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CONTENTS

COVER *Alberta Oil Sands*

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Message from the President

Bryan Watts, President of Canadian Geotechnical Society.

In June I had the pleasure of attending the 11th International & 2nd North American Symposium on Landslides from June 4th to 8th. Mr. Corey Froese was the Chair for the symposium with Dr. Erik Eberhardt chairing the Technical Committee. The Symposium also hosted the Council Meeting of the IAEG, the International Association for Engineering Geology and the Environment. I attended the council meeting on behalf of Canada and had the pleasure of meeting President Carlos Delgado and members of the IAEG Council. The Symposium attracted 450 people to the Banff Springs Hotel. The venue was especially appropriate because construction of the CPR railway through the Bow Valley and over the Kicking Horse Pass was arguably the start of engineering geology in Western Canada. One can almost hear Gordon Lightfoot's railroad trilogy echoing from the halls of the hotel. Attending such a Symposium reveals the calibre of Canada's contribution to landslide technology. Our Drs. Doug Stead, Oldrich Hungr, and Serge Leroueil gave keynote/invited lectures which were masterful. I also enjoyed the keynotes by Dr. D.H. Cornforth of the US and Dr. D. Petley of the UK. Unfortunately, I had to leave on Thursday morning to attend the EIC Awards dinner in Edmonton that evening. Leaving with me was Dr. Doug Stead of SFU who became a Fellow of the EIC that evening as did Dr. Hesham El Naggar of the University of Western Ontario. As you will know from prior announcements, Dr. Kerry Rowe received the Sir John Kennedy Medal,

Derek Martin, Fred Matich, and Kerry Rowe (left to right) with their awards in Edmonton on June 7th, 2012.

Dr. Derek Martin received the John B. Stirling Medal, and Mr. Fred Matich won the Julian C. Smith Medal. The accompanying photograph shows the three CGS medal winners that evening in Edmonton. Also attending the awards dinner were Dr. N.R. Morgenstern and Dr. Dennis Becker.

In my June message, I reported that the CGS must be compliant with the new Canada Not-for-profit Corporations Act (NFP Act) by October 17, 2014 or be dissolved! We posted the Articles of Continuance and the CGS bylaws on the website in August and informed all members that we would be voting on these two items at the luncheon business meeting at the Winnipeg Conference on October 2, 2012. On the website you will see that the Articles of Continuance are simply a list of facts about the society; e.g. name, address, purpose, board members, etc. The bylaws are those from the Administrative Manual and have been updated over the years. These two documents must accepted by 2/3 of the CGS members present at the Winnipeg meeting. A quorum is 30 CGS members. I am looking forward to seeing everyone in Winnipeg and to getting this registration behind us.

le Message du président

En juin, j'ai eu le plaisir d'assister au 11e symposium international et 2e symposium nord-américain sur les glissements de terrain qui avaient lieu du 4 au 8 juin. M. Corey Froese présidait le symposium, alors que Erik Eberhardt, Ph. D., présidait le Comité technique. Le symposium était aussi l'hôte de la réunion du Conseil de l'IAEG, ou International Association for Engineering Geology and the Environment. Au nom du Canada, j'ai assisté à cette réunion et ait eu le plaisir de rencontrer le président Carlos Delgado et les membres du Conseil de l'IAEG. Le symposium a attiré 450 personnes à l'hôtel Banff Springs. Cet emplacement était particulièrement approprié, car la construction du chemin de fer Canadien Pacifique à travers la vallée Bow et le col de montagne Kicking Horse marque incontestablement le début de la géologie de

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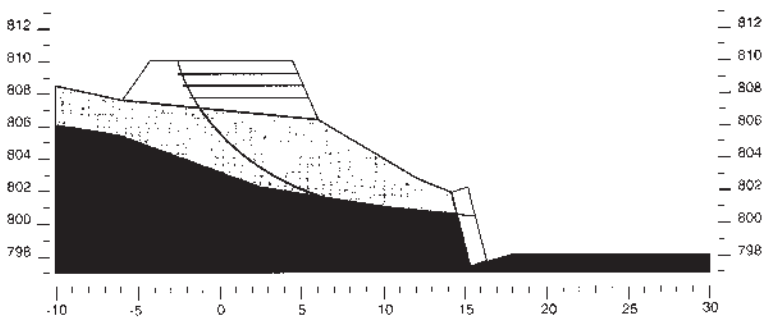

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l'ingénieur dans l'Ouest du Canada. On pouvait presque entendre la trilogie de chansons sur le chemin de fer de Gordon Lightfoot résonner dans les murs de l'hôtel!

Le symposium a révélé le calibre des contributions du Canada en matière de technologie pour contrer les glissements de terrain. Trois de nos membres, Doug Stead, Oldrich Hungr et Serge Leroueil, tous détenteurs de Ph. D., ont prononcé des conférences magistrales, à titre de conférenciers d'honneur ou de conférenciers invités. J'ai également apprécié les conférences d'honneur de D.H. Cornforth, Ph. D., des États-Unis, et de D. Petley, Ph. D., du Royaume-Uni. Malheureusement, j'ai dû quitter jeudi matin, pour aller assister au banquet de remise des prix de l'ICI qui avait lieu à Edmonton durant la soirée. J'étais accompagné de Doug Stead, Ph. D., de l'Université Simon Fraser, qui est devenu fellow de l'ICI ce soir-là, tout comme Hesham El Naggar, Ph. D., de l'Université Western Ontario. Comme je vous l'annonçais dans un message précédent, Kerry Rowe, Ph. D., a reçu le Prix Sir John Kennedy, Derek Martin, Ph. D., a remporté la Médaille John B. Stirling, et M. Fred Matich a gagné la Médaille Julian C. Smith. Prise durant cette soirée à Edmonton, la photo montre les trois lauréats de la SCG. N.R. Morgenstern, Ph. D., et Dennis Becker, Ph. D., assistaient également au banquet.

Dans mon message de juin, j'indiquais que la SCG devait se conformer à la nouvelle Loi canadienne sur les organisations à but non lucratif (la LCOBNL) d'ici le 17 octobre 2014 ou être dissoute. Nous avons déposé des clauses de prorogation et des règlements généraux de la SCG sur le site Web au mois d'août et avons informé tous les membres que nous allions voter sur ces deux questions lors du déjeuner d'affaires qui aura lieu durant la conférence de Winnipeg, le 2 octobre 2012. En allant sur le site Web, vous constaterez que les clauses de prorogation ne sont qu'une liste de faits sur la Société, p. ex., le nom, l'adresse, le mandat, les membres du conseil d'administration, etc. Les règlements généraux proviennent du manuel administratif et ont été mis à jour au fil des ans. Ces deux documents doivent être acceptés par les deux tiers des membres de la SCG qui seront présents à la réunion à Winnipeg. Pour atteindre le quorum, nous avons besoin de 30 membres. J'ai hâte de vous voir tous à Winnipeg et d'en avoir fini avec la démarche exigée par la LCOBNL.

From the Society

Upcoming Conferences

65th Canadian Geotechnical Conference - GeoManitoba 2012

The Canadian Geotechnical Society (CGS) and the Manitoba Section of the Canadian Geotechnical Society invite you to the 65th Canadian Geotechnical Conference. The Conference will be held at the Fairmont Hotel located in downtown Winnipeg, Manitoba, Canada from September 30 October 3, 2012. The "GeoManitoba 2012 Building On The Past" conference reflects the heritage of geotechnical engineering in Canada and how our past will help us going forward in new research, developments and advancements in geotechnical engineering. It also reflects the ever increasing need to restore or upgrade our country's aging infrastructure.

Call for Abstracts GéoMontréal 2013 Geoscience for Sustainability

The Canadian Geotechnical Society (CGS) and the Western Québec Section of the Canadian Geotechnical Society, the International Association of Hydrogeologists – Canadian National Chapter (IAH-CNC) and the

North American Geosynthetics Society (NAGS) invite you to **GéoMontréal 2013.** The Conference will be held at the **Hilton Montreal Bonaventure** located in downtown Montreal, Quebec, Canada from September 29 to October 2, 2013. GéoMontréal 2013 will jointly present the 66th Canadian Geotechnical Conference, the 40th Annual IAH-CNC Congress and the NAGS Conference. The technical program is designed to meet the needs of practitioners in the geotechnical, hydrogeological and geosynthetics fields.

The conference organizing committee invites members of the Canadian and International geotechnical and hydrogeological communities to contribute recent research developments and advancements in geotechnical engineering, engineering geology, rock mechanics, soil mechanics and foundations, mining geotechnique, cold regions engineering, geoenvironmental engineering, geosynthetics and hydrogeology. The conference will cover a wide range of topics, including special sessions that are of local and national relevance to the fields of geo-engineering and hydrogeology. In addition to the technical program and plenary sessions, the conference will include a complement of local tours, workshops and short courses.

Authors are invited to submit abstracts through the conference web site *www.geomontreal2013.ca* that will be launched just after the GeoManitoba 2012 conference in Winnipeg. Abstracts can be written either in French or English – **the deadline for abstract submission will be January 14, 2013.** Invitations for submission of full papers will be sent to authors whose abstracts are accepted by the conference's Technical Committee by **March 1, 2013**. The submitted papers will be reviewed prior to final acceptance for inclusion in the conference proceedings, which will be also available on CD-ROM. At least one author of an accepted paper must register for the conference.

Please look for more details this fall on the **GéoMontréal 2013** website *www.geomontreal2013.ca* – all CGS members will receive e-news details of the conference website launch and the Call for Abstracts in October.

Questions regarding sessions, topics and the technical program should be directed to the Local Organizing Committee contacts given below:

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G-I News

Wissmann becomes new G-I Board Governor

Kord J. Wissmann

The G-I Board of Governors proudly announced that **Kord J. Wissmann, Ph.D., P.E., D.GE** will become the new G-I governor at the conclusion of the fall 2012 Board meeting. Upon learning of his new role, Wissmann stated, "It is an honor and a privilege to help lead the Institute in such a special way. I'm excited about the prospects of serving our great profession and the wonderful people who are our G-I constituents."

Wissmann has been the president and chief engineer at Geopier Foundation Co. in Mooresville, NC since 2001 where he is responsible for company operations, business planning, engineering activities, design approach development, and research/development. Prior to joining Geopier in 1998, he was a principal engineer with Shannon & Wilson, Inc., in St. Louis, MO from 1995-1998 where he specialized in soil and site improvement, ground modification, driven piles, seismic studies, finite element analyses, cellular cofferdam designs, tunnel support design, and dewatering and relief well systems, in-situ testing. Wissmann earned his Ph.D. and his B.S. in civil engineering at Virginia Tech and his M.S. in civil engineering at the University of California at Berkeley.

Wissmann has been an active GeoInstitute member currently serving as a member and past chair of the GI Organizational Member Council, as well as other numerous activities.

What G-I LinkedIn members are talking about

When was the last time you added your "two cents" to a geotechnical discussion on the Geo-Institute LinkedIn page at *http://www.linkedin.com*. Here's what folks have been talking about lately:

- SPT-N Value in Foundation Design
- Pile interaction between retaining wall piles designed for k0
- Sampling depth problem
- Recommendations on the presuremeter test? Which soils / rocks are best for this test? Any experience with erroneous data?
- Swell test data for assessment of earth pressures
- How to evaluate soil stability when drilling through without casing
- Requirements on drilling mud
- Lateral creep of the soil under permanent transverse bending of the drilled shaft
- The use of helical foundation products on commercial construction projects
- When do you use Pocket Penetrometer and Torvane and how do you sequence them?
- Swell test data for assessment of earth pressures

