Volume 28 Number 4 December 2010

GEOTECHNICAL NEWS

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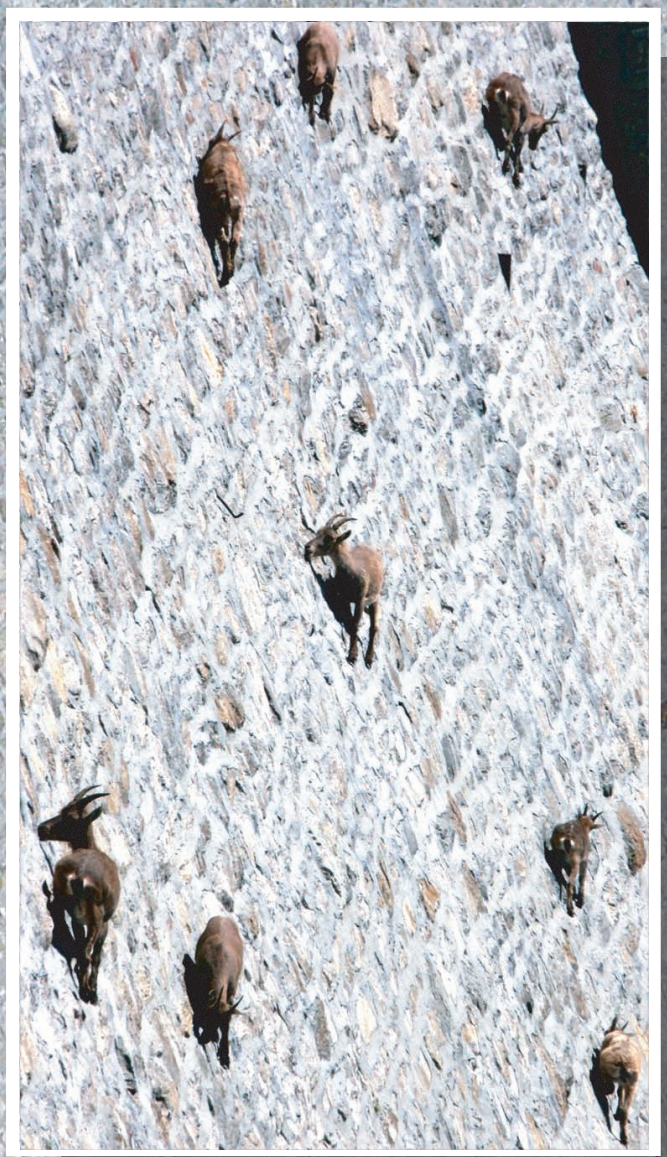

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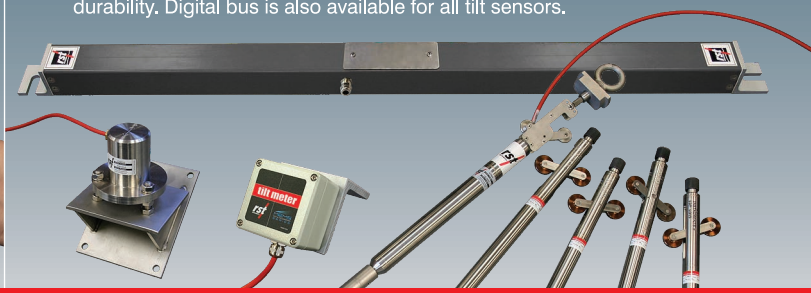

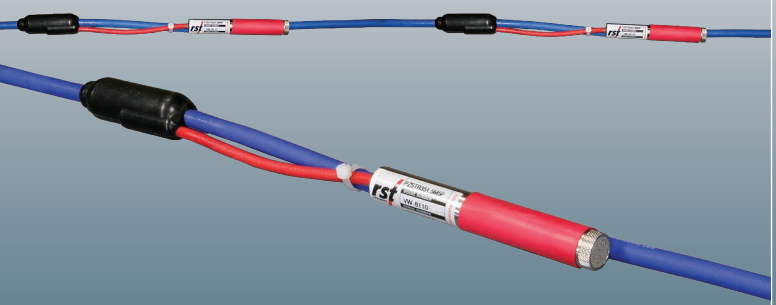

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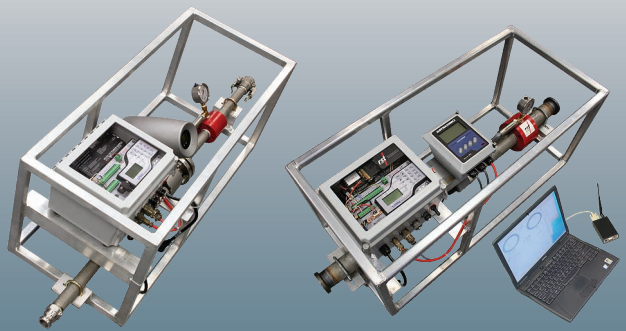

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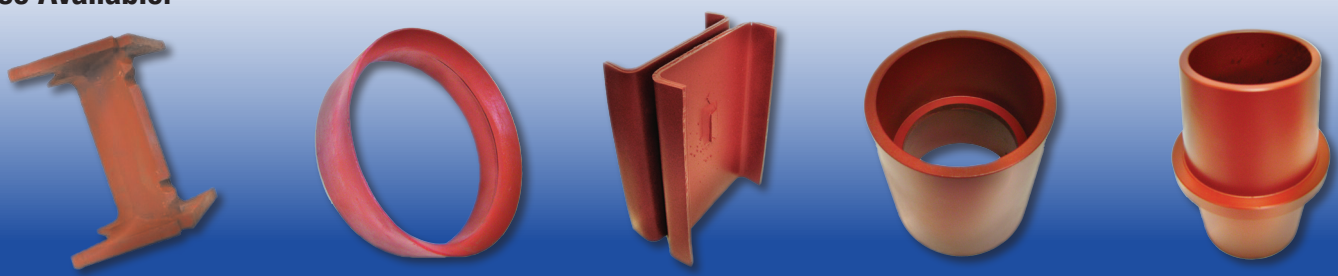

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Cover

Ibex Sheep climb the face of the Cingino Dam Italy. Story page 64. Photos by Adriano Migliorati with permission of "catersnews.com".

CGS NEWS

Message from the President

Michel Aubertin, President of Canadian Geotechnical Society

Dear Colleagues,

The Board of the Canadian Geotechnical Society (CGS) held its annual meeting in Calgary on September 12, 2010. This was a busy day with many activities, events, and issues being discussed. Among the important information that was provided, our President-Elect for 2010, **Bryan Watts**, introduced the new Vice-Presidents: **John Sobkowicz** (Technical), **Jean-Marie Konrad** (Communications), and **Peter Gaffran** (Finance). They will become the core of the Executive Committee of the Society for 2011-2012, and we wish them the best of success.

A number of Board members have completed their mandate this year. It is my pleasure to acknowledge: **Dave Caughill, Yves Cormier, Nigel Denby, Dmitry Garagash, Ed Hoeve, Richard Jackson, Andrew Lister, Catherine Mulligan, Sterling Parsons, Lynden Penner, Steve Rose**, and **Dharma Wijewickreme**. We are very grateful for their sustained volunteer contributions.

Several summary reports were presented during the Board meeting, with the main elements also presented to CGS members during the Business Luncheon on September 14. These reports indicated that most of our Technical Divisions, Local Sections, and Committees are doing well. There are, however, a few Divisions and Sections where the situation could be improved. Already, efforts have been deployed to address some of the most critical issues, including the increased participation of CGS members at the annual Division meetings. The low CGS membership numbers in some Sections is also a concern. In this regard, a special Task Force, chaired by **Richard Bathurst,** has been put together to work on the membership issue.

For many CGS members, the Canadian Geotechnical Conference is the highlight of our annual activities. The GEO2010 conference held in Calgary has been a real success thanks to the

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efforts of the Local Organizing Committee under the leadership of **Charles Kwok, Brian Moorman, Jim Henderson,** and **Rob Armstrong**. We thank them, and their team, for a very enjoyable conference.

An important tradition during our annual CGS conference is the presentation of the Colloquium, which was given this year by **Corey Froese** from the Alberta Geological Survey. The Colloquium speaker for 2011 was announced by the Chair of the Geotechnical Board (GRB), **Dieter Stolle**. The committee has selected **Craig Lake** of Dalhousie University to present the Colloquium in Toronto. It was also announced that the GRB has selected a Vice-Chair, **James Blatz**, who will take over the Chair position in 2011.

A number of Awards were presented to CGS members during the Calgary conference and the identity of many recipients is provided elsewhere in this issue. However, I would like to mention here that CGS has awarded the R.F. Legget Medal, its most prestigious award, to **Dennis Becker,** who received the 2010 Medal during the Legget Luncheon.

The 3rd Canadian Young Geotechnical Engineers and Geoscientists Conference (2010 cYGEGC), organized by **Kent Bannister** and **Kathy Kalenchuk**, was held immediately after the Calgary conference. This conference, which took place in Alberta's beautiful Waterton National Park, was a very pleasant event for all those who attended. The presentations from our young colleagues were quite interesting and keynotes from experienced colleagues also raised some important issues for those considering a career in our field, whether in industry or in academia. I came back from this conference more convinced than ever that the future of CGS will be in very good hands.

Many other events are at the planning stage. In particular, our Society will be joining forces with the ISSMGE in 2011 to host the combined 64th CGC - PanAm - PCTLGE (teaching and learning) Conference in Toronto. Information on this conference can be found on their web site: www.panam-cgc2011.ca. We hope to see you there in large numbers.

The good reputation of CGS lies, in part, in the excellence of the Canadian Geotechnical Journal (CGJ) published by NRC Press. The Editor of the journal, **Ian Moore**, has informed the Board that important changes are ongoing within the publisher. This situation is being monitored closely as both the Board and Executive Committee have expressed the will to maintain their support to keep the CGJ going strong and available to all CGS members.

The Cross Canada Lecture Tour is continuing with two annual tours, which are funded through the Canadian Foundation for Geotechnique. A successful fall 2010 tour was completed by **Sarah Springman,** while the spring 2010 lecturer was **Don Hayley,** who also attracted very good audiences across the country.

One of the objectives of the Society is to develop, maintain and improve communications among geoprofessionals in Canada. With a country as large as ours, appropriate communications means must be used. In this regard, it has already been announced that the CGS web site will be modified significantly, to become more friendly and efficient. CGS will also be moving to an earlier registration for members in the fall, with 2011 renewals accepted online by the end of November 2010. Additional information will continue to be provided to our members by e-mail and through our regular E-News.

Despite our steady-state membership, the financial state of CGS remains strong. However, care must be exercised to ensure our long term financial health as some of the unexpectedly large revenues of recent years may not be repeated in the coming years.

As this is my last message to you as President of the Canadian Geotechnical Society, I would also like to acknowledge the contributions of colleagues and close collaborators, and thank them for their assistance to me and the Society. In this regard, I would like to express my gratitude to our three Vice-Presidents, who have worked with me on the Executive Committee for two years: **Doug Stead**, VP Technical, **Stéphanie Perret**, VP Communications, and **Don Lewycky,** VP Finance. For the past twelve months, we also benefited from the collaboration from the Executive Representatives for the Local Sections, **Marolo Alfaro**, and Technical Divisions, **Jitendra Sharma,** who are both completing their term this year. My work as President was also greatly facilitated by the continued support of our Secretary General, **Victor Sowa**, and our CGS Administrator, **Wayne Gibson.** I would like also to thank **Phil Bruch,** Editor of

CGS News, for his contribution to the publication of the information appearing in this magazine.

In summary, I am pleased to report that the Canadian Geotechnical Society is doing well overall. I have enjoyed meeting many of you during my term as President and have enjoyed serving you. I encourage all members to get involved to help keep the Society strong and vital in 2011 and during the years to come.

I wish you a happy holiday season.

Le mot du Président

Chers collègues,

Le Conseil de la Société canadienne de géotechnique (SCG) a tenu sa réunion annuelle à Calgary, le 12 septembre 2010. Ce fut une journée bien remplie, avec de nombreuses activités, présentations et sujets de discussion. Parmi les informations importantes diffusées à cette occasion, notre Président élu pour 2010, **Bryan Watts**, a présenté les nouveaux Vice-présidents: **John Sobkowicz** (Technique), **Jean-Marie Konrad** (Communication), et **Peter Gaffran** (Finance). Ils formeront le cœur du Comité exécutif de la Société pour 2011-2012. Nous leur souhaitons un grand succès.

Plusieurs membres du Conseil ont achevé leur mandat cette année. Je suis heureux de remercier nos collègues: **Dave Caughill, Yves Cormier, Nigel Denby, Dmitry Garagash, Ed Hoeve, Richard Jackson, Andrew Lister, Catherine Mulligan, Sterling Parsons, Lynden Penner, Steve Rose,** et **Dharma Wijewickreme.** Nous sommes très reconnaissants pour leur contribution aux activités de la Société.

Divers rapports ont été présentés durant la réunion du Conseil, et les principaux éléments ont aussi été présentés aux membres de la Société lors de notre déjeuner d'affaire, le 14 septembre. Ces rapports indiquent que la plupart des Divisions techniques, Sections locales, et Comités vont bien. Des améliorations pourraient toutefois être apportées dans quelques cas. D'ores et déjà, des efforts ont été déployés pour corriger certains des problèmes les plus pressants, incluant une participation accrue aux réunions annuelles de nos Divisions. Le petit nombre de membres dans certaines sections est également une préoccupation. Un sous-comité spécial a été mis sur pied, sous la direction de **Richard Bathurst,** afin de se pencher sur le problème.

Pour plusieurs de nos membres, la Conférence canadienne de géotechnique est l'événement marquant de l'année. La conférence GEO2010 qui s'est tenue à Calgary a été un réel succès, grâce aux efforts du comité local dirigé par **Charles Kwok, Brian Moorman, Jim Henderson,** et **Rob Armstrong**. Nous les remercions, ainsi que leur équipe, pour une conférence très bien organisée et très agréable.

Une tradition importante associée à la Conférence annuelle de la SCG est le Colloquium, présenté cette année par **Corey Froese** (Alberta Geological Survey). Le nom du présentateur du Colloquium pour 2011 a été dévoilé par le Président du Conseil de recherche en géotechnique (GRB), **Dieter Stolle**. Le comité a ainsi choisi **Craig Lake** (Dalhousie University) pour présenter le prochain Colloquium à Toronto. Le GRB s'est également choisi un nouveau Vice-président, **James Blatz**, qui en prendra la charge en 2011.

De nombreux prix ont été décernés durant la conférence de Calgary à des membres méritants de la SCG; l'identité de plusieurs récipiendaires est mentionnée ailleurs dans ce numéro. J'aimerais néanmoins mentionner ici que la Société a accordé la médaille R.F. Legget, son prix le plus prestigieux, à **Dennis Becker**, qui a reçu la médaille 2010 durant le déjeuner Legget.

La rencontre de la 3rd Canadian Young Geotechnical Engineers and Geoscientists Conference (2010 cYGEGC), organisée par Kent Bannister et Kathy Kalenchuk, s'est tenue immédiatement après la conférence de Calgary. Cette rencontre de deux jours, qui s'est déroulée dans le splendide parc national de Waterton, en Alberta, a été très plaisante pour tous ceux qui ont pu y assister. Les présentations de nos jeunes collègues se sont révélées être très intéressantes. Celles de collègues plus expérimentés ont pour leur part permis d'aborder des aspects importants pour ceux qui envisagent de poursuivre une carrière dans notre domaine, tant dans l'industrie que dans le milieu académique. Je suis revenu de cette conférence plus convaincu que jamais que le futur de la SCG est entre bonnes mains.

Plusieurs autres activités sont actuellement à l'étape de la planification. En particulier, notre Société joindra ses forces à la Société internationale de mécanique des sols et géotechnique (SIMSG - ISSMGE) en 2011 pour or-

ganiser sa 64e Conférence annuelle (CGC - PanAm - PCTLGE Conference) à Toronto ; vous trouverez des informations sur cet événement sur le site www.panam-cgc2011.ca. Nous espérons vous y rencontrer en grand nombre.

La bonne réputation de la SCG repose, en partie, sur l'excellence de la Revue canadienne de géotechnique, publiée par les presses du CNRC. L'Éditeur de la revue, **Ian Moore**, a informé le Conseil que des changements importants étaient survenus chez la maison de publication. La situation est suivie de près. Le Conseil et le Comité exécutif ont confirmé leur soutien, afin de maintenir la qualité et la disponibilité de la Revue auprès des membres.

Les tournées de conférences pancanadiennes se poursuivent, avec deux séries annuelles financées par la Fondation canadienne de géotechnique. La tournée d'automne 2010 a été présentée par **Sarah Springman,** alors que **Don Hayley** a parcouru le pays au printemps avec une autre présentation très courue.

Un des objectifs de la Société est de développer, de maintenir et d'améliorer la communication entre les professionnels de la géotechnique au Canada. Un pays aussi vaste requiert des moyens de communication appropriés. A cet égard, il a déjà été annoncé que le site web de la SCG serait modifié substantiellement, afin de faciliter sa consultation et d'améliorer son efficacité. La Société permettra aussi l'adhésion annuelle plus tôt pour 2011, soit à partir de la fin novembre 2010. D'autres informations seront distribuées à nos membres par courriels et avec le E-News.

En dépit d'un nombre de membres à peu près stable, la situation financière de la SCG demeure saine. Toutefois, il convient de demeurer prudent afin d'assurer la santé financière de la Société à long terme. Certains revenus inhabituellement élevés ces dernières années pourraient notamment ne pas se renouveler dans les années à venir.

Il s'agit ici de mon dernier message en tant que Président de la Société canadienne de géotechnique. J'aimerais souligner la contribution de collègues et proches collaborateurs, et les remercier de leur aide. En ce sens, je veux exprimer ma gratitude aux 3 Vice-présidents qui ont œuvré avec moi sur le Comité exécutif au cours de ces deux années: **Doug Stead**, VP Technique, **Stéphanie Perret**, VP Communication, et **Don Lewycky**, VP Finance. Au cours des douze derniers mois, nous avons aussi reçu l'appui des représentants des Sections locales, **Marolo Alfaro**, et des Divisions techniques, **Jitendra Sharma**, qui achèvent tous deux leur mandat cette année. Mon travail comme Président a été grandement facilité par le soutien constant de notre Secrétaire général, **Victor Sowa**, et de l'Administrateur de la Société, **Wayne Gibson**. Je désire également remercier **Phil Bruch**, Éditeur de CGS News, pour sa contribution à la publication des informations dans ce magazine.

En terminant, je peux affirmer que la Société canadienne de géotechnique se porte bien. J'ai apprécié les rencontres que j'ai eues avec plusieurs d'entre vous pendant mon mandat, et j'ai été heureux de pouvoir servir la Société. J'invite tous les membres à participer activement aux activités de la SCG, afin de maintenir notre vitalité pour les années à venir.

Meilleurs vœux pour la saison des fêtes.

From the Society

Canadian Geotechnical Society Awards and Honours, 2010

R.F. Legget Award: Dennis E. Becker

R.M. Quigley Award: Peter Robertson "Interpretation of cone penetration tests - a unified approach." (Vol.46 (11) pp.1337-1355).

Honourable Mention: Alex Strouth and Erik Eberhardt. "Integrated back and forward analysis of rock slope stability and rockslide runout at Afternoon Creek, Washington." (Vol. 46, (10) pp.1116-1132).

Honourable Mention: John A. Cholewa, Richard W.I. Brachman,

and Ian D. Moore. "Response of a polyvinyl chloride water pipe when transverse to an underlying pipe replaced by pipe bursting." (Vol. 46 (11) pp. 1258-1266).

G. Geoffrey Meyerhof Award: Adel M. Hanna, Concordia University, Civil and Environ. Engineering, Montreal, QC

Thomas Roy Award: Réjean Couture, Geological Survey of Canada, Ottawa, ON

Roger J. E. Brown Award: Lukas U. Arenson, BGC Engineering, Vancouver, BC

John A. Franklin Award: Not scheduled for 2010

Geoenvironmental Award: Ernest K. Yanful, Geotechnical Research Centre, Univ. of Western Ontario, London, ON

Geosynthetics Award: Richard W.I. Brachman, Dept. Civil Engineering, Queens University, Kingston, ON

Robert N. Farvolden Award: (Joint award with IAH-CNC) Robert O. van Everdingen, University of Calgary, Calgary, AB

Graduate Student Paper Award: 1st Prize Saman Zarnani, "Application of EPS Geofoam for Seismic Buffers in Rigid Retaining Walls" Department of Civil Engineering, Queen's University, Kingston; Advisor, Dr. Richard Bathurst.

2nd Prize: Michael Van Helden, "Enabling Probabalistic Modelling in Mainstream Practice Through Improved Simulation Techniques" Department of Civil Engineering, University of Manitoba, Winnipeg; Advisor, Dr. James Blatz.

Undergraduate Student Report (Individual)

1st Prize: Isaac Dennett, "Evaluation of Soil Nails for Riverbank Stabilization" Department of Civil Engineering, University of Manitoba, Winnipeg; Advisor, Dr. James Blatz.

2nd Prize: Eric Wolinksky, "Application of Digital Signal Processing to the Measurement of Landslide Acceleration Using PIV Image Analysis" Civil Engineering, Queen's University, Kingston; Advisor, Dr. Andy Take.

Undergraduate Student Report (Group)

1st Prize: Catherine Hynes, Kevin Mathison, Charlie Patrick, and Matthew Weisbrod, "Design of Landslide Mitigation Alternatives for Control Section 56-02-40" Department of Civil & Geological Engineering, University of Saskatchewan, Saskatoon; Advisor, Dr. Jitendra Sharma.

2nd Prize: Jennifer Brown and Candice Cooney, "Mapping Heat Transfer of Gas and Leachate Production at Closed Landfill Sites" Department of Geological Sciences and Geological Engineering, Queen's University, Kingston; Advisor, Mr. Steven Rose.

Canadian Foundation for Geotechnique National Graduate Scholarship: Nelson Ferriera, University of Manitoba

A.G. Stermac Awards

- Robert P. Chapuis, (Ecole Polytechnique)
- Catherine Mulligan, (Concordia University)
- Siva Sivathayalan, (Carleton University)
- Sai K. Vanapalli, (University of Ottawa)

CGS R.M. Hardy Keynote Address: James M. Oswell, Naviq Consulting Inc.

CGS Keynote Address: Not scheduled for the 2010 CGS Calgary Conference.

MacKay Lecture: Steven V. Kokelj, Science Lead, Indian and Northern Affairs Canada, Yellowknife

Canadian Geotechnical Colloquium: Corey R. Froese, Manager, Alberta Geological Survey, Energy Conservation Board

Cross Canada Lecture Tours: Don Hayley, (Spring 2010), Sarah Springman, (Fall 2010)

Awards from Engineering Institute of Canada (EIC)

La Médaille Julian C. Smith Medal: Dennis Becker, Golder Associates in Calgary

La Médaille CPR Engineering Medal: Robert P. Chapuis, Professor at École Polytechnique de Montréal

Fellowship of the Institute (FEIC): Donald Scott, Emeritus Professor, University of Alberta

Call for Nominations – The Canadian Geotechnical Colloquium, 2012

The Canadian Geotechnical Colloquium is a commissioned work financially supported by the Canadian Foundation for Geotechnique (CFG). It is awarded annually to a member of the Canadian Geotechnical community. The purpose of the Colloquium is to provide information of a particular interest to Canadian geotechnique and to provide encouragement to a younger member of the Society in pursuing studies in the Colloquium's preparation. The Colloquium is presented at the CGS-SCG Annual Conference and must be suitable for publication in the Canadian Geotechnical Journal. It must be prepared in the format established by the Journal; however, the decision to publish in the Journal is exclusively the responsibility of the Journal Editor. The choice of the individual and topic is made by the Society's Selection Committee of the Geotechnical Research Board based on the nominations received. The successful candidate receives an honorarium of $5,000 and a framed certificate.

Each nomination letter must provide an introduction to the candidate and their main accomplishments. It must be accompanied by an abstract of about 2000 words of the proposed lecture, emphasizing the importance of the topic to the Canadian geotechnical community, a brief review of the state-of-the-art on that problem, an outline of the significance of the candidate's contribution, and a curriculum vitae listing the nominee's practical experience relevant to the topic and the nominee's publication record. Information on the nomination criteria can be obtained starting on page 36 of the "Awards and Honours Manual 2010" at http://www.cgs.ca/cgsdocuments/manuals/.

Nominations should be submitted prior to January 31, 2011 to Dieter F.E. Stolle, P.Eng., Civil Engineering Dept., McMaster University, 1280 Main Street W., Hamilton ON L8S 4L7, stolle@mcmaster.ca or care of the CGS Secretariat.

The Robert N. Farvolden Award for Hydrogeology

Every year, in conjunction with the Canadian National Chapter of the International Association of Hydrogeologists (CNC/IAH), the Canadian Geotechnical Society presents the Robert N. Farvolden Award to an individual or group to recognize excellence in hydrogeology in one or more of the following areas: research and publication, professional practice and education, and service to the professional community or public, either nationally or internationally. Recent winners have been Garth van der Kamp (2005), Emil Frind (2007), Frank Patton (2008), the late

Pierre Gélinas (2009) and Robert van Everdingen (2010).

For the 2010-2012 Farvolden Awards, because the two organizations are not meeting jointly, the nominations must be received by the CGS Secretary, Dr. Vic Sowa (vsowacgs@dccnet.com), or by Dr. Grant Ferguson (Grant Ferguson [gferguso@stfx.ca]), President of the CNC/IAH, by April 1st of the year of the Award. The 2011 Award will be announced first at the CNC/IAH meeting in Québec City in August and then presented at the Pan-American meeting of the CGS in Toronto in October.

A nomination for the Farvolden Award must describe the contributions of the candidate(s). Each nomination will be considered by the Award Selection Committee. This Committee may reject, without further consideration, any nomination that, in its opinion does not adequately detail the contributions of the candidate(s). The nominee (or nominees in the case of a joint nomination) may be a specialist or a generalist working in academia, or for a government agency or in consulting. The nominee(s) should display a similar integrity, mentorship, or similar unselfish leadership that distinguished Robert N. Farvolden in his career. The nomination should be supported by additional letters of support which must include support from outside the institution to which the nominee(s) belong(s). An appropriate nomination will include a summary of the person's (or persons') academic background, their mentoring and/or teaching credentials, their achievements during their career, and their contributions to Canadian hydrogeology through their leadership and participation. A single nomination submitted by April 1st of the Award year is sufficient to initiate and complete the annual process of selection on the basis of the nominee's excellence in research and publication, or professional practice and education or professional service or some combination of these areas.

