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Volume 31 • Number 4 • December 2013

# GEOTECHNICAL news

## A Reusable Instrumented Test Pile

# innovation

DIGITAL MEMS INCLINOMETER SYSTEM

## in MEMS Digital Inclinometer Systems

## How the best just got better.

For measuring any lateral movement down in the earth, via inclinometer casing, the Digital MEMS Inclinometer System from RST Instruments Ltd. was the first, and is still the best, Digital MEMS Inclinometer System available.

Over the last 10 years, RST's Inclinometer systems have had the shortest overall length available for a given base length compared to competitive inclinometers. Undaunted, we've forged ahead and improved on our very own industry-leading specifications. With a new minimum negotiable casing radius of 1.93 m, RST's Digital MEMS Inclinometer can still traverse a smaller radius bend than all other inclinometers available in the industry.

Above, the RST Digital MEMS Inclinometer Probe with industry leading system accuracy of ±2 mm per 25 m, shown connected to the cable. Below, the Ultra-Rugged Field PC functions as the data collector. It provides a high-level user interface, "at-the-borehole" data analysis and graphical comparison to previous data sets.

### OTHER INCLINOMETERS VS. RST

**Other Inclinometers** → ← **RST Inclinometer**

### Interference

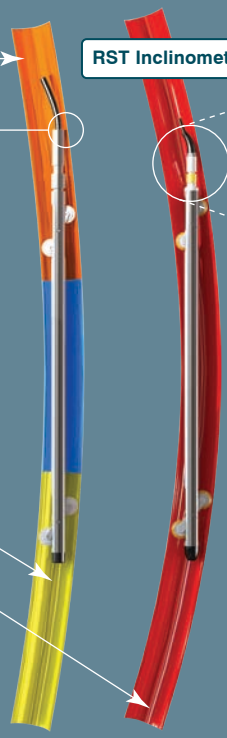
Interference at connector is visibly inherent in other inclinometers (left) while RST's Digital MEMS Inclinometer (right) can clearly traverse a smaller radius bend (1.93 m) than all other inclinometers.

### Minimum Negotiable Casing Radius

***Other Inclinometers:***
**3.12 m**

***RST Inclinometer:***
**1.93 m**

0.5 m wheelbase probes shown in 70 mm OD inclinometer casing.



RST's newly developed connector is by far the industry leader for the least amount of connector interference.

RST also provides the most robust cable on the market with a breaking strength of 2.67 kN (600 lbs.) Also, our new, non-slip, swaged cable marks are unmatched in grip strength.

The compact reel system with 50 m cable weighs a very manageable 4.7 kg and can be easily held with one hand. A padded carrying case is included.

MEMS TILT & INCLINATION SERIES


### SYSTEM INCLUDES:

MEMS Digital Inclinometer probe, cable system, reel with battery power, and an Ultra-Rugged Field PC that functions as a wireless readout, analysis, and data storage device. Includes all accessories, as shown at left. Please contact the RST sales team for complete details.

inclinalysis™
digital inclinometer analysis software

RST Inclinalysis™ Software is a powerful companion to the RST Digital MEMS Inclinometer System. It allows the user to quickly and efficiently reduce large volumes of inclinometer data into a variety of formats suitable for analysis and presentation.

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innovation in geotechnical instrumentation

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# $5.5 Billion Panama Canal Project Relied on Bentley Geotechnical Software

## To Access Integrated Subsurface Data for Intelligent Decision Making

Panama Canal Widening Project

When the cost of dredging 20 million cubic meters is calculated on type and volume of materials – and on whether it is above or below sea level – you need accuracy you can rely on. The $5.5 billion Panama Canal widening project consists of more than 10 different types of material and methods of removal. Jan De Nul used Bentley's geotechnical software to store and analyze geological data and used our road design software to build 3D models of the material profiles that were also used for machine control.

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## Model GK-405 Vibrating Wire Readout


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*Geokon Vibrating Wire Load Cell*

**The rugged Model GK-405 can be used with all Geokon vibrating wire sensors, in all kinds of weather conditions:**

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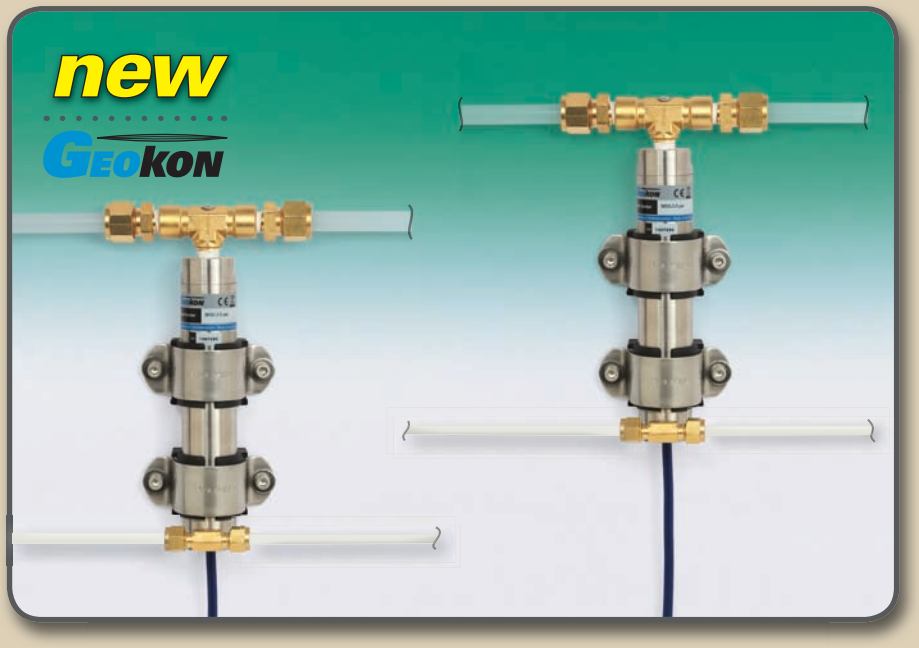
- Real-time datalogging
- Two modes of data acquisition
- Data and configuration storage on internal 4 GB Solid State Drive
- Rechargeable Li-ion battery
- Cold weather operation

For more information, please visit:
**www.geokon.com/GK-405**

# 34 YEARS OF INNOVATION AND QUALITY
## In Geotechnical Instrumentation

## Multipoint Settlement Systems




**Geokon Model 3650-2 and 4650-2** are Multipoint Settlement Systems comprised of a series of sensitive Semiconductor Pressure Transducers or Vibrating Wire Pressure Transducers connected together with a special Nylon tube filled with de-aired water or, where necessary, de-aired water and anitfreeze. The string of sensors are connected to a common reservior with a large liquid capacity.

Ideal for the measurement of differential settlements in:

- Tunnels
- Bridges
- Excavations
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- Compensation grouting

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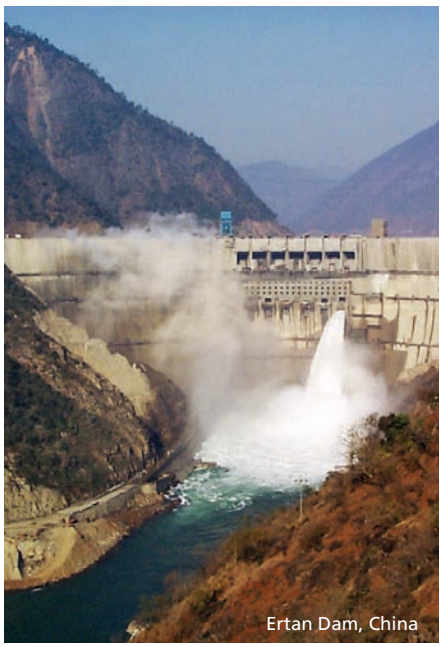
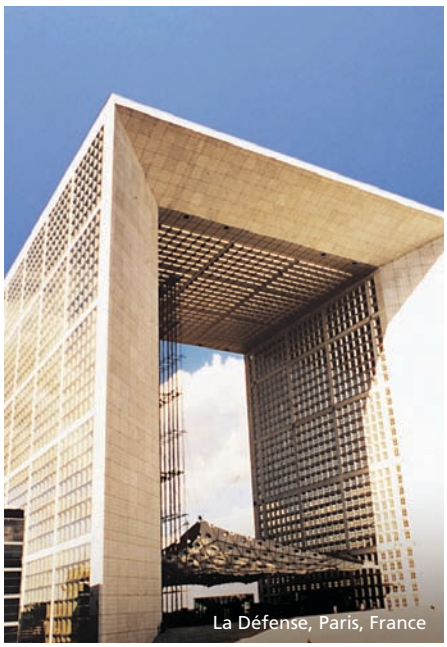
# Leader in Geotechnical & Structural Monitoring

Esplanade Riel, Winnipeg, Canada (courtesy of GPP architecture)



Ertan Dam, China



La Défense, Paris, France

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NOVA METRIX

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# New From SLOPE INDICATOR


## Digitilt AT Inclinometer System

- Bluetooth©
- Hands Free
- Solo Operation
- Simple User Interface

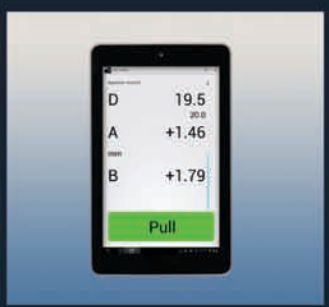
The Digitilt AT system leverages advances in sensor technology and mobile computing to bring simplicity to inclinometer survey operations. The MEMS-Based AT probe provides a rapid settling time. The light-weight control cable is easy to read and easy to carry. The optional fully-ruggedized Android© readout via Bluetooth© provides a large, bright display and intuitive touch interface. A convenient hands-free mode records readings when you pull the cable. High resolution plots are one tap away, and a second tap sends survey data to the office by email or Dropbox©.


**Cable**

Lightweight control cable has 5 x more labels for easy reading.

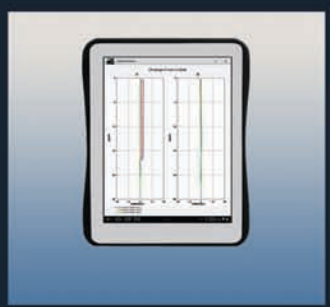
**Compact Cable Gate**

Compact cable gate aligns cable at top of casing and makes depth control




**Nexus© tablet**

Convenient hands-free mode records readings when you pull the cable.



**Panasonic© tablet**

Fully-ruggedized Android© tablet provides high-resolution plots and full internet connectivity.

**Durham Geo Slope Indicator**
Tel: **425-493-6200 / 866-916-0541**
Web: **www.slopeindicator.com**

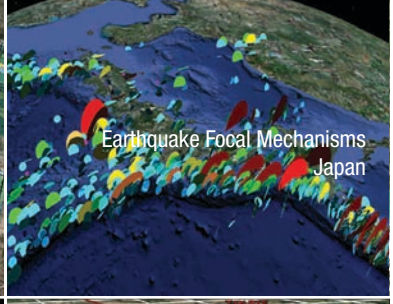


NOVA METRIX

# CONTENTS

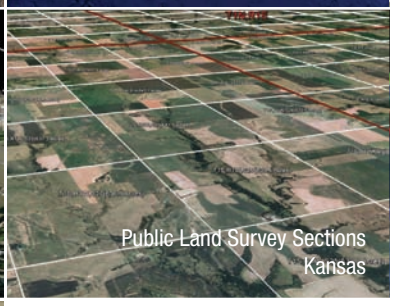


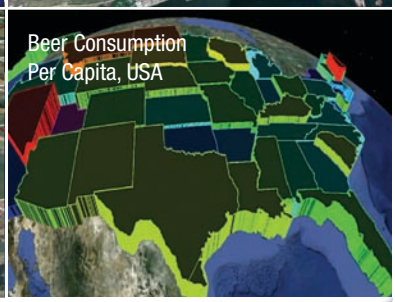
*Cover* Image of dynamic installation of Reusable Test Pile at Oakland, CA test site using the Becker drill rig. (Photo by Jason DeJong).







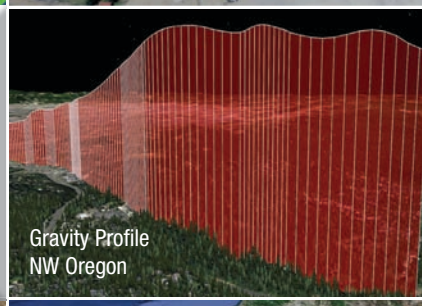



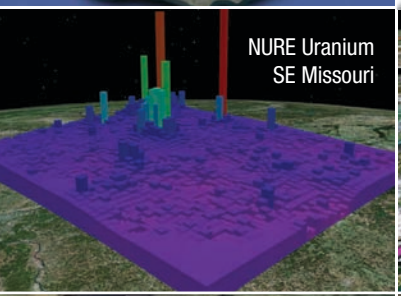


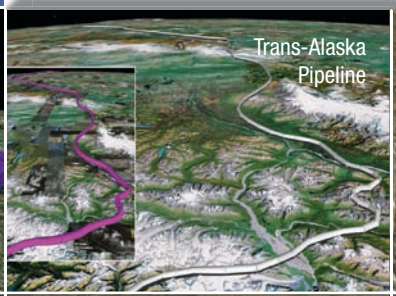

**RockWorks16 EarthApps**

# FREE

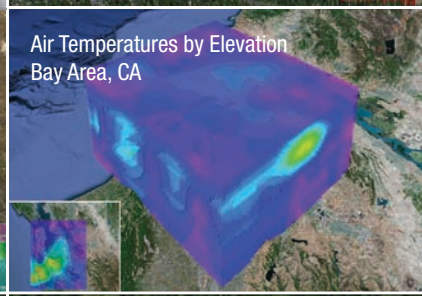
The RockWorks16 EarthApps is a **FREE** collection of over 70 programs for plotting your data within Google Earth. It does **NOT** require any other software (other than Google Earth). It's **FREE**. Really.

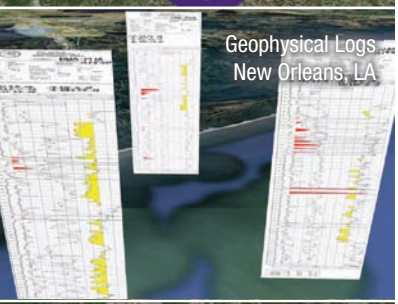


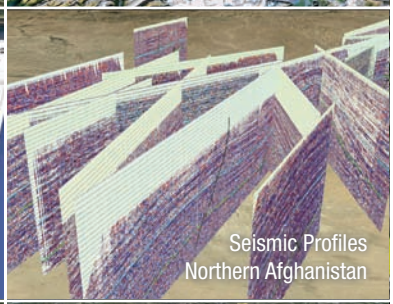



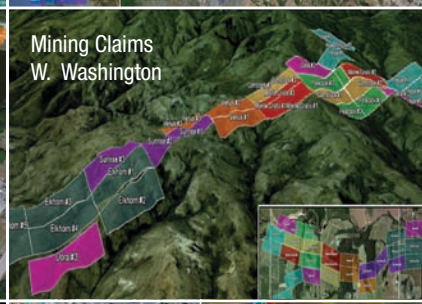


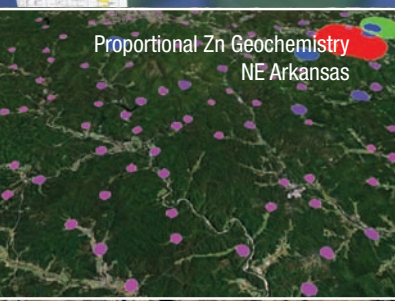


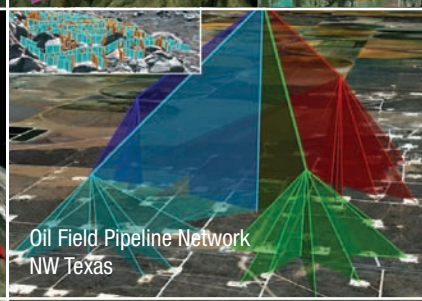



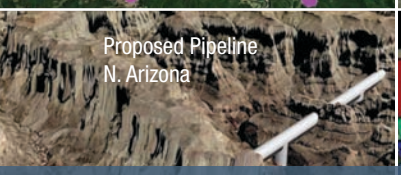




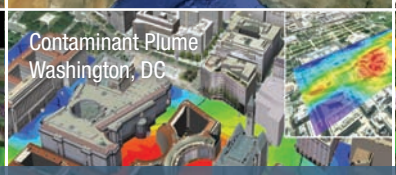



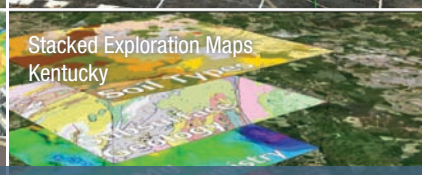




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## Message from the President

*Richard J. Bathurst, President of Canadian Geotechnical Society*

Much has happened since my last message published in the September issue of Geotechnical News. In September I had the pleasure of attending the Council Meeting of the **International Society of Soil Mechanics and Geotechnical Engineering** in Paris as the CGS representative. At that meeting, **Roger Frank** from France was elected as the new President of the ISSMGE and we wish him the very best over the next four years. He has inherited from immediate past-President **Jean-Loius Briaud** and his team, a vibrant and healthy society. At the same meeting, Seoul Korea was voted to be the host country for the **19th International Conference on Soil Mechanics and Geotechnical Engineering in 2017**. In addition, the next **Pan-American ISSMGE conference** will be held in Buenos Aires, Argentina in 2015. During the ISSMGE council meeting, the activities of the 88 constituent member societies were summarized and I was proud to observe that the Canadian Geotechnical Society is one of the most active despite the larger memberships of some other countries. I was delighted to see that the ISSMGE has taken ownership of the **International Journal of Geotechnical Case Histories,** which is free and contains extended case studies with an online repository of project data that enhances the value of the reported case studies. This is a valuable resource for both academics and practitioners. The Society also includes a total of 32 **Technical Committees** of which four are led by CGS members (**TC103 Numerical Meth-**

# innovation

## in geotechnical readouts + data loggers

### Digital Tilt Logger
***Data Logger and Tilt Meter***

A data logger and tilt meter in a single, compact unit that measures tilt in either one or two perpendicular axes in the plane of the base.

