Online
www.geotechnicalnews.com
Volume 37 • Number 4 • December 2019

GEOTECHNICAL news

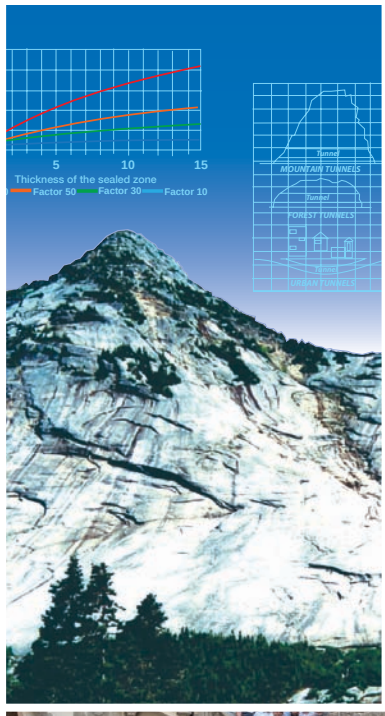






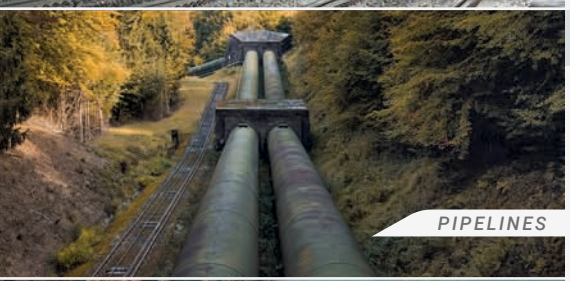

Our final issue 1982 - 2019

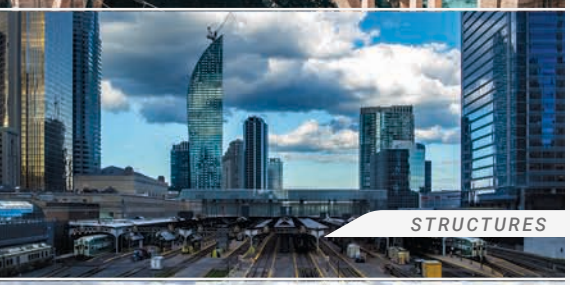


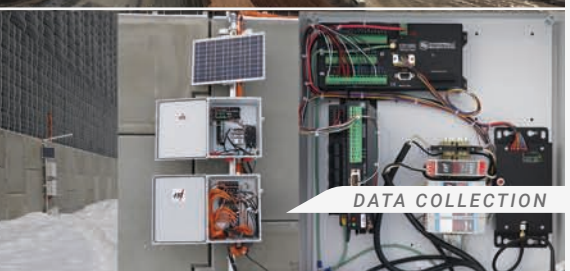




1982 37 GEOTECHNICAL news 2019
YEARS







Monitor with Confidence

RELIABILITY + ACCURACY

RST Instruments Ltd. is a world leader in the design, manufacturing and sale of geotechnical, environmental and structural monitoring instruments and data collection systems. Since 1977, our customers have depended on our reliability & accuracy to help them:

- Improve Decision Making
- Improve Safety
- Optimize Design
- Reduce Costs
- Increase Productivity
- Manage Risks

info@rstinstruments.com
www.rstinstruments.com

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, BC Canada V2X 0Z5
TEL: CANADA / USA - Sales, Service & Manufacturing: 604 540 1100
TEL: EUROPE / MIDDLE EAST / AFRICA - Sales: +44 1449 613677
TOLL FREE: CANADA / USA: 1 800 665 5599

YouTube www.youtube.com/user/RSTgeotechnical

LinkedIn www.linkedin.com/company/rst-instruments-ltd-

The RST Instruments Ltd. Quality Management System is certified ISO 9001:2015

MIG0628A

GEOTECHNICALnews

PUBLISHER John W. Gadsby

MANAGING EDITOR Lynn Pugh

Editors

Robert Chapuis
John Dunnicliff
Ward Wilson
Richard Guthrie
Paolo Gazzarrini
Nick Beier

Managing Editors and Advertising

BiTech Publishers Ltd.
211 - 10180 Ryan Road
Richmond, British Columbia
Canada V7A 4P9
tel 604-277-4250 • fax 604-277-8125
email *gn@geotechnicalnews.com*
web *www.geotechnicalnews.com*

GEOTECHNICAL NEWS is published quarterly.

Paper subscription rates:

- within North America: $60.00 CDN per year
- overseas: $100.00 US per year through BiTech Publishers Ltd.

Electronic version:

GEOTECHNICAL NEWS is also available in electronic version.
For details,visit
www.geotechnicalnews.com

Canadian Editorial Office

Canadian Geotechnical Society

Nick Beier, Editor, CGS News • email: *nabeier@ualberta.ca*

Membership Information : Canadian Geotechnical Society

Gibson Group Association Management
Wayne Gibson, 8828 Pigott Road • Richmond, BC V7A 2C4 • tel: 604-277-7527 • email: *cgs@cgs.ca*

Editors

Groundwater

Robert P. Chapuis, Dept. CGM, Ecole Polytechnique, PO Box 6079, Sta. CV Montréal, QC, H3T 1J4
tel: 514-340-4711 • fax: 514-340-4477, • email : *robert.chapuis@polymtl.ca*

Instrumentation

John Dunnicliff, Little Leat, Whisselwell, Bovey Tracey, Devon TQ13 9LA, England
tel: +44 1626-832919 • email: *john@dunnicliff.eclipse.co.uk*

The Grout Line

Paolo Gazzarrini, 11-2246 Folkestone Way, West Vancouver, BC, V7S 2X7 • tel: 604-913-1022
fax: 604-913-0106 • email: *paolo@paologaz.com*

Waste Geotechnics

G. Ward Wilson, Professor, Geotechnical and Geoenvironmental • University of Alberta, Dept. of Civil & Environmental Engineering, 3-069 NREF, Edmonton, AB T6G 2W2 • tel: 780-492-2534
fax: 780-492-8198 • email: *wwilson2@ualberta.ca*

Geohazards

Richard Guthrie, Senior Principal, Director, Geohazards and Geomorphology, Stantec,
200-325 25 Street SE, Calgary, AB T2A 7H8, • tel: 403-441-5133, •
email: *Richard.Guthrie@stantec.com*

Printed in Canada

A note from the Publisher

After thirty seven years BiTech Publishers Ltd. is closing down on December 31, 2019. This December issue of Geotechnical News will be the last. The Canadian Geotechnical Society (CGS) will continue publishing a quarterly magazine working with Lisa Reny and her company *Karma Link*.

In 1982 Geotechnical News started as a type written new sheet to promote general information and activities of the CGS. It was separate from the technical content provided in the *Canadian Geotechnical Journal*. The newsletter was converted to a glossy newsmagazine in 1983 at the Vancouver PanAm Conference and started to add technical articles on any topics related to geotechnical engineering. Technical articles for Geotechnical News have not been peer reviewed. The only requirement has been that they were well written in French or English.

In the years we have seen significant changes in the publishing industry. Desktop publishing has completely changed the production process of magazines and conference proceedings are now almost entirely produced on USB sticks.

We thank the advertisers for their continuous support and the editors who solicited the wide range of articles.

It has been a very interesting and rewarding experience. We are pleased we have been able to support the ongoing success of the Canadian Geotechnical Society

Lynn Pugh – John Gadsby

Volume 37 • Number 4 • December 2019

CONTENTS

Geotechnical + Structural **Instrumentation**

Linear Displacement
- Crackmeters
- Extensometers
- Settlement systems

Angular Displacement
- Inclinometers
- Tiltmeters
- Pendulums

Load
- Load cells
- Strain gauges

Pore Water Pressure
- Piezometers

Total Stress in Soil
- Pressure cells

Stress Change in Rock
- Borehole pressure cells
- Stressmeters

Temperature
- Temperature sensors
- Thermistor strings

Data Acquisition
- Readouts + Dataloggers
- Wireless networks
- Cloud hosting + data visualization

Vibration
- Vibration monitors

CELEBRATING 1979 40 2019 YEARS

GEOKON | **TRUSTED MEASUREMENTS™**

www.geokon.biz/Geotechnical

GEOKON | Lebanon, NH | USA | +1.603.448.1562

Message from the President

A word from Mario - Un mot de Mario

2019-2020 CGS President, Mario Ruel

Mario Ruel, President of Canadian Geotechnical Society.

Dear friends, colleagues, and members – Bonjour!

Winter is setting in and most of our 2019 active construction projects should be almost done as we are finalizing reports, closing budgets and planning for 2020. It has been a busy year at the CGS and we are concluding the first half of our mandate. I'll briefly go over what has occurred over the last quarter and highlight some of what your CGS Executive Committee accomplished in 2019.

At the end of September, there was a great deal of CGS activities packed into one intense week.

GeoSt.John's 2019: Starting on Sept 29th, we held our 72nd Annual CGS Conference in St-John's, Newfoundland & Labrador. This was particularly special since it had been 23 years since the CGS held a conference at this location. Thanks to the leadership of **Sterling Parsons** and his team, GeoSt.John`s 2019 was very successful and well attended. All delegates were able to learn from strong technical presentations from Universities as well as from experiences shared by geo-practitioners aiming at raising the profile of geotechnical practice in Canada. Highlights included an excellent R. M. Hardy Lecture delivery by **Ryan Phillips**; a touching Legget Medal Luncheon for our new and well deserving R. F. Legget Medal winner, **Arun Valsangkar**; and **Suzanne Powell** was selected as our first winner of the new CGS Early Achievement Award. CGS also proudly presented Honorary Life membership awards to **John Gadsby** and **Fred Matich**; these two new members represent over 100 years of CGS experience and contribution. Finally, I am glad to confirm that **Ian Moore** will be the CGS President-Elect for 2020, and President in 2021-2022; Ian will present his team during the 73rd Annual Conference in Calgary next September.

Preceding the conference over the weekend, we held our Annual Board of Director's (BOD) meeting with 45 volunteer leaders representing CGS Divisions, Committees and all local Sections across Canada. Several key decisions were made about issues related to communications, development of initiatives and the operation of our Society. For instance, the BOD accepted Saskatoon`s proposal to host the 75th CGS Annual Conference in the fall of 2022. You can find more details on the BOD meeting within the Annual reports on the CGS website. Thanks are expressed to all members of the Board for investing their time away from their families for their voluntary work that is so essential for our Society. I was glad to see all members working in harmony and focusing efforts on common objectives for the success of the CGS.

Our Young GeoPros in action in St-John`s:** A few days prior to GeoSt. John`s, Co-Chairs **Vincent Castonguay and **Vincent Cormier** lead the team that organized the 6th Canadian Young Geotechnical Engineers and Geoscientists Conference (cYGEGC). The CGS actively participated in this dynamic and very well-organized event. Thank you to the young "Vincent`s" and their Organizing Committee. After seeing the "next generation" in action, I feel very confident that the future of the CGS will be in very good hands.

The end of September, early October period in St-John`s was very intense but above all, it was a lot of fun for our delegates. I've personally really enjoyed the cYGEGC, the BOD, the GeoSt.John's 2019 and, even after a few months, I am still full of enthusiasm and looking forward to next year`s GeoCalgary Conference in September 2020, organized under the leadership of Co-Chairs **Justyna Kos-Fairless** and **Daniel Bertrand**.

Looking back at 2019

As we are concluding the first year of our mandate, I'll briefly go over some highlights of how our CGS is doing.

I am pleased to report that our CGS continues to be strong and healthy. Our finances are well managed under the direction of VP Finance, **Kent Bannister** and membership is steady. We are making efforts with creative ways to increase member services, promote loyalty and help grow our society along with a communication plan implemented this fall by VP Communications, **Judith Bouchard**. Over the last few months, we supported new initiatives by sections, such as the RGG GeoCelebration

Geotechnical Engineer: Chung & Vander Doelen Engineering Ltd
Structural Engineer: Stephenson Engineering Ltd
General Contractor: Reid & DeLeye Contractors Ltd
Geopier Installer: GeoSolv Design/Build Inc.

GEOPIER IS GROUND IMPROVEMENT®

Geopier rigid inclusions were installed in soft, compressible soils to support a 12-story condo with 2-levels of below grade parking.

Geopier rigid inclusion products enable you to:

- Provide increased bearing capacity
- Minimize settlement
- Replace deep foundations

REQUEST FEASIBILITY ASSESSMENT
800-371-7470 • info@geopier.com
www.geopier.com/feasibilityrequest

GEOPIER®
Tensar®

and the Burland mini-tour. The CGS encouraged Young Professional Representative, **Maraika DeGroot**, who initiated the creation of seven student chapters, started monthly coaching webinars, proposed an early achievement award and also actively supported for the cYGEGC. Efforts toward gender balance saw tangible progress, which included publications about Women in Canadian Geotechnique and a Women's Networking Breakfast during GeoSt.John's 2019. These are in line with our mission toward youth, women, practitioners and francophones, while maintaining loyalty and encourage new membership.

At the start of our mandate, the CGS Executive Committee informed you that we would tackle the challenge of producing the new online CFEM within 2 years, which would then become our most tangible deliverable. Following regular exchanges with the CGS VP Technical, **Rob Kenyon**, the Project Coordinator of CFEM 2021, **Ken Skaftfeld**, is on track with this objective in mind. Good progress was made in 2019 with the production of the Chapter Outline, selection of Chapter Leads and Contributors as well as initiation of some Chapters. The first Chapter to be ready will be Limit States Design in 2020 with the remaining chapters coming in 2021. So far, we have had an excellent response from our community of CGS experts from coast to coast to contribute to this National Challenge.

The Cross Canada Lecture Tours (CCLT) has been successful this Spring with **Charles Shackelford** (Colorado State University) and this Fall with **Ian Moore** (Queen's University). The next CCLT are already planned under Rob Kenyon`s direction with **Guy Houlsby** (Oxford University) committed to the Spring of 2020, and **Doug Stead** (Simon Fraser University) in the Fall of 2020.

Kathy Kalenchuk successfully presented the 2019 Colloquium at GeoSt. John's. We will encourage Kathy to continue with the Colloquium Lecture Series so her presentation can be given at different locations (on University campuses) across the country.

Local sections lead by **Andrea Lougheed** and Divisions and Committees coordinated by **Jack Seto**, Representatives on the Executive Committee, have also been quite active in 2019 and we are striving for even more collaborations and interactions in the future.

Three of our Executive Committee (EC) members are completing their terms at the end of 2019: Andrea Lougheed (Local Sections Representative), Maraika DeGroot (Young Professionals Representative) and Jack Seto (Divisions Representative). I extend my sincere appreciation for their time and tremendous contributions to our CGS. It has been very rewarding to work with you and also very pleasant working together. I am pleased to welcome **Billy Singh** and **Vincent Castonguay** who will join our team, on the EC, to represent the Local Sections and the Young Geo-Professionals starting in January 2020. The new Division and Committee Rep will also be selected shortly.

Our EC has also been working successfully on preparing for a few other important changes in 2020. Transition is well underway for the Administration of CGS, from GGMI to Karma-Link. The production of our new CGS Magazine with the proposed name ''Canadian Geotechnique'' is also progressing well. The EC and the CGS Communication Task Force is collaborating actively with our new publisher Karma-Link for the first publication next spring 2020. BiTech, our publisher over the past 30 years is publishing this last issue Geotechnical News. I would like to thank **Lynn Pugh** and **John Gadsby** at BiTech, for all the good work they have done over the years with this magazine, for the benefit of our CGS members.

In the name of the CGS, I also want to express our sincere appreciation to **Wayne Gibson** for his over 10 years of dedicated services as the CGS Direction of Administration and Finance.

Thanks also to our CGS National office: Executive Director, **Michel Aubertin**; Director of Communications and Member Services, **Lisa Reny** and Communications Coordinator, **Emily Fournier.** We appreciate their dedication and guidance. They are essential to us in the Executive committee and our CGS would not be able to function without their hard work.

Upcoming events

In a few weeks, CGS will be partnering with the ASCE Geo-Institute to organize the GeoCongress 2020 in Minneapolis, on February 25th-28th. Later on this year, we will all get together again for the 73rd conference planned for Calgary, September 13th – 16th. We are also looking forward to the 74th Annual CGS conference in Niagara Falls, in 2021,

Other important dates to keep in mind for 2020; **membership and corporate sponsorship renewals** are due for **January 1**; the nominations for the 2021 CGS Colloquium to be sent by **January 31** and most **CGS award nominations are due by May 15th** . More information on all of these can be found elsewhere in this issue of *Geotechnical News*, on the CGS Website or by contacting Lisa at *admin@cgs.ca.*

I am honored to lead a great CGS Executive Committee and I am super proud to be the President of the CGS. My goal is to have a strong society which will be able to serve our members even better and help our geo-profession to be even more present in our society.

Thanks again for investing your time in reading my thoughts. I invite you to get back to me with your questions or feedback at *president@cgs.ca*.

I wish you a very pleasant and relaxing holiday Season and a very happy New year in 2020!

À l'année prochaine mes amis ! – See you next year, my friends!

Mario Ruel
President - 2019/2020

Message du président

Chers amis, collègues et membres ~ Bonjour!

L'hiver s'installe et la plupart de nos projets de construction actifs de 2019 devraient être pratiquement terminés alors que nous finalisons les rapports, bouclons les budgets et planifions pour 2020. La SCG a connu une année bien remplie, et nous concluons la première moitié de notre mandat. Je reviendrai brièvement sur ce qui s'est passé au cours du dernier trimestre et soulignerai certaines des réalisations de votre Comité exécutif (CE) en 2019.