The IAH and CGS call on Canadian hydrogeologists to submit nominations for the Farvolden Award to honour those who have displayed the very qualities that Bob Farvolden brought to our profession.

Richard Jackson,
Chair CGS Hydrogeology Division
INTERA Engineering Ltd.
11 Venus Crescent, Heidelberg,
Ontario, N0B 1Y0
email: rjackson@intera.ca

Membership Registration for 2011

Visit the Canadian Geotechnical Website at www.cgs.ca to renew your membership.

Membership Benefits include:

- Keep up with local, national and international developments
- Share insights, visions and experience
- Present projects and research to peers
- Record Continued Education Unit (CEU) and Professional Development Activities (PDAs)
- Attend lectures, Cross Canada Lectures, short courses, workshops, seminars and conferences etc. organized locally or nationally at membership rates
- Eligible to participate as Executives in local or national committees and boards
- Meet, socialize and know colleagues with common interests, potential employers or employees
- Develop contacts with colleagues across Canada
- Sponsorship and mentorship initiatives
- Membership fee includes free internet access to all early Canadian Geotechnical Journal plus 12 new issues per year
- Geotechnical News - 4 issues per year
- Website www.cgs.ca, CGS News, CGS e-News

We look forward to your membership renewal or joining as a new member soon. We also ask that all current members to invite a friend or colleague to join the Canadian Geotechnical Society. With your help, we can continue to provide the benefits the society brings to our profession.

2011 CGS Membership Fee Increase to Provide Online Canadian Geotechnical Journal

As President Aubertin has reported in the last few issues, the federal government has privatized NRC Research Press, the publisher of the Canadian Geotechnical Journal. As of January 2011, the CGJ will no longer be available free of charge as an online service to all Canadians; however, as the sponsoring Society, we have been offered a very preferential annual rate so we can continue to provide online access to all CGS members.

At its September meeting the Board agreed that, as this charge will be a recurring operational expense, the Society cannot absorb it but must pass all, or most, of it on to members – it was agreed that access to the CGJ for student and retired members would be partially subsidized.

The 2010 regular member fee of $175 included 5% GST of $8.33 resulting in a net fee of $166.67 – the 2010 net student and retired fees were $61.90. To offset the CGJ online access charges, 2011 CGS fees (before taxes) have been set as follows: Regular Member (in Canada) - $190; International Member - $210; Retired Member - $70; and Student Member - $70. The applicable GST or HST based on one's province of residence will be added to these prices.

2011 Renewals - Contact Information Update

CGS membership renewal has traditionally not been available until January 1 of the New Year. As part of the CGS website redevelopment project, we have revised the member database programming so renewals can commence before January 1 – this early renewal should be available by the time of publication of this issue of Geotechnical News. This change will now permit members to renew before the end of the calendar year. Member accounts will also not become inactive immediately on January 1 in order to permit a grace period should one's renewal be delayed until early in the New Year.

Whether you choose to renew and pay online (now adopted by almost 95% of CGS members) or by fax or mail, we will be sending 2011 CGS membership details to everyone in December in order to ensure a quick and easy renewal process. You can help ensure our e-mails or letters arrive successfully by updating your contact information online at http://members.cgs.ca/. After logging in with your CGS Username and Password – if you have forgotten one or both of these you can use the online recovery feature or call us at 1-800-710-9867 – choose the Edit Account link on the left side of the page to update your contact information, and your preferred e-mail address. If desired, you can also change your password by selecting the Edit Password link from the left navigation menu.

We look forward to seeing all of you return as members in 2011 – and don't forget to encourage your colleagues to join the Canadian Geotechnical Society!

Geo2010: 63rd Canadian Geotechnical Conference and 6th Canadian Permafrost Conference - Summary

Geo2010, the 63rd Canadian Geotechnical Conference and 6th Canadian Permafrost Conference, was held in Calgary from September 12 to 16, 2010. The Hyatt Regency Hotel accommodated over 550 conference delegates, with over 230 technical papers and 50 exhibitor booths. The conference theme was "GEO2010: In the New West", reflecting Calgary's role and impact in the development of western Canada, as well as the past and future potential in research developments and advancement in geotechnical in geotechnical and permafrost engineering and science.

On Sunday, preconference workshops on Introduction to Geosynthetics, Permafrost Geophysics, Remote Sensing of Permafrost and Introduction to Oil Sands Tailings Planning, Production, Treatment and Reclamation were presented. Also a tour of various Calgary construction sites was conducted. A tour of the Frank Slide and Turtle Mountain was conducted on Thursday.

Plenary session presentations consisted of the R.M. Hardy Address by Jim Oswell on Pipelines in permafrost – geotechnical issues and lessons and the McKay Lecture by Steven Kokelj entitled Permafrost as a unifying discipline for northern environmental change research: Environmental studies across treeline, Mackenzie Delta region, NWT. The CGS Colloquium was presented by Cory Froese on Evolving Technology Trends in Modern Geological Hazard Risk Management and the CGS Graduate Student Paper was presented by Saman Zarnani on Application of EPS Geofoam for Seismic Buffers sin Rigid Retaining Walls.

The primary CGS Award, the 2010 R.F. Legget Medal was presented to Dr. Dennis Becker of Golder Associates Ltd. at the luncheon on Monday. Later that evening at the awards gala, the remainder of the awards and honours were presented.

The social program offered wonderful combinations of food, drink and entertainment, starting at the Sunday eve-

ning icebreaker, through the Awards Gala, to the local colour night at the Calgary Tower and the closing luncheon. Western hospitality was prevalent throughout the events.

We would like to express thanks to Conference Chair Charles Kwok and all members of the organizing committee for an entertaining, informative and successful conference. We wish to also recognize our conference sponsors for their generosity: Platinum - ConeTec, Rapid Impact Piers, Geo-Slope International, Reinforced Earth, BGC Engineering, Golder Associates, MEG Consulting, Stantec, Coffey Geotechnics, AMEC, Thurber Engineering; Gold - Almita, Klohn Crippen Berger, Nilex, Norwest Corporation; Silver - EBA Engineering, Geotech Drilling, North American Construction Group, WorleyParsons; Bronze - Hayward Baker, LVM, O'Connor Associates and Syncrude.

2010 Legget Medal Award Introduction for 2010 Legget Medal Recipient: Dr. Dennis Becker

Introduction by: Jack Crooks, Golder Associates Ltd.

Mr. President, honoured guests, ladies and gentlemen.

I can not express how delighted I am to have the opportunity to introduce this year's Legget Medal winner, Dennis Becker. Dennis has been a friend and colleague since he joined Golder in eastern Canada in the mid 1970s after finishing his bachelor's program. At that time, we worked together on a major landslide project in 1975 in Quebec; this slope failure actually made the front page of the Globe and Mail!! I think it may have been the numbing experience of drilling so many deep boreholes through hard glacial deposits that drove Dennis back to do a doctoral program on soft clay at Western. When I moved to Golder's Calgary office in 1982, I was delighted to meet up with Dennis again; we are still working here together and as always, it is a pleasure.

Dennis has had a very successful career. Many of you are aware of the major contributions he has made to geotechnical engineering as a whole and also to this society: his presidency of this society, editor of the Canadian Geotechnical Journal, a participant in many significant technical committees, a large portfolio of technical papers….. the list goes on.

While all of these contributions are truly appreciated, I would like to focus on two of Dennis' other contributions to our profession firstly by inspiring the young people who join our profession and secondly in the philosophy that he brings to his project work.

Dennis is not a "lone wolf" practicioner. He works on projects that typically require the support of many others including both professional and administrative staff. He is a natural team builder with a very positive approach to his work. He inspires younger professionals to have and to achieve their dreams. As the result of Dennis' efforts there are a large number of young professionals who are working with us in Canada and are members of this society. His enthusiasm for his work is infectious. It would be simply impossible for him to work in a profession that he did not enjoy. This enthusiasm transmits itself to others in a very intense way…..the mark of a real leader.

Dennis' attention to quality in his work is legendary. His client roster is mainly populated by repeat clients – they know that if Dennis is involved in their work, it will receive detailed attention from a very competent individual. As a co-author with Dennis on some of his many technical publications, I am acutely aware of his drive for quality in what he publishes…. there are no short cuts in his work.

So without further ado, please join me in welcoming this year's Legget Medal winner – Dennis Becker!!!

Legget Medal Award, 2010

Acceptance by Dennis Becker

It is indeed a great honour and privilege to receive this special award of recognition from the CGS. This award means a lot to me, and the fact that I'm receiving it in Calgary in the presence of some members of my family, and in front of many of my CGS friends and colleagues is a bonus. I was fortunate enough to attend an awards ceremony earlier this year during which one of the well deserved recipients said "this is great – it feels good to get an award". He is so right – it indeed feels good.

I extend special thanks to my nominators and supporters for taking precious time from their busy schedule and life to prepare the nomination documents. It is a great pleasure in seeing most of them here to today. Thank you so much. I also thank the CGS Awards Selection Committee for considering me worthy of this recognition.

The CGS, through its members, has been very good to me. I truly can say

(from left to right) Jack Crooks, Michel Aubertin, Doug Van Dine, Dennis Becker.

that I have benefited far more greatly from the CGS and its members than I have given back to our Society. The experiences and insight gained through CGS has had significant, positive influence on my career and professional development.

If you will permit me, I want to re-emphasize the theme during my term as your President. That is, the relevance and importance, if not a necessity, of being a member of a learned society such as CGS, CSCE, CDA, TAC or whatever society you consider relevant. There is a positive, complementary relationship between being a member of a professional licensing body and of a learned society. Both are needed for enhanced career and professional development and growth. The experiences and opportunities gained through participation in learned societies will expand your perspective through the interaction with people of varied and broad background, and seeing how they approach and solve problems. As leaders and mentors, it is our responsibility to assist and guide in the professional development of our colleagues.

Mentorship is a very special relationship and I've been extremely privileged and fortunate to have many-over the years**.** I want to take a minute or so to acknowledge and thank these people who are legends and giants in the Canadian and international geotechnical community. I'm also delighted and honoured that many are in the audience today. I will identify these special people in chronological order of them having on-going influence on my career and professional development – some for more than 35 years, and most for more than 25 years.

- Jack Crooks
- Professor K. Y. Lo
- the late Bob Quigley
- the late Jack Clark
- John Seychuk
- the late Victor Milligan
- Jim Graham
- Kerry Rowe, and
- Nordie Morgenstern.

Over the past few years I've been asked a few times "what does it take to be successful?" To me, this is a curious question because it firstly assumes that I am successful and, secondly, it depends on the definition of success. On the basis that I am apparently successful, I say that I've been most fortunate and privileged throughout my career to work with so many talented people. I've also received very strong support from my family and from Golder Associates in my many "extracurricular" activities. Without that support and the mentoring that I have generously received throughout my career, I would not have been able to accomplish things that others feel are worthy of recognition. In essence, success is largely due to the people you have around you.

Success is something that you do not plan – it develops on how one responds to mentoring, having a risk-taker perspective, and making the best of opportunities that come your way. Never shy away from an opportunity.

My Dad and Mom taught their six children as we grew up on the family farm in Southern Ontario to work hard, and that any job, no matter how big or small, deserves being done right and with quality. It was through those early days that I learned the importance of being meticulous and paying attention to details.

In addition to the influence of my family, there are statements made by others that have had an immense impact on my career and professional development, and my perspective on life.

The first of these is from Victor Milligan – "to thyself be true". It is extremely important to preserve your personal integrity and stand up for what you believe is right. I've learned that you must firstly satisfy yourself - if you meet your own expectations then there is a strong likelihood that you will also meet the expectations of others.

Another lesson comes from my dear friend and colleague, Jack Crooks, who 28 years ago said when we were deliberating whether to response to an RFP – "remember, we can do it just as good, if not better, than others". This positive and confident statement has stuck with me and I've repeated it to my younger colleagues when faced with and executing tasks on challenging projects. In some of these projects highly innovative ideas and "breakthroughs", in the words of others, were developed. In a couple of circumstances they are now part of standard state-of-practice.

My dear colleagues and friends, John Seychuk (alias "Big Bad" John), who has a nickname for almost everyone (mine is "Dr. D.") and Jim Graham (alias the Reverend Billy Graham) have taught me that we should not take ourselves too seriously - the importance of being down to earth - and that we must always strive for quality in our work. John, in addition to technical skills, has taught me the importance of understanding the consulting business, people and working relationships, and "not to trust lawyers".

Over the years I've emphasized the importance to my working colleagues that having a good sense of humour and having fun are extremely important. Humour has a special way of dealing with stress and can bind a team together through tough times. I can't imagine working a job that I didn't like,

or where no one has fun. One of my hopes is that when people, who know me well, are asked to describe me that they mention the "Becker" sense of humour. My kids and some of my colleagues will attest that I liken many experiences and situations to a particular Seinfeld episode, and there are many!

My wife Lori and I love country music. If the truth was known, the primary reason we decided to come back to Calgary about 8 years ago is that we were tired of being "closet" country music fans in Toronto. Sorry Jack, Les and other Golder Calgary colleagues. There are many great lessons to be learned from the lyrics of new country music. For example, back in 2005 when I was CGS President, Craig Lake asked that I present a Limit States Design Workshop in Halifax and, if I was up to it, also one in St. John's. I've noticed that as you get older, people start thinking (or is it questioning?) one's physical abilities and stamina. I immediately emailed Craig back quoting the words of a Toby Keith song – "I'm not as good as I was once was, but I'm good once as I ever was". There is also the current hit by Billy Currington about the importance of being good at something. The man in the song recognizes that he's not good at working hard or long at a variety of things, but he proudly states "but I'm pretty good at drinking beer". I love this down to earth fashion of describing the good feeling people have when they excel at something.

To wrap things up, I want to again thank the support and understanding of Lori and our 4 children Debbie, Julie, Krista and Matthew who tolerated the many extracurricular activities associated with my career. I was often not at home when I should have been. It's very important, but often difficult, to achieve the right balance between your home life and work.

Thank you.

Ode to the Legget Medal Winner

In honour of Dennis Becker's receipt of the Legget Medal, and based on the content of his acceptance speech, the following ode was written by Richard Jackson, and was recited to the attendees of the Legget Award Winners dinner, which was held after the GEO2010 conference:

Y'all can't be a singing cowboy in T.O.,
So Dennis left for the Bow,
This River inspired his soul,
A cowboy singer is now his goal,
But Golder wished they had hired Hank Snow!

Canadian Foundation for Geotechnique

Introducing the Canadian Foundation for Geotechnique Website

The Canadian Foundation for Geotechnique (the Foundation) is a registered charitable organization that works at arm's length from the Canadian Geotechnical Society (CGS) to recognize and foster excellence in the geotechnical field in Canada. It does so by, among other things, funding some of the CGS awards, prizes and lectures, and by offering a National Graduate Scholarship. In order to fulfill its mission, the Foundation relies on donations and interest-free loans from the geotechnical community – individuals, corporations, and the local sections and technical divisions of the CGS.

Over the past several years, the Foundation has developed a website. This brief article introduces the website to you.

The Foundation uses its website at www.cfg-fcg.ca to communicate information about its activities and events. Upcoming Cross-Canada Lecture Tours (CCLT) are listed on the *Upcoming Events* page. CCLT sponsors are recognized on the *Home* page, with links to the sponsor companies' websites. Recent articles prepared by the Foundation and its Annual Reports can be found on the *News* page.

The Foundation provides financial support for the CGS' awards and prizes, including the Legget Medal, the Geotechnical Colloquium, the many Technical Division Awards, and student prizes. Descriptions of these awards are posted on the *Awards and Prizes* page of the website. Recently, the Foundation introduced the National Graduate Scholarship, a $5000 award presented each year to a deserving graduate student studying in the geotechnical or geoscience field at a Canadian university. Three scholarships have been awarded since the program was introduced in 2008. Information for graduate students wishing to apply for the scholarship can be found on the *Awards and Prizes* page.

A list of the Foundation's Trustees, as well as the Board of Directors and their contact information, are provided on the *Contact Us* page of the website.

Donations to the Foundation can be made by downloading the donation form found on the *How to Donate* page, and mailing the completed form with a cheque to the Foundation's Treasurer. Alternatively, donors can elect to include a donation to the Foundation when they register or renew their CGS membership through the Society's electronic registration.

Work is now progressing on the French website, with the intent being to have it completed in 2011.

If you would like to learn more about the Foundation and its activities, please visit the website at www.cfg-fcg.ca, or contact Doug VanDine at vandine@islandnet.com.

Upcoming Conferences

14th Pan-American Conference on Soil Mechanics and Geotechnical Engineering and 64th Canadian Geotechnical Conference

The Canadian Geotechnical Society and the International Society for

Soil Mechanics and Geotechnical Engineering invite you to the 14th Pan-American Conference on Soil Mechanics and Geotechnical Engineering (PCSMGE), the 64th Canadian Geotechnical Conference (CGC) and the 5th Pan-American Conference on Teaching and Learning of Geotechnical Engineering (PCTLGE) at the Sheraton Centre Hotel in Toronto, Ontario, Canada from October 2 to 6, 2011. Details for the conference are located on the website, www.panam-cgc2011.ca.

The technical program for the 2011 Pan-Am CGS Geotechnical Conference will consist of a series of short courses, workshops, technical tours, technical sessions and invited lectures – at present the technical committee is considering the following broad topic areas/themes for author submissions:

- Laboratory & in situ testing
- Laboratory testing
- In situ testing
- Foundation engineering
- Shallow foundations
- Deep foundations
- Retaining walls
- Ground improvement/remediation
- Geoengineering for development & education
- Geoenvironmental engineering
- Climate change & geohazards
- Mining & rock mechanics
- Buried structures & subsurface systems
- Behaviour of unsaturated soils
- Earthquake engineering & geophysics
- Geotechnics for energy exploitation
- Embankments and dams
- Hydrogeology and seepage
- Transportation geotechnics
- Permafrost engineering
- Mine waste disposal
- Landslides
- Probability and reliability based design

5th Canadian Conference on Geotechnique and Natural Hazards, May 15 - 17, 2011 Kelowna, BC, Canada

The Canadian Geotechnical Society (CGS) is pleased to invite you to the 5th Canadian Conference on Geotechnique and Natural Hazards (GeoHazards 5). Geohazards are more relevant every day as population growth and exploitation of natural resources increases interactions between the earth and human activities. Indeed, the earth itself is being affected by environmental changes induced by human activities.

The GeoHazards conferences are the premiere forum in Canada for the sharing and dissemination of scientific and engineering knowledge related to geohazards. GeoHazards 5 will be held May 15-17, 2011 at the University of British Columbia's Okanagan campus in beautiful Kelowna, British Columbia!

Kelowna is the gateway to the Okanagan. It is a modern city nestled amongst stunning mountains, picturesque lakes, lush wineries and sumptuous orchards. Kelowna's spectacular setting will be the backdrop to what promises to be another fantastic technical conference. Great talks, great food, great wine and great friends; we look forward to seeing you in 2011.

Dr. Dwayne Tannant
Chair, Organizing Committee
chair@geohazards5.ca
Dr. Richard (Rick) Guthrie
Chair, Technical Program
geotech@geohazards5.ca

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G-I News

Jedele Becomes New G-I President

Larry P. Jedele, P.E., D.GE, M.ASCE, became the new Geo-Institute president on October 7, 2010, having served as a Board governor since 2007. Jedele, currently with Soil and Materials Engineers, Inc. in Plymouth, MI, has more than 36 years experience in geotechnical evaluations and design recommendations. He is a specialist in geodynamic services including measuring vibrations, conducting field testing, evaluating data, and providing recommendations. In addition, Jedele is skilled in hydrogeological evaluations for landfills, municipalities, housing, and commercial developments. His one-year term, according to G-I Bylaws, runs from the end of the Fall Board meeting until the end of the next year's Fall Board meeting.

4 Conferences in One Location:

Geo-Frontiers 2011
March 13-16, 2011
Sheraton Dallas Hotel
Dallas, TX, USA
www.geofrontiers11.com/

Save time. Save money. Attend Geo-Frontiers 2011 to be able to participate in four conferences in one location due to the collaboration of meetings of the Geo-Institute (G-I), Industrial Fabrics Association International (IFAI), the North American Geosynthetics Society (NAGS), and the Geosynthetic Institute (GSI). Geo-Frontiers 2011 will give you the opportunity to learn about and to share new developments in geotechnical engineering technologies. Here's your chance to get the latest state-of-the-art and practice as applied to geotechnical engineering information.

Register online at
http://www.geofrontiers11.com/Registration_Pricing.cfm

Exhibit Space is Selling Quickly…

A great way to reach over 1,8000 geo-professionals.

Call: IFAI at +1.651.225.6987 or searman@ifai.com for information.

Cadden Elected to G-I Board

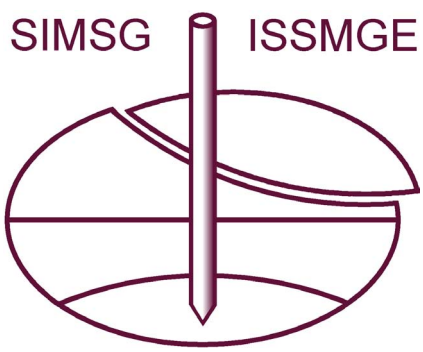
Allen Cadden, P.E., principal and director of Geotechnical Engineering for **Schnabel Engineering** joined the G-I Board as a governor for a 3-year term on October 8, 2010. Cadden has more than 20 years of field,

project engineering, and management experience in a variety of projects throughout the East Coast. His experience includes geotechnical investigations, design, instrumentation, and construction monitoring services. As a designer, project manager, and senior reviewer, he has worked on a variety of geotechnical efforts involving shallow and deep foundations, geosynthetic applications, pavements, and grouting. In addition, he has provided analysis and designs for new and existing dams, ground improvement, excavation bracing, underpinning, and micropiles, as well as instrumentation and data acquisition.

Hermann Elected ASCE President

Andrew W. Herrmann, P.E., SECB, F.ASCE, a structural engineer with nearly 35 years of active involvement at all levels of ASCE, was elected the Society's President-elect for 2011. Herrmann will work alongside 2011 President Kathy J. Caldwell, P.E., M.ASCE, and succeed to the presidency in 2012. He will be inaugurated in late October at ASCE's 140th Annual Conference in Las Vegas.

Receive International News with an ISSMGE Membership



ISSMGE lettered logo.

Past G-I President Jean-Louis Briaud, now President of ISSMGE encourages you to become an ISSMGE member. A $15 membership gives you the opportunity to learn about international geo-professional news and information.

The International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) promotes the advancement and dissemination of knowledge in the field of geotechnics and its engineering and environmental applications, through conferences, technical committees, and member societies. ISSMGE has 80 National Member Societies worldwide representing over 18,000 individual members who include practicing engineers, teachers, researchers, and equipment designers and manufacturers. The Society also has 20 corporate sponsors from industry. The Geo-Institute is proud to be ISSMGE's U.S. Member Society.

ASCE members may join by enrolling on your annual ASCE renewal form, by logging in to your member account at *www.asce.org*, or by calling 800.548.2723. An ISSMGE membership is already included in a Geo-Institute-only membership.

Take a look at ISSMGE: *www.issmge.org/*

G-I Upcoming Conferences

Visit *www.geoinstitute.org/events.html* for other upcoming events.

Geo-Frontiers 2011
March 13-16, 2011
Sheraton Dallas
Dallas, TX
www.geofrontiers11.com/

Members in the News

Filshill Receives Ph.D

Archie Filshill.

Archie Filshill, A.M.ASCE, of CETCO and Delaware Valley Geo-Institute (DVGI) Board member received his Ph.D. in Civil Engineering with a concentration in Geosynthetics from Drexel University. The title of his thesis was "Long Term Structural Design of Geosynthetic Storm Water Chambers and the Use of Nanocomposites to Enhance Their Performance." The research reviewed the application, testing, and design of plastic storm water modules. The focus was on the structural design of polymeric modules, how they are tested, the design of flexible pavement above such systems, the repetitive loading, and the long term durability of the plastics used in their manufacture. The testing proved how the properties of both virgin and recycled polymers are enhanced by the addition of nanocomposites.

Greene Joins Gannett Fleming

Brian H. Greene, Ph.D., P.G., joined the Pittsburg, PA office of **Gannett Fleming** as a senior engineering geologist. With more than 32 years of experience with the U.S. Army Corps of Engineers, he provides quality review and technical direction on geotechnical, dam, levee, and other water resources projects. He also assists with the development, implementation, and execution of marketing strategies within the firm's geotechnical, dams, and hydraulics areas of practice. In 2009, Greene accepted the position as chair of the Association of Environmental & Engineering Geologists (AEG) Dams Technical Working Group and has organized symposia on dams at recent AEG national conferences. He has authored and co-authored numerous technical papers on dams and is guest editor for a special edition on the subject which was published in the *Environmental and Engineering Geoscience* journal in September 2010.

Gribb Heads SD School of Mines and Technology

Molly M. Gribb, Ph.D., P.E., M. ASCE is the new head of the Department of Civil and Environmental

Engineering at the South Dakota School of Mines and Technology (SDSM&T) in Rapid City, SD. The school is a state-supported university with 2,100 students seeking degrees at the baccalaureate, master's, and doctoral levels in engineering, the sciences, and computer technology. Gribb was a *Geo-Strata* Editorial Board member from 2000-05 and former professor of Civil Engineering and director of the Center for Environmental Engineering at Boise State University.

Lewis Appointed Manager at Gannett Fleming

Paul J. Lewis.

Paul J. Lewis, P.E., was appointed manager of the Geotechnical Practice of Gannett Fleming where he is responsible for maintaining the quality and consistency of work products across the practice companywide, leading the geographic growth of the practice, and facilitating work sharing and staffing of projects. He serves as a vice president and manager of the Geotechnical Section based in the firm's corporate headquarters in Harrisburg, PA.

Lewis has more than 27 years of geotechnical engineering experience and is a registered professional engineer in five states. He is a member of the ASCE, Chi Epsilon, Tau Beta Pi, Deep Foundations Institute, the Association of Conservation Engineers, and the American Society for Testing and Materials (ASTM) International. He holds a bachelor of science in civil engineering from West Virginia University, and is a former instructor for the Pennsylvania State University.

Thorne Elected New VP of the AGP

Steve Thorne.

