the fault could be just as easily be attributed to misinterpretation or misapplication. Ralph's consulting activities were broadening, so it was decided to perform test work only for jobs being done in house.

To round off the story of the birth of Tonkin & Taylor, Don Taylor bought out Nigel about a year later, and the two partners had a harmonious relationship in a phenomenally successful enterprise for a good twenty years or more. I admire them especially for resisting the tempting offers from overseas firms to "amalgamate" in which the firm would have lost its identity.

In 1969 Ralph took part in a Colombo plan evaluation of projects overseas which could use New Zealand expertise and could be funded by NZ aid money. This lead to engineering firms working in Malaysia and Indonesia then expanding to Kenya Philippines, Laos, Solomon Islands and Fiji and the establishment of joint ventures and overseas offices which function to this day.

Ralph unfortunately developed Alzheimer's disease, which became apparent in letters that Don and I saw which did not make sense. That was the first indication but the condition soon worsened. Then he was not permitted to drive a car so he bought a bicycle. He died in 1985. A sad end for a man of great capabilities.

Whau Valley Dam, Whangarei

Ralph and I cooperated in the design of Whau Valley dam, which continues to provide most of Whangarei's water. I believe that story is worth recalling.

I used to call in fairly regularly to see the Whangarei City Engineer, a man of advanced years. How it began, I don't remember exactly, but it was perhaps that I had been recommended to him by Cyril Firth, in the Waterworks Department of the Auckland City Council, where I had worked in a very junior capacity earlier. (My first job, in fact.)

There was strong public opposition to the dam. The local radio station had aroused the wrath of the citizens by saying that it would be "a sword of Damocles poised above their heads", no doubt envisaging a thin concrete arch dam. Their concern was understandable.

The Whangarei Engineer proposed that we should be appointed to do the job, saying that we would have to appear before the whole Council. I personally dreaded this. They were bound to ask what dams we had designed before. The answer was "Not a lot – only a few farm dams". But we were accepted to design the dam and no doubt each breathed a sigh of relief. As I mentioned above, Ralph could and did envisage the layout of the whole project. I designed the dam itself. It was not the easiest of sites, having a deep layer of

compressible clays beneath it. The solution was to build it over two seasons, to allow time for pore pressure dissipation. Its most vulnerable times were at the end of each construction season and its safety could be checked using the instrumentation installed. At that time, there were many newly-devised instruments that could be inserted during

construction. When built, it was the most highly instrumented dam in the country!

We found a very capable site engineer, who was surprised when I insisted that he exactly follow the specifications, carefully written by me after much study of world literature. So there are many wires, tubes etc that lead to the gauge house, with provision for de-airing the tubes. Regular monitoring followed, but for how long I know not.

As soon as the good citizens of Whangarei saw the great width cleared for the dam base, their fears subsided. I have visited the dam from time to time but have been disconcerted to find it looks like some hillside in the bush, covered with large trees, and not with the smooth green lawn, kept in trim by mowers (or sheep) that I had envisaged.

Then and Now

Leafing through Geomechanics News caused me to ponder on the changes that had taken place during half a century. Some changes have indeed been major. The specialist geotechnical processes then available were very few. Now a large number of firms offer their expert services for a great variety.

Enormous changes have taken place in the engineering profession. It is now much more 'professional', in that it is mindful of its public image. Membership fees have escalated and many more short courses and mini-conferences are held in expensive places. My memories go back as far as the days when it was the "NZIE" and tended to be run by 'the old guard'.

There has been an enormous increase in the number of small conferences at luxury locations with colossal fees, tax deductible no doubt, and also in the number of small groups or "sub-societies" with their own restricted range of expertise.

On the other hand, the questions being raised in correspondence seem to be much the same as they used to be.

The University's 100 Years of Engineering

Only two years ago, to mark the 100 years since its inception (as a School of Mines) the Faculty of Engineering at Auckland invited UoA graduates to a lavish dinner where there were nearly 600 people seated in the Hyatt hotel's largest hall. I wandered around the room, and was surprised to find what a large proportion were geotechnical people, most of them ex-students of mine, many themselves retired. Many faces I could remember, though I was not as good at recalling names.

Conclusion

I must thank the editors for allowing me so much space in the magazine. I hope they will continue their commendable efforts in the years to come.

Peter W. Taylor
NZGS Life Member
NZGS Geomechanics Lecture Award 1984

GEOTECHNICAL INVESTIGATIONS AND ENVIRONMENTAL SAMPLING

OVER WATER DRILLING

- Drilling and dynamic probing over water on purpose built self-propelled aluminum barge
- Transported by trailer and easily launched at standard boat ramps
- Can operate in water as shallow as 200mm or as deep as 5m

LIMITED ACCESS

- Lightweight and manoeuvrable track-mounted rig can access most sites that larger rigs cannot
- We have a reputation for a ‘can-do’ attitude when it comes to establishing and operating the rig in difficult site conditions or where access constraints are present

ENVIRONMENTAL SAMPLING

- Large diameter samples (100mm)
- Samples contained in plastic liners (no cross-contamination)
- Clean drilling: No drilling fluids. No hydrocarbon lubricants. No excess spoil
- Installation of monitoring wells.
- Can core through concrete surfaces

GEOTECHNICAL LOGGING SERVICE

- Quality geotechnical logging carried out by Trevor Banks CPEng, a director of Soil Engineering Ltd with over 20 years experience in geotechnical investigations
- His site observations and interpretations have provided useful information to clients

Soil Engineering Ltd

Ph. (09) 838 0370
www.soilengineering.co.nz

TECHNICAL ARTICLES

Ground Improvement using Turbojet Deep Soil Mixing
– Case Study

ABSTRACT
This paper presents a case study on the inaugural use of Turbojet deep soil mixing (DSM) in New Zealand. DSM was selected to provide the necessary ground improvement required for the Hastings District Council (HDC) Waste Water Treatment Plant upgrade. Reduced settlement and mitigation against liquefaction were key design considerations for the construction of two new bio-filter trickling tanks.

1 INTRODUCTION

1.1 Background
In October 2001 Hastings District Council (HDC) was issued a coastal permit (resource consent) to discharge treated wastewater from a new Domestic Wastewater Treatement Plant (WWTP) to the coastal marine area through HDC's existing 2.7km ocean outfall at East Clive, some 10km north east of Hastings.

Hastings District Council engaged MWH to provide professional services in relation to the project management, and design the new WWTP, adjacent to the existing milliscreening facility which is to be retained as an industrial WWTP.

Separated industrial flows are treated through the existing facility (fine screening & grit removal prior to outfall discharge) and all domestic and non-separable industry flows, septic imports and storm water are treated through the new domestic WWTP plant.

The new WWTP is based upon the concept of the biological filtration of finely screened wastewater.

1.2 Project Description
Key structures in this process are two 37m diameter Biological Trickling Filters (BTFs) 11m high. These structures are constructed from precast, prestressed and post-tensioned concrete, and are filled with plastic media to support the establishment of the biomass. The influent wastewater is pumped from a BTF feed pumping station to a rotating distributor in the BTF and the influent trickles down through the media.

Influent passes over the biomass, which establishes on the plastic media. The biomass removes organics from the wastewater by adsorption and assimilation of the soluble and suspended constituents.

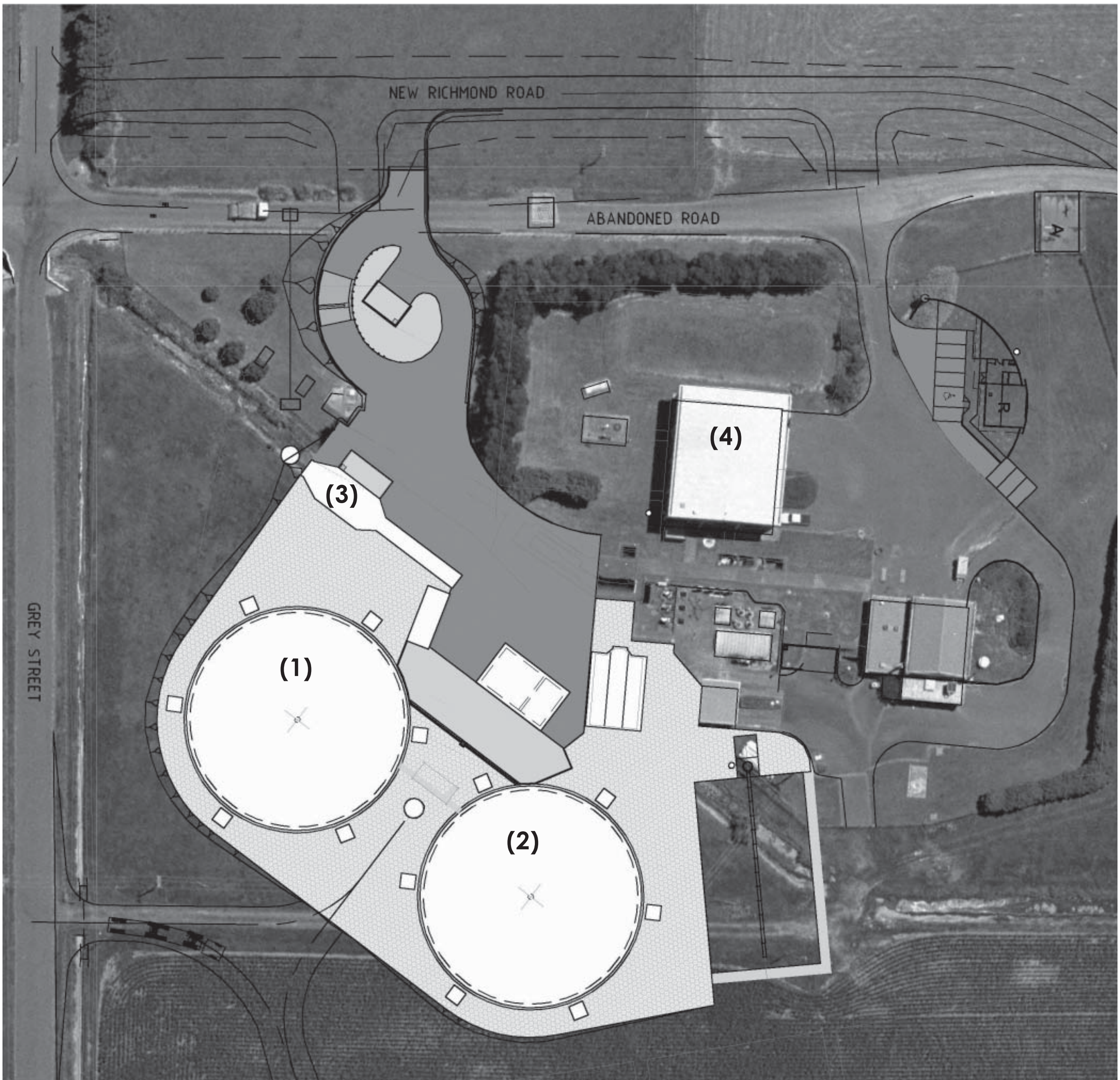


Figure 1: Site layout

KEY
1) BFT Tank 1 3) Screening Structure
2) BFT Tank 2 4) Existing Milliscreening facility

A layout of the proposed plant showing the location of the two BTFs is shown below in Figure 1.