À la fin de septembre, beaucoup d'activités de la SCG ont eu lieu durant une semaine intense.

GéoSt.John's 2019 : À partir du 29 septembre, nous avons tenu notre 72e conférence annuelle de la SCG à St. John's, à Terre-Neuve-et-Labrador. Cet évènement a été particulièrement spécial, car cela faisait 23 ans que la SCG n'avait pas organisé de conférence à cet endroit. Grâce au leadership de **Sterling Parsons** et de son équipe, GéoSt.John's a été populaire et très réussie. Tous les délégués ont pu apprendre d'excellentes présentations techniques d'universitaires ainsi que des expériences racontées par des géopraticiens désireux de rehausser la visibilité de la pratique de la géotechnique au Canada. Les faits saillants ont compris une excellente Conférence R. M. Hardy donnée par **Ryan Phillips**, un touchant dîner de remise de la Médaille Legget à notre nouveau lauréat méritant, **Arun Valsangkar**, et **Suzanne Powell** a été notre première lauréate du nouveau Prix d'excellence en début de carrière de la SCG. La SCG a également présenté fièrement des titres de membre honoraire à vie à **John Gadsby** et à **Fred Matich**; ces deux nouveaux membres représentent plus de 100 années d'expérience et de contribution de la SCG. Finalement, je suis heureux de confirmer qu'**Ian Moore** sera le président désigné de la SCG pour 2020. M. Moore présentera son équipe durant la 73e conférence annuelle à Calgary, en septembre prochain.

Au cours de la fin de semaine précédant la conférence, nous avons tenu la réunion annuelle de notre Conseil d'administration (CA) avec 45 leaders bénévoles représentant les divisions, les comités et toutes les sections locales de la SCG au Canada. Plusieurs décisions importantes ont été prises par rapport à des questions concernant les communications, l'élaboration d'initiatives et le fonctionnement de notre Société. Par exemple, le CA a accepté la proposition de Saskatoon d'accueillir la 75e conférence annuelle à l'automne 2022. Vous pouvez trouver de plus amples renseignements sur la réunion du CA dans les rapports annuels affichés sur le site Web de la SCG. Je remercie tous les membres du Conseil d'investir de leur temps loin de leurs familles pour leur bénévolat qui est si essentiel à notre Société. J'étais heureux de voir tous les membres travailler en harmonie et axer leurs efforts sur des objectifs communs pour le succès de la SCG.

Nos jeunes géoprofessionnels en action à St-John's : Quelques jours avant GéoSt.John's, les coprésidents **Vincent Castonguay** et **Vincent Cormier** ont dirigé l'équipe qui a organisé la 6e Conférence canadienne des jeunes géotechniciens et géoscientifiques (CCJGG). La SCG a participé activement à cet évènement dynamique et bien organisé. Merci aux jeunes coprésidents et à leur comité organisateur. Après avoir vu la « prochaine génération » en action, je suis convaincu que l'avenir de la SCG sera entre de bonnes mains.

La période de la fin septembre et du début octobre à St. John's a été très intense, mais par-dessus tout, elle a été très amusante pour tous nos délégués. J'ai personnellement beaucoup apprécié la CCJGG, la réunion du CA et GéoSt.John's 2019 et même après quelques mois, je suis très enthousiaste et impatient d'assister à la conférence GéoCalgary en septembre 2020, organisée sous la direction des coprésidents **Justyna Kos-Fairless** et **Daniel Bertrand**.

Retour sur 2019

Alors que nous terminons la première année de notre mandat, je reviendrai brièvement sur certains des points saillants de l'état de la SCG.

Je suis heureux de signaler que notre SCG continue d'être forte et en santé. Nos finances sont bien gérées sous la direction du v.-p. aux finances, Kent Bannister, et le nombre de membres est stable. Nous nous efforçons de trouver des façons créatives d'augmenter les services aux membres, de favoriser la loyauté et d'aider à faire croître notre Société avec un plan de communication mis en œuvre cet automne par la v.-p. aux communications, **Judith Bouchard**. Au cours des derniers mois, nous avons appuyé de nouvelles initiatives des sections, comme GéoCélébration du Groupe géotechnique de Regina et la mini-tournée du professeur Burland. La SCG a encouragé la représentante des jeunes professionnels, **Maraika DeGroot**, qui a instauré la création de sept chapitres étudiants, qui a mis sur pied des webinaires d'encadrement mensuels et qui a proposé un Prix d'excellence en début de carrière, et a aussi soutenu activement la CCJGG. Les efforts pour équilibrer les sexes ont donné lieu à des progrès tangibles, qui ont compris des publications sur les femmes dans le domaine de la géotechnique au Canada et la tenue d'un Déjeuner de réseautage pour les femmes durant la conférence GéoSt. John's 2019. Cela s'inscrit dans notre mission à l'égard des jeunes, des

femmes, des praticiens et des francophones, tout en maintenant la loyauté et en encourageant de nouvelles adhésions.

Au début de notre mandat, le CE de la SCG vous a informés que nous relèverions le défi de produire le nouveau *Manuel canadien d'ingénierie des fondations (MCIF)* en ligne en deux ans, ce qui deviendrait notre contribution la plus tangible. À la suite d'échanges réguliers avec le v.-p. technique de la SCG, **Rob Kenyon**, le coordonnateur du projet du *MCIF* 2021, **Ken Skaftfeld**, est sur la bonne voie pour atteindre cet objectif. Le travail a bien progressé en 2019 avec la production du plan des chapitres, la sélection des auteurs principaux et des contributeurs des chapitres, ainsi qu'avec le début de la rédaction de certains. Le premier chapitre qui sera prêt en 2020 sera Calcul aux états limites, et les autres chapitres paraîtront en 2021. Jusqu'à maintenant, notre communauté d'experts de la SCG d'un océan à l'autre a très bien répondu à ce défi national.

La Tournée de conférences transcanadienne (TCT) a été couronnée de succès ce printemps avec **Charles Shackelford** (Université d'État du Colorado) et cet automne avec **Ian Moore** (Université Queen's). Les prochaines TCT sont déjà planifiées sous la direction de Rob Kenyon, avec **Guy Houlsby** (Université Oxford) qui s'est engagé pour la Tournée du printemps 2020, et **Doug Stead** (Université Simon Fraser) pour celle de l'automne 2020.

Kathy Kalenchuk a connu du succès en présentant le Colloquium 2019 à la conférence GéoSt.John's. Nous encouragerons Mme Kalenchuk à effectuer la Série de conférences du Colloquium pour qu'elle donne sa présentation à différents endroits (sur des campus universitaires) au pays.

Les sections locales dirigées par **Andrea Lougheed**, et les divisions et les comités coordonnés par **Jack Seto**, des représentants sur le CE, ont aussi été assez actifs en 2019, et nous visons à ce qu'il y ait une collaboration encore plus grande et encore plus d'interactions à l'avenir.

Trois des membres de notre CE terminent leur mandant à la fin de 2019 : Andrea Lougheed (représentante des sections locales), Maraika DeGroot (représentante des jeunes professionnels) et Jack Seto (représentant des divisions). J'exprime ma sincère reconnaissance pour leur temps et leurs contributions exceptionnelles à notre SCG. Il a été très enrichissant et plaisant de travailler avec vous. Je suis heureux d'accueillir **Billy Singh** et **Vincent Castonguay** qui se joindront à notre équipe sur le CE pour représenter les sections locales et les jeunes géoprofessionnels à compter de janvier 2020. Le nouveau représentant des divisions et des comités sera aussi bientôt sélectionné.

Notre CE a également travaillé avec succès à la préparation de quelques autres changements importants en 2020. La transition de la gestion des affaires administratives de la SCG, du GGMI à Karma-Link, avance bien. La production de notre nouveau magazine de la SCG que nous avons proposé d'appeler « Géotechnique canadienne » progresse aussi bien. Le CE et le Groupe de travail sur les communications de la SCG collaborent activement avec notre nouvel éditeur Karma-Link pour la première publication au printemps 2020. BiTech, notre éditeur des 30 dernières années publie ce dernier numéro de Geotechnical News. J'aimerais remercier **Lynn Pugh** et **John Gadsby** de BiTech pour l'excellent travail qu'ils ont fait au fil des ans avec ce magazine au bénéfice des membres de notre SCG.

Au nom de la SCG, j'aimerais exprimer notre reconnaissance à **Wayne Gibson** pour ses quelque 10 années de service dévoué à titre de directeur, Administration et finances de la SCG.

Merci aussi au personnel du bureau national de la SCG : le directeur général, **Michel Aubertin**; la directrice, Communications et services aux membres, **Lisa Reny** et la coordonnatrice des communications, **Emily Fournier.** Nous apprécions leur dévouement et leurs conseils. Ils nous sont essentiels au CE, et notre SCG ne pourrait fonctionner sans leur travail acharné.

Évènements à venir

Dans quelques semaines, la SCG s'associera au Geo-Institute de l'ASCE pour organiser le GeoCongress 2020 à Minneapolis du 25 au 28 février. Plus tard cette même année, nous nous réunirons à nouveau pour la 73e conférence prévue à Calgary, du 13 au 16 septembre. Nous nous réjouissons également d'assister à la 74e conférence annuelle de la SCG à Niagara Falls en 2021.

Voici d'autres dates importantes à garder à l'esprit en 2020 : la date limite du **renouvellement des adhésions et des commandites** est le **1er janvier**, les candidatures pour le **Colloquium 2021 de la SCG** doivent être envoyées d'ici le **31 janvier et la date limite des candidatures pour la plupart des prix de la SCG est le 15 mai**. Vous pouvez obtenir de plus amples renseignements sur ces échéances dans ce numéro de *Geotechnical News*, sur le site Web de la SCG ou en écrivant à Lisa Reny *à admin@cgs.ca*.

Je suis honoré de diriger un formidable Comité exécutif de la SCG et suis très fier d'être président de la SCG. Mon objectif est d'avoir une Société forte qui pourra servir encore mieux ses membres et aider la profession géotechnique à être encore plus présente dans notre société.

Merci encore de prendre le temps de lire mes réflexions. Je vous invite à me transmettre vos questions ou commentaires à president@cgs.ca.

Je vous souhaite une très heureuse et paisible saison des fêtes et une très bonne année 2020!

À l'année prochaine mes amis! – See you next year, my friends!

Mario Ruel
Président – 2019/2020

From the Society

Canadian Geotechnical Society – Awards and Honours for 2019

R.F. Legget Medal - Arun Valsangkar, University of New Brunswick

R.M. Quigley Award - Lin Guo, Yuanqiang Cai, Richard J. Jardine, Zhongxuan Yang, Jun Wang, "Undrained behaviour of intact soft clay under cyclic paths that match vehicle loading conditions", Canadian Geotechnical Journal, 2018, 55(1): 90-106.

Honourable Mentions - Marie-Pier Ethier, Bruno Bussière, Michel Aubertin, Abdelkabir Maqsoud, Isabelle Demers, Stefan Broda, "In situ evaluation of performance of reclamation measures implemented on abandoned reactive tailings disposal site", Canadian Geotechnical Journal, 2018, 55(12): 1742-1755.

R. Kerry Rowe, Richard W.I. Brachman, W. Andy Take, "Field measurements of overlap reductions for two reinforced fabric-encased geosynthetic clay liners (GCLs)", Canadian Geotechnical Journal, 2018, 55(5): 631-639.

Amin Askarinejad, Sarah M. Springman, "A novel technique to monitor subsurface movements of landslides", Canadian Geotechnical Journal, 2018, 55(5): 620-630.

Fredlund Award Yan-Jun Du, Ning-Jun Jiang, Song-Yu Liu, Fei Jin, Devendra Narain Singh, Anand J. Puppala, "Engineering properties and microstructural characteristics of cement-stabilized zinc-contaminated kaolin", Canadian Geotechnical Journal. Canadian Geotechnical Journal, 2014, 51(3): 289-302.

G. Geoffrey Meyerhof Award
Alex Sy, Klohn Crippen Berger

Thomas Roy Award
Nicholas Vlachopoulos, Royal Military College of Canada

John A. Franklin Award
Giovanni Grasselli, University of Toronto

Geosynthetics Award
Marolo Alfaro, University of Manitoba

Robert N. Farvolden Award
Jim Hendry, University of Saskatchewan

(Joint award with IAH-CNC)

Robert Schuster Medal
John Clague, Simon Fraser University

(Joint award with AEG)

Graduate Student Paper Award

1st Prize - Vincent Boulanger-Martel, "Thermal performance of two insulation covers to control sulfide oxidation at Meadowbank mine, Nunavut", Research Institute on Mines and the Environment (RIME), Université du Québec en Abitibi-Témiscamingue (UQAT), Bruno Bussière

2nd Prize - Josephine Morgenroth, "Probabilistic Modelling vs. Machine Learning for Streamlining Geomechanical Data", Department of Civil Engineering, York University, Dr. Matthew Perras

Undergraduate Student Report (Individual)

1st Prize - Megan McKellar, "Footprints in the Sand: A study of the Unsaturated Bearing Capacity of a Fine Sand", Queen's University, Dr. Andy Take

Undergraduate Student Report (Group)

1st Prize Jesse Zonneveld, Mat Stephenson, Shawn Matthies, Stephen Marks, "Tailings Storage Facility Prefeasibility Study", Earth, Ocean and Atmospheric Sciences & Geological Engineering, University of British Columbia (Vancouver), Maureen Kelly

2nd Prize - Sam Balcom, Ahmed Hamad, David Quinn, Jeremy Wyatt, "Design and Construction of a Raised Embankment Tailings Storage Facility", Department of Civil and Resource Engineering, Dalhousie University, Hany El Naggar

Canadian Foundation for Geotechnique Michael Bozozuk National Graduate Scholarship - Haley Schafer, Department of Civil and Environmental Engineering, University of Alberta

Dennis Becker Canadian Foundation for Geotechnique M.Sc. Student Award - Andrea Walsh, Department of Civil Engineering, Queen's University

Early Achievement Award - Suzanne Powell, Thurber Engineering Ltd.

A.G. Stermac Awards - **Wayne Gibson**, Gibson Group Management Inc., **Lynn Pugh**, BiTech Publishers Ltd., **Don Lewycky**, Retired, **Seán Mac Eoin**, AECOM, **Ian Moore**, Queen's University

CGS R.M. Hardy Keynote Address Ryan Phillips, C-CORE

Canadian Geotechnical Colloquium Kathy Kalenchuk, RockEng

Cross Canada Lecture Tours Dr. Charles Shackelford (Spring 2019), Dr. Ian Moore (Fall 2019)

Awards from Engineering Institute of Canada (EIC)

Sir John Kennedy Medal
Suzanne Lacasse, Norwegian Geotechnical Institute

Julian C. Smith Medal
Jacques Locat, Université Laval

John B. Stirling Medal
Doug Stead, Simon Fraser University

Canadian Pacific Railway Medal
Kevin Biggar, Canadian Foundation for Geotechnique

Fellowship of the Institute (FEIC)
Jean Côté, Université Laval

Fellowship of the Institute (FEIC)
Craig Lake, Dalhousie University

2019 Canadian Professional Geoscientist Award John Clague, Simon Fraser University

Provided by Lisa McJunkin, Director, Communications and Member Services
Directrice, Communications et services aux membres

Canadian Geotechnique - The CGS Magazine/ Géotechnique canadienne – Le périodique de la SCG

As you may already know, this is the last issue of **Geotechnical News**. Lynn Pugh and John Gadsby, publishers of **GN** for the last 37 years, are retiring at the end of 2019. Over the past several years, a CGS internal communication task force, made up of members from across the country, investigated the long term viability of creating a new, refreshed member magazine. The feedback from the task force, as well as from several member surveys, indicated that our members enjoy receiving a quarterly, mailed publication.

Therefore, starting March 2020, all CGS members will be mailed a new quarterly publication called **Canadian Geotechnique - The CGS Magazine / Géotechnique canadienne – Le périodique de la SCG** highlighting what is going on within the CGS, the Canadian Geotechnical community, and our national and international affiliate organizations. There will also be an enhanced electronic version available to members and subscribers. We will be introducing some new columns and reconfiguring existing ones, while maintaining the technical content and integrity as a top priority.

We are really excited about this new CGS initiative and look forward to engaging all CGS members and the Canadian geotechnical community at large. The first issue of **Canadian Geotechnique - The CGS Magazine / Géotechnique canadienne – Le périodique de la SCG** will be mailed to all CGS members in March 2020. Look for it in your mailbox!

Interested advertisers please email *lisa@karma-link.ca* for more information and a media kit. Discounts given to all CGS National Corporate Sponsors.

Canadian Geotechnique – The CGS Magazine/ Géotechnique canadienne – Le périodique de la SCG

Comme vous le savez peut-être déjà, il s'agit du dernier numéro de **Geotechnical News** (GN). Lynn Pugh et John Gadsby, les éditeurs de **GN** depuis les 37 dernières années, prennent leur retraite à la fin de 2019. Au cours des dernières années, le Groupe de travail sur les communications de la SCG, composé de membres de partout au pays, a examiné la viabilité à long terme d'un nouveau magazine actualisé pour les membres. La rétroaction du Groupe de travail, ainsi que de plusieurs sondages des membres, a indiqué que nos membres apprécient recevoir par la poste une publication trimestrielle.

Par conséquent, à compter de mars 2020, tous les membres actifs de la SCG recevront par la poste une nouvelle publication trimestrielle appelée **Canadian Geotechnique – The CGS Magazine/Géotechnique canadienne – Le périodique de la SCG**. Ce périodique soulignera ce qui se passe à la SCG ainsi que dans la communauté géotechnique canadienne et nos organisations nationales et internationales affiliées. Une version électronique rehaussée sera également offerte aux membres et aux abonnés. Nous présenterons de nouvelles rubriques et en remanierons d'autres, tout en continuant à prioriser le contenu technique et l'intégrité.