Steven Thorne, P.E., D.GE, M.ASCE, of Melick-Tully and Associates, P.C. in Somerset, NJ, was unanimously voted in as the Academy of Geo-Professional's (AGP) next vice president. Thorne has served on the Board of Trustees of AGP since its inception in October 2008 and was also involved in the creation of the Academy. His term runs October 1, 2010 - September 30, 2011. On October 1, 2011, he will then become president of the Academy.

Withiam to Receive Wisely Award

Jim Withiam.

Geo-Strata Editor **James L. Withiam, Ph.D., D.GE, M.ASCE**, will receive the 2010 William H. Wisely American Civil Engineer Award for his outstanding leadership in creating and delivering the flagship Institute magazine, *Geo-Strata*, and for his leadership in the Task Committee in redesigning *Civil Engineering* magazine. This award recognizes ASCE members for their continuing efforts to promote appreciation for the history, tradition, developments, and technical and professional activities of the Society.

Withiam is a principal of **D'Appolonia**, a geotechnical engineering firm headquartered in Monroeville, PA. He attended Syracuse University where he earned B.S., M.S., and Ph.D. degrees in civil engineering. At D'Appolonia, Withiam is responsible for management and technical direction of geotechnical projects and research studies. His principal areas of expertise comprise foundations and retaining structures; soil and rock slopes; embankments and dams; remedial design of failed earthworks; characterization of soil and rock; and research investigations, including studies to develop specifications for the design of highway bridge substructures, and the application of nondestructive test methods to detect corrosion of metal-tensioned systems used for geotechnical applications.

Allied Organizations

Watch for this call for papers:

43rd Symposium on Engineering Geology and Geotechnical Engineering (EGGE)
March 23-25, 2011
University of Las Vegas
Las Vegas, NV
http://2011.eggesymposium.com/

The Symposium on Engineering Geology and Geotechnical Engineering (EGGE) is an annual event designed to convene professionals to showcase innovative work in the fields of engineering geology and geotechnical engineering. The conference theme is

"Water, Soils and Sustainability in the Intermountain West."

This symposium will provide you the opportunity to meet and exchange technical information relating to engineering geology and geotechnical engineering. Though the emphasis is on water, soils, and sustainability in the Intermountain West, contributions from all areas of engineering geology and geotechnical engineering are welcome. A proceedings volume will be published on CD. Oral or poster presentations can be made. Plenary presentations and breakout sessions, a field trip and an exhibit hall are planned.

Anticipated timeline:

- October 23, 2010 Preliminary announcement and call for papers
- January 10, 2011 Abstracts due
- January 24, 2011 Authors notified of abstract acceptance
- February 16, 2011 Final papers or abstracts due

The 12th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst
January 10-14, 2011
St. Louis, MO
www.pela.com/sinkholeconference2011.htm

This is the 12th in a series of highly successful interdisciplinary conferences which were first organized by the Florida Sinkhole Research Institute in 1984 as a means for geologists and geographers who study how and where karst develops and how sinkholes form, to interact with engineers, planners, and others, who must apply this information to build and maintain society's infrastructure and protect the environment. The goal of this conference is to share knowledge and experience among disciplines by emphasizing scientific and technological aspects of karst that have practical applications, together with case histories of those applications.

Industry News

IACMAG 2011
13th Int'l Conference of the Int'l Assoc. for Computer Methods and Advances in Geomechanics
May 9-11, 2011
Melbourne, Australia

IACMAG 2011 will address recent developments and advances in computer methods, constitutive models, and applications to different areas of geomechanics, emerging technologies, and future needs, documented case studies, constitutive modeling, laboratory and field tests, and validation procedures. The special theme for the Conference is "Geomechanics in the Emerging Social, Environmental & Technological Age." The conference will stress problems raised by the society due to rapid industrialization and globalization, in addition to the objectives covered by the previous conferences. The Conference venue is the new Melbourne Convention and Exhibition Centre (MCEC) that has set a new world benchmark for events with the world's first 6-star, Green Star rating and its advanced applications in presentation technology.

News from ASTM International

The abrasiveness of rock plays a crucial role in the performance of any mechanical excavation machines because overall costs are affected by the rate of cutting tool replacement and/or repair and machine downtime. The need for a standard that assists the civil and mining industries in quantifying rock abrasiveness properly and uniformly has been answered by a new ASTM International standard. The new standard, ASTM D7625, Test Method for Laboratory Determination of Abrasiveness of Rock Using the CERCHAR Method, was developed by Subcommittee D18.12 on Rock Mechanics, under the jurisdiction of ASTM International Committee D18 on Soil and Rock. To purchase ASTM standards, visit *www.astm.org* and search by the standard designation number, or call: 610.832.9585; *service@astm.org.*

To submit information for Geo-Strata magazine, or possible posting on the Geo-Institute website at www.geoinstitute.org, send us brief news about your recent honors, awards, special appointments, promotions, etc. High-resolution photos must be sent as separate pdf, tif, or jpeg files. Send to geo-strata@asce.org. Sales-oriented content should be directed to Dianne Vance, Director of Advertising at dvance@asce.org.

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Geotechnical Instrumentation NEWS

Geotechnical Instrumentation News

John Dunnicliff

Introduction

This is the sixty-fourth episode of GIN. Two articles this time.

Web-based Data Management Software

In the previous GIN I told of a request from a colleague for information about web-based data management software and responded with, " What an excellent suggestion!" Here's an article by David Cook that identifies *things to consider*, intended to assist a person who needs instrumentation geotechnical database management in determining what is important, before committing to a particular system.

A few weeks ago I sent the article to several firms who supply web-based data management software, inviting each to respond with a one-page "Ours will do this" article. I've had positive responses from seven firms and plan to include their contributions in the next GIN, March 2011.

More on Fiber-Optic Sensing Systems

Earlier GINs have included:

- From Switzerland: "Overview of Fiber Optic Sensing Technologies for Geotechnical Instrumentation and Monitoring", and "Distributed Fiber Optic Sensors: Novel Tools for the Monitoring of Large Structures", both by Daniele Inaudi and Branko Glisic, September 2007.
- From England: "Distributed Optical Fibre Strain Measurements in Civil Engineering", by Peter Bennett, December 2008.

Here's another article about distributed fiber-optic sensing by colleagues from the Institute for Geotechnical Engineering, ETH Zürich - Swiss Federal Institute of Technology, who appear to be playing a leading role in developing this technology. Because I expect that you'd like to have information on commercial sources, I asked the authors to include this but, being a professional institute, they preferred not to do so. At the end of the article I've therefore included an *Editor's Note* with eight commercial sources - if you know of others, please let me know, and I'll update the list in a later GIN.

Next Instrumentation Course in Florida

Since my previous GIN column, the dates of the next course have been changed. Dates are now April 3-5, 2011 at Cocoa Beach. Details are on page 33 and on www.conferences.dce.ufl.edu/geotech.

Next International Symposium on Field Measurements in Geomechanics (FMGM)

As many of you will know, FMGM symposia are organized every four years, the previous one being in Boston in September 2007. They are "the places to be" for folks in our club. The next FMGM will be in Berlin, Germany on September 12-16, 2011. Information is on www.fmgm2011.og. The deadline for submission of abstracts is December 31, 2010.

Alex Feldman

Alex Feldman.

The following has been sent to me by Alex's colleagues at Shannon & Wilson, Inc., Seattle, Washington.

> Alexander I. Feldman, an internationally known structural and instrumentation engineer, passed away on August 14, 2010. Alex came to the US in the late 1970s following a meeting with Stan Wilson, one of Shannon & Wilson's co-founders, at a conference in Russia. Stan was impressed and later sponsored Alex and his family to emigrate to the U.S.
>
> Alex had a brilliant mind, particularly for instrumentation, and never backed down from a challenge. Among his other accomplishments, he pioneered the use of open-channel liquid level systems to monitor vertical displacements of sensitive structures such as tunnels and dams. Alex was a long-time member of Shannon & Wilson. Ever the innovator, he secured patents for

a "Tensional Bellows Pressure Transducer" and, with three co-workers, a patent for a "Method and Apparatus for Measuring *in situ* Strain and Stress of Concrete." After retiring, Alex often returned to Shannon & Wilson to help with projects that needed his special expertise.

Alex was an accomplished amateur photographer, an avid reader, and enjoyed a lively discussion. Once you met Alex, you did not forget him.

I worked with Alex on several projects, and can echo "ever the innovator" and "brilliant mind". Our instrumentation community will miss him.

The editor with new friends.

A Breathtaking Experience

Have you seen the movie *The Bucket List?* I started my list, with *Safari* as Item One. The Masai Mara in Kenya. A most extraordinary experience, beating Taj Mahal, Giza pyramids, Grand Canyon, Niagara Falls et al at al. Lions, elephants, cheetahs, buffalos, giraffes (and many more) galore, often as close as 15 feet from the 4WD. And those idiotic wildebeests, crossing the Mara River as part of the annual migration of 1.3 million of their brethren. Large numbers don't make it – they either drown or become dinner for the crocodiles. Spectacular! Go gotta go! If you'd like specific suggestions, please let me know.

Enjoy the wonderful Kenya welcome song "Jambo Bwana" (Hello sir) on www.youtube.com/watch?v=fK0wPpLryc4, and learn some Swahili too!

Closure

Please send contributions to this column, or an article for GIN, to me as an e-mail attachment in MSWord, to john@dunnicliff.eclipse.co.uk, or by mail: Little Leat, Whisselwell, Bovey Tracey, Devon TQ13 9LA, England. Tel. +44-1626-832919.

Maisha marefu! (Swahili, "Long life" – Kenya of course!)

Fundamentals of Instrumentation Geotechnical Database Management – Things to Consider

David Cook

Introduction

The purpose of this article is to identify elements of geotechnical monitoring databases: collection, verification, storage, visualisation and dissemination of monitoring data, which need to be considered. This should allow users to make more informed decisions early in the procurement process. There are no right or wrong answers, only a determination of need related to specific project requirements.

This is not a checklist, but it discusses instrumentation, software and hardware elements to be considered. Inevitably it is not a discussion of how to achieve these results technically, but indicates the outcomes required. It is a personal list, and others' experience may identify different considerations which are more important for their situation.

Why Do I Feel Able to Write This Article?

Readers may ask why my comments might assist others in their decision making. I have been involved in monitoring and the use of custom interfaces to allow interpretation of the results since the late 1980s, commencing with the Docklands Light Railway Extension into the City of London (which included 3D-spatial survey, displayed via AutoCAD) through Heathrow Express, Channel Tunnel Rail Link, Heathrow Terminal 5 and Amsterdam Noord/Zuidlijn, an EPSRC study examining the benefits of 3D presentation of monitoring results and as a Member of the British Tunnelling Society Subcommittee producing "Monitoring Underground Construction: a best practice guide."

Historic Context

At the outset, virtually all monitoring software was custom-made for each project, with Excel a favoured data visualisation tool. Since then proprietary software has become more commonplace. However, some clients will require monitoring visualisation software to be incorporated with their own systems, and that increasingly means within a corporate Geographic Information System (GIS).

Client Decisions

Data handling responsibilities must be clearly determined at an early stage. For example, does the monitoring contractor merely provide the data, with responsibility only for verifying that it is correct, or do they also provide a visualisation package and analysis services? If a client chooses to split these roles, does the client have the capability of ensuring that mitigation actions can be directed accordingly? This decision will fundamentally direct what is required.

Table 1 indicates some fundamental decisions which need to be made.

Interface

How comprehensive an interface is required? Is 3D visualisation required and the added complexity this can involve appreciated?

Systems are usually graphical, indicating the locations being considered, for easy assimilation.

Is a comparison of different instrument types within the same graphical output possible, for example comparisons between borehole extensometer readings at surface and related precise levelling can be instructive in determining where problems lie?

Is the system sufficiently flexible to allow selection of particular locations for comparison purposes, which have not been pre-determined?

Can the data be viewed in different graphing formats? For example inclinometer readings are often displayed in a "tail-wagging" form but for examining data against time, but it may be more useful to determine trends on a movement versus time graph, at a particular level.

Table 1. Access requirements to monitoring data

Category	Considerations
Viewing	Who needs to view the data and for what purpose? Is only local access (from within one office or network) needed or is remote access, possibly via the Internet, also required?
	Are multiple or limited simultaneous accesses by the various parties required? There may be a performance hit in terms of system response from multiple simultaneous accesses.
Access Limitations	Consider the access limitations to be put in place and related security considerations for each user. This could be from a Full Administrator Read and Write capabilities (including ability to add or remove access to/from others) through to Read Only which, in itself, could be Read Only full access to data for the main project team or partial access only for third parties.
Maintenance	Is it possible for an on-call engineer to access remotely and respond to alarms raised, without needing to attend the monitoring office? It should be possible for limited provision, even if general viewing of results by the team is not planned.

Response Times

What is the time delay from collection, through import, to use being made within the visualisation software? This may be a project-wide standard frequency, but more frequent at focused locations (if required) without compromising more global frequencies elsewhere.

Does an increase in the data held slow down response times, which then make ease of archiving and re-import (if required) a consideration? Timescale issues are covered in Tables 2 & 3.

Alarm Raising Functionality

Assuming that the monitoring office will not be staffed 24/7, the system will need to provide notification of trigger limit (response level) breaches or potential trigger level breaches to an on-call monitoring engineer. This could be provided by SMS text, e-mail (Blackberry), or a digitised voice over a mobile phone. Consider how reliable each of these communication routes is at the project location, before fixing on one. There need to be escalation capabilities if the initial contact does not respond within the requisite time scale. How does the software escalate the alarm raising? The alarm message is more meaningful if it gives specific location where the breach is taking place, the breach level which is occurring (Red/Amber) (or predicted to occur within a certain time), the current value and the previous value plus the times at which these details were recorded.

Instrumentation Types

Does the system handle all the instrumentation systems envisaged and is there the capability to incorporate additional instrumentation types or at

Table 2. Project/data timescale issues - generic	
Category	Considerations
Timescale	Over what timescales are the pre-construction, construction and close-out monitoring to be performed, and what use is to be made of that data after close-out monitoring is completed?
Software	Updates for operating systems/monitoring software etc. are likely to take place within a project timescale and recognition taken of this need. For example, if monitoring software is based on a proprietary GIS, updates on the base GIS software may result in custom routines needing to re-written.
Computer Hardware	Developments may prevent use of earlier software. Whilst old software may run very fast on newer operating systems, it may not work at all.
File Format and Storage Media	The data file format and means to read it over time are important if long-term use is to be made. An example is the NASA 1960 space shots where there are warehouses of punched cards which no longer have the necessary reading equipment. The AGS Data Format may prove to the way forward, but be wary of proprietary formats which may not be supported in future. What storage media is to be used and will it need updating over time? Over the last 20 years there have been 8", 5.25" & 3.5" [720kb, 1.44Mb, 120Mb] floppy disks, Bernoulli drives, Zip drives, CD, DVD [+R/-R/RW], as relatively common examples. Many organisations would now have trouble reading a 5 ¼" floppy. What provision (if any) is to be made for the project data longer term?
Time/Date Format Convention	A very simple point to indicate the importance of convention is that the Time/Date format (as expressed in output) should not be capable of confusion between different countries. An example is date/month/year as indicated in UK v US systems and in countries where there is an hour change, from example Greenwich Mean Time (GMT) to British Summer Time (BST) in the UK: is it clear what is being viewed? How are the 23:00, 00:00 and 01:00 GMT readings indicated in a system which shows BST readings?

least store output from other packages within the monitoring database? For example railway track monitoring vehicles may be used as part of a monitoring system and derivation of data from such a specialist system may be beyond generic monitoring software systems, but the ability to make a link to the data at relevant site locations is all part of the necessary data assimilation/ review process.

Other Functionality

In addition to viewing monitoring results for trigger limit (response value) breaches, there should be clear demonstration of both instrument and reading availability (where these fundamentally differ) to allow effective maintenance targeting. For example, a robotic total station (RTS) takes readings from a number of monitored prisms. The loss of an RTS will result in a total loss of readings for all those prisms. Alternatively local line-of-sight issues (RTS to prism) will result in some prisms not being read. The database software should be capable of this discrimination, thereby assisting in maintenance operations.

There should be an ability to annotate the information held. For example maintenance work may affect readings at a certain location. Whilst the team may be aware of the reason at that time, two years later researching the history becomes more difficult if that information is not readily available.

The capability to include other relevant information, such as reference photographs and details of construction progress may be required.

Ability to compare information between primary and secondary instrumentation systems may be required.

Is the ability to be able to compensate for pre-construction movements important?

How is the software segmented operationally? Does a problem with data collection overspill onto visualisation, effectively locking the system up?

Is the system sufficiently scaleable to encompass requirements at all monitoring stages? A monitoring database sufficient to provide access to data during pre-construction monitoring may not meet the full project-wide system requirements during the construction phase. This could be in terms of locations being monitored, instruments being used or user access requirements. Any such limitations should be appreciated at commencement of pre-construction monitoring, and not discovered part-way though construction. Some specific data management considerations are covered in Table 4.

Output

Generally outputs are graphical in order to aid review, but data in a numeric form often needs to be available for evaluation outside the main monitoring package. This can be provided with an export facility to Excel and other statistical and analysis packages.

Conclusions

My apologies for the inevitable number of questions rather than answers in this

Table 3. Project/data timescale issues - specific	
Category	Considerations
Customisation	For custom software, what customisation services are available? As an example, are simple predictive capabilities needed/available?
Response Time (General	Does the software process the data and then draw from a database of that processed data, or does it process on the fly for each query? What is the typical response time from time of query to delivery of results? Do the numbers of system users affect it at the time?
Response Time (Data/Volume)	Maintain access to data. Data quantity may require archiving if magnitude slows system down too much, but base information needs to be retained. Historic (archived) data may need to be accessed - how is this accomplished?

article. But, as indicated at the beginning, there is not a "right" answer for what is required. My intention is to assist a person who needs instrumentation geotechnical database management in determining what is important, before committing to a particular system. If it assists in that aim it will have served its purpose.

Bibliography

Cook D.K. (1996). Heathrow Express – Settlement Monitoring – Data Collection/Processing, Institution of Civil Engineering Surveyors Conference.

Cook D.K and Akbar M.S. (1999). Data Collection and Management, FMGM, Singapore.

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Table 4. Data management	
Category	Description
Collection	How secure is data input to the system? For example is data placed on an FTP site which the software then imports, or does the software dial-up individual logger boxes to collect the data? How is access managed? It is important that both raw and processed data are collected and stored, even though is unlikely that raw data would need to be accessed unless a dispute arises. Is Manual Data Capture information readily input and if Remote Data Capture (RDC) communication links are temporarily unavailable can manually collected data from RDC instruments be readily imported to the system?
Verification	It is important that data verification checks are carried out before the data is used. If imported monitoring data is subsequently determined to be incorrect, the ability to re-import/reprocess is an important consideration, without overwriting data determined to be incorrect, but being able to flag it as not for use. Consideration must be given to storing both raw and processed data.
Processing	Is time to process the data within the visualisation software affected by the import system used? Can the system handle/process the quantity of data envisaged, and can it be more focussed when the situation demands it?
Replication/ Archiving	In some systems, whilst backing-up is taking place, access to the monitoring data may not be possible. In this eventuality a form of data replication will be required to allow ongoing access to data. It should go without saying there needs to be a disaster recovery system in place.

Advanced Geotechnical Applications of Distributed Fiber-Optic Sensing

Alexander M. Puzrin
Michael Iten
Dominik Hauswirth

Introduction

Distributed fiber-optic (FO) strain sensors are offering new possibilities in the field of geotechnical monitoring. By integrating a single FO cable into soil or structure, an unprecedented amount of accurate, spatially resolved data can be obtained. Current commercially available technology allows for strain measurements in the microstrain (με) range (0.0001%) with a spatial resolution of 1m along a 30km long fiber.

In this article we describe recent novel geotechnical FO technology applications in the laboratory and field. The emphasis is to sketch the FO cable layout, integration and the monitoring results, with details of the projects given elsewhere (Iten et al., 2009a; Hauswirth et al., 2010; Iten & Puzrin, 2010).

For locating landslide boundaries, a soil-embedded sensor system, a road-embedded sensor and the reactivation of an old inclinometer are described. In addition, a new monitoring ground anchor is presented. Finally, laboratory testing of a novel sensor technology offering spatial resolution below 5cm indicates the direction where FO sensor technology is heading: substitution of hundreds of individual local strain gauges with one single FO cable.

Distributed Fiber-Optic Sensing

Measurement Technology

Continuous strain can be measured along optical fibers by several techniques based on the Brillouin scattering effect: spontaneous Brillouin Optical Time Domain Reflectometry (BOTDR) occurs when a light pulse guided through a silica fiber is backscattered by a nonlinear interaction with thermally excited acoustic waves. In the more refined Brillouin Optical Time Domain Analysis (BOTDA), two counter-propagating light waves (pump and probe) at different frequencies interact via stimulated acoustic waves.

The scattered light undergoes a frequency shift, which is directly related to the strain and temperature in the medium. Thus, in addition to the strained FO cable, a loose fiber must be placed for temperature compensation. The backscatter is recorded in the time domain to obtain information of the scattering location along the fiber and the frequency shift of the signal is analyzed and converted into strain and temperature data. The strain measured is the average value over the spatial resolution (typically >1m), which corresponds directly to the length of the light pulse sent down the fiber. Remote control and automatic measurement mode is possible.

Recently, a significant breakthrough was achieved in narrowing the spatial resolution down to 5cm with extremely short pulse durations in the Brillouin Echo Distributed Sensing (BEDS) setup. The BEDS concept is based on observing a "negative" gain created by a very short-time phase shift applied on the pump that interferes destructively with the reflected light. BEDS is not commercially available yet, but first testing in soil has shown its potential for future applications.

Table 1 gives an overview of the listed technologies (see also Thévenaz, 2010).

Fiber-Optic Cables

FO cables used for integration into different environments have to comply with several requirements, such as being strong enough to withstand harsh installation conditions, transmitting strain applied on the jacket without loss to the fiber core, allowing unproblematic handling and offering flexible adjustment to project modifications. The quality of the FO cable and its fixations strongly influences the overall measurement accuracy of the sensing system.

Increasingly, specialty FO cables for strain sensing are available from cable manufacturers. Most important for the user is to focus on the quality

Table 1. Comparison of distributed FO strain sensing technologies, according to manufacturer information

	BOTDR	BOTDA	BEDS
	Brillouin Optical Time Domain Reflectometry	Brillouin Optical Time Domain Analysis	Brillouin Echo Distributed Sensing
Measurement accuracy	20με to 40με	2με to 10με	10με to 20με
Spatial resolution	1m	1m	0.05m
Max. distance	30km	30km	More than 5km
Availability	Commercially	Commercially	Lab prototype
Comment	Single fiber	Loop required	Loop required

Table 2: FO cables used						
BSM	TSM	S06	S08	P07	S09	M07
Bare fiber	Tight buffered fiber	Heat shrink tube protected TSM	Polyurethane protected cable	Polyamide protected cable	Polyamide & metal protected cable	Metal protected cable
0.25mm diameter	0.9mm diameter	2mm by 3mm	2.8mm diameter	1.6mm diameter	3.2mm diameter	0.9mm diameter
EA = 0.9kN	EA = 0.9kN	EA = 2kN	EA = 2.5kN	EA = 3kN	EA = 50kN	EA = 70kN
Commercial product	Commercial product	Custom produced	Prototype	Prototype	Prototype	Prototype

and quantity of the strain transfer from the jacket to the fiber, as by far not all commercially advertised "FO strain sensing cables" do fulfill this requirement sufficiently. In addition, the FO cable design needs to allow for stripping of the protection layers down to the fiber itself in order to repair (splice) the broken fiber.

Several single mode FO cables were used in this study, ranging from bare fibers to well-protected prototypes of tight buffered FO strain sensing cables. Special attention was given to include only easy repairable FO cables in our research. Table 2 gives a brief overview of these FO cables.

Defining and Monitoring of Landslide Boundaries

Motivation

Differential soil displacements initiated by creeping landslides can cause immense problems by damaging infrastructure and buildings in the sliding area. Moreover, special construction and reinforcement requirements, or even total halt of construction within a landslide area may be demanded by local construction laws. In some cases it is therefore of crucial importance to determine the exact position of the boundary between the landslide and the stable part of the slope. Geodetic measurements can identify the boundary on the surface, but not necessarily with high accuracy. Inclinometers serve for detection of the sliding surface, but once an inclinometer casing is excessively distorted, a conventional inclinometer probe can not be inserted and the inclinometer will no longer produce results.

New landslide monitoring techniques by means of distributed FO technology can offer an unprecedented amount of high quality data at reasonably low costs. By performing optical strain measurements along the FO cable, the transition zone between the sliding and the stable parts can be identified. Several systems to determine this boundary have been successfully implemented in field projects on creeping landslides in the area of St. Moritz, Switzerland, as described below.

Asphalt Road-Embedded FO Cable

The first system, an asphalt road-embedded FO cable, serves for the evaluation of such a boundary in an urban area. An instrumented road, which intersects this boundary, can be seen as a large-scale strain gauge. The FO cable (of longitudinal stiffness EA between S06 and P07 in Table 2) was glued at 1m intervals inside a trench (about 10mm wide by 70mm deep) cut into asphalt, with a temperature sensor placed on top of it. Subsequently, the whole trench was filled with an elastic cold sealing compound.

Since 2006 three such road-embedded systems have been integrated and tested in the field. The differential strain along a 90m long FO cable accumulated in a 7 months period is shown in Figure 1. The transition zone has been identified as a 15m long section and the landslide movement estimated at about 20mm (by multiplying the measured strain by the length of the transition zone and assuming that the FO cable crosses the boundary at 45° angle). This was later independently verified by geodetical data. Good repeatability of measurements was confirmed by installing another FO cable at the same location.

Soil-Embedded " Micro-Anchor" -FO Cable System

For the boundary identification in an area where no road or other infrastructure exists, to which the FO cable could be attached, a soil-embedded " micro-anchor" -FO cable

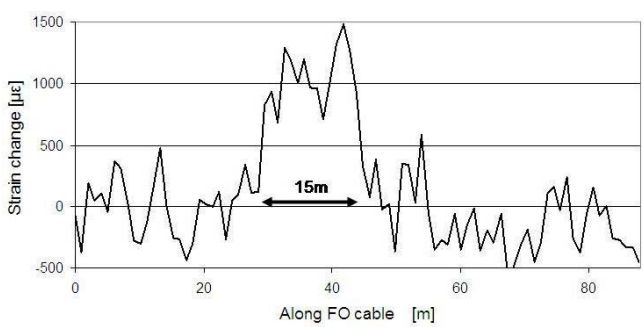

Figure 1. Strain data along a road-embedded FO cable.