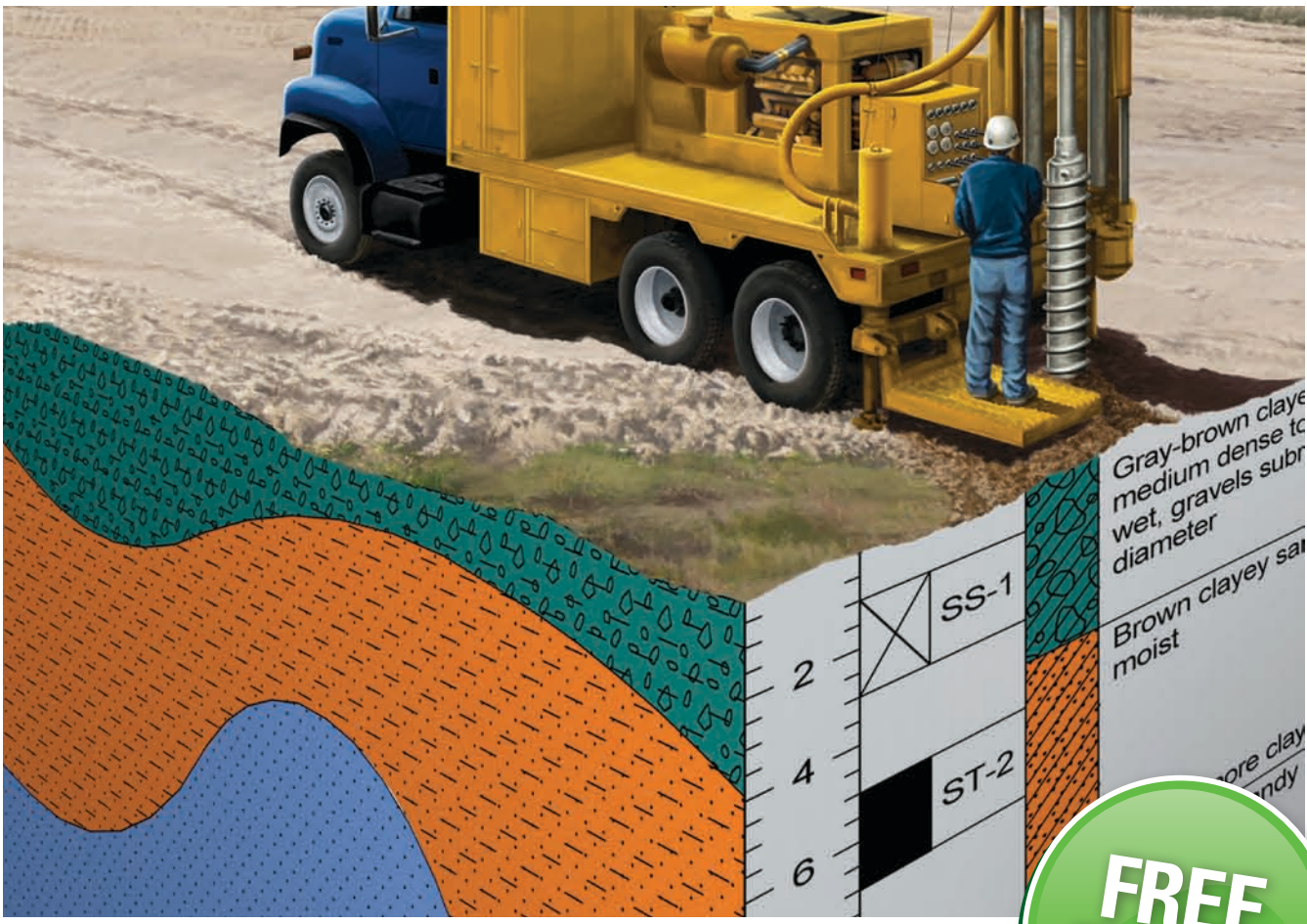
G-I introduces new ethics web page

Take a minute to visit the G-I website's new ethics page at *www.asce.org/geo/Ethics/Ethics/* where you can earn PDH's by viewing current and future videos.

The Academy of Geo-Professionals hosted its inaugural ethics session during the 2012 Geo-Congress in Oakland, CA. During the session, **Ron Smith, P.E., D.GE, F.ASCE**, provided real-life examples of business ethics situations. His presentation was recorded and is available for viewing on the ethics page. Highlights of the recorded lecture include:

- Personal, Business and Professional Ethics
- ASCE Fundamental Ethical Practices
- ASCE Cannons of Ethics
- ASCE Bylaws Regarding Ethics

You can earn up to 2.0 PDHs when combined with a review of the case history presentations on the AGP website at *www.geoprofessionals.org/ethics2.html*. Upon completion, send an email to *info@geoprofessionals.org* to receive your credit.



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An AGP-organized ethics course is planned for the 2013 Geo-Congress and is tentatively scheduled for Sunday, March 3, 2013.

Do you like Geo-Strata's new page-turning format?

Geo-Strata online has a new page-turning format which makes reading current and past issues of the magazine easier. ASCE/G-I members or G-I only members can access *Geo-Strata* magazine online with its new format at *www.asce.org/geo/Members-Only/View-Geo-Strata-Magazine/*.

Let us know what you think by sending your comments to *geo-strata.org*.

The G-I announces 2014 geo-congress venue

2014 Geo-Congress
February 23-26, 2014
Westin Peachtree Plaza Hotel
Atlanta, GA

The 2014 Geo-Congress will focus on two central themes which will bring a unique perspective to geotechnical engineering issues facing practitioner and educators: Site Geo-characterization and Sustainability.

The conference hotel is a downtown landmark with its 73-story tower, topped by the revolving Sun Dial Restaurant. Conveniently connected to AmericasMart, The Westin Peachtree Plaza Hotel is steps from CNN, the Georgia Aquarium, Georgia World Congress Center and the Georgia Dome. Watch for conference details, calls for papers, and more in upcoming months.

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ASCE/G-I Co-Sponsored Online Webinars

Load and Resistance Factor Design (LRFD) for Geotechnical Engineering Features - Earth Retaining Structures: Fill Walls
Monday, Sept 10, 2012 / Noon - 1:30 pm

Load and Resistance Factor Design (LRFD) for Geotechnical Engineering Features: Earth Retaining Structures - Cut Walls
Friday, Sept. 28, 2012 / Noon – 1:30 pm

For more webinars and information: *www.asce.org/Continuing-Education/Webinars/Live-Webinars/*

ASCE/G-I co-sponsored seminars

Design of foundations for dynamic loads
Sept 5-7, 2012
Houston, TX

Design and construction of micro-tunneling projects
Sept 19-21, 2012
San Diego, CA

and

Oct 31 – Nov 2, 2012
Portland, OR

Instrumentation & Monitoring Bootcamp: Planning, Execution & Measurement Uncertainty for Structural & Geotechnical Construction Projects
November 8-9, 2012
Phoenix, AZ

For seminar information: *www.asce.org/Continuing-Education/Seminars/Face-to-Face-Seminars/*

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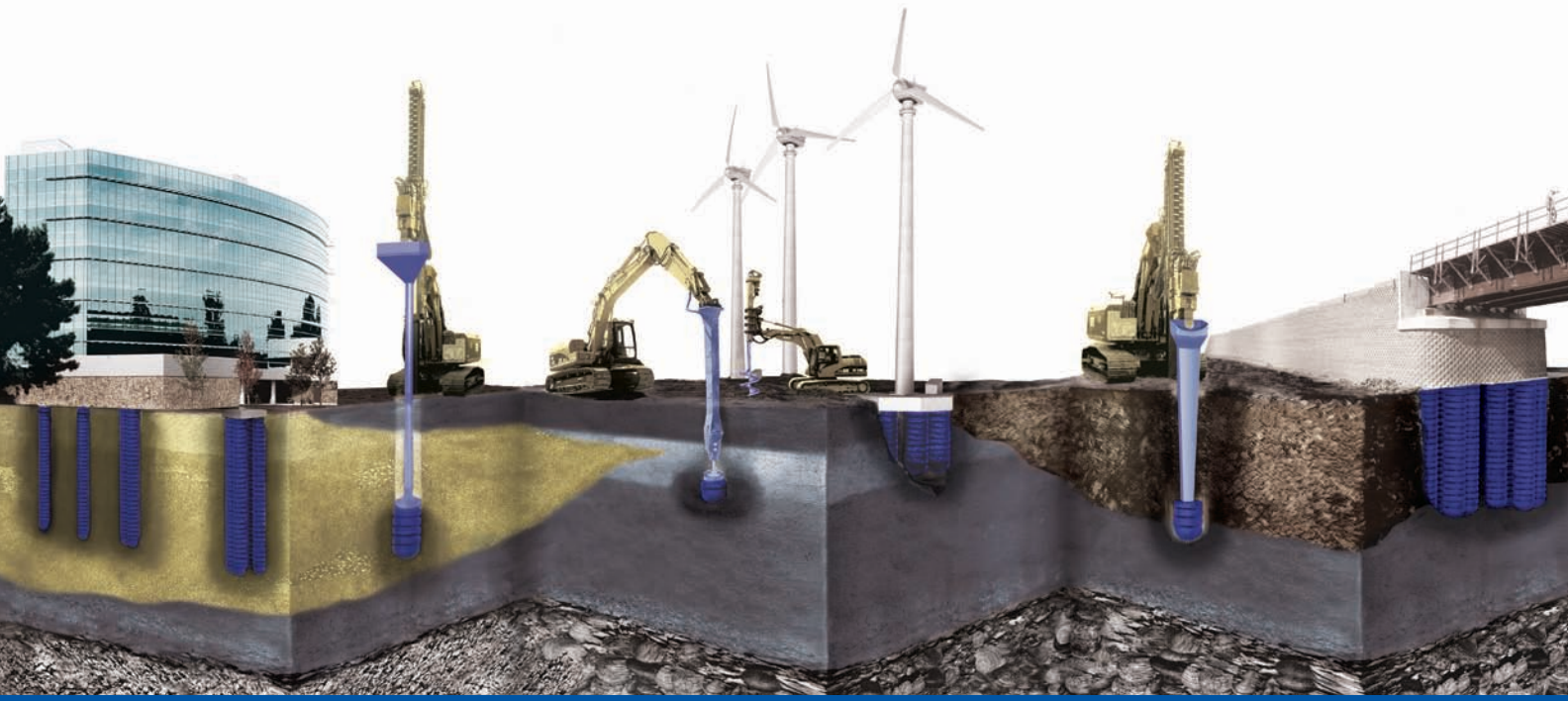

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Access *myASCE* at *www.asce.org/myasce* or from the "myASCE" link at the top of most pages on the website. Once you have logged in, you can begin editing your profile by adding a profile picture or updating your status.

Members

Macnab receives 2012 Harry Schnabel Jr. Award

Alan Macnab, P.Eng., D.GE, was presented The 2012 Harry Schnabel Jr. Award at the 2012 Geo-Congress in Oakland, CA. Macnab, a past-president of the Geo-Institute, received the award in recognition of his more than 30 years of service to the earth retaining structures industry as a contractor, author, and ASCE leader.

Alan Macnab receives Schnabel Award.

"It was particularly significant that the nomination for this award came from Hubert Deaton and his fellow professionals at the Schnabel Foundation Company", said Macnab. "Schnabel has always been fierce competitors, but they comport themselves as gentlemen which makes their nomination special to me. Harry Schnabel took the time when I was a young man first attending technical events such as Geotechnical Division seminars to spend some time mentoring me. Perhaps he felt he had found a kindred soul who had the same fascination with and passion for the earth retention business that he had. "

The Award was established by the Geo-Institute in 2006 as a memorial which recognizes Harry Schnabel's accomplishments in the field of Earth

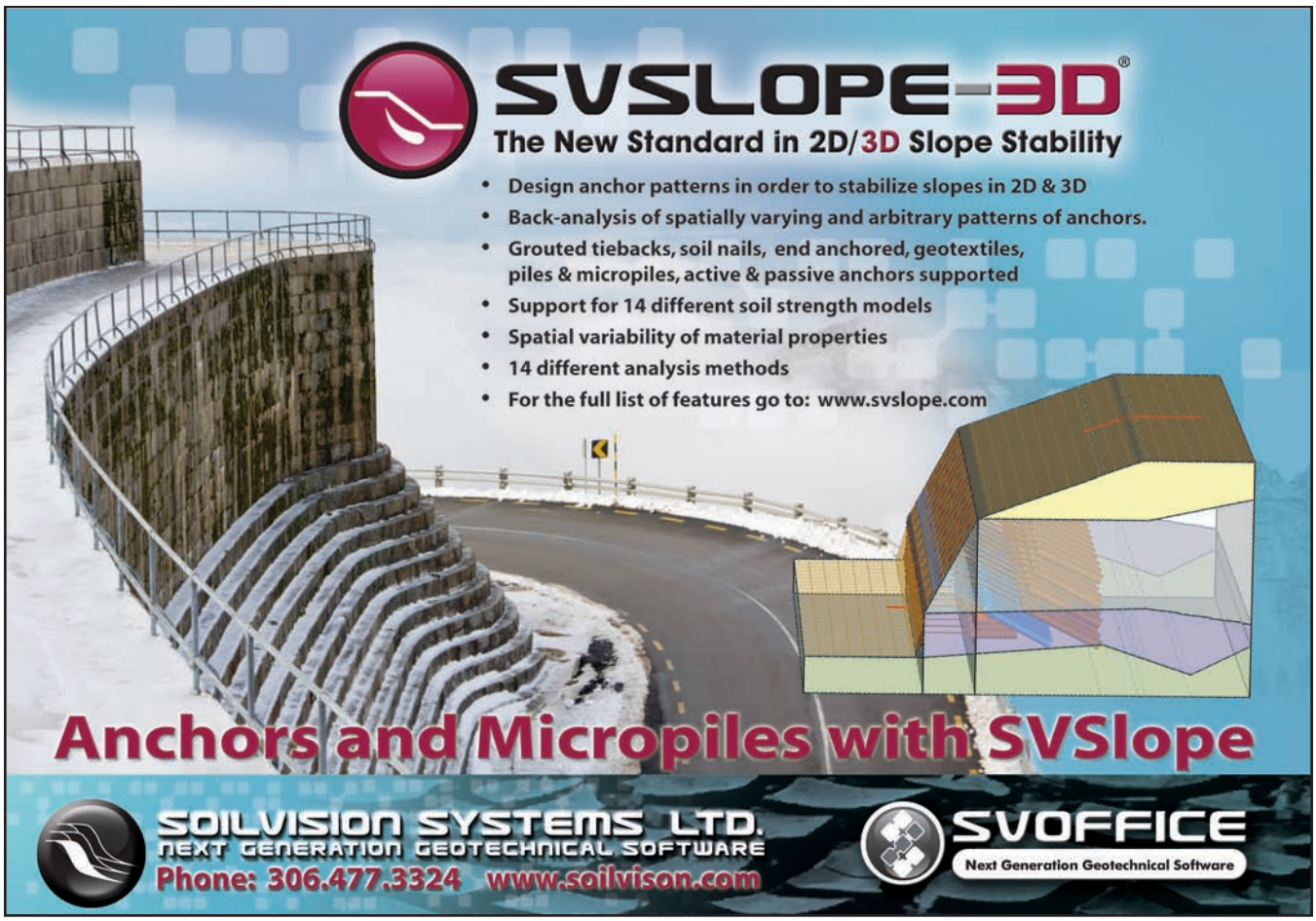
Retaining Structures over his 50-year career. Additionally, it encourages continued excellence and innovation for those making a career in the earth retaining structures industry. The award is funded by an endowment from the Schnabel Foundation Company.