Nous nous réjouissons de cette nouvelle initiative de la SCG et espérons qu'elle intéressera tous les membres de la SCG et l'ensemble de la communauté géotechnique canadienne. Le premier numéro de **Canadian Geotechnique – The CGS Magazine/Géotechnique canadienne – Le périodique de la SCG** sera posté à tous les membres actifs de la SCG en mars 2020. Surveillez votre boîte aux lettres!

Les annonceurs intéressés peuvent écrire à *lisa@karma-link.ca* pour en savoir plus et obtenir une trousse d'information. Des rabais sont offerts à tous les commanditaires nationaux de la SCG.

CGS National Corporate Sponsors 2019

We would like to thank our Corporate Sponsors for their 2019 support ~

ConeTec

Dyregrov Robinson Inc.

DownUnder Geotechnical Limited

GEOSLOPE International Ltd.

GKM Consultants

Golder Associates

Insitu Contractors Inc.

Klohn Crippen Berger

Knight Piésold Consulting

Naviq Consulting Inc.

Reinforced Earth Company Ltd.

Rocscience

SoilVision Systems Ltd. / Bentley Systems Inc.

Stantec

Thurber Engineering Ltd.

TREK Geotechnical Inc.

Wood.

If you would like to know more about the CGS Corporate Sponsor program go to *http://www.cgs.ca/become-a-sponsor.php* or contact Lisa at *admin@cgs.ca*

CGS Membership Registration for 2020

It is time to renew your CGS membership for 2020. Login to your account at *www.cgs.ca* and renew online with a few easy steps. Membership fees remain the same as 2019. We are introducing a new option to select "automatic renewal" going forward.

Membership benefits continue to include:

- online access to the monthly Canadian Geotechnical Journal, including all past issues, and special price for the printed and mailed Canadian Geotechnical Journal
- online and printed copies of the new quarterly Canadian Geotechnique - A CGS Magazine / Géotechnique canadienne – Le périodique de la SCG
- the monthly electronic CGS E-News
- online access to all past CGS Conference proceedings, Keynote lectures, various webinars
- special member price for all CGS conferences
- early information about the spring and fall CGS Cross Canada Lecture Tours
- membership in one or more of seven CGS technical divisions and associated international societies
- involvement in one of 20 CGS local sections
- involvement in any of the eight CGS standing committees
- opportunities to network and connect with other geotechnical professionals

We look forward to your participation in 2020!

Adhésion à la SCG pour 2020

Il est temps de renouveler votre adhésion à la SCG pour 2020! Connectez-vous à votre compte à l'adresse www.cgs.ca/index.php?lang=fr et effectuez votre renouvellement en ligne en quelques étapes faciles. Les cotisations des membres restent inchangées. Nous vous proposons désormais la nouvelle option de « renouvellement automatique ».

Les avantages de l'adhésion continuent à comprendre :

- -un accès en ligne à la Revue canadienne de géotechnique mensuelle, y compris à ses numéros précédents, et à un tarif spécial pour sa version imprimée et postée;
- -le nouveau magazine trimestriel Canadian Geotechnique – The CGS Magazine / Géotechnique canadienne – Le périodique de la SCG en version électronique et imprimée;
- -l'E-info de la SCG publiée chaque mois;
- -un accès en ligne à tous les comptes-rendus des précédentes conférences de la SCG, aux conférences d'honneur et à différents webinaires;
- -des prix spéciaux pour toutes les conférences de la SCG;
- -de l'information opportune sur les Tournées de conférences transcanadiennes du printemps et de l'automne de la SCG;
- -une adhésion à une ou à plusieurs des sept divisions techniques de la SCG et aux sociétés internationales associées;
- -une participation dans l'une des 20 sections locales de la SCG;
- -une participation à l'un des huit comités techniques de la SCG;
- -des possibilités de réseauter et d'interagir avec d'autres professionnels de la géotechnique.

Nous espérons que vous participerez en 2020!

Canadian Foundation for Geotechique

Canadian Foundation for Geotechnique — CFG FCG — La Fondation canadienne de géotechnique

Fall update

The Canadian Foundation for Geotechnique was proud to sponsor the award winners announced at GeoStJohn's during the week of 30 September. The awards and recipients are described in detail elsewhere in this issue. Sponsorship for these awards is made possible by individual and corporate donations from our members. The Foundation provides approximately $50,000 each year to these awards as well in support of the Cross Canada Lecture Tour and the Colloquium Tour. Going forward we look forward to sponsoring additional initiatives in support of our society for the benefit of all members.

You will note that most of the awards presented at the CGS Annual Conference are for students and young professionals, who are the future of our society. If you believe as I do that promoting our young professionals in this manner is a worthy goal of the Foundation and the Society, please consider making a tax-deductible donation to the Foundation. This may be most easily accomplished when you renew your CGS membership, and we will be working to make it even easier through the CFG website.

This year, we were pleased to present for the first time the Dennis Becker MSc Prize, in honour of Dennis's numerous significant contributions to the Society, including President of the CGS, as well as being a recipient of the R.F. Legget Medal. As an added bonus, Dennis was available to present the award to Ms. Andrea Walsh, who Dennis knew personally from her time working as a student at Golder Associates.

As an added bonus this year for the student award winners, the Foundation and the CGS have partnered to provide all award recipients with a copy of the Canadian Foundation Engineering Manual. What better way to encourage and support potential future CGS members than with a copy of one of

the best geotechnical guidance documents available in our profession.

We were delighted to announce at GeoStJohn's that **Thurber Engineering** has become our newest Legacy Corporate Sponsor, which recognizes corporate donations in excess of $30,000 to the Foundation. They join **The Wood Group (formerly AMEC Environment and Infrastructure), BGC Engineering, Golder Associates, Reinforced Earth (Canada), Stantec (formerly Jacques Whitford)**, and **Tetra Tech Canada** as Legacy Corporate Sponsors of the Foundation, principally through their support of the Cross Canada Lecture Tour, which benefits geotechnical engineers across the country twice annually.

The Foundation is pleased and honoured to be able to provide funding for the awards and prizes to recognize excellence in our profession, and to encourage younger members to become active in the society and to learn what a great society we have. If you know of a worthy recipient for the Foundation-sponsored awards please take the time to become familiar with the terms of reference (available on the CGS website) and nominate them.

For these awards and prizes, it is worthy of note that the Foundation has the easy job – we simply provide the funding for these awards. The 'heavy lifting' and most important work is done behind the scenes by those volunteers who organize and adjudicate the various nominations and student competitions, and make the very difficult selection of the winners from the very high-quality presentations. I would like to thank all those nameless volunteers who have contributed to preparing and adjudicating the submissions.

The Foundation would like to extend a big thank you to the 73 CGS members, who contributed in 2018 which is on par with the number of donors in 2017, and above the 50 the year before – so we're headed in the right direction. However, the number of individual donors is only roughly 5% of the CGS membership. The Foundation would like you all to think about this when you renew your CGS membership for 2020, and perhaps we can get this figure up to 10%. Keep in mind that the donations are tax deductible.

The Foundation is run entirely by volunteers through its Board and Members. There are 13 Members and I would like to take this opportunity to acknowledge them: Dennis Becker, Robert Chapuis, Jean Hutchinson, Suzanne Lacasse-Hoeg, Jorn Landva, Harry Oussoren, Bob Patrick, Lynden Penner, Ryan Phillips, Siva Sivathayalan, Jean-Pierre Tournier, Sai Vanapalli, and Nick Vlachopoulos.

Nouvelles automnales de la Fondation canadienne de géotechnique

La Fondation canadienne de géotechnique (FCG) était fière de parrainer les prix de la SCG décernés à la conférence GéoSt.John's au cours de la semaine du 30 septembre. Les prix et leurs lauréats sont décrits dans ce numéro. Le parrainage de ces prix est rendu possible grâce aux dons personnels et d'entreprises de nos membres. La Fondation verse environ 50 000 $ chaque année pour ces prix ainsi que pour appuyer la Tournée de conférences transcanadienne et la Série de conférences du Colloquium. Nous nous réjouissons de continuer à parrainer d'autres initiatives appuyant notre Société au profit de tous les membres.

Vous remarquerez que la plupart des prix présentés à la conférence annuelle de la SCG sont destinés à des étudiants et à de jeunes professionnels, qui représentent l'avenir de notre Société. Si vous croyez comme moi que la promotion de nos jeunes professionnels de cette façon est un objectif louable de la Fondation et de la Société, je vous prie d'envisager de faire un don déductible d'impôt à la Fondation. Il vous sera peut-être plus facile de le faire lorsque vous renouvellerez votre adhésion à la SCG, et nous nous efforcerons de vous faciliter la tâche par l'entremise du site Web de la FCG.

Cette année, nous avons eu le plaisir de remettre pour la première fois le Prix Dennis Becker pour les étudiants à la maîtrise, en l'honneur des nombreuses contributions importantes de M. Becker à la Société, dont celles d'avoir été président de la SCG ainsi que lauréat de la Médaille R. F. Legget. En prime, M. Becker était présent pour remettre le prix à M^{me} Andrea Walsh, qu'il connaît personnellement depuis qu'elle a travaillé comme étudiante chez Golder Associates.

De plus cette année, la Fondation et la SCG se sont associées pour offrir un exemplaire *du Manuel canadien d'ingénierie des fondations* à tous les étudiants lauréats d'un prix. Quelle meilleure façon d'encourager et d'appuyer les futurs membres potentiels de la SCG qu'en leur remettant un exemplaire de l'un des meilleurs documents de référence géotechniques disponibles dans notre profession!

Nous avons été ravis d'annoncer à GéoSt.John's que **Thurber Engineering** est devenue notre plus récent commanditaire Héritage, qui reconnaît les dons d'entreprise de plus de 30 000 $ à la Fondation. Elle se joint à **The Wood Group (anciennement AMEC Environment and Infrastructure), BGC Engineering, Golder Associates, Reinforced Earth (Canada), Stantec (anciennement Jacques Whitford)** et **Tetra Tech Canada** à titre de commanditaire Héritage de la Fondation, principalement en raison de son appui à la Tournée de conférences transcanadienne, dont profitent des géotechniciens de partout au pays deux fois par année.

La Fondation est heureuse et honorée de pouvoir financer les prix et les honneurs qui reconnaissent l'excellence dans notre profession et d'encourager les jeunes membres à devenir actifs au sein de la Société et à découvrir à

quel point elle est exceptionnelle. Si vous connaissez un lauréat potentiel pour les prix parrainés par la Fondation, veuillez prendre le temps de vous familiariser avec le mandat (affiché sur le site Web de la SCG) et de proposer sa candidature.

Pour ces prix et honneurs, il est important de noter que la Fondation a la tâche facile : nous ne faisons que les financer. Le travail le plus laborieux et le plus important est effectué en coulisse par les bénévoles qui organisent et évaluent les différents appels de candidatures et concours pour les étudiants, et qui font la très difficile sélection des lauréats parmi les candidatures de très haute qualité. J'aimerais remercier tous ces bénévoles anonymes qui ont contribué à la préparation et à l'évaluation de candidatures.

La Fondation tient à remercier chaleureusement les 73 membres de la SCG qui lui ont versé un don en 2018, ce qui correspond au nombre de donateurs en 2017, et dépasse les 50 de l'année précédente; nous sommes donc sur la bonne voie. Le nombre de donateurs individuels ne représente toutefois qu'environ 5 % des membres de la SCG. La Fondation aimerait que vous y réfléchissiez tous lorsque vous renouvellerez votre adhésion à la SCG pour 2020; nous pourrions peut-être faire grimper ce pourcentage à 10 %. N'oubliez pas que les dons sont déductibles d'impôt.

La Fondation est entièrement gérée par des bénévoles par l'intermédiaire de son Conseil d'administration et de ses 13 membres, et je voudrais profiter de l'occasion pour les remercier : Dennis Becker, Robert Chapuis, Jean Hutchinson, Suzanne Lacasse-Hoeg, Jorn Landva, Harry Oussoren, Bob Patrick, Lynden Penner, Ryan Phillips, Siva Sivathayalan, Jean-Pierre Tournier, Sai Vanapalli et Nick Vlachopoulos.

Call for Nominations for the CGS Colloquium Deadline January 31, 2020

Established in 1977, the CGS Colloquium is an annual commissioned presentation and paper. Along with the honour comes a $5,000 honorarium provided by **Canadian Foundation for Geotechnique**. It is targeted towards a younger CGS member to provide information of particular interest to the geotechnical community on topics of importance to the Canadian geotechnical field. A younger CGS member is typically regarded as being less than 40 years of age, with preference given to candidates 33 to 38 years at time of age at time of nomination.

Nominations can be made by any CGS member. The nominations for the **45th CGS Geotechnical Colloquium, which will be presented at the CGS conference in Niagara Falls, On in the fall** of 2021, are due by **January 31, 2020**. The selection will be made by the CGS Geotechnical Research Board in April 2020, 18 months prior to the presentation.

The nomination submission should include:

- a nomination letter that introduces the nominee with his/her main accomplishments
- an extended abstract of the proposed talk (approximately 2000 words), including a statement of the importance of the topic to the Canadian geotechnical community;
- the originality of the nominee's contribution, and
- the nominee's resume including practical experience relevant to the topic and publication record

The **44th Colloquium will be presented at GeoCalgary 2020 by Ariane Locat in Calgary**.

Contact CGS Headquarters at *admin@cgs.ca* or 1-800-710-9867 for more information or to send in your nomination.

Appel de candidatures pour le Colloquium de la SCG Date limite : 31 janvier 2020

Établi en 1977, le Colloquium de la SCG consiste en une présentation et un article annuels commandités. Cet honneur est accompagné d'une rétribution de 5 000 $ offerte par la **Fondation canadienne de géotechnique**. Il vise à ce qu'un jeune membre de la SCG donne de l'information présentant un intérêt particulier pour la communauté géotechnique sur des sujets d'importance pour le domaine géotechnique canadien. On considère ici qu'un jeune membre de la SCG est habituellement considéré comme étant âgé de moins de 40 ans, avec une préférence pour les candidats âgés de 33 à 38 ans au moment de leur candidature.

Les candidatures peuvent être soumises par tout membre de la SCG. Les candidatures pour le **45e Colloquium géotechnique de la SCG, qui sera présentée à la conférence** canadienne de géotechnique de **Niagara Falls On à l'automne 2021**, doivent être reçues d'ici le **31 janvier 2020**. La sélection sera faite par le Conseil de recherche en géotechnique de la SCG en avril 2018, 18 mois avant la présentation.

Les candidatures doivent comprendre :

- une lettre de candidature présentant le/la candidat(e) ainsi que ses principales réalisations;
- un résumé détaillé de la conférence proposée (environ 2 000 mots), y compris un énoncé sur l'importance du sujet pour la communauté géotechnique canadienne;
- l'originalité des contributions du/de la candidat(e);
- le curriculum vitae du/de la candidat(e) comprenant l'expérience pratique pertinente au sujet et le dossier de publication.

Le **44e Colloquium sera présenté à la conférence GéoCalgary 2020 par la Dr Ariane Locat de l'Université Laval**.

Pour obtenir de plus amples renseignements ou soumettre une candidature, communiquez avec le siège social de la SCG à *admin@cgs.ca* ou au 1-800-710-9867.

Upcoming Conferences and Seminars

Geo-Congress 2020 February 25-28, 2020, Minneapolis, Minnesota

Two decades into a new century, Geo-Congress 2020: Vision, Insight, Outlook is using the 2020 conference as an opportunity to reflect on the past, assess the present, and imagine the future. They are introducing some new programming and themes to make this conference a "signature event" for consulting engineers, contractors, researchers, owners, and students.

For more information, visit our website at *https://www.geocongress.org* or contact us at *BKeelor@asce.org*.

73rd Canadian Geotechnical Conference September 13 to 16, 2020, Calgary, Alberta, Canada

The Canadian Geotechnical Society (CGS) and Geotechnical Society of Calgary invite you to **GeoCalgary 2020**, the 73rd Canadian Geotechnical Conference. The conference will be held at the Hyatt Regency in downtown Calgary, Alberta from **Sunday, September 13th to Wednesday, September 16th, 2020**.

The theme for **GeoCalgary 2020** is **Reflection on Resources**. The prosperity of Canada is largely founded on the extraction, transformation and utilization of resources from several sources, such as agriculture, oil and gas, metals and minerals, hydropower and wind energy. These activities all require infrastructure, facilities, plants, dams or dykes; the design and construction of which necessitate solving great geotechnical challenges. The conference intends to focus on past and recent geotechnical achievements, and the lessons that can be learned from them to improve current practices and build a better sustainable future. The technical program will encompass a wide range of topics, including specialty sessions that are of local and national relevance. In addition to the technical program and plenary sessions, the conference will include a complement of distinguished keynote speakers, high calibre short courses, social events, and technical tours.

Calgary is situated near the confluence of the Bow and Elbow River, close to the foothills and less than an hour away east of the front ranges of the Canadian Rockies. Over the decades, Calgary has matured into a vibrant and modern city. The City is internationally recognized for its high quality of life and great outdoors and is home to a population of about 1.3 million people. Calgary is Canada's energy centre and that energy goes beyond our natural resources. Calgary is charged with opportunities. It thrives on welcoming people from around the world and the city's most palpable energy is its people: young, diverse, educated, affluent and innovative.