### DT2040
***Data Logger***

Designed for reliable, unattended monitoring of up to 40 sensors which may be any mix of vibrating wire sensors and thermistors.

### MTCM
***Graphing Logger***

Reads, displays, logs and graphs mine tunnel convergence from instruments based on linear potentiometers.

### Carlson MA7
***Resistance Strain Gauge Readout***

The intended readout for all Carlson Instruments.

### VW2106
***Vibrating Wire Readout***

Reads, displays, and logs both vibrating wire sensors and thermistors. Vibrating wire load cells can also be read without additional accessories.

### IR420
***4-20 mA Transmitter Readout***

Reads, displays, logs and powers 4-20 mA transmitters.

### TH2016B
***Thermistor Readout***

Reads, displays, and logs up to 16 thermistor string points at the push of a button.

### QB120
***Resistance Strain Gauge Readout***

The intended readout for TENSMEG - Tension Measuring Gauges.

### LP100
***Linear Potentiometer Readout***

Reads, displays, and logs linear potentiometers.

### SG350
***Bridge Transducer Readout***

Reads, displays, and logs bridge transducers.

### IR5000
***Voltage Transducer Readout***

Reads, displays and logs DC voltage transducers.

### VW2110
***Vibrating Wire Readout Calibrator***

Provides a means of independently checking vibrating wire readouts and loggers.

designed to your exact specifications | **READY TO RUN**

**flexDAQ** DATALOGGERS

pre-assembled
pre-wired
pre-tested
pre-programmed

RST's flexDAQ Data Loggers allow for custom data logger systems that can be designed for almost any project requirement. Shown here is an Instrument House with a mounted RST flexDAQ Data Logger and solar panel.

RST Instruments Ltd. offers many types of readouts and data loggers which are used to collect data from sensors in dams, tunnels, bridges, mines, natural slopes and other geotechnical applications. Most sensor types and gauges can be read: vibrating wire, thermistor, TENSMEG, linear potentiometer, strain gauge and MEMS. For readouts and flexDAQ Data Loggers offering manual monitoring or remote data acquisition configurations with alarm triggering, contact RST for more information.

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**ods in Geomechanics** - vice-chair **Richard Wan; TC104 - Physical Modelling in Geotechnics** – vice-chair **Andy Take; TC208 Slope Stability in Engineering Practice** - chair **Jonathan Fannin; TC 307 -Sustainability in Geotechnical Engineering** – chair **Dipanjan Basu**). In my previous message, I gave details of the ISSMGE awards received by three of our younger members **Greg Siemens** (RMC), **Nicholas Beier** (University of Alberta) and **Vincent Goreham** (Dalhousie University). Congratulations again and please read their report on the conference, included below. I invite all our members to visit the ISSMGE website at *www.issmge.org* to read about current and upcoming activities of our international mother society.

The annual CGS board meeting was held in Montreal on September 28th, immediately before the **66th Annual CGS Conference** (GeoMontreal). Some highlights of the board meeting was the welcome news that the Society now has 1238 active members of which 95 are student members and that the annual membership fees will remain unchanged from last year. To further encourage student participation in our Society, CGS members at the annual business luncheon approved a board motion to give each student who registered for the GeoMontreal conference a free student membership for 2014. CGS members also voted to accept the proposal by the Vancouver Geotechnical Society to host the **69th Annual CGS Conference** in Vancouver in 2016. This is most appropriate since this will mark 10 years since our annual conference was last held in Vancouver. Finally, at the request of the **Hydrogeology Division**, a motion was passed to change the name of the division to the **Groundwater Division (Division des eaux souterraines)** to better reflect the scope and interests of the division members. The **2013 CGS Annual Report** will be made available on the CGS website (*www.cgs.ca)* at the end of the calendar year.

Of course, the most important news to report is the hugely successful **66th Canadian Geotechnical Conference** (GeoMontreal), held at the Hilton Bonaventure Hotel in beautiful downtown Montreal. The conference attracted over 875 delegates and 57 exhibitors. A total of 348 oral presentations were assigned to 7 parallel sessions over three days. Another 30 papers were delivered in a poster session. The technical program was very broad as a result of our partnership with the **North American Geosynthetics Society (NAGS) and the International Association of Hydrogeologists – Canadian National Chapter (IAH-CNC)**. The conference co-chairs **Mario Ruel** and **Sylvain Roy**, along with the conference management team led by **Wayne Gibson** and **Lisa McJunkin** must be commended for putting this conference together. Many thanks also to **Victor Sowa** (CGS Secretary General) who worked tirelessly to ensure that all CGS events were well-scripted and occurred on time, and to **Catherine Mulligan**, our VP Communications, who somehow found time in her busy schedule to be chair of the conference Technical Committee.

The first plenary session of the conference was the **CGS Hardy Address** by **Michel Aubertin** of École Polytechnique on the topic of *Self-Weight Consolidation Problems Related to Surface and Underground Disposal of Fine-Grained Mine Wastes*. The **2013 CGS Colloquium** was given by **Paul Simms** of Carleton University on *Geotechnical and Geoenvironmental Behaviour of High Density Tailings.* **Scott McDougall** of BGC Engineering was announced as the **2014 CGS Colloquium** winner and will give his talk next year in Regina at the **67th Canadian Geotechnical Conference**.

CGS awards were given to some of our outstanding members at the conference Awards Banquet. The most senior award of the CGS is the **R.F. Legget Medal**. The 2013 Legget Medal was given to **Serge Leroueil** from the University of Laval. His colleague, **Jean-Marie Konrad** introduced Serge with the recognition of Serge's "outstanding contribution to the development of theoretical and applied techniques related to various geotechnical issues particularly those related to the behavior of soft soils, compacted soils, dams and slopes." The complete text of Serge's introduction and acceptance speech are included below. Congratulations to Serge.

The winners of the **2013 R.M. Quigley Award** for the best paper published in the Canadian Geotechnical Journal in 2012 were **Gang Zheng, Si Yuan Peng, Charles W.W. Ng and Yu Diao** for their paper *Excavation Effects on Pile Behavior and Capacity.* The **Schuster Medal**, which is a joint award of the CGS and the Association of Engineering and Environmental Geologists, was presented to **Jacques Locat** of Laval. The **Robert N. Farvolden Award**, which is a joint award of the (IAH-CNC) and the CGS, was won by **Richard Jackson**. Other important awards given out were the **John A. Franklin Award** to **Erik Eberhardt** of UBC, the **Thomas Roy Award** to **Jean Hutchinson** of Queen's University and the **G. Geoffrey Meyerhof Award** to **Jean Lafleur** of École Polytechnique.

Jean Lafleur was also the team leader for the French translation of the **4th Canadian Foundation Engineering Manual** (CFEM), which became officially available at the conference. The **A.G. Stermac Award** for distinguished service to the CGS was presented to the members of his editorial team: **Paul Chiasson** and **Michel Massiéra** of Moncton University, **Denis Leboeuf, Muhsin-Elie Rahhal** and **Jean-Marie Konrad**, all from Laval University.

Younger members of our geotechnical fraternity were also recognized. The Best Graduate Student Paper Presentation was given by **Ryley Beddoe** of Queen's University on *Physical*


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*Modeling of Rainfall Induced Landslides*. Her presentation followed the CGS Colloquium speaker on the last morning session of the conference. The **Best Undergraduate Student Report** winners were **Steven Harms** of the University of Manitoba in the individual submission category and **Gary Cui, Jessica Galavan, Duncan Leung** and **Matthew Lloyd** of Queen's University in the group submission category. Congratulations to all the winners identified above. Finally, I am pleased to announce that the **2013 Canadian Foundation for Geotechnique National Graduate Scholarship** winner was **Bryan Tatone** of the University of Toronto.

A summary of all Award winners and recognitions that were made during the CGS events at GeoMontreal can be found later in this section of the Canadian Geotechnical Society News.

The CGS annual conference was followed immediately by the **4th Canadian Young Geotechnical Engineers and Geoscientists Conference** in Mount Tremblant. I was delighted to take part in the conference tour of the Beauharnois Generating Station and associated geotechnical works prior to departing to Mount Tremblant. There were a total of 30 delegates, all under 35 years of age. The organizing committee led by **Ariane Locat** (Laval) and **Matt Perras** (Queen's), kindly allowed me to present a keynote address on *The Canadian Geotechnical Society, Past, Present and Future*. This gave me the opportunity to not only talk about our Society that was formed in 1972, but also to link the Society and some of its famous members to important accomplishment in Canadian geotechnique. **Angela Küpper** (CGS VP Technical), **Lukas Arenson** (Chair CGS Cold Regions Division), **André Rancourt** (VP at Hydrosys). and **Jocelyn Grozic** (University of Calgary) also gave keynote talks that described their careers in industry, academia and lessons learned. The young delegates also provided useful feedback on how to better engage our young student members before and after graduation.

Other notable events at this conference included a presentation celebrating the 50th anniversary of the **Canadian Geotechnical Journal** by the current and past-editors of the Journal, **Ian Moore** and **Dennis Becker.** I also had the pleasure of reminding the CGS audience that our Journal is highly regarded internationally and is routinely placed in the top tier of peer-reviewed "geo-journals" by journal ranking agencies.

In addition to the annual meetings of the CGS Divisions and Committees, two ad-hoc meetings were held. The first was a meeting chaired by myself with members of the CGS Executive, past editors of the 4th CFEM and other interested persons present. We discussed ideas regarding the scope, objectives and delivery of the next 5th CFEM. The group agreed that an electronic survey will be sent to all CGS members to gather their ideas on this very important update of the CFEM.

The second meeting was chaired by our VP Technical, **Angela Küpper**. It was focused on future programs to raise the visibility of the Society and to better engage our young members. A starting point for this discussion was the **2011 CGS Membership Committee Task Force Report** which can be found on the CGS website. Angela presented a number of ideas including grants from the CGS to get more students to our annual conference, a student/CGS member mentoring program at our annual conference, and funding for a program to place academics with consultants so that case history data that is located in the vaults of many consulting firms can be released to young academics who can use the data to support practical research projects. Angela will be reporting on progress

on these initiatives in 2014.

In closing, the CGS has had a very active 2013 and the future appears just as exciting. I wish all our members the very best for 2014.

*Provided by Richard Bathurst – President*

## Message du président

Il s'est passé bien des choses depuis mon dernier message publié dans le numéro de septembre de Geotechnical News! En septembre, j'ai eu le plaisir d'assister à la réunion du Conseil de la **Société internationale de mécanique des sols et de géotechnique (SIMSG)** à Paris, à titre de représentant de la SCG. Lors de cette réunion, le nouveau président de la SIMSG a été élu. Il s'agit du Français **Roger Frank**, à qui nous souhaitons la meilleure des chances au cours des quatre prochaines années. Il prend la relève du président sortant **Jean-Louis Briaud** et de son équipe, qui lui ont légué une société dynamique et florissante. Lors de cette réunion, la Corée (Séoul) a été sélectionnée par vote pour être le pays d'accueil de la **19e conférence internationale sur la mécanique des sols et la géotechnique**, en 2017. De plus, la prochaine **conférence panaméricaine de la SIMSG** aura lieu à Buenos Aires (Argentine), en 2015. Durant la réunion du Conseil de la SIMSG, on a résumé les activités des 88 sociétés qui en sont membres. Avec fierté, j'ai observé que la Société canadienne de géotechnique est l'une des plus actives, malgré le fait que des sociétés d'autres pays comptent un nombre de membres bien plus élevé. J'ai été ravi d'apprendre que la SIMSG a obtenu les droits sur l'**International Journal of Geotechnical Case Histories**. Cette revue gratuite présente des études de cas exhaustives et est dotée d'un service en ligne qui archive les données des projets, ce qui augmente davantage la valeur des études de cas présentées. Cela en fait une ressource valable tant pour les universitaires que les praticiens. La SIMSG comprend aussi un total de 32 **comités techniques** dont quatre sont dirigés par des membres de la SCG (**TC103 Numerical Methods in Geomechanics**, dont le vice-président est **Richard Wan; TC104 Physical Modelling in Geotechnics**, dont le vice-président est **Andy Take; TC208 Slope Stability in Engineering Practice**, dont le président est **Jonathan Fannin; TC 307 -Sustainability in Geotechnical Engineering,** dont le président est **Dipanjan Basu**). Dans mon message précédent, j'avais indiqué que trois de nos jeunes membres avaient remporté des prix de la SIMSG, soit **Greg Siemens** (Collège militaire royal), **Nicholas Beier** (Université de l'Alberta) et **Vincent Goreham** (Université Dalhousie). Félicitons-les

à nouveau et prenons la peine de lire leur rapport sur la conférence, qui se trouve en annexe. Pour être au fait des activités actuelles et à venir de notre société mère internationale, j'invite tous nos membres à visiter le site de la SIMSG, à *www.issmge.org*.

La réunion annuelle du conseil d'administration de la SCG a eu lieu le 28 septembre à Montréal, immédiatement après la **66e conférence annuelle de la SCG** (GéoMontréal). Parmi les faits saillants de la réunion du CA, il convient de mentionner deux bonnes nouvelles : la Société compte désormais 1238 membres actifs, dont 95 sont des étudiants, et les frais d'adhésion annuels ne changeront pas par rapport à l'année dernière. Pour stimuler la participation des étudiants à notre Société, les membres de la SCG ont approuvé, lors du dîner d'affaires annuel, une résolution du CA proposant d'accorder une adhésion gratuite pour l'année 2014 à chaque étudiant qui s'était inscrit à la conférence GéoMontréal. Les membres de la SCG ont également adopté par vote la proposition que la Société de géotechnique de Vancouver accueille la **69e conférence annuelle de la SCG**, à Vancouver en 2016. Cette décision est des plus appropriées, puisque 2016 correspondra à la dixième année depuis la dernière fois que notre conférence annuelle a eu lieu à Vancouver. Enfin, à la demande de la **Division de l'hydrogéologie,** on a adopté une résolution pour en changer le nom. Elle devient donc la **Division des eaux souterraines (Groundwater Division)**, pour mieux refléter les activités et les intérêts des membres de la division. Le **rapport annuel 2013 de la SCG** sera affiché dans le site Web de la SCG (*www.cgs.ca*) à la fin de l'année civile.