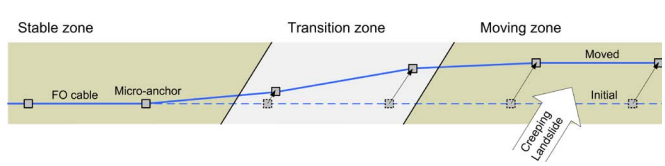

Figure 2. The "micro-anchor" - FO cable system.

system has been developed (Figure 2). The principle of this second system is that a FO cable fixed to "micro-anchors" buried in soil experiences the same movement than the soil around it. The "micro-anchor" (Figure 3) consists of three perpendicular planes in order to provide bearing resistance in all directions and to act as a three dimensional "dead" anchor. The anchor size (side length of 40mm, 60mm or 80mm, respectively) is chosen as a function of the anchor depth and the stiffness of the chosen FO cable (preferably S08 and S09, Table 2).

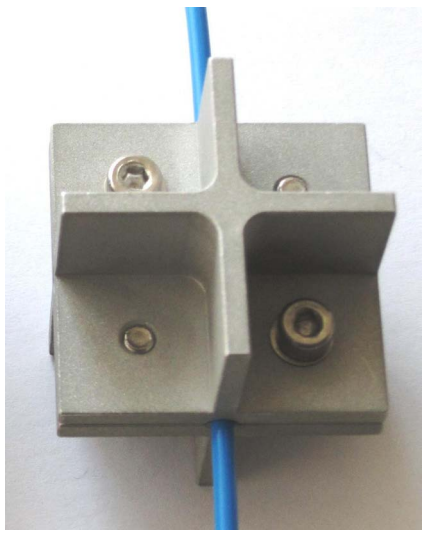

Figure 3. The "micro-anchor".

Large scale laboratory testing of the system in a 9m long shear box proved the system to be very efficient. Compared with data obtained by FO cables buried without anchors and FO cables embedded into geotextiles, this system is significantly more sensitive. Figure 4 shows data from such a test of a FO cable without anchors and a FO cable with anchors. Additionally to the laboratory testing, an 80m long system has been successfully installed in a field project in St. Moritz. The temporal change in the measured strain increments correlates well with the independent geodetical and inclinometer measurements in this location.

Reactivation of Old Inclinometer Casings

The third monitoring system takes advantage of old, out-of-service, inclinometer casings. In order to continue using such casings, a FO cable (P07 or S08, Table 2) is placed inside and the casing is filled with cement-bentonite grout. The current sliding surface can then be identified and displacements on this surface back-calculated. Installation of such a system on site in 2008 allowed for the sliding surface to be detected within three months.

Applications in Ground Anchors

Motivation

The determination and monitoring of the stress distribution along the grouted section of a loaded ground anchor tendon is essential for the understanding of its bearing behavior. Strain along anchor tendons is normally measured at distinctive points by various sensors, such as conventional strain gauges and more recently, fiber Bragg gratings. Other approaches are based on elongation measurements in a very limited amount of tendon sections, such as the regularly-used commercially available monitoring anchors that offer strain readings in up to four sections.

A novel monitoring ground anchor using embedded FO cables allows for continuous strain assessment along the anchor tendon, and thus provide a powerful tool for calculating the load distribution in the anchor tendon, which is of interest to the geotechnical community, as other reliable methods are rare.

Design and Installation

The monitoring anchor is built of a tendon consisting of a hollow steel bar with a threaded outer surface of 35mm diameter. As the integration of FO cables is one of the key factors, two different integration methods were tested: integration in grooves machined on the outside of the tendon at 180 degrees to each other and internally in the hollow of the tendon. In the groove (1mm wide, 2mm deep), the FO cables (BSM, TSM & P07) are directly glued to the tendon. In internal integration, the FO cables (P07, S08 & M07) are placed inside the hollow center of the tendon later filled with a low viscosity injection resin. In 2009, such an 8m long monitoring anchor has been installed in a drillhole with a fixed anchor length of 5.75m (grouted). The anchor was integrated into a sheet pile wall supporting an excavation pit.

Monitoring

During anchor pullout testing, the anchor was loaded in stages up to 470kN, almost reaching its ultimate bearing capacity. BOTDA measurements were taken at each loading stage recording

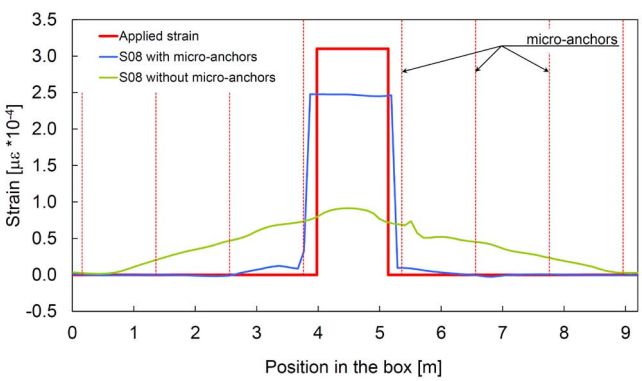

Figure 4. Strain measurements in a shear box obtained by a FO cable only and the "micro-anchor" - FO cable system.

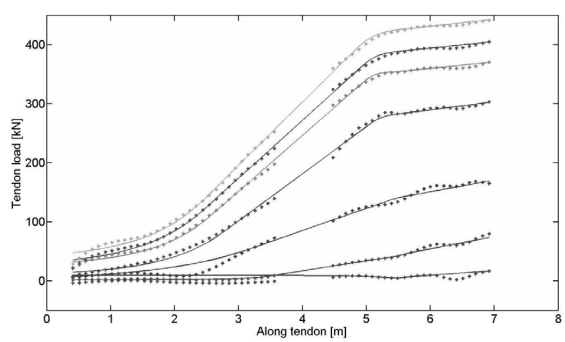

Figure 5. Monitoring ground anchor: load distribution from FO measurements for selected load steps.

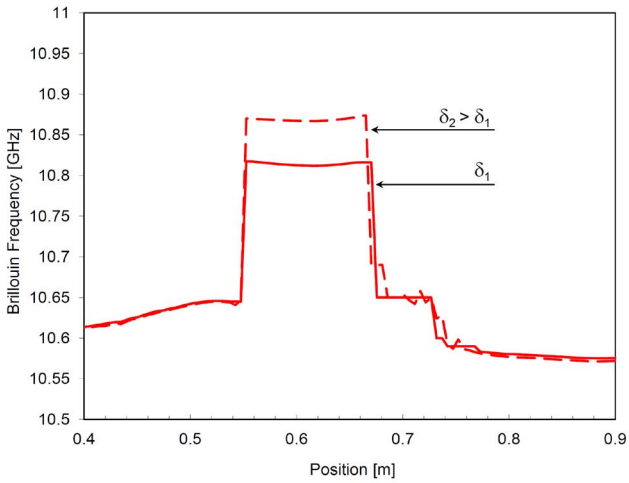

Figure 6 Monitoring of single crack opening with 5cm resolution (in collaboration with Foaleng Mafang S. and Thévenaz L, EPF Lausanne, Switzerland).tif

the load distribution along the tendon (Figure 5). This provides a better understanding of the real strength mobilization and progressive failure than some currently commercially available monitoring anchors.

Applications Requiring High Spatial Resolution

The novel BEDS technology, allowing for measurements with a spatial resolution of 5cm, is likely to expand the applications for FO sensing in geotechnical monitoring. It becomes possible to detect single cracks in structures affected by ground movements, and gives a comprehensive strain profile along geotechnical structures such as the monitoring anchor or a pile. At the laboratory scale, two applications have been explored. In the first one, the strain profile evolution in a 2m long FO cable pulled out of sand was successfully monitored (Iten et al., 2009b). In the second application a crack monitoring was performed by fixing a FO cable at both sides of the "crack" leaving 10cm of the free cable length and moving one fixation point by 0.1mm (simulating a crack opening). The BEDS data clearly detects the crack opening (Figure 6). With this technology becoming commercially available during the next years, hundreds of individual cracks can be monitored with one single FO cable.

Conclusions and Outlook

In contrast to structural health monitoring, FO geotechnical monitoring applications are not yet very common. However, their ability to provide enormous amounts of data at low cost per reading (in spite of the relatively expensive measurement units) is a convincing fact. The issues that have to be handled with care are (a) FO cable selection, (b) FO cable integration and (c) data interpretation. FO cables of a broad range of stiffness and protection are now available. The FO cable integration is project-specific and methods have been outlined in the references. The data interpretation requires background knowledge of FO technology. The authors are convinced that for the applications described in this article, FO technology is a valuable alternative to conventional methods.

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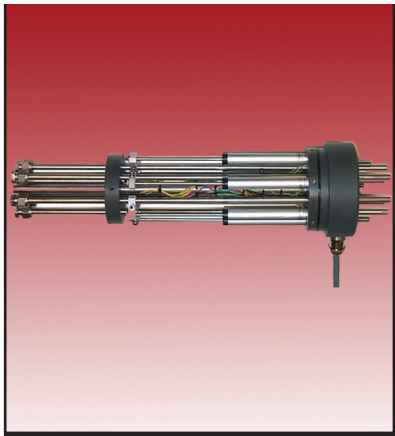
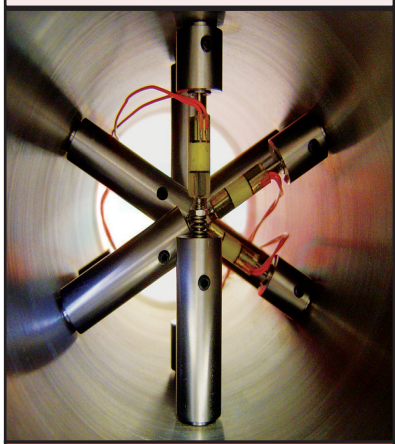
Editor's Note

Some readers may want to know the commercial sources of FO sensing systems. Here's a partial list. If you know of others, please let me know, and I'll update the list in a later GIN.

Company Name and Country	Website
FOS&S, Belgium	www.fos-s.be
Inventec, The Netherlands	www.inventec.nl
Micron Optics, USA	www.micronoptics.com
Omnisens, Switzerland	www.omnisens.ch
OpSens, Canada	www.opsens.com
Sensornet, England	www.sensornet.co.uk
Smartec, Switzerland	www.smartec.ch
Tencate, The Netherlands	www.tencate.com





The University of Florida

Geotechnical Instrumentation for Field Measurements

April 3-5, 2011

Doubletree Hotel • Cocoa Beach, Florida

Course Director: John Dunnicliff
Lectures by Users of Instrumentation
Lectures and Displays
by Manufacturers of Instrumentation

COURSE EMPHASIS: The emphasis is on why and how, and will be updated to include web-based monitoring, wireless monitoring, emerging technologies and online sources of information. Prior to the course, registrants may submit questions and requested discussion topics, and a half day has been assigned for responding to these requests.

WHO: Engineers, geologists, and technicians who are involved with performance monitoring of geotechnical features of civil engineering projects. Project managers and other decision-makers who are concerned with management of **RISK** during construction.

WHY: To learn the who, why, and how of successful geotechnical monitoring. To meet and discuss with others in the geotechnical instrumentation community.

WHAT: Practical information by leaders of the geotechnical instrumentation community, respresenting both users and manufacturers:

- John Dunnicliff, Consulting Engineer
- Martin Beth, Sol Data
- Aaron Grosser, Barr Engineering
- Daniele Inaudi, Roctest/Smartec
- Allen Marr, Geocomp
- Justin Nettle, Federal Energy Regulatory Commission
- Tony Simmonds, Geokon
- Robert Taylor, RST Instruments

For full details visit:
www.conferences.dce.ufl.edu/geotech

GROUND WATER

Influence of Element Size in Numerical Studies of Seepage: Large-scale or Regional Studies

Robert P. Chapuis

Many of us use numerical codes to study groundwater seepage within aquifers and often to solve the following inverse problem: What are the values of the hydraulic conductivity K within an aquifer given the hydraulic heads at some monitoring wells, and some (usually limited) information about flow rates, pumping and field permeability test data? Textbooks teach us that an inverse problem can have several solutions. For example, a numerical code that correctly solves the inverse problem on a given grid may yield an incorrect solution on a more refined grid. The key questions are: why does this happen, and how can we control this?

A Simple Example Problem

A simple example will illustrate what happens numerically with different grids. We examine an ideal confined aquifer, which is homogenous and horizontal, with constant thickness and constant saturated hydraulic conductivity. The hydraulic gradient is constant in the aquifer before any pumping. The well is pumped at a constant rate and has reached steady-state conditions.

The finite element code Seep/W (Geo-slope International 2003), which has passed a battery of tests (Chapuis et al. 2001), is used here. This code uses the soil characteristic functions, $K(u_w)$ and $\theta(u_w)$, in which u_w is the pore water pressure, $K(u_w)$ is the hydraulic conductivity function, and $\theta(u_w)$ is the volumetric water content function. The equations of Darcy (1856) for seepage, and Richards (1931) for fluid mass conservation, are solved numerically as u_w-based equations. The code can find complete solutions for saturated and unsaturated seepage. Once the numerical analysis is completed, the code provides equipotentials, flow lines and flow rates through previously defined surfaces.

We study the steady-state pumping problem in a rectangular ideal confined aquifer (Figure 1). The aquifer abscissa x varies from -500 m to +1800 m. The aquifer ordinate y varies from -500 m to +1200 m. The aquifer transmissivity ($T = Kb = 4 \times 10^{-4}$ m^2/s) and thickness b are constant. The pumping well is located at x = 550 m, y = 350 m. The boundary conditions (BC) for all grids are as follows: impervious boundary (or flow line) along the lateral boundaries y = -500 m and y = +1200 m; constant hydraulic head h = 14.00 m along the upgradient boundary x = -500 m; constant hydraulic head h = 10.00 m

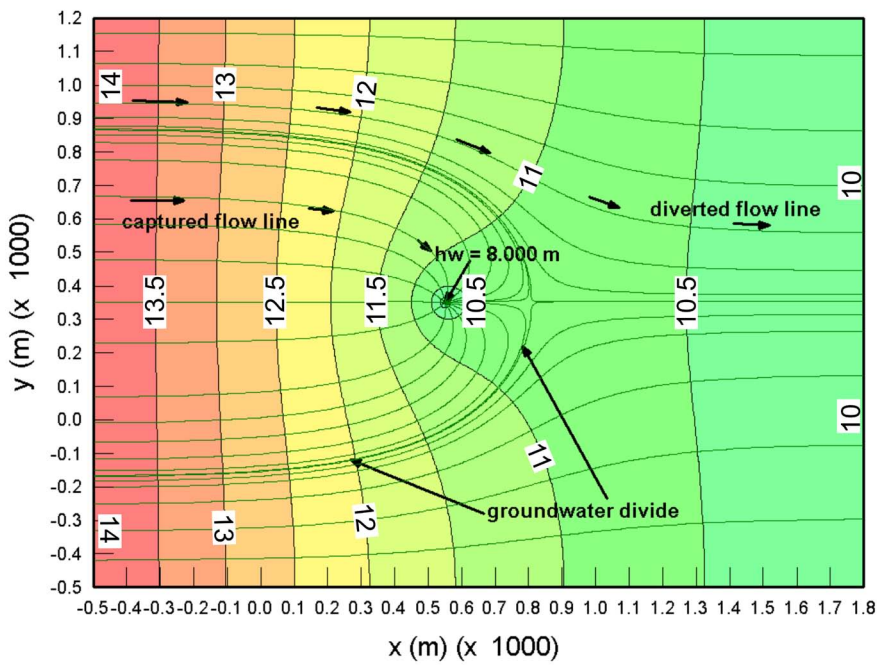


Figure 1. Example flownet for the ideal confined aquifer, steady-state pumping (equipotentials in metres).

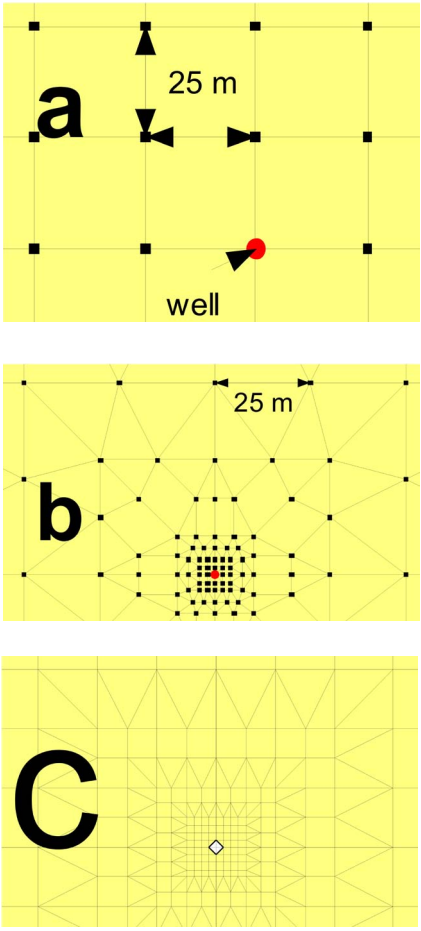


Figure 2. Three examples of grids that have been used to study groundwater steady-state seepage in the ideal confined aquifer: (a) uniform grid, the pumping well is represented by a single node; (b) refined grid around the pumping well, still represented by a single node; (c) very refined grid (squares of 15 cm) around the pumping well, represented by four nodes.

along the downgradient boundary x = +1800 m. Thus, before pumping the regional gradient is constant at 1.7391 x 10^{-3} (4 m / 2300 m) in the ideal aquifer. A flownet with the pumping well is shown in Figure 1 for one of the seven grids that have been considered for this paper. At the pumping well, the boundary condition (BC) is either a constant head h_w of 8.00 m (corresponding to a drawdown of 4.174 m) or a constant flow rate Q_w of 87 m^3/d. These two BC conditions are our "observations" at the pumping well. Using several grids we have found what is the computed flowrate when h_w = 8 m is used as the BC condition, and what is the h_w value

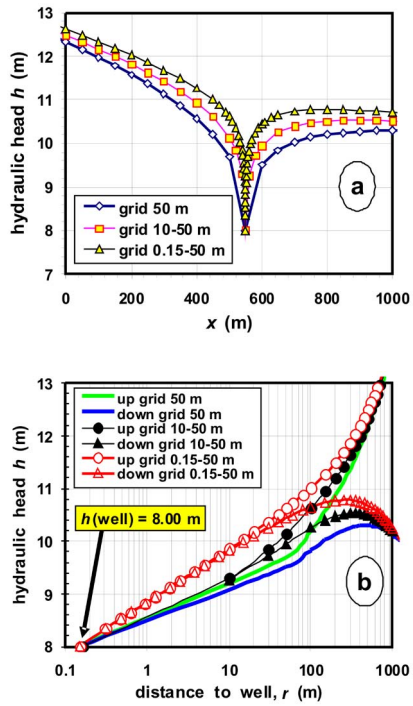


Figure 3. Numerical results in the x direction for several grids. The BC at the pumping well is h = 8.00. (a) Hydraulic head versus x; (b) Hydraulic head versus r along the x-axis.

when Q = 87 m^3/d is used as the BC condition. Then, we have found for each grid what is the K value to be used to match both the h_w and Q "observed" values.

Seven grids were used to study how the element size influences the numerical solution. Square elements of 100, 50, or 25 m (Figure 2a) were used for grids 1 to 3. The pumping well of grid 1 is the center of a 100 m square element divided into 4 triangles. Grids 3 to 6 have uniform meshes of 50 m except in the 200 m x 200 m square around the well: their smallest elements have a size of 10, 2.5 and 1.0 m (Figure 2b). For grids 1 to 6, the well is simply represented by a single node at the well center. Grid 7 has smallest elements of 15 cm around the well to better simulate a real well of diameter 30 cm; the well screen is represented by the 4 nodes of a square (Figure 2c), which is a rough but still reasonable representation of a cylindrical vertical well.

Numerical Results

a. Using the well drawdown as the boundary condition

A few numerical results are shown in Figures 3 and 4. It is observed first that the coarser the grid, the wider the drawdown cone (Figure 3a). The local variation of hydraulic head h (and therefore the gradient) close to the well is poorly estimated using grids with equal square elements (Figure 3b). To correctly compute the gradient, and thus the pumped flow rate, a very refined mesh is needed.

When a node (or vertical line of nodes) represents the pumping well, the numerical code gives an incorrect gradient in the elements containing the well node(s). Specifying a drawdown at a well node creates a gradient passing from a positive to a negative value at the well node, thus a discontinuity which results in poor numerical estimates of both gradient and flow rate.

The pumped flow rate, Q, for the same drawdown at the well, increases with the element size of the grid (Figure 4). With equal square elements of 100 m, the Q value is overestimated by 94% in this problem. The refined (6^{th}) grid, with elements of 1.0 m close to the well, provided a Q value 8% higher than that of the most refined 7^{th} grid.

b. Using the pumped flow rate as the boundary condition

When the pumped flow rate (87 m^3/d) is used as the BC at the pumped well, then the computed hydraulic head at the well of grids 1 to 6 is not 8.00 m as it should be to match the observation. Therefore, in order to match the observed Q and h_w at the pumping well, the aquifer K value must be modified as shown in Figure 5. With equal square elements of 100 m, the computer best fit K value is only 51% of the true K value. As previously seen for the Q value, only grid 7 provides a correct best fit estimate of the K value.

Our results for the simple case of an ideal confined aquifer (Figures 3 to 5) indicate that the best fit with coarse grids yield poor estimates of either the K values or the Q values. If the drawdown data and measured Q data are used as benchmarks to solve the inverse problem, then all values of K providing a best fit will be severely underestimated. This means that the water and contaminant transport velocities will

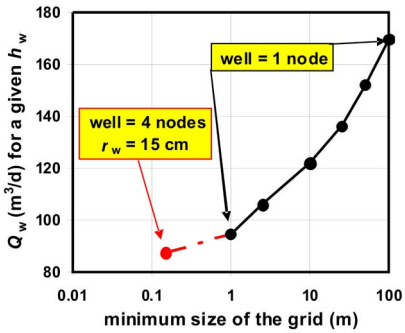


Figure 4. Numerical results for the pumped flow rate when the same drawdown is the boundary condition at the pumping well, the grid size being the only variable in the studied problem.

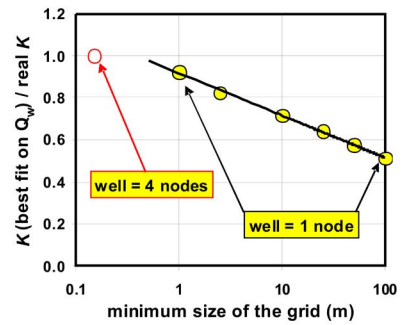


Figure 5. Numerical results when the same flow rate is the boundary condition at the pumping well, the grid size being the only variable in the studied problem: values of the required hydraulic conductivity (or transmissivity) to be used for the ideal aquifer.

be underestimated by a factor that may be close to 2 in the present numerical study. Only the grids with very refined meshes around the pumping wells can provide correct estimates for the values of *K* and Darcy velocities.

Consequences for the General Inverse Problem

Consider now briefly the more general inverse problem of finding the distribution of the *K* values within an aquifer knowing a few hydraulic head data at a few monitoring wells, and a few flow rates and drawdown data at a few pumping wells. Coarse regular grids are used most of the time to solve this inverse problem.

To understand why coarse grids are used, consider a 40 m thick unconfined aquifer over a surface of 7 km x 10 km. The numerical model may include 40 layers for the unconfined aquifer, thus 40 elements in the vertical direction. In the horizontal plane, if the model uses square elements of side 50 m, there will be 140 x 200 elements. In the volume, there will thus a total of 40 x 140 x 200 = 1,232,000 elements. Few codes can solve the equations for such a high number of elements, but the grid is still coarse. If the unconfined aquifer is located above a confined aquifer, water will be exchanged between the aquifers through an aquitard. The volumes of exchanged water cannot be neglected for such a large scale problem. The study of the regional system may need 20 more layers for the aquitard and the deeper aquifer, which will increase the number of elements up to 1,848,000.

Using coarse grids to study regional problems has two major drawbacks from the point of view of numerical analysis: (1) excessive element dimensions and (2) excessive aspect ratios. The element aspect ratio is the ratio of its maximum dimension to its minimum dimension, 50 in the above example. To avoid inaccuracies, the aspect ratio should be kept close to one, but can reach 2 or 3 to accommodate geometric constraints, as used in some textbooks of numerical analysis.

The consequences of the first major deficiency have been shown in Figures 3-4-5 for our simple 2D example: using large elements creates large errors, even if the aspect ratio for the seven grids of our example did not exceed 2. This occurs because a coarse grid cannot provide a correct solution to an inverse problem with pumping wells, due to the discontinuity in hydraulic gradient at each well, a mathematical singularity in the mesh, which is poorly treated by any numerical code. Even when the code's solution methods are unknown, the errors and convergence characteristics can be studied using several theories and techniques (Roache 1994, 2009). The related mathematical issues, however, are beyond the scope of this short paper.

The second major deficiency is due to excessive aspect ratios. In the preceding 3D regional example, the aspect ratio is 50, whereas it is recommended to keep it below 2 or 3. This high value of the aspect ratio generates more error in a 3D regional study than that previously found for our 2D ideal case study (with an aspect ratio below 2).

In addition to these two major deficiencies, the results obtained with a coarse 3D grid may also be plagued by errors resulting from cumulative round-off errors: this increases with the number of elements and depends on the accuracy with which numbers are manipulated in the computer.

According to our experience, most of the time, numerical studies are made without addressing grid adequacy and convergence issues. Due to current limitations of computers, large grids seem necessary to study regional problems. However, consultants and their clients should be aware that large grids are prone to provide incorrect answers to inverse problems.

General Rules for Meshing

Over the past few decades, more advanced computer methods have become available: they frequently give an illusion of being easy to use. We have just seen that these numerical tools are still complex to handle. In the 1980's and 1990's the number of nodes was a key parameter because the computer memory was limited and the computers were relatively slow. Since the computing time for a given problem is roughly proportional to the square or the cube of the number of nodes, there was a tendency to use simple meshes and thus limit the number of nodes. With the present computer capacity, there seems to be less concern for the number of nodes. This does not mean, however, that we should always model very finely any problem.