Mabry becomes 2012 Geotechnical Engineer of the Year

Richard Mabry, P.E., M.ASCE, was cited as the Philadelphia Section of the ASCE 2012 Geotechnical Engineer of the Year. Philadelphia Section President, Ann M. Tomalavage, P.E., M.ASCE presented the award to Mabry at the Section's annual Spring Social on May 18.

Mabry is a senior engineering manager with GAI Consultants at the firm's local office in Berwyn, PA. He specializes in geotechnical engineering and has a particular expertise in mine

(l to rt) Ann Tomalavage presents award to Richard Mabry.



subsidence. Mabry has a vast resume of experience in geotechnical applications, including building foundations, commercial and industrial developments, and transportation facilities. He additionally performs forensic analysis and investigation related to insurance claims and litigation.

Mabry received his bachelor's in engineering from Swarthmore College in 1963 and a master's from the Massachusetts Institute of Technology in 1965. In addition to being active in the Section, he is active in the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE). Mabry also served as chair of the Geotechnical Technical Group of the Philadelphia Section.

ISSMGE News

ISSMGE International Society for Soil Mechanics and Geotechnical Engineering
Société Internationale de Mécanique des Sols et de la Géotechnique

Five new awards for members

The ISSMGE Board announced the creation of five new awards to recognize members who have made important contributions to the profession, society and the world. The awards include Outstanding Technical Committee, Outstanding Geotechnical Project, Outstanding Innovator, Outstanding Member Society and the Outstanding Paper Published in the *International Journal of Geo-Engineering Case Histories.*

These new awards are in addition to the existing Young Geotechnical Engineer Award, the Terzaghi Oration, and the Kevin Nash Gold Medal awards.

Awards will be presented during a special session at the 18th International Conference on Soil Mechanics and Geotechnical Engineering in Paris in September 2013. For details: ISSMGE at *www.issmge.org/en/issmge-awards*.

ICGI Willongong 2012
October 30 – November 2, 2012
University of Wollongong
Wollongong City, Australia
www.icgiwollongong.com

The Centre for Geomechanics and Railway Engineering and the Australian Geomechanics Society, under the auspices of ISSMGE, is hosting the International Conference on Ground Improvement and Ground Control: Transport Infrastructure Development and Natural Hazards Mitigation (ICGI). The Conference is focused on promoting ground improvement concepts and applications predominantly in the fields of transportation geotechnology and natural hazards mitigation.

ICGI is fully supported by the ISSMGE, with active participation of Technical Committees, TC 211, 214, 303 and 202 and is also co-sponsored by the Geo-Institute, the International Geosynthetics Society, and the Southeast Asian Geotechnical Society.

ICGI will act as a platform to disseminate the most recent research and field advances to the geotechnical community around the globe and is expected to be the biggest ground improvement conference to be held in Australia. Outstanding keynote lectures, State of Art presentations, heritage lectures and numerous technical discussions will provide three days of scientific and technical discourse followed by an excursion encompassing the natural landscape of the south coast of New South Wales.

The Conference proceedings will be included in the Thomson Reuters (ISI) Citation Index within the Web of Science which should facilitate worldwide access to the proceedings. For information, contact the ICGI Conference Secretariat at: *icgi_2012@uow.edu.au*

Keep up with geotechnical world news
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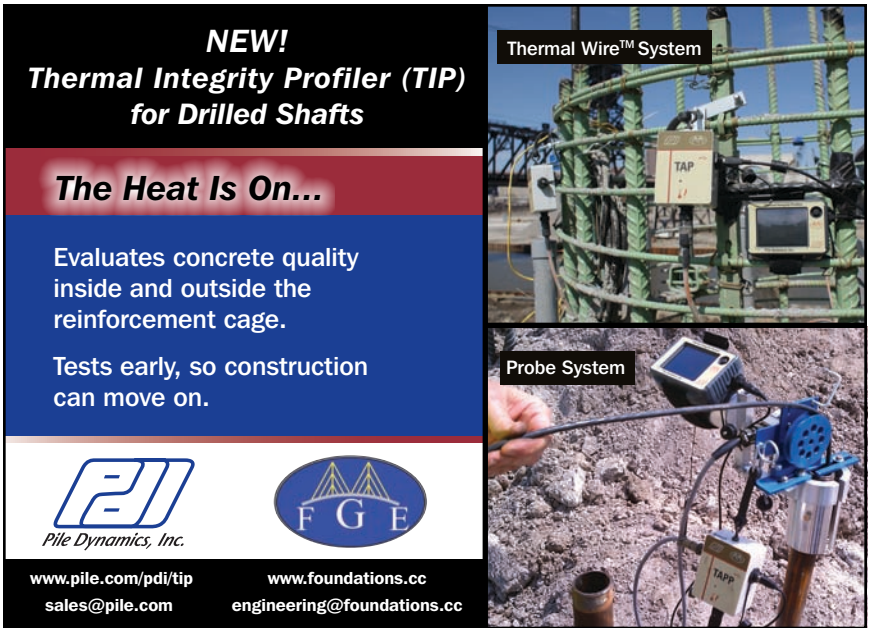
ASCE members: Your $15 ISSMGE membership is *in addition* to your ASCE and G-I membership. Log in to your member account at or contact ASCE Member Services at 1.800.548.2723 to renew your ISSMGE membership.

Geo-Institute members, but not an ASCE member? Your ISSMGE membership is included in your G-I membership. If you haven't renewed your G-I membership for 2012, contact ASCE Member Services at 1.800.548.2723.

Not a member of the Geo-Institute? ASCE members can add the G-I as a primary or secondary Institute of Interest. Discover the benefits of G-I membership on the G-I website at *www.asce.org/geo*



Students

A message from the G-I

Hope you're having a great summer and following the G-I on facebook and Twitter.

It's not too soon to start thinking about the G-I's 2013 Geo-Challenges: the GeoWall, GeoPrediction, and Geo-Poster challenges that will take place during the 2013 Geo-Congress in San Diego, CA, March 3-6, 2013. Check the G-I website for upcoming details or contact Jennifer Canning at *jcanning@asce.org*.

A great idea! Form a GSO at your school

Enhance your education as you prepare to become a geo-professional. Plus, have a lot of fun by forming a local GSO (Graduate Student Organization) at your school. You'll be able to network with any of the Geo-Institute's 16 GSOs and engage in activities of your GSO's choice, provided the activities are in compliance with the Geo-Institute's Code of Ethics.

All GSO members must be active Geo-Institute members. There are no dues requirements for the GSO. For information and an application: *http://content.geoinstitute.org/MC/Students/GSO.html.*

Student internship opportunities

Looking for an internship opportunity? Then explore the positions listed on the ASCE website at *http://careers.asce.org/jobs#/results/keywords=internship&resultsPerPage=12/1,false* to help further your career path. Come back often since new positions are added all the time.

Industry News

Cal geo reports: project labor agreements shown the door

Project Labor Agreements (PLAs) for government projects are a growing concern for many of the California Geotechnical Engineering Association's members, as they expand union requirements to non-union companies. This can include requiring prevailing wages for all employees and mandating that companies pay into a series of trust funds for their non-union employees without employees receiving any benefit. Relief from this burden may be on the way for members doing work in San Diego, but with a twist.

Prop. A was passed by San Diego voters in June, outlawing the use of PLAs in that city's contracts. The measure passed with 58 percent of the vote -- a significant victory for non-union companies.

Despite the San Diego victory, a union-supported bill was passed by legislature that would make cities that outlaw PLAs ineligible for state funding. Threat of the legislation didn't deter San Diego voters, but their project funding may now be in peril. Likely, the courts will have to decide.

Winners of the 2012 SP Research Award

Since 1990, the Shamsher Prakash Research Award has been annually awarded to an outstanding young geotechnical researcher, engineer, or scientist who specializes in geotechnical engineering and/or geotechnical earthquake engineering with significant independent contributions and excellence in research. The award includes an $1100 cash prize. This year's awards were received by:

Ioannis Anastasopoulos, assistant professor, civil engineering at the National Technical University of Athens (NTUA) was recently elected assistant professor in the School of

Ioannis Anastasopoulos

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Civil Engineering at the National Technical University of Athens, GA (NTUA). His research spans several areas of geotechnical earthquake engineering with emphasis on soil–structure interaction. Combining numerical analysis with physical modeling, he has published 45 journal papers and more than 100 book and conference proceedings. Additionally, he is the driving force behind the development of a new Experimental Facility for Simulation of Soil-Structure Systems at NTUA. He has participated in several european research projects, and served as a consultant in a variety of engineering projects in Greece, the U.S., U.A.E., and Qatar. He was recently selected by the ISSMGE as the inaugural recipient of the Young Researcher Award in Geotechnical Earthquake Engineering.

Dominic Assimaki, A.M.ASCE, associate professor, School of Civil and Environmental Engineering, Georgia Institute of Technology since 2005. Her teaching and research interests focus on numerical simulation of dynamic nonlinear soil response, soil-structure interaction, and inverse problems in near-surface geophysics.

Dominic Assimaki

She has a BS in civil engineering from the National Technical University of Athens (Athens, Greece), and a MS and a ScD from the Department of Civil and Environmental Engineering at MIT (Cambridge, MA). She has been a research fellow of the European Research Training Network Seismic Assessment for Earthquake Risk Reduction (SAFERR) in Paris, France, and a post-doctoral researcher at the Institute for Crustal Studies at the University of California, Santa Barbara. Assimaki has authored and co-authored more than 100 publications in books, peer-reviewed journals, and conference proceedings. She is the recipient of the 2008 Bill Schutz Junior Faculty Teaching Award for Excellence, the 2012 Excellence in Research Award from the Georgia Institute of Technology, and the 2009 Arthur Casagrande Professional Development Award from the Geo-Institute.

First monolith for locks on Pacific side of Panama Canal completed

Construction of the first of 46 monoliths for the new locks on the Pacific end of the Panama Canal has been completed. The concrete and steel structure has a height of 111 feet, width of 24.6 feet and depth of 88.6 feet and is in the upper chamber. It took 232 tons of reinforced steel and 91,995 cubic feet of concrete to build it. The new locks are expected to be finished in 2014 and scheduled to open for traffic in 2015.

The new locks on the Pacific side of the canal will enable ships with more than double the container capacity of the current Panamax-sized ships to transit one set of locks, instead of the two existing locks, from the sea level of the Pacific Ocean up to the level of Lake Gatun and then through another set of new locks down to the level of the Caribbean Sea.

United States Society on Dams 2013 Annual Meeting and Conference

February 11 - 15, 2013
Phoenix, AZ
http://ussdams.org/2013conf.html

This USSD conference theme is "Changing Times — The Challenges and Risks of Managing Aging Infrastructure under a New Financial Reality". The responsibility to create sustainable projects that are sensitive to environmental, social, financial, geographical and political needs of the world's population is ever increasing. At the same time, the average age of the nation's existing dam infrastructure is rising, and in the next five years nearly 60,000 of the more than 80,000 dams in our national inventory will have exceeded their design life. In addition, many older dams that were constructed to protect agricultural interests are now protecting people and personal property, and many of these structures' classifications have changed to high hazard, bringing new costly challenges for owners to retrofit or modify the existing dams in response to the new role of the structure.

A Tuesday morning plenary session featuring invited speakers discussing timely dams and water resource issues will begin the Conference Technical Program, followed by oral presentations during concurrent technical sessions, as well as a poster session on Tuesday evening. Three Workshops organized by USSD Technical Committees on Monitoring and Instrumentation; Construction Cost Estimating; and Risk Assessment will be held on Thursday, addressing timely topics of interest to the dams and water resources community.