1.3 Geotechnical Investigation, evaluation, and contract award

Geotechnical investigations were undertaken in June-August 2006 and further testing in 2007. Tests identified ground conditions considerably different to that experienced on the existing milliscreen/outfall pump station site. Laboratory testing was commissioned to determine consolidation parameters, liquefaction potential, strength characteristics, etc.

A number of design options were considered, including:

- Stiff concrete raft founded at approx. 2m below ground level
- Wick drains and preloading
- Stone columns
- Soil Mixing
- Piled solution – steel H piles
- Lightweight fill replacement

Move the tanks to where gravel strata is more persistent (eastwards on existing site or a new site altogether)

After consideration and discussion the options were

Subsurface Material		Maximum Thickness (m)	SPT Values	Qc (MPa)
1	Clayey silt (very soft – soft)	5.0	0 – 3	<0.5MPa
2	Silty sand (very loose – loose)	4.0	0 – 20	>5MPa
3	Sandy gravel (very loose – medium dense)	2.5	24 – 27	>20MPa
4	Clayey silt (soft – firm)	5.5	2 – 7	<1MPa
5	Clayey silt (firm - stiff)	7.0	7 – 10	1 – 2MPa
6	Silty sand/ sand (medium dense)	NA	13 – 32	>10MPa

Table 1: Interpreted subsurface profile

narrowed to either a pre-load and wick drain option, or stone columns. At that time it was believed that no NZ company had the ability to undertake the required depth of deep soil mixing (DSM).

The stone column option was favoured over the pre-load option but at about that time Hiway Stabilizers advised that they intended to import plant suitable for DSM to the depths required at the site. Thus the request for tender documents permitted flexability in the improvement technique to ensure that the best value solution could be obtained for the client, in the event a DSM option was tendered along with the stone column option.

The tenders were evaluated and the tender awarded to Hiway Stabilizers Environmental (HSE) using DSM columns based on the design, technical submission, price, plus the high degree of quality assurance provided.

Compliance testing is an important aspect of DSM works, and is a major advantage of the DSM ground improvement option. A proposed series of trial mixes, test columns, and production column tests provided high levels of quality assurance.

There is a shallow confined aquifer at the site and the nature of the DSM columns provided assurance to the Regional Council during the resource consenting of this work that the penetration of the aquifer by the DSM columns would preclude contamination and saline intrusion via the DSM columns.

The contract was awarded to HSE in 2007. The site was mobilised in early January 2008 and by late February the ground improvement was complete with 500 DSM columns being installed up to 14.5 metres depth.

2 GROUND CONDITIONS

2.1 Geotechnical Investigations

The geotechnical investigation carried out by MWH comprised 25 cone penetration tests, 6 machine boreholes and 5 test pits. Boreholes were drilled to a maximum depth of 25.5. The CPTs were investigated to a maximum depth of 25 metres. Two additional boreholes were drilled by SKM, HSE's designer, in 2007. A series of laboratory testing was carried out.

2.2 Geological Model

The site is underlain by Holocene alluvium of the Heretaunga series which comprises fossiliferous marine sands intercalated in fluviatile sands and silts.

Available investigation data reveal that the upper 3 to 5 metres of the alluvial deposit consists predominantly of very soft to soft clayey silt with undrained shear strength ranges from 6 to 45 kPa. It is subsequently underlain by a layer of granular deposits comprising very loose to loose silty sand/ sand and sandy gravel. The gravel layer is thickest on the eastern side of the site and gradually thins out toward the west. The granular layer is then underlain by soft to stiff clayey silt and medium dense sand.

The inferred subsurface profile and testing results are summarised in Table 1.

Groundwater seepage was recorded at 2 to 2.5 metres below existing ground level. For design purpose, a groundwater depth of 2 metres has been adopted.

3 DESIGN

3.1 Design Concept

DSM is a ground improvement technique that improves the foundation characteristics by mixing insitu soil with cementitious binders to form stabilised soil-cement columns.

To minimise consolidation settlement and reduce the likelihood of soil liquefaction, an array of DSM columns were installed over the tank footprint. The DSM columns were founded at the non-liquefiable stratum. This arrangement mitigates liquefaction by restraining the shear deformation of the soil during an earthquake. Both the dynamic earth pressure and inertia force of the surrounded soil mass will be carried by the soil-cement columns. The DSM columns were designed to support the BTF tank structures during an earthquake.

3.2 Design Approach

The performance of ground treatment design in terms of settlement reduction and liquefaction mitigation was evaluated using a finite element programme, Plaxis

DSM Configuration						
Treatment Area (m^2)	Spacing		Depth (m)	Equivalent Replacement Ratio (%)	Total No. of Columns	Total Linear Length (m)
	Radial (m)	Circumferential (m)				
2175	1.2 to 2.0	1.6 to 3.0	12.5 to 14.5	6.6%	496	6576

Table 2: Turbojet design

Depth below EGL (m)	Baseline Conditions – No Ground Treatment		With Ground Treatment	
	Max Shear Stress (kPa)	FOS against Liquefaction	Max Shear Stress (kPa)	FOS against Liquefaction
4	16	0.5	12	1.1
6	24	0.6	15.2	1.4

Table 3: Summary of liquefaction potential

version 8.6.

The effectiveness of the ground treatment design in terms of mitigation of the effect of liquefaction has been measured by comparing the liquefaction potential of the liquefiable deposit prior to and after the ground treatment. The liquefaction potential of the site has been evaluated using the modified Robertson method. This method calculates an equivalent safety factor against liquefaction by comparing the cyclic resistance ratio (CRR) with the cyclic stress ratio (CSR) induced in the soil during a seismic event.

The cyclic resistance ratio (CRR) refers to the shear capacity of the soil. It is determined using the available CPT data and can be calculated for the loose sand deposit at various depths.

The cyclic stress ratio (CSR) is the normalised shear stress induced during an earthquake. The CSR can be determined by simulating a design seismic event using the dynamic module in Plaxis to estimate the amount of shear stress being induced in the soil during an earthquake.

3.3 Performance Criteria

The ground improvement was designed to achieve the following criteria:

- Maximum post-construction settlement under static conditions - 50mm.
- Differential settlement 5 mm.
- The columns designed to carry all applied load under dynamic conditions.
- Factor of safety against liquefaction of 1.1 or above.

3.4 DSM Properties

The design was based on column strength achievable in the lower bound strength material being the silty clay layers. The design column stiffness was assumed to be 360MPa and corresponding UCS strength of 2 MPa. Column diameter is 600 mm.

55 unconfined compression strength (UCS) tests were carried out to determine the strength of stabilised soil using various cement mix designs. These results are consistent with the previous laboratory test results from similar soil-cement column samples completed to date.

3.5 Design Seismic Acceleration

The design peak ground acceleration is taken as 0.56g.

Seismic action is simulated in Plaxis using the actual accelerogram recorded in March 1987 at Matahina Dam recording station during the Edgecumbe earthquake. The input motion has been scaled to generate a maximum ground acceleration of 0.56g.

3.6 Results

The recommended DSM design is summarised in Table 2.

Results summarised in Table 3 indicate that the DSM design can significantly reduce the induced shear stress in the soil mass. This demonstrates the proposed ground treatment arrangement will confine and restrict deformation of the liquefiable sand deposit.

The shear stresses within DSM columns were checked using finite element analysis. It is noted that the maximum deviatoric stress within the column will be less than the design UCS value, indicating the columns are unlikely to be failed by shear.

4 CONSTRUCTION

4.1 Turbojet Description

Turbojet is a recently developed "wet" method of DSM. The method was developed as a hybrid system incorporating the benefits of both high pressure "jet" cutting and mechanical mixing to provide a highly efficient method of soil mixing.

Grout is injected at high pressure through a series of

Figure 2: Turbojet rig and plant

Figure 2a: Turbojet plant – Grout batching plant and high pressure pump

outlet nozzles on the mixing tool, cutting soils as the mixing tool advances. Soil cutting (pre disgregation) cutting is thereby achieved in most soil types including conventionally more problematic cohesive plastic clays.

The mechanical mixing of grout and soil (disgregation) is achieved using a mixing tool featuring cutting teeth and inclined blades and mixing head. The mixing tool for this project was modified and configured to allow for cutting and mixing of both silty clay soils and the sand and gravel layers.

4.2 Implementation

The type of binder and application rate was selected based on the existing knowledge of soil types and the results of the laboratory mixing and testing of recovered soils. Following initial laboratory testing, a series of 7 trial columns were initially constructed immediately beyond the periphery of tank 1 to a depth of 14.5 metres. The trial columns comprised three different mix designs representing 300 to 400 kg cement per m^3 plus the addition of lime to one mix design. Various water cement ratios were also selected along with various nozzle sizes and outlet positions and various delivery pressures. The primary purpose of the trial columns was to determine the effectiveness of achieving mixing and homogeneity plus confirmation that the design column strength and stiffness could be achieved.

The trial incorporated both single phase (grout injection during drilling and withdrawal) and double phase (water injection during drilling and grout injection during jetting. Based on the field trial results, the higher cement and lime mix was selected with the addition of lime achieved effective breakdown and homogenising of the silty clays. As a result of the trial, the single phase method was selected.

Grout was batched on site using an automated GM14 grout batching plant featuring automated electronic weighing of binders, accurately controlled water injection and a series of high sheer mixer and agitator tanks. Grout was continuously tested to ensure correct density.

Grout is delivered to the mixing tool using a high pressure triplex piston pump capable of delivery pressure up 500 bars. Grout pressure can be varied and is selected depending on the soil types and the column mix design. Grout pressure of 200 Bar was selected for this project.

During production, up to 8 underground obstructions were met, preventing column installation to full design depth. These logs and wood obstructions were found predominately at the top of the gravel layer at approximately

6 meters depth, representing the geological riverbed deposition. The possibility of obstructions was foreseen based on site investigations and were addressed at tender time. The client and contractor taking a risk share approach towards dealing with obstructions with new replacement columns were reinstalled all to within 1.5 metres of the design position.

4.3 Quality Assurance

Turbojet features a high degree of quality control throughout the installation process. A Jean Lutz Taralog computer within the cabin of the drill rig, provides continuous monitoring and real time data capture of both drilling and grout parameter. This provides continuous and accurate recording of drilling depth, drilling rate, rotation speed, rotary torque and thrust, plus grout flow, volumes and pressures.