Bien entendu, la nouvelle la plus importante est l'immense succès qu'a remporté la **66e conférence annuelle canadienne de géotechnique** (GéoMontréal), qui a eu lieu à l'hôtel Hilton Bonaventure, dans le superbe centre-ville de Montréal. La conférence a attiré plus de 875 délégués ainsi que 57 exposants. En tout, 348 présentations orales ont été réparties en sept thématiques parallèles, échelonnées sur trois jours. De plus, 30 autres articles ont été présentés lors d'une séance d'affiches. En raison de notre partenariat avec la **North American Geosynthetics Society (NAGS)** et l'**Association internationale des hydrogéologues - Section nationale canadienne (AIH-SNC)**, le programme technique était très vaste. Les coprésidents de la conférence, **Mario Ruel** et **Sylvain Roy**, de même que l'équipe de gestion de la conférence, dirigée par **Wayne Gibson** et **Lisa McJunkin**, méritent tous nos éloges. Nous remercions aussi **Victor Sowa** (secrétaire général de la SCG) qui s'est inlassablement assuré que les événements de la SCG soient bien structurés et aient lieu à temps, ainsi que **Catherine Mulligan**, notre vice-présidente des communications, qui est parvenue à présider le Comité technique de la conférence en dépit de son horaire chargé.

La première séance plénière a commencé par la **Conférence R.M. Hardy de la SCG**, donnée par **Michel Aubertin** de l'École Polytechnique. Elle s'intitulait *Problèmes de consolidation sous leur poids propre de rejets miniers à grains fins entreposés en surface ou sous terre.* La conférence du **Colloque 2013 de la SCG** a été prononcée par **Paul Simms** de l'Université Carleton et s'intitulait *Comportement géotechnique et géoenvironnemental des résidus miniers à forte densité*. Le conférencier retenu pour le **Colloque 2014 de la SCG** est **Scott McDougall,** de BGC Engineering. Il présentera sa conférence à Regina, lors de la **67e conférence canadienne de géotechnique**.

Lors du banquet de remise des prix, les prix de la SCG ont été décernés à certains membres exceptionnels. Le

prix le plus prestigieux de la SCG est la **Médaille R.F. Legget.** La médaille 2013 a été décernée à **Serge Leroueil**, de l'Université Laval. C'est son collègue **Jean-Marie Konrad** qui a présenté Serge, soulignant sa « contribution exceptionnelle au développement des techniques théoriques et appliquées relatives à divers problèmes géotechniques, dont ceux tout particulièrement liés au comportement des sols mous, des sols compacts, des barrages et des pentes ». Les versions intégrales du texte présentant Serge et son discours d'acceptation se trouvent en annexe. Félicitations à Serge.

Les gagnants du Prix **R.M. Quigley de 2013**, qui souligne le meilleur article publié dans la *Revue canadienne de géotechnique* durant l'année 2012 étaient **Gang Zheng, Si Yuan Peng, Charles W.W. Ng** et **Yu Diao**. Leur article s'intitulait « Excavation Effects on Pile Behavior and Capacity » et traitait des effets des excavations sur le comportement et la capacité des pieux. La **Médaille Schuster**, un prix conjoint de la SCG et de l'Association of Engineering and Environmental Geologists, a été présentée à **Jacques Locat**, de l'Université Laval. Le **Prix Robert N. Farvolden**, un prix conjoint de l'Association internationale des hydrogéologues (AIH-SNC), a été remporté par **Richard Jackson.** Parmi les autres prix importants qui ont été décernés, il convient de mentionner le **Prix John A. Franklin,** remis à **Erik Eberhardt** de l'Université de la Colombie-Britannique, le **Prix Thomas Roy**, attribué à **Jean Hutchinson** de l'Université Queen's, et le **Prix G. Geoffrey Meyerhof**, présenté à **Jean Lafleur** de l'École Polytechnique.

Jean Lafleur dirigeait aussi l'équipe responsable de la traduction française de la quatrième édition du Canadian Foundation Engineering Manual (CFEM). Le **Manuel canadien d'ingénierie des fondations (MCIF)** a été officiellement lancé durant la conférence. Le **Prix A.G. Stermac**, qui souligne les services remarquables des membres à l'égard de la Société, a été présenté aux membres de son équipe de traduction. Les lauréats sont **Paul Chiasson** et **Michel Massiéra**, de l'Université de Moncton, **Denis Lebœuf, Muhsin-Elie Rahha**l et **Jean-Marie Konrad**, de l'Université Laval.

Les jeunes membres de notre fraternité géotechnique ont également été honorés. Le **Prix de la SCG pour étudiant diplômé** a été décerné à **Ryley Beddoe** de l'Université Queen's. Son article portait sur la modélisation physique des glissements de terrain provoqués par la pluie (*Physical Modeling of Rainfall Induced Landslides)*. Elle a présenté son article à la suite de

la conférence du Colloque de la SCG, durant la dernière session matinale de la conférence. Les gagnants du **Prix de la SCG pour étudi**ants du premier cycle étaient **Steven Harms**, de l'Université du Manitoba (prix individuel) et **Gary Cui, Jessica Galavan, Duncan Leung** et **Matthew Lloyd**, de l'Université Queen's (prix collectif). Nous félicitons tous les gagnants. Enfin, le récipiendaire de la **Bourse nationale pour études supérieures 2013 de la Fondation géotechnique canadienne** était **Bryan Tatone**, de l'Université de Toronto.

Le résumé des gagnants de tous les prix et distinctions qui ont été décernés durant les événements de la SCG pendant la conférence GéoMontréal se trouve plus loin dans cette section des actualités de la Société canadienne de géotechnique.

La conférence annuelle de la SCG a été immédiatement suivie de la **4e conférence canadienne des jeunes géotechniciens et géoscientifiques** (ou cYGEGC), à Mont-Tremblant. J'ai tout particulièrement apprécié la visite guidée de la centrale hydroélectrique de Beauharnois, qui permettait de connaître les travaux géotechniques qui lui ont été associés. La visite avait lieu avant le départ pour Mont-Tremblant. Les 30 délégués de cette conférence étaient tous âgés de moins de 35 ans. Le comité organisateur, qui était dirigé par **Ariane Locat** (Laval) et **Matt Perras** (Queen's), m'a aimablement permis de présenter un exposé sur le passé, le présent et l'avenir de la Société canadienne de géotechnique. Cela m'a donné non seulement donné l'occasion de parler de notre Société, dont la fondation remonte à 1972, mais aussi d'établir des liens entre diverses réalisations importantes du domaine géotechnique canadien et notre Société et certains de ses membres célèbres. **Angela Küpper** (vice-présidente technique de la SCG), **Lukas Arenson** (président de la Division de la géotechnique des régions froides), **André Rancourt** (vice-président à Hydrosys) et **Jocelyn Grozic** (Université de Calgary) ont également présenté des conférences décrivant leurs carrières dans l'industrie ou le milieu universitaire, et les leçons qu'ils en ont tirées. Les jeunes délégués nous ont également donné des pistes utiles pour susciter une plus grande participation de nos jeunes membres étudiants, pendant leurs études de premier cycle et après l'obtention de leur diplôme.

L'un des autres événements remarquables de cette conférence était la présentation du 50e anniversaire de la **Revue canadienne de géotechnique** par **Ian Moore**, rédacteur en chef actuel, et **Dennis Becker**, ancien rédacteur en chef. J'ai aussi eu le plaisir de rappeler aux membres de la SCG que notre revue jouit d'une excellente réputation internationale et figure systématiquement au palmarès des « géorevues » compilés par les organismes de classement des revues savantes à comité de lecture.

En plus des réunions annuelles des divisions et des comités de la SCG, deux réunions ponctuelles ont eu lieu. Je présidais la première de ces réunions, à laquelle participaient des membres de l'exécutif de la SCG, les rédacteurs précédents de la 4e édition du CFEM et d'autres personnes intéressées. Nous avons échangé des idées sur la portée, les objectifs et la réalisation d'une 5e édition. Le groupe a convenu d'envoyer un sondage électronique à tous les membres de la SCG pour obtenir leurs idées sur cette mise à jour très importante du CFEM.

La deuxième réunion était présidée par **Angela Küpper,** notre vice-présidente technique. Elle portait sur de futurs programmes visant à augmenter la visibilité de la Société et la participation de nos jeunes membres. Le **rapport du Groupe de travail spécial sur les adhésions (2011),** qu'on peut consulter dans le site Web de la SCG, a servi de point de départ à cette discussion. Angela a présenté de nombreuses idées, notamment des subventions qu'accorderait la SCG pour permettre à davantage d'étudiants de participer à notre conférence annuelle, un programme de mentorat étudiant/membre de la SCG lors de la conférence annuelle, et le financement d'un programme de placement d'universitaires dans des cabinets d'experts-conseils pour que les données historiques d'études de cas archivées dans plusieurs de ces cabinets puissent être mises à la disposition de jeunes universitaires, qui pourraient les utiliser dans le cadre

de projets de recherche appliquée. Angela rendra compte des progrès de ces diverses initiatives en 2014.

En guise de conclusion, je souligne que la SCG a connu une année 2013 fort bien remplie et que la prochaine promet de l'être tout autant. Meilleurs vœux à tous nos membres pour l'année 2014.

*Del la part de Richard Bathurst - président*

### 2014 President-Elect - Douglas F. VanDine, CGS President for 2015-2016

In accordance with the By-Laws of the Society, a Nominating Committee was formed to propose a suitable candidate for the President-Elect. The nominating committee consisted of **Bryan Watts** (Chair), **Dennis Becker** (Past-President), **Heinrich Heinz** and **Michel Aubertin** (general members of CGS).

The Nominating Committee proposed the name of **Mr. Douglas F. VanDine, P.Eng., PGeo**., to the members of the CGS as a candidate for the position of President-Elect in 2014, and the President in 2015 and 2016. Mr. VanDine agreed to let his name stand as a candidate to serve in this position.

The CGS membership was given the opportunity to propose other candidates for President-Elect, but no other nominations were received by the required deadline of June 15, 2013.

At the Annual CGS Board Meeting held on September 29, 2013 in Montreal, the Board of Directors unanimously acclaimed Douglas F. VanDine as President-Elect in 2014 and President, 2015-2016.

## From the Society

### Canadian Geotechnical Society Awards and Honours for 2013

**R.F. Legget Award** - Serge Leroueil.

**R.M. Quigley Award** - Gang Zheng, Si Yuan Peng, Charles W.W. Ng and Yu Diao. "Excavation Effects on Pile Behaviour and Capacity", *Canadian Geotechnical Journal* (Vol.49, No.12): 1347-1356.

**Honourable Mentions**
R. Kerry Rowe, Melissa Chappel, Richard Brachman and Andy Take. "Field Study of Wrinkles in a Geomembrane at a Composite Liner Test Site", *Canadian Geotechnical Journal* (Vol.49 No.10): 1196-1211.

R. Kerry Rowe "Short- and Long-term Leakage Through Composite Liners", The 7th Arthur Casagrande Lecture, *Canadian Geotechnical Journal* (Vol. 49, No. 2): 141-169.

**G. Geoffrey Meyerhof Award**
Jean Lafleur. Professor, École Polytechnique de Montréal.

**Thomas Roy Award**
D. Jean Hutchinson. Professor, Queens University.

**Roger J. E. Brown Award**
Not scheduled for 2013.

**John A. Franklin Award**
Erik Eberhardt. Professor, University of British Columbia.

**Geoenvironmental Award**
Not scheduled for 2013.

**Geosynthetics Award**
Not scheduled for 2013.

**Robert N. Farvolden Award**
Richard E. Jackson. Principal, Geofirma Engineering Ltd. **(Joint award with IAH-CNC).**

**Graduate Student Paper Award**

**1st Prize**: Ryley Beddoe. "Physical Modeling of Rainfall Induced Landslides". Department of Civil Engineering, Queen's University; Advisor, Dr. Andy Take.

**2nd Prize:** M. Meckkey El Sharnouby. "Monotonic and Cyclic Behaviour

of Steel Fiber Reinforced Helical Pulldown Micropiles"; Civil and Environmental Engineering, University of Western Ontario; Advisor, Dr. Hesham El Naggar.

### Undergraduate Student Report (Individual)

**1st Prize:** Steven Harms. "Large Scale Field Testing and Evaluation of Temporary Flood Protection Products"; Department of Civil Engineering, University of Manitoba; Advisor, Dr. James Blatz.

2nd Prize: Dale Brunton. "Characterizing the Instability Line of Silica Sand as a Potential Landslide Triggering Mechanism"; Department of Civil Engineering, Queen's University; Advisor, Dr. Andy Take and Dr. Greg Siemens.

### Undergraduate Student Report (Group)

**1st Prize:** Gary Cui, Jessica Galavan, Duncan Leung and Matthew Lloyd. "Holmestrand Underground Rail Cavern"; Geological Sciences and Geological Engineering, Queen's University; Advisor, Dr. Mark Diederichs.

**2nd Prize:** Jenna Bowling, Ryun Humenjuk, Crystal Lei, Adam Woods and Xiao Qin Yang "Foundation and West approach Embankment Design"; Earth, Ocean and Atmospheric Sciences, University of British Columbia; Advisor, Susan W. Hollingshead.

**Canadian Foundation for Geotechnique National Graduate Scholarship**
Bryan A. S. Tatone, University of Toronto.

### A.G. Stermac Awards

Paul Chiasson - Université de Moncton.

Michel Massiéra - Université de Moncton.

Denis LeBoeuf - Université Laval.

Muhsin-Elie Rahhal - Université Laval.

Jean-Marie Konrad - Université Laval.

**CGS R.M. Hardy Keynote Address**
Michel Aubertin, Ecole Polytechnique.

**Canadian Geotechnical Colloquium**
Paul Simms, Carleton University.

**Cross Canada Lecture Tours**
Bob Cameron (Spring 2013), Ed Kavazanjian (Fall 2013).

### Awards from the Engineering Institute of Canada (EIC)

**Julian C. Smith Medal**
Peter K. Kaiser.

**John B. Stirling Medal**
Ian D. Moore.

**Fellowship of the Institute (FEIC)**
Iain G. Bruce.

**Fellowship of the Institute (FEIC)**
Robert J. Fannin.

**Fellowship of the Institute (FEIC)**
Denis LeBoeuf.

## CGS Certificates of Appreciation

The following individuals were awarded Certificates of Appreciation for their valued contributions to the CGS.

**2013 Retiring Canadian Geotechnical Society Directors and Chairs**

Lukas Arenson – Chair, Cold Regions Geotechnology Division

R. Kerry Rowe – Chair, Geosynthetics Division

Chris Neville – Chair, Hydrogeology Division

Jean Côté - Chair, Geotechnical Research Board

Bipul Hawlader – Chair, Soil Mechanics and Foundations Division

Paul Lach – Geotechnical Society of Edmonton

Shahid Azam - Regina Geotechnical Group

Kelly Pardoski – Saskatoon Geotechnical Group

Nelson Ferreira – Winnipeg Geotechnical Section

Martin Burger – Kingston Group

Tommi J. Leinala – Sudbury Group

Anthony Urquhart – Nova Scotia Chapter

Greg Siemens – Education Committee

Kent Bannister – Professional Practice Committee

**2013 Retiring Associate Editors – Canadian Geotechnical Journal**

Dave Chan

Oldrich Hungr

Wayne Savigny

**2013 Annual Canadian Geotechnical Society Conference – Montreal Organizing Committee**

Mario Ruel - Co-Chair

Sylvain Roy - Co-Chair

Catherine Mulligan - Chair, Technical Program

Robert Chapuis - Manager, Technical Program

Jocelyn Lavoie - Manager, Social Activities

Sébastien Dubeau - Manager, Social Activities and Partner Program

Maxime Paradis - Manager, Social Activities

Stéphane-Éric Thivierge - Manager, Exhibitors and Technical Tours

Eric Blond - Representative NAGS

Dominique Sorel - Representative IAH-CNC

Janik Brochu - Manager, Volunteers

Martin Tremblay - Manager, Technical Tours and Courses

Benoit Rioux - Manager, Technical Courses

Richard Gervais - Manager, Logistics

Claire Mollereau - Manager, Local Sponsorship

**2013 4th Canadian Young Geotechnical Engineers and Geoscientists Conference - Organizing Committee**

Ariane Locat - Co-Chair

Matthew Perras - Co-Chair

Jennifer Day - Treasurer, Webmaster

Kristen Van Esch - Technical Committee

Ehsan Ghazvinian - Technical Chair

Julian McGreevy - Technical Committee

Rebecca Turley - Registration

Michael Van Helden - Sponsorship

Jeff Oke - Sponsorship

Catherine Cloutier - Venue Organizer

Mylène Sansoucy - Venue Organizer

Nick Wodzianek - Technical Tour

Andrea Wolter - Promotions

*Provided by Victor Sowa – Secretary General*

## Call for Nominations – The 2015 Canadian Geotechnical Colloquium

The Canadian Geotechnical Colloquium is a commissioned work financially supported by the Canadian Foundation for Geotechnique. 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 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 2,000 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 from Item C-2 of the "Awards and Honours Manual 2012", or the latest edition. To find this Manual, CGS members can log-in at *http://cgs.ca/login.php* then proceed to Online Member Resources.