Geo-Institute Annual Congress Calendar

2013 Geo-Congress
"Stability and Performance of Slopes and Embankments"
March 3-6, 2013
Town & Country Resort
San Diego, CA
www.asce.org/geocongress

2014 Geo-Congress 2014
February 23-26, 2014
Westin Peachtree Plaza Hotel
Atlanta, GA

To submit information for *Geo-Strata* magazine, send your brief news about your recent honors, awards, special appointments, promotions, etc. to *geo-strata@asce.org*. High resolution photos must be sent as separate files. Refer to production guidelines on the Geo-Institute website at *www.asce.org/geo/* Sales-oriented copy should be directed to Dianne Vance, Director of Advertising at *dvance@asce.org*.

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IN MEMORIAM

John Franklin 1940-2012

A long-term CGS Member, a former Professor of the Department of Earth and Environmental Sciences at the University of Waterloo, a primal force in the area of Rock Engineering, Dr John Franklin of Orangeville, Ontario, has passed on.

John served as the President of the International Society for Rock Mechanics for a four-year term (87-91) and contributed massively to the profession throughout his career (test methods, education initiatives, monitoring, field measurements…). He was a premier consulting engineer involved in important projects in Canada and internationally, such as the foundations of the CN Tower in Toronto, the Sudbury Science North Centre, a rock breakwater at the end of the world (Tierra del Fuego), high dams, deep mines, steep slopes, and many other construction projects on, in, and with rock. John understood integrated geoscience and rock engineering better than anyone I ever encountered.

For the last 20 years, John battled Parkinson's. His wife, Kersty, supported him through the worst of the battle, which seemed never to destroy his spirit while it ravaged his body, forcing him from our lives on Friday, July 06, 2012.

John brought to Rock Mechanics and Rock Engineering a dedication that all of us could learn from. His achievements remind us that the world is built on the ideals of a few visionaries who lead us forward and often appear ahead of their time. He was such a visionary, and remained intellectually active long after his physical disability restricted his movements and travel scope. Last year, he travelled to the ISRM quadrennial Congress in Beijing; the ISRM was his home, and he was saying goodbye to his family.

If our International Society for Rock Mechanics has become an important professional organization, it is in part because of John Franklin.

Please join the Canadian Geotechnical Society community in extending our appreciation for his life and contributions, as well as our condolences for the loss to Kersty and the rest of John's family. The University of Waterloo will dedicate a large monolith in the Rock Garden some time in the near future (http://uwaterloo.ca/peter-russell-rock-garden/rock-garden). The CGS has the John Franklin Award, and I hope that an eponymous award in the ISRM can also be established.

Sincerely yours and with fond memories of John, I remain,
Maurice Dusseault, University of Waterloo

Introduction by John Dunnicliff, Editor

This is the seventy-first episode of GIN. Three minus three articles this time. To explain—one week before going to press there were three, but the week has brought challenges (and frustrations!). I won't bore you with the details. I'm consoled by the fact that, after many weeks of rain, the sun is finally shining here in the Mother Country.

Manual of geotechnical engineering

My review of the excellent "ICE Manual of Geotechnical Engineering" was in June GIN. In my introduction to GIN I included some quotations from the chapter on geotechnical risks, including one attributed to Donald Rumsfeld. I've since received an e-mail from Don Shields, indicating that the correct source is our much-respected geotechnical colleague Elio D'Appolonia (D'App). Here is part of Don's e-mail:

> In your introduction to your review of *ICE Manual of Geotechnical Engineering* you repeat a quotation from the Manual attributed to Donald Rumsfeld. To whit:
>
> *"... as we know, there are things that we know we know. We also know that there are known unknowns; that is to say we know there are things we do not know. But there are also unknown unknowns - the ones we don't know we don't know."*

I first heard this statement more than 30 years ago (probably in 1979) from a much nicer person than Rumsfeld. The nicer person is Elio D'Appolonia, who appeared at a hearing on the future of uranium mining in British Columbia.

During his testimony, Dr. D'Appolonia made exactly the same statement to the commissioners that is now attributed to Rumsfeld. I remember Elio's statement perfectly because it was one of those moments when one says to oneself: Why didn't I think of that!

> Now I ask myself: How do I go about getting D'Appolonia credit for this statement?

Answer to Don—right here!

The next continuing education course in Florida

This is scheduled for April 7-9, 2013 at Cocoa Beach. Details are now on www.conferences.dce.ufl.edu/geotech. Also see the announcement on facing page.

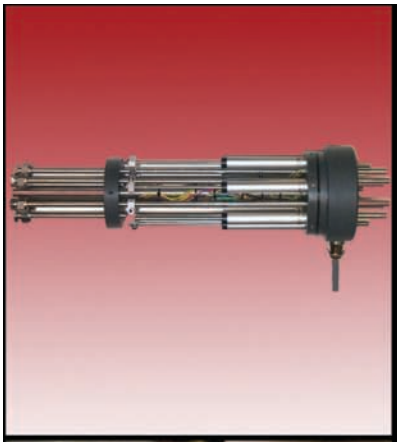
Closure

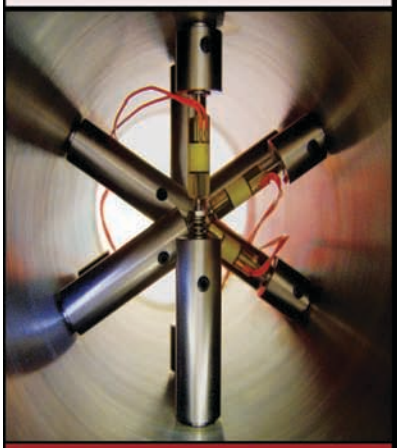
Please send contributions to this column, or an abstract of an article for GIN, to me as an e-mail attachment in MSWord, to john@dunnicliff.eclipse.co.uk, or by mail: Little Leat, Whisselwell, Bovey Tracey, Devon TQ13 9LA, England. Tel. +44-1626-832919.

Yasas! (Greece)

Errata

There is a significant error in the article "Update of the fully-grouted method for piezometer installation" by Contreras et al, published in the June 2012 episode of GIN (page 20). The cement-bentonite grout mix given near the beginning of the section subtitled "Laboratory" should be 2.5:1:0.3, NOT 1:2.5:0.3.





The University of Florida

Geotechnical Instrumentation (GI) for Field Measurements

April 7-9, 2013

Doubletree Hotel • Cocoa Beach, Florida

Course Director: John Dunnicliff, Consulting Engineer

COURSE EMPHASIS: is on why and how to use GI to monitor field performance. The course will include planning monitoring programs, hardware and software, recent developments such as web-based and wireless monitoring, remote methods for monitoring deformation, case histories, and lessons learned. Online sources will be included, together with an open forum for questions and discussion.

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

OBJECTIVE: to learn the who, why, and how of successful geotechnical monitoring while networking and sharing best practices with others in the GI community.

INSTRUCTION: provided by leaders of the GI community, respresenting both users and manufacturers:

- Marcelo Chaqui, Monir Precision Monitoring
- Loic Galisson, SolData Group
- Pierre Gouvin, GEO-Instruments
- Aaron Grosser, Barr Engineering
- Daniele Inaudi, Roctest/Smartec
- Allen Marr, Geocomp
- Paolo Mazzanti, NHAZCA
- Justin Nettle, Federal Energy Regulatory Commission
- Tony Simmonds, Geokon
- Robert Taylor, RST Instruments

For full details visit:

www.conferences.dce.ufl.edu/geotech

Putting tailings on ice

Vivian Giang

Although water and oil don't mix, Dr. Dave Sego has found that ice and oil make a perfect research combination.

Dr. Dave Sego standing on oil sands MFT after a one-year cycle of freeze thaw and drying (circa 1992).

Dr. Dave Sego is a world-renowned expert in permafrost engineering research and oil sands tailings research – two fields that on first glance could not seem further apart. Yet Sego has skillfully applied his expertise in permafrost engineering to oil sands tailings and mine waste management research. How did he make the connection?

What started off as an "innocent question" from a fellow colleague and mentor turned out to be a large boon to the oil sands and mining industries.

In 1990, at the apex of permafrost engineering research in Canada, Dr. Norbert Morgenstern approached Sego and asked, "If you froze and thawed mature fine tailings (MFT), how much water would be released?" Sego, who at this point never researched oil sands tailings, asked what the density of MFT was (1.2-1.3 t/m3), turned to a frozen soil engineering textbook and found out that 50% water would be released. With a slightly knowing smile, Morgenstern suggested Sego, then an Assistant Professor at the University of Alberta, write a research proposal.

From that moment to this day, Sego has established a record of successfully incorporating his passion for permafrost engineering to the most challenging mine waste management projects in Canada's northern regions. With the re-emerging interest in northern development and subsequent need for geotechnical engineers with expertise in permafrost, Sego continues teaching permafrost engineering through short courses at the University of Alberta's Geotechnical Centre. In a country that has over 50% of its landmass covered in permafrost, Sego's cold regions research and courses have been important in Canada, especially as permafrost engineering had greatly subsided during the mid-1990s.

"Between 1991 and 1995, three out of five cold facilities dedicated to permafrost engineering in Canada closed, leaving only the University of Alberta and University of Laval with permafrost research capabilities," says Sego, now a Professor Emeritus at the University of Alberta. Additionally, there had not been a PhD in Permafrost Engineering awarded at the University of Alberta since 1991. Sego currently is co-supervising three doctoral candidates who will be the first to graduate with PhDs in Permafrost Engineering at the University of Alberta in over two decades. Those students are currently working on leading research in Canada's north, including on the Diavik Mine Waste Rock Project.

Although much of his northern mine waste research was a natural result of his Arctic-related research, Sego's permafrost knowledge significantly contributed to oil sands tailings research and management in northern Alberta. "In the mid-90s, we conducted full-scale field experiments to

investigate the freezing and thawing of mature fine tailings at several sites in the Athabasca region," recalls Sego. "This was one technology that industry never picked up on due to the emergence of consolidated tailings."

As time went on, Sego continued conducting innovative and practical research that had an impact on the development of Alberta's oil sands: he tried artificial ground freezing to recover undisturbed samples using liquid nitrogen, and then in the early 2000s, he tested various dewatering approaches for mine wastes, including cross flow filtration. According to Morgenstern, Distinguished University Professor Emeritus at the University of Alberta, "Dave's early research underpins many aspects of current tailings management at an industrial scale. His related work also resulted in major advances in spray freezing to improve contaminated water and agricultural waste. [With regards to permafrost research,] his studies into saline permafrost and the development of ground freezing for undisturbed samples of sand substantially contributed to the ground-breaking CANLEX (Canadian Liquefaction Experiment) Project."

Sego's research acumen and foresight also resulted in the technological transfer of several of his innovative developments. For example, under Sego's leadership, a cross-disciplinary collaborative team at the University of Alberta developed a novel hand-held naphthenic acids fluorescence sensor in 2009, offering a cost effective, bench scale, non-invasive and continuous water quality monitoring tool that can detect, characterize and track changes of naphthenic acids in process-affected waters. Currently, Sego is developing in-line dewatering techniques which can rapidly dewater mine tailings. These techniques will increase the amount of recycled water available for use in resource extraction operations, and specifically in oil sands operations, can prevent the formation of MFT.

Committed to forging strong ties between academia, industry, consultants and regulators, Sego developed internationally acclaimed conferences, including the First International Congress on Environmental Geotechnics and the International Oil Sands Tailings Conference (both of which continue today), and was instrumental in bringing the Tailings and Mine Waste conference to Canada for the first time in 2009.

Dr. Dave Sego surrounded by his graduate students at his retirement celebration.

However, Sego's greatest contributions to the oil sands industry and permafrost engineering was his role in the establishment of three state-of-the-art research facilities: the $2.2-million Oil Sands Tailings Research Facility (OSTRF) in Devon and the CFI/I2P2-funded Geotechnical & Geoenvironmental Engineering Cold Regions Research Facility and the Geochemistry Laboratory at the University of Alberta. Through these facilities, he expanded engineering research and development in the challenging areas of both the Arctic and oil sands engineering. Sego also oversaw and conducted studies into the geotechnical aspects of mining and processing oil sands tailings, contributing to the enhanced safety, environmental integrity and economy of developing the resource.

These three research facilities have been used to train scores of graduate students who are working to better manage oil sands and mine tailings. Sego's former students are now either working for educational institutions, operating companies, regulatory agencies and consulting firms providing professional services across North America and around the world or have continued in PhD-level studies in geotechnical engineering. It was these very students who came together to honour Sego on April 26-27, 2012, when the David C. Sego Symposium was held in Edmonton, Alberta. Commemorating Sego's service as an educator, mentor and researcher, the Symposium themes included cold regions engineering, mine waste management and geotechnical and geoenvironmental engineering – areas in which Sego has made significant contributions in the past three decades.