Call for Abstracts/Papers

The GeoCalgary 2020 conference organizing committee invites members of the Canadian and international geotechnical and geoenvironmental communities to contribute recent research, developments and advancements in their respective fields of interest and practice. The technical program of the conference will cover a wide range of topics, including special sessions that are of local, national and international relevance to the fields of geotechnical and geoenvironmental engineering.

Authors are invited to submit abstracts of a maximum of 300 words by January 17th, 2020 through the Online Submission page of the conference website. Abstracts can be written in English or French.

Abstracts should generally fall within the following themes:

Geotechnical Themes

- Soil Mechanics and Foundations
- Rock Mechanics and Engineering Geology
- Landslides and Geohazards
- Mining Geotechnics and Hydrogeology
- Geoenvironmental Engineering
- Transportation Geotechnics
- Geosynthetics
- Cold Regions Geotechnology
- Sustainable Geotechnics
- Professional Practice
- Special Geotechnical Themes
    - Offshore and Nearshore Geotechnical Issues
    - Dams and Embankments
    - Risk Management in Geotechnical Projects
    - Structures Founded on Clay Shale
    - Pipelines and Trenchless Technologies
    - Soft and Sensitive Clays
    - Oil Sands Geotechnology
    - Application of Remote Sensing and Mapping

Visit *www.geocalgary2020.ca* to submit your abstract.

Section News

A Tale of Two Towers

In early September, Professor **John Burland** of Imperial College London, a legend of geotechnical engineering, delivered four hugely successful lectures across Canada. The one-week long tour had Professor Burland traveling between four local sections

of the Canadian Geotechnical Society, including Western QC (Montreal), Southern ON (Toronto), Northern AB & Territories (Edmonton) and Southern AB (Calgary). His lecture, "A Tale of Two Towers - Pisa and Big Ben" describing the response of these two famous towers to stabilization works, was extremely well attended, with over 500 guests attending the four events. Along the way, members and representatives from the local sections met with Professor Burland to share their experiences and glean some wisdom from his experiences. Professor Burland even managed to squeeze in some time to visit classic Canadian landmarks including Lake Louise, Alberta, and the CN Tower in Toronto, Ontario.

An event like this would not have been such a success without the dedication and support from the four local sections, the CGS National Office and all of the sponsors of the events. **Pouya Pishgah** (Southern ON) started planning this event in early spring 2019 and soon after were joined by **Gholamreza Saghaee** (Western QC), **Courtney Mulhall** (Northern AB & Territories) and **Remco Kleinlugtenbelt** (Southern AB) to bring Professor Burland across Canada. Additionally, many volunteer members and executives from the local sections aided with the logistics and organization of the four events. Each local section was also generously supported by its local geotechnical community by way of financial sponsorship to ensure the event's success.

Lunch at 360, the Restaurant at the top of the CN Tower, in Toronto. Left to Right: Jason Lee, Professor Burland, Pouya Pishgah and Billy Singh (Southern ON Section).

Delakshan Inparajah thanking Professor Burland at the Edmonton event (Northern AB & Territories Section).

Professor Burland speaking to a full house in Toronto.

Professor Burland thoroughly enjoyed his experience in Canada during this tour and was thankful for the generosity in terms of time and resources from our members to support and attend the events. A big thank you to all the members and sponsors that took time from their busy fall season to make this a very memorable visit for all. I look forward to the next great event from our local sections and CGS National Office.

Social Media – follow us!

We are now on LinkedIn, Twitter, Facebook and Instagram. Get the latest information about our activities and social events. Don't miss another opportunity to participate in your Local Section, Division/Committee, or annual conference! Contact Emily at

Lake Louise, Alberta. Left to Right: Remco Kleinlugtenbelt, Professor Burland and Bryan Simpson (Southern AB Section).

efournier@cgs.ca for suggested posts. We are always looking for material that is of interest to our members.

Médias sociaux – suivez-nous!

Nous sommes maintenant sur LinkedIn, Twitter, Facebook et Instagram. Obtenez les tout derniers renseignements sur nos évènements et activités sociales. Ne passez pas à côté d'une autre possibilité de participer aux activités de votre section locale ou d'une division/un comité, ou à la conférence annuelle! Si vous avez des suggestions de publication, écrivez à Emily Fournier, à *efournier@cgs.ca*. Nous cherchons toujours du matériel pouvant intéresser nos membres.

Editor
Nicholas Beier, PhD, P.Eng.
Edmonton, AB
Tel.: 780-492-8183
Email: nabeier@ualberta.ca

2019 R.F. Legget Medal Award - le Médaillé R.F. Legget 2019 Awarded to Arun Valsangkar

Introduction of 2019 R.F. Legget Medal Winner by Paul Deering

Dear colleagues/chers collègues,

It is my great pleasure and honor to announce that the 2019 Robert F. Legget Medal recipient is Dr. Arun Valsangkar. Sterling Parsons, from Stantec and our 2019 conference Chair, led Arun's nomination, which was supported by some 20 nomination letters including:

- Kerry Rowe, Queens University
- Andy Take, Queens University
- Craig Lake, Dalhousie University
- Michael Whitford, Co-Founder of Jacques Whitford Limited now Stantec

Arun Valsangkar has over 50 years of combined experience in teaching, research, and consulting. He was a professor at the Department of Civil Engineering, University of New Brunswick until his retirement in 2009. Following his retirement, he received the honorable distinction from UNB as Professor Emeritus in Civil Engineering where he continues today.

Arun was educated in India and arrived in Canada in 1974 to work as a post doctorate fellow for the infamous Professor Geoffrey Meyerhof at the Technical University of Nova Scotia. During this time, through the mentorship of the late Dr. John Brown, he was introduced to Hector Jacques and Michael Whitford who had recently started a geotechnical engineering firm in Halifax. It was these early years that Arun began to see the applications of how he could leverage his theoretical background in geotechnical engineering into positive impacts on the geotechnical engineering practice.

In 1981, Arun moved to Fredericton where he joined the University of New

Left to right: Mario Ruel, Arun Valsangkar, Paul Deering, Kevin Biggar.

Brunswick as a Professor at the Civil Engineering Department. For the next four decades, through his relentless dedication, Arun gained a reputation for his combined excellence in teaching, research, service, and professional practice.

During his 28 years of teaching at UNB he supervised over 50 masters and PhD students, 130 undergraduate senior reports, and served as director of UNB's geological engineering program from 1990 to 1995. His research on soil structure interaction has been published in more than 60 peer reviewed journal articles and he has presented at 53 conferences in 12 countries. He provided service at the national level for the CGS where he served as Editor of the Canadian Geotechnical Journal from 2002 to 2007 and as an Associate Editor from 1992 to 2002. In addition, since the mid 1970's Arun maintained a role as a Senior Consultant with Jacques Whitford, now Stantec.

Arun's work in consulting and research have earned him worldwide recognition and several awards with more than 20 honors and recognitions including;

- G. Geoffrey Meyerhof Award, R.M. Quigley Award, Stermac Award, and the R. M. Hardy Address of the Canadian Geotechnical Society;
- John B. Stirling Medal of Engineering Institute Canada;
- Eric Garland Award and the Allan P. Stuart Award of the University of New Brunswick;
- Fellow of the Engineering Institute of Canada, the Canadian Academy of Engineering, and the Canadian Society of Civil Engineering; and
- Fellow of the Churchill College, Cambridge University, UK.

As a consultant, Arun provided significant contribution to the success on many national and international projects. Considering the 2019 conference is here in St. John's, it would be fitting to note some of the local world class projects:

- Hibernia and Hebron Offshore Oil Platforms,
- White Rose and Terra Nova FPSO
- Vale's Voisey's Bay Mine and Long Harbour Processing Plant; and
- Nalcor's Muskrat Fall Hydroelectric Project.

With an appreciation of his contributions to the geotechnical engineering profession, Arun is a deserving winner of the CGS' highest award. In support of this award here are some excerpts of his supporting letters:

Kerry Rowe - *Arun oversaw a critical period of growth of the Canadian Geotechnical Journal with a rapid expansion of its submissions from international authors that helped lay the foundation for the journal to achieve its current position as a top international journal in our field.*

Craig Lake - *An examination of his research output will see his emphasis on practical engineering problems that have been funded by industry and government organizations. This emphasis on practical research has allowed him to create knowledge that has led to application in many major consulting projects in Atlantic Canada.*

Andy Take - *If I have one goal for my career as Canada Research Chair at Queen's University, it is to attempt in my own small way to emulate Arun – to work to inspire undergraduate students and to ensure every student I mentor succeeds wildly beyond what they thought possible for themselves.*

Mike Whitford - *"With clients, he was nothing short of excellent. He is always able to find the right path to explain the problem and the subsequent solution. In fact, that may well be his most valuable trait."*

For myself along with many of my colleagues, Arun has made a significant impact in shaping our careers, both professionally and personally.

Sterling captured this well in his nomination letter; *outside Arun's technical guidance, he always reinforced the importance of being professional, ethical, and representing yourself and the practice with distinction.*

Arun is a very modest individual who never seeks notoriety or acknowledgement for his achievements. He continues to enjoy life to the fullest along his wife and lifetime partner, Hema. For the early morning walkers and runners around the UNB Campus, his routine is well known - A steady 40 minute pace, **rain or shine**! While there are many well documented benefits to exercise, it is during these early morning walks where he professes that most of his critical thinking and problem solving have been done.

Without further ado, please join me in welcoming and congratulating the 2019 Robert F. Legget Medal recipient; Arun J. Valsangkar.

Chers collègues,

J'ai l'immense plaisir et honneur d'annoncer que le lauréat de la Médaille Robert F. Legget est le Dr Arun Valsangkar. Sterling Parsons, de Stantec et le président de notre conférence GeoSt.John's 2019, a présenté la candidature du Dr Valsangkar, qui a été appuyée par 20 lettres de support, y compris celles de :

- Kerry Rowe, Université Queen's;
- Andy Take, Université Queen's;
- Craig Lake, Université Dalhousie;
- Michael Whitford, cofondateur de Jacques Whitford Limited, maintenant Stantec.

Arun Valsangkar cumule plus de 50 ans d'expérience combinée en enseignement, en recherche et en consultation. Il a été professeur au Département de génie civil de l'Université du Nouveau-Brunswick (UNB) jusqu'à sa retraite en 2009. Suite à cette retraite, il a reçu le titre honorifique de professeur émérite en génie civil de l'UNB, où il continue de pratiquer aujourd'hui.

Le Dr Valsangkar a été formé en Inde et est arrivé au Canada en 1974 pour travailler à titre de boursier post-doctoral avec le réputé Professeur Geoffrey Meyerhof à la Technical University of Nova Scotia. Durant ce temps, grâce à son mentor, feu Dr John Brown, il a été présenté à Hector Jacques et à Michael Whitford qui avaient récemment mis sur pied une entreprise de géotechnique à Halifax. C'est au cours de ces premières années que le Dr Valsangkar a commencé à voir les façons dont il pourrait tirer profit de sa formation théorique en géotechnique pour avoir une incidence positive sur la pratique de la géotechnique.

En 1981, le Dr Valsangkar a déménagé à Fredericton où il s'est joint à l'UNB à titre de professeur au Département de génie civil. Au cours des 40 années suivantes, grâce à son dévouement sans faille, il a acquis une réputation d'excellence pour son enseignement, ses recherches, son service à la communauté et son exercice professionnel.

Durant ses 28 ans d'enseignement à l'UNB, il a supervisé plus de 50 étudiants de maîtrise et de doctorat et 130 rapports d'étudiants de premier cycle; il a aussi agi à titre de directeur du programme de génie géologique de 1990 à 1995. Sa recherche sur les interactions sol-structures a été publiée dans plus de 60 articles de revue révisés par des pairs et a été le sujet de 53 articles de conférence qu'il a présentés dans 12 pays. Il a servi la SCG au niveau national en agissant à titre de rédacteur (éditeur en chef) de la Revue canadienne de géotechnique de 2002 à 2007 et de rédacteur adjoint de 1992 à 2002. De plus, depuis le milieu des années 1970, le Dr Valsangkar est expert-conseil principal chez Jacques Whitford, maintenant Stantec.

Le travail de consultation et de recherche du Dr Valsangkar lui a valu une reconnaissance mondiale et plus de 20 prix, honneurs et reconnaissances, y compris :

- les Prix Geoffrey Meyerhof, R.M Quigley, et A. G. Stermac et la l' Allocution d'ouverture R. M. Hardy de la Société canadienne de géotechnique;
- la Médaille John B. Stirling de l'Institut canadien des ingénieurs;
- le Prix Eric Garland et le Prix Allan P. Stuart de l'Université du Nouveau-Brunswick;
- le titre de Fellow de l'Institut canadien des ingénieurs, de l'Académie canadienne du génie et de la Société canadienne de génie civil;
- le titre de Fellow du Collège Churchill et de l'Université Cambridge, au Royaume-Uni.

À titre d'expert-conseil, le Dr Valsangkar a contribué de manière considérable au succès de nombreux projets nationaux et internationaux. Comme la conférence de 2019 se déroule ici, à St. John's, il serait approprié de dénoter certains des projets locaux de classe mondiale auxquels il a participé :

- les plates-formes de forage pétrolier extracôtières Hibernia et Hebron;
- les FPSO de White Rose et de Terra Nova;
- la mine de Voisey Bay de Vale et l'usine de traitement de Long Harbour;
- le projet hydroélectrique de Muskrat Fall de Nalcor.

Le Dr Valsangkar remporte le prix le plus prestigieux de la SCG pour ses contributions à la profession géotechnique. Voici quelques extraits des lettres d'appui à sa candidature :

Kerry Rowe - *Le Dr Valsangkar a supervisé une période cruciale de la croissance de la Revue canadienne de géotechnique avec une augmentation rapide des soumissions d'auteurs internationaux qui a permis d'établir les bases solides afin d'atteindre sa position actuelle comme l'une des principales revues internationales dans le domaine.*

Craig Lake - *Un examen de ses résultats de recherche démontre l'accent qu'il met sur les problèmes techniques pratiques, financés par l'industrie et par des organisations gouvernementales. Cet accent sur la recherche pratique lui a permis de créer des connaissances qui ont pu être appliquées à de nombreux projets de consultation importants au Canada atlantique.*

Andy Take - *Si j'ai un objectif professionnel à titre de titulaire d'une Chaire de recherche du Canada à l'Université Queen's, c'est d'essayer à ma façon d'imiter le Dr Valsangkar; m'efforcer d'inspirer des étudiants de premier cycle et de m'assurer que chaque étudiant dont je suis le mentor réussit au-delà de ce qu'il croyait pouvoir faire.*

Mike Whitford - *Avec les clients, il n'était rien de moins qu'excellent. Il réussit toujours à trouver la bonne façon d'expliquer le problème et la solution subséquente. En fait, cela pourrait bien être sa plus grande qualité.*

Pour moi et pour un grand nombre de mes collègues, le Dr Valsangkar a eu une grande incidence sur l'orientation de nos carrières, tant sur le plan professionnel que personnel. M. Parsons a bien saisi cela dans sa lettre de mise candidature; *en dehors des conseils techniques du Dr Valsangkar, il insiste toujours sur l'importance de faire preuve de professionnalisme et d'éthique ainsi que de se représenter soi-même et la pratique avec distinction.*

Le Dr Valsangkar est une personne très modeste qui ne cherche jamais à obtenir de la notoriété ou à être reconnue pour ses réalisations. Il continue à profiter pleinement de la vie avec sa femme, sa partenaire de vie, Hema. Sa routine est connue de tous les marcheurs et les coureurs matinaux sur le campus de l'UNB : une marche de 40 minutes au rythme soutenu **beau temps mauvais temps!** Bien qu'il y ait de nombreux avantages bien documentés à l'exercice, il prétend que c'est durant ces promenades matinales qu'il fait la majeure partie de son raisonnement critique et qu'il résout le plus de problèmes.

Sans plus attendre, veuillez-vous joindre à moi pour accueillir et féliciter le lauréat de la Médaille Robert F. Legget 2019, Arun J. Valsangkar.

Paul Deering
September 2019

2019 R.F. Legget Medal Award Acceptance Speech Arun J. Valsangkar.

Legget Medal:

Thank you Paul for your introduction and kind words. I would also like to thank Sterling Parsons for taking the lead in preparing my nomination and all those who have written letters of support. It is truly an honor to receive the Legget Medal from the Canadian Geotechnical Society in front of my peers and colleagues. Even though I am receiving this honor, the award also recognizes the contributions of individuals and organizations who have shaped and supported my career over a span of five decades. I would like to take next few minutes to acknowledge these contributions.

I completed my undergraduate degree in 1963 and was accepted as a graduate student at the Indian Institute of Science, Bangalore. After completing my Master of Engineering degree, I continued at the Institute to do my doctoral degree research in the area of pile-soil interaction under the supervision of Prof. Siva Reddy. He introduced me to the advanced methods of theoretical and numerical analysis in geomechanics along with computer programming. He was an excellent supervisor who laid a solid foundation for my research career.

Following my graduate studies, I joined Indian Institute of Technology, Kanpur, as a faculty member. I continued to do research in the area of pile soil interaction using analytical and numerical methods and expanded my research in the area of raft and strip foundations.

After getting my tenure at the Indian Institute of Technology, Kanpur, I came to Canada to work with Prof. Geoff Meyerhof at the Nova Scotia Technical College in the area of pile-soil interaction using experimental approach. The research work involved 1-g model testing to study the behavior of piles under axial loads in layered soils. I soon learned from Prof. Meyerhof the importance of research as it relates to its practical applications. I also got to know Dr. John Brown very well. Besides being a faculty member at the College, John was also working part time with the newly started firm of Jacques Whitford and Associates. John introduced me to Hector Jacques and Mike Whitford, with whom I had informal discussions on consulting projects in Nova Scotia.