Nominations should be submitted prior to January 31, 2014 to Jean Côté, ing., Département de génie civil et de génie des eaux, Pavillon Adrien-Pouliot, local 2912A, 1065, rue de la Médecine, Université Laval, Québec (Québec) G1V 0A6, *Jean.Cote@gci.ulaval.ca*, or in care of the CGS Secretariat at *cgs@cgs.ca.*

## Appel de mises en candidature – Le Colloque canadien de géotechnique 2015

Le Colloque canadien de géotechnique est la présentation d'un travail de recherche commandé et payé par la Fondation canadienne de géotechnique (FCG). Cet honneur est décerné tous les ans à un membre de la communauté géotechnique canadienne. Le but du Colloque est de renseigner sur un sujet d'intérêt particulier dans le domaine de la géotechnique canadienne et d'encourager un jeune membre de la société à poursuivre les recherches nécessaires à la préparation du Colloque. Il est présenté lors de la conférence annuelle de la SGC et doit pouvoir être publié dans la Revue canadienne de géotechnique. Il doit être préparé selon le format établi par la revue. Toutefois, la décision de le publier relève exclusivement du rédacteur en chef de la revue. Un comité de sélection formé par le Conseil de recherche en géotechnique de la société choisi l'individu et le sujet à partir des nominations reçues. Le candidat retenu reçoit des honoraires de 5 000 dollars et un certificat encadré.

Chaque lettre de nomination doit présenter le candidat et ses principales réalisations. Elle doit être accompagnée d'un résumé d'environ 2 000 mots sur la présentation proposée en soulignant l'importance du sujet pour la communauté géotechnique canadienne, d'un bref survol de l'état des connaissances sur la problématique, des grandes lignes de l'importance de la contribution du candidat, d'un curriculum vitæ faisant état de l'expérience pratique du candidat liée au domaine ainsi que d'une liste de ses publications. Pour obtenir des renseignements sur la mise en candidature, consultez l'édition 2012, ou ultérieure, du manuel sur les prix et les distinctions (Awards and Honours Manual 2012, en anglais seulement), à la section C-2. Pour y accéder, les membres de la SCG peuvent ouvrir une session à *http://www.cgs.ca/login.php?lang=fr*, et aller à la section ressources en ligne à l'intention des membres.

Les mises en candidature doivent être envoyées avant le 31 janvier 2014 à Jean Côté, par courrier à ing., Département de génie civil et de génie des eaux, Pavillon Adrien-Pouliot, local 2912A, 1065, rue de la Médecine, Université Laval, Québec (Québec) G1V 0A6, ou par courriel à *Jean.Cote@gci.ulaval.ca*, ou encore aux soins du secrétariat de la SCG, à *cgs@cgs.ca.*

## Upcoming Conferences and Seminars

### 67th Canadian Geotechnical Conference
### GeoRegina 2014
### Call for Abstracts
### September 28 - October 2, 2014
### Regina, Saskatchewan

The Canadian Geotechnical Society (CGS) invites you to its 67th annual conference, **GeoRegina 2014**, at the Delta Hotel in Regina, Saskatchewan. It will be held from Sunday, September 28 to Wednesday, October 1, 2014.

The conference organizing committee calls on members of the Canadian and international geotechnical community to contribute recent research developments and advancements in their respective fields of interest and practice. Case studies and papers dealing with the latest advances in geotechnical engineering under extreme conditions from across Canada and around the world are especially sought. Presentations illustrating analysis, techniques and innovative solutions as well as research on recent trends or future prospects, are also encouraged.

Authors are invited to submit abstracts of a maximum of 400 words through the Online Submission page of the conference web site www.geo-regina2014.ca. Abstracts can be written either in French or English, with the deadline for submission of January 17, 2014.

Invitations for the submission of full papers will be sent to authors whose abstracts are accepted by the conference's Technical Committee by February 28, 2014. The submitted papers will be reviewed and at least one author of an accepted paper must register for the conference prior to final acceptance for inclusion in the conference proceedings.

### 6th Canadian Geohazards Conference
### June 15 - 18, 2014
### Queen's University
### Kingston, Ontario

The 6th Canadian Geohazards Conference will be held at Queen's University, Kingston Ontario from June 15 to 18, 2014. Be sure to reserve this date in your calendar and look for the website launch announcement in the spring of 2014.

For more information, email *gauthier@geol.queensu.ca*

### International Discrete Fracture Network Engineering Conference
### October 19 - 22, 2014
### Sheraton Wall Centre
### Vancouver, British Columbia

This conference will be the inaugural international meeting of engineers and geoscientists who use discrete fracture network engineering in the characterization of rock masses and solutions of engineering problems. This new and rapidly expanding area of engineering has wide applications, including underground and surface mining, underground nuclear waste disposal, petroleum geomechanics, civil engineering and natural hazards. This special conference will explore recent innovation and key developments in the application of Discrete Fracture Networks (DFNE) in rock engineering. DFNE will provide a forum for consultants, engineers, mining and petroleum companies, and researchers to exchange best practices in DFNE.

For more information, go to the conference website at *http://www.dfne2014.ca/*

### Membership Registration for 2014

Your Canadian Geotechnical Society membership is expiring! You are encouraged to visit the Canadian Geotechnical Society website at *www.cgs.ca*, to renew your membership for 2014 as soon as possible.

Membership benefits include:

- Online access to the electronic version of the Canadian Geotechnical Journal (published monthly) including all past issues;
- Member pricing for print subscriptions to the Canadian Geotechnical Journal;
- A complementary print subscription to Geotechnical News (four issues annually);
- Online member access only to past CGS conference electronic proceedings;
- Member pricing for the CGS-sponsored professional development opportunities, including the Society's popular Annual Conference, to be held this year in Regina;
- Preferred member information on CGS's spring and fall Cross Country Lecture Tour featuring recognized National and International speakers;
- Membership in one of CGS's technical divisions – Soil Mechanics and Foundations, Engineering Geology, Geoenvironmental, Rock Mechanics, Geosynthetics, Groundwater and Cold Regions;
- Complementary membership in the International Society related to your Division of choice, i.e., ISSMGE, IAEG, ISRM, IGS or IPA. Additional memberships at preferred second society member pricing (CSCE, IAH, NAGS, etc.);
- Access to information from CGS's technical committees – Professional Practice, Education, Landslides, Computing, Transportation Geotechnics and Heritage.

We welcome all new and renewing members and look forward to your participation in 2014. We are planning several new programs this year and encourage you to recommend a friend or colleague to join the Canadian Geotechnical Society so that we can continue to improve upon the benefits the Society offers our profession.

## 5th iYGEC and 18th ICSMGE Two Young Geotechnical Engineers' Perspective

The 5th International Young Geotechnical Engineers' Conference (5th iYGEC) was held from August 31 to September 1, 2013 at École des Ponts ParisTech in Marne-la-Vallée, France. We, **Nicholas Beier** (University of Alberta) and **Vincent Goreham** (Dalhousie University/Stantec Consulting), were selected by the Canadian Geotechnical Society (CGS) to attend the conference. Both the CGS and the Canadian Foundation for Geotechnique provided us financial aid to attend. The 5th iYGEC was held in conjunction with the 18th International Conference on Soil Mechanics and Geotechnical Engineering (18th ICSMGE), held from September 2 to 6, 2013 in Paris, France which also allowed us the opportunity to attend that conference.

The 5th iYGEC was attended by 164 delegates from 57 countries, with roughly equal representation between academia and practicing members. For the first time, the conference invitation was extended beyond selected society members and allowed any young geotechnical engineer to attend the conference. This change nearly doubled the attendance from the 4th iYGEC held in Alexandria, Egypt in 2009. All delegates were required to submit a short technical paper and to deliver a presentation.

The technical discussions covered a broad range of geotechnical topics including foundations, slope stability, modeling, soil behaviour, contaminant transport, remediation and case studies. Many presentations generated significant discussion and fostered collaborations and sharing of ideas. This discussion also provided insight and perspective into geotechnical practice from the around the world. A social gala held after the first day allowed the delegates to continue the discussions and develop friendships that will undoubtedly continue into the future.

Since 2009, the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) formed the „Student and Young Member Presidential Group". The purpose of this group is to enhance the membership and participation of that demographic within ISSMGE conferences and technical committees. All young geotechnical engineers are encouraged to join (refer to www.issmge.org for more information).

Highlights of the 18th ICSMGE included **Suzanne Lacasse's** delivery of the Terzaghi Oration, *Protecting Society from Landslides – the Role of the Geotechnical Engineering* and the first R. Kerry Rowe Lecture by **Charles Shackelford**, *The Role of Diffusion in Environmental Geotechnic.*

Attending the 5th iYGEC and the 18th ICSMGE provided us a rare opportunity to develop contacts and friendships with geotechnical engineers throughout the world as well as to broaden our perspective on geotechnical engineering. We would like to thank the CGS and the Canadian Foundation for Geotechnique for this unique and memorable experience.

*Delegates to the 5th. iYGEC and 18th. ICSMGE in France.*

*caption: Attendees of the 5th iYGEC. Submitted by Vince Goreham and Nicholas Beier*

## Canadian Geotechnical Journal Celebrates Golden Jubilee

It is both a pleasure and privilege to write this note at the end of 50 years of the Canadian Geotechnical Journal, a milestone that is much easier to be excited about than my own 50th birthday a few years ago!

Contributions to the first volume included those from a number of Canadian practitioners and researchers whose names are now commemorated with awards from the Canadian Geotechnical Society and associated organizations (**Bozozuk, Hardy, Leggett, Lo, Meyerhof, Quigley and Stermac**). The first volume was presented in four issues during 1963 and 1964, with sixteen articles, 4 discussions, 4 news articles, and one review published over 244 pages. In contrast, volume 49 of the journal published in 2012 contained 90 articles, 17 notes, and 17 discussions and closures, forming a total of 1447 printed pages.

In his introduction to the first issue, Dr Leggett expressed the objectives of the new publication: "The Journal is intended to provide a medium for the publication of papers in the applied geotechnical field. It is anticipated

that most of the papers presented will deal with soil mechanics. In keeping, however, with the liaison with allied fields that has always characterized Canadian soil mechanics work, papers dealing with associated subjects such as engineering geology, pedology, muskeg, hydrology, and the mechanics of snow and ice will always be welcomed by the Editorial Board." Leggett also expressed the goal that both Canadian and "suitable contributions from other countries will be accepted". In 2012, the articles and the international experts contributing them remain aligned with those initial goals.

As I prepared for the 50th year, I looked once again through the first four issues. They present clear evidence of the early roots of the Journal's excellent history of contributions to unsaturated soil mechanics. **Dyregrov and Hardy** discuss "the formidable engineering problem in the design of satisfactory foundations for building" associated with swelling of the Lake Agassiz clay deposits, and **Hamilton's** article *Volume changes in undisturbed clay profiles in Western Canada* described the distribution and characteristics of shrinking and swelling materials more generally. Another contribution was Meyerhof's highly cited article *Some recent research on the bearing capacity of foundations*, summarizing his bearing capacity equations.

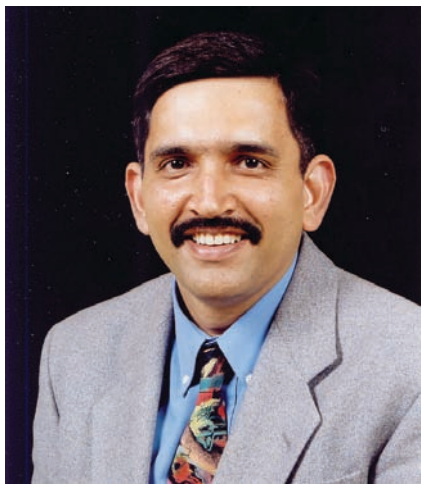
We continue to reinforce the Journal's practical focus reflective of the objectives laid out in 1963. While the Journal does publish articles involving computational or bench-scale laboratory work, articles must be directed either towards the solution of a practical problem and include specific guidance on the implications for geo-engineering practice, or it must focus on one of geotechnical materials of special interest to the Journal such as unsaturated soils, Leda clays or frozen ground. The Journal rarely publishes new theoretical work without a practical component. High quality theoretical contributions are routinely declined with encouragement, to resubmit to one of the excellent journals that do publish theoretical studies.

During the past 50 years, geotechnical engineering has become a mature discipline, and I believe that the depth and breadth of the contributions to the theory and practice of geo-engineering published in the Journal during its history are an extraordinary legacy of great benefit to present day readers, authors, as well as society and the environment. It is a credit to the outstanding contributions made by past authors, reviewers, editorial boards and the publishers. The current board remains committed to working with the international community, Canadian Science Publishing and the Canadian Geotechnical Society to maintain and enhance this legacy.

*Submitted by Ian D. Moore*
*Editor of the Canadian Geotechnical Journal*

## Members in the News

### Jit Sharma Named Educator of the Year



*Jit Sharma*

The Canadian Geotechnical Society extends its congratulations to **Professor Jit Sharma**, who has been selected to receive the 2013 Educator of the Year Award by the Saskatoon Engineering Society. The new Chair of Civil Engineering at the Lassonde School of Engineering at York University, Professor Sharma previously taught at the Civil Engineering and Geological Engineering at the University of Saskatchewan. Professor Sharma was a member of the CGS Board from 2006 to 2009 as the **Chair of the Soil Mechanics and Foundation Division** and is also an Associate Editor of the **Canadian Geotechnical Journal**.

## In Memoriam

### Michael Bleakney - 1956 – 2013

On the morning of Wednesday, September 18, 2013, the geotechnical engineering community in Ottawa and Canada lost a valued and respected member, **Michael Bleakney,** P.Eng. Michael was one of the victims of the tragic bus/train accident that took his life and those of five other individuals. The CGS wishes to extend its sympathies to his family, friends and co-workers.

*Submitted by Dr. Mamadou Fall*
*Director of the Ottawa Geotechnical Group*

The Society publishes obituaries of members and former members on its Heritage Archives pages at ***http://www.cgs.ca/lives-lived.php?lang=en.*** If you wish to write an obituary, please contact the President or Secretary General of the Society before beginning.

### Editor

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# 2013 Legget Medal Award

## Introduction for 2013 Legget Medal Award Recipient: Professor Serge Leroueil Université Laval

## Introduction delivered by Professor Jean-Marie Konrad, Université Laval

Monsieur le Président, distingués invités, honoured guests, mesdames et messieurs, ladies and gentlemen. J'ai l'immense honneur et plaisir de vous présenter le récipiendaire de la médaille R. F. Legget, it is my privilege to introduce the R.F. Legget Medal recepient for 2013. Permettez-moi de vous rappeler que cette médaille est la plus haute distinction décernée par la Société à une personne pour sa contribution exceptionnelle au domaine de la géotechnique pendant toute sa carrière. Let me remind you that this R.F. Legget Medal is the Society's highest honour awarded to an individual for outstanding, life-long contributions to geotechnique.