Although officially retired from teaching, Sego actively mentors students, conducts collaborative research and develops pioneering technologies in these three fields. Through his

From left to right: Drs. Daniel W. Smith, Peter K. Robertson and David C. Sego at the David C. Sego Symposium held April 26-27, 2012, in Edmonton, Alberta.

involvement in the Alberta Innovates – Energy and Environmental Solutions Oil Sands Tailings Road Map, Sego also continues to have an impact on the future development of Alberta's oil sands. Much of his noteworthy research developments and breakthroughs came via the unlikely union of permafrost engineering and oil sands tailings and mine waste management—a winning combination for oil sands and mining industries globally.

V. Giang, Communications and Grant Strategist, University of Alberta Geotechnical Centre, Department of Civil & Environmental Engineering, email: viviang@ualberta.ca.

GET THE BIG PICTURE . . . and send it in!

We'll feature your geotechnically related photo on our cover page !

Digital submissions of images pertaining to geotechnical subject matter are invited.
Deadlines for this year's issues are July 15 and October 15, 2012. Submit suitable digital images as jpgs at 300 dpi; image size 8.5" x 11" (portrait).
If submitting smaller images that require enlargement, please use higher resolution.
Include photography credit and contact information.
Send digital files to *gn@geotechnicalnews.com*.
State subject as : *Cover Photo*

Paolo Gazzarrini

Overture

Here we are with the 28th edition of the Grout Line, approaching midsummer, hoping that everyone is enjoying the well deserved sunshine.

For this issue, the first thing I am publishing is the following email from Stuart Littlejohn (gslittlejohn@ntlworld.com) as "**Errata Corrige**" of an article published in the June issue of the Grout Line:

Dear Paolo,

Having just received a copy of Volume 30 Issue No. 2 of Geotechnical News, I read with interest the article on the conference reprinted from the magazine "Deep Foundations". Unfortunately, there is a serious error in the 2nd paragraph of the 2nd column concerning the 5,200 anchors holding down the floor of the Burnley Tunnel over a 2km length beneath the River Yarra in Melbourne, Australia. The reprinted article states "all 5,200 grouted anchors were corroded and had to be remediated". Nothing is further from the truth as the 5,200 anchors were in fact the remedial solution.

The original paper was presented at the conference by Dr Devon Mothersille and written by Devon and myself. Following grouting to seal construction joints in the tanking membrane, it was found during testing that the tunnel concrete invert was unable to withstand uplift pressures of 600kPa without up to 200mm of heave in places and cracking of some floor panels. As a consequence, concerns were raised about the ability of the tunnel to withstand the 60m head from the river. As the structural remediation solution, 5,200 permanent corrosion protected ground anchors were installed through the concrete invert and grouted into the underlying Melbourne Mudstone to a very high standard of practice, after which each anchor was rigorously proof load tested to 150% working load before being accepted.

I would be grateful if you would recognise the importance of the error and arrange for a correction in the next issue of "Geotechnical News".

Kind regards,
Stuart Littlejohn

(P.S. I am proud to be one of the G.R.E.A.T.S.)

Thanks Stuart for your email and clarification about the mistake. I would like to remind our readers that Stuart was awarded with the G.R.E.A.T.S. at the recent 4th Grouting conference. G.R.E.A.T.S. in the grouting industry is an award for Grouters dedicated to Research, Education, Advancement of Technology and Service.

The second thing I would like to point out to anyone interested in grouting is that I just came back from Golden (Colorado School of Mine), where the 33rd Annual Grouting Fundamentals and Current Practice Course was held.

Here is a short note from Jim Warner (warner@sti.net).

Another grouting extravaganza

33rd Short Course on Grouting

Each year, pressure grouters from around the world gather for a week of education and interplay during the week long short course on Grouting Fundamentals and Current Practice at the Colorado School of Mines in Golden, Colorado. Though some are new to the field, many are well seasoned but attend to learn what is new, as well as rub shoulders with each other. This past June 18-22, nearly 80 specialists from around the world including 13 from Canada alone, as well as Australia, Austria, Brazil, Norway, and Sweden gathered.

Pressure grouting is a specialized construction procedure few geo-professionals use often, but most will employ occasionally. Traditionally used for strengthening and reducing seepage through soil or rock, it now extends to correcting settlement problems, and even repairing porous concrete and masonry. Grouting procedures are also essential to the ever increasing use of ground improvement, construction of micropiles, and soil and rock anchors.

A high point of the annual event is the Thursday afternoon Demo, and this year was as spectacular as ever. Following a barbecue lunch provided by Rio Grande Construction Supply, the Demo began with a review of the latest packer technology by Hank Baski. Following were demonstrations of special headers and equipment attached to a mini submarine for installing injection ports in deep water, formulation and use of cellular grout,

Photo 1:The always popular permeation of various ultrafine cement grouts into sand columns.

compaction grout, urethane solution grout injection into soil, groutjacking with both cementitious grouts and urethane foam, grout rheology, stability, and bleed, installation of self drilling micro-piles, and testing of soil anchors. The latest developments in real time computer monitoring of grouting parameters were featured by, Atlas Copco, Sweden, and RST Instruments, Canada, both of which provide the original input data to the clients representatives in standard format such as Microsoft Excel. Equipment on display or used in the demonstration included grout mixers and pumps from Airplaco, NCIF, Atlas Copco, Cementech , and ChemGrout. And the grand finally this year, lifting a 10,000 pound concrete block attached to the lift line only by friction supplied from a special Baski down-hole packer!

Photo 2: Automatic real time recording of grouting parameters are described by Bill Warfield of Atlas Copco during injection for a self drilling micro pile.

The always popular penetrability evaluation of ultrafine cement grouts into sand deposited in transparent columns was repeated. This event has been an important force in the development of ultrafine cement grouts for the solidification of sandy soils. Therein, various grout mixtures are injected into the bottom of the sand columns at a pressure of 10 psi and for a maximum time of 20 minutes. The relative penetrability is determined by the distance permeated or the time required for the grout to reach the top of the columns. Through the years, nine manufacturers of ultrafine cement from five different countries have sent their product to be evaluated. Some have actually changed their formulation when less than good performance was experienced, and these tests have been responsible for a substantial advance in this developing technology.

A variety of grout materials including cementitious, chemical solution, and resin based were mixed and handled. Influence of the latest material science and admixture technology for cementitious grouts was illustrated by the filling of eight foot tall transparent tubes to evaluate various grout stability and bleed characteristics.

The short course sponsored each year by the Colorado School of Mines is the only one of its kind anywhere in the world, and has become the place to see and be seen for those involved in grouting. Throughout the years, participants have come from virtually every major organization involved with grouting, be they government agency, designer, supplier, or contractor. They run the gamut from relative

novices to the top engineers, managers, and technicians. Many individuals have returned repeatedly so as to keep abreast of the latest developments as provided by a faculty of the world's leading practitioners.

Under leadership of Professor Scott Kieffer, P.E. C.E.G., Head of Institute and Professor of Engineering Geology, Graz University of Technology, Institute of Applied Geosciences, Austria, the primary instructors were James Warner, P.E., Consulting Engineer, who helped with the original organization of the course in 1979, is author of the Practical Handbook of Grouting and credited with development of the Compaction Grouting Process, the only major grouting technology to originate in the U.S.; Trent Dreese, P.E., V.P. Gannett Fleming, Inc., Harrisburg, PA; Paolo Gazzarrini, Sea to Sky Geotech, Vancouver BC, Canada; Donald Bruce, Ph.D. C Eng. FICE, Principal, Eco GeoSystems, Pittsburgh, PA; Joe Harris, V.P., Hayward Baker, Denver, CO; Brian Iske, President, DeNeef Construction Chemicals, Waller, Texas; and George Burke, V.P. Engineering, Hayward Baker, Odenton, MD.

Plans are already being made for the 2013 presentation which is scheduled for June 10-14, 2013. For further information, contact the course director at: kieffer@tugraz.at, or consult the course website at: http://outreach.mines.edu/cont_ed/grouting/index.html.

For grouting stories, case histories or only comments, you can write to me: Paolo Gazzarrini, fax 604-913 0106 or paolo@paologaz.com , paologaz@shaw.ca or paolo@groutline.com.

Ciao

Thirty years in print

In 1982, a need was felt for a communication vehicle linking the various disciplines within the North American geotechnical community. Expanding upon the focus of the *CGS News*, *Geotechnical News* was formed, with John Gadsby as publisher.

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Check the elevations of monitoring wells: They can change with time

Robert P. Chapuis

This paper presents an example of how monitoring well (MW) elevations can change over time. The MWs were installed in stratified sediments at Sorel, about 100 km north-east of Montreal, on the south shore of the St-Lawrence River. Polytechnique Montreal has been using the site for student field training in groundwater engineering and geophysics over the past decade. The site is part of a large wastewater treatment facility, including lagoons of 320000 m^2, which were made watertight using sand-bentonite liners. The fully fenced site is under the surveillance of wastewater operating teams. The site is located on a large floodplain at the confluence of the Richelieu and St-Lawrence Rivers.

The surface of the training site is about 150 m x 150 m, and is nearly flat. Two sides of the site have a drainage ditch, with water flowing most of the year (Fig. 1). The MW positions (one per borehole) appear in Fig. 1. The mean spacing between BHs is 30 m, except in the pumping well area where many MWs were installed close to the pumping well for measuring the groundwater drawdown in four directions.

Boreholes were advanced using a flush-joint NW casing, which was driven into the ground. The casing inside was washed using clear water and upward water flow. Soil samples were taken using a standard split spoon. The stratigraphy includes an upper part of about 5.25 m made of many layers of fine sand (deposited in low velocity water) and silty clay (deposited in ponds), and a deeper part of silty clay. A more complete description is given in Dallaire (2004).

The MWs are made of flush-joint PVC pipes, of 1.5 inch in internal diameter. Plastic slotted screens are 46-cm long, most of which were installed at depths between about 4.0 and 5.25 m, usually in a fine sand semi-confined aquifer. The annular space between the casing and the MW pipe, above the filter sand (1.0 to 1.5 m high on average), was sealed using bentonite pellets, except for its upper part, near the surface, which was filled with fine crushed rock.

A very limited budget was available for the site investigation and instrumentation. As a result, there are no security steel casings around the plastic MWs. The water table is close to, or at the ground surface at

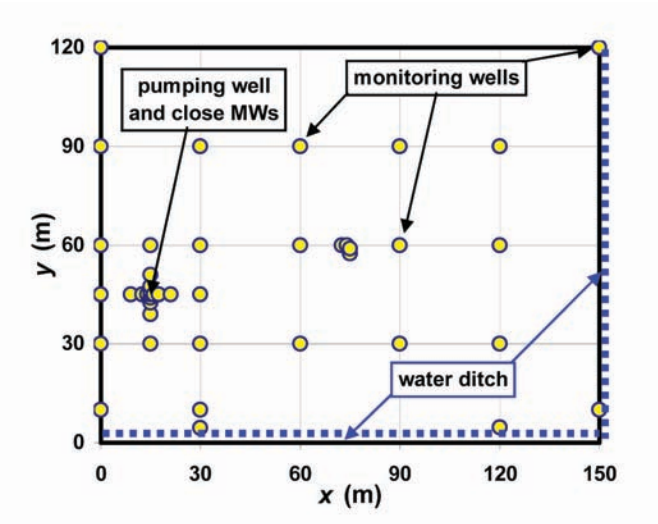

Figure 1. The Sorel experimental site.

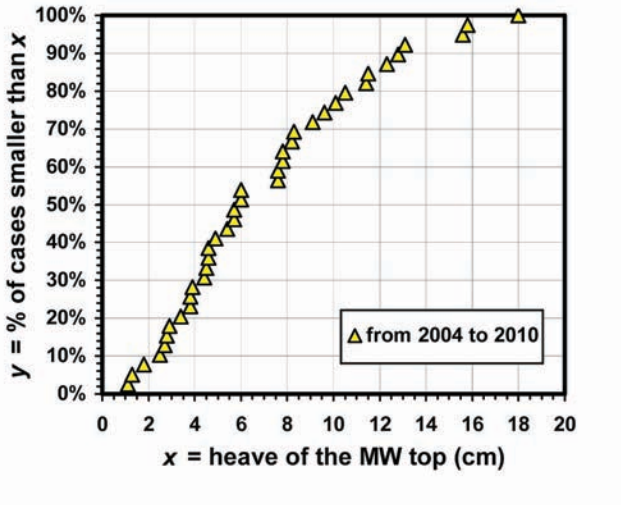

Figure 2. Measured heave for the top of monitoring wells, between 2004 and 2010.