Individual columns are continually recorded in both the Drilling (insertion) and Jetting (withdrawal) phase. The Taralog features preset automated drilling functions plus a manual control function. Data download and processing enables analysis of individual columns to ensure that design parameters are achieved.

A comprehensive sampling, testing and post construction testing programme is implemented to validate design strengths and ensure that the design criteria are met.

4.4 Results

The QA plan required recording of grout batch data. The computer memory block was downloaded daily to check drill and grout parameters. Column samples were extracted using a push tube sampler. Soil cement cylinders were tested at 7, 14 and 28 days.

Additionally, two production columns were cored using PQ drill tool to full 12.5 metre depth. A series of recovered cores at 2 metre incremental depths were strength tested. These cores provided verification that the strength and stiffness were achieved. UCS results revealed that an average strength of 3.5 MPa and an average Youngs modulus of 520 MPa was achieved in the silty clays and almost double that strength and stiffness was achieved in the sands and gravel layers.

5 CONCLUSIONS

Assessments indicate that the DSM ground improvement successfully improved the soil characteristics such that the liquefaction potential and post-construction settlement comply with the clients needs. DSM proved to be a cost effective and rapid ground improvement solution which met with the clients requirements on this project.

REFERENCES

Youd, T.L. et al. (2001) Liquefaction resistance of soils: summary report from the 1996 NCEER and 1998 NCEER/ NSF workshops on evaluation of liquefaction resistance of soils. *J Geotech. and Geoenvironemental Engrg., Vol. 127(10), ASCE, 817 - 833.*

Youd, T.L., Idriss, I.M. (1997) *Proceedings of the NCEER workshop on evaluation of liquefaction resistance of soils.* NCEER.

Reported by:
Graeme Quickfall
Hiway Stabilizers Environmental Ltd, Silverdale, New Zealand
Wataru Okada
Sinclair Knight Merz Ltd, Auckland, New Zealand
Tim Morrison
MWH, Christchurch, New Zealand

Geological Factors Affecting TBM Penetration and Utilisation, Second Tailrace Tunnel – Manapouri Power Station

Background

The underground Manapouri Power Station was completed in high-grade metamorphic terrain in 1970, harnessing the waters of lakes Te Anau and Manapouri, Fiordland, New Zealand (Figure 1). Although designed to generate 700MW, unexpected friction in the 10 km long tailrace tunnel resulted in reduced hydraulic head, and consequent lost output by as much as 115MW.

Feasibility studies in the early 1990s led to a decision by the government-owned operator (Owner) to construct a second 10 km tailrace tunnel 70 m from and parallel to the first tailrace tunnel (Heer et al, 1997). Whereas the first tunnel was excavated by drill and blast method, the Owner identified a Tunnel Boring Machine (TBM) as the preferred method of excavating the second tunnel.

The contract was awarded to a New Zealand/Austria/US joint venture (the Contractor). Excavation began in 1998 and the TBM holed through in April 2001. However, the time taken for the TBM to complete the tunnel was substantially more than anticipated by the Contractor (by some 440 days), who claimed compensation from the Owner on the basis of differing site conditions (DSC). The project represented the first use in a New Zealand contract document of a Geotechnical Baseline Report (GBR) in association with the Differing Site Conditions (DSC) clause. The GBR established a contractual baseline of geotechnical conditions anticipated to be encountered during underground construction on which the Contractor relied in establishing his TBM performance assessment model, and for the purpose of allocation of risk between Owner and Contractor.

This paper gives an overview of the geological factors affecting TBM penetration and utilisation from the Contractors perspective, which formed a part of the Contractor's DSC claim. For the purpose of the Contract, the tunnel was divided into four reaches each of which exhibited different geological characteristics. The Contractor's DSC claim was initially focused on the first reach of the tunnel which was referred to a Disputes Resolution Board and resulted in a global agreement between the parties in July 2001 for the entire tunnel and the dispute process being subsequently discontinued. The claim for Reach 2 of the tunnel had been submitted to the Owner at the time the dispute process was discontinued. The focus of this paper is mainly in relation to the geological factors affecting the claims for Reaches 1 and 2 of the tunnel, but several of the DSC factors continued throughout the entire tunnel construction.

Regional Geology

Fiordland is one of the most geologically complex regions

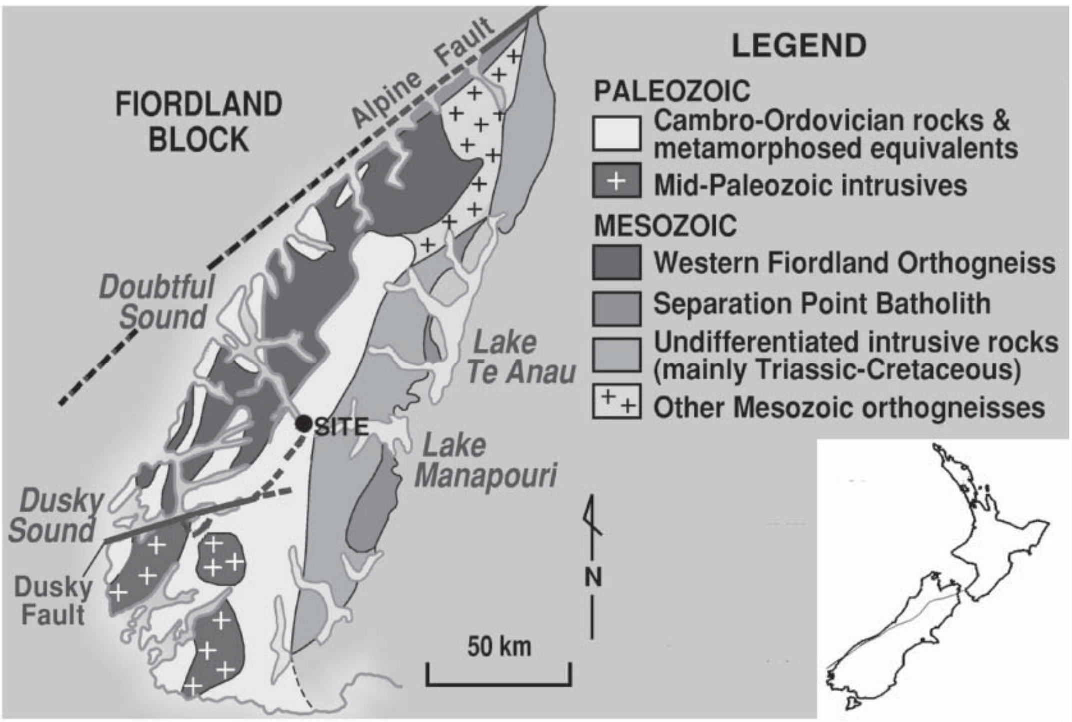


Figure 1: Simplified geological plan of Fiordland showing relationship to site of Second Manapouri Tailrace Tunnel

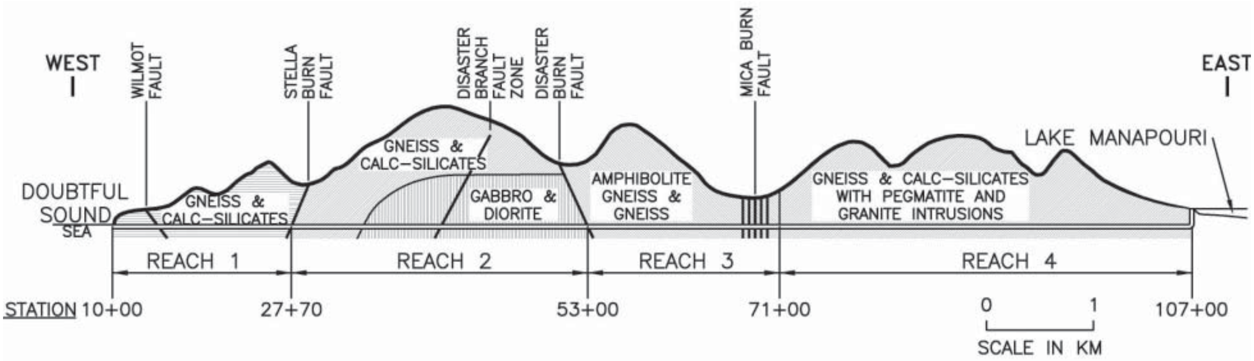


Figure 2: Simplified geological cross section along Second Manapouri Tailrace Tunnel

Tunnel Reach	General Geological Description
1	Gneiss and mixed meta-sediments with cross cutting mafic dyke intrusions.
2	Gabbro/diorite and diorite gneiss with cross cutting mafic dyke intrusions.
3	Banded gneiss, amphibolite and amphibolite gneiss with subordinate pegmatite and granite.
4	Banded and non-banded massive gneiss with subordinate calc-silicate, pegmatite and granite.

Table 1: Summary of the geology for each of the four tunnel reaches

in New Zealand, reflecting the growth of continental crust along the Paleo-Pacific-Gondwana margin throughout Paleozoic-Mesozoic time, through the tectonic accretion, deformation, and high-grade metamorphism of sedimentary terrains, and the multiple intrusion of subduction-related basic to siliceous magmas. The general lithological and structure characteristics of Fiordland were described by Oliver and Coggon (1979). Deformation, concurrent with the original sediment's amalgamation into the continental crust of Gondwana, developed isoclinal folding, and metamorphosed rocks to temperatures of between approximately 650º – 700º C, (i.e. conditions covered by the amphibolite facies). In addition to complex folding, multiple intrusion of the meta-sedimentary rocks by various mafic and granitic plutons (with concomitant partial melting) brought about severe disruption of the stratigraphy.

The most comprehensive surface geological description covering the project area was by Gibson, (1982). He showed that the project area consisted of two different geological sequences: a western sequence comprising mainly meta-sedimentary rocks (including paragneiss, calc-gneiss and marble) intruded by variably foliated granite, gabbro and diorite, and an eastern sequence dominated by various granitic rocks and pegmatite and including only minor meta-sedimentary rocks.

The regional geology and its relationship to the project site is illustrated in plan in Figure 1 and in section in Figure 2.

All of the rock types summarised in Table 1 were anticipated by the GBR with the exception of a system of cross cutting metamorphosed dykes encountered in Reaches 1 and 2 of the tunnel. These mafic composition rocks were part of a swarm of dykes cross cutting regional foliation and are considered to be associated with the Mt George Gabbro (Gibson, 1982).

The tunnel passed through a number of major geological structures including the Wilmot, Stella Burn, Disaster Burn and Mica Burn Faults. While most of the major faults were mainly steeply dipping (>60º) and crossed the alignment at oblique angles to the tunnel axis as anticipated by the GBR, many minor faults and shears were much more gently dipping a condition which was not anticipated and resulted in significant TBM issues.