Fort de ses 43 années d'activités fécondes en géotechnique, le professeur Serge Leroueil mérite amplement que la Société reconnaissent ses contributions exceptionnelles tant au niveau des concepts régissant le comportement des sols qu'au niveau du transfert des connaissances pour les praticiens. For his 43 years of geotechnical activities, Professor Serge Leroueil richly deserves the Society's recognition for his outstanding contributions in both theoretical soil mechanics and design oriented approaches.

Serge Leroueil a obtenu son diplôme d'ingénieur de l'INSA (France) en 1970 et obtenu sa maîtrise de l'Université Laval en 1971 en bénéficiant d'une bourse du Conseil des Arts du Canada. Après deux années de coopération en Tunisie dans le cadre du service militaire, encore obligatoire à l'époque, il revient à l'Université Laval pour y entreprendre un doctorat sous la direction du Professeur François Tavenas. C'est en 1975 que nous devenons collègues-étudiants gradués et déjà en 1975 nous les étudiants à la maîtrise l'appelions le jeune Terzaghi tellement il était passionné de la mécanique des sols. Il obtient son doctorat en 1977 sur l'étude des lois de comportement des argiles naturelles en cisaillement et en consolidation, le développement d'un modèle, YLIGHT, appliqué au comportement des remblais. En 1978, il passe 3 mois à Cambridge (Angleterre) dans le cadre d'un post-doctorat.

*L to R – Serge Leroueil, Jean-Marie Konrad, Doug VanDine, Richard Bathurst.*

Serge graduated in Civil Engineering from INSA (France) in 1971 and obtained an MSc from Université Laval in 1970. After 2 years in Tunisia fulfilling his military duty as civil assistant, he returned to Université Laval for doctoral studies under the supervision of Prof. François Tavenas. It is in 1975 that I met Serge and even then, we the graduate students called him young Terzaghi because he was so passionate about soil mechanics. He graduated in 1977 with a milestone contribution on the behaviour of natural clays and the development of the YLIGHT model applied to embankments. In 1978, he spent 3 months at Cambridge University as a post-doctoral fellow.

Since 1980, Serge has been at Université Laval and enjoyed 4 sabbatical leaves at Imperial College of Science and Technology in 1986, at ENTPE in 1993, at Nanyang Technological University (Singapore), Université de Naples in 2000 and LCPC (France) in 2007. His first 10 years of research were devoted to the study of the behaviour of natural clays. Stabilité des pentes, regression des ruptures, compressibilité consolidation et essais in situ, recherches qui aboutissent dans l'écriture d'un livre Remblais sur argiles molles` en collaboration avec F. Tavenas et J.-P. Magnan. The second period of his activities until about 1995 deals essentially with the study of structured soils and compacted soils using the framework of limit state soil mechanics. This was a significant contribution to our profession and a quantum leap into the understanding of the physics of these unsaturated

man-made soils. Sa troisième période de recherche porte sur le développement d'une loi constitutive incorporant l'anisotropie, la microstructure, la viscosité et la non-saturation des sols naturels et compactés et de son application au cas pratiques des pentes, des excavations et des barrages. His third research period deals with applying a generalized constitutive model to slopes, excavations and earth dams.

During his career, Serge earned many awards: the Thomas Roy Award and the R.M. Quigley Award (twice) from the CGS, the Telford Premium Award (three times) from the British Geotechnical Society and was the 39th Rankine Lecturer in 1999. He was the 2001 K.Y Lo Medal recipient from the Engineering Institute of Canada and is a Fellow of the EIC, and a Fellow of the Royal Society of Canada. Le professeur Leroueil a supervisé une soixantaine d'étudiants gradués et publié plus de 200 articles, ce qui démontre l'impact énorme des travaux de Serge sur notre profession et société.

Depuis maintenant 38 ans, je connais Serge comme collègue et ami. Je peux vous affirmer que c'est un travailleur acharné, extrêmement méticuleux et rigoureux et surtout très généreux de ses connaissances. Serge est une source d'inspiration pour tous ses collègues. His contributions in geotechnical engineering are enormous and it is most appropriate that the Canadian Geotechnical Society recognizes Professor Serge Leroueil as one of our leading engineers with the presentation of the 2013 R.F. Legget Medal.

# 2013 R.F. Legget Medal Award acceptance speech: Professor Serge Leroueil, Université Laval

Thank you Mr. President. Merci Jean-Marie pour cette gentille introduction. I first would like to thank the Canadian Geotechnical Society, the Canadian Foundation for Geotechnique and the Award Committee for selecting me for this prestigious award. I am not sure I deserve it, but I accept it with great pleasure.

I chose two anecdotes to tell you. La première s'est passée durant mon doctorat sous la supervision de François Tavenas. J'avais beaucoup de résultats d'essais de laboratoire mais nous ne savions plus très bien où nous allions, et j'ai même pensé abandonner. Cependant, un matin de tempête de neige de janvier 1976, tous ces résultats se sont mis en ordre et les concepts d'état limite et d'état critique développés à l'Université de Cambridge devenaient applicables aux argiles naturelles en incluant l'anisotropie ainsi que les effets de vitesse et de structure. Moment Eurêka comme on en a peu dans une carrière! While I was not progressing very well during my Ph.D. studies, suddenly, all the results came together well to show that the concepts of limit and critical states developed at Cambridge University were applicable to natural clays, including the effects of anisotropy, strain rate and structure. An Eureka Moment as we don't have many in a career!

The second anecdote happened in the late eighties. My knowledge at that time was essentially limited to soft clays. I went to Imperial College, London, for a sabbatical year where I met Peter Vaughan who was working on residual soils with Brazilian students. Discussing at tea times, we realised that we had similar views on the importance of structure on the behaviour of soils. We then developed a framework and applied it, in addition to soft clays and residual soils, to other materials such as stiff clays, cemented sands and weak rocks. Chalk and soft clay were behaving the same! So we wrote a paper and submitted it to the Canadian Geotechnical Journal. Rejected! So, we submitted it to Géotechnique. It was accepted for publication, won a Telford Premium Prize from the British Geotechnical Society, and became one of the most often cited articles from Géotechnique. Un article que nous avions écrit avec Peter Vaughan de l'Imperial College à Londres, sur l'importance de la structure dans les sols et qui montrait en particulier que les craies et les argiles molles se comportaient de la même manière, fut soumis à la Revue canadienne de géotechnique et fut rejeté. L'article fut alors soumis à la revue Géotechnique anglaise. Il fut accepté, reçu un Prix Telford Premium de la British Geotechnical Society, et devint un des articles de la revue Géotechnique les plus souvent cités.

Il y a plusieurs leçons que l'on peut tirer de ces anecdotes, et je m'adresse particulièrement à nos jeunes collègues:

- ayez confiance en vous;
- soyez persévérants;
- la chance est importante, mais il faut être prêt à la saisir;
- les cadres de raisonnement sont importants car ils constituent des moyens efficaces pour organiser nos connaissances;
- sachez utiliser les rencontres avec des collègues pour élargir votre domaine d'expertise.

There are several lessons that can be learned from these anecdotes, and I am addressing these words mostly to our young colleagues:

- be confident in yourself;
- never give up;
- luck is important but you have to be prepared to grasp it;
- frameworks are important as they are efficient tools for organising our knowledge;

- make use of meetings with people for extending your expertise domain.

Many people have contributed to my career. Il y a de nombreuses personnes qui ont contribué à ma carrière. Je vais mentionner le “top ten” avec quelques mots pour decrire ce qu’ils m’ont appris ou apporté:

- François Tavenas: Le sens du mot recherche. The meaning of the word research.
- Pierre La Rochelle: L’importance du jugement. The importance of judgement.
- Raymond Garneau: La pratique de la géotechnique. Geotechnical practice.
- Jean-Pierre Le Bihan: Que les résultats aberrants n’existent pas, qu’ils ont toujours une explication. Aberrant results don’t exist, they always have an explanation.
- Jacques Locat: Sa complémentarité dans le domaine des mouvements de terrain et l’importance de l’épicurisme. His complementarity in the domain of mass movements and the importance of epicurism.
- Peter Vaughan: Le lien essentiel entre la géotechnique et la géologie. The essential link between geotechnical engineering and geology.
- Jean-Marie Konrad: L’importance des aspects fondamentaux et son enthousiasme contagieux. The importance of fundamentals and his contagious enthusiasm.
- David Hight: Chaque projet est une opportunité pour améliorer nos connaissances. Each project is an opportunity to improve our knowledge.
- Luciano Picarelli: L’importance de l’observation à différentes échelles. The importance of observations at different scales.
- Denis Demers: Qu’un bon leader sait allier les besoins de son organisme, des connaissances avancées et de bonnes relations humaines. That a good leader knows how to combine the needs of his organisation, advanced knowledge and good human relationships.

J’ai été très chanceux de rencontrer ces gens et d’en faire presque toujours des amis. Je les en remercie très sincèrement. Je ne voudrais pas non plus oublier la contribution essentielle du personnel technique et des étudiants, dont plusieurs sont ici.

Also, I don’t think we can succeed in life without the support from the family and friends. Je voudrais remercier mon épouse, Françoise, mon fils Vianney, ma belle-fille Gabrielle, ainsi que mes petits-enfants pour leur amour et leurs encouragements.

Finally, I must say that what I like the most in geotechnical engineering is that each project is a new challenge and that, compared to many other domains, relationships among people are generally very friendly. I think we can be very proud of our profession. Je pense que nous pouvons être très fiers de notre profession.

Merci beaucoup. Thank you very much.

*Richard Bathurst and friends.*

## Introduction by John Dunnicliff, Editor

*This is the seventy-sixth episode of GIN. One article this time, and also a discussion of a previous article, together with the authors' replies.*

### Costa Concordia—watch this space!

It was described by the media in England as "An absolutely sensational engineering spectacle" and "A monumental feat of engineering". The righting of the Italian cruise ship Costa Concordia—"The Parbuckling Project" (www.theparbucklingproject.com) - see the video "The Parbuckling phase in 90 seconds". Unless you've been on the moon during the last few months, you'll know about this. I have a promise of an article in GIN that will describe the measurements used to control the rotation.

### Continuing education courses

In the previous GIN I said that there will be no more of these courses in Florida, but perhaps elsewhere. Plans are now well underway to start a new series in beautiful Tuscany, Italy, on June 4-6, 2014. By the time you read this, the website should be up and running: *www.geotechnicalmonitoring.com.* In addition to the content of the Florida courses, there will be substantial content on remote methods for monitoring deformation—my Italian colleagues are experts at this. There will also be six sessions on case histories and lessons learned. Additional information is on page 35.

Come and join us in the 13th century castle! The wine is good, too!

### Graduate level course on instrumentation in New Orleans

The Civil and Environmental Engineering department at the University of New Orleans offers a graduate-level course on geotechnical instrumentation. The course includes:

- Soil and rock behavior
- Soil properties affecting geotechnical instrumentation
- Field monitoring principles
- Systematic approach to geotechnical instrumentation
- Review of geotechnical instrumentation hardware
- Theory and field measurement of deformation, groundwater pressure, stresses, load and strain
- Application of geotechnical instrumentation to real projects
- Advancement in remote monitoring and automatic data acquisition
- Case studies related to geotechnical instrumentation and field performance monitoring.

For more information, please contact: Malay Ghose Hajra, Assistant Professor at The University of New Orleans, tel. 504-280-7062, e-mail: mghoseha@uno.edu.

Out-of-state students can take the course online, and should contact Malay Ghose Haria for the arrangements.

### 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.

De hoje á um ano, com todos juntos e com boa saude! – "This day next year, with everyone together and in good health" (Portugal – yes, I know that I'm missing an accent in 'saude' – blame the symbols menu on my computer!)

# A Reusable Instrumented Test Pile for Improved Pile Design

*Jason DeJong, Aravinthan Thurairajah, and Mason Ghafghazi*


### Abstract

Accuracy in estimating driven pile capacity at a project site is limited due to an inability to capture the full complexity of the soil deposit, soil properties, pile drivability, dynamic soil/pile interaction, and pile setup. These potential errors/uncertainties are usually compensated for by using a safety factor. Development of an in situ testing device that replicates the anticipated construction conditions to the greatest extent possible and provides data to predict pile capacity at the design phase of a project would result in safety and economic benefits. This article presents an overview of a reusable instrumented test pile (RTP) being developed at the University of California Davis as an in situ testing device for improved pile design in granular soils. The RTP system consists of short instrumented sections that provide measurements of axial load, radial stress, pore pressure and acceleration, and are connected in series with standard Becker pipe

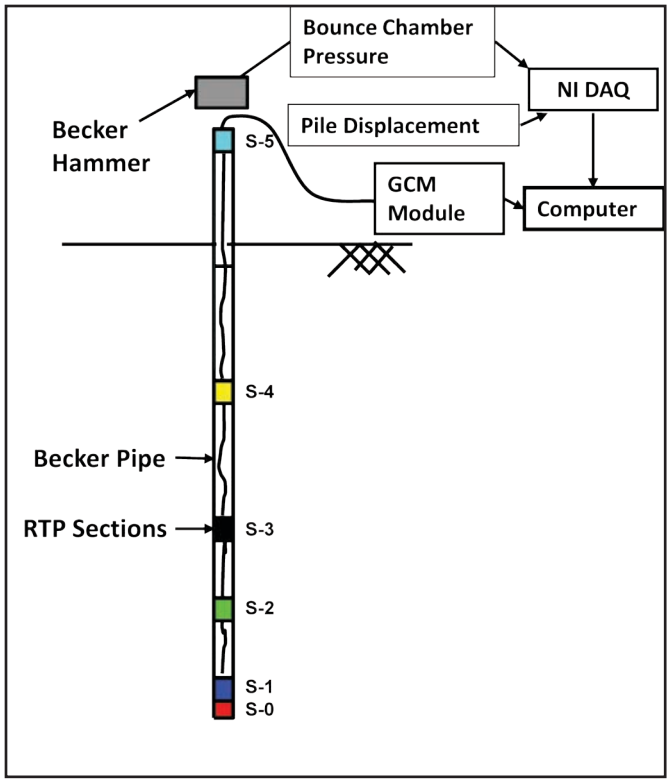


*Figure 1. Schematic of RTP system.*

*Figure 2. RTP assembly.*

sections. The RTP-Becker pipe string is driven using the standard Becker rig pile driving hammer. RTP measurements obtained during driving provide detailed information regarding pile drivability, measurements during static tests captures load transfer along the pile, and measurements during pile setup capture capacity gain over time.

## Context and motivation

Improvement in prediction of driven pile capacity in granular soil is currently limited due to the factors of inability to capture the full complexity of soil deposits and its engineering behavior with available sampling and testing techniques, and inability to accurately model the soil/pile interaction during the pile driving process. In practice, these uncertainties are addressed using a large safety factor, typically ranging from 2 to 4. Furthermore, unexpected stratigraphic conditions can impact pile drivability resulting in costly change orders. The RTP is being developed to remove some of this uncertainty. The RTP will be deployed during initial site investigation, and all measurements obtained available during project bidding. Ideally this would enable engineers and contractors to increase the efficiency of pile design and the likelihood of arriving on site with the correct pile and installation equipment.

## Removable test pile

The design of the RTP system was guided by the following primary factors:

- Mobility,
- Commercial integration,
- Durability and robustness,
- Measurement types,
- Measurement sensitivity and reliability,
- Measurement frequency and duration.

Of particular challenge, as evident in previous research, is development of a system that can withstand dynamic pile driving and that also has sufficient measurement resolution to detect small stress changes during pile setup.

The RTP system assembly is shown schematically in Figure 1 and photographs during testing are presented in Figures 2, 3 and 4. The central component is the modular instrumented pipe sections, which are 61 cm (2 ft) long with an outer diameter of 168 mm (6.625 in). Each instrumented section contains transducers for measurement of axial force, axial acceleration, pore pressure, and radial stress. The modular sections are assembled in series

Figure 3. RTP driving.