After completing my research with Prof. Meyerhof, I went to Cambridge University to work with Prof. Andrew Schofield in the area of centrifuge modelling. Prof. Schofield had just

then accepted the position of Chair in geotechnical engineering and embarked on an ambitious centrifuge modelling research. As a Research Assistant of Prof. Schofield, I worked in pipe soil interaction but also participated in other centrifuge modelling projects. I gained very valuable experience in advanced experimental methods at Cambridge and enjoyed many discussions with Prof. Schofield on a variety of research areas in geotechnical engineering. While at Cambridge, I also took courses from Dr. Peter Wroth in Critical State Soil Mechanics and its application to analysis and design.

Having gained research and teaching experience I realized that I needed to get practical experience and therefore came back to Canada to work with Jacques Whitford and Associates on a full time basis and continued to work with Prof. Meyerhof on a part time basis. Dr. John Brown mentored me in early years of my consulting career. He introduced me to the National Building Code and the draft version of the Canadian Foundation Engineering Manual. He encouraged me to do field work and laboratory testing so that I had better appreciation of soil characterization used in analysis and designs. I also remember his advice: "Try to understand the problem first before rushing to solve it", and "Use two concise sentences to convey your message rather than using two confusing paragraphs".

In 1981, John Brown decided to leave Nova Scotia Technical College and join full time JWA. Prof. Meyerhof also retired and JWA expanded with opening offices in New Brunswick. As a result, I moved to Fredericton to join University of New Brunswick as a full time faculty member and part time consultant with JWA.

In the initial years at the University of New Brunswick, I developed experimental facilities to do 1-g model testing coupled with instrumentation and monitoring of prototype structures. I was fortunate to have Prof. Arvid Landva as my colleague who provided critical and through reviews for my research ideas. In addition to developing facilities for 1-g model testing, we started making plans for building a medium size centrifuge at UNB. In this regards I received tremendous help from Dr. Bob Mitchell who shared design notes and drawings of his centrifuge at Queen's University. I also had many discussions with Prof Schofield while I was on my sabbatical at Cambridge regarding design of UNB centrifuge. I am very proud to say that our students did the entire design and the centrifuge was commissioned in 1989 with funding of $100, 000 received from the Gillin Endowment Fund. The facility is in use since then to do research on a variety of problems in the area of soil structure interaction. The model testing research is supplemented with instrumentation and monitoring of prototype structures and I would like to thank the New Brunswick Department of Transportation and Infrastructure for providing significant grants to support this research.

I would like to take this opportunity to acknowledge the contributions of many students at UNB and young and mid-career engineers at JWA (now Stantec Consulting), for supporting my research and consulting activities in last 30 years.

A few words about my association with the Canadian Geotechnical Society. I have been a member of the society since 1977. I was encouraged by Dr. Bob Mitchell to serve as an Associate Editor of the Canadian Geotechnical Journal while he was the Editor and continued in that role when Dr. Dennis Becker became Editor. I was encouraged by both Dennis and Bob to take over as Editor when Dennis stepped down. I would like to thank Dennis, Bob and all Associate Editors for their support during my 5-year term as Editor of the Journal. During my term, we switched from six issues per year to 12 issues, expanded the editorial board to include more international Associate Editors, and in the final year switched from hard copy to electronic submission of papers.

Finally I would like to thank my wife Hema for her unconditional support by travelling to different countries with our small children so that I could develop my professional career and more importantly allowing me to play in the "sandbox" and jump in "mud puddles" over 5 decades of our married life.

Thank you all.

Médaille Legget :

Merci, Paul, pour votre présentation et vos bons mots. J'aimerais également remercier Sterling Parsons d'avoir pris en main la préparation de ma mise en candidature et tous ceux qui ont écrit des lettres d'appui. C'est vraiment un honneur de recevoir la Médaille Legget de la Société canadienne de géotechnique devant mes pairs et collègues. Même si je reçois cet honneur, ce prix reconnaît également les contributions de personnes et d'organisations qui ont façonné et appuyé ma carrière durant 50 ans. J'aimerais prendre quelques minutes pour reconnaître ces contributions.

J'ai obtenu mon diplôme de premier cycle en 1963 et j'ai été accepté en tant qu'étudiant gradué à l'Institut indien des sciences de Bangalore. Après avoir terminé ma maîtrise en génie, j'ai poursuivi mes études à cet institut pour faire ma recherche doctorale dans le domaine des interactions pieux-sol sous la supervision du professeur Siva Reddy. Il m'a présenté les méthodes avancées d'analyse théorique et numérique en géomécanique ainsi que la programmation informatique. Il a été un excellent superviseur qui a jeté de solides bases pour ma carrière en recherche.

À la suite de mes études aux cycles supérieurs, je me suis joint à l'Institut indien de technologie de Kanpur à titre de membre du corps professoral. J'ai continué à faire de la recherche dans le domaine des interactions pieux-sol

à l'aide de méthodes analytiques et numériques et j'ai élargi ma recherche à celui des radiers et des semelles filantes.

Après avoir obtenu mon poste à l'Institut indien de technologie de Kanpur, je suis venu au Canada pour travailler avec le professeur Geoff Meyerhof à la Technical University of Nova Scotia dans le domaine des interactions pieux-sol en utilisant une approche expérimentale. Le travail de recherche consistait à faire l'essai d'un modèle de 1 g pour étudier la réaction des pieux sous des sollicitations axiales dans des sols en couche. Le professeur Meyerhof m'a rapidement appris l'importance de la recherche par rapport à ses applications pratiques. J'ai aussi appris à très bien connaître le Dr John Brown. En plus d'être membre du corps professoral de la Technical University of Nova Scotia, le Dr Brown travaillait aussi à temps partiel pour la nouvelle société Jacques Whitford and Associates (JWA). Il m'a présenté à Hector Jacques et à Mike Whitford, avec lesquels j'ai eu des discussions informelles sur des projets de consultation en Nouvelle-Écosse.

Après avoir terminé ma recherche avec le professeur Meyerhof, je suis allé à l'Université Cambridge pour travailler avec le professeur Andrew Schofield dans le domaine de la modélisation par centrifugeuse. Le professeur Schofield venait tout juste d'accepter le poste de titulaire de la Chaire de recherche en géotechnique et entamait une recherche ambitieuse sur la modélisation par centrifugeuse. À titre d'adjoint à la recherche du professeur Schofield, j'ai travaillé sur les interactions pieux-sol, et j'ai également participé à d'autres projets de modélisation par centrifugeuse. J'ai acquis une précieuse expérience en méthodes expérimentales avancées à l'Université Cambridge et j'ai eu de nombreuses discussions avec le professeur Schofield sur différents domaines de recherche en géotechnique. Pendant que j'étais à Cambridge, j'ai également suivi des cours du Dr Peter Wroth sur la mécanique des sols à l'état critique et son application en analyse et en conception.

Ayant acquis de l'expérience en recherche et en enseignement, j'ai constaté que j'avais besoin d'expérience pratique et je suis donc revenu au Canada pour travailler chez JWA à temps plein tout en continuant à travailler avec le professeur Meyerhof à temps partiel. Le Dr John Brown a été mon mentor au cours des premières années de ma carrière d'expert-conseil. Il m'a présenté le Code *national du bâtiment* et l'ébauche du *Manuel canadien d'ingénierie des fondations*. Il m'a encouragé à travailler sur le terrain et à mener des essais en laboratoire pour que j'aie une meilleure compréhension de la caractérisation du sol utilisée en analyse et en conception. Je me souviens aussi de ce conseil qu'il m'a donné : « Essayez d'abord de comprendre le problème avant de vous empresser de le résoudre », et « Utilisez deux phrases concises pour transmettre votre message plutôt que deux paragraphes déroutants. »

En 1981, le Dr Brown a décidé de quitter la Technical University of Nova Scotia et de se joindre à temps plein à JWA. Le professeur Meyerhof a également pris sa retraite et JWA a pris de l'expansion en ouvrant des bureaux au Nouveau-Brunswick. J'ai alors déménagé à Fredericton pour me joindre à l'Université du Nouveau-Brunswick (UNB) à titre de membre à temps plein du corps professoral et d'expert-conseil à temps partiel pour JWA.

Au cours de mes premières années à l'UNB, j'ai conçu des installations expérimentales pour mener des essais sur un modèle de 1 g ainsi que l'instrumentation et la surveillance de prototypes. J'ai eu la chance d'avoir le professeur Arvid Landva comme collègue; il m'a fourni des analyses critiques et approfondies de mes idées de recherche. En plus de concevoir des installations pour les essais d'un modèle de 1 g, nous avons commencé à élaborer des plans pour construire une centrifugeuse de taille intermédiaire à l'UNB. À cet égard, j'ai reçu une aide exceptionnelle du Dr Bob Mitchell qui a partagé les notes de calcul et les plans de sa centrifugeuse à l'Université Queen's. J'ai également eu de nombreuses discussions avec le professeur Schofield sur la conception de la centrifugeuse de l'UNB durant mon année sabbatique à Cambridge. Je suis très fier de dire que nos étudiants ont effectué toute la conception et que la centrifugeuse a été autorisée en 1989 avec un financement de 100 000 $ du Gillin Endowment Fund. L'installation est utilisée depuis pour effectuer de la recherche sur différents problèmes dans le domaine des interactions sol-structures. La recherche sur les essais sur modèle est complétée par l'instrumentation et la surveillance de prototypes. J'aimerais remercier le ministère des Transports et de l'Infrastructure du Nouveau-Brunswick qui a fourni d'importantes subventions pour appuyer cette recherche.

J'aimerais profiter de cette occasion pour reconnaître les contributions des nombreux étudiants de l'UNB et ingénieurs en début et en milieu de carrière chez JWA (maintenant Stantec) à mes activités de recherche et de consultation au cours des 30 dernières années.

Maintenant, quelques mots sur mon association avec la Société canadienne de géotechnique. Je suis membre de la Société depuis 1977. Le Dr Bob Mitchell m'a encouragé à agir à titre de rédacteur adjoint de la *Revue canadienne de géotechnique* alors qu'il en était le rédacteur (éditeur en chef) et à poursuivre dans ce rôle lorsque le Dr Dennis Becker l'a remplacé. Les Drs Mitchell et Becker m'ont encouragé à devenir rédacteur lorsque le Dr Becker a quitté ce poste. J'aimerais remercier les Drs Mitchell et Becker ainsi que tous les rédacteurs adjoints pour leur appui durant mon mandat de cinq ans à titre de rédacteur de la *Revue*. Durant mon mandat, nous

Arun and Hemlata Valsangkar.

sommes passés de six à 12 numéros par année, avons élargi le comité de rédaction pour inclure un plus grand nombre de rédacteurs adjoints internationaux, et la dernière année, nous sommes passés d'une version papier à une soumission électronique des manuscrits .

Finalement, j'aimerais remercier ma femme Hema de son appui inconditionnel en voyageant dans différents pays avec nos jeunes enfants pour que je puisse progresser sur le plan professionnel et surtout, de m'avoir permis de jouer dans le « carré de sable » et de sauter dans des « mares de boue » durant 50 ans de notre vie conjugale.

Merci à tous!

A. J. Valsangkar, Ph.D., P.Eng., FEC, FICE(UK), FCSCE, FEIC, FCAE

Professor Emeritus/Honorary Research Professor/Senior Consultant, STANTEC
University of New Brunswick
September 2019

Fred Matich and John Gadsby: CGS's newest Honorary Life Members

At the 72nd CGS Canadian Geotechnical Conference in St John's, NL, this past fall, CGS President, **Mario Ruel** presented two Honorary Life Memberships to long-time CGS members **Fred Matich** and **John Gadsby**. They are the recipients of the second and third such memberships of the Society; the first one being presented to Gordon McRostie in 2015.

Fred Matich, a New Zealander by birth, came to Canada in 1953 after obtaining a Master's degree in Civil

Fred Matich.

Engineering from Harvard University under the joint supervision of Professors Arthur Casagrande and Karl Terzaghi. He joined the Soils Engineering Department of The Foundation Company of Canada in Montreal. In 1954, that department became a consulting firm known as Geocon Ltd.

By the mid-1960s, Fred was President of that firm, which by then had expanded to four offices across Canada. In 1961, he moved to Toronto. In 1975, Geocon was purchased by Lavalin Inc., with whom Fred worked until 1990, the last five years as a Senior Geotechnical Advisor. In 1990, he formed MAJM Corporation Ltd., and for the past 29 years, Fred has primarily served on a number of geotechnical review boards including Barrick Gold, Inco/Vale Canada and Syncrude Canada. He has been associated with Barrick since 1988, Inco/Vale since 1956 and with Syncrude since 1962. Fred has applied his geotechnical expertise in more than 40 countries, primarily associated with resource development projects.

Fred has been a member of the CGS since its inception in 1972. Prior to that, he was a member of the local soil mechanics groups in Montreal and Toronto. Over the years Fred has attended many of the CGS annual conferences, and presented many papers. He served as Chair of the CGS's First Marine Geotechnical Conference, and has been for many years a member of the CGS Heritage Committee. Fred was a Cross Canada Lecturer in 1975 and was the recipient of the R.F. Legget Award (as it was known then) in 1986. Fred received The Association of Professional Engineers of Ontario Engineering Medal in 1978. He became a Fellow of the Canadian Academy of Engineering in 1990. Fred became a Fellow of the Engineering Institute of Canada in 1992 and has subsequently been awarded two EIC Medals: the K.Y. Lo Medal in 2000 and the Julian Smith Medal in 2012.

John Gadsby worked as a Soils Engineer in the UK during the 1950s before attending Purdue University in the early 1960s where he obtained a Master's degree in Civil Engineering under the supervision of Professor Ralph Peck. He then moved to Vancouver, BC, in the early 1960s, and over the next 20 years worked with Geocon, CBA Engineering, Piteau Gadsby McLeod and Thurber Engineering, opening that firm's Vancouver

John Gadsby.

office. When at Geocon, Fred Matich was John's boss.

Since 1983, John has worked as an independent geotechnical consultant, mainly in the mining industry. He pioneered the concept of "Design and Operation for Mine Closure", a concept that has now been adopted by many countries around the world. He has travelled and lectured extensively on that concept.

John has been a CGS member since its inception in 1972. He was the first CGS British Columbia Director, and was on the committee that produced the first draft, in 1975, of what is now the *Canadian Foundation Engineering Manual*. He has been involved with the *CGS News* since 1979, and in 1983 became the founder and publisher of *Geotechnical News*. *Geotechnical News* will publish the last of its almost 150 issues in December 2019. John became an Engineering Institute of Canada Fellow in 1997 and was awarded the EIC's CP Rail Medal in 2000. In the same year he was awarded the CGS's A.G. Stermac Award.

Now both Fred Matich and John Gadsby can refer to themselves as CGS Honorary Life Members for their many and varied contributions to the geotechnical profession and geotechnical community in Canada and abroad.

Fred Matich et John Gadsby, nouveaux membres honoraires à vie de la SCG

John Gadsby and Fred Matich receiving their awards at GeoSt.John's 2019
John Gadsby et Fred Matich recevant leurs titres à GéoSt.John's 2019

À la 72e conférence canadienne de géotechnique de la SCG à St. John's, à Terre-Neuve-et-Labrador, cet automne, le président de la SCG, **Mario Ruel**, a remis deux titres de membre honoraire à vie à des membres de longue date de la SCG, **Fred Matich** et **John Gadsby**. Ils sont les deuxième et troisième lauréats de ce titre de la Société; le premier ayant été remis à Gordon McRostie en 2015.

Fred Matich, d'origine néo-zélandaise, est arrivé au Canada en 1953 après avoir obtenu une maîtrise en génie civil de l'Université Harvard sous la supervision conjointe des professeurs Arthur Casagrande et Karl Terzaghi. Il s'est joint au Service d'étude des sols de la Foundation Company of Canada à Montréal. En 1954, ce service est devenu une société d'experts-conseils appelée Geocon Ltd.

Au milieu des années 1960, M. Matich était président de cette société, qui comptait alors quatre bureaux au Canada. En 1961, il a déménagé à Toronto. En 1975, Geocon a été achetée par Lavalin inc., pour laquelle M. Matich a travaillé jusqu'en 1990, les cinq dernières années à titre de conseiller principal en géotechnique. En 1990, il a créé MAJM Corporation Ltd., et au cours des 29 dernières années, M. Matich a principalement travaillé sur plusieurs comités d'évaluation géotechnique, y compris sur ceux concernant Barrick Gold, Inco/Vale Canada et Syncrude Canada. Il est associé à Barrick depuis 1988, à Inco/Vale depuis 1956 et à Syncrude depuis 1962. M. Matich a appliqué son expertise en géotechnique dans plus de 40 pays, principalement en lien avec des projets d'exploitation de ressources.

M. Matich est membre de la SCG depuis sa création, en 1972. Auparavant, il était membre de groupes locaux relatifs à la mécanique des sols à Montréal et à Toronto. Au fil des ans, M. Matich a assisté à de nombreuses conférences annuelles de la SCG et a

présenté un grand nombre d'articles. Il a agi à titre de président de la première Conférence de géotechnique marine de la SCG et a été membre du Comité sur le patrimoine de la SCG pendant de nombreuses années. M. Matich a été le conférencier de la Tournée de conférences transcanadienne de la SCG en 1975 et le lauréat du Prix R.F. Legget (alors ainsi appelé) en 1986. M. Matich a reçu la médaille de l'Association des ingénieurs professionnels de l'Ontario en 1978. Il est devenu Fellow de l'Académie canadienne du génie en 1990. Il est également devenu Fellow de l'Institut canadien des ingénieurs (ICI) en 1992 et a reçu subséquemment deux médailles de l'ICI : la Médaille K.Y. Lo en 2000 et la Médaille Julian Smith en 2012.