TBM issues

The Owner had, as part of the tender documents, stated that a TBM be used for the construction of the tunnel and prescribed in detail the specifications of the TBM required. A 10m diameter full-face, main beam, hard rock TBM constructed by Atlas Copco Robbins was brought to New Zealand in parts and assembled on site. The geological conditions encountered as boring continued caused significant problems for the TBM resulting in:

- Reduced TBM penetration rate;
- Decreased TBM utilization;
- Major damage to the TBM cutterhead;
- Increased cutter damage; and
- Delay and disruption of the overall operation.

The delays caused by the differing site conditions in Reach 1 are summarised in Table 2 below.

	Tender Estimate Value	As-Built Value	Percent Difference
Weighted average TBM rate of penetration (ROP)	1.55 m/hr	1.14 m/hr	-26.45%
TBM Utilization (Excluding Regrip)	60.56%	37.97%	-37.30%

Table 2: Reach 1 TBM excavation tender estimate vs. "as-built" production

	IMPACT ON TBM		
	Reduced Penetration	**Reduced Penetration And Utilisation**	**Reduced Utilisation**
DSC	Joint spacing, persistence, and orientation more adverse than GBR predictions.	Mixed Face Conditions (causing machine vibration, reduced thrust, and cutter head damage).	Low angle faults not predicted by the GBR causing overbreak and reduced stand-up time.

Table 3: Impact of DSCs on TBM Performance for Tunnel Reaches 1 and 2

Differing Site Conditions

There were three (3) principal differing site conditions (DSCs) amongst several claimed by the Contractor (Grocott & Riddolls, 2002):

- The presence of low angle faults not predicted by the GBR resulting in high overbreak and leading to reduced stand up time of faulted ground and increased ground support stabilization.
- Mixed face conditions (MFC) arising out of unidentified and substantially more adverse rock types than those identified in the GBR. This DSC mainly related to the occurrence of a swarm of mafic (doleritic) dykes which intersected Reaches 1 and 2 and which resulted in very uneven tunnelling conditions for the TBM. The mafic dykes were not identified by the GBR but were to be anticipated as revealed by original tunnel logs for the first tailrace tunnel and published descriptions of the regional geology (Gibson, 1982).
- Joint spacing, persistence and joint orientation more adverse than predicted by the GBR. This DSC related mainly to the un-conservative assessment of joint spacing and persistence by the GBR which was estimated from tunnel logs and mapping of the drill and blast-constructed first tailrace tunnel.

Impact of DSCs on TBM Performance

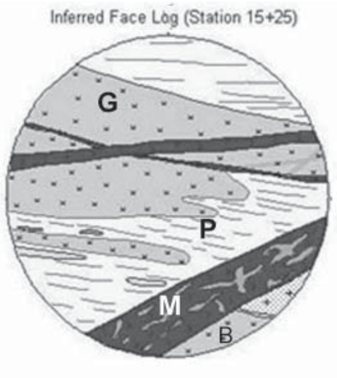
All of the above three DSCs were claimed by the Contractor to have hindered TBM progress in both its ability to penetrate the rock mass and reduced utilization. Table 3 summarises the Contractor's claims relating to the impact of the individual DSCs on TBM performance for Reaches 1 and 2.

Of all the DSCs claimed by the Contractor for Reach 1 of the tunnel, there was agreement by the Owner on only being substantially different from the GBR baseline, this being in relation to the occurrence of numerous low angle faults/shears, whereas the GBR had predicted these discontinuities to be near-vertical. However, the parties could not agree on the time and money impacts of this DSC on TBM performance, being the considerable amounts of overbreak and reduced stand up-time experienced in Reach 1.

The issues surrounding the other two DSCs as claimed by the Contractor were:

- Mixed face condition (MFC): The Contractor defined this DSC as the occurrence of two or more hard rock types of very different boreability characteristics being encountered simultaneously in the heading (Buchi, 1992). The impacts of MFCs were considered by the Contractor to be twofold: firstly, the TBM experienced considerable vibration, probably as a result of differential penetration and uneven loading of the cutter head discs, with the result that the cutterhead sustained much damage as did individual cutters; secondly, in order to reduce vibrations to acceptable levels and to minimise cutterhead damage, the TBM thrust had to be reduced below optimal resulting in lower penetration rates than would have been possible had a uniform rock type been encountered throughout the heading. In particular, the presence of strong metamorphosed mafic dykes (Figure 3) making up approximately 19% of the Reach 1 rock types was considered to have been a major contributor to MFC, and detailed tunnel logging (Figures 3 and 4) demonstrated that about 90 % of Reach 1 was constructed in highly variable rock types that could be classified as MFC. Significantly, the presence of mafic dykes was noted on the tunnel logs for the first tailrace tunnel, but was not predicted in the GBR. Dykes of mafic composition are found everywhere throughout Fiordland and were previously noted also in surface geology by Gibson (1982).

- Joint characteristics more adverse than GBR: Joint characteristics throughout the entire tunnel were considerably more adverse than GBR predictions, particularly the wide spacing, lack of persistence, and orientation of joints, all of which impacted on TBM penetration. Firstly joint spacing proved to be considerably wider than GBR predictions mainly due to the un-conservative assessment of joint spacing made on the basis of original tunnel logs from and mapping of the adjacent drill and blast-constructed first tunnel. Secondly, the GBR acknowledged that the various descriptions it contained relating to jointing would support TBM performance assessment methods developed by, amongst others, the University of Trondheim and known as the NTNU predictor model (University of Trondheim, NTH-Anleggsdrift, 1994). As the GBR was silent as to joint persistence in the tailrace tunnel, the Contractor reasonably assumed the GBR term "joint" (for the purpose of estimating penetration rates at bid time) to be consistent with the NTNU model, which is a continuous fracture around the full tunnel diameter (equivalent to a wall trace of 32 m for a 10 m diameter tunnel). The reality was very different, with virtually no continuous joints being encountered, most persisting for typically 2 – 6 m along the tunnel wall (Macfarlane, et.al., 2008). Thirdly, the angle between the tunnel alignment and joint orientation (alpha angle) was more adverse for rock breakage than GBR predictions. The overall effect of a wider than anticipated joint spacing combined with a very short joint persistence and a flatter alpha angle compared with GBR predictions resulted in a considerably slower rate of penetration for the entire tunnel than was anticipated at bid time.



Lithology Proportions in Inferred Face Log

Lithology	Lithology Area (%)	Brazilian Tensile Strength (BTS) (MPa)			Uniaxial Compressive Strength (UCS) (MPa)		
		No. of tests	Mean "As-Built" BTS corrected	(uncorrected)	No. of tests	Mean "As-Built" UCS corrected	(uncorrected)
Granitic Gneiss G	44	1	18.2	(12.8)	9	137.9	(96.8)
Biotite Hornblende Gneiss B	3	-	-	-	6	138.9	(97.5)
Meta-dolerite M	15	3	20.5	(14.4)	16	201.6	(141.5)
Paragneiss P	34	-	-	-	-	-	-

Figure 3: Example of detailed tunnel logging showing mixed face conditions

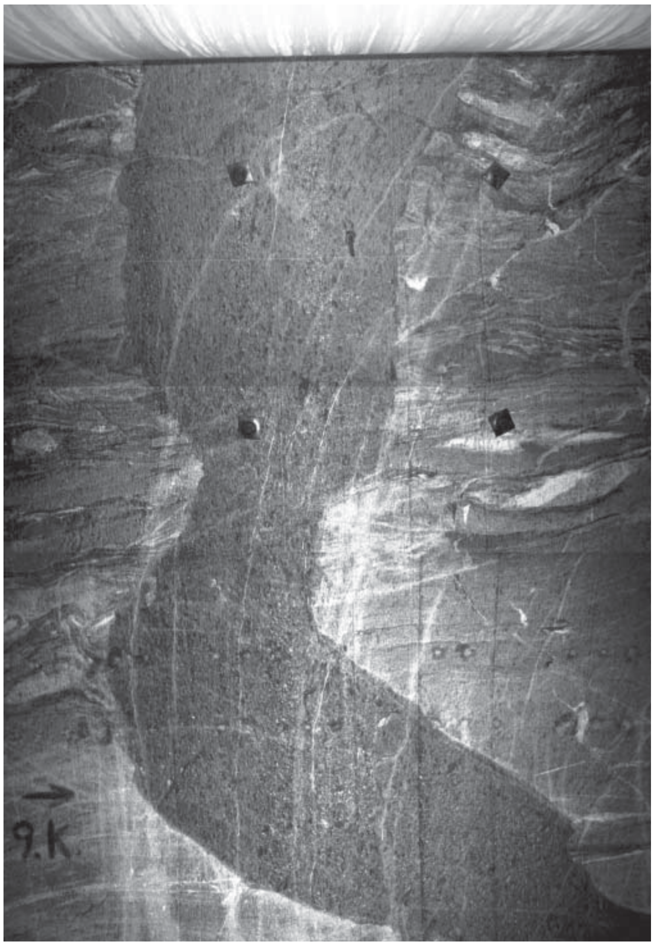


Figure 4: Photograph of tunnel wall showing a cross cutting dolerite dyke

Conclusions

The Second Manapouri Tailrace Tunnel was completed some 440 days behind schedule and geological factors were considered by the Contractor to be a significant contributor to these delays. While the use of a GBR in association with the DSC clause as used at Manapouri had merit in establishing a contractual baseline of geotechnical conditions, it resulted in overly optimistic assessments of TBM performance by the Contractor.

Of the three DSCs claimed by the Contractor for Reach 1 of the tunnel, both parties agreed that low angle faults/shears differed from GBR predictions. The effect of low angle faults/shears on TBM progress was to cause considerable amounts of overbreak and reduced stand-up time for the rock mass where low angle structures were encountered in the roof.

Mixed rock types occurred throughout Reaches 1 and 2 of the tunnel mainly due to an unpredicted swam of mafic dykes which cross cut regional foliation patterns. The effect on TBM performance of two or more hard rock types in the face with very different boreability characteristics resulted in significant cutter head damage and required the machine to be operated at a lower than optimal thrust in order to reduce vibration. Similar effects on TBM performance from MFC have been noted in hard mixed-rocks in Sweden (Buchi, 1992).

The rock mass encountered in the tunnel clearly had much wider fracture spacings than was anticipated from the GBR which had a significant impact on the ability of the TBM to achieve optimal penetration through the ground. Fracture persistence is also a critical factor in the assessment of TBM performance and contractual baseline descriptions should provide accurate descriptions of this parameter only if accurately delimited. A key lesson is that existing drill-and-blast tunnels (as in this case) can provide an over-estimation of the actual rock mass fracture spacing and should not be relied upon for contractual baselines

The over-riding lesson from Manapouri which is generally applicable to owners and constructors of TBM projects is that a very high level of experienced engineering geological input is required at all stages from feasibility through to design and construction monitoring. The absence of such input at any stage has the potential to result in significant financial implications arising out of claims for DSCs.