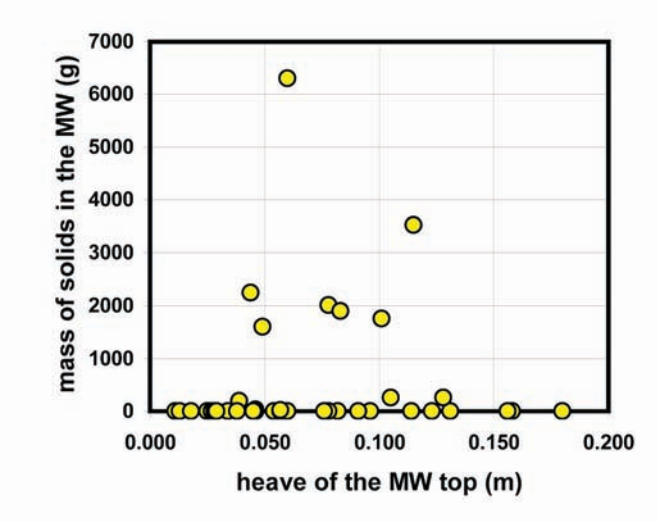

Figure 3. Correlation of MW heave to the dry mass of sediments recovered when cleaning the insides of the monitoring wells.

the end of winter, and about 1.5 m deep in summer. Frost penetration is in the 1.2-1.5 m range. Temperature measurements in the MW static water column, in early May, indicate that the soil around the MW pipe is still frozen at depths in the 0.5-1.0 m range.

For training and research activities, the elevation of the top of the MWs has been surveyed yearly using a local relative datum. However, the elevations were surveyed relative to a distant absolute reference in 2004 and 2008. In addition, almost yearly, a team of students have taken elevation surveys of the ground surface, using the local datum.

The changes in elevations between 2004 and 2010 are presented in Fig. 2. After six winters, the MWs have risen by up to 18 cm. Since the climatic and soil conditions (fine sand layered with fine silty clay layers, shallow water table) are favourable to frost heaving of the upper frozen layer, the upward expansion of freezing soil has slowly but surely jacked the MWs from the ground. During freezing, the upper part of the MW pipe is squeezed by frozen soil, and jacked upwards by swelling freezing soil underneath. The upward movement is resisted by friction forces along the unfrozen lower part of the MW casing. At the end of winter, the MW casing moves downwards, but its drop is always smaller than its winter lift.

Since the MW total heave has exceeded 10 cm for many MWs, one may wonder whether the stress condition in the MW pipes may have broken joints or separated pipe sections. Over the years 2005-2009, the insides of the MWs were cleaned yearly, but the mass of recovered sediments (usually a few grams to less than 100 g) was not measured. In 2010, the sediments were recovered when cleaning the MWs, and the dry masses were measured. Figure 3 plots the dry recovered mass versus the MW heave. It appears that 7 MWs contained between 1500 and 6200 g of solid sediments. These MWs are considered as broken: solid particles and also groundwater can enter into the MW pipe through the cracks or separations. As a result, the data obtained using these MWs were considered as unreliable for groundwater studies. However, it seems that there is no correlation between heave and pipe damage (Fig. 3) for these MWs, as assessed using the dry mass of sediments found in the MW pipe.

What are the consequences of having a broken MW due to frost jacking? First, the monitored hydraulic head is modified close to the MW, due to upper aquifer layers providing water directly into the broken MW pipe. This modification yields an incorrect seepage flow net, if the data of the damaged MW are used. As a result, the hydraulic gradient and the groundwater velocity are also incorrectly evaluated. Second, the MW cracks or separation may bring some contaminated water from shallow depths directly into the MW pipe. For example, if an upper unconfined aquifer has been polluted, the polluted water can easily reach the broken MWs and pollute deeper water around the MW screen, which was installed to monitor a lower confined aquifer. Being unaware of a broken MW may yield the incorrect conclusion that the confined aquifer is polluted, whereas the pollution may exist only around the damaged MWs and their screens.

To conclude this short paper, considering the importance of frost heave and resulting damage to a MW pipe, it is important to regularly check monitoring well elevations, which may fluctuate throughout the year. Elevations are usually higher in winter than in summer, but usually do not return to their previous positions, of exactly one year before: as a result, on average, the elevations can raise over years.

Acknowledgments

The author thanks the Régie de l'eau de Sorel-Tracy and Aquatech, for their authorization to use the Sorel site.

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Influence of element size in numerical studies of seepage: Unsaturated zones, steady-state

Robert P. Chapuis

Between the water table and the ground surface, there is an unsaturated zone. Here, the hydraulic conductivity K can vary by several orders of magnitude over a small suction range, and thus over short vertical distances. When using a numerical code, small elements are needed to accurately model groundwater seepage and contaminant migration. This paper examines the influence of element size on the numerical solution for a simple example under steady-state conditions. It suggests a rule-of-thumb to select the size or height of finite elements.

Background

A first companion paper (Chapuis 2010) explained what happens with large meshes and large elements, especially when trying to study a regional groundwater problem. A second companion paper (Chapuis 2012) provided basic rules for assessing the influence of small details especially in engineering projects This paper is the third of a series dealing with the influence of element size.

The example in this paper is that of a vertical column under steady-state conditions. This is a 1D (one-dimensional) problem, which can be solved using a variety of numerical codes, but only those solving the complete conservation equation (Richards 1931), and not a simplified or modified equation. However, each code has its own ways of treating the Darcy and conservation equations, to select element sizes and time steps, using more or less automatic procedures. These internal features of each numerical code are not discussed hereafter. The results of this paper were obtained using the finite element code Seep/W (Geo-slope 2003, 2007), which was shown to give reliable results when correctly used (Chapuis et al. 2001). Similar results can be obtained using any code, although built-in specific procedures of a code may obscure our understanding of convergence and oscillation issues for unsaturated seepage.

The exact numerical study of unsaturated seepage is more difficult than that of saturated seepage. This happens because seepage equations involve the volumetric water content $\theta(u)$ and unsaturated hydraulic conductivity $K(u)$ versus pore water pressure u, which are described by highly non-linear functions. Of course, a few numerical codes still make simplifications, and either use constants for these functions, or strongly linearized equations for highly non-linear physical phenomena that require highly non-linear equations for their correct description. To obtain correct solutions (e.g., Chapuis and Dénes 2008; Chapuis et al. 2005), the mesh must be refined vertically in the vadose zone to avoid convergence problems and to overcome the difficulties associated

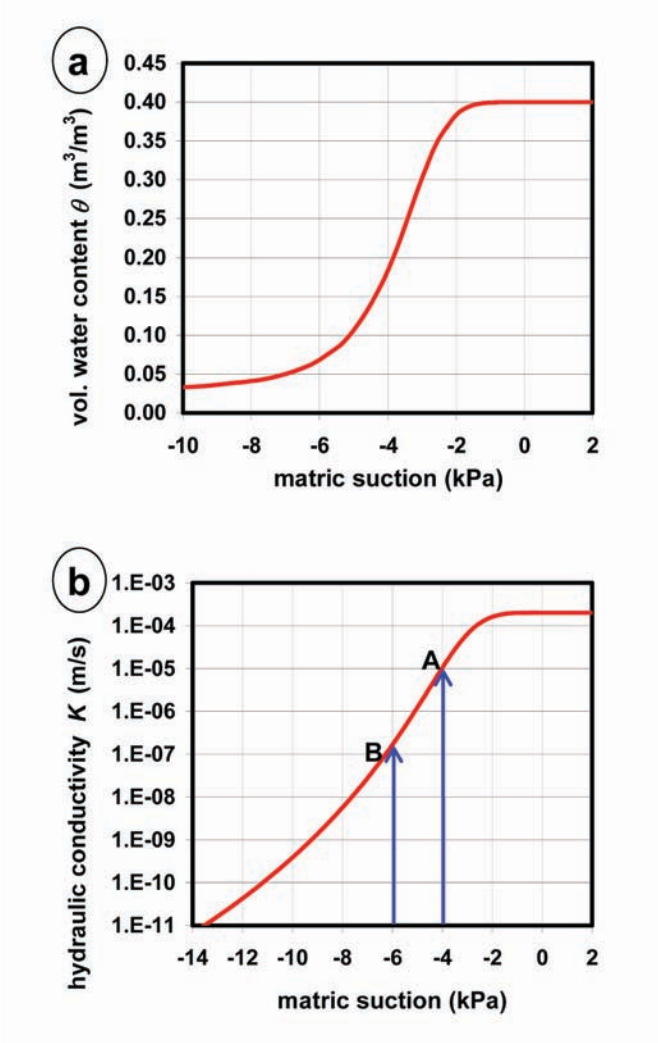

Figure 1. Unsaturated functions for volumetric water content θ and hydraulic conductivity K. These functions are used in the 1D column example.

with the non-linearity of the equations and hydraulic parameters.

Start with the mesh refinement

When using any code for unsaturated seepage, the first step is to reduce the element size to avoid potential numerical oscillations, and ease the convergence process. This is verified using steady-state (time independent) conditions. The second step is to reduce the time step to ensure proper convergence towards the correct solution, and not towards an incorrect solution.

This paper examines only the first step, reducing the mesh size for steady-state conditions.

Any seepage problem usually has a saturated domain and an unsaturated domain. The meshing rules of previous companion papers (Chapuis 2010, 2012) can be used for the saturated domain, which helps to avoid poor numerical results (Chapuis and Chenaf 2010). For the unsaturated domain, a simple meshing rule can be obtained by observing the graphs of $\theta(u)$ and $K(u)$. In the example of this paper, a single soil will be used with the functions of Fig.1. Consider two points A and B in the steepest zone of the $K(u)$ graph (Fig. 1b): for a suction (u) drop of 2 kPa, from -4 to -6 kPa, the K value drops from 10^{-5} to 10^{-7} m/s. Consider now a no-flow condition in a vertical column: the hydraulic head (or total head) is constant. A suction change of 2 kPa occurs for an elevation change of about 20 cm. The data of Fig. 1b thus indicate that the K value may change by two orders of magnitude over a vertical distance of 20 cm. In numerical calculations, the code will have to select some mean K value within each finite element. If the finite elements are 20 cm high, the mean K value has to be selected by the code within a range of two orders of magnitude: there will be tendencies for overshooting or undershooting, and thus numerical convergence issues. If the elements are 10 cm high, the mean K value for each element has to be selected over a range of one order of magnitude: there will be fewer numerical issues.

As a rule of thumb for meshing unsaturated zones, we suggest to restrict the element height to the value giving a maximum change of one order of magnitude for K under a no-flow condition. This corresponds to elements 10-cm high for our example (Fig. 1).

This rule of thumb produces adequate initial meshes for engineering problems, for example assessing the unsaturated drainage conditions in highway foundations. However, it may yield very large meshes for regional groundwater problems. For example, if the water table in an aquifer has a yearly fluctuation of 2 m around a mean position at a depth of 3 m, there will be a 5 m (3+2) deep vadose zone in which the water content θ and the hydraulic conductivity K will vary with time. In aquifer soils K typically varies by 4 or 6 orders of magnitude in the vadose zone. It would be incorrect to numerically treat a 5 m high vadose zone with five rows of 1 m high elements. The mesh must be refined with elements about 10 cm high (or smaller) for the vertical distance along which K has large variations, which can be known by examining the K(u) graph. This means using 30 to 60 more layers of elements for the vadose zone, which may double or triple the total number of elements in the mesh, as compared to using 1 m high elements in the vadose zone. As a result, the computing time to reach a certain convergence criterion may be multiplied by a factor of about 5 to 20. If the computing time was 36 hours with the

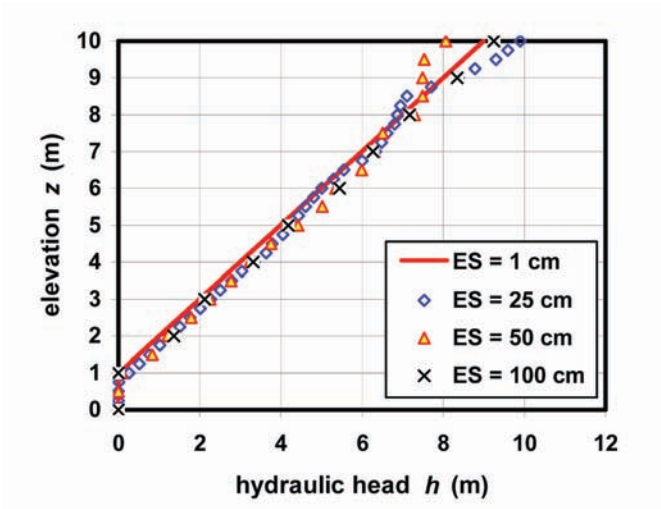

Figure 2. Numerical results for uniform meshes: Note the numerical oscillations of hydraulic head h versus elevation z.