A few basic principles should be observed, which are provided below. First, we must have a preliminary idea of how the hydraulic head varies within the volume of our study. For a first appraisal we can use a coarse mesh, which will give us a first solution. We must examine this first solution and identify the zones with large local variations in hydraulic head *h*, and (for unsaturated zones) in water pressure *u*. These zones are those where our mesh must be refined. For a second apprais-

al, we can keep the large initial mesh for the volumes where the *h* variations are small, and generate finer meshes in the volumes of high *h* variations (high gradient zones). When examining the second solution and the zones of high variations, we may find that some local refinements are still needed. Once we are satisfied with our last refinement and believe that further refinement would add nothing, we should not be satisfied with our belief, but prove it. We must prepare a confirmation mesh in which all elements will be smaller (by half for example) of what we thought would be our last mesh. The confirmation mesh should give the same results (heads, gradients, velocities, flow rates, etc.) as our last mesh. If it is the case, then we have the proof that we have designed and retained a correct mesh. Note that the computing time for the verification mesh may be about four to nine times longer than the time for our final and correct mesh. Thus, we should avoid using the verification mesh for long transient problems (the computing time for this verification could take many hours) but use it first for faster-to-solve steady-state problems (which could then also serve as initial conditions for the longer transient simulations).

Two simple rules to observe are:

(i) The higher the local variations in *h* (anywhere), gradient and *u* (unsaturated zones), the finer the local mesh;

(ii) The final solution must be independent of the mesh size.

Conclusion

This short paper has examined the case of a pumping well in an ideal homogeneous confined aquifer, with seven grids of 391 to 2672 elements. The code used here easily converged for this simple 2D case (immediate convergence in two steps, relative error on the modulus of the pore pressure vector below 10^{-6}), due to the linearity of equations (confined fully saturated aquifer, steady state) and the small number of elements. However, different numerical solutions were obtained for different grid sizes. In short, the finer the 2D grid, the more accurate the numerical solution. It is also preferable to model all geometric details as accurately as possible. For example, a pumping well is better modelled using 4, 8, 16 or 32 nodes located on its screen than using a single node representing the well center (it is then a well of infinitesimal diameter).

To complement this paper which focuses on large scale or regional studies, two forthcoming papers will provide a few examples for small scale studies with high local variations of the hydraulic head, and for cases in which unsaturated seepage plays a key role.

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ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

Foundation Drilling Conducts a Roundtable Interview

The following article appeared in the August issue of Foundation Drilling, *published by ADSC:The International Association of Foundation Drilling.*

It began, formally, in 1969 as Associated Soil and Foundation Engineers (ASFE), a business-focused association of geotechnical engineering firms desperate for survival: Their liability problems were so severe, professional liability (PL) insurers worldwide withdrew coverage. ASFE's mission was to learn what was behind the situation and to develop programs, services, and materials member firms could apply to make the problems less onerous. An independent survey conducted by Birnberg & Associates in 1985 revealed that ASFE was achieving its mission: ASFE-member firms were able to obtain PL coverage from most AE insurers, and they were paying rates lower than most other AE firms'. The survey also revealed that ASFE members were the most profitable of all the nation's design and environmental firms.

The organization was prospering, too. Membership had grown considerably as had the members' average size and service mix. In fact, geotechnical engineering had become but one of many geoprofessional services most member firms provided, in addition to environmental, geo/civil design, geology, and construction materials engineering and testing. This diversification prompted the group to change its name to its by-then well-known acronym, begetting ASFE, Inc., which is still the group's legal name. For clarity's sake, the organization added taglines to explain itself. Most recently, it became ASFE/The Geoprofessional Business Association, but the change of name was just one of several important changes the organization adopted. The group also embraced a new purpose, "To maximize the geoprofessions' importance and value to the marketplace." *Foundation Drilling* Editor Scot Litke wanted to learn more and invited the group's Executive Committee to participate in a roundtable discussion. Guests included ASFE President James W. "Jay" Martin, P.E. *(AMEC Earth & Environmental, Inc.),* President-Elect David R. Gaboury, P.E. *(Terracon)*, and David A. "Dave" Schoenwolf, P.E. *(Haley & Aldrich, Inc.)*. This is what they had to say.

Litke: So what prompted this move? ASFE has spent 40-plus years creating a reputation for risk management.

Martin: We're not abandoning risk management. It's an essential business tool and one that we're really good at it, frankly. What we're trying to do now is a lot bigger than risk management. In essence, our new purpose is to change the environments where most of the risks seem to come from.

Litke: And which are those?

Martin: The markets where geoprofessionals are marginalized and commoditized.

Litke: I think we need to define terms. "Marginalized and commoditized" means what?

Gaboury: Marginalized means we're put into a position where we have little or no opportunity to apply what we know so we can add value to a project. We're on the outside looking in instead of being on the inside looking out. We're not sitting around the table as major project participants or contributors. We're order-takers. We're not invited to the decision-making process. Sometimes we're not even invited to the jobsite unless something goes wrong. And given the nature of geoprofessional practice, it's easy for things to go wrong, if geoprofessional services are applied ineffectively.

Litke: And commoditized?

Schoenwolf: Commoditization occurs most frequently in those markets where client representatives and other AE professionals tend to regard geoprofessionals as all more or less the same. In other words, they seem to think that it doesn't matter which geoprofessional you retain, you'll get more or less the same kind of results and, in many cases, the same kind of me-first attitudes about risk avoidance.

Litke: I assume risk avoidance and risk management are not one and the same.

Schoenwolf: Correct. Unfortunately, it seems as though a lot of geoprofessionals think risk avoidance and risk management *are* the same, and that has aggravated some of the over-arching problems we've reorganized to deal with. In the same markets where geoprofessionals are commonly marginalized and commoditized, they're also criticized by client representatives and professional colleagues who believe geoprofessionals want to avoid responsibility for what they do. And all too often, the criticisms are valid. A proj-

ect team member who wants to avoid responsibility frustrates client representatives and others on the team. That aggravates the problems that make effective risk management so necessary.

Litke: You're aware that one of the problems ADSC members and other foundation contractors have to deal with is skimpy geotechnical reports that make it difficult to come up with an effective bid. Are you saying that the solution is geoprofessionals earning more respect from other project-team members?

Martin: Yes. Inadequate bids lead to delays, change-orders, budget overruns, distrust, disputes, and claims, problems that can affect just about all principal project-team members. Top-flight geoprofessionals want to avoid all those problems and now exactly how to. But in order to have their guidance sought and listened to, they have to be a respected member of the project team; they have to step up to the plate. Bottom line, they have to be good consultants. You can't be that if you move forward continually watching your backside. It's not good professional behavior.

Litke: But good professional behavior has to recognize that the professional services are being delivered through a business, and in order to stay in business you have to keep risks under control and be profitable.

Gaboury: Of course, but it's a matter of how you go about doing that. Everything we've learned over the years shows that professionalism is profit's best friend, because professionalism creates long-term relationships. When you have a long-term relationship, the client comes back time and again for more of the same and for new services that often involve even more responsibility. On the one hand that increases profits and, on the other, it lowers risks, because more often than not you'll be engaged sole-source or through qualifications-based selection, so you're dealing with better scopes of service and with people whose needs and preferences you know well.

Martin: Professionalism is also what gets you to the C-level, so you have much more opportunity for dealing with the CEO, the COO, or the CFO of an organization, or at least with the key decision-makers for a given project.

Litke: So ASFE's focus on effective risk management in particular has taken you to effective practice management in general?

Gaboury: Yes. Businesses that do things right minimize the risk of things going wrong. Stated another way, the most effective risk management is doing things right. The more you do right, the fewer risks you have to contend with. Some people seem to think there are shortcuts; that effective risk management means using certain types of contract provisions or obtaining certain types of insurance coverages. That's important, but it's really just a small part of it. I like to believe that ASFE-member firms understand this; that they get it, and know how to run their businesses well, without compromising professional principles.

Litke: So where's the disconnect? If these firms know how to run their businesses well, why is ASFE needed to "maximize the geoprofessions' importance and value to the marketplace"?

Martin: ASFE-member firms tend to predominate in certain markets and, frankly, they've earned their stripes there. They've earned the respect of their client representatives and colleagues and that's why they participate in project decision-making. As a result, the entire team is able to deal with a range of issues at the outset, so fewer things are left to chance. That translates into fewer risks and fewer risks mean fewer things go wrong, even though the projects associated with the markets involved are often large and complex.

Litke: Which markets?

Martin: The railroad market, for one. Most of the client representatives involved understand the importance of having an outstanding geoprofessional service performed. A reliable subsurface evaluation. Well-thought-out recommendations with the client's needs and preferences in mind.

Gaboury: The same can be said for the tunneling market, for mining, and for offshore work.

Schoenwolf: Most high-rise owners understand, and most brownfield developers get it, too: The geoprofessional component of the project is just too important to let it go to just anyone. You retain well-respected geoprofessionals to give you advice and you follow the advice.

Litke: And when you don't?

Martin: Things go wrong. Unfortunately, the markets where marginalization and commoditization are most predominant also generate the most projects. These are the vertical construction markets in particular: single- and multifamily residential. Commercial. Institutional. Given the size of these markets, it's understandable that they generate the most claims. And given the existing attitudes about geoprofessional practice, it's understandable why, to the best of our knowledge, geoprofessional problems are the most common source of construction problems; of unanticipated conditions, delays, budget overruns, failures, claims, disputes, and litigation.

Litke: So these things are all avoidable?

Schoenwolf: Just about, yes.

Litke: How?

Schoenwolf: By doing what client representatives and colleagues do in those markets where geoprofessionals are not marginalized or commoditized.

Litke: And they're not going to do that until geoprofessionals change their own behavior.

Martin: A lot of geoprofessionals need to perform better, to be sure. But we also have to make more client representatives and colleagues aware of the benefits they can derive by selecting geoprofessionals more carefully and getting them involved. So we want to increase the demand for high-quality geoprofessional services at the same time that we try to increase the supply.

Litke: So how would you characterize this effort to maximize the geoprofessions' importance and value to the marketplace? Would you call it the next step in risk management?

Martin: It's much bigger than that. We're looking to reduce the problems created by the *status quo* by changing the *status quo*.

Gaboury: As we see it, Scot, risk management means being in the umbrella business.

Litke: In what way?

Martin: Risks rain down. Over the years, ASFE has helped its members by creating umbrellas. Contract terms like limitation of liability, for example. Model contracts. Alternative dispute resolution. Training programs of various type. So ASFE-member firms have the umbrellas they need to protect themselves, and the data show that those umbrellas been extraordinarily effective. So we're not going to stop making umbrellas.

Litke: So your new purpose is to stop the rain. And until you're successful, you'll keep on making new umbrellas, too.

Martin: Exactly.

Litke: And how do you propose to stop the rain?

Gaboury: Through outreach. We want to work with the many fine organizations like ADSC that are made up of geoprofessionals, in whole or in part. And we also want to work with the organizations that represent owners and other client types, including architects, civil engineers, structural engineers, and others. We all have a vested interest in this. Things don't have to be as they are. Projects that involve delays and disputes should be rarities. Right now, they're not.

Litke: So you want to shrink the market for commoditized services. Do you really believe you can you do that?

Gaboury: If we thought we couldn't, we never would have set out on this path. We want to stimulate the market for the kind of geoprofessional service that makes problems far less likely, and we want to increase the supply of people and firms able to fulfill that demand.

Litke: But you're not a technical organization. How do you plan to increase supply?

Martin: Elevating technical competence is always important, and a number of other organizations are doing a great job of it. But even the most technically astute geoprofessionals are still treated like commodities in part because they lack the ability to deliver what many client representatives regard as a top-of-the-line professional consulting service, or because they're not given an opportunity to provide that kind of service, in part because they don't know how to create the opportunity for themselves.

Litke: So it's far more of how to succeed in a service business than it is how to improve one's technical capabilities.

Martin: Exactly. We need to educate more geoprofessionals in how they go about performing what client representatives regard as an outstanding professional service. And that's not difficult for ASFE; we've been doing it since day one. What we want to do, and what we have to do, is share our knowledge and experience in this arena with other geoprofessionals and geoprofessional organizations. We want to create and cultivate allies who have the same

outlook that we do, so we're all singing from the same hymnal. Right now, the tune seems to be out of the Rodney Dangerfield songbook: "We don't get any respect." To the extent that's true, there's a reason for it: More geoprofessionals need to do better. And they can.

Schoenwolf: Some don't need to improve much to get to the top, and we need to reach out to client and colleague groups – the decision-makers and decision-influencers – so they have a better understanding of the benefits they can get from a better service – saving time and money, for example – and so they realize that people and firms are available right now to help them. They'd be foolish to not want to save money and save time, and not many of them are foolish.

Litke: Of course, clients will have to pay more for a better service. Will clients be willing to do that?

Schoenwolf: That's actually a debatable point. If you plug in the average amount of money that has to be paid, per project, to resolve the problems that arise from a cheap, unconcerned service, the net price for high-quality service is probably less, not more.

Gaboury: The issue is value, not fee. Realistically, most informed client representatives would be willing to pay more to save time and save money. They know that the real cost is determined by the outcome. We have hundreds of case histories that demonstrate how the investment in a high-quality geoprofessional service saved far, far more than the cost of the service itself.

Litke: The cost of the service or the premium paid for a higher-quality service?

Gaboury: Of course the premium, but realistically, a $50,000 geoprofessional service could easily save a client $100,000 or more, and, again, we have case histories to prove that point.

Litke: Isn't ASFE already known for its case histories?

Schoenwolf: Yes, but the cases we have illustrate failures; the kinds of things that go wrong. They give us the raw material we need to make umbrellas.

Litke: So by developing cases of what happens when things go right…

Martin: …we can encourage more clients and colleagues to do what it takes to have things go right and we can encourage more geoprofessionals to do what it takes to have things go right.

Litke: So you'll put the low-performing geoprofessionals out of business.

Gaboury: That's not our goal at all. What we want to do is increase the demand for high-quality geoprofessional services that add real value to a project and to increase supply by encouraging and assisting all geoprofessionals to provide such services. Look: Geoprofessionals aren't stupid. In fact, the exact opposite is true. But far too many of them receive very little instruction in how to conduct themselves in business. Over the years that deficit has been a major causal factor in the commoditization and marginalization that affects the majority of geoprofessionals in various marketplaces, no matter how good they are technically.

Litke: So those are some pretty daunting marching orders you've given yourselves.

Martin: True, but ASFE has done it before. People laughed at us when we introduced the limitation of liability concept in 1969. They said, "Do you really believe you can convince owners to limit your liability when right now you're giving them unlimited liability?" We thought we could and we did. It took a lot of hard work and a lot of effort, yet today limitation of liability is a common feature in the contracts of most design professionals. We're able to explain why it's reasonable; why it benefits clients and consultants alike.

Schoenwolf: Our success will benefit other consultants, too, because litigation is like fly paper; everybody gets stuck in the mess. To the extent that a project experiences fewer problems, all parties benefit. Right now, geoprofessional problems predominate. All parties will benefit when that changes, and all parties are in a position to help implement that change.

Litke: But, realistically, some services are a commodity.

Martin: A professional service is a professional service; it's not a commodity. If you believe otherwise, you'll believe anybody can get the same result so it's acceptable to find the lowest-price providers. As in just about any area of human endeavor, there are those who are far better at getting the work than performing it; who like being selected on what they charge rather than what they're capable of providing. They don't care if they're treated like commodities. That's exactly how they treat their clients. If you really believe that some professional services are a commodity, that the service is the same no matter who performs it, retain one firm to provide the service as a commodity and another to provide it with professionalism held foremost. I guarantee you'll see a huge difference from start to finish.

Litke: How much time will ASFE be willing to spend on this campaign?

Martin: We're moving forward in three-year strategic planning increments. We'll spend as much time as it takes. This is our new purpose; our new reason for being.

Litke: Gentlemen, thank you. And good luck.

A Call to Action from ASFE President James W. "Jay" Martin, P.E.

Congratulations! You are a vital part of **ASFE/The Geoprofessional Business Association**. Our purpose is to "maximize the geoprofessions' importance and value to the marketplace." To do it, we must overcome the commoditization and marginalization that affect all too many geoprofessionals in all too many markets.

Realistically, we've done this to ourselves: Commoditization and marginalization are largely the result of ill-advised business practices geoprofessionals must change if their fortunes are to change. Even ASFE-Member Firms and the people who comprise them can do better in order to better demonstrate the insight and skills needed for client representatives and others to change their opinions about geoprofessionals. But more than ASFE members are involved in the geoprofessions. As such, if we are to establish an overall geoprofessional "brand" that will truly "maximize the geoprofessions' importance and value to the marketplace," we will need widespread geoprofessional self-improvement. At a minimum, this means improved grasp of the business issues circulating in the marketplace every day. And not just geoprofessional business issues. Our clients' and colleagues' business issues are just as important if not even more so. By recognizing that, and doing something about it, we can become better – more valuable and more valued – consultants.

ASFE can help, because we have created an astonishing, unmatched array of proven-effective programs, services, and materials geoprofessionals can use to contribute meaningfully to more gratifying, satisfying, and profitable outcomes for all project participants. *If we cannot increase our value to others, our claims will ring hollow.* I therefore urge you to use more of what we have, almost all of which is available to you free of charge.

ASFE cannot do it alone. We will need the active cooperation of allied organizations with geoprofessional components, and our plan calls for us to engage them. We will also need the active support of organizations whose members – owners, developers, contractors, construction managers, and other design professionals, among others – will benefit from recognizing and seeking the value geoprofessionals are truly capable of providing. Our plan addresses that issue, too, and the plan is well-underway.

And there's one more element we absolutely must engage if we're going to move from here to there… You.

We need you to carry the ASFE message to everyone in your firm, so you're all on the same page. We also need you to carry the message to other groups you're involved in, so they, too, can join the effort. And please consider getting more involved in ASFE. We have new committees and more of them; join, if not as an active member, then at least as a corresponding member; someone who stays involved by staying aware, and who from time to time antes up with your own two cents. Go to *www.asfe.org/index.cfm?pid=11350* for information about each ASFE committee and the form I urge you to fill out to indicate "I want to make the future happen."

And, finally, this note: ASFE needs to generate more income to do what we have to do. I'm not asking you to give more, but merely to encourage peers in nonmember firms to at least give membership their consideration. Remind them that, when they belong to ASFE, ASFE belongs to them. Their dues will purchase an unrivalled opportunity for self-improvement and for improving geoprofessionals' value in the marketplace.

This can be an exciting, rewarding future for us all, and we can make that future ours by working to achieve it. I echo the sentiments of many others by saying that being part of the solution is one of the most satisfying things I've ever done.

New *ASFE Practice Alert* Helps You Become a Better Consultant

It's all about people, as every geoprofessional should know, and the most important people of all tend to be client representatives; the folks responsible for giving you and your firm repeat business, opportunities to provide new services and delivery methods, encouragement to open new offices, and (especially on your request) recommendations and referrals. They can also be the people who decide to give you another chance or a claim; who stick up for you in their organization… or not. What do you have to do to be that GREAT consultant who has the trust and loyalty of client representatives? That's revealed in the ASFE Education Committee's new ***ASFE Practice Alert 49: Ten Things You Need To Know about Client Representatives.*** Adapted from material developed several years ago for *ASFE NewsLog*, this new document has been updated and makes excellent reading. Like other ASFE materials, it's available to members free of charge.

40 Organizations Now Endorse *Recommended Practices…*

Forty organizations now endorse *Recommended Practices for Design Professionals Engaged as Experts in the Resolution of Construction Industry Disputes*, an annotated list of 13 "shoulds and should-nots" originally developed by the Interprofessional Council on Environmental Design (ICED), an "umbrella organization" also including, among others, ASFE, the American Society of Civil Engineers (ASCE), National Society of Professional Engineers (NSPE), American Council of Engineering Companies (ACEC), and The American Institute of Architects (AIA), all of which are endorsers.

ASFE recognized the need for the document and spearheaded its development. ICED assigned ASFE responsibility for the document's publication and management, as well as gathering additional endorsers. Thirty-one additional U.S.-national organizations have endorsed the document. They include such well-known organizations as: the American Society of Mechanical Engineers (ASME); American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE); Illuminating Engineering Society of North America (IES); Society of Manufacturing Engineers (SME); and American Association of Engineering Societies (AAES). The four remaining endorsers include an international association of national engineering organizations (the International Federation of Consulting Engineers) and three U.S. regional groups.

According to **ASFE President James W. "Jay" Martin, P.E. (AMEC),** *Recommended Practices…* is believed to have received more construction-industry organization endorsements than any other similar document or position statement ever developed. Created by ICED in 1988, *Recommended Practices…* has been used extensively in legal proceedings, especially in matters involving the standard of care. According to ASFE Executive Vice President John P. Bachner, "To find a design professional negligent, a trier of fact – a judge or a jury – has to believe that the design professional failed to uphold the standard of care. But first the trier of fact has to decide what the standard of care actually was at the time of the incident in question. As it so happens, the standard of care is a moving target. It's what's commonly done by peer professionals operating in a given area at a given time. Practices evolve, however. What is common today may have been unheard of just five years ago."

Bachner explained that courts almost always require an expert witness to explain the standard of care in terms the trier of fact – usually a jury – can readily understand. He went on to say, "All too often, however, experts testify about the standard of care based on what they would have done or what a book says to do, and either or both of these measures may be seriously out of sync with reality. Experts need to conduct research to know what the standard of care was at the time in question, and 40 prestigious organizations concur unanimously. Experts who are cross-examined need to be able to explain how they reached their opinion about the standard of care. This is particularly important given that experts are insulated from liability for just about anything they say. This protection can encourage some experts to alter their testimony to suit the needs of their clients."

Some of the other issues addressed in the document include conflicts of interest, expert qualifications, research methods and integrity, illustrative devices, and confidentiality.

ASFE's First Webinar a Smash!

More than 90 ASFE-Member Firm offices tied into ASFE's first webinar. Developed by the New Leaders' Committee, it featured **Terracon Vice President/General Counsel Michael J. "Mike" Yost, Esq.,** addressing the issue of client-focused contract negotiations. Early results of the participant survey showed an overall ranking of 9 of a possible 10 points!

This being our first webinar, we are looking into several methods of making the material available to those who missed the initial webcast. We're also looking into additional topics to cover, with an eye to making each webinar about one hour long, for showing near the noon hour. **Do you have some suggestions or requests?** If so, PLEASE address them to us at *info@asfe.org*.

Have You Downloaded the New Scope Development Lunch & Learn?

What are best practices for development of a geoprofessional scope of service? ASFE's Education Committee provides answers in its newest Lunch & Learn self-contained seminar kit, "Scope Definition."

As noted by ASFE Education Committee Chair **Laura R. Reinbold, P.E.** ***(TTL, Inc.),*** each Lunch & Learn includes guidance to the presenter, a complete script, hand-out materials for participants, and a PowerPoint presentation. Designed for presentation during lunch or after work, ASFE Lunch & Learns can be easily customized so an individual firm can make any Lunch & Learn uniquely its own. They reference ASFE materials that ASFE-Member Firms can order free of charge or download with a click.

Other ASFE Lunch & Learn kits focus on electronic delivery of documents, high-risk language, workplace harassment, and meeting management, among other topics. All are described at the ASFE website: www.asfe.org.

Business 101

The following materials was based on an article by Steve Tobak, a consultant, writer, and former senior executive with more than 20 years' experience.

In dreams, people succeed at everything they do. In reality, they sometime fail, ask questions to learn from the experience, adjust their techniques and styles, and try again, sometimes in a new environment. Of course, you have to know what failure looks like and, once you see it, you need the guts to admit that you've failed or are about to. In the geoprofessions, failure can occur in the technical arena or the nontechnical. The nontechnical – usually management – breeds more failure, in part because you are asked to manage without having adequate instruction on how you should go about doing it. That doesn't mean you will fail; only that you're more likely to than someone with more education and experience. What's particularly important is knowing when you're in trouble, so you can respond as quickly as possible. How do you know? Consider looking for these ***seven warning signs that you're a lousy manager:***

1. **Your team is underperforming**. Management flows downhill. If your team's metrics are falling or already low compared to others, it says something about you…like it or not. Is it your leadership style? Do you need to acquire more management skills? Are you supervising effectively? You need to answer the question, "Wazzup?"
2. **You're making poor decisions.** Results are visible and measurable. Poor results stem from actions that are misdirected or not in harmony with one another. Actions stem from decisions. Bad decisions equal bad management.
3. **Your manager is putting the screws to you.** When effective senior managers believe a subordinate may be losing effectiveness or not displaying the effectiveness they thought was there, they'll yank the subordinate's chain to see which links break. Is your boss putting you under more than the usual pressure? If so, it could be a sign your performance is being questioned. You might want to ask your boss about it.
4. **Your friends and allies are distancing themselves from you.** You know how fast word spreads in an organization. If you learn that good old Joe is on the outs with the top brass, chances are you don't want to get too close or stay too close to Joe; he's starting to look like a lead life preserver. If your friends and allies at work are waving from a distance, they might know something you don't…but should.
5. **You're acting like a jerk.** Have you noticed that you've been experiencing a lot of stress and anxiety lately? Have your nearest and dearest told you that stress and anxiety may be the reason why you seem to be treating your poorly? While you may be in denial about being an ineffective boss, chances are you're aware of your shortcomings on some level, and that can take a toll on you.
6. **Your personal relationships are in trouble.** Management is largely a "people function." If you're being an ineffective manager, chances are your personal relationships are suffering, too, for many of the same "people reasons."
7. **Your employees are unhappy with you.** Do you hear laughter all around you and when you get up to find out what's so funny, the laughter stops. Do your employees look away or loss busy when you walk by? Do they look guilty? Do they go out for drinks after work, but don't invite you?

Dick Stehly, P.E.

Richard D. "Dick" Stehly, P.E., a founder, senior vice president, and principal engineer of American Engineering Testing, Inc. and American Petrographic Services, Inc., passed away suddenly on September 18, 2010.

Dick began his career at Twin City Testing as a materials intern in 1971, with a special interest in concrete design, batching, forensics, and failure analysis. In 1974, he led research efforts into the use of fly ash as a concrete additive, showing that the waste material improved the strength and durability of concrete while reducing the amount of the material sequestered in landfills and holding ponds. He also led the research team that investigated pavement-joint erosion and coined the term "deicer distress." His research won the Consulting Engineers Council Grand Award for the Minnesota and Wisconsin Departments of Transportation. In 1997, Dick co-authored the book *Cancer of Concrete*, which included his deicer-distress research.