References

Bradshaw, J.Y., 1990: Geology of crystalline rocks of northern Fiordland: details of the granulite facies Western Fiordland Orthogneiss and associated rock units. *NZ Journal of Geology and Geophysics, 1990, Vol 333*. pp 465-484.

Buchi, E. (1992): New TBM Generation with 20" Cutters. Tunnelling experience at Klippen Hydropower – Sweden. TBM Symposium, Lucia, Stockholm, Sweden.

Gibson, G.M., 1982: Stratigraphy and petrography of some metasediments and associated intrusive rocks from central Fiordland, New Zealand. *N.Z. Journal of Geology. & Geophysics. Vol. 25,* pp. 21 - 43.

Grocott, G.G., Riddolls, B.W., 2002: Use of "As-Built" Engineering Geology for a GBR-based TBM claim: The Contractor's Perspective. Proceedings of 9th International Congress. International Association of Engineering Geology & the Environment, 16 – 20 September 2002, Durban, South Africa pp. 1945 –1952.

Heer, B., Essex, R. Young, D, 1997: Second Manapouri Tailrace Tunnel design and construction considerations. *Proceedings of the Rapid Excavation and Tunnelling Conference (Las Vegas, 1997)*. pp 3-19

MacFarlane, D.F., Watts, C.R. & Nilsen, B., 2008: Field application of NTH Fracture Classification at the Second Manapouri Tailrace Tunnel, New Zealand. *North American Tunnelling Conference, San Francisco, California*, June 9-11, 2008.

Oliver, G.J.H., and Coggan, J.H. 1979: Crustal structure of Fiordland, New Zealand. *Tectonophysics*. 54 pp. 253- 292.

Papke, M. & Heer, B., 1999: Building the Second Manapouri Tailrace Tunnel, *Tunnels & Tunnelling International*, May 1999.

University of Trondheim, NTH-Anleggsdrift (1994). Project Report 1-94 Hard Rock Tunnel Boring.

Reported by:
Guy Grocott (Editor Geomechanics News 1983, 1984; Secretary 1982; Chairman 2000, 2001)
Edwin Ladley
Bruce Riddolls (Vice President, IAEG 1999 -2002)
All originally of Riddolls & Grocott Ltd

OBITURARY

Dr Keith Simpson – In Memoriam

Above: Keith at the Beca bar-be

Dr Keith Simpson, most recently of Beca, Auckland lost his battle with cancer on 25 June 2008.

Keith commenced his geotechnical career with Beca Carter Hollings and Ferner in 1988, prior to completing a Masters and PhD in Soil Mechanics and Engineering Seismology at Imperial College of Science, Technology and Medicine, London between 1991 and 1996. After further post doctoral research Keith joined Coffey Geosciences in Sydney where he managed many projects, large and small including work on the Lucas Heights Research Reactor.

He returned to Beca in Auckland in mid 2005 as a senior member of Beca's Geotechnical team. Keith's recent projects included the ONTRACK DART8 Duplication–Henderson to Swanson investigations, concept and detailed design, the Victoria Park Tunnel geotechnical engineering assessment and seismic and liquefaction assessment and ground improvement design for the Pegasus Development in Christchurch.

Keith is well remembered by his colleagues and friends at Coffey and Beca as being dedicated, thorough and energetic. He was valued not only for his expertise, but his counsel on all matters. Regardless of the time or the topic, Keith was always willing to swap thoughts or anecdotes with everybody he worked with. He was committed and passionate in all things he did and formed close personal relationships with all he worked with. Keith's friends and colleagues in Australia and New Zealand remember him for his devotion to his wife Karin and their four children. He made time and had energy for them no matter how demanding his work schedule.

In researching this obituary many people came forward with information and stories on Keith. It would be good to include all of these but space precludes this. The following is an account of Keith's work during the last months of his life from a colleague in Auckland which expresses the devotion and energy that Keith put into his work, and in fact also gave to his family and all aspects of his life.

I remember Keith most as a good friend – he was someone you could always talk to about anything: marathons to liquefaction techniques; work ethic to sky diving – and you could trust him for an honest and intelligent opinion and one that would remain just between you. He had so much talent as an engineering geologist and as an engineer, but this didn't preclude his having fun and living to the full. He treated his illness as any other 'project' – he learned all he could about it; he was matter of fact; he took over the management of it and made decisions for himself based on his understanding and knowledge. He included us all as part of the 'project' team. Keith was still dealing with contractors and completing reports the week before he passed away. When the legal team and the client want to support you and your family by being at your funeral, you know that you have made a lasting impact and made a significant contribution, not only on a work level, but also on a personal level, and this is what happened as the Vic Park Tunnel team re-convened in Meadowbank to farewell Keith. Keith has left all of the team here with a role model and a sense of needing to make the most of our life opportunity – something he has given each of us that is very special in itself.

Ian Shipway (Coffey, Australia)
Gavin Alexander (Beca, Auckland)

FOREIGN CORRESPONDENT

Warwick Sitana

Toowong, Queensland, Australia

Warwick Sitana
Engineering Geologist
Cardno (Qld) Pty Ltd

"Trai-ees (Tracey), its Peeeda (Peter) on-da phone for ya, he wants to come in on Mandi (Monday)" It was like a bad dream, I thought I must have done something terribly wrong to be chucked into a den full of Ozzies! Or is it because the Ozzies have invaded NZ and hence I am hearing this funny accent? It suddenly dawned upon me that my thinking was erroneous, I am actually sitting behind a desk at Cardno Ullman and Nollan Geotechnics (CUNG) in Mackay, Queensland, and the funny accent was from one of our admin ladies, crikey mate! It's fair dinkum! (I'll probably be in trouble if she reads this!).

One would think that NZ and OZ are the same, well after having been here for a couple of months I can confirm they are not. Apart from the difference in accent and weather, one can't help but notice the passion the people here have for 4x4s. About 70% of the vehicles on the road are 4x4s, this can be attributed to the fishing and off-road driving lifestyle they have here. The living cost here is cheaper than NZ, dollar for dollar but alcohol is more expensive, however dairy products are cheaper than NZ. We find the customer service here far better than NZ as well. I always laugh at TV advertisements here making fun of NZ for having too much sheep and lacking an air force.

Mackay is located some 1000 km north of Brisbane, Queensland. This is the gateway to the Great Barrier Reef alongside Airlie. Its subtropical with lots of palm trees, sandy beaches and wildlife - this includes snakes (the other day we came across eight brown snakes - one of the most venomous species in the world), spiders, crocs, roos and an abundance of bird life. The fishing here is exceptional. We are currently experiencing temperatures up to 25°C and 60% humidity. Sugar cane plantations are everywhere – it used to be the main GDP earner for Queensland till the 'Black Gold Boom' came along. Like NZ, people here love their sports. Mackay is predominantly League domain. The NZ Warriors beating the Storms rang louder than the All Blacks beating the Wallabies, however more people play football (soccer) socially than any other sports (I proudly wear my Pounamu and Warriors Jersey to work).

I am not sure what the media coverage of the current global economic situation is like in NZ. Over here its front page stuff and first news item on TV. I remember business news used to be before sports and you usually find it in the middle of the paper, how times have changed!

Above: Pile inspection for power pylon.

Mackay and greater QLD are fortunate to have had a strong sugar and quite recently booming coal industries that provided a buffer against the downturn in global economy. However it is feared that the weakening Chinese economy (which consumes most of the Ozzie coal, besides Japan & India) would have an adverse impact on the economy. The slight drop in the Chinese economy is a reflection of the plummeting exports to the U.S and Europe (whose economies are built on borrowed money). Ironically, Chinese exports to emerging markets like Russia, Latin America, Africa and the Middle East are skyrocketing. According to Sagami "the reason for the dichotomy is simple: Developed countries are sitting on billions of quasi-worthless mortgage bonds, while emerging market countries never had enough money to invest in the toxic bonds Wall Street alchemists created, packed, and peddled"(Ref 1). Here is a bit of advice to those who have disposal cash to spare or want to protect their assets, experts have recommended hedging your assets in precious metals like platinum, palladium, gold and silver (either physically or own stocks in companies that produce these commodities). The general consensus is that the next bubble would be in energy (alternative energy or improving efficiency). They say greater profits can be made during a market downturn as a lot of investors shy away from trading. The most costly investment strategy is to do nothing!

I almost forgot that this is meant to be an NZGS article as opposed to a travel or investment newsletter.

After having toyed with the Waitemata Group Soils and Northland Allochthon of Auckland and its greater region; and the Canterbury plain alluvial sediments and the Alpine greywacke and semi-schist and central Otago Schist, I was ready for something different. What I found was different alright - The geology here is ancient, dead and

Above: Rescuing a 'sunken' dragline.

boring (mostly Cretaceous to early Carboniferous Rocks), i.e. compared to rumbling volcanoes, active faults, debris flows, lahars, geothemal hot pools, uplift of the Alps, scree cones & retreating glaciers of New Zealand! Seismicity is never or rarely incorporated into design of foundations and structures here.

The company I work for (CUNG) is part of the greater Cardno Group of Companies with offices around the world; the biggest presence is in Australia itself. Our office in Mackay basically serves all of the east coast of Queensland, even up to Darwin in the north. There is no competition here (the only other geotech firm - Bowler Geotechnical was bought out by Cardno last year as well) as such there is too much work on our plates at the moment. We have our own soil and rock testing lab with mobile labs stationed at different mines in Queensland. We also have two drill rigs and possibly acquiring a third one soon.

Most of the work here is directly related to the Coal mining industry or as spin-offs. Expansion of mines is ever increasing so the ripple effect of infrastructure development, industrialisation and urbanisation. We are currently involved in material testing, foundation design and slope stability work at mines, corridor, duplications (roads, bridges, railways...etc...), expansion of coal handling areas, foundations for power pylons, subdivisions, contract supervision and inspection; and contamination studies to name a few. Everything here is huge - big projects with big budgets involving big machines. There is so much work going in Mackay and the surrounding area. The locals have commented how fast the area has grown in the last ten years – thanks to coal boom.

I try to spend half of the time in the office and the other half in the field. I typically undertake writing of proposals, carrying out field investigation, analysis and reporting.

I always look forward to weekends. I drive to different beaches (accompanied by my wife and 2 year old son) for lunch after church on Sunday and to catch some fish for dinner. The water here is warm, clear and very pleasant. I have also been going out for night time fishing with some of the locals. Next on the list is to practice casting nets and setting crab pots in billabongs (recently added to my vocab). Perhaps catching crocs and roos would be next!