John Gadsby a travaillé comme ingénieur de la mécanique des sols au Royaume-Uni durant les années 1950 avant de fréquenter l'Université Purdue au début des années 1960, où il a obtenu une maîtrise en génie civil sous la supervision de professeur Ralph Peck. Il a ensuite déménagé à Vancouver, en Colombie-Britannique, au début des années 1960, et au cours des 20 années suivantes, a travaillé chez Geocon, CBA Engineering, Piteau Gadsby McLeod et Thurber Engineering, inaugurant le bureau de Vancouver de cette société. Lorsqu'il était chez Geocon, Fred Matich était le patron de M. Gadsby.

Depuis 1983, M. Gadsby travaille comme expert-conseil indépendant en géotechnique, principalement dans l'industrie minière. Il a créé le concept de « Conception et exploitation d'une mine en fonction de la fermeture », qui a maintenant été adopté par de nombreux pays. Il a beaucoup voyagé et a donné de nombreuses conférences portant sur ce concept.

M. Gadsby est membre de la SCG depuis sa création en 1972. Il a été le premier administrateur de la Colombie-Britannique de la SCG et a fait partie du comité qui a produit, en 1975, la première ébauche de ce qui est maintenant le *Manuel canadien d'ingénierie des fondations*. Il participe à la rédaction de *CGS News* depuis 1979, et en 1983, il est devenu le fondateur et l'éditeur de *Geotechnical News.* Après près de 150 parutions, le dernier numéro de *Geotechnical News* sera publié en décembre 2019. M. Gadsby est devenu Fellow de l'Institut canadien des ingénieurs (ICI) en 1997 et a reçu la Médaille CP Rail de l'ICI en 2000. La même année, il a été le lauréat du Prix A.G. Stermac de la SCG.

Dorénavant, Fred Matich et John Gadsby peuvent se considérer comme des membres honoraires à vie de la SCG pour leurs nombreuses contributions variées à la profession et à la communauté géotechniques au Canada et à l'étranger.

Workshop on the Practice of Geotechnical Engineering, Quebec City, February 2019

This is a contribution from the Eastern Québec section of the CGS.

The Workshop on the Practice of Geotechnical Engineering was held in the Quebec City area on February 7, 2019. It brought together 172 participants from the academic, public and private sectors from all across the Province of Quebec. The objective of the workshop was to discuss various aspects and challenges encountered in the geotechnical engineering community. This event was organized under the umbrella of the Eastern Québec section of the CGS.

Mario Ruel, President of the Canadian Geotechnical Society, got the ball rolling with a talk on the role of the CGS and the services and benefits available to the members. Nancy Verreault, of the Ordre des ingénieurs du Québec (OIQ), then spoke about practice inspections and more specifically, what the expectations of the OIQ are towards the members and what efforts are being made to improve the inspections. She also shared a word about the geotechnical engineering competency profile and gave some practical guidelines.

A total of eleven guest speakers then shared their experience with the attendees, covering several specific subjects. In the morning session, Régis Bouchard (SNC-Lavalin), Gilles Grondin (Laboratoires d'Expertises de Québec), Raymond Juneau (Laboratoires d'Expertises de Québec), Martin Tremblay (Ville de Montréal), Vincent Fournier (Terrapex Environment), Pierre Jean (Englobe Corp), Marie-Claude Lévesque (Englobe Corp) and Denis Demers (Ministère des Transports de Québec) presented case studies. In the afternoon, Serge Leroueil (Univérsite Laval), Marie-Christine Delisle (Ministère des Transports de Québec) and Jean-Marie Konrad (Univérsite Laval) explored avenues for improving the practice of geotechnical engineering. These presentations were followed by a round table where everyone could express their opinions and share their suggestions on the topic. The worskshop ended with an outdoor social event around a bonfire.

Delegates at the Workshop on the Practice of Geotechnical Engineering, Quebec City, February 2019
Participants à l'atelier sur la pratique de la géotechnique, Québec, février 2019.

The workshop was judged a great success by the participants. The organizing committee is now continuing its work and is looking into creating more opportunities that will allow the various actors in the geotechnical community to continue to discuss the important challenges encountered in the practice of geotechnical engineering.

Atelier sur la pratique de la géotechnique, Québec, février 2019

Cet article est une contribution de la section locale Est-du-Québec, de la SCG.

L'Atelier sur la pratique de la géotechnique a eu lieu à Québec, le 7 février dernier. Cette activité a permis de réunir 172 participants des milieux privé, public et universitaire en provenance de différentes régions du Québec afin de discuter des différents aspects du travail de l'ingénieur en géotechnique. Cet Atelier était chapeauté par la Section Est-du-Québec.

Lors de cette journée, Mario Ruel, président de la Société canadienne de géotechnique, a fait une allocution sur le rôle de la Société ainsi que les services et avantages offerts aux membres. Nancy Verreault, responsable des inspections à l'Ordre des ingénieurs du Québec (OIQ), a présenté les attentes de l'Ordre face à ses membres lors d'une inspection professionnelle, les mesures d'amélioration en lien avec l'inspection, le profil de compétence en géotechnique et quelques guides pratiques. Onze conférenciers invités ont partagé leur expérience avec les participants sur les différents thèmes abordés lors de l'Atelier. En avant-midi, Régis Bouchard (SNC-Lavalin), Gilles Grondin (Laboratoires d'Expertises de Québec), Raymond Juneau (Laboratoires d'Expertises de Québec), Martin Tremblay (Ville de Montréal), Vincent Fournier (Terrapex Environment), Pierre Jean (Englobe Corp), Marie-Claude Lévesque (Englobe Corp) et Denis Demers (Ministère des Transports de Québec) ont présenté des études de cas. Tandis qu'en après-midi, des pistes de solutions ont été évoquées par Serge Leroueil (Univérsite Laval), Marie-Christine Delisle (Ministère des Transports de Québec) et Jean-Marie Konrad (Univérsite Laval). La journée s'est terminée avec une table ronde afin que les participants puissent échanger sur l'amélioration de la pratique de la géotechnique, et a été suivi d'une activité de réseautage extérieure autour d'un feu de joie.

La journée fût très appréciée de tous les participants présents. Le Comité organisateur poursuit donc son travail afin de renouveler l'expérience et de permettre aux divers intervenants de continuer à partager sur la pratique de la géotechnique.

6th Canadian Young Geotechnical Engineers and Geoscientists Conference (cYGEGC 2019) -- A Great Success

This is a contribution by the organizing committee of the 6th cYGEGC. It was written by Vincent Castonguay (vincent.castonguay.2@ulaval.ca) (co-chair of the conference and the incoming CGS Young Professional Representative), and Kathryn Dompierre and Hugh Gillen, members of the committee.

This past fall (September 26-28, 2019), the 6th Canadian Young Geotechnical Engineers and Geoscientists Conference (cYGEGC) was held in the beautiful city of St. John's, NL. For the occasion, 34 young engineers and scientists gathered for two days of technical proceedings and a one-day technical tour around St. John's. The technical tour began on Bell Island with a visit to a closed iron ore mine where delegates were taken underground to get a taste of the working conditions miners endured a century ago. The group then proceeded to Cape Spear, the easternmost point of continental North America, where professor Derek Wilton (Memorial University of Newfoundland) explained the peculiar geological conditions found at the site.

Dr. Wilton was one of six keynote speakers invited to the conference. Joining him were Mario Ruel (President of the Canadian Geotechnical Society), Jocelyn Hayley (University of Calgary), Kent Bannister (TREK Engineering), Paul Deering (Stantec), and Pete Quinn (BGC Engineering). Each speaker presented a topic of their choice, and provided valuable insights on their career choices and experiences. A panel discussion allowed the delegates to ask the keynotes (who were joined by Wayne Clifton from Clifton Engineering Group) any questions they desired. This session led to some very interesting discussions on a variety of subjects such as the current state of geotechnical engineering and geoscience, and how climate change affects their practice. It was a curious turn of events that this panel discussion should take place on the same day that tens of thousands of Canadians were marching in the streets to ask for greater commitments from our governments to fight climate change. The delegates seemed to be keenly aware that the future of geotechnique will be shaped by climate change, so Wayne Clifton's advice for young professionals was to get involved in defining political platforms in order to have a bigger impact on our profession and Canada's future.

6th cYGEGC delegates at Cape Spear, Newfoundland. Derek Wilton (Memorial University of Newfoundland) is in the middle of the back row
Les délégués de la 6e CCJGG à Cape Spear, Terre-Neuve. Derek Wilton ß(Memorial University of Newfoundland) est au centre de la rangée arrière.

In addition to the keynote talks, all delegates gave a three-minute "elevator pitch" providing a high-level description of the poster they brought to share with the other delegates. The elevator pitch-style of presentation encouraged the delegates to practice summarizing technical work into concise, understandable messages. Given the smaller size of the conference, it also offered delegates a more intimate, friendly environment in which to present. This is especially valuable for those that haven't attended a conference before, encouraging them to attend the national conference and giving them more confidence for future networking. The elevator pitches and posters generated lots of lively conversations - there never seemed to be enough time as the delegates always had to be pulled away from the posters! After the daily technical sessions, the evening activities included a night at the historical Yellow Belly Brewery on George Street and a cocktail reception with the executive committee of the Canadian Geotechnical Society. This offered delegates a unique opportunity to meet leaders in our profession.

As with the previous cYGEGCs, many great connections were made. Delegates now have a network of geotechnical and geoscience professionals across Canada, from a variety of backgrounds and working in different sectors. Many delegates who attended the previous cYGEGC three years ago also decided to make the trip to St. John's this year to reconnect with friends they made in Whistler, BC. The cYGEGC is evolving to become not only a conference where technical content is discussed, but most importantly, an event where delegates establish friendships that will last throughout their careers.

6e Conférence canadienne des jeunes géotechniciens et géoscientifiques (CCJGG 2019) – Un succès retentissant

Ce texte est une contribution du comité d'organisation de la 6e CCJGG. Il a été écrit par Vincent Castonguay (vincent.castonguay.2@ulaval.ca) (co-président du comité d'organisation de la conférence et prochain représentant des jeunes professionnels de la SCG), ainsi que Kathryn Dompierre et Hugh Gillen, membres du comité d'organisation.

C'est au cœur de la magnifique ville de St-John's (NL) que se tenait cet automne (26 au 28 septembre 2019) la 6e édition de la Conférence canadienne des jeunes géotechniciens et géoscientifiques (CCJGG). Pour l'occasion, 34 jeunes ingénieurs et scientifiques se sont réunis pour deux jours de conférences techniques et une journée de visite technique dans les environs de St-John's. La visite technique débutait sur Bell Island par la visite d'une ancienne mine souterraine de minerais de fer. Les délégués ont pu en apprendre plus sur les difficiles conditions de travail que les mineurs devaient endurer il y a un siècle. Accompagné du professeur Derek Wilton (Memorial University of Newfoundland), le groupe s'est ensuite dirigé vers Cape Spear, le point le plus à l'est du continent nord-américain, pour en apprendre davantage sur les conditions géologiques particulières au site.

Dr Wilton était l'un des six conférenciers invités à la conférence, joint par Mario Ruel (président de la Société canadienne de géotechnique), Jocelyn Hayley (University of Calgary), Kent Bannister (TREK Engineering), Paul Deering (Stantec) ainsi que Pete Quinn (BGC Engineering). Chaque conférencier effectuait une présentation sur un sujet de leur choix, faisant également part de certaines de leurs expériences professionnelles significatives. Les conférenciers étaient aussi appelés à former un panel pour répondre aux questions des délégués portant sur divers sujets. Pour l'occasion, Wayne Clifton (Clifton Engineering Group) s'était joint aux autres experts. Cette séance de discussion a donné lieu à des conversations fort pertinentes quant à l'état de la pratique en ingénierie géotechnique et géoscience, ainsi que sur l'impact des changements climatiques sur leur profession. Le hasard faisant bien les choses, ce panel avait lieu au moment même où des dizaines de milliers de Canadiens marchaient dans les rues pour revendiquer des actions plus concrètes de la part des gouvernements pour combattre les changements climatiques. Les délégués semblaient tout à fait convaincus que cet enjeu allait redéfinir leur pratique professionnelle dans les années à venir. Wayne Clifton a profité de cette discussion pour conseiller aux délégués de s'impliquer activement dans leurs communautés afin de définir les plateformes politiques et ainsi générer un impact plus important, autant pour le futur de leur profession que pour le futur du Canada.

Les délégués ont également eu l'occasion d'effectuer une présentation courte de style *elevator pitch* pour introduire le sujet de leur affiche technique à leurs pairs. Ce style de présentation encourageait les délégués à résumer un sujet technique de manière concise et aisément compréhensible. La nature plus intime de cette conférence fournissait d'ailleurs aux délégués un environnement de présentation décontracté, ce qui était d'autant plus apprécié des présentateurs n'ayant jamais participé à des conférences d'envergure. Les présentations *elevator pitch* et les séances d'affiches techniques ont donné lieu à des conversations animées, où le temps semblait toujours manquer! Après les séances techniques journalières, les délégués étaient conviés à des activités sociales en soirée, notamment à la brasserie historique Yellow Belly, située sur George Street, ainsi qu'à un cocktail avec le comité exécutif de la Société canadienne de géotechnique. Ces soirées ont permis aux délégués de rencontrer et d'échanger avec les leaders de notre profession.

Tout comme lors des CCJGGs précédentes, de nombreux liens se sont tissés à St-John's. Les délégués ont pu se bâtir un réseau de contacts avec des professionnels de leur âge disséminés partout au Canada. De nombreux délégués ayant participé à la CCJGG précédente avaient d'ailleurs décidé de faire le voyage jusqu'à St-John's pour retrouver des amitiés créées trois ans plus tôt, à Whistler, C-B. Plus que jamais, la CCJGG évolue. Elle est certes une conférence où du contenu technique est partagé, mais surtout elle est un événement où des amitiés sont établies. Des amitiés qui, nous l'espérons, perdureront durant toute la carrière des délégués.

Some parting remarks by John Dunnicliff, Editor

Introduction

For this 93rd and last episode of GIN I decided to write about a few of my pet subjects, mostly to do with communication among us. But first, John Gadsby, Publisher of Geotechnical News, asked me whether I'd be willing to identify 'best' GIN articles among the 160 or so that are available on www.geotechnicalnews.com/instrumentation_news.php.

'Best' GIN Articles

I was initially uncomfortable about this, because I don't want to imply that any author was 'second best'. However, based on my 'Golden Rule Number 2' for articles in GIN (I'll identify Number 1 later):

The goal of articles in GIN is to provide information that will be useful to readers in their engineering practices. This is a different goal from "I want to share with you what I did". The latter goal is not acceptable.

and feedback from readers, I zeroed in on these four:

- **The Use of the Fully-grouted Method for Piezometer Installation, Parts 1 and 2** by Ivan Contreras, Aaron Grosser and Richard Ver Strate of Barr Engineering in Minneapolis, June 2008. These authors have been leaders in the campaign to convince the rest of us that the fully-grouted method provides better quality, lower cost, as well as easier and faster installation than the "traditional" method of sand, bentonite chips/pellets/balls and grout.
- **Update of the Fully-grouted Method for Piezometer Installation** by the same authors as the above article, June 2012.
- **Remote monitoring of deformation. An overview of the seven methods described in previous GINs** by Paolo Mazzanti of NHAZCA in Rome, Italy, December 2012. I'd been very impressed by the number of papers about remote methods for monitoring deformation at the 2011 International Symposium on Field Measurements in GeoMechanics (FMGM) in Berlin. Because I knew almost nothing about several of these, with their multiple acronyms, I decided to find knowledgeable people and ask each to write a brief article for GIN. These seven article were in GIN in March and June 2012. Paolo Mazzanti (the organizer of our annual monitoring courses in Italy) agreed to write this concluding article, with a comparative analysis of the various techniques.
- **Eight Common Sense Rules for Successful Monitoring** by Martin Beth of Sixence Soldata, in Paris, France, June 2016. Those of you who know me will be aware of my focus on 'human factors' as opposed to 'technical factors'. This article follows that focus. When I told Martin Beth how useful I thought this was, he replied, "But everyone knows these rules". Not true!

Suggestions for Content of Professional Lectures at Courses

Having directed many Continuing Education Courses (that's a North American term; elsewhere they're usually called Continuing Professional Development Courses) about geotechnical and structural monitoring, I've learned a few lessons about content of lectures during these courses.

1. The basic basic aspect is to be clear in your own mind about your objective, which seems to me to be "To provide clear guidelines for my audience on how to improve their professional practices".
2. And then the follow-up basic basic question. "Will my planned presentation keep my focus on those 'clear guidelines' so that my audience will understand and remember them?
3. Inherent in this question is "Will I be attempting too much?" i.e. "Am I planning to present so much information that the 'clear guidelines' will be obscured?"
4. I suggest that you think of your primary theme as 'Main Street'. During your presentation define Main Street and stay on Main Street! Turning left or right will detract from your primary theme.
5. This is my Golden Rule Number 1 for articles in GIN - a quotation by Joseph Pulitzer, which in my view applies both to the written word and to the spoken word at courses:

Put it before them briefly so they
will read it,
clearly so they will appreciate it,
picturesquely so that they
will remember it
and, above all, accurately
so that they
will be guided by its light.

Wonderful!