Dick was actively involved in a number of organizations, the American Concrete Institute (ACI) in particular, and just last July testified on behalf of ACI in Washington, DC on the continued use of fly ash as a concrete admixture.

Dick served as the project manager for the Metrodome as well as the new Minnesota Twins Ballpark. He contributed to the rebuilding of the Pentagon and was there to personally rededicate the new structure.

A graduate of the University of Minnesota Institute of Technology, Dick was 60 years old at the time of his death. He left behind a loving family and countless friends worldwide who mourn his passing.

Human Resources Management

Research shows that 86% of recruiters look at social media sites like Facebook, Twitter, and MySpace to learn more about job applicants and *44% turn down applicants based on their findings*. According to Pamela Eyring, president of The Protocol School of Washington (PSOW), the **top five social-media myths** are:

- Facebook is personal. (Businesses from sole practitioners to Fortune 50 companies use Facebook.)
- Facebook is private. (Default privacy settings are minimal. Select privacy settings manually.)
- Only my followers read my Twitter posts. (The Library of Congress has started collecting Twitter posts as a way to record history.)
- Recruiters Don't Look at MySpace or YouTube. (Recruiters look everywhere.)
- My Facebook profile and pix can be deleted. (Even deactivated content remains on Facebook's server.)

Engineers Leadership Foundation Launches Program to Make Kids Better Readers and Better Students

The Engineers Leadership Foundation is pilot-testing its new *Engineering Better Readers* program, an initiative designed to incentivize elementary-school students to read more and to propel participating engineers into leadership roles in their respective communities.

"Engineers solve problems and we see a serious one that the Engineering Better Readers program can address – the diminishment of strong reading skills among the nation's children," says Foundation President (and ASFE Past President) Gerald J. "Gerry" Salontai, P.E. "Studies show that kids who do not master reading skills by the third grade have learning difficulties later and are far more likely to drop out before high-school graduation. Nothing much can be accomplished in any field – including engineering – without knowing how to read. This is a serious national problem that, despite so many well-intentioned efforts, is getting worse. America now faces too much international competition for us to treat this issue as anything other than one of our highest priorities. This program is a great start in the right direction."

According to Patty Bachner, Engineering Better Readers program director, "Our research shows that kid-friendly incentives not only work, but also give kids a chance to experience achievements and empowerment through reading skills." She will be directing the program's three pilot efforts in Newark, N.J., Houston, and Denver. Bachner says the program is modeled after a highly successful prototype operated in Tuscaloosa, AL by TTL Inc., a local geotechnical-engineering firm. "Two factors separate Engineering Better Readers from other reading-incen-

tive programs," Bachner says. "First, it offers incentives that kids *really* want. Second, it is sponsored by committed engineers."

Under the program, a participating engineering firm coordinates with local school authorities to sponsor a reading initiative in a designated underperforming school. The firm purchases the incentives and provides mentors who encourage students to read, provide assistance when needed, and discuss books chosen to enrich the reading experience. Incentives include iPods, Wiis, and other electronic items; nonviolent toys and games; skateboards, basketballs, and other sports equipment; and bicycles, among many others. Children begin to read books for points with the involvement of the engineering firm's volunteer mentors, and "purchase" the incentives by using the points they accumulate.

Mr. Salontai said the Engineering Better Readers program can also help engineers develop their own leadership skills, which relates directly to the Foundation's mission. Those skills will serve them well not only in their own companies, but also in their communities and in other aspects of society, says the former engineering-firm CEO. "We have designed *Engineering Better Read*ers to encourage the principals and employees of engineering firms to get directly involved in an important community outreach activity," Mr. Salontai said. "It's often difficult for those in the private-sector to gain exposure to the community by doing their day jobs, but that exposure is fundamental to community leadership. Clearly, what's been done before hasn't worked. We're extremely optimistic that Engineering Better Readers has the potential to be successful on many fronts."

The Engineering Better Readers program is also designed to shrink the growing gap between the demand for engineers in the U.S. and the supply. "We've been promoting the wonders of math and science for decades and 'the pitch' is obviously falling on too many deaf ears," Mr. Salontai observed. "Many people choose engineering and related technoprofessional careers based on interactions with practitioners they respect and admire. Engineers make a difference through the work they do, but they can also have a huge impact by demonstrating to the community – particularly its kids– who they are and what they can get done. The more kids who know engineers, the more kids who will want to become engineers themselves."

For more information about the Engineering Better Readers program and the Engineers Leadership Foundation, visit www.engineersleadership.org or contact the organization at *info@engineersleadership.org or 301/588-6650.*

Professional Selling

Isn't it wonderful to get a telephone call from a complete stranger who offers you a plum assignment because "John Doe told me to get in touch"? How does that happen? Usually because the complete stranger knows John and says something on the order of, "I need a geoprofessional I can trust. Any recommendations?" Serendipity like that is great when business is good. But when business is a little slow, as it is now, can you really afford to wait for serendipity? "No" is the obvious answer, which means that you have to make serendipity happen. And it's SO EASY! Call one of your favorite client representatives and offer to take the person to lunch (a nice lunch!) with the promise that "I need to pump your brains." Over lunch explain how much you enjoy working with the person (that's the truth) and ask if the individual knows other persons in the same company, same field, or in some other field who may benefit from your services. Chances are you will obtain a lead or two; follow up and be sure to keep your client representative apprised of your progress! Understand this: You enjoy working with a given client representative typically because the individual is honest, friendly, trusting, easy to work with, and pays on time! The client rep will more than likely refer and recommend you to folks just like that. Why doesn't the client representative do it without your prompting and requests? Because what's foremost n your mind is way on the client representative's back burner. UNLESS YOU ASK!

This Just in at Press Time: Bad News from FHWA. Do What You Can!

The following memo was issued to ACEC/Michigan members by the group's executive director, Ronald W. Brenke, P.E. It's pretty self-explanatory and Michigan is not the only state affected. If your firm provides both geotechnical engineering and CoMET services, you need to be concerned!

MDOT has received a request from the Federal Highway Administration (FHWA) to implement new conflict-of-interest policies for local public agencies and their use of consultants on federal-aid projects. MDOT has since requested input from ACEC.

As I read the FHWA letter, they are requesting that MDOT adopt a new conflict-of-interest policy for LOCAL AGENCY projects where a consultant would be <u>prohibited</u> from performing design services and construction [materials] engineering [and testing] services on the same project. I believe they are also saying that if a consultant is hired as a city engineer, they also cannot perform design/construction engineering services for the city. This applies when federal aid is used for any phase of work.

I have spoken to the FHWA, and they state that they have no examples of problems with the current practice, but believe having the same consultant do multiple phases of work for the same project is a conflict of interest and provides the "opportunity" for fraud and abuse.

ACEC will be responding to this request and outlining our opposition. We have also contacted the Michigan Municipal League and the County Road Association of Michigan to get their input. This new policy could drastically change the way consultants currently work with local government agencies on federally funded transportation projects. It could also be costly to local units of government. If you work for a local unit of government, I would encourage you to talk with them and see if they would be willing to express their opposition to this request.

The American Council of Engineering Companies (ACEC) has written to FHWA Administrator Victor Mendez, former head of the AZ DOT and an ASU MBA grad, to no avail.

This is really dumb thinking, as far as we're concerned, given that CoMET services provided by other-than the geotechnical engineer of record are almost always less effective than otherwise, because the geotechnical engineer of record has a more intimate understanding of basic project and geotechnical issues, and because the geotechnical engineer's field representatives are not at all reluctant about calling "the boss." When field representatives are employed by someone else, they seldom if ever call someone associated with "the competition." In brief, this foolish suggestion is aimed at solving a problem that does not and never has existed, and will do much to degrade the quality of engineering otherwise available to citizens of the United States. Good news, maybe: ASCE has reviewed the FHWA stance and, in essence, says the agency has applied the conflict-of-interest rules far more broadly than originally intended and that, in fact, the do not apply at all to "construction engineering" (i.e., CoMET) services. (Request a copy of the memo from info@asfe.org.) Now let's see what FHWA has to say.

A Civil Engineer! A Civil Engineer! My Kingdom for a Civil Engineer

"Despite this nation's rise as a technology titan with some of the world's best engineering minds, India's full economic potential is stifled by potholed roadways, collapsing bridges, rickety railroads and a power grid so unreliable that many modern office buildings run their own diesel generators to make sure the lights and computers stay on." So begins an article by Vikas Bajaj in *The New York Times'* August 25, 2010 edition.

So what's the problem? "It is not for want of money," Bajaj wrote. "The Indian government aims to spend $500 billion on infrastructure by 2012 and twice that amount in the following five years." So what is it the want of? Skilled civil engineers.

"Civil engineering was once an elite occupation in India, not only during the British colonial era of carving roads and laying train tracks, but also long after independence as part of the civil service. These days, though, India's best and brightest know there is more money and prestige in writing software for foreign customers than in building roadways for their nation," Bajaj explained.

Take the case of Vishal Mandvekar, a 26-year-old BSCE grad who writes software code for a Japanese automaker. Although he works in a contemporary office building with all the right amenities, his 9-mile motor-

cycle commute takes him a maddening 30 minutes because of crowded roads filled with potholes. His salary – $765 a month – salves some of the sting, in part because it's *more than three times* what he earned when he started out in civil engineering three years ago. Which is what causes a lot of young Indian civil-engineering grads to exit civil engineering.

The Times article goes on to note that, "in 1990, civil engineering programs had the capacity to enroll 13,500 students, while computer science and information technology departments could accept but 12,100…. [By 2007,] computer science and other information technology programs ballooned to 193,500; civil engineering climbed to only 22,700. Often, those admitted to civil engineering programs were applicants passed over for highly competitive computer science tracks."

In essence, India wants to pour about $1 trillion-plus into infrastructure upgrades, but it can't, largely because it doesn't have the civil-engineering talent it needs to design the improvements, which creates yet another worry: A government report cites faulty civil-engineering design as partly to blame for the collapse of an elevated span in New Delhi's metro rail system; six died in the accident and a dozen more were injured.

The government plans to build 30 universities to help overcome the civil-engineering shortage, and may even allow foreign universities to set up campuses in India.

But offering more civil-engineering curricula will not solve the low-pay problem and, until that is solved, civil-engineering graduates are likely to choose something other than civil engineering. While anecdotal evidence suggests that civil engineers' pay catches up with their software engineering counterparts' in five years or so, how many of today's young people want to wait that long? Private-sector companies aren't about to pay more, however, because they cannot derive enough value from young civil engineers' limited competencies. And the government isn't going to pay more given highly complex civil-service salary formulas that indicate everything is just fine the way it is.

Does any of this sound familiar? It's not encouraging.

Unions Gain Big Advantage with New NLRB Bannering Decision

The National Labor Relations Board (NLRB) has ruled that a long-standing union tactic of displaying large stationary banners at a "secondary" or "neutral" employer's place of business does not violate federal labor law. The decision covers three Arizona cases where Local 1506 of the United Brotherhood of Carpenters and Joiners of America used "bannering" to protest contract work performed for the employers by nonunion contractors that allegedly paid employees less than union scale. The union had no dispute with the three employers' labor practices and evidence revealed the nonunion contractors were performing no work at two of the three bannered locations.

In the case of one neutral employer, Banner Medical, union agents held up a 16-by-3-foot banner on a public sidewalk in front of the company's parking lot and 500 feet from the medical center's front entrance. "SHAME ON BANNER THUNDERBIRD MEDICAL CENTER," the banner read, flanked by the words "LABOR DISPUTE."

The union hit Northwest Hospital with two 20-by-3-foot banners held up a few hundred feet from the hospital's front entrance and vehicle entrance. "SHAME ON NORTHWEST MEDICAL CENTER," the banners read, flanked by "LABOR DISPUTE" on both sides.

The third neutral employer – RA Tempe, a restaurant – had to deal with a 15-by-3-foot, "DON'T EAT RA SUSHI" banner held up 15 feet from the establishment's front door. It, too, included the words "LABOR DISPUTE" on the display.

The three employers protested the union tactics to the National Labor Relations Board (NLRB), claiming they violated National Labor Relations Act (NLRA) Section 8(b)(4)(ii)(B). Section 8(b)(4)(ii)(B) states it is an unfair labor practice for a union:

> to threaten, coerce, or restrain any person engaged in commerce or in an industry affecting commerce, where an object thereof is…forcing or requiring any person to cease doing business with any other person….

Splitting along party lines in a 3-2 opinion, the NLRB decided that Local 1506 had not violated Section 8(b)(4)(ii)(B). In essence, the NLRB agreed with the union that, while picketing against a neutral party would be unlawful coercive activity, bannering speech protected by the First Amendment. "Banners are not picket signs," the majority wrote.

This gives unions a powerful new tool, allowing them to banner the offices of a project owner whose general contractor retains a nonunion CoMET consultant to perform quality assurance services. What to do? Check with experienced legal counsel for an answer to that one. (If you'd like to have a copy of the NLRB decision, send your request to *info@asfe.org*.)

The National Infrastructure Bank: An Idea Whose Time Has Come

Felix G. Rohatyn is an 82-year-old investment banker (he prevented the bankruptcy of New York City in the 1970s) and former U.S. Ambassador to France. He wrote about the Obama-administration-proposed infrastructure bank in a September 15, 2010 *Wall Street Journal* op-ed, saying that a "national infrastructure bank could leverage private capital for projects of regional and national significance… [and] begin to reverse federal policies that treat infrastructure as a way to give states and localities resources for projects that meet local political objectives rather than national economic ones." Another advantage? "The bank would evaluate prospective infrastructure projects on consistent terms. It would be able to negotiate with state or local sponsors of a project what their cost shares should be. The bank also could help groups of states come together for regional projects such as high-speed rail and better freight management. Such consolidation would improve project selection," he said.

Would there be other benefits? Yes, he wrote: "The bank also could ensure that states and localities consider all other options—from wetlands preservation to implementing tolls—before structural options are funded. It would create an avenue for private investors to put risk capital into new projects and bless their involvement with the bank's own participation. In short, it would treat infrastructure like a long-term investment, not an expense." And in conclusion? "By investing significantly in infrastructure we would act in the tradition of American leaders whose bold programs shaped our progress. President Lincoln transformed the country by beginning a transcontinental railroad during a time of war. FDR's GI Bill allowed millions of Americans to attend college and become the source of our technological and intellectual power. President Eisenhower built the interstate highway system, creating millions of jobs and a suburban economy still basic to the U.S. Renewing our country's infrastructure will have similar impact. The infrastructure bank is an idea whose time has come." Amen.

New Members

ASFE has been reaching out to geoprofessional faculty of late, in an effort to spread the word about the geoprofessions and geoprofessionals to university students via their professors, all as part of our efforts to achieve our new purpose. That's why we are delighted to announce three new Faculty Members. We want more! If you know geoprofessional faculty who would benefit from knowing more about ASFE, what we're about, and what we have available for them and their students, let them know a about ASFE. Encourage them to visit our website and, if they're interested in membership, to contact John Bachner (john@asfe.org). Membership is by-invitation only and costs just $50 per year. And PLEASE do not be hesitatnt about encouraging geoprofessional practitioners to have their firms join ASFE. The more members we have, the more we can do for each.

Our three new Faculty Members are...

David Arellano, Ph.D., P.E. *(Department of Civil Engineering / University of Memphis / 104 Engineering Science Building / Memphis, TN 38152 / tel: 901/678-3272 / fax: 901/678-3026)* Dr. Arellano is an assistant professor of civil engineering in the Department of Civil Engineering at the University of Memphis.

Allen L. Jones, Ph.D., P.E. *(South Dakota State University / Department of Civil and Environmental Engineering / CEH 124 / PO Box 2219 / Brookings, SD 57007 / tel: 605/688-6467 / fax: 605/688-6476)* Dr. Jones is a tenured associate professor in South Dakota State University's Department of Civil and Environmental Engineering.

Ali Maher, Ph.D. *(Rutgers University / Dept. of Civil and Environmental Engineering / 100 Brett Road / Piscataway, NJ 08854-0577 / tel: 732/445-0579 / fax: 732/445-0577)* Dr. Maher is a professor of civil and environmental engineering at Rutgers and the director of the Center for Advanced Infrastructure & Transportation, a USDOT-funded University Transportation Center.

Antonio "Tony" Marinucci, Ph.D., P.E., MBA *(ADSC, Parkway Tower, 8445 Freeport Parkway, Suite 325, Irving, TX 75063 / tel: 469/359-6000 / fax: 469/359-6007)* is our newest **Practitioner Member**. He is director of operations for ADSC: The International Association of Foundation Drilling.

And our newest **ASFE-Member Firm** is **Vertical V, Inc**. *(200 S. Park Road /Suite 350 / Hollywood, FL 33021 / tel: 954/495-2112 / fax: 954/495-2101)* Vertical V offers an extensive range of technical services and solutions including preconstruction services, geotechnical engineering, construction materials engineering and testing, geotechnical and environmental drilling, and standard penetration testing. **Alexander A. Hockman, P.E.** is chief operations officer; and **Steven E. Black P.E.** is vice president.

WASTE GEO Technics

Tailings Dam Failures: A Review of the Last One Hundred Years

Shahid Azam
Qiren Li

Introduction

Tailings dams are some of the largest earth structures geotechnical engineers construct. These embankments are often built with steep slopes using the coarse fraction of the tailings thereby saving on cost. To keep such impoundments standing is one of the most challenging tasks in mine waste management. Generally, these containment facilities are vulnerable to failure because of the following reasons: (i) dyke construction with residual materials from the mining operations; (ii) sequential dam raise along with an increase in effluents; (iii) lack of regulations on design criteria, especially in developing countries; and (iv) high maintenance cost after mine closure (Rico et al., 2007). For a world inventory of 18401 mine sites, the failure rate over the last one hundred years is estimated to be 1.2%. This is more than two orders of magnitude higher than the failure rate of conventional water retention dams that is reported to be 0.01% (ICOLD, 2001).

The mining industry has experienced several significant dam failures in recent history: Merriespruit (South Africa), 1994; Omai (Guyana), 1994; Los Frailes (Spain), 1998; Baia Mare (Romania), 2000; and Aitik (Sweden), 2000. An acute societal concern over such events has resulted in enforcing stringent safety criteria at mining operations in some parts of the globe. However, the standard of public reporting varies considerably from country to country and from region to region. A large number of tailings dam failure incidents remain unreported or lack basic information when reported. This has seriously hindered the development of safety regulations in such areas. Despite insufficient data, a generalized statistical analysis is exigently needed to help minimize tailings dam failure events.

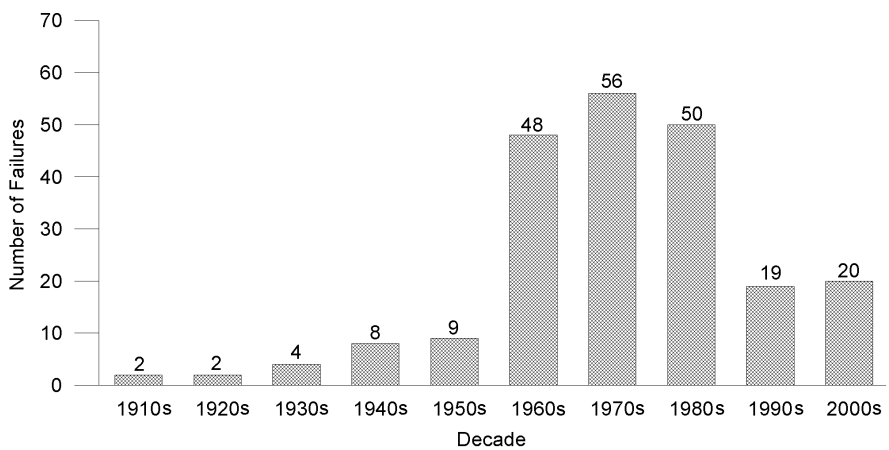

Figure 1. Failure events over time.

Scope of this Study

A comprehensive worldwide database for all historical failure events is virtually inexistent. Still, a number of databases can be used in conjunction. The primary databases are given as follows: (i) United Nations Environmental Protection (UNEP); (ii) International Commission On Large Dams (ICOLD); (iii) World Information Service of Energy (WISE); (iv) United States Commission On Large Dams (USCOLD); and (v) United States Environmental Protection Agency (USEPA). Even these databases should be considered as subsets of the actual number of tailings dam failure incidents in the world. Nonetheless, this article attempts to statistically analyze the available data on tailings dam failures by dividing the failure events into two time groups, namely: pre-2000 events and post-2000 events.

A total of 198 pre-2000 events and 20 post-2000 events were identified. Among the former, 147 and all of the post-2000 events contained enough information to help conduct the analyses. A significant portion of the reported failures had to be categorized as "un-

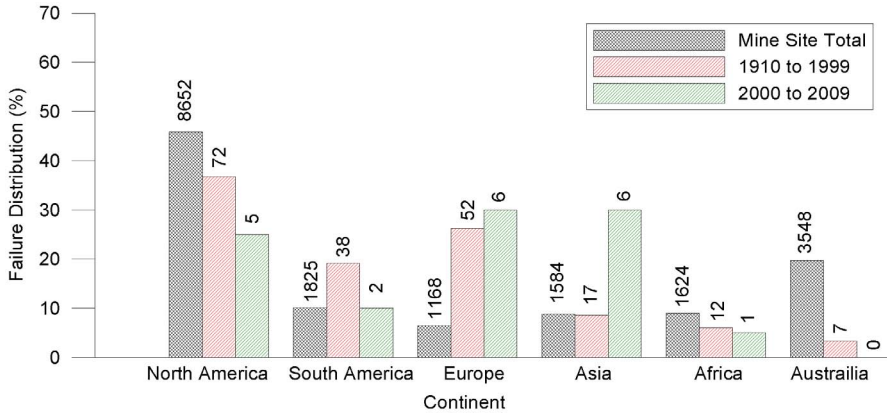

Figure 2. Failure distribution by region.

known" because of missing data on a certain parameter. The analyses focused on understanding tailings dam failures with respect to time and space, causes, and consequences. To compare data within the two time groups, failure distributions for various parameters were calculated using the following formula:

Failure Distribution (%) = (Cases in a parameter/Cases in a time group) × 100

Temporal and Spatial Distributions

Figure 1 summarizes failure events over time. Tailings dam failures remained around 8 to 9 per decade in the 1940s and 1950s but peaked to around 50 events/decade during the 1960s, 1970s and 1980s. The high failure rate during these later decades may be attributed to an increased mining activity immediately after World War II to address the high global demand for metals, minerals, and raw materials. This demand was related to post-war reconstruction in North America and Europe and to the initial development of newly independent countries at the end of colonialism in Asia and Africa. With sufficient engineering experience, implementation of tougher safety criteria, and improved construction technology, failures were significantly reduced in the 1990s and remained at about 20 events/decade in the 1990s and 2000s.

Figure 2 gives the regional failure distribution in relation to mine site totals. Of the 198 pre-2000 cases, most failures occurred in North America (36%), Europe (26%), and South America (19%). Conversely, the 20 post-2000 cases primarily took place in Europe and Asia with a combined failure distribution of 60%. Despite the high mining activity in North America, South America, Africa, and Australia, the decline in failure events in these regions over the past decade is attributed to an improved engineering practice. Meanwhile, the Asian and European mining operations have experienced an increased failure rate because of a booming Chinese economy requiring vast metal and mineral resources and a higher reporting from Eastern Europe after the demise of communism. Clearly, tailings dam failure incidents have shifted geographically from developed countries to developing countries. Therefore, it is crucial for these countries to learn from the post-war experience of the developed countries to reduce tailings dam failures.

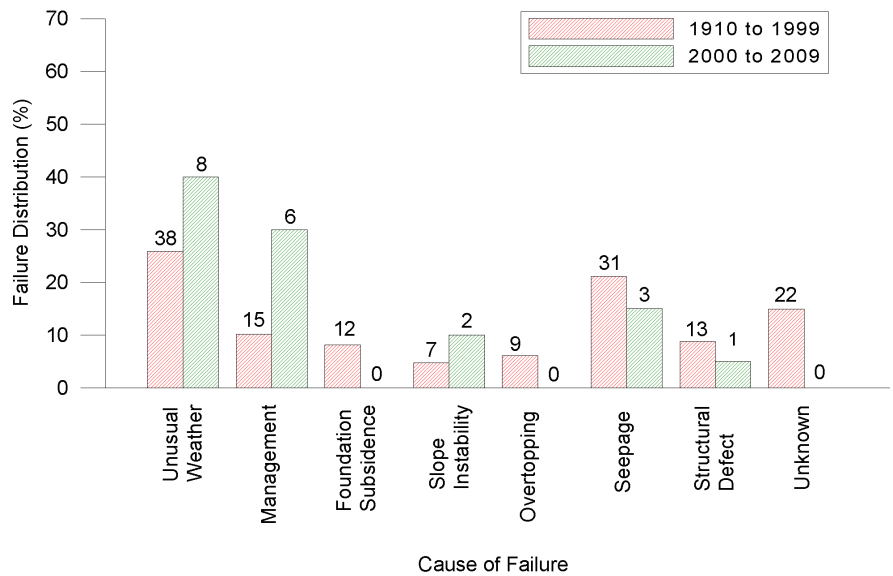

Figure 3. Failure distribution by cause.

Causes of Failure

Figure 3 illustrates the distribution of tailings dam failures by cause. This figure differentiates the climatic and managerial reasons of dam failure from the mechanicisms of failure. Failures due to unusual rain increased from 25% pre-2000 to 40% post-2000. This might be attributed to the recent changes in climatic conditions, particularly at mine sites close to the seas and/or located in equatorial regions that have received high precipitations. As such conditions may increase in both numbers and severity, dam design in such areas must incorporate the effect of climate change. Likewise, failures due to poor management accounted for 10% and 30%, respectively, for the two time groups. This increase indicates the rush for natural resource exploitation while compromising on engineering standards in various parts of the globe. According to Rico et al. (2007), poor management includes inappropriate dam construction procedures, improper maintenance of drainage structures, and inadequate long-term monitoring programs. The climatic and managerial reasons have a bearing on all of the mechanisms of tailings dam failure.