Figure 4. Load testing.

with standard 152 cm (5 ft) and 305 cm (10 ft) long Becker pipes, enabling positioning of the instrumented sections in the drill string at target final elevations required by project-specific soil stratigraphy. Installation is achieved using the conventional Becker drilling system that is equipped with an International Construction Equipment (ICE) Model 180 double-acting diesel hammer. Down-hole data acquisition units (computer modules manufactured by GeoDaq, Inc.) in each RTP section provides signal conditioning (sensor excitation, gain, and filtering), digitizes and buffers the signals, and transmits the data serially (i.e. through additional computer modules in line) to the control unit above ground (labeled GCM in Figure 1). The digital transmission results in only a single 4-wire cable running along the RTP connecting all instrumented modules to the above ground computer. The above-ground computer controls which modules and sensors are connected and should be recorded, as well as the sampling rate and duration. A separate above-ground data acquisition system (based on National Instruments hardware; labeled NI-DAQ in Figure 1) collects data from displacement gages (string potentiometers) to measure vertical displacement of the

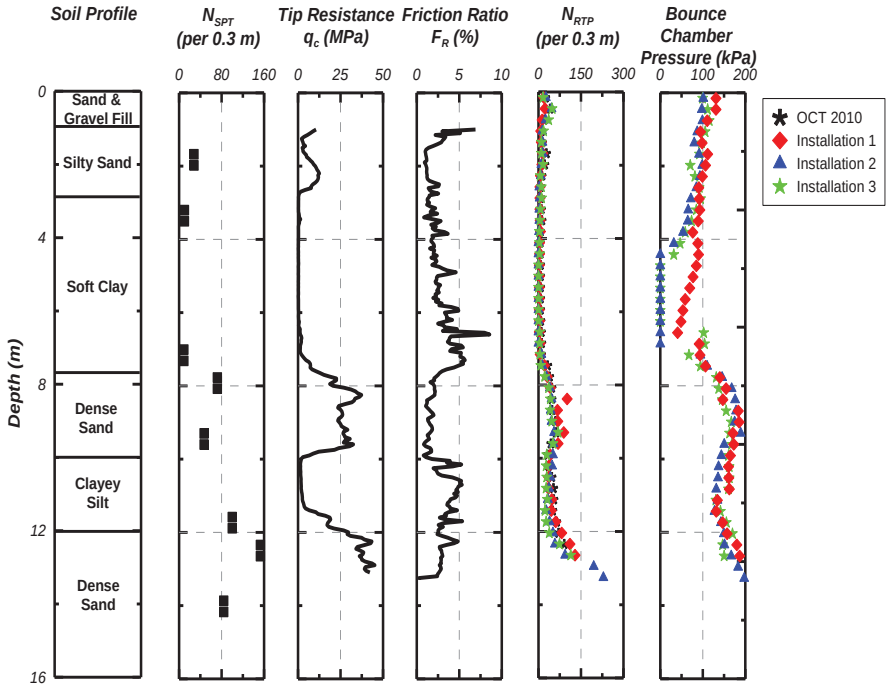


Figure 5. Site profile as well as resistance measurements from SPT, CPT and RTP systems.

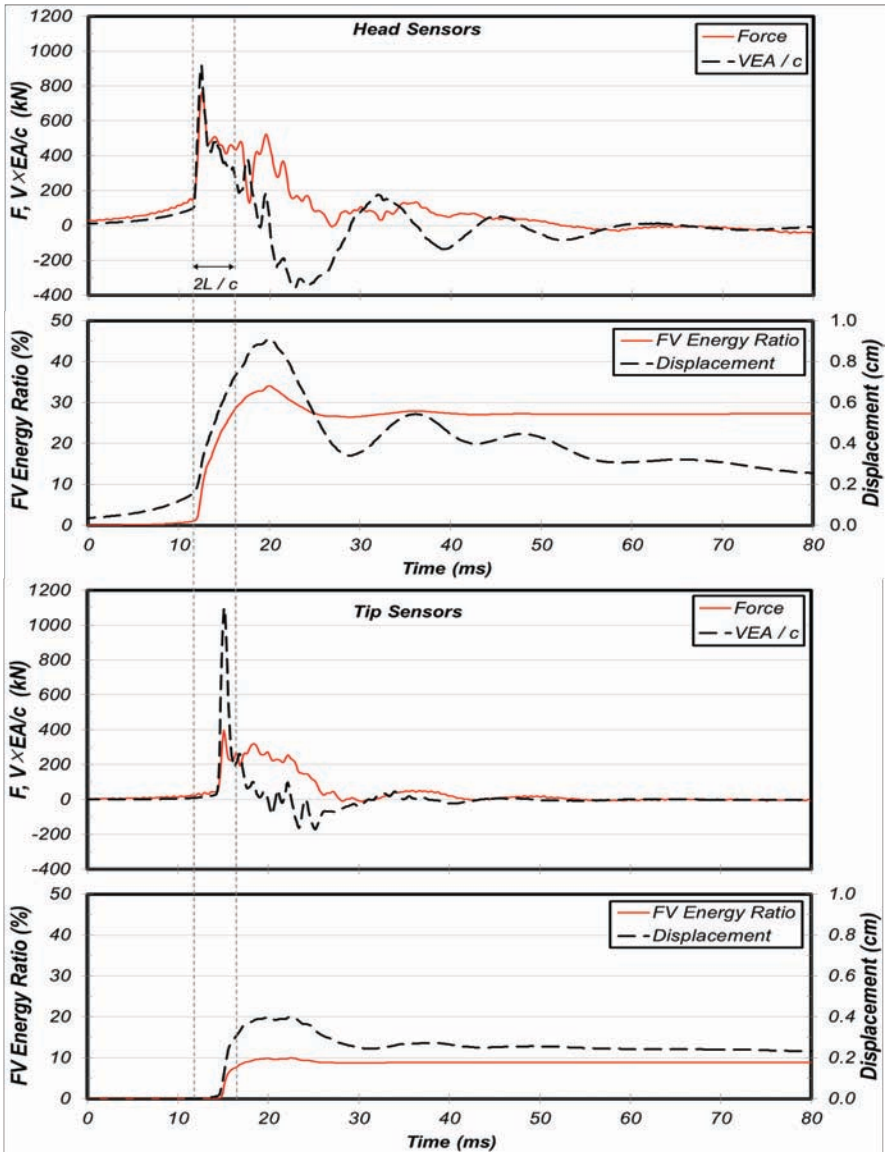


*Figure 6. Representative measurements obtained during dynamic driving.*

pile during driving and static loading testing. The modular nature of the RTP system and its integration with the Becker system enables testing down to 30 m to be completed in one day with limited time for pile setup.

## Example results

A field test was carried out to evaluate the initial design and performance of the RTP sections. The field testing was performed at the Caltrans I-880 interchange site in Oakland, CA where the soil profile varies from soft clay to very dense sand. Figure 5 summarizes the soil variation with depth along with CPT tip resistance, CPT friction ratio, SPT N values, and RTP blow count values and bounce chamber pressure. As evident, the RTP hammer blows correlate well with SPT and CPT data.

RTP recording during dynamic driving provide insight into installation conditions, including forces, accelerations, energy, and displacements at all locations where the RTP modules are located. An example output from instrumented section position behind the tip and at the head of the drill string during hard driving through dense sand at a depth of 9.4 m is presented in Figure 6. The corresponding measured RTP blow counts were 89 for 0.3 m (1 ft) penetration. The force and velocity (multiplied by section impedance), as well as the displacement and energy time histories measured at head and tip sections is shown. The force-velocity proportionality is confirmed at the head section during the first *1L/c* interval with small deviations due to shaft resistance. The wave arrives at the tip section with an approximate *L/c* delay. As expected in hard driving conditions, a large negative velocity pulse returns at the head. There is a significant difference between the maximum displacement recorded and the residual displacement, showing the elastic compression of the pile during the impact. The maximum velocities measured at the head and tip are similar, while about 50% of the recorded force at the head arrives at the tip. Only a fraction of the energy measured at the head arrives at the tip. The residual displacements measured in the head and tip sections are close, providing more confidence in the accuracy of the measurements.

RTP tension load tests, with or without pile setup, provide insight into both overall capacity and the distribution of load along the pile length. Results from a tension load test performed after installation to 12.8 m and after 4 hours of pile setup are presented in Figure 7. The upper (light blue) curve corresponds to measurements above ground while the lower (dark blue) curve corresponds to axial force in the pile at 10 m depth. The displacement required to reach full pullout capacity occurred before 10 mm of displacement. The total tensile capacity of nearly 600 kN was observed to increase by 100 kN relative to an adjacent pile load test where no setup time occurred (not presented). About 50% of the tensile load was mobilized above 10 m depth, primarily due to the high shaft friction in the upper dense

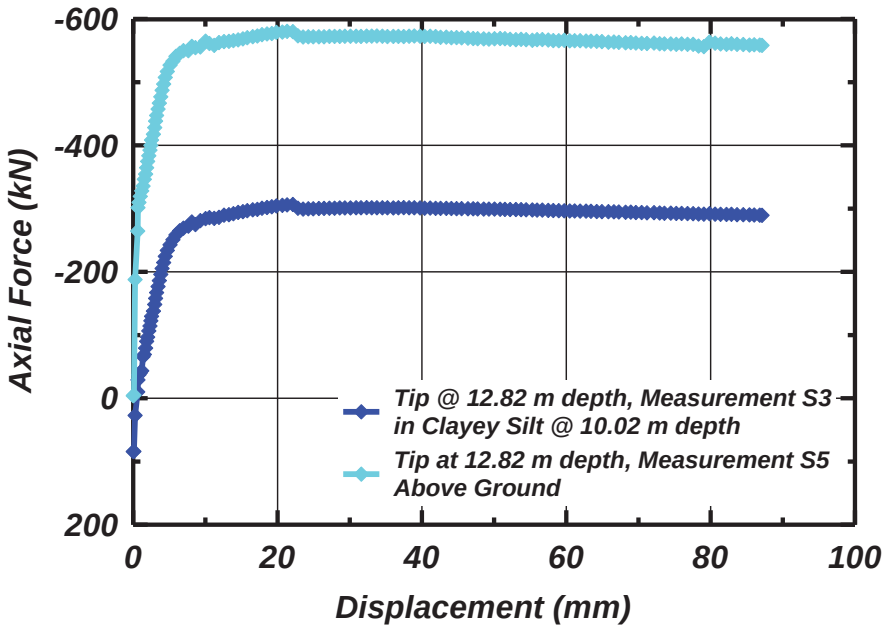


*Figure 7. Representative load-displacement curve obtained from tensile load test.*

sand layer between 7.6 and 9.9 m depth. The additional tensile capacity is primarily due to the lower dense sand layer.

## Summary

A new reusable test pile (RTP) has been developed to improve the design of driven piles. The RTP measured blow counts generally agree with other in situ data. Dynamic measurements during driving provide insights into driving forces, energy propagation, and dynamic and permanent pile displacements. Static measurements during pile setup (not shown) and tension load tests provide insights into pile capacity and load distribution along the pile shaft. Further field testing at additional test sites where full scale pile load tests have been performed is underway.

## Acknowledgements

The authors wish to thank California Department of Water Resources (Division of Safety of Dams) and California Department of Transportation, especially Tom Shantz, for funding this work. Thanks to Great West Drilling, Inc., Robbie Jaeger, Bill Sluis and Daret Kehlet for their assistance in development and field testing.

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# Discussion of: "Field monitoring challenges, Episode 2 Unforeseen movements (depth and magnitude)"

**Marcelo Chuaqui and Wing Lam, Geotechnical News, Vol. 31 No. 2, June 2013**

*Storer J. Boone*

The authors present a curious case related to the use of inclinometers and survey data for monitoring subsurface movements. The conclusions and data suggest that perhaps a few additional lessons could be learned if the authors are at liberty to answer a few questions provided below.

## Lesson Learned 2

Lesson Learned 2 states that the field personnel did not understand that the inclinometers should be installed into a stable stratum at the bottom of the borehole. Fundamental to the stated communication problems may be training of the field people and the financial arrangements for the project and these issues prompt the following questions:

- Why were the selected field personnel installing the instruments if they did not understand their purpose and the associated critical need to install the bottom into a stable soil stratum?

- Were the budget and field plan fixed with no allowance for subsurface uncertainties?
- Was no sampling carried out during the drilling for inclinometer installation?
- Were the inclinometers only attached to piles that did not extend fully through the soft soils?
- Was the instrumentation part of a "low-bid-wins contract"? Were the least-costly personnel chosen for the work to meet a low-bid budget?

## Authors' Reply

*In response to Mr. Boone's questions we first have to emphasize that this was from the perspective of the instrumentation contractor. Typically, the field technicians are provided the depth to which the instrument will be installed such as a borehole inclinometer, or it is set in the case of an attached inclinometer to a pile. The field technicians were present for the installation of the instrument after drilling was completed and achieved that depth. Upon further review, the inclinometer was confirmed to be founded in stable ground at the correct depth; however, due to large horizontal deflections in the casing caused by the installation of adjacent drilled shafts, the inclinometer probe was not able to reach the bottom of the casing and the "zero" anchoring point was lost.*

*No sampling was done during the installation; however, independent sampling was done by the geotechnical engineer.*

*The work was of an emergency nature and there was a negotiated rate for the work and not a bidding process, so a low bid contract was not a factor. We concur that low bid is not the best route to a successful monitoring program.*

*The engineers designed the monitoring program with redundancy in mind, knowing that the combination of tight site access and difficult geotechnical conditions could result in damage to monitoring instruments. The team used the full complement of instrumentation to analyze the unusual inclinometer movements, therefore there was no reason to stop the job and add additional inclinometers.*

## Lesson Learned 3

Lesson Learned 3 states that innovative thinking was able to provide a solution whereby surveying was used to locate the horizontal position of the top of the inclinometer. While surveying of inclinometer tops can be useful to adapt to the situation the authors describe (and many others), accurately surveying horizontal positions is often far more difficult than commonly understood. Even with modern and highly precise surveying instruments, such measurements can vary by +/- 20 mm or more, reflecting the combination of instrument, skill level of some operators, set up, and sighting angles to reference points among other factors. With the right instruments, highly skilled operators and all other details carefully controlled the systematic variability in horizontal survey measurements can be reduced to +/- 3 mm or so. However, "the devil is in the details" and, unfortunately, details are often missed. The published sample inclinometer plot illustrates five virtually parallel lines of subsurface displacement data and they do not appear to indicate a discernible pattern, at least in comparison to the illustrated dates. For example, the first and last dates show the minimum and maximum displacements, respectively. The penultimate reading (#4), however, illustrates less displacement than the other two intervening reading dates (#2 and #3 in date order). Are the displacements real or might they be a figment of survey error? If the differences between individual and parallel inclinometer survey event plots are not figments of survey error, certainly there must be some other rational explanation for the changes.

Answers to these questions may provide additional valuable lessons learned. It would be very useful in a future episode for the authors to also illustrate how the other instrument data was used in combination with an understanding of the construction processes and soil mechanics to rationalize the measured displacements.

## Authors' Reply

*We agree that the type of instrument and skill of the operators is vital to achievement of accurate data. In our experience the survey measurements achieved are within ±1 mm with proper procedures in place. Of course there can always be bad readings and lessons learned from those experiences. In the inclinometer plot, the product was a sample created for the column. A re-zeroing of the survey data for the top of the inclinometer occurred that was not factored into the sample plot. In the actual reporting, minimal movement had occurred. Fortunately, these top-anchored inclinometer plots were supplemental data to the pile-attached inclinometers. Further research can be done in more controlled conditions rather than in emergency situations.*

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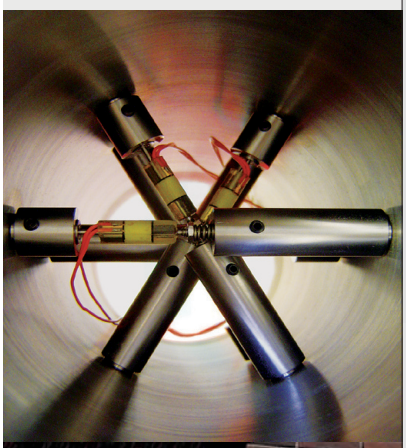

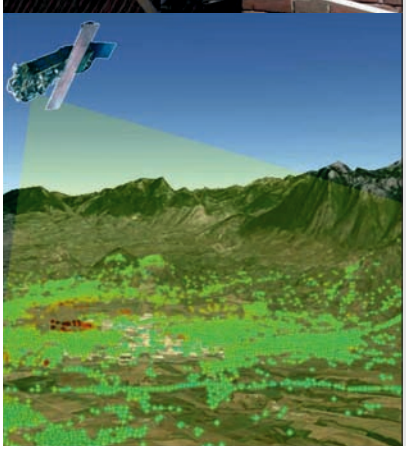

International Course on

# Geotechnical and Structural Monitoring

June 4-6, 2014

"Castle of Poppi", Tuscany (Italy)

Course Director: **John Dunnicliff**, Consulting Engineer

Organizer: **Paolo Mazzanti**, NHAZCA S.r.l.