We are not sure as to how long we going to be here for or where we would settle. It could be NZ, Oz, Chile or the Solomons. But at the moment we are having fantastic time here in Mackay!

Ref 1: Sagami T, 'The Chinese Perspective: What Global Recession?' Money and Markets, 21 Oct 2008.

COMPANY PROFILES

Geotechnics Ltd

Left: Inclinometer monitoring at the Wellington Inner City Bypass

Geotechnics Limited was established in Auckland in 1959 and was for many years the only privately owned soil mechanics laboratory in New Zealand. Geotechnics was formed initially to service the then fledgling geotechnical engineering consulting practice of Tonkin & Taylor Limited. Since then we have grown to over 50 staff, with offices in Auckland, Tauranga and Wellington. Our testing operations in Auckland and Tauranga are IANZ accredited and our Sales operation is ISO9001 certified. Our main business is providing testing services, equipment sales and calibration to the Geotechnical, Civil, and Environmental Engineering disciplines throughout New Zealand and the Pacific.

Testing

The primary reason Geotechnics was created was to provide a testing service. Many of our key staff have more than 15 years testing experience, with some having more than 25 years civil engineering testing experience. The main areas of testing we offer are:

- Drilling with window samplers and a small percussion terrier rig.
- Environmental monitoring of soil, water, trade waste, dust, vibration.
- Geotechnical investigations.
- Insitu pressuremeter testing.
- Instrumentation Installation and monitoring – inclinometers, profilometers, extensometers, seismographs.
- Land development and earthworks testing - strength and density tests.
- Specialist Laboratory testing – triaxial, consolidation, permeability, ringshear.
- Standard soil, aggregate, concrete and rock testing
- Pavement testing – Geobeam, Benkelman beam, insitu CBR, pavement pits, traffic control

Equipment Sales

From the very early days, Geotechnics represented several leading overseas equipment suppliers and this side of the business expanded to specialist geotechnical instrumentation and environmental equipment. We also manufacture a range of products which we sell locally and overseas.

We have a dedicated service team to provide calibration, maintenance and repairs for the products we supply.

Calibration

Geotechnics purchased The Measurement and Calibration Centre (MCC) in 2007 to complement the Testing and Sales Divisions. We calibrate

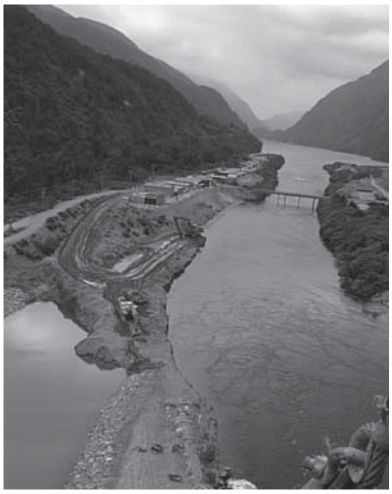
- Civil and Geotechnical equipment ie Hand shear vanes, Impact testers, Scala Penetrometers, Nuclear densometers
- Linear measurement – dial gauges, rulers, tapes
- Load cells, proving rings and balances
- Compression and tension machines

Projects

Geotechnics has provided project testing services to many of the larger projects in New Zealand, most of which have required the establishment of IANZ accredited site laboratories. Such projects include Marsden Point Refinery Expansion, Glenbrook Steel Mill, Clyde Dam, Kinleith Pulp and Paper Mill, Golden Cross Gold Mine, Martha Hill Gold Mine, Manapouri Second Tailrace Tunnel, Northport Log Pavement and various roading projects throughout Auckland and the upper North Island. Other project work

Left: Earthworks testing at the northern runway

Below: Digging the new channel for the second tail race, Manapouri



has been undertaken offshore in the South Pacific and Asia (Fiji, Samoa, American Samoa, Solomon Islands, Malaysia and Laos).

Construction of Auckland Airport's New Northern Runway - Stage I

The new runway is parallel to and north of the existing runway. It is being developed in stages to be 2,150 metres long. Stage I is 1,200 metres long and due for completion in late 2010, in time for the Rugby World Cup in New Zealand. Smaller, slower aircraft will be shifted to the Northern runway, enabling better use of the existing runway and aprons for larger aircraft.

Our role is to provide the earthworks quality control testing. We have technicians on site during the construction season performing density tests and ultimately up to 7,500 dynamic cone penetrometer (DCP) scala tests over the duration of the project. We also monitor construction settlement and pore pressure with geotechnical instrumentation. We have installed and are monitoring 2.4km of settlement tubing and 16 vibrating wire piezometers.

Wellington Inner City Bypass Project

This project involved the construction of a two lane road that will reduce traffic levels in the central business district. Geotechnics was primarily involved with monitoring the stability of a large trench structure that forms part of the bypass. We were able to provide the requested instrumentation, install it and provide ongoing monitoring services. Instrumentation included inclinometers and vibrating wire and open stand-pipe piezometers.

Manapouri Second Tailrace Tunnel, Fiordland

Geotechnics established an on site (IANZ accredited) laboratory to provide an independent testing service to the 10km tailrace tunnel project. We supplied all testing equipment and instrumentation and were responsible for equipment commissioning and ongoing operation during the five year contract.

The site facility catered for the testing of a wide range of materials including concrete, shotcrete, rockbolts, aggregates, grout, soils and water. Other activities included instrumentation installation and monitoring (piezometers, inclinometers, etc) and environmental testing and monitoring.

Golden Cross Gold Mine

Geotechnics was awarded the contract to establish and operate a project laboratory for all civil works associated with the development and ongoing operation of this gold mine. The project duration was 11 years and at the height of construction, the site team comprised seven personnel involved in testing and monitoring activities. Other inputs to the project were the supply, installation and monitoring of geotechnical instrumentation (piezometers, inclinometers, extensometers, etc) and site based environmental testing.

Contact Details

Auckland: Ph 64 9 356 3522
Tauranga: Ph 64 7 571 0280
Wellington: Ph 64 4 381 8584
Email: enquiries@geotechnics.co.nz

GEOTECHNICS

NZ Geotechnical Society PHOTO COMPETITION WINNER

...history never repeats

"This is taking spring loading to a new level!" **David McKay** – Apex Consultants Ltd, New Plymouth

HIGHLY COMMENDED

"After abseiling down the cliff!" – **Sigfrid Dupre** – Connell Wagner, Auckland

"I hope there's no sharks in that water" **Jason Kelly** – Tonkin & Taylor, Auckland

"For those of us who appreciate having our feet remaining on stable ground there are palisade walls. Unlike our photographed visitor, the wall designer also enjoys keeping his feet on stable ground." **Peter Quilter** – Tonkin & Taylor, Auckland

"Treading dangerous ground" – **Warwick Sitana**, Cardno, Australia

BROWN BROS DRILLING

GEOPROBE MODEL 7720DT

High capacity multi purpose direct push machine, long stroke mast.

With CPT and MIP options

GEOPROBE MODEL 7720DT

Automatic SPT Drop Hammer

DT325 Soil Coring

MC5 Soil Coring

Hollow Stem Auger Soil Coring

Concrete Coring

GEOPROBE MODEL 7720DT

- Wireless remote control
- Rubber track mounted
- Fast, clean and efficient
- No drill waste or drill cuttings produced
- No water or drilling additives required
- No compressed air required
- On board water supply and decontamination system
- 1.956mm probe cylinder stroke
- Over 20 ton of retraction force
- Multi purpose Environmental / Geotechnical tool

BROWN BROS (NZ) LTD

AUCKLAND
(09) 298 0449

HAMILTON
(07) 849 2919

EMAIL
geoprobe@brownbro.co.nz

www.brownbro.co.nz

Damwatch

Damwatch is a highly respected niche consultancy based in Wellington, New Zealand. The company specialises in dam engineering, safety, instrumentation and surveillance. Damwatch also has a wealth of experience in river engineering, civil asset management and compliance

Damwatch enjoys an international reputation for innovation and excellence. The Arapuni Foundation Enhancement project won the EEA Engineering Excellence Award and generated interest from the USA to Turkey. "Detailed geotechnical investigations and analysis led to an elegant and robust solution at half the cost of a complete foundation cut-off wall" says Peter Amos, Managing Director.

Damwatch is a responsive business focussed on developing smart solutions for dam owners, always focused on 'best for project' outcomes. Quality and safety come first, its dynamic team ensures solutions are appropriate for today's clients. The very skilled team, with seven senior specialists having over 200 years dam engineering experience, delivers wise judgement and doing the right thing.

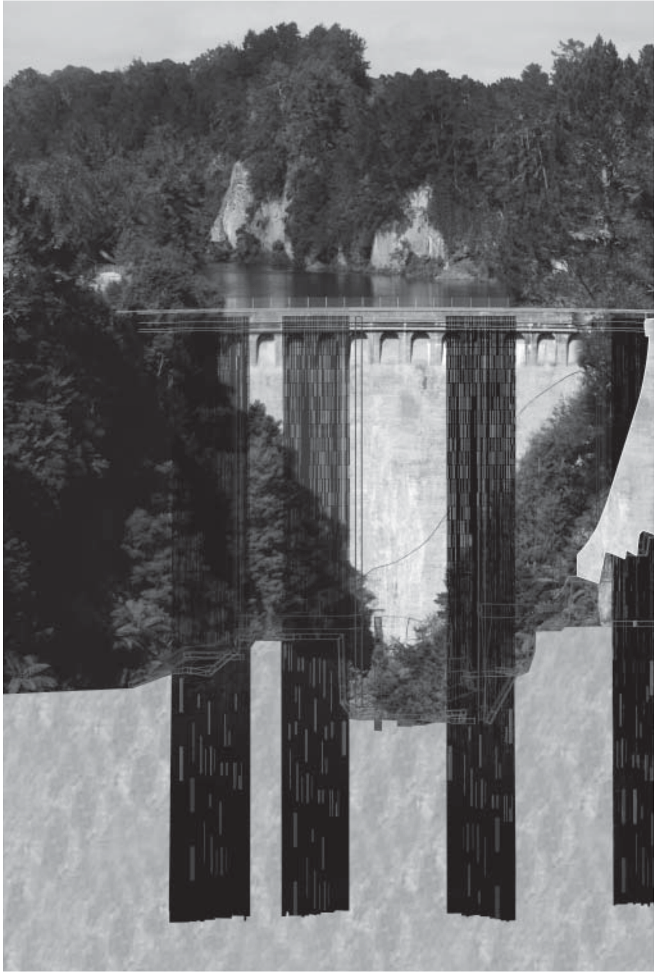
"Dam owners have a responsibility to the public for safety and environmental well-being. The public risk and cost in a failure can be significant. Dam protection is good business for dam owners, and we understand that." Brendan Paul, Business Manager.