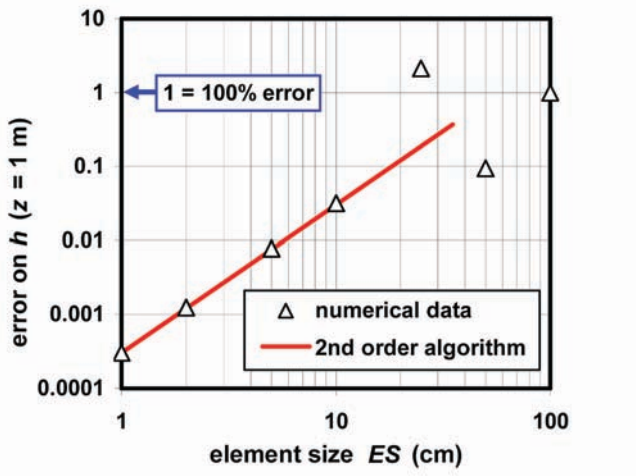

Figure 3. Example of results for uniform meshes: The numerical error on h (z = 1m) is random (oscillating) for large elements, and diminishes when the element size is decreased.

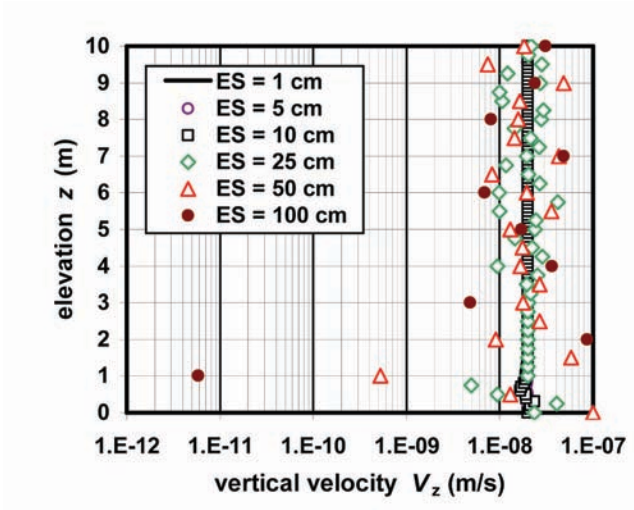

Figure 4. The element size has a large influence on V_z. However, the problem definition implies that in the real solution V_z is constant.

initial mesh of the regional study, it will increase to 7.5 to 30 days, which may be impractical. This explains why numerical studies of regional seepage may yield poor solutions, especially for unconfined aquifers (Chapuis 2010).

Example and numerical results

Our example here is that of a 10 m high vertical column. This is a 1D (one-dimensional) steady-state problem. The boundary conditions (BCs) are as follows: the BC at z = 0 m is h = 0 m; the BC at z = 10 m is a Darcy velocity of 2 x 10^{-8} m/s (imposed flow rate); the side of the column is impervious.

Eight meshes with a single element height were used to study how the element size influences the numerical solution: the element sizes are 100, 50, 25, 10, 5, 2, 1, and 0.1 cm.

A few numerical results are given in Figures 2-6. It is observed first that coarse meshes provide a poor evaluation of h versus elevation z (Fig. 2), with numerical oscillations around the correct h value obtained using 1cm (or less) high elements.

The numerical error on a single h value, for example h (z = 1 m), is about 200% with elements of 25 cm; it becomes less than 3% when the element size is smaller than 10 cm. Other error values (larger or smaller) can be found for the h value at other elevations z. For larger elements, the error is random or oscillating. For smaller elements, the error smoothly follows the characteristics of the interpolation scheme (Fig. 3). When the algorithms used in a code are known, the errors and convergence characteristics of the finite element equations can be studied mathematically. This is, however, outside the scope of this short paper.

The element size influences the numerically calculated vertical velocity, V_z, which involves the local gradient (dh/dz) and the local unsaturated K value. However, the problem definition implies mathematically that V_z has a constant value in the column. The numerical solutions have large fluctuations for element sizes between 100 and 25 cm, and small fluctuations of about ± 15% at the bottom of the column for a 10-cm element size (Fig. 4). The previously proposed rule-of-thumb – restrict the element height to the value giving a maximum change of one order of magnitude for K in a no-

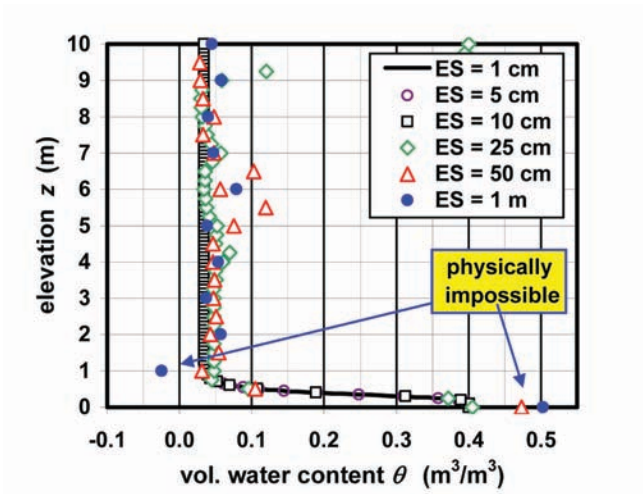

Figure 5. Solutions having converged numerically: The values for θ oscillate when large elements are used, and can take physically impossible values, either negative or higher than the value at saturation.

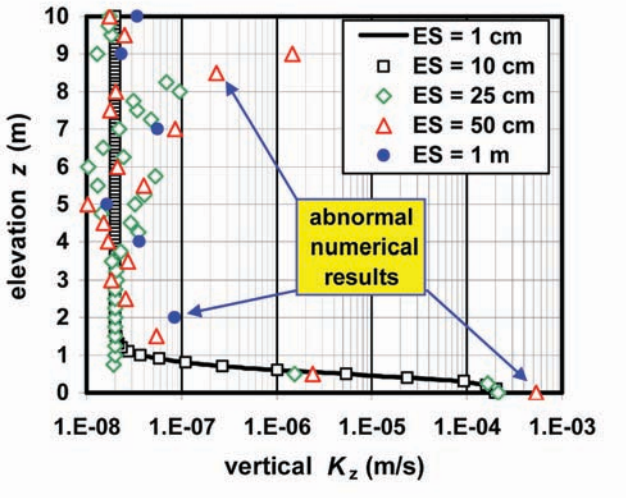

Figure 6. Solutions having converged numerically: The values for K oscillate when large elements are used, and can take a value higher than the saturated one.

flow condition – yielded elements no more than 10-cm high for our example (Fig. 1). Therefore, the proposed rule-of-thumb worked fairly well for the example.

Finally, we observe that the θ and K functions, those which were input functions for the code, are not respected by the final numerical solutions (once the code has met the criteria for numerical convergence) for elements between 100 and 10 cm (Figs. 5 and 6). This illustrates that the code numerical convergence does not mean convergence towards the physically correct solution.

Conclusion

This paper has examined a simple 1D case of a vertical column in steady state, using uniform meshes, the only variable being the element size or height. The code took a few hundred steps to converge numerically. The numerical convergence criterion was a relative error on the modulus of the pore pressure vector below 10^{-6}. The numerical convergence is much slower than for saturated problems, due to the highly non-linear equations for unsaturated conditions.

Different numerical solutions were obtained, one for each element size. In short, the finer the mesh, the more correct the solution. However, this does not mean that we should finely discretize any problem. A few basic principles should be observed. They are provided hereafter.

First, we must have a preliminary idea of how the hydraulic head varies within our study domain. For a first appraisal we can use a coarse mesh, which will give us a first rough solution. We must examine this first solution and find out the zones with high variations of h, θ, and K. These zones are those where our mesh must be refined. For a second appraisal, we can use finer meshes in the zones of high variations. For unsaturated zones, a rule-of-thumb is to restrict the element height to the value giving a maximum change of one order of magnitude for K in a no-flow condition. When examining the second solution we may find that some local refinements are still needed. Once we are satisfied with the last refinement and believe that further refinement would add nothing, we should not be satisfied with our belief, but prove it. We can prepare a verification mesh in which all elements are half the dimension of what was thought to be the last mesh. The verification mesh should give the same results (heads, gradients, velocities, flow rates, etc.) as our last mesh. If this is the case, then we have proved that we had designed and retained the correct mesh. Note that the computing time for the verification mesh will be about four to nine times longer than the time for our final and correct mesh. Thus, we will avoid using the verification mesh for transient problems (the verification could last many hours) but use it first for faster-to-solve steady-state problems.

Once this choice of mesh has been proven to be adequate for steady-state condition, it can then be used in transient conditions for which the time increments must then be selected to ensure proper convergence at each time.

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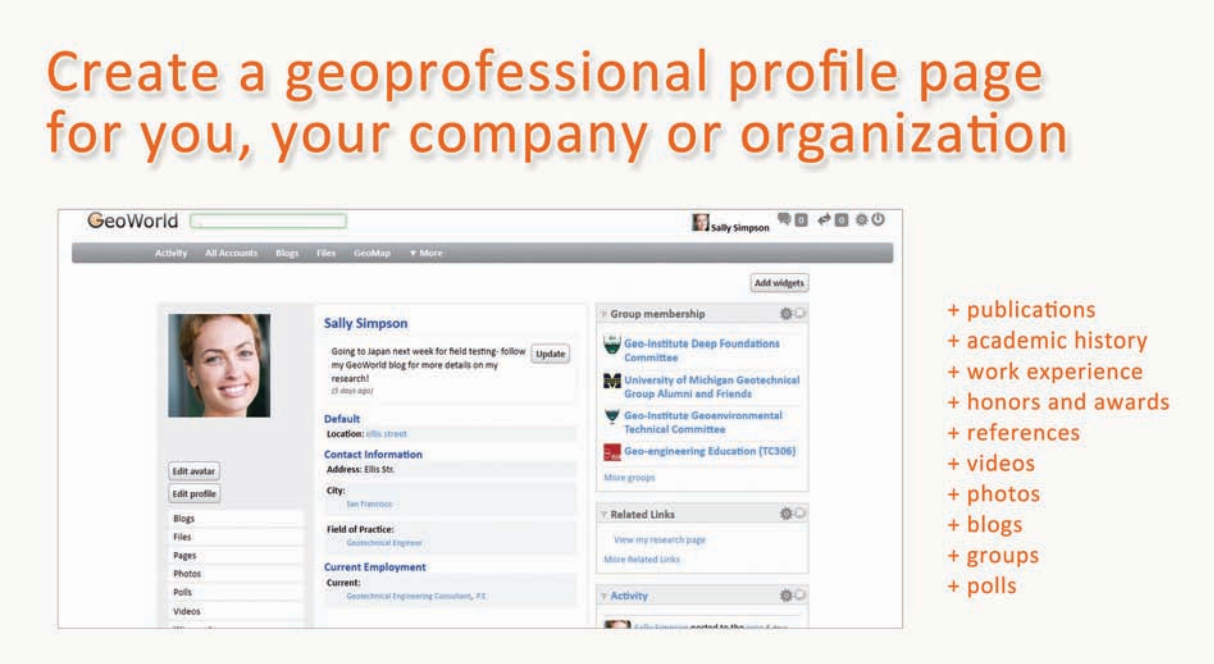

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New meshing algorithm

Alfredo Arenas

Introduction

Three dimensional advanced numerical analyses are becoming more common in daily engineering practice. The first step in a 3D numerical analysis is to set up the mesh, thus closely representing the physical problem. This is not always an easy task and frequently requires the help of meshing tools. There are many meshing tools capable of creating advanced models, but most of them lack of important features essential for static and dynamic analysis.

The present article presents the development of a meshing tool that overcomes many of these limitations.

The limitations of currently readily available meshing tools summarized below.

- They are sold separately from the main core software. Although, they are a powerful and flexible platform for creating models, they can cost as much as US $12,000.
- They are complex to use and may require several steps to create the mesh.
- They produce non-structured meshes. Several programs use tetrahedral elements because they can be adapted to various shapes by adjusting the orientation and size of the element, but at the cost of producing chaotic unstructured meshes. This often leads to having very small elements at places were the geometry is complex and tight.
- They do not use transitioning schemes. The majority of these programs when creating structured meshes, use a constant number of elements in the elevation direction, thus when the meshing process reaches a convex shape, a concentration of elements is inevitable.
- They avoid the use of wedged-type elements, because they are hard to incorporate in the model, but a wedge-type form is necessary, for example in the case of the toe of an embankment dam.
- They use non-balanced meshes. Most of the time the creation of un-structured meshes produce unbalanced meshes, i.e. a very small ratio of the smallest element volume to the largest element volume in the mesh, thus leading to a large computing time.
- They require large computer processing time. Many algorithms take hours in developing the 3D mesh, making them impracticable when comparing different geometric shapes.

In the light of these limitations, it was decided to develop a meshing tool that would be easy to use, creates semi-structured meshes, includes transitioning schemes, uses wedge shapes, produces balanced meshes and requires short processing time.

Initial definitions

A careful selection of the base element is required to create a meshing tool capable of reproducing complex geometries such as irregular surface topography. The element has to allow mobility in the model space and be oriented in any direction. The most common and basic shapes are the triangle, square and rectangle. Of these, the triangle is the most flexible (adaptable). The triangle can perfectly match all of the three corners to an irregular surface without altering the face planarity and it can be extruded to form a triangular prism.