NEW COURSE: This annual course in Italy replaces the long-standing series of continuing education courses in Florida. The format will be similar to the Florida courses, but with the addition of **substantial content on remote methods for monitoring deformation**.

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

WHO: Engineers, geologists and technicians who are involved with performance monitoring of geotechnical features of civil engineering, mining and oil and gas projects. 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 and structural monitoring while networking and sharing best practices with others in the geotechnical and structural monitoring community.

INSTRUCTION: **provided by leaders of the geotechnical and structural monitoring community**, representing users, manufacturers, designers and people of academia from Italy, England, Australia, France, Germany, Norway, Switzerland, USA, Hong Kong and The Netherlands.

WHERE: the 3-day course will be held in Poppi (Tuscany, Italy), in the main room of a 13th century castle (www.castellodipoppi.com). Poppi is in the countryside of Tuscany, near the city of Florence. **Dedicated transportation to Poppi from Florence main train station and city airport will be available**.

**www.geotechnicalmonitoring.com**

# Contamination of Till Aquitard by DNAPL: Is it Actual, or Drilling Artefact?

*Robert P. Chapuis*

During my career as a consultant, and then as a professor, I have had the privilege to be an expert in several cases. This is the second old case that I present in Geotechnical News. It explains a situation that many professionals may have suspected but not documented. Over the past few years, I have asked for authorization to publish scientific issues on old (over 20 years) but still interesting cases. Having no authorization to publish is unfortunate for professional knowledge. The owners and their current legal counsels gave authorizations, but they came with the request that all names and legal issues be kept confidential. In addition, no photograph can be published, which would enable identification of a site or person. The actual year cannot be given.

## Context

This case is about investigation of a pollution problem. DNAPL spills had sink below the water table where they usually form pools and fingers that dissolve slowly. The upper sand–and–gravel aquifer, and also the fractured rock aquifer below the glacial till were contaminated. The several meter thick, non–plastic, till was an aquitard between the two aquifers. During the first stages of investigation, many boreholes were drilled and conventional monitoring wells (MWs) were installed in the two aquifers (conventional = a single MW in a single borehole), with 1.5 to 4.5 m long screens. A few 6 or 8 in. boreholes lodged two MWs, one in each aquifer. The annular space between the MW solid pipes and the till wall was sealed with bentonite pellets and grout. The field and laboratory data were used to delineate two contamination plumes, one for each aquifer. The two plumes travelled more or less horizontally through the two aquifers.

The plume in the fractured rock had high levels of contamination, which had started the field investigation and legal process. Also, it travelled, as expected, much faster than the plume in the sand–and–gravel aquifer. As usually, the DNAPL concentrations groundwater fluctuated in time and space. Such fluctuations are produced by irregular DNAPL emission at the surface (spills, dumps) and internal sources (pools and fingers), fluctuations of infiltration and groundwater table position, and most important, aquifer heterogeneity (e.g., Johnson and Pankow 1992).

During the investigation, a question was raised about how high concentrations of DNAPL had rapidly reached the lower confined aquifer. The consulting company, owner, and regulating body, believed that the DNAPL had percolated through the till aquitard, close to the DNAPL source zones. Another phase of investigation was designed to assess and quantify the movement of DNAPL through the till aquitard.

## Till investigation

The non–plastic till contained boulders: it was not possible to drive a penetrometer system or a flush–joint casing, which is the less disruptive of non–destructive drilling methods (Morin et al. 1988). At the time of this case history, the sonic drilling method was unknown. The till was investigated using diamond drilling and a flush–joint casing, with upwards clean water jets as washing fluid for the cored sediments. Split spoons were used to recover closely spaced very dense till samples. These are known to be class–4 soil samples in any geotechnical classification and not intact samples as sometimes found in geological papers. No field representative water samples could be recovered in the process. The sampling recovery was most often in the 35–75% range. The soil samples were analyzed for DNAPLs. It was important to know whether the glacial till was micro–fractured and how much, because a DNAPL can form a free–product pool on the uneven top on aquitard, and then can easily move through downward through near–vertical micro fractures. This was the initial explanation of high pollution in the fractured rock aquifer.

The end result of the till investigation is summarized as follows. Among all the till samples, a few were highly polluted, a few were moderately polluted, but most were not polluted. No relationship was found between concentration and depth, till thickness, distance to the known source of DNAPL. Several explanations were proposed to try to explain the findings. None of them was convincing, because all of them assumed unverifi-

able mechanisms, including that of the "lucky" boreholes that had hit a subvertical fracture in the till layer.

When the author was asked to examine the data, at the beginning he was as puzzled as the consultant. Then he asked to see documents that usually are not given to the client, the handwritten field reports by the field inspectors (geologists or engineers). The consultant was unwilling to provide them. His position was that the expert (the author) had already received everything he needed, and that the expert would lose and make lose time and money at collecting insignificant flaws in handwritten documents. However, according to the law of engineers, the consultant must carefully keep and file the field reports. The borehole logs were prepared using these field reports and the laboratory reports, but the logs summarize information, they do not give all information. Finally, copies of the handwritten field reports were provided.

As it happens frequently for groundwater investigations, the field reports were largely less detailed, less complete than those that are required for geotechnical investigation of future dams or other facilities with major safety issues. However, the field reports gave the times at which the drilling and sampling operations took place. This added information was very useful for the case history.

Using the time information, the author found that if a till sample was highly polluted, it was always the first sample collected in the morning. If a till sample was moderately polluted, it was always the first sample collected in the afternoon. In addition, when the polluted till samples were found, the last (deepest) sample of sand–and–gravel was also highly polluted. This finding supported the idea that free–product pools filled depressions of the uneven till surface.

As a result, there was a simple explanation to having found erratic levels of DNAPL in the till layer. The DNAPL in the upper aquifer moved downward in the small space between the casing and the till wall: it reached the bottom of the hole to contaminate the till at the toe of the casing. The split–spoon sample contained a polluted till if the DNAPL had time enough to seep along the casing. All the highly polluted samples were first ones in the morning, after a night rest for the drill. All the moderately polluted samples were first ones in the afternoon, after a small rest for the drill during the lunch. Clearly, the DNAPL contamination of the till aquitard was cross–contamination during drilling, and mostly between drilling periods. During the morning and the afternoon, it seems that the DNAPL had no time enough to move along the casing to reach the next sampling level.

After finding the reason for having erratic DNAPL levels in the till layer, the author (expert) recommended additional investigation. Surprisingly, no geophysical surveys had been done for this case, whereas the simple stratigraphy was perfect to obtain clear geophysical information. The subsequent geophysical surveys revealed that the aquitard (till layer) was discontinuous, with large "windows" between the sand–and–gravel aquifer and the fractured rock aquifer. This was afterwards verified using boreholes that confirmed the till absence and thus the till layer discontinuity. Therefore, the till aquitard could not protect the underlying fractured rock aquifer against fast and intense contamination. The windows easily explained the high level of pollution in the rock aquifer.

## Conclusion

DNAPL cross–contamination may happen from an upper unconfined aquifer down to a confined aquifer, via natural paths such as large apertures (windows, pinchouts) and small apertures (near–vertical fractures) in the aquitard, and via man–made paths such as vertical spaces along drilling casings, incorrectly sealed monitoring wells, and long–screened MWs. All these potential pathways must be investigated.

When a borehole is drilled, or when a penetrometer is driven, through a contaminated unconfined aquifer, there is a small space between the casing and the hole wall. This small annular space acts as a conduit or preferential pathway for any DNAPL that can travel downwards along the casing and reach a deeper aquifer. A drilling method using a dense mud may help to prevent this migration; however the use of mud may cause further problems, especially for developing the MWs and then collecting representative groundwater samples.

In the worst scenario, the DNAPL reaches the aquitard material as soon as it is sampled, or after a few hours. This is what happened in the 1980s case of this paper. Similarly, U.S. EPA (1992, 1994) warned groundwater professionals that DNAPL can be carried to greater depths during drilling. This drilling cross–contamination creates a bias in soil– and water–quality samples, leading to an incorrect evaluation of groundwater contamination.

Cross-contamination may also happen after drilling due to a poor sealing of the borehole when installing a MW, or due to non–sealable damage or defects in the wall, that were created by drilling (Chapuis and Sabourin 1989; Meiri 1989; Avci 1992; Lacombe et al. 1995; Lapham et al. 1995; Yesiller et al. 1997; Chapuis 1998; Chapuis and Chenaf 1998; Chesnaux et al, 2006; Chesnaux and Chapuis 2007), or seal deterioration (U.S. EPA 1992, 1994). It may also be due to long–screened monitoring wells, which act as long man–made vertical drainage paths (Church and Granato 1996; Santi et al. 2006; Mayo 2010). From an engineering point of view, wells may be viewed as a weakness in a natural barrier system (Warner 1996). Wells may be designed, drilled, and constructed to try to minimize cross–contamina-

tion, but the risk still exists.

The installation of a single MW or of a multilevel system in the aquitard must proceed as soon as the borehole is completed. This avoids having a long period of time with cross contamination and diffusion, which starts in the small annular space between the casing and the aquitard during drilling or in the open–hole (waiting time prior to MW installation) as soon as a DNAPL enters these spaces. Otherwise, misinterpretation of contamination will result from misunderstanding the reasons for cross–contamination.

This 1980s case history teaches us that cross–contamination may happen during drilling. Also, since the details reported here never went public, many professionals were kept unaware of this problem and the simple way (time of soil sampling) to detect it. This negative aspect of the confidentiality rules, which work against the order or corporation's mandate to protect the public, is unfortunate for the engineering profession.

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*Paolo Gazzarrini*

## Overture

33rd episode of the Grout Line. It's Christmastime and it's a good time for a fairy tale. So here we are; a short rock grouting fairy tale.

The need to talk (again!) and to write (again!) about very "basic" concepts of rock grouting, is once again obvious after attending few conferences and reading several grouting specifications.

"Basic" concepts such as: grout mixes and grout pressures- let's leave all the different grouting theories out, for the moment.

I realized that still now in 2013 (nearly 2014), I repeat 2013!, some of us grouters, are still working with old theories and procedures that I was hoping had been completely abandoned and forgotten. So I am obliged to insist, insist, insist!

And so begins my short tale.

Of course all of the characters described in the story are absolutely real, but the story is totally fictitious. Any resemblance to real facts and real persons is purely and accidentally coincidental!

## A Christmas Fairy Tale of Rock Grouting in a Dam!

Characters:

- The Hopeful Dam
- The Thirsty Rock Mass (Main character)
- The Self-Conscious Grout Curtain, Grout Mixes and Grouting Pressures (All Main characters, of course)
- The Trusting Owner
- The Happy Engineer
- The Main Contractor and the Drilling & Grouting Contractor
- The Very Happy Grouting Consultants

Once upon a time in a faraway land there was a valley. (*Classic start of a fairy tale*).

One day, someone decided that it was a good idea to build there a dam and a power house to produce energy. (*Up to here nothing strange*).

The Owner hired an Engineering Firm and a design was born. Voilá. (*Again up to this point nothing strange*).

With the design in hand, the Engineer prepared the Specifications.

"No problem", thought the Engineer. "For the concrete we have a lot of experience. For the rebar the same, as well as for the earthmoving."

As for the Rock Grouting? Again: "No problem", as the Engineer remembered a job at XYXY Dam. "We can copy and paste the specifications used there!" And so it was done. Unfortunately the Engineer had forgotten that XYXY Dam had been built in 1961, more than 50 years ago! (*And herein the problems begin*).

The Specifications were completed, the Owner found the money, and the tender was issued with a Main Contractor selected.

The work started to the great satisfaction of everybody.

Now we need to open a parenthesis and clarify that the Dam location was in a very remote area of the World (*quite usual for a Dam*), with very extreme meteorological conditions. Consequently the Contractor had a very short window (6 months) to build the Dam.

A construction schedule was prepared, a D & G contractor was chosen, and the Grouting started immediately. The schedule allowed two months for the grouting, with the following four months for the Dam Construction. Everything was looking very good!

The Grouting Design called for a single row (the rock mass was supposed to be fairly good), 10 meters deep with conventional Primary holes (with spacing of 5 meters) and Secondary holes (also with spacing of

5 meters). Tertiary holes, would be as required, depending on the take of the Secondary holes.

The main part of the Grouting Specification (*please remember, copied and pasted from 50 year old Specs*) called for:

- Use of very unstable grout mixes W/C= 4 and gradual thickening to W/C=3, W/C=2 and finally W/C=1 ("*colored water"* to "*dirty water*").
- Use of grouting pressures based on the principle (rule of thumb) of 1 psi/ft or 0.23 bar/meter.
- "Refusal" (*poor rock mass that is obliged to refuse grout, despite maybe being quite thirsty!*) criteria 1 liter/minute/meter.
- Acceptance criteria < 2 Lugeon.

The D&G contractor started the job on time, following the Specs, and after completing a few additional Tertiary holes, in only one month (earlier than expected, WOW!), completed the grouting job. To verify the grout curtain, the Engineer instructed some WPT that (oops!) provided terrible results, with very high values of Lugeon.

The poor Rock Mass felt very sad, about having "refused" some grout mix, and the Grout Curtain was very upset because it was not able to satisfy everyone's expectations!

Panic on site was evident! The Owner fighting with the Contractor, the Contractor fighting with the Engineer, etc. The risk was huge, considering that if the dam was not completed on time, before the window of the weather, the production of energy would need to be postponed by one year with great losses for the Owner.

So the Contractor hired a Grouting Consultant, the Engineer another Grouting Consultant (both consultants very happy!) and a new strategy was defined.

It was decided, using the same criteria of P, S and T, to:

Firstly, use STABLE mixes.

Secondly, increase the grouting pressures.

And thirdly, use computers to monitor in real time, and record the behavior of the grouting.

A brand new row was constructed and the result..... was astonishing!

The Lugeon value dropped to the required level, the job was done in three weeks -permitting the completion of the dam on time in the remaining four months- with great satisfaction to the Owner, Engineer and Contractor. And more importantly, to the Rock Mass and the Grout Curtain, the two of whom felt very "tight" and happy!

and they all (Rock Mass, Grout Curtain and Dam)

..... lived happily ever after!

**Merry Christmas with a happy end!**

## Morals of the Fairy Tale

- Never copy and paste yesterday's Specs to today's job. Instead, let's try to stay with the state-of-the-art of the Grouting industry.
- Always use stable mixes! It is time to stop after the unsuccessful results of the past decades to continue in this dangerous direction. It is not admissible anymore to say, "..but I did it that way all my life!".
- Engineers, please, specify computers, computers and computers for monitoring and recording of the grouting behavior. It is no longer acceptable that in a grouting job on a Dam site, computers for grouting are not used.
- Why not increase the grouting pressures? Also here I think it is time to stop asking the poor rock mass to "refuse" grout at 15 psi (1 bar!). How can the mix penetrate small fissures if the pressure is not enough? Engineers, please, don't specify the maximum pressure; let's let the rock mass, with its existing network of fissures, decide the right pressure to be used! (Understand that the poor rock mass also has a soul and desires!).
  The pressure shall, of course, be controlled with real time monitoring to avoid hydro- jacking or hydro-fracturing.
  Rhetorical questions: if you have granite to grout with no fissures, what is the maximum grouting pressure you can use at 20 meters (60 ft)? 4 bars = 60 psi?
  And with fissures?
  The logic (see Dr. Lombardi and Dr. Deer articles @Lombardi.ch) behind this higher pressure theory is that it is very improbable to have hydro-jacking or hydro-fracturing of the rock mass if there is not a combination of high grout take and high pressures.