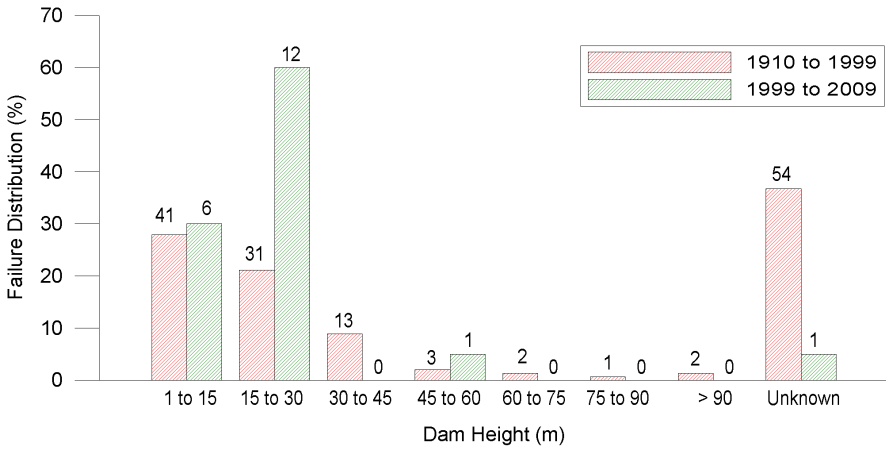

Figure 4. Failure distribution by dam height.

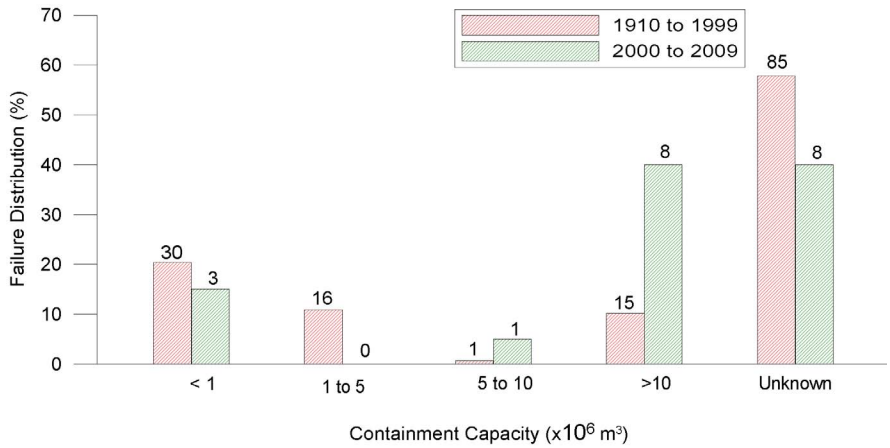

Figure 5. Failure distribution by containment capacity.

Geotechnical engineers have long understood the importance of observing pore water pressures and embankment deformations in tailings containment facilities. This is because these data correlate well with several types of failure and as such provide a basis to rectify the situation throughout the mine life and beyond (Peck, 1969). We must learn to earn the confidence of multi-disciplinary teams, which are operative at mine sites, to ensure the safety of tailings dams. Perhaps, we have learnt that message with regards to seismic liquefaction (that results in swift and drastic events), where failures of this type have dropped from 14% in pre-2000 cases to zero in post-2000 cases:the 2010 Chilean earthquake of magnitude 8.8 did not cause any failure. Good earthquake designs are partly because of our understanding of dynamic loading such as blasting that is common practice at mine sites.

Figure 4 shows the distribution of tailings dam failures by dam height. Failures are found to mainly occur in dams with heights of up to 30 m. A plausible reason may be that unconsolidated materials with high pore water pressures in such relatively low dams (possibly in their early stages of development) are yet to develop adequate shear strength to counter the resisting forces. This is especially the case when the tailings dams are constructed using the upstream method that is still a common practice in some of the developing countries (Vick, 1999). Further, a comparison of the two time groups reveals that failure in dams of up to 15 m height increased from 28% to 30% whereas failure in dams with heights between 15 m to 30 m increased from 21% to 60%. The recent increase in failure of such dam heights may be attributed to the combined effect of rapid dyke construction along with poor monitoring. This is particularly true for some of the re-opened mines (due to increased commodity prices in the 2000s) for which the tailings containment facilities were raised based on pre-closure construction practice.

Figure 5 gives the distribution of tailings dam failures by containment capacity. This figure corroborates well with data in the previous figure by indicating that about 31% (pre-2000 events) of failures occur in small to intermediate size facilities that contain up to 5 x 10^6 m^3 of tailings. The drop in such events to 15% in the post-2000 cases may be ascribed to containment geometry requiring low dams. Similarly, the increase in tailings dam failures from 10% to 40% in large dams (storing in excess of 10 x 10^6 m^3 of tailings) should be due to one or more of the afore-mentioned reasons.

Impact of Failures

Figure 6 summarizes the failure distribution by tailings release amount. The figure illustrates that a significant portion (29% for pre-2000 cases and 40% for post-2000 cases) of the dam failures released up to 0.5 x 10^6 m^3 of tailings to the environment. This correlates well with data depicted in Figures 4 and 5 where a comparable number of incidents fell in small to intermediate size dams. The current figure shows that usually about one-fifth of the contained volume is released. Even such volumes are sufficient to cause extensive damage to life, property, and health. For example, 0.5 x 10^6 m^3 of released tailings are enough to drown about 1200 North American style single-family homes.

Figure 7 illustrates the distribution of tailings dam failure by socio-economic impact. Failures were assigned to a certain parameter that best described the actual incident. The main impacts were found to be environmental pollution, loss of life, and infrastructure damage. Parameters such as environmental pollution and infrastructure damage were found to respectively decrease from 52% and 20% for pre-2000 events to 35% and 15% for post-2000 cases. This is in accordance with the above findings that about one-

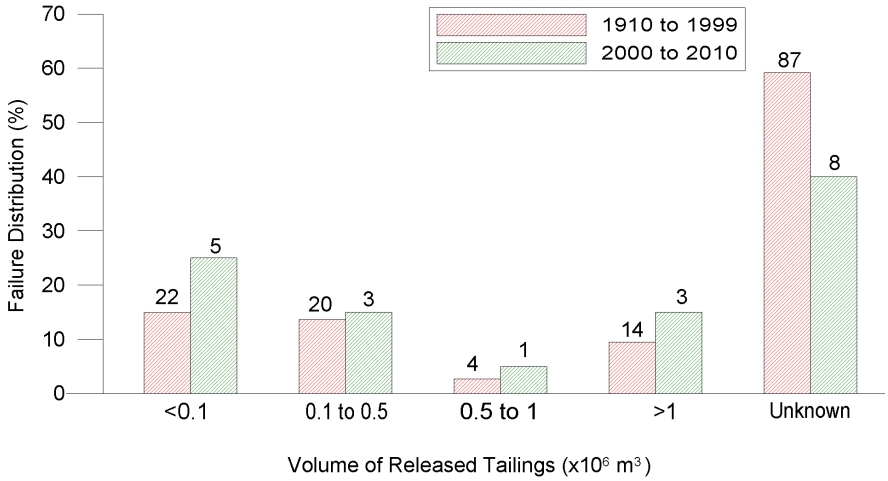

Figure 6. Contaminant release during failure.

third of the failures occur in small to intermediate size facilities: the released tailings from such failures can be managed relatively easily because of their smaller amounts. The relative increase in impact on public health and loss of life should be associated with the failure of large dams.

Summary and Conclusions

This article aimed at understanding the tailings failure history using a statistical approach. Whereas a significant portion of failure incidents fell under the "unknown" category, some general trends were developed with respect to time and space, causes, and consequences. The main findings of this work can be summarized as follows:

1. Tailings dam failures peaked to around 50 events/decade in 1960s through 1980s but have dropped down to about 20 events/decade over the last twenty years. The frequency of such incidents has recently shifted geographically from developed countries to developing countries.
2. The main reasons for dam failures are "unusual rain" and "poor management" and these causes have a profound effect on failure mechanisms. The inclusion of climate change effects in the initial design and of the observational method during construction, maintenance, and monitoring are highly desirable.
3. Failures predominantly occur in "small to medium" size dams that are up to 30 m high and contain a maximum tailings volume of 5 x 10^6 m^3. Such incidents can be minimized by employing proper engineering standards and by avoiding upstream construction as much as possible.
4. Upon dam breakage, the released tailings generally amount to about one-fifth of those contained within the facilities. Environmental pollution and infrastructure damage can be managed in "intermediate failures". Loss of life and health issues are associated with large catastrophic spills.

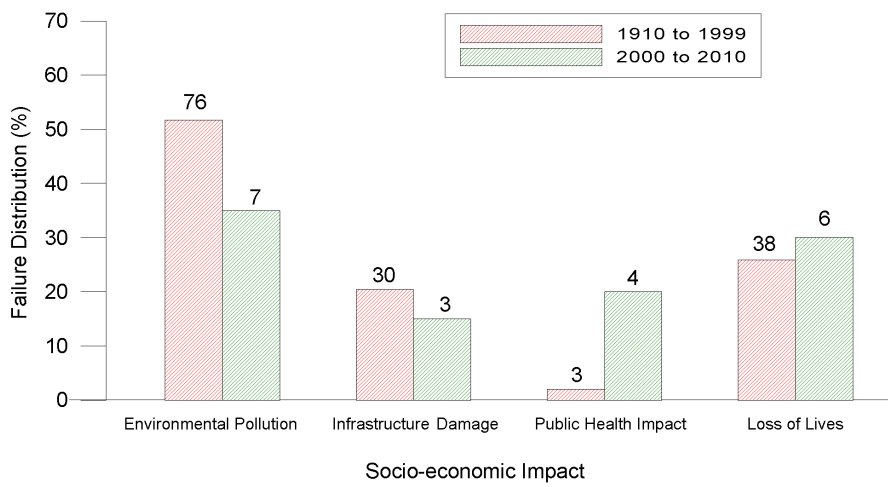

Figure 7. Socio-economic impact of failure.

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Epilogue

The recent dam failure in Hungary (October 4, 2010) that released about 700,000 m^3 of tailings and has a huge impact on life, property, health, and the environment, is a grim reminder of the importance of understanding these incidents more closely.

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The GROUT LINE

Grout Line

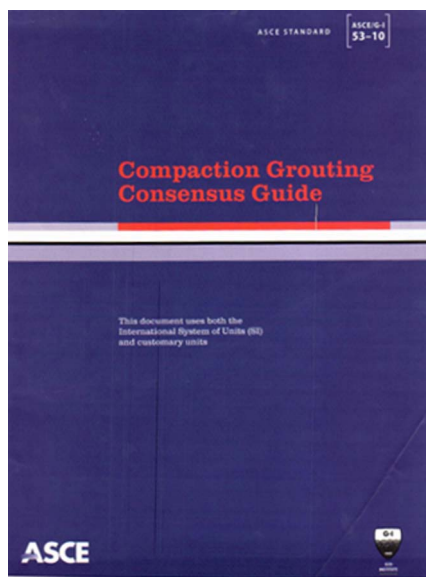
Paolo Gazzarrini

Overture

For this 22nd issue of the Grout Line there have been no articles, comments or signs of life from you, my loyal and few readers. But for this time, and this time only, everyone in our industry is excused! As I mentioned in a previous issue, just about everyone in our grouting industry, all over the world, has been very busy in preparing the abstracts for the 2012 Grouting Conference (to be held in New Orleans in 2012 one week prior of the Mardi Gras – February 15-18) The results from grouters all over the world has been really amazing. **MORE THAN 250 ABSTRACTS FROM 33 COUNTRIES**! It is for sure a record, and a sign of the strength and vitality of our industry all around the world. If this level of participation is any indication, we can expect a most interesting and lively conference.

I would also like to use this opportunity to introduce an ASCE geotechnical special publication titled "Compaction Grouting Consensus Guide". This guide is the result of more than twenty years of hard work by members of the Subcommittee for the Compaction Grouting Guideline, by the Committee on Grouting. This is the first "consensus" document from the committee and was prepared according to the highest standards for ASCE Codes and Standards. The subcommittee consisted of a balanced group representing all phases of the industry, owners, users, academics, designers, and contractors. It then required unanimous approval through balloting, first by the committee, then ASCE as a whole, and finally the public.

As promoted by ASCE, "The goal of this standard is to promote good practice in compaction grouting. Compaction grouting is a ground improvement technique that increases the density, strength and stiffness of the ground through slow, controlled injection of low-mobility grout that compacts the soil as the grout mass expands. The technology can be applied to a wide range of soils, in most cases being used to improve the engineering properties of poorly compacted fills and loose native soils."



In my opinion this guide is a "must" for every grouter.

Another short reminder related to the ASCE-Geo Institute – Grouting Committee. A few days ago, before I wrote this article, I was participating in our bi-annual meeting in Hollywood, California, on the occasion of the DFI Annual meeting. The reminder is related to the people interested in participating in this committee. The only 2 conditions required to be a member of the committee are that you must: a) be member of ASCE b) be interested in (guess what?)…… GROUTING!

I know that the 2012 Conference is requiring a lot of time and effort as you finish preparing your papers for January 28, 2011, paper submittal deadline, but after that you will be free to prepare an article for me and the Grout Line. I await your contribution. Write to: Paolo Gazzarrini, fax 604-913 0106 or *paolo@paologaz.com , paologaz@shaw.ca or paolo@groutline.com.* Or tweet me @groutline

Ciao!

GEO INTEREST

the Water in the Soil – Part 1

Bill Hodge

Introduction

Professor Alec Skempton of Imperial College was my external examiner at the provincial Irish university where I finished my masters in Soil Mechanics and Soil Physics in 1963. I remember being quite scared at the prospect of being questioned on my thesis by this British icon. But when it came down to it, he really only asked me one simple question: "What is the most important thing in Soil Mechanics?" My answer was equally to the point: "Water", I said, and couldn't think of anything else to add to make my response a bit longer. I remember him pondering there and really not bothering to examine me further. Now, after the forty plus years of geotechnical practice that has passed in the meantime I've not found a good reason to change my mind.

The thing that caught my attention time and time again during my working years was the power of water, not in the sense of generating electricity, but how water was almost always the cause of a slope failure, and how civil contractors used dewatering to make unnaturally steep excavation slopes below the water level. But in those intervening years I also came to realize that I was not at all sure that we engineers properly understood how water behaved in soils under deformation, not to mention during earthquake shaking. Neither was I convinced my engineering colleagues

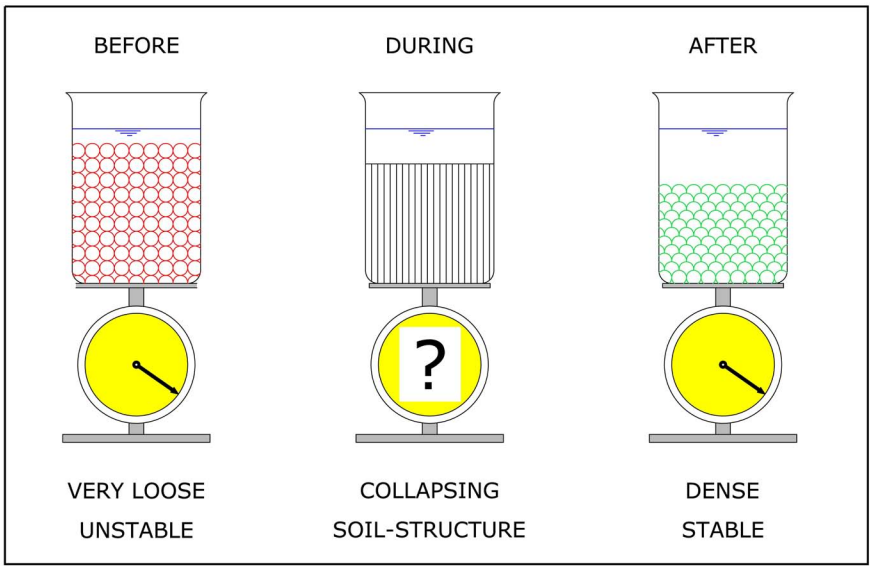


Figure 1. The three beaker question.

in academia knew any better. So slowly, as work allowed, I set about trying to figure it out for myself – from first principles.

Over the past two decades I've spent much of my spare time thinking about the real basics of pore water pressure in both saturated and unsaturated soils, doing so in the hope that I might eventually come up with a rational explanation for each of these soil conditions. In this series of articles I want to concentrate on pore pressure generation in saturated granular soils, leaving unsaturated soils and cohesive materials for another occasion.

Later in this series I will propose the following equation for the generation of excess pore water pressure at any point within a saturated granular soil experiencing deformation:

$$K (24 \mu + \varrho D v) L v / 2 D$$

I won't complicate things right now by explaining each of the terms, other than to say that the only unfamiliar terms are "K" and "L", and that these two will be fully developed in subsequent articles. Incidentally, nothing more than the early bits of Physics 101 will be needed to follow my line of argument.

Square One

In making a fresh start I had the luxury of deciding where to begin. And the easiest place for me to get going was liquefaction. Apart from being an attention grabber, I see liquefaction as a physical activity where it is easiest to grasp what's happening in the motion between the two phases (solid and liquid).

I do hope readers don't get too hung up on the term "liquefaction": This simple concept has been much abused over the years. So I suggest for those folk who believe dense sand, or a well graded granular fill can liquefy, you read instead something like "total collapse of a saturated soil-structure". In any event what I have in mind here is what happens when, in a fully saturated environment, a very loose mass of similarly sized sand grains falls into a denser arrangement due to some change in the stress system which had been keeping it in a precarious structure of mutual support.

The reason I think liquefaction is a good point of departure is this. As a consequence of collapse the soil-structure can no longer act as a rigid formwork for the discrete grains, and for some time thereafter they no longer interact or support each other. It is during this momentary separation of the two phases, as the two soil components merge into a composite fluid, that paradoxically, an opportunity is afforded to view the particles as acting independently and be apprehended in isolation as separate individuals.

To focus my attention on this particular phenomenon I dreamed up a cartoon of liquefaction in the simplest form I could imagine. I call this "thought-experiment" the three beaker question, and I will now described how it goes.

The Weight of Failure

Figure 1 shows three identical beakers containing particles submerged in water. In fact what I really have in mind is the same beaker at three different times. The number and size of the solid particles and the amount of water is exactly the same in each beaker. The beakers sit on weighing scales. The particle packing in the "before" beaker is as loose as can be and consequently is at the point of structural collapse. The "during" beaker has been subjected to a jolt which causes failure of the structure, so what is represented here is a soil being weighed during failure of the soil-structure. The "after" beaker is the situation prevailing shortly after failure when the new soil-structure has settled into a denser, more stable, packing arrangement.

The question is: Is there a difference in the weight between the three beakers? More specifically, is the weight of the middle beaker different from that of the ones on either side.

I believe there are several "right" answers to that question, depending on particular details of particle size and the time at which the weight of the active beaker is recorded. My answer is that in most cases, most of the time, the weight of the active beaker is less than the other two – the other two (inactive) beakers being exactly the same in weight. My thinking goes along the following lines.

Since the two outside beakers (before and after failure) have the same mass of solids and water, and since they are static, just sitting there with nothing moving, there is no reason to justify a difference in weight. Using "g" for gravitational attraction, the weight of the first and third beakers is simply equal to m times g.

But things are different in the "during" beaker: There is movement, and that movement is downwards into the gravitational field. More than that, because the solids/particles were initially

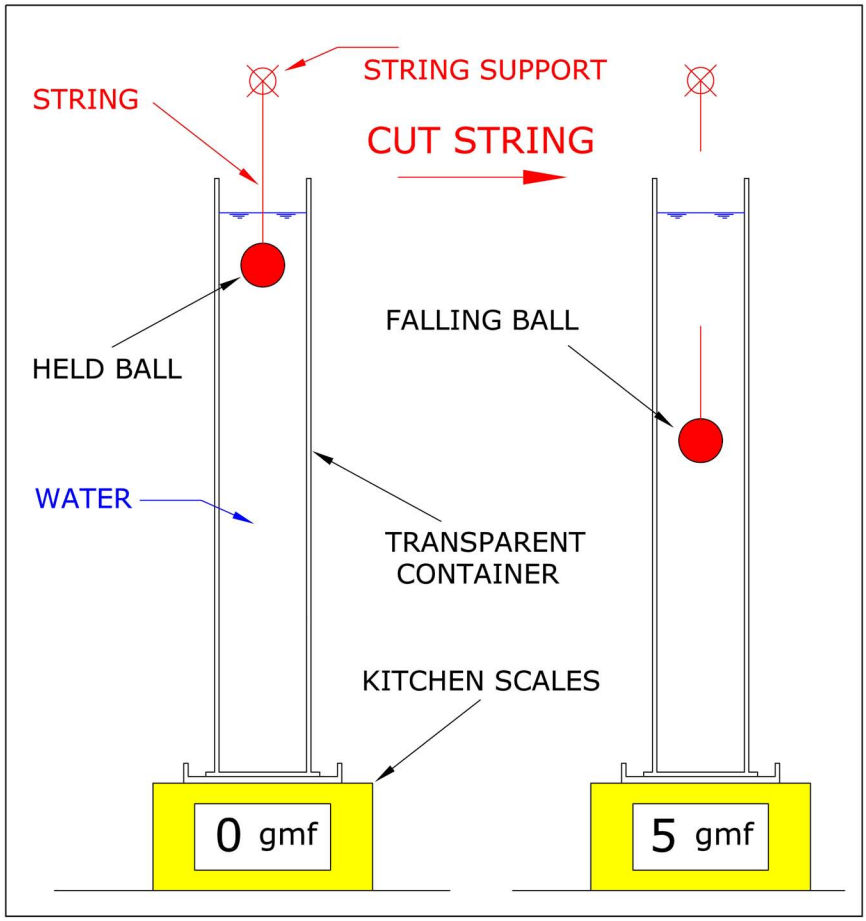


Figure 2. The kitchen experiment.

at rest and ended up at a lower elevation, the particles must at some stage have being accelerating downwards. That means they were experiencing some modification, let's call it "a", superimposed on the original gravitational field "g". They were in fact under the influence of a "g minus a" flux. Therefore, the weight of the beakers as measured by the scales should be:

Before	m g
During	m (g – a)
After	m g

And this quite definitely would prove the stable conditions were equal in weight and the "during" beaker lighter than both. Fortunately, however, things are not quite as simple as that: In what I've done so far I've been ignoring the water !

This introduces a few complications: The fact is that the solids moving down had to be accommodated by an equal volume of water moving up, and at some stage the water had to be accelerating too. Water density is only about 60% of buoyant grains and this argues in favour of the active beaker still being lighter. I simply don't know the ratio of the accelerations. To add to the murkiness of the situation, don't we all know failure is accompanied by an increase in pore water pressure when a contractive structure collapses ? So could water pressure on the base of the beaker make up the difference caused by the descending solids, and just add up to making everything turn out the same in the end ?

As we engineers know, thinking about problems only gets you so far, eventually you need to step into the real world of a site to get the answers to what really might be going on. Obviously it is now time for a reality check by a real life enactment of the "thought experiment". The problem here is that a laboratory test would be quite a difficult experiment to perform since it would involve some way of introducing a jolt enough to cause failure without the attendant commotion upsetting the vertical reading. Next best thing would be to reduce the test to its bare essentials and see if I could find a way of doing the measurement with what I could find around the house.

Kitchen Experiment

Looking at the "before" and "after" beakers it is apparent that mainly what changed was the position of the centre of gravity of the particles; it is lower after the collapse than before. So perhaps a very simple test involving just one solid particle would tell me something about what might be the range of possibilities in the "during" beaker. And this setup was so simple that I found in my kitchen enough for a "quick and dirty" version of such a test. Figure 2 shows all that's required. Setup to cleanup takes about half an hour.

To have enough time to see what was happening I needed to arrange to keep the action slow, and at the same time to produce a weight (buoyant) heavy enough to show up on my scales. After trying a few things which worked well enough, like a small potato and an egg (hard-boiled for obvious reasons), I settled on a golf ball.

The procedure was to hold the ball by a wire thread just below the water surface in a tall clear plastic container (spaghetti jar). Then, after taring/zeroing the readout, let the ball fall while at the same time watching the reading on the scales. Right away I had what I was looking for. What I saw was that the scales showed nothing much until the golf ball had fallen about 10 cm – then it showed the full buoyant weight of the ball (~ 5 grams), and this appeared at a stage where and when the ball was still far above the bottom. This demonstrated quite clearly that the weight of the particle was felt when it had no hard physical contact with the scales. Two clear and undeniable conclusions are:

1. that the weight of the ball was transmitted to the scales by a column of pressurized water under the falling ball, and
2. that pressure transmission required some amount of movement by the ball through the water.

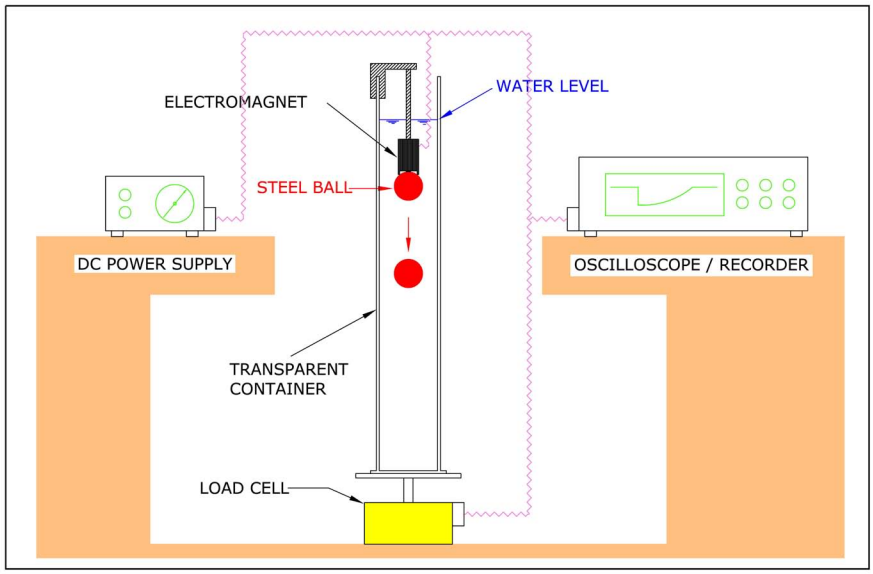


Figure 3. UBC laboratory test setup.

My reasoning from there went like this: Water pressure exerted on the base of the cylinder, and felt by the scales, was obviously a response to the weight of the falling ball above. But why the delay ? Why not the full weight right away ? There had to be another force involved temporarily, acting as a buffer. I couldn't think of anything to fit the bill other than viscous drag. And such a drag force is known to be generated between a solid and a fluid in relative motion. Fluid Mechanics had this all wrapped up generations ago so, as you'll see, it was just a matter of going to their comprehensive literature to work things out from there.

My scales was not sensitive enough, nor did it respond fast enough, to let me see what was happening between these two values. For this I needed to find a good laboratory in some university which would listen to a maverick with an odd notion about the genesis of pore water pressure.