I have a story about when this quotation came in very handy. The US

National Science Foundation has a practice of assembling teams of individuals to review various technical activities. The teams are usually made up of three federal employees, three from academia and three from private practice. I was on one of those teams assigned to review plans for long-term deep disposal of high level nuclear waste. We sat through two days (or was it three? It felt like a week!) of presentations by scientists, with PowerPoint slides with bullet points, flow charts and other gobbledegook. We understood only some of the technical stuff and found ourselves getting more and more aggravated by their inability to communicate with us. "How do you think that the folks out there are going to allow you to do this potentially dangerous thing unless you improve your communication skills?" We wrote a technical review, as best we could, and included our concerns about communication by quoting Joseph Pulitzer!

Suggestions for Content of Other Professional Lectures

Meaning conferences, symposia, local professional society meetings et al. It seems to me that the above suggestions 3, 4 and 5 apply to all professional lectures.

Suggestions for Preparation of PowerPoint Slides

At the top of this I wrote "I decided to write about a few of my pet subjects, mostly to do with communication among us". When watching (enduring!) PowerPoint slides I've often wanted to shout out "Your slides are terrible!" Here are my suggestions:

1. Use light colours on a dark background. Dark on light causes glare. The worst is non-bold black on a white background, and this seems to be highly popular, hence my stifled shouting! Consider using yellow, white and/or very light blue on a black background.
2. Use a clear font. Verdana bold is good. Large enough to be seen clearly at the back of the room. I like to use Verdana 28 bold for titles and Verdana 20 bold for text on the slides.
3. This follows up on the above "Will I be attempting too much?" I suggest that you limit your number of slides to about one per minute. If you have substantially more than this, you may well get into time trouble or you may speak too quickly. The 'bottom line' is: are you comfortable with presenting your slides within your allotted time without speaking quickly?
4. Avoid a lot of words on a slide. If you have too many words this tends to work in opposition to slides acting as visual aids. It is better just to have a few words on a slide to remind you what to say, and to speak a brief number of words to elaborate.
5. Simple title of six words or less
6. This is related to #4: Avoid the trap of having words on the screen, hoping that your audience will read those words, while at the same time you're speaking different words – this tends to happen when the slides are too wordy.
7. If you have multiple graphics on a slide, consider whether explaining each might cause time problems.
8. No busy slides. Pictures and clear concise schematics rather than detailed drawings and graphs.
9. Keep the flow of slides simple. I like to use "Appear" for any animations, and to select "None" on the Transitions tab.
10. Unless yours is publicized as a commercial presentation, avoid any commercialization, except perhaps for your company logo on the first slide.

Suggestion for Microphone at Professional Meetings

Try to arrange for a 'Lavalier-type' microphone at the podium. This is the type that has a small microphone attached to the front of clothing or hung from a ribbon around the neck, together with a transmitter that goes in the pocket. This is far preferable to a conventional microphone beause if one of those is used speakers tend to position their mouths too near or to far, with distortion or low volume respectively.

Suggestions for Discussions During Professional Meetings

These excellent suggestions have been written for this article by John Burland, Emeritus Professor and Senior Research Investigator at Imperial College London. He calls them 'The Grand Inquisitor Method'.

"I've used The Grand Inquisitor Method a couple of times in the past with some success. I dreamed it up because I got tired of attending conferences where members of expert panels came with bland pre-prepared responses to pre-notified questions. I felt that, provided the panel members were told only of the general area of discussion, the responses were much more likely to be lively and animated if they had no notice of the questions. This often leads on to greater audience participation.

"The way I've run them in the past has been for the chairperson of the session to have a few prepared (unseen) questions. The session could begin with one of the questions just to get things going, the panellists answering first. The audience is then invited to ask questions and respond to what the panellists have said. Depending on how the discussion goes, the chairperson might then move on to another prepared (but unseen) question and hopefully the panel responses will open up another set of audience questions and comments. The aim of all this is to get the panellists to say what they really think rather than carefully honed and rather bland responses, and in this way provoke the audience to engage more. It can be like riding a tiger but in my experience it can lead to some interesting and animated discussions that continue in the bar after the session!"

And I Can't Resist Including This

This year is the 100th anniversary of the Amritsar Massacre, in which the British army in India opened fire on unarmed Indian civilians, killing hundreds. A recent documentary on our TV interviewed the grandchildren of the British general who gave the order to fire. They were in denial, claiming that the army acted in self-defence: clearly this is untrue. The interviewer responded with what I think is a classic quote, one that we could use in future when a professional lecturer uses outrageous logic.

"You have conveniently not sought objectivity".

Another wonderful quote!

Closure

So this closes the door on GIN, after 93 episodes in 25 years. Some regret, some relief! I will miss having an outlet for my blatherings, but I will NOT miss all the editing! Most important of all, I will miss the interactions with John Gadsby, Publisher of Geotechnical News and Lynn Pugh, Managing Editor. Thank you to John for allowing me access to your space. Thank you to Lynn for your outstanding cooperation, which has regularly 'gone beyond the call of duty'. It's been a motivating partnership.

Post Script

As explained elsewhere in this issue of Geotechnical News, this is the last issue. Early next year Canadian Geotechnical Society will initiate a new magazine, *Canadian Geotechnique*, and this will have a section *Instrumentation and Monitoring*, edited by Pierre Chouquet of RST Instruments. Following these parting remarks of mine, Pierre shares with us his plans for future articles. Thank you, Pierre, for keeping the tradition alive.

John Dunnicliff
Little Leat
Whisselwell
Bovey Tracey
Devon TQ13 9LA
England
Tel +44-1626-832919
john@dunnicliff.eclipse.co.uk

A word from the next editor

Pierre Choquet

I am truly happy and honoured to become the new editor of the column on Instrumentation and Monitoring, starting in the first issue of the new *Canadian Geotechnique* magazine in early 2020.

I have read John's episodes of GIN for as long as I can remember and always with such great interest. I have always thought that these quarterly updates, articles and discussions on geotechnical instrumentation were very pertinent and very original in the variety of topics that were covered. I know that I have always looked forward to the next magazine to find out what John had dug out for us in our wide world of instrumentation.

I wish to thank John a lot for all that he has done for the geotechnical instrumentation community and geotechnical community at large as well, and I will elaborate on this in a future column.

I hope to continue the tradition of great insights in this field of instrumentation and I have suggested to the editors of *Canadian Geotechnique* to name the column "Instrumentation and Monitoring" in order to reflect not only the means but also the objectives of our geotechnical instrumentation programs.

For my first column, I am thinking of offering the opportunity to GIN readers to send tributes for John's efforts over the years to write so many episodes and how it has been instrumental (yes!) to foster so much improvement and progression in our community and how the state of the practice has improved so much under his guidance.

Can you email me your contributions, especially the tributes, prior to January 15, 2020 (as my deadline for the first magazine issue will be January 18, 2020)? I will be very glad to publish them in the first edition of my column in early 2020.

I'm also very open to your suggestions on what you would find useful to include in future columns. Of course, if you have already an article to send to me, please do so. I have not yet prepared my own publishing guidelines, but they should be very similar to John's guidelines. Please email if you need them.

On a legacy theme, I would like to assure you that all GIN episodes will remain available online. The exact form has not yet been finalized as we are still working on the details with the editor of *Canadian Geotechnique*

(Karma-Link), but you can be assured that this wealth of information will not be lost. I understand also that Karma-Link will have a great online companion to the new magazine.

I really look forward to the opportunity of doing my own part to help spread technical knowledge on geotechnical instrumentation and monitoring, and I truly believe that it will be even more an integral part of proper designs and the observational method in geotechnical engineering in future years.

Pierre Choquet
Dr.-Eng., P.Eng.
pchoquet@rstinstruments.com
https://www.linkedin.com/in/pierrechoquet/

Tribute to John Dunnicliff by Barr Engineering in Minneapolis

Aaron Grosser, Ivan Contreras, Joel Swenson

The geotechnical engineering staff at Barr Engineering Co. are eternally grateful to John Dunnicliff for the mentoring and enthusiastic support he has provided through training short courses and long distance correspondence. John's excitement and critical eye with respect to the research and publication of the Fully Grouted Method for Piezometer Installations was inspiring for us to continue to build upon work we learned of from him and Erik Mikkelsen at one of the early Geotechnical Instrumentation for Field Measurements short courses. His critical eye for detail, gentle goading and reminders for publications, and email responses at all hours with his typical British humor were well received by all of us. Many thanks to John and the effort he has expended on teaching the geotechnical community the important steps of instrumentation and monitoring.

New Institute launched to make mine reclamation sustainable and responsible

Gord McKenna

By its nature, mining drastically disturbs the land. While progressive reclamation is common at almost all mines, the environmental legacy of natural resource extraction continues to pose political, social, and legal challenges, and the current state of practice seldom results in full reclamation after closure. In recent decades, the need for mine owners and society to improve how they work together to ensure mine lands are made safe and useful has become increasingly apparent.

Helping practitioners build sustainable mining landscapes is the objective of the new non-profit Landform Design Institute, which was introduced in September to a receptive audience of reclamation specialists at the 42nd British Columbia Mine Reclamation Symposium in Kimberley, BC.

What is landform design?

Landform design is an emerging process used to successfully reconstruct mine land. It allows industry, regulators, and communities to work together to manage costs and risks, minimize liability, and produce progressively reclaimed landscapes with confidence and pride. Landform design embraces conventional reclamation but is broadly focused. It starts before mining begins in order to provide design, construction support, and stewardship throughout the life of the mine and beyond.

Landform design operates at the element, landform, landscape (mine site), and regional scales. Typical mining landforms include waste-rock dumps, mined-out pits, tailings storage facilities, and the surface-water drainage system. Design teams include planners, engineers, geologists, hydrologists, geochemists, keepers of traditional knowledge, ecologists, and operations and reclamation specialists. They start with a design-basis memorandum that sets out agreed upon goals, objectives, and design criteria for each landform and landscape. This living contract evolves over the decades between the initial vision and final signoff.

LANDFORMDESIGN INSTITUTE

Why an Institute?

The Institute's goal is to make landform design common in the mining industry by 2030. It's dedicated to creating and supporting a community of landform design practitioners. It will help teams design and build truly sustainable reclaimed lands by providing the practical "how to" of landform

Landform design operates at the element, landform, landscape (mine site) and regional scales.

Landform design teams, once assembled, are charged with ensuring that reclaimed landscapes contribute to sustainability and biodiversity at multiple scales.

design for sustainable mining. The Institute will provide principles, tools and practices, a library of references, and workshops and other opportunities to share experiences and lessons learned. There is already much good work going on in every country – the Institute will allow designers to share their knowledge and experience and work together to create new tools and processes. It will also provide information and training that supports local communities and regulators and allows them to work truly collaboratively with and within the design teams.

Short-term projects for the Institute include a graduate-level landform design university course at the University of Alberta in late 2019, a supporting textbook in 2021, and a series of workshops and case-history symposia devoted to sharing the latest knowledge and experience. Specific training courses will allow professionals to add to their skills in support of design teams. One of the Institute's long-term goals is establishment of graduate courses at universities around the world, some of which will offer degrees in landform design.

A role for geotechnical engineers

Geotechnical engineers, who often have lead roles in mining, will inevitably and necessarily play critical roles in the landform design process. Building landforms that evolve over time,

Landform design has several critical steps, all equally important.

that manage seepage and erosion, and can be easily reclaimed will be a central task for each team. Landform design teams, once assembled, are charged with ensuring that reclaimed landscapes contribute to sustainability and biodiversity at multiple scales. They will anticipate and remediate problems such as those posed by acid-rock drainage, contamination from tailings ponds, seismic activity, invasive species, and extreme weather. They will have to acquire a full understanding of the ecological parameters of the site and the many and multi-faceted influences of climate change.

Added to this tool kit is a necessary appreciation for the culture and philosophy of the local communities. Stakeholders need the land returned to them in a form they can use, for agriculture, industrial and commercial development, recreation, wildlife habitat, or traditional activities. In many cases, users of the land will be Indigenous communities who can supply important historical and ecological contexts. Their interests need to be respected, not only by government regulators, but by the technical experts and administrators overseeing reclamation projects. In these areas, mines will learn to build landscapes *with* Indigenous communities rather than *for* them.

The Institute is international in nature, helping people work in all countries around the world, in different regulatory regimes, in all the world's climate zones. It will rely on worldwide experience of its members to forge a robust, comprehensive process, using new and best practices from every corner.

Landform design from day one

Ensuring that all these activities are managed efficiently, and that the costs of meeting regulatory requirements for reclamation are kept under control, requires that landform design gets a seat at the planning table from day one. A system of effective adaptive management, complete with performance predictions, monitoring, and pre-planned contingencies needs to be established. In other words, designs for dams, waste rock dumps, channels, and pits all must anticipate the needs of closure, decommissioning, and landform design before the first ground is broken.

The need for landform designers is only going to accelerate. According to 2019 figures from the International Organizing Committee for the World Mining Congresses, in the past two decades mining production rates have nearly doubled to a global annual total of more than 17 billion tonnes. Since the turn of the century, production is up almost 100% in Asia, 132% in Australia, and 9% in North America. Demand for rare earth metals and other constituents of information-age and renewable-energy technology is rapidly growing.

Making mine reclamation a sustainable and responsible business cannot be tackled by engineers alone. This is an interdisciplinary and collaborative project that will test the capacity of both the mining industry and its professional ranks to embrace change. The Landform Design Institute seeks to support design teams, the mines, the local communities, and the regulator in their quest to build sustainable reclaimed landscapes, useful to all. Interested in learning more? Visit the website (www.landformdesign.com) and sign up for the mailing list.

Landform designers need a seat at the table from the earliest planning stages of the mine itself.

Gord McKenna,
Founder
Landform Design Institute
5223 Laurel Drive
Delta, BC, V4K 4S4 Canada
604-838-6773
info@landformdesign.com

Paolo Gazzarrini

54th episode of the Grout Line, after a very busy year, with articles on and off, but still alive!

For this issue some information about our grouting industry and an article about a very interesting application of jet grouting and MPSP as a grout curtain in a hydroelectric project in Bulgaria (EU). This project was already presented at the 44th DFI Annual Conference and thanks to DFI for the authorization to produce it here.

Grouting industry news:

The first news is about the Grouting Fundamentals & Current Practice course. See below and stay tuned for further information.

40th Annual Short Course & 1st European Edition

The 1st European edition of the internationally renowned *Grouting Fundamentals & Current Practice* short course was held at the Bundeswehr University in Munich (UniBw) from September 16-19, 2019. This 4-day professional training event was organized by the Institute of Applied Geosciences at the Graz University of Technology together with the publishing house Wiley-Ernst & Sohn, and in cooperation with the Institute of Soil Mechanics and Foundation Engineering at UniBw and the Bavarian Chamber for Civil Engineering. With over 50 attendees representing 11 countries, the inaugural European course was a resounding success!

The *Grouting Fundamentals & Current Practice* course was founded in 1979 in the USA, and since then has provided unique professional training and education to thousands of grouting professionals worldwide. For over 20 years the course was directed by the late Prof. Norbert Schmidt, and Prof. Scott Kieffer has provided consistent direction for the past 17 years. By covering fundamental theory while focusing on current state-of-the-practice, the course fills a wide gap in traditional university education. With few exceptions globally, the subject of grouting is simply absent from civil engineering curricula. Furthermore, while theory and calculations can be conveyed in a traditional university environment, they alone cannot compensate for lack of practical grouting experience. The agenda has thus been tailored specifically for Owners, Regulators, Consultants and Contractors that are utilizing pressure grouting as a means for geo-structural construction and remediation.

The Munich course included a faculty of 19 experts from 11 countries, providing exceptional breadth and expertise concerning fundamental aspects of grouting and international best practices. The attendees came from as far as Australia and Mexico, and represented a broad cross section of the grouting industry, including design firms, specialty geotechnical contractors, hydropower facility owners, equipment manufacturers and material suppliers. Major course topics included:

- grout rheology
- cementitious and chemical grouting materials
- overburden and rock drilling methods
- optimizing and verifying grouting during construction
- permeation grouting
- compaction grouting
- compensation grouting
- deep soil mixing
- composite seepage barriers
- jet grouting
- GIN and RTGC in rock grouting
- amenability theory
- rock anchors and SBMA design
- micropiles
- grouting for tunnels
- concrete repair and rehabilitation

An integral part of this course is the ½ day Field Demonstration. Contractors, manufacturers and suppliers converged on the UniBw campus to provide an impressive array of hands-on instruction concerning grouting equipment, materials and procedures. The Munich Field Demo included:

- Live exhibition of sonic drilling and sampling technology (Eijkelkamp SonicSampDrill)
- Ground anchor drilling and installation (Keller Grundbau GmbH)
- Live exhibition of anchor load testing (DSI Underground)
- High capacity tube-a-manchette (MPSP) grouting (Sireg Geotech S.r.l.)
- Colloidal mixing and compact grout plants (ChemGrout, Häny AG, SPIBO, Mai International GmbH)
- Hybrid polyurethane-cement and acrylic-cement injection (Webac Chemie GmbH, Züblin AG)
- Soil permeation grouting (UTT Mapei AS)
- Chemical grouting for water cut-offs and anchoring (DSI Underground, TPH Waterproofing Systems)
- Chemical grouting for concrete repair and rehabilitation (Sika AG)

- State-of-the-art fully instrumented multi-pump containerized grout plant technology (Züblin AG)

Looking Ahead

The course organizers are delighted to announce an extended collaboration in order to deliver annual (USA – Europe) course offerings on a consistent international platform. The 41st annual course will be held in Phoenix, Arizona from September 14 – 18, 2020. It is further planned to memorialize the course content by Wiley-Ernst & Sohn publishing a practical grouting reference book, having the title…you guessed it…"Grouting Fundamentals & Current Practice".