Damwatch has an enviable reputation for understanding owners' needs, drawing on our extensive experience in owning major dam and water assets. Our solutions are innovative, right for the client, and right for the project. Our clients know that.

Damwatch Specialists' geotechnical experience includes:

- Matahina Dam foundation investigation and 40m deep abutment repair
- Arapuni foundation investigations and remediation
- Karapiro Dam left abutment foundation strengthening
- Mangahao Dam Spillway foundation repairs
- Roxburgh Dam foundation investigations and instrumentation
- Foundation investigations and monitoring for canal
- Hinze Dam instrumentation
- West Warwick Reservoir Stability Assessment. Investigations planned to enable development of a geotechnical model and establish parameters for analysis.

Our comprehensive services ensure the safety of the dam over its productive life. We have expertise covering all aspects of dam infrastructure, with our New Zealand based team and international network of on-call experts, to ensure our services are correctly targeted at the client's problem



Above: Arapuni Dam Foundation Enhancement Project

While dams are our core business, the diversity of Damwatch's technical and commercial proficiency is recognised through the company's involvement in a wide range of projects, including: wind farm asset management, wind data surveillance, geophysical surveys, river and floodplain engineering, Building Act compliance and resource consent input.

Contact Details

Damwatch
PO Box 1549, Wellington
Ph: 64 4 381 1300
Email: info@damwatch.co.nz
Website: www.damwatch.co.nz

Damwatch
Dam Engineering Specialists

MEMBER PROFILES

David Burns

Occupation
Engineering Geologist
Maunsell AECOM

Kate caught me in an unguarded moment a while ago, spotting an opportunity to fill a few paragraphs in Geomechanics News by collaring a new arrival on the Committee. The result was a commitment to produce a few words about my life in geotechnical engineering. Rather than presenting a CV, I thought that I would present a little of my background, as an example of the many and varied paths that can lead to a life in engineering.

I suppose I came to the profession by accident really, having grown up around major construction projects all over the country in the boom times of the fifties through to the seventies. That included practically living on construction sites and enjoying access, as a child, to all those construction 'toys' that would cause OSH mayhem today and result in questions in Parliament. Having completed my final few years of schooling in Turangi and declining to take my parents advice and consider engineering, I took myself off to Waikato University and enrolled in Earth Science, thinking that Geology sounded as good as anything else. University vacations labouring on earthworks construction sites, including stints in site laboratories, were an excellent training ground and provided a nudge towards an inevitable foray into an engineering career. The final push was provided by the need to generate an income while completing my masters and so I found myself as a field technician monitoring fill construction at the Ruahihi Power Project near Tauranga. I was employed by the designers Mandeno Chitty and Bell, a company that through various mergers and acquisitions has morphed into Maunsell AECOM.

I have been fortunate as an engineering geologist with Maunsell to have been exposed to many interesting projects, fascinating countries and great colleagues and friends. It was never on the cards that a geologist was going to land overseas postings to Paris, Madrid or Tokyo, so I was content with jungles, village accommodation, dodgy air travel and strange characters; and, in the true New Zealand fashion of having a go, finding myself frantically digesting sufficient information to stay one step ahead of disaster.

I am writing this at 1700m up a volcano in West Java contemplating a day's fieldwork in the rain, which is just where any engineering geologist would want to be.

Philip Robins

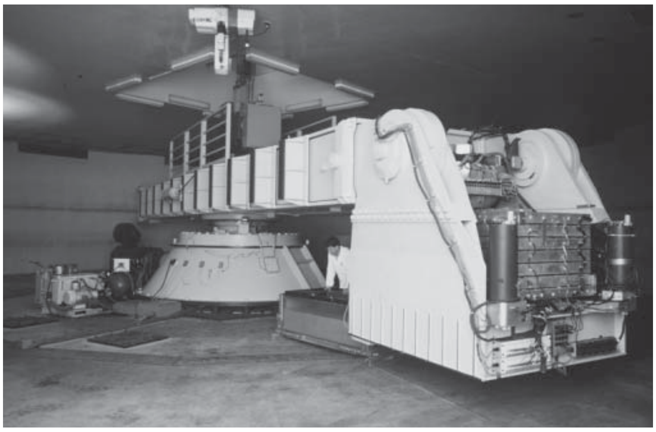
Occupation
Senior Geotechnical Engineer
Golder Associates (NZ) Ltd

In the Beginning

Growing up in Africa was quite cool, especially as a young boy in the middle of the Zimbabwean civil war. But that was a long time ago and before diving into a civil engineering degree at the University in Durban, South Africa after which I worked in general civil engineering design and construction. Some of the work there included hydraulic studies of the Umbilo River and flood protection works for an eighteen-hole golf course at San Lameer on the East Coast.

Ground Engineering

It wasn't until working in the Kalahari Desert where we were installing foundations for telephone microwave towers that a passion for ground engineering developed.



Above: UC Davis Centrifuge

The work was interesting and the foundations included deep rafts, Franki piles or grouted ground anchors. The job also provided enough foreign currency for my OE which started in Perth, included the USA, Canada and Europe.

Overseas Experience

Eventually I landed in Hong Kong at the time when the British government was pouring billions of dollars into the country prior to the 1997 hand over. I caught up with

Left: Onboard Laboratory San Francisco Bay Bridge

an old university mate, who offered me a job with Fugro where most of my work revolved around slope stability assessments and design of soil nail remedial works.

Graduate Experience

Having always wanted to return to university, I applied for Masters in geotechnical engineering at the University of California at Davis. Davis is a small campus in the middle of the Californian Central Valley. In addition to it being an excellent veterinary school the Engineering Department is home to a large geotechnical centrifuge. The centrifuge was handed down from NASA and includes a 9-metre-radius arm and has a 240 g - tonnes capacity. When the centrifuge was brought to UC Davis it was fitted with a servo-hydraulic shaking table. As a research assistance while doing my MSc, I worked with a team on 6 centrifuge models that we spun up to 50g and shaken with a variety of earthquake motions. Even though the control room was some distance from the rotunda we often felt the simulated earthquakes we generated. It was an exciting time especially as I got to do some interesting research with Bruce Kutter and attend some of Ed Idriss's classes. I often remembers some sage advice from Prof Idriss; "make the problem simple BUT not too simple".

Post Graduate Work

Following the Loma Prieta earthquake in 1989, the State of California started working on the seismic retro fit to the San Fancisco Oakland Bay Bridge. So at the time I graduated from UC Davis, I re-joined Fugro and work 12 hour shifts onboard a drilling barge. The drilling barge was also equipped with an onboard geotechnical laboratory where we did all the logging and laboratory testing (even un-drained triaxial testing). Following the drilling work we advanced almost 100 CPT soundings using a 20 tonne seabed mounted rig up to 60 metres in the San Francisco Bay Mud. When the drilling and CPT work stopped, we went onto designing the very large diameter steel piles (2.4 metres).

Other large infrastructure projects that I have had the pleasure to work on included the design and construction of the Container Wharf for the Port of Los Angeles Pier 400.

New Zealand

Not unlike a lot of immigrants, I moved to Nelson with my family in 2004, to take advantage of the great lifestyle we have here. In my opinion, New Zealand has a very high calibre of geologists, engineering geologists and geotechnical engineers. We should all be proud and passionate about the work we do.

Since joining Golder Associates, I have been involved in a wide variety of geotechnical work include some subdivision developments in Nelson, the SH20 Manukau Extension design/construct project, and more recently, mining projects on the West Coast. I was delighted to be voted onto the Management Committee of the NZGS this year. What a great bunch of hardworking individuals.

Looking Back and Forward

One of the developments within our field that I am particularly pleased to see is the change in our safety culture. We should continue to work safe and go home safe.

In your day to day work, I would also encourage you to take the opportunities and challenges when they arrive, and stretch to reach your goals. I also think you will find participation in your New Zealand Geotechnical Society activities rewarding.

EVENTS DIARY

Links are available from the NZ Geotechnical Society website – www.nzgeotechsoc.org.nz

2009

6 - 7 MAY 2009
Perth, Australia
1st International Seminar on Safe and Rapid Development Mining (ACG)
http://www.srdm.com.au/

25 - 27 MAY 2009
Kyoto, Japan
International Symposium on Prediction and Simulation Methods for Geohazard Mitigation
nakisuna2.kuciv.kyoto-u.ac.jp/tc34/is-kyoto/

11 - 12 JUNE 2009
Gifu, Japan
2nd International Symposium on Geotechnical Safety and Risk
http://www.cive.gifu-u.ac.jp/%7Eis-gifu2009/

15 - 17 JUNE 2009
Tsukuba, Japan
IS-Tokyo 2009 - International Conference on Performance-Based Design in Earthquake Geotechnical Engineering - from case history to practice
www.rs.noda.tus.ac.jp/ytsoil/IS2009.htm

22 - 25 JULY 2009
Harbin, China
3rd International Geotechnical Symposium (IGS 2009) on Geotechnical Engineering for Disaster Prevention and Reduction.

9 - 11 SEPTEMBER 2009
Chengdu, China
The 7th Asia Regional Conference of IAEG "Geological engineering problems in major construction projects"
http://www.iaeg2009.com/

9 - 11 SEPTEMBER 2009
Perth, Australia
4th International Conference on Mine Closure
http://www.mineclosure2009.com/

5 - 9 OCTOBER 2009
Alexandria, Egypt
XVII International conference on soil mechanics and geotechnical engineering.
The Egyptian geotechnical society with great pleasure invites you to Bibliotheca Alexandria in 2009 to attend this international conference.

29 - 31 OCTOBER 2009
Dubrovnik-Cavtat, Croatia
ISRM International Symposium EUROCK'2009 - Rock Engineering in Difficult Ground Conditions – Soft Rocks and Karst
http://www.eurock2009.hr

2010

23 - 27 MAY 2010
Brazil
9th International Conference on Geosynthetics
http://www.9icg-brazil2010.info

9 - 11 MAY 2010
California, United States
2nd International Symposium on CPT, CPT'10
www.cpt10.com/

28 JUNE - 1 JULY 2010
Hönggerberg Campus , Zurich, Switzerland
7th International Conference on Physical Modelling in Geotechnics
www.icpmg2010.ch/

5 - 10 SEPTEMBER, 2010
Auckland,Aotearoa New Zealand
11th IAEG Congress - Geologically Active
http://www.iaeg2010.com/

8 - 12 NOVEMBER 2010
New Delhi, India
6th International Congress on Environmental Geotechnics
6icegdelhi@gmail.com

2011

23 - 28 MAY 2011
Hong Kong, China
XIV Asian Regional Conference Soil Mechanics and Geotechnical Engineering

7 - 11 NOVEMBER 2011
Melbourne, Australia
11th Australia - New Zealand Conference on Geomechanics

NEW ZEALAND GEOTECHNICAL SOCIETY INC.