I hope you enjoyed my brief fairy tale and if you have some comments or grouting stories or case histories, send me your material to:

*Paolo Gazzarrini,*
*E: paolo@paologaz.com,*
*paologaz@shaw.ca or*
*paolo@groutline.com.*

**Ciao! Cheers!.. and a FABULOUS 2014 to everybody!**

# Landmark research on oil sands mine closure landforms underway at the University of Saskatchewan

*Vivian Giang*

Dr. S. Lee Barbour is a salt of the earth kind of man, figuratively and quite literally.

In 1997, the University of Saskatchewan Professor of Civil & Geological Engineering was simulating patterns of salinization in Saskatchewan when environmental scientists from Syncrude Canada Ltd. approached him to conduct research on salinity problems they were facing in the overburden shales of their oil sands operations.

"We began our first instrumented landform in 1998, looking into how water moved within reclaimed landforms and how this affected salinity in the area," says Barbour. He continued to work with Syncrude on their salt issue, but over the years, the research began expanding into other areas of concern.

"Our major questions regarding salt slowly turned toward the capability of the reclamation covers to support upland forests," explains Barbour. In 2000, he initiated a collaborative multidisciplinary research program into the performance of reclamation soil covers at Syncrude's oil sands mine sites, a program which lasted 12 years. Near the end of this study, Syncrude approached him again, this time with the idea of establishing an NSERC Industrial Research Chair (IRC) program.

Barbour, an expert in the areas of contaminant transport in saturated and unsaturated soils and in mine waste reclamation, discussed a few research ideas for the Chair with Syncrude, but the topic of how water moves through the reclaimed landscape following mine closure was of particular interest to industry. The oil sands industry uses open pit mining methods that result in hundreds of square kilometres of disturbed land, much of it covered by new landforms comprised of various forms of mining waste. Oil sands operators have developed designs for progressive reclamation of these landscapes, including the use of end pit lakes or wetlands as methods to collect surface and groundwater from these landforms for eventual release. Barbour proposed an investigation into ways of tracking the long-term hydrogeological evolution of these landforms, including the development of novel methods of monitoring water movement and chemical transport in these upland structures for the IRC.

In 2012, Barbour was awarded an NSERC Industrial Research Chair in Hydrogeological Characterization of Oil Sands Mine Closure Landforms. Funded by Syncrude with matching funds from NSERC, the research program is worth $2.6 million and focuses on developing better tools to track and monitor the migration of groundwater released from reclaimed oil sands mine landforms. Specifically, he has been investigating the transport and fate of water in two watersheds within reclaimed land at Syncrude's Mildred Lake facility, north of Fort McMurray. According to Barbour, the research

*One of Dr. Lee Barber's research field sites is located on a watershed that is part of Syncrude's permanently reclaimed land at the company's Mildred Lake facility, 35 kilometres north of Fort McMurray. The area depicted in the photo is known as the South Bison Hills.*

*Dr. Barbour's research also extends into Syncrude's 57-hectare watershed that features a 17-hectare fen pilot project, the oil sands industry's first attempt at creating a wetland from the ground up, on land formerly mined and now in the process of being reclaimed.*

aims to "develop strategies to ensure that water released after mine closures doesn't have a detrimental impact on the environment." He will extend the research program into another two areas currently being reclaimed by Syncrude. One of the areas is a new 50-hectare reclaimed tailings basin which includes a 17-hectare fen pilot project. The pilot project will be the first in the oil sands industry to create a wetland on formerly mined land.

"The key questions revolve around what it will take to restore these mine sites back to naturally performing landscapes with an equivalent capability to that which existed prior to mining. The industry works to establish uplands with water and nutrient balances which are similar to natural sites. They then try to understand the key processes that are operative as they monitor the evolution of these landforms towards fully functioning natural systems," says Barbour.

While Barbour is tracking the water movement in these areas, Dr. Matthew Lindsay, Assistant Professor of Environmental Geochemistry at the University of Saskatchewan, is proposing to study the biogeochemical evolution of these hydrogeological systems. Lindsay is presently preparing an application as an Associate IRC to Barbour's Senior IRC. The results from their combined research efforts will enable the long-term monitoring of the performance of the landscapes and facilitate environmentally sustainable mine closure planning for the oil sands industry.

Though Barbour says that his IRC program is one "small part" of several research partnerships contributing to a path toward the proper closure and reclamation of oil sands mine sites, his research will have far-reaching effects into a variety of industrial mine sites, including coal and metal mine sites.

At these sites, tailings and acid rock drainage are major environmental concerns, and Barbour's research will provide industry with the tools for monitoring and evaluating the performance of these landscapes and will provide a basis for the design of sound closure scenarios from a hydrogeological point of view.

One can sense that much of the work Barbour is conducting is driven by his commitment to protecting Canada's natural environment and preserving it for future generations. At the same time, he will be training the next generation of geotechnical engineers, environmental scientists and researchers to continue this important collaborative work with the oil sands and mining industries. Of his collaborations with Syncrude's scientists and engineers, Barbour says, "it is in large measure the energy and passion that these researchers bring to this journey that gives me the encouragement I need to take this on."

***Vivian Giang, MA***

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# The First Interactive GeoSoftware Database is here!

***After months of development, in October 2013, Geoengineer.org launched The First Interactive Geo-Software Database worldwide!*** *You can find it online at http://www.geoengineer.org/software/home.* Our goal was to create the most *comprehensive* database for geo-industry software. This new database is a major upgrade of the previous database that was already very popular. However, the new one has dramatically improved features and its content is growing daily. Upon launch, it included approximately 200 software in 20 categories and has grown tremendously since then!

Among the **powerful features** of this new database are:

- *The latest news on geo-software and featured articles on software upgrades, new releases and capabilities. These are highlighted on the main page of the Software database, the news center and even the main page of Geoengineer.org, reaching thousands of geo-professionals*
- *Improved rankings of software on search engines; Pages included in Geoengineer.org rank very high with Google and other search engines providing visibility to listed programs.*
- *Visitors can download software and receive software discounts*
- *An advanced search and indexing*
- *Tags that can promote software in directories related to the software's capabilities*
- *Each software listing includes photos and videos associated with the software*
- *Visitors can provide ratings and comments for each software*
- *Visitors can ask questions to software providers*
- *Each software page is shareable in social media*

In the near future, the database will also be integrated with the GeoWorld professional networking website that has over 3,300 members and will alert premium software providers about postings in software (and other) forums.

## List your software for free!

All software companies, and individuals who have developed a geo-software program, can now list their software in the database for free! To list your software, simply sign up here: http://www.geoengineer.org/software/home (takes 2 minutes) and choose the basic plan. You can then start adding software and taking control of how it is displayed!

## Promote your software to thousands of geoprofessionals!

If you are interested in standing out from the crowd and promoting your software to thousands of monthly visitors, you can also take a look at the sponsorship plans offered here: http://www.geoengineer.org/software/sponsorship-levels and choose the one that best fits your marketing needs.

Here are some examples of the type of promotion you would get at the Lead Sponsorship level costing only $1,500 for a whole year:

- *deactivate all "featured software" ads of other/competing software on your software page*
- *receive an email notification when someone posts comments/questions about your software and reply option*
- *receive automatic statistics in your email inbox every quarter*
- *promote your software by offering discounts (your software stands out with a discount signal)*
- *have our expert geotechnical editors write a featured editorial article about your software, highlighted on the Geoengineer.org homepage, software main page and the news center*
- *place your display banner ad on the software homepage*
- *list your software as "Featured Software" for a particular category of your choice (your software appears first in the listing of that category and stands out with a featured sign)*

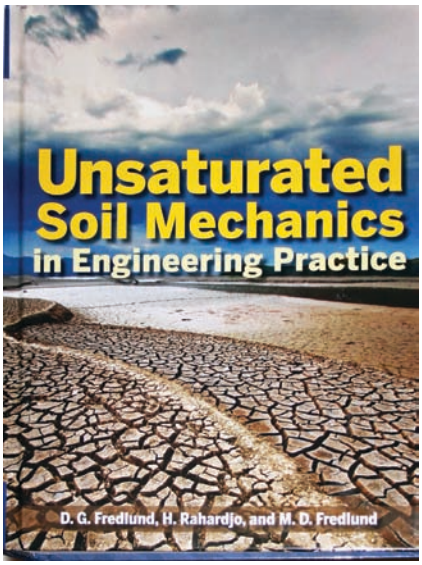
If you are have any questions about the new software database or promotion of your software programs, please contact me.

***Marietta Zarogiannopoulou***

*Marketing Director*
***marketing@geoengineer.org***
*http://Geoengineer.org*
*http://myGeoWorld.info*

## Unsaturated Soil Mechanics in Engineering Practice

*Book Reviewed by G. Ward Wilson*




The recently released book titled, "Unsaturated Soil Mechanics in Engineering Practice", constitutes a new and exhaustive synthesis of the present state of knowledge for unsaturated soil mechanics. The book identifies a range of physical processes common to all soils near to the ground surface. In addition to water flow through unsaturated soils, shear strength and volume change, the book addresses the physical processes of heat flow, water vapour flow and air flow. The theory associated with each of the physical processes is presented in a step by step manner using common engineering notation. The theory is followed by descriptions of laboratory tests that can be used to measure unsaturated soil property functions relevant to each physical process. An extensive explanation is then given on how the unsaturated soil property functions can be estimated with the assistance of the soil-water characteristic curve, SWCC. Finally, protocols for prudent geotechnical engineering practice are presented.

An abundantly instructive and comprehensive chapter is solely dedicated to the measurement and the estimation of the soil-water characteristic curve. This chapter shows how the SWCC is used to estimate the unsaturated soil property functions required for numerical and analytical simulations of processes common to unsaturated soils. There is also a chapter devoted to the quantification of the ground surface moisture flux. For example, it is shown how weather station data is used to compute actual evaporation from ground surface. Actual evaporation is combined with other ground surface water balance components to calculate the net moisture flux at ground surface. Engineering protocols based on the practical experience of the authors are described for a range of geotechnical engineering applications.

In general, the application of unsaturated soil mechanics in engineering practice has been subdivided into two broad categories: namely, the Preliminary Stage and the Design Stage. In this, it is possible to provide estimations of the likely behaviour of unsaturated soils based on grain-size distribution curves or other estimation techniques for the SWCC. The preliminary type of exercises are later followed by more detailed design procedures.

The emphasis of the new book is clearly centered on the ability to estimate unsaturated soil property functions based on the saturated soil properties and the SWCC. An estimation of the SWCC can be obtained from the grain-size distribution curve or correlations with soil classification properties. There are complexities associated with the use of the SWCC. For example, there is a drying and wetting SWCC. The issues related to hysteretic and volume change are addressed in the book.

The chapter on the use of weather station data for the determination of moisture and temperature flux conditions at ground surface is presented in a manner that is particularly useful for geotechnical engineers. Details are presented for the calculation of potential evaporation and actual evaporation. Solutions for both "coupled" and "uncoupled" procedures for satisfying heat and moisture flow are described. Procedures for handling the interaction between precipitation and runoff are also suggested for geotechnical engineering problems.

Numerical modeling has become an integral part of solving engineering problems involving saturated-unsaturated soil systems. The authors of this new book have shown how it is possible to make use of numerical modeling parametric type studies to embrace conditions that are likely to occur. The theory and soil parameter estimation are closely linked to software that is able to accommodate the solution of nonlinear partial differential equations. All problems are formulated within a consistent "boundary-value problem" framework.

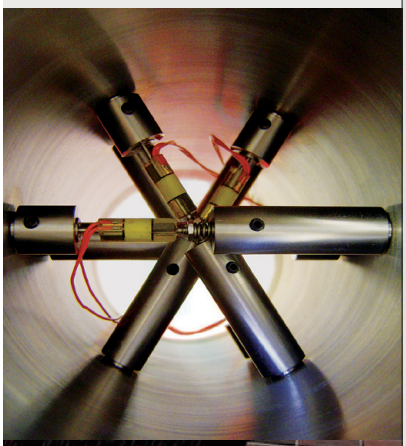
The need for comprehensive engineering software becomes immediately apparent when solving problems involving unsaturated soils. The equations that need to be solved take the form of nonlinear partial differential equations. Their solution must not only ensure convergence, but also ensure convergence to the correct solution.

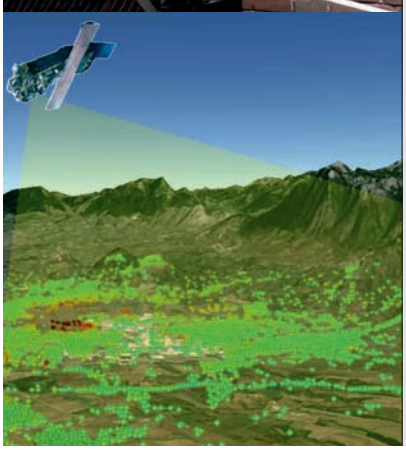
It is immediately clear from an examination of the contents that this book is not simply a second edition of their 1993 book titled, "Soil Mechanics for Unsaturated Soils". The new book is almost 1000 pages in length – almost twice that of the 1993 book. The new book reveals much about the progress that has been made in unsaturated soil mechanics over the past two decades. Most important, the book presents vital information regarding many of the gaps in our original understanding. Those gaps were a hindrance to the implementation of unsaturated soil mechanics into routine engineering practice.

There appears to be an ever-increasing range of geotechnical engineering problems where the application of unsaturated soil mechanics is relevant. Originally, the primary focus was on the behaviour of expansive or swelling soils. Slope stability problems were of concern because of the close linkage between weather-related conditions and the failure of slopes. Later, our concerns extended to environmental engineering and sustainability. Contaminant transport problems were often dominant near the ground surface where the soils were unsaturated. Soil cover designs became a particularly fruitful area where unsaturated soil mechanics principles could be applied through numerical modeling. More recently, there has been an increase in unsaturated soil applications related to the mining industry. Unsaturated soil mechanics theories can be applied to waste rock and tailings materials, heap leach operations, solid waste facility operations and other situations where there is an interaction between the weather and the ground surface materials.

As society demands greater environmental accountability and sustainability, particularly for the resource extraction industries, it becomes increasingly necessary to be able to simulate processes involving unsaturated soils near the ground surface. As a practitioner who continuously deals with unsaturated soils in engineering design and research, this latest book has become a crucial and fundamental reference for me. "Unsaturated Soil Mechanics in Engineering Practice", by D. G. Fredlund, H. Rahardjo and M. D. Fredlund is an essential and rich guide for geotechncial engineering practice, which I strongly recommend.

*John Wiley & Sons; 926 pages; Hardcover is $138.35; Kindle is $87.99. Available from Amazon.ca*





## International Course on
## Geotechnical and Structural Monitoring

June 4-6, 2014
"Castle of Poppi", Tuscany (Italy)

Course Director: **John Dunnicliff**, Consulting Engineer
Organizer: **Paolo Mazzanti**, NHAZCA S.r.l.

NEW COURSE: This annual course in Italy replaces the long-standing series of continuing education courses in Florida. The format will be similar to the Florida courses, but with the addition of **substantial content on remote methods for monitoring deformation**.

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

WHO: Engineers, geologists and technicians who are involved with performance monitoring of geotechnical features of civil engineering, mining and oil and gas projects. 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 and structural monitoring while networking and sharing best practices with others in the geotechnical and structural monitoring community.

INSTRUCTION: **provided by leaders of the geotechnical and structural monitoring community**, representing users, manufacturers, designers and people of academia from Italy, England, Australia, France, Germany, Norway, Switzerland, USA, Hong Kong and The Netherlands.

WHERE: the 3-day course will be held in Poppi (Tuscany, Italy), in the main room of a 13th century castle (www.castellodipoppi.com). Poppi is in the countryside of Tuscany, near the city of Florence. **Dedicated transportation to Poppi from Florence main train station and city airport will be available**.

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