The 3D meshing tools

An extruded triangle was selected to form the basic element for the new 3D meshing tool. Two extruded triangles can be arranged in a cubical shape, as shown in Figure 1a. Note that the basic element corners can be vertically positioned at different elevations, as shown in Figure 1b. In addition, pyramid (Figure 1c) and tetrahedral (Figure 1d) elements can be used for transition schemes; they are minimally

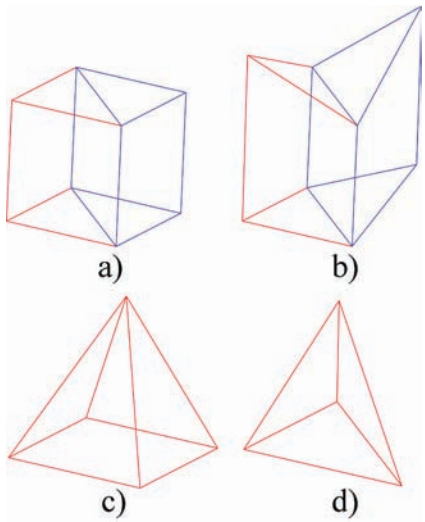

Figure 1. Base elements for meshing tool.

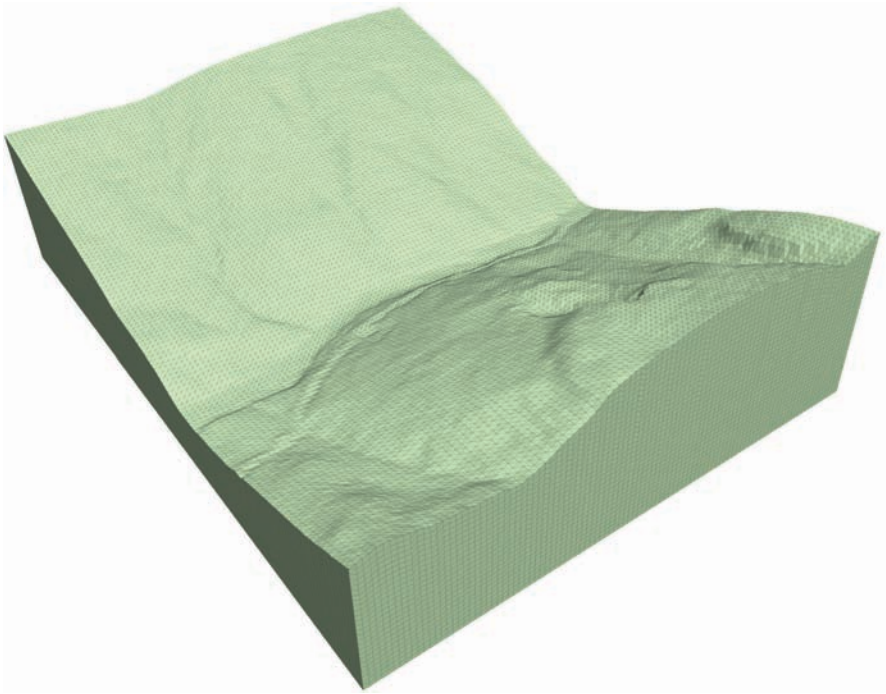

Figure 2. Valley mesh.

used in the entire mesh, only between 5 – 10%.

By joining and stacking these elements a complex topographic form can be constructed.

The use of the extruded triangle and arrangement in a semi-structured manner ensures creates a well balanced mesh.

The steps for developing 3D meshes are:

1. Create a 2D triangular mesh using as a guide the contour plan of the study area;
2. Assign an elevation to each triangle corner. The mesh file created in Step 1 can be cross referenced with the CAD topography to provide the elevation at each triangle corner; and
3. Use one of the meshing tools to form the 3D model to the depth required for the analytical study.

Meshing example

To illustrate the power of the meshing tools a 3D mesh will be developed for a cross-valley mine-waste dam using Flac3D. Initially a starter dam will be constructed in the valley and the dam is then raised in stages to accommodate the production of the mine tailings.

Figure 2 shows the valley model with the main features, such as creeks, scarped areas and a road on the right side of the valley. The meshing tools produced the 590 000 elements shown in Figure 2, in only 5 minutes of computer processing time.

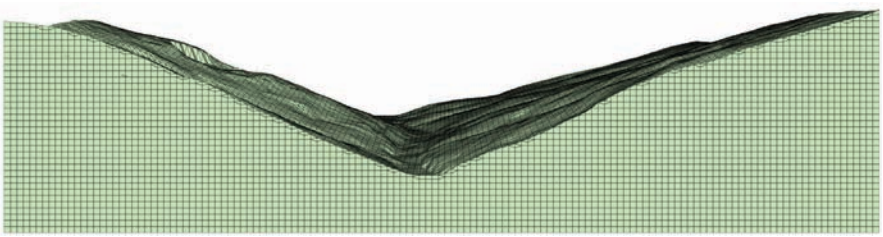

Figure 3. Valley side view.

Figure 3, a side view of the valley, demonstrates two important characteristics of the meshing tool.

- the number of elements at the higher elevations of the topography is greater that the number of elements at the bottom of the valley. The algorithm reduces the number of elements as it moves to lower elevations; and
- the elements are kept about the same size across the model, thus producing balanced meshes.

This last point becomes is very important when performing dynamic analyses.

Once the topography surface has been developed the dam is inserted onto the topographic form.

Figure 4 shows the Starter Dam - it has a height of 38 m, a crest width of 10 m with upstream and downstream slope of 2:1.

Figure 5 shows the final configuration for the dam, it has a total height of 90 m, a crest width of 15 m, and the same slope configuration as in the coffer-dam.

Figure 6 shows a cut section of the model through the dam downstream toe. Each layer in the starter dam (as well as in the mine-waste dam) is horizontal, thus by individually activating them allows for construction simulation. In addition, this figure shows two different stages of the dam construction. The user can use as many stages as necessary to simulate raising of the dam.

Integrating these structures into the model is automatic and seamless. The meshing tool takes care of this process by updating the connectivity, selecting the appropriate element at transitions, and merging the repeated nodes and faces.

Finally, it is very easy to insert the mine-waste dam into a model. The user only has to input 5 geometric parameters; the crest location, eleva-

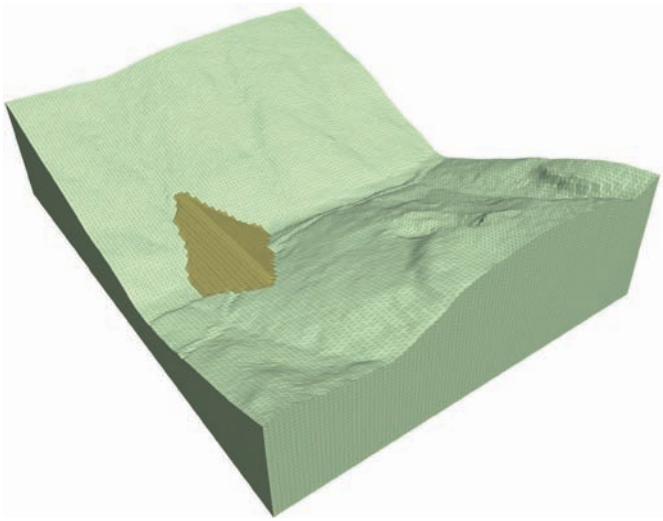

Figure 4. Starter dam.

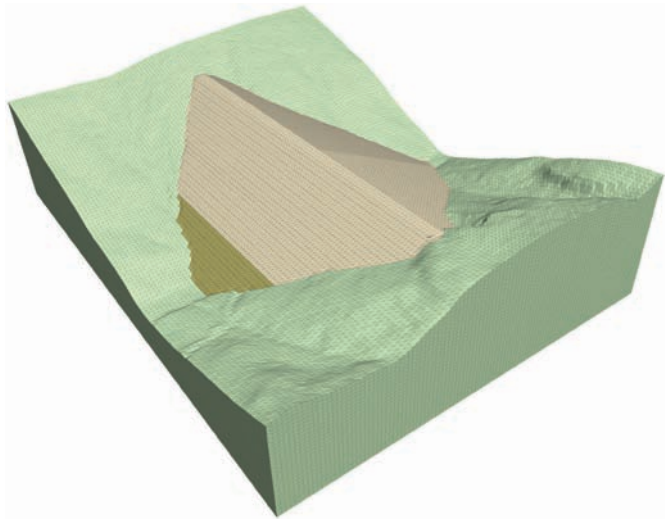

Figure 5. Final stage – showing the starter dam and final dam.

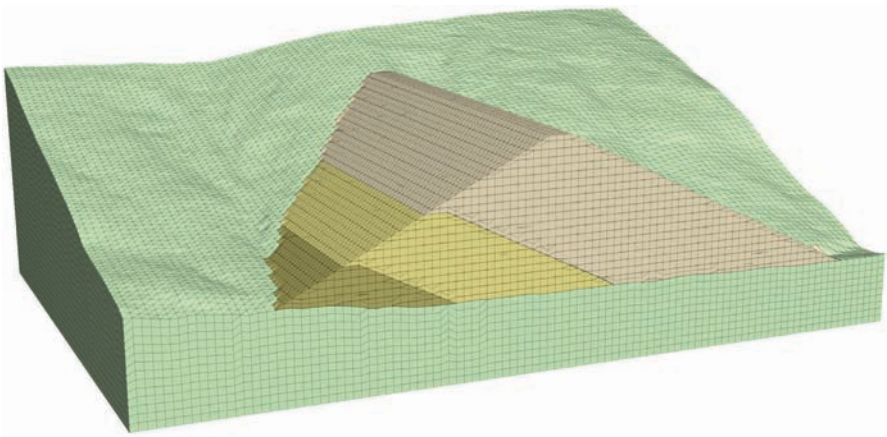

Figure 6. Cross section through downstream sand dam toe.

tion and width; and upstream and downstream slopes.

Applications

This meshing tool has been successfully applied to generate 3D meshes in preparation for 3D analyses. During the static and dynamic analyses the generated meshes have proved to be stable and well balanced, improving convergence time.

Some of the meshes generated so far include tunnels, natural slopes with several stratums, excavations, dams, waste deposits and MSE walls.

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SHORT COURSES

Geotechnical Instrumentation for Field Measurements Cocoa Beach, Florida April 7-9, 2013

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

The course will include planning monitoring programs, hardware and software, recent developments such as web-based monitoring and wireless monitoring, remote methods for monitoring deformation, case histories, and lessons learned. Online sources will be included, together with an open forum for questions and discussion

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

www.conferences.dce.ufl.edu/geotech

MILESTONES

Douglas Baker joins RST Instruments

Douglas G. Baker, P.Geo., has recently joined RST Instruments Ltd. as a Technical Specialist. Doug graduated with a B.Sc. in Geology, from the University of British Columbia. He brings 35 years of practical hands-on experience in geotechnical investigations, instrumentation design, geotechnics, field performance monitoring, project management and construction from his prior position with British Columbia Hydro Engineering. In his new role at RST, Doug will be closely involved within our technical design and sales team as we work toward providing our clients with practical advice and innovative instrumentation solutions to civil and geotechnical challenges.For more information visit: *www.rstinstruments.com*

MARKETPLACE

New accessory for Cross Hole Sonic Logging makes testing more comfortable

Cross Hole Sonic Logging (CSL) is one of the most popular testing methods to evaluate integrity of drilled shafts. It involves inserting probes – two at a time – in tubes built into the shafts especially for the test. The probes, on spooled cables, are lowered to the bottom of the shafts and pulled back up. As they travel along the shaft, one of the probes emits a sonic wave, and the receiver probe picks it up after it travels through the concrete. The intensity and time of arrival of the wave at the receiver probe is indicative of concrete quality. The test is typically performed in shafts with at least 4 access tubes, but sometimes as many as 10. Test procedures require filling the tubes with water, and testing all possible paths between tubes. Remember your combinatorial analysis and you'll figure out that those probes will be pulled many times (15 for a shaft with 6 tubes). Even rugged field engineers wearing water resistant gloves become quite uncomfortable after pulling the wet cables by hand a few times.

Pile Dynamics Inc has solved this problem by designing a Motorized Probe Deployment System (Automated Reels) that works with its CSL testing equipment, the Cross Hole Analyzer.

In addition to sparing the testing engineer from constantly handling wet and often cold cables, the Motorized Probe Deployment System keeps the cables neatly organized on the spool, and allows the tester to gather information at a consistent speed (this reduces the possibility of missed data points due to too fast a pull). The system is powered by either an 8 hour duration battery or by an external 12 V power source.

In addition to the Cross Hole Analyzer and its Motorized Probe Deployment System, Pile Dynamics produces several other quality assurance and quality control products for the deep foundations industry. Its products are recognized throughout the world as the ultimate solutions for testing and monitoring of deep foundations. The company is based in Cleveland OH and has commercial representatives worldwide. For more information visit *www.pile.com.*

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