Management Committee Address List 2008

NAME	POSITION	ADDRESS, EMAIL	PHONE, FAX
Williams,(A) Ann ⋆	Chairperson NZ IAEG Representative	Beca Infrastructure Ltd 132 Vincent Street P O Box 6345, Auckland 1141 ann.williams@beca.com	09 300-9172 (DDI) Work 09 300-9300 Fax
Blakey, A (Amanda) +	Management Secretary	81 Esperance Road Glendowie Auckland nzgeotechnicalsociety@xtra.co.nz	09 575 2744 Home
Bowman, E (Elisabeth) •	YGP Representative	Senior Lecturer Civil Engineering University of Canterbury Private Bag 4800 Christchurch 8140 elisabeth.bowman@canterbury.ac.nz	03 364 2987 (DDI) Work ext 7476
Burns, D (David)⋆	Committee Member	Maunsell Ltd 47 George Street Newmarket david.burns@maunsell.com	09 336 5374 (DDI) Work 09 379 1201 Fax
Chin, C Y	Immediate Past Chairman	Maunsell Limited 47 George Street Newmarket Auckland cy.chin@maunsell.com	09 336 5333 Work 09 379 1210 Fax
Professor Davies M, (Michael)⋆	Committee Member NZ ISSMGE Representative	Dean of Engineering Faculty of Engineering, University of Auckland Private Bag 92019 Auckland New Zealand michael.davies@auckland.ac.nz	09 373 7599 (DDI) Work
Robins, P (Philip)⋆	Committee Member	Golder and Associates (NZ) Ltd Level 1 Concordia House 200 Hardy Street Nelson probins@golder.co.nz	03 548 1707 Work 03 548 1727 Fax
Stewart D, (David)⋆	Committee Member	Opus International Consultants PO Box 12-003 Wellington David.Stewart@Opus.co.nz	04 471 7155 (DDI) Work 04 471 1397 Fax
Williams, K (Kate) •	Editor Geomechanics News	Tonkin & Taylor Ltd 105 Carlton Gore Road Newmarket Auckland kwilliams@tonkin.co.nz	09 355 0741 (DDI) Work 09 307 0265 Fax
Young, R (Richard)⋆	Treasurer	Beca Infrastructure Ltd PO Box 13960 Christchurch richard.young@beca.com	03 374 3714 (DDI) Work 03 366 3188

• Co-opted position
+ Appointed position
⋆ Elected members of committee

continued>

Carter J (John)	ISSMGE Australasian Vice President	Faculty of Engineering and Environment University of Newcastle Callaghan NSW 2308 johncarter@netspace.net.au	+61 02 492 16025 Work +61 02 492 17062 Fax
Meyers, T (Tony)	ISRM Australasian Vice President	PO Box 210 Rundle Mall Adelaide SA 5001 tony@rocktest.com.au	+61 08 8376 9096 Work
Moon A (Alan)	IAEG Australasian Vice President	Coffey Geotechnics Pty Limited 14B Henley Beach Road Mile End SA 5031 South Australia Alan_Moon@coffey.com.au	+61 08 835 21744 Work +61 08 823 40932 Fax
St George, J (John)	NZ ISRM Representative	Department of Civil and Environmental Engineering University of Auckland Private Bag 92019 Auckland j.stgeorge@auckland.ac.nz	09 373 7599 Work ext 88195 09 373 7462 Fax

NEW ZEALAND GEOTECHNICAL SOCIETY INC.

Objects

a) To advance the education and application of soil mechanics, rock mechanics and engineering geology among engineers and scientists.
b) To advance the practice and application of these disciplines in engineering.
c) To implement the statutes of the respective international societies in so far as they are applicable in New Zealand.
d) To ensure that the learning achieved through the above objectives is passed on to the public as is appropriate.

Membership

Engineers, scientists, technicians, contractors, students and others who are interested in the practice and application of soil mechanics, rock mechanics and engineering geology.

Members are required to affiliate to at least one of the International Societies.
Students are encouraged to affiliate to at least one of the International Societies.

Annual Subscription

Subscriptions are paid on an annual basis with the start of the Society's financial year being 1st October. A 50% discount is offered to members joining the society for the first time. This offer excludes the IAEG bulletin option and student membership. No reduction of the first year's subscription is made for joining the Society part way through the financial year.

Basic membership subscriptions (inclusive of GST), which include the magazine, NZ Geomechanics News, are:

Members	**$75.00**
Students	**Free**
Annual IPENZ service centre fee applies to all NZGS members who are not members of IPENZ	**$33.75 (incl GST)**

Affiliation fees for International Societies are in addition to the basic membership fee:

International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)	**$24.00**
International Society for Rock Mechanics (ISRM)	**$33.00**
International Association of Engineering Geology & the Environment (IAEG)	**$21.00**
(with bulletin)	**$70.00**

All correspondence should be addressed to the Management Secretary. The postal address is:

NZ Geotechnical Society Inc, P O Box 12 241, WELLINGTON

The Secretary
NZ Geotechnical Society Inc.
The Institution of Professional Engineers New Zealand (Inc)
P.O. Box 12-241, WELLINGTON

NEW ZEALAND GEOTECHNICAL SOCIETY INC.
APPLICATION FOR MEMBERSHIP

(A Technical Group of the Institution of Professional Engineers New Zealand (Inc))

FULL NAME (Underline Family Name): ....

POSTAL ADDRESS: ....

Phone No: (   )...................... Fax No: (   ) .... E-MAIL: ....

DATE OF BIRTH ....

ACADEMIC QUALIFICATIONS: ....

PROFESSIONAL MEMBERSHIPS: .... **Year Elected**..

PRESENT EMPLOYER: ....

OCCUPATION: ....

EXPERIENCE IN GEOMECHANICS: ....

STUDENT MEMBERS: ....

TERTIARY INSTITUTION: .... **SUPERVISOR:** ....

SUPERVISORS SIGNATURE: ....

Note that the Society's Rules require that in the case of student members "the application must also be countersigned by the student's Supervisor of Studies who thereby certifies that the applicant is indeed a bona-fide full time student of that Tertiary Institution". . . ; Applications will not be considered without this information.

Affiliation to International Societies: All full members are required to be affiliated to at least one society, and student members are encouraged to affiliate to at least one Society. Applicants are to indicate below the Society/ies to which they wish to affiliate.

I wish to affiliate to:

International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)	Yes/No
International Society for Rock Mechanics (ISRM)	Yes/No
International Association of Engineering Geology (IAEG)	Yes/No
& the Environment (with Bulletin)	Yes/No

DECLARATION: If admitted to membership, I agree to abide by the rules of the New Zealand Geotechnical Society

Signed .... Date ....../....../.......

ANNUAL SUBSCRIPTION: Due on notification of acceptance for membership, thereafter on 1st of October. Please do not send subscriptions with this application form. You will be notified and invoiced on acceptance into the Society

PRIVACY CONDITIONS: Under the provisions of the Privacy Act 1993, an applicant's authorisation is required for use of their personal information for Society administrative purposes and membership lists. I agree to the above use of this information:

Signed .... Date ....../....../......

(for office use only)

Received by the Society ....

Recommended by the Management Committee of the Society ....

NEW ZEALAND GEOTECHNICAL SOCIETY INC. PUBLICATIONS 2008

Publication Name	List Price Members	List Price Non-Members
New Zealand Geomechanics Society Conferences:		
Proceedings of Technical Groups, Vol 22, Issue 1G **(1 left)** *Geotechnical Issues in Land Development* Hamilton 1996	$20	$35
Proceedings of the New Zealand Geotechnical Society Symposium – *Roading Geotechnics 98* Auckland 1998	$40	$70
Proceedings of the New Zealand Geotechnical Society Symposium – *Engineering and Development in Hazardous Terrain* Christchurch 2001	$50	$70
Proceedings of the New Zealand Geotechnical Society Symposium – *Geotechnics on the Volcanic Edge* Tauranga 2003	$50	$70
Proceedings of the New Zealand Geotechnical Society Symposium – *Earthquakes and Urban Development* Nelson 2006	$50	$70
Proceedings of the 18th New Zealand Geotechnical Society Symposium – *Soil-Structure Interaction*, Auckland 2008. (CD)	$50 $20	$70 $25
Australia – New Zealand Conferences on Geomechanics:		
Proceedings of the 2nd Australia – NZ Young Geotechnical Professionals Conference, Auckland, December 1995	$25	$40
Proceedings of the 5th Australia – NZ Young Geotechnical Professionals Conference, Rotorua, March 2002 (spiral bound reprint)	$75	$85
Proceedings of the 6th Australia – NZ Conference on Geomechanics Christchurch, February 1992	$50	$100
Proceedings of the 9th Australia – NZ Conference February 2004 – 'To the enz of the Earth' **(Vol 2 only)**	$150	$200
Other Publications:		
NZ Geomechanics News Collection 1970–2003 Volumes 1–66 (CDRom)	$25	$40
Shear Vane Guidelines	$15	$20
Back Issues of *NZ Geomechanics News* **(selected issues)**	$5	$5

Prices do not include GST or postage & handling

Orders to: Amanda Blakey, Management Secretary. Email: nzgeotechnicalsociety@xtra.co.nz

ADVERTISING INFORMATION

NZ Geomechanics News is published twice a year and distributed to the Society's 650 plus members throughout New Zealand and overseas.

The magazine is issued to society members who comprise professional geotechnical and civil engineers and engineering geologists from a wide range of consulting, contracting and university organisations, as well as those involved in laboratory and instrumentation services.

Advertisement Location	Single Issue	Advert. Size (mm)
Black & White		
Full Page Internal	$270	185 wide x 265 high
Half Page Internal	$210	90 wide x 265 high
		185 wide x 130 high
Quarter Page Internal	$180	90 wide x 130 high
Colour		
Back Cover	$720	210 wide x 297 high
Inside Cover (Front or Back)	$600	210 wide x 297 high
Full Page Internal	$480	210 wide x 297 high
Half Page	$240	175 wide x 130 high
A3 Centrefold	$900	420 wide x 297 high

Inserts

Insert to be posted with magazine – $240/flyer
Maximum size single A4 page
Special price given on request for other types and sizes

Note

1. All rates exclude GST
2. Space is subject to availability
3. A 3mm bleed is required on all ads that bleed off the page. Bleed must be set up on all files that are supplied.
4. Advertiser to provide all flyers

If you are interested in advertising in the next issue of *NZ Geomechanics News* please contact:

Management Secretary
Amanda Blakey
Email: nzgeotechnicalsociety@xtra.co.nz