UBC Test Setup & Prediction

Fortunately for me my good friend Yogi Vaid is Professor Emeritus at UBC and still had access to the fundamental soils laboratory at UBC which gained recognition as a world leader in triaxial testing during his tenure. Yogi, who was well used to listening to me ramble on about my abiding prejudice that pore water pressure had to come from relative motion between the phases, was happy to help. Here I got not only the better scales and a better readout device that I needed, but also the assistance of Scott Jackson and his experimental expertise.

For this opportunity I designed the apparatus shown in Figure 3. The design intent was to discover what was going on during the intermediate period between releasing the ball and the time its weight showed up on the scales. I decided the best thing to do was to record only one thing – the weight of the full system, that is, ball, water, and apparatus hardware. This involved some compromises. To get sensitivity in the readout the weight of the water had to be kept within reasonable limits and this meant using a cylinder which was a bit shorter and narrower than I'd have liked. Also the ball had to be quite heavy. I decided on a 2 inch ball bearing, using steel rather than ceramic because of its far greater buoyant mass density. Steel had the added advantage that it could be held in place by an electromagnet which could also drop it with a flick of the switch. The whole system, ball and all, sat on a load cell which was connected to an oscilloscope and a data recorder. All was necessary after things were setup was to power up the recorder and switch off the magnet.

In lab testing, as in site investigation sampling and construction instrumentation, you get much more out of it if you have already thought enough about what to expect to let you risk a prediction. With this in mind I calculated the weight history I anticipated on the basis of the hydrodynamics that I thought were going on. This prediction is shown on Figure 4. I wanted it to be a clear understanding that if the prediction was right then the hypothesis was justified, and if the prediction was wrong then it was time to forget the whole thing. Needless to say I wouldn't be writing this if it turned out all wrong.

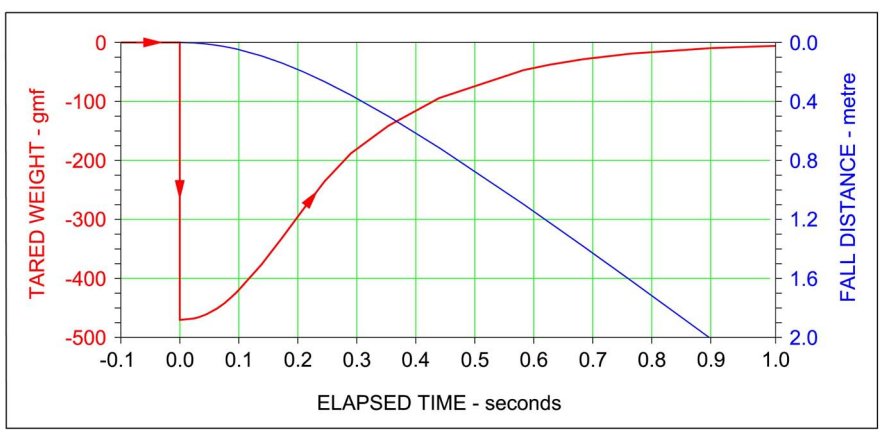


Figure 4. Prediction of UBC test results.

In the Next Article

In the next of this series I'll give the results of the UBC test and compare them with the prediction made beforehand. And there I will also lay out the reasoning behind the predictive method and explain how the required calculations were made.

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Mud Bricks and Shred Geogrids as Sustainable Material

Hamed Niroumand
Klodiana Millona

Abstract. This session presents a survey and the performance of the role of shred geogrids in mud brick's compressive strength and a comparison of it with the normal mud bricks. Mud brick consists of clay, water and different materials. Its massive use may become an important evaluation due to its low cost and higher compressive strength compared to the concrete blocks. Many experiments conducted on earth blocks without any addition material, report about its low compressive strength. Thus, many testing on the strength of the mud brick, with different additional materials were done. These different additions may be shred tires, which consist in narrow strips of rubber. Another material is the shred geogrids, which consists in polyester strips grid. The paper articulates the change of compressive strength of mud bricks with these different additional materials. This is evident in the compressive test days 3,7,14 and 21 where the results show that due to different bricks with normal mud bricks and shred geogrids with sizes of 10cm×10cm×10cm, have 20% moisture content. The tires are one of the materials that cause environmental pollution and it is used less after consumption in the automotive industry, thus we used a cheap material for surveying the strength in mud brick. As well the geogrids are used in soil stabilization, where they have additional pieces in construction, so we used them in mud bricks. The results show that performances of mud bricks with shred geogrids were better than normal mud bricks.

Keywords: Mud Brick, Shred geogrid, Comprehensive strength, Sustainable material

Introduction

Mud bricks should ideally be made with earth containing a clay content of not more than 80% and not less than 50%, the reminder being sand and granular material. At this stage, it is helpful to have a general idea about the crystal structure of the clay. The actual clay minerals are the hydrated aluminum silicates, which may be divided into three basic groups, the kaolin group, the montmorillite group and the illite group. Kaolin clays have a non-expanding crystal structure, while clays of the other two groups have expanding crystal structures. Clays with expanding crystal structures will expand in volume when water is added, and if this water evaporates, drastic shrinkage and cracking will occur. They are also very strong, with a high heat resistance, and they show little water damage even if they are shortly wet after they have been made. Pure kaolin is white and usually is found as subsurface clay.

A mould may be nothing more than four boards nailed together with handles attached at either end. Our first choice will be whether to have a single or a multiple mould. Single brick moulds appeals us because we can tramp the soil down very firmly. The sizes of the brick should be carefully considered in this research. The sizes for the brick used in our case are 10cm×10cm×10cm.

Geogrids and woven geotextiles have been used effectively to improve the performance of embankment sand back fills, by reducing deflections, settlement, and earth pressures within the embankments or backfills, and by increasing the bearing capacity of these structures.

This research tests compressive strength of normal mud bricks and shred geogrids reinforced mud bricks with moisture content of 20% in pure kaolin due to the compaction test on kaolin with different water content in geotechnical laboratory. The compaction tests were performed by the standard proctor test, that the kaolin compacted by 5.5lb hammer and the mold was filled with three equal layers of kaolin, where each layer is subjected to 25 drops of the hammer.

The materials of this research were pure kaolin, shred geogrid and water. The shred geogrids were same size, since they were cut the same. Geogrids are used only in soil reinforcement. Geogrids represents a speed growing segment within geosynthetics. Rather than being a woven, nonwoven or knitted textile fabric, geogrids are polymers formed into a very open, grid like configuration.

They have large apertures between individual ribs in the machine and cross machine directions. Geogrids are (a) either stretched in one or two directions for improved physical properties, (b) made on weaving or knitting machinery by standard textile manufacturing methods, or (c) by bonding rods or straps together. There are many specific application areas; however, they function almost exclusively as reinforcement materials.

Kaolin was used pure and without addition materials. Kaolin is a clay mineral with the chemical composition $Al_2Si_2O_5(OH)_4$. It is a layered silicate mineral, with one tetrahedral sheet linked through oxygen atoms to one octahedral sheet of alumina. Kaolin-type clays undergo a series of phase transformations upon thermal treatment in air at atmospheric pressure. Endothermic dihydroxylation (or alternatively,

Figure 1. Moulds in laboratory.

Figure 2. Compaction test of kaolin.

Figure 3. Mixing of kaolin with optimum moisture content.

Figure 4. View of shred geogrid in 1-3 layer of mould.

Figure 5. View of different cases in compression test.

dehydration) begins at 550-600 °C to produce disordered metakaolin, Al-2Si2O7, but continuous hydroxyl loss (-OH) is observed up to 900 °C and has been attributed to gradual oxolation of the metakaolin. Because of historic disagreement concerning the nature of the metakaolin phase, extensive research has led to general consensus that metakaolin is not a simple mixture of amorphous silica (SiO2) and alumina (Al2O3), but rather a complex amorphous structure that retains some longer-range order (but not strictly crystalline) due to stacking of its hexagonal layers.

2 Al2Si2O5(OH)4 → 2 Al2Si2O7 + 4 H2O

Further heating to 925-950 °C converts metakaolin to a defect aluminuim-silicon spinel, Si3Al4O12, which is sometimes also referred to as a gamma-alumina type structure:

2 Al2Si2O7 → Si3Al4O12 + SiO2

Upon calcination to ~1050 °C, the spinel phase (Si3Al4O12) nucleates and transforms to mullite, 3 Al2O3 • 2 SiO2, and highly crystalline cristobalite, SiO2:

3 Si3Al4O12 → 2 Si2Al6O13 + 5 SiO2

Mixing of Different Materials

The main material mixed in this case is the dry kaolin. It is combined with optimum moisture content, due to the compaction test in different tests. Then it is mixed by kneading until cohesion soil is achieved. The sizes of the bricks to be made are 10cm×10cm×10cm and the mixture is placed in three layers in steel moulds. They consist of two layers composited of additional materials that are the shred geogrids are placed at 1/3 and 2/3 of its height.

Test of Mud Bricks

The mud bricks were used for 4 tests and taken out from the moulds. Then they were tested for compressive strength for 3,7,14 and 21 days.

Conclusion

The compressive strength test s results on mud bricks that have additional material, such as shred geogrids are illustrated in table 1. The results of compressive strength show that performance of shred geogrids are better than normal mud bricks by time passing. They show an increase of the compressive strength until 14 days and then a decrease. The main reason that causes this decrease is the moisture range, due to the wet climatic conditions of Malaysia. The shape of additive materials can be as well, a factor that causes this decrease in the compressive strength in a long period of time. The first reason, regarding to the moisture has the highest impact on this compressive strength. The shred tires increased the status of tension in mud bricks. The performance of shred geogrids increased properties of compression in different cases, although performance of mud bricks without addition material wasn't good in earthquake of Bam-2003 in Iran but there is a hope that shred tires mud brick can carry out high strength in the future.

Table 1.The results of compressive test of mud bricks with shred geogrids and normal mud bricks.

Type	Days			
	3	7	14	21
Kaolin + water	1.90N/mm^2	2.94 N/mm^2	2.52 N/mm^2	1.49 N/mm^2
Kaolin + Water + Shred Geogrids	1.91 N/mm^2	2.57 N/mm^2	2.62 N/mm^2	1.81 N/mm^2

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Jack Clark
1932-2010

Jack Clark, O.C., passed away peacefully with his family, photos and many well-wishes by his side.

Jack believed he was fortunate to have had incredibly interesting projects. The work he did in the 1970s on the Arctic gas pipeline where new ground was literally and figuratively being broken was an opportunity that would never be repeated until he got the opportunity to go to C-CORE.

In the early 1990s Jack figured that Canada needed a geotechnical centrifuge large enough to need its own building. He raised the funds, he convinced the people, he hired the expertise. Completed in 1993, C-CORE's centrifuge is one of the largest in the world.

Jack - who touched many with his wit, extraordinary intelligence, courage, strength and famous hospitality - will be missed by those who knew him.

Jack has left his wife Joan, his children Tim, Tony and Sara, daughters-in-law Laurie and Pam, and grandchildren Anthony, Emma, Hanna, Emily and Samuel with a rich tapestry of memories: travels and adventures afar, many fine meals, laughs and, of course, the Cabin--the House that Jack Built--which has played host to many friends and family. Jack earned the respect and love of his peers, from his days at Acadia, playing basketball, track and field and embarking on the start of his life as engineer and a lifelong lover of ideas. In his career with RM Hardy & Associates, Golder Associates and his beloved C-CORE, Jack led by example, and time and time again, showed himself to be a leader in his field. This culminated in the award of 4 honourary doctorates, the Leggett Award, and the Order of Canada. Jack left giant foot-prints and imprints, and he will be deeply missed.

Special thanks go to the medical team that helped Jack in his illness, Dr. Roger Butler, and the physicians and nurses at the Waterford Hospital and Health Sciences Centre. In lieu of flowers, please consider donating to the Kidney Society of Canada: www.kidney.ca or 1-800-361-7494.

Bert Hoare
1924 – 2007

Dr. Beverley (Bert) Girling Hoare, a leading Canadian expert in management of mine tailings facilities, passed away in Pembroke, Ontario, December 23, 2007 after a period of deteriorating health. In his passing, both the mining industry and the geotechnical engineering profession in Canada lost a notable pioneer.

Dr. Hoare served as a pilot in the Royal Canadian Air Force during the Second World War between 1943 and 1945, and later attended Queens University where he graduated with a Bachelors Degree in Engineering in 1949. Between 1945 and 1965 he gained broad-based experience in the Mining Industry, working with mining companies such as Falconbridge, Denison, Iron Ore of Canada, Alcan and the Cleveland Cliffs Iron Company. During this period he held senior positions in engineering, operations and management. Notably, his experience led him to conclude that there was a very important need in the mining industry for management of mine tailings facilities using sound engineering principles. In his characteristic thorough manner he decided to do something about it. He enrolled at the University of Waterloo

where he graduated first with a M.A.Sc. in Civil Engineering (water resources) in 1968 and followed this with a Ph.D in Civil Engineering in 1972.

Dr. Hoare's doctoral thesis is titled "The Disposal of Mine Tailings Material". It is one of the first of its kind in that it covers the overall management of tailings storage facilities in the mining industry. It combines his practical experience with theoretical principles which have virtually all become recognized as essential to the planning, design, operation and closure of tailings facilities in a safe, environmentally acceptable, and efficient manner. He recognized at an early stage the importance of management of both natural and process-affected water associated with such facilities, as well as the engineering and chemical characteristics of tailings solids deposited hydraulically. His research included geotechnical investigations of existing tailings deposits in-situ as well as laboratory testing to determine properties such as gradation, permeability, strength and consolidation. It also advanced the application of geotechnology to design of tailings storage facilities.

Following this second period of studies, Dr. Hoare joined the Federal Energy Resources and Mines Department in Ottawa and worked on Manuals of special value to the mining industry. His expertise became widely sought after as a consultant and in 1976 he formed the company Mine Tailings International Ltd. whose clients included mining companies across Canada, in the United States, and in various countries abroad such as Chile, Brazil and Guyana. Dr. Hoare stressed the importance of inspecting tailings operations first-hand and meeting with mine representatives and designers. Because of his varied career, he had an easy rapport with both groups. He made presentations on tailings-related topics to regulatory and mining organizations in Canada and the U.S.A., and was known for his integrity, experience, engineering judgement, and particularly for his ability as a mentor.

Bert is survived by his wife Eveline Elizabeth Hoare of Pembroke, ON, and his siblings William Hoare and Sheila Thomson of Ottawa, ON and Alicia Brown, of Fort St. John, B.C.

Dennis E. Netherton, P.Eng. and M.A.J. (Fred) Matich, P.Eng.

Jerry Yamamuro 1954-2010

Jerry Yamamuro died on August 18, 2010, just short of 56 years old, after having suffered from diabetes and associated diseases for many years.

Following his Bachelor's degree in Civil Engineering from Oregon State University, Jerry worked for nine years as a civil engineer for the Forest Service in Oregon. He came to UCLA as a graduate student in the area of Structures, in which his background was excellent, and he took the majority of graduate courses offered in Structures at UCLA. However, he developed an interest in and also took all the graduate courses Geotechnical Engineering. For the M.S.-degree he designed and assembled an automated high pressure triaxial loading system consisting of a 100 ton loading machine with a 10,000 psi (67 MPa) triaxial cell. This project succeeded only with the help of Jerry's expertise, tenacity, and hard work. Jerry put together the equipment, built the necessary electronic converters, wrote all the control programs, made it work, and explained it all in his M.S. thesis.

This equipment was used for his Ph.D.-research to study the stress-strain behavior and the conditions for instability of granular materials at high pressures. He conducted a program of carefully performed and well thought out experiments that resulted in considerable insight into the behavior of granular materials at high pressures.

He moved to the Johns Hopkins University in Baltimore in July of 1993. One of the discoveries made at the time was that liquefaction of granular materials is initiated due to a condition of instability inside the failure surface. This resulted in renewed interest in liquefaction, and after coming to Hopkins, Jerry carried out a program of research to study liquefaction under static loading conditions. New and very surprising findings emerged from these experiments, namely that liquefaction is a low pressure phenomenon and that loose silty sands exhibit 'reverse' stress-strain behavior due to its high compressibility.

Jerry was hired from July 1, 1995 in the Department of Civil and Environmental Engineering at Clarkson University. He continued his stellar performance there: He received a CAREER grant from NSF to continue the studies of static liquefaction. Over the years he obtained most of his research funding from NSF and AFOSR. He also demonstrated his ability to teach well, and he was very much liked by the students. He received a teaching award for his performance in the undergraduate foundation engineering course in 1996, and he was recipient of the Albert D. Merrill Award as the Outstanding Civil and Environmental Engineering Faculty in 1997-1998.

Jerry was an enthusiastic individual whose interest, hard work, and considerable skills in experimental and analytical research served him well. He was a competent and thorough researcher who could synthesize knowledge from a variety of sources, and he was highly motivated, dependable, and hard working. Jerry authored or co-authored over 40 journal papers and 40 conference papers, some of which are still to be published.

Jerry is survived by his two brothers, Nick and Bob, and his sister, Linda, and her husband, Ronald, and their two daughters, Jana and Kira, and a former wife, Betsy.

News from Geoengineer.org
A Center for Information Dissemination on Geoengineering

A note from the Founder

Geoengineer.org is very excited to collaborate with the GN Magazine. We hope that through this column, you will hear more about our activities and that you will find it informative. We look forward sharing more news about Geoengineer.org and its features in the future. You can visit Geoengineer.org at: http://www.geoengineer.org.

GEOLIFI – Geotechnical Literature Finder: Papers of the International Journal of Geotechnical Engineering and other conference added to the database!

GEOLIFI, a searchable online database of geoengineering papers, continues to rapidly expand, offering access to almost 3,000 geotechnical papers published either in conferences or journals. GEOLIFI has successfully expanded its collection to include all papers published in the "International Journal of Geotechnical Engineering" as well as all papers published in the International Conference on the Development of Urban Areas and Geotechnical Engineering that took place in St. Petersburg, Russia, in June 2008. The database is expected to continue to expand in coming months. GEOLIFI can be found at: http://geolifi.geoengineer.org.

International Journal of Geoengineering Case Histories (IJGCH): Issue#4 has been published

The latest 4th issue of Volume 1 of the International Journal of Geoengineering Case Histories (IJGCH) has been completed. The IJGCH is an official Journal of the International Society for Soil Mechanics and Geotechnical Engineering, Papers published in this refereed journal are available in color and are accompanied by databases that include the electronic data presented in the paper as well as additional figures (as necessary). The locations of the case histories are also positioned in a downloadable Google Earth database. You can download and read the papers of the 4th issue as well as the papers included in past issues at no cost by visiting the journal's website at: http://casehistories.geoengineer.org.

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Edited by: Dimitrios Zekkos, Ph.D., P.E. Managing Director of Geoengineer.org and Assistant Professor, Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, USA. Contact e-mail: zekkos@geoengineer.org

COVER STORY

Mountain Ibex on the Cingino Dam, Italy

The Cingino reservoir is at an elevation of 2250 m in the Italian Alps. The Cingino Dam was built in the late 1920s and raised the level of an existing glacial lake to form the reservoir. The reservoir has a capacity of about 4.5 cubic meters.

A herd of male Mountain Ibex was captured by photographer and mountain climber Adriano Migliorati (adrimiglio@libero.it) on the face of the 50 m high Cingino Dam in the Alps of Northern Italy.

The Alpine Ibex has for a long time been regarded as a mystical animal – almost all of its body parts and its excrement were sought after as cures for various illnesses and as ingredients for magical potions. An ancient Egyptian recipe for the cure of baldness included ibex fat among its ingredients.

The Mountian Ibex is typically found in very steep and rocky terrain, at altitudes of up to 15,000 feet in the European Alps. They seek refuge at high altitudes to protect themselves from predators.. The Ibex are even-toed hoofed animals (ungulates). The Ibex climb steep faces by using the nails on the front of their hooves to cling onto steep slopes - on flat surfaces the nails do not touch the ground.

As a result of very extensive hunting, the ibex was almost extinct as early as the beginning of the 19th century. In the 1850s King Emmanuel II of Italy decided to allow no one but the royal family to hunt the few remaining Alpine Ibex, creating a game preserve in the Italian Alps. The Mountain Ibex population has grown steadily from the 1960s. In the 1990s it was estimated that about 30, 000 ibex live in the Alps of Switzerland (15, 000) Italy (9,700) France (3,300) and Austria (3,200). All current populations originate from re-introduction of the species

"Peter Bosshard, policy director for International Rivers, interprets these impressive scenes as indicative of how nature will overcome mankind's often destructive engineering accomplishments.

Dam builders may use the pictures as proof that dams provide some unexpected benefits in spite of all their negative impacts. Dam busters may find hope in the fact that if we can't decommission dams, goats can at least re-commission them." (source treehugger.com).

Since photos appeared on the Internet in September 2010, the behavior of the Ibex has appeared in national papers in the UK, Italy, and even the National Enquirer magazine.

SHORT Courses

Geotechnical Instrumentation for Field Measurements
Cocoa Beach, Florida
April 3-5, 2011

This continuing education course will include presentations by users of instrumentation from USA, England and France. There will also be technical presentations and instrument displays by major manufacturers of geotechnical instrumentation from USA, Canada and Switzerland.

To reflect modern trends, there will be new lectures since the previous course in 2009, including web-based monitoring, wireless monitoring, emerging technologies and on-line sources of information, and more case histories than last time. There will also be an opportunity for registrants to submit, to the Course Director prior to the course, questions and requested discussion topics, and a half day has been assigned for responding to these requests.

Emphasis will be given to obtaining high quality data to help answer specific geotechnical questions for the management of RISK.

The Course Director is John Dunnicliff

See page 33 for more details, or visit http://conferences.dce.ufl.edu/geotech

MILE STONES

Geotechnical Services, Inc. Expands to Ft. Collins, Robert Dornfest New VP Named

Geotechnical Services, Inc. (GSI) has expanded their operations to include a new office in Fort Collins, Colorado. GSI is a major provider of geotechnical engineering services in the Midwest with seven other offices in Iowa, Kansas and Nebraska. Heading up the Fort Collins branch office is newly named Vice President Robin Dornfest, a ten-year veteran in the fields of geotechnical engineering and engineering geology, and Fort Collins resident since 2000.

Dornfest has worked on a wide variety of projects throughout the US, including dams and reservoirs, large public works projects, earth retention and dewatering projects, and geologic hazard evaluation and mitigation projects. Additionally, he has co-authored several publications related to research and projects. He knows the subsurface geology of the region and its potential for impacting projects.

The new office is located at 1136 East Stuart Street, suite 2040, Fort Collins Colorado 80525.

Geotechnical Services, Inc. is a veteran-owned consulting firm specializing in geotechnical engineering, environmental services, professional drilling, construction materials testing (CMT), and special inspection services.

MARKET PLACE

Pile Dynamics, Inc (PDI) Re-designs the Pile Installation Recorder (PIR) Automated Monitoring Equipment

PDI has launched a new model of the Pile Installation Recorder (PIR), its popular instrument for monitoring installation of augered cast-in-place, continuous flight auger and drilled displacement piles. The PIR assists in the correct installation of these piles by displaying target versus actual pumped concrete / grout volume in real time. The equipment is installed on the crane, and easily monitors the installation of every pile on site.

PDI has kept all the features that make the PIR compliant with the Geotechnical Engineering Circular Number 8 from the US Federal Highway Administration (FHWA GEC 8), while introducing several improvements.

- High contrast color LCD with LED backlighting
- A red / green indicator making it easier for the drill rig operator to maintain the target auger withdrawal rate
- Wireless depth measurement unit that is smaller and lighter
- Auger rotation data sent via a wireless transmitter
- Results can be displayed on screen and printed in real time
- Data retrieval from the PIR is via USB memory stick, while still maintaining the ability to print an installation record in the field
- Simple data entry and display interpretation via touch screen interface

Pile Dynamics offers the PIR for sale or rental (rentals for domestic customer only). Please contact us at Sales@pile.com for a quote or with any questions.

For almost 40 years Pile Dynamics, Inc. has been recognized as the world leader in quality assurance systems for deep foundations. Our goal is technical superiority, product reliability and outstanding customer support. We continually improve our product line, constantly incorporating the latest technological innovations into our products.

Please visit us online at www.pile.com to view all our products as well as numerous reference papers.

Terracon and Midwest Testing Laboratory, Inc. Join Together to Expand Services in North Dakota

Terracon Consultants, Inc. is pleased to announce the acquisition of Midwest Testing Laboratory, Inc. (Midwest Testing), a firm providing geotechnical engineering and construction materials engineering and testing services. Midwest Testing has offices in Fargo, Bismarck, Grand Forks, Jamestown and Dickinson, N.D. Terracon is one of the nation's largest employee-owned engineering consulting firms with headquarters in Olathe, Kan.

The acquisition allows Terracon to further expand its services to local and national clients, and gives Terracon a presence in North Dakota.

Established in 1975, Midwest Testing has provided geotechnical engineering and construction materials engineering and testing services on a wide variety of projects in the upper Midwest, including North Dakota, South Dakota, Minnesota and Montana.

Midwest Testing will continue functioning under the same name, but it will operate as part of Terracon. As Terracon also performs environmental engineering and facilities services, Midwest Testing will now be able to offer additional services to clients.

Terracon is an employee-owned engineering consulting firm with more than 2,700 employees providing geotechnical, environmental, construction materials and facilities services from more than 100 offices in 39 states nationwide. Terracon currently ranks 41st on Engineering News-Record's List of Top 500 Design Firms. For additional information about Terracon, please visit www.terracon.com.

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- Seismic Cone Penetration Testing
- Mud Rotary Drilling and Coring
- Auger Drilling
- SPT Energy Testing
- Borehole and Surface Geophysics
- PDA Services
- Software:
  - Liquefaction Spreadsheet Macros
  - LCPC Pile Capacity Analysis

35 Ton CPT Rig

Tracked CPT Rig

Environmental

- Auger Drilling and Sampling
- Direct Push Vapor and Water Sampling
- UVIF Cone Penetration Testing
- Resistivity Cone Penetration Testing
- Well Installations
- ORC / HRC Injection
- Hydraulic Fracturing
- Limited Access Drill Rigs
- Membrane Interface Probe (MIP)

Mud Rotary Drill Rig

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- Drill Ships and Barges
- Sectional Barges
- CPT and Seismic CPT
- Deep Water Mini-CPT
- Mud Rotary Drilling and Coring
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