Join us in Phoenix, Arizona for the 41st Annual Course: September 14-18, 2020

For additional information visit www.grouting-fundamentals.com

The second news item is related to the 6th International Grouting Conference, following the 5th, 2017 conference held in Honolulu, HI.
The organizing committee is still at work on the details, but we already have the dates: **February 13-16, 2022 at New Orleans Marriott, one week before the Mardi Gras. Mark your calendar and prepare your abstract/papers!**

A Combination of Jet Grouting and MPSP Grouting in Iskar River Cascade Hydropower Plant in Bulgaria

Andrea M. R. Pettinaroli, Mario Ruggiero,
Gabriele Balconi, Massimo Poggio, Riccardo Castellanza

Introduction

The Iskar River Cascade Hydropower Project is situated north of Sofia, Bulgaria, and it is composed by nine plants. Actually five of them have been built and produce energy. Each plant is composed of a penstock followed by the turbine building, a spillway, and an earth dam that contains the reservoir.

Figure 1: Power plant of Lakatnik.

The Iskar river runs in a narrow valley characterized by diorite or diabase rocks, with an upper deposit of alluvial soil, composed mainly of gravel and sand.

Each plant required an impervious curtain under the structures and in correspondence with the earth dam: this has been obtained by means of a jet grouting treatment of the alluvial coarse soil, and a grouting treatment with cement mixtures of the underlying rock using the MPSP technology.

During the construction of the structures, the site has been shielded from the river water by a temporary earth embankment that has been statically improved and waterproofed by jet grouting columns reinforced with steel tubes; this allowed work to be done without interruption even in case of flood of the Iskar River.

The design of the plants

The design of each plant included a detailed campaign of geotechnical investigation, and a long term monitoring system for the control of the efficiency of the impervious curtain and of the stability of the earth dam. In Fig. 1 the typical plant.

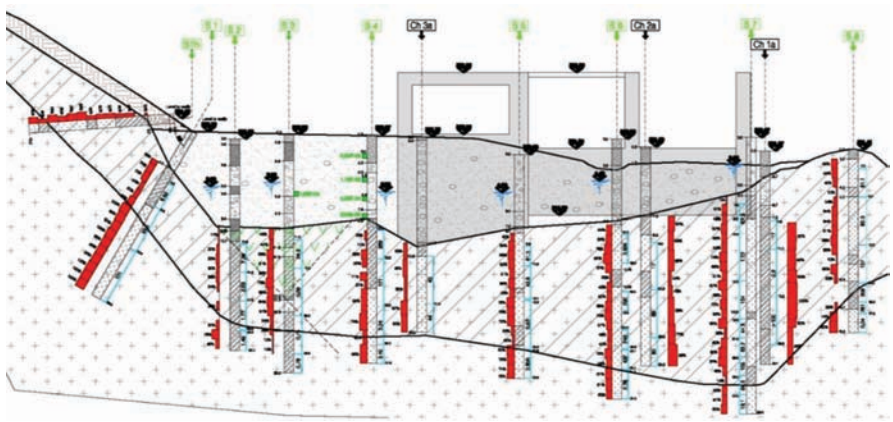


Figure 2: Geotechnical investigation at the power plant of Lakatnik.

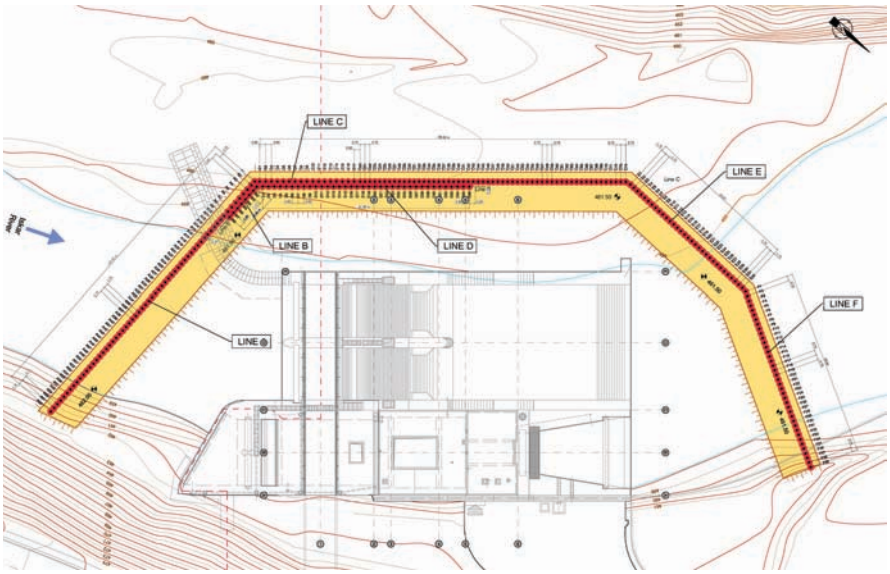


Figure 3: Cofferdam as protection of the site during the activities in case of river flood.

Geotechnical investigation

The execution of several corings along the main cross section of each barrage allowed for reconstruction of the bedrock surface covered by the surficial alluvial layer.

In each hole, permeability tests have been carried out at different depths: Lefranc tests into the alluvial soil strata, Lugeon tests in the rock. Usually the corings put in evidence that the upper part of the rock is rather highly fractured. This information has very often been confirmed and is better proven by the Lugeon test results. The cross section in Fig. 2 concerns the plant of Lakatnik.

Power plant design

Each plant is composed by: the main building that includes the intake channel, the turbine, the outlet channel, the control hall; the weir with the gates; the lateral earth dam (see fig. 1).

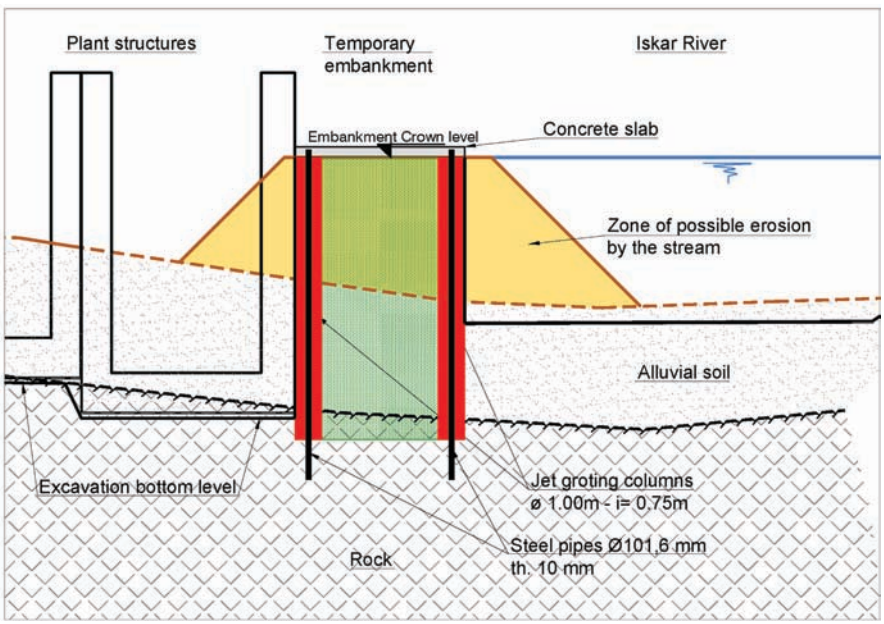


Figure 4: Cofferdam reinforced with jet grouting columns and steel pipes.

During the plant construction, an earth embankment was built in order to protect the front, the back and a side site of the area from the river, as shown in the following figure 3. The embankment has been waterproofed by executing, down to the bedrock level, a line of temporary jet grouted columns. This line of jet grouted columns allowed for the execution of the concrete structures and the installation of the turbine and the electromechanical devices regardless of the variation of the flow rate of the river: no seasonal interruptions of the activities were necessary.

In some sites the plant lies in correspondence of a narrow section of the valley, so in order to guarantee the necessary flowing section of the river, the embankment was placed beside the external alignment of the abutment wall of the plant. In this case the embankment has been considered as a gravity structure, with two lateral lines of jet grouting columns axially reinforced with a steel pipe anchored into the bedrock (see fig. 4).

The internal side of the embankment has been excavated to uncover the jet grouting columns; during the works the grouted wall was protected with a mesh of reinforced shot concrete, until the cast of the abutment wall finally covered the vertical surface. The reinforcements were designed taking into account that the water flow might remove the slope of the embankment, and considering the hydraulic load applied to the remaining treated core with the deeper level reachable during the plant excavation. So the reinforced double jet grouting sheet has a double function: to assure the equilibrium of the embankment and to protect it from the erosion by the river water.

For each plant a FEM analysis of the steady-state seepage process following the construction of the dam and hence the presence reservoir was carried out by applying a three-dimensional finite element code (Fig. 5).

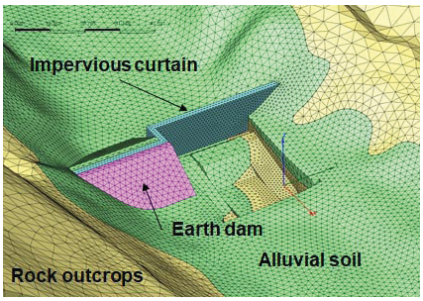


Figure 5: The 3D model mesh.

The setup of the geometry of the three-dimensional model was performed starting from the implementation of the 3D DTM (Digital Terrain Model) of the area and assembling the geometry of the dam structure according to the proper design. Then, based on the hydraulic properties of the rocks and the soils affected by the dam construction, which have been derived from the results of the investigations available, and the boundary conditions assigned to the model, the continuity equation governing the water seepage in the soil domain was integrated in order to derive the values of the hydraulic head for each node and the values of the pore water pressure accordingly. The main features of the seepage regime consequent to the construction of the dam were calculated in order to design the impervious curtain under the weir and the dam foundation. A sensitivity analysis was carried out taking into account different values for the size of the impervious curtain to assess the optimal length of the same structure according to a cost-effective solution (fig. 6 and fig. 7).

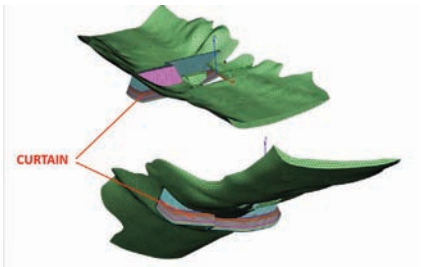


Figure 6: A detail of the curtain elements.

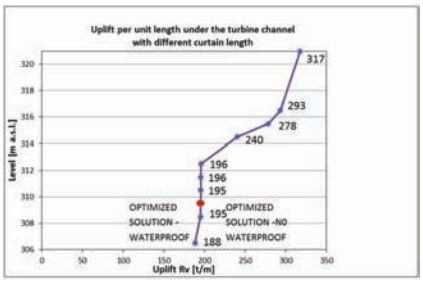


Figure 7: Sensitivity analysis of the curtain depth.

The impervious curtain

For all the plants the deepest excavation level is placed in the area of the power house, where the bedrock is always uncovered. Hence the impervious curtain required to treat the most surficial rock mass, all along the alignment, the coarse surficial deposit on the sides of the section, and the earth dam core.

The investigations showed that the upper part of the bedrock was very weathered with a thickness highly fissured zone variable from 2 m to 5-6 m and presenting very low RQD values. The permeability values, measured with Lugeon test, vary normally between 3 and 50 Lugeon Units (UL), and in several cases they can rise up to 600 UL. According to the design model, the target of the treatment for the curtain was to not exceed 3 UL.

The alluvial formations were composed of gravel and sand, in some sites including 15-30% of silty fraction; boulders were detected in the zone of the current riverbed and in the flood plain side areas, but normally only in a surficial position. The permeability, measured with Lefranc test, gave results between 10^{-4} to 10^{-6} m/s (m/s = 3.2 ft/s) : the target after the soil treatment in those strata and in the earth dam core was fixed at 1-5x10^{-7} m/s.

For the execution of the impervious curtain, it was decided to treat the soil with two lines of double fluid jet grouting columns Ø 1.30 m (4 ft), and to grout the rock with cement mixes. The curtain was carried out after the execution of the earth dam, and, usually (but not always, due to the main works scheduling), after the cast of the weir and power house foundation plate.

The critical issues of this solution were hence:

- the locally highly fractured rock in the transition zone to the upper alluvial deposit
- the possible weakness of the jet grouting treatment at the bottom of the columns, in correspondence of the contact with the underlying rock
- the contact zone between the ground and the concrete foundations of the weir and the power house, because of the surficial disturbance of the rock due to the excavation (made with blasting or with non-explosive agent) and of the discontinuity with the concrete casts that need to be properly sealed.

In order to obtain a homogeneous treatment in all those critical zones, it was decided to perform the rock grouting by means of the MPSP (multiple packer sleeve pipes) placed into the holes that crossed the jet grouted soil or the concrete foundations. MPSP was chosen to avoid the risk of losing packers, and consequently holes, in the highly fractured rock.

The Ground Treatments

Jet grouting

Jet grouting columns were executed as first, using air and a water/cement ratio W/C =1 for the grout, injected with a pressure of 40 MPa (5.8 ksi).

At the beginning of the activities, a trial field was executed in order to evaluate the result of treatment (see

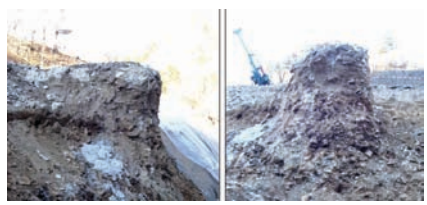


Figure 8: Jet grouting trial columns executed at the start of the works.

Figure 9: On the left - Works in progress with the jet grouting wall protection from the river bed.

On the right – The road on the crown of the embankment, used for the site traffic

pictures in fig. 8) of the discovered columns) and to set up the operational parameters (flow rate and pressure of grout and air, uplift velocity, rotational speed) after the treatment energy procedure (Tornaghi et al. 2004).

In order to allow a more regular high pressure injection during the uplift phase, even in presence of boulders, each column execution was preceded by a predrilling, carried out 1 m down into the bedrock, by means of a dedicated drilling unit.

Some preliminary pre-drillings along the columns' alignment (for the cofferdam as well as for the impervious curtain) were initially made, in order to detect the bedrock level and hence to draw an accurate profile of the alluvial deposit base.

The geometry of the treatment involved the execution of inclined columns at the two ends of the curtain, with drillings made with angles up to 43° from the vertical.

During the treatment of the cofferdam, the steel pipe reinforcement was usually inserted in the hole made for the jet grouting.

The effect of the treatment was successfully tested during the excavation for the plant construction. The picture in fig. 9 shows on the left the jet grouted wall that separates the riverbed from the area of the site for the power house and the gates building. No significant water income from the waterproofed embankment occurred.

This allowed for completion of all the activities for the power plant construction (from the embankment construction to the test on the turbine) in 18 months without any interruption. In case of seasonal interruption (without the waterproofing of the cofferdam), 6 additional months should have been considered. Until today, during the works for the five plants completed, only on one occasion the river has overflowed the embankment, causing a flood that interrupted the works. The site was evacuated on time, thus limiting the damages. Two months were necessary for restoring the yard.

Rock grouting

The treatment of the rock for the impervious curtain was carried out using the MPSP (Multiple Packer Sleeve Pipe) system. After the hole was drilled, a Ø 1"1/2 PVC TAM pipe (40/48 mm inner/outer diameter) was installed. The TAM pipe was equipped, every 3 to 5 meters, with several Heavy Duty Obturator Bags, made in polypropylene geotextile and mounted on one or two sleeves. The bags were initially folded and fixed to the pipe at the ends by a metallic tie (see fig. 10). The tube was centred by means of plastic collars.

Once the pipe was in place, the bags were filled with injected cement grout (ratio W/C=0.6:1) by a double packer lowered to one of the correspondent sleeves, and finally sealing the annular space between the plastic pipe and the borehole. Under the pressure of the injection, the cement of the grout separated from the water, being the latter ejected per seepage through the geotextile. As a result, the hole was

Figure 10: Folded and injected obturator bags mounted astride a manchette.

divided into several stages by means of the tough sealings obtained injecting each obturator bag; a curing time of 18-24 hours were sufficient for the aim (see fig. 11).

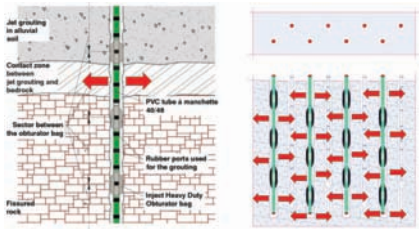


Figure 11: Scheme of the MPSP system grouting.

The grouting of each stage was then made with the conventional MPSP injection procedure. The double packer was placed astride one of the sleeves of the deeper sector, but in this case no plastic sheath was necessary. In fact, the grout filled initially the annular void between the pipe and the borehole, and then it flushed into the fissures intercepted by the hole stage.

The injection was then carried out following the prescribed rules for the rock treatment. The curtain was formed by two alignments of TAMs, spaced 1.50 m (5ft) and with interaxis of 1.50 m (5ft) between the boreholes. In a first phase primary pipes were drilled and injected; then the secondary pipes phase followed (fig. 12).

Along the earth dam axes the holes were drilled passing through the jet grouted columns.

The obturator bags were installed every 3 to 5 m (10 to 16 ft) in the pipe stretch into the rock to be treated. Another bag was mounted about 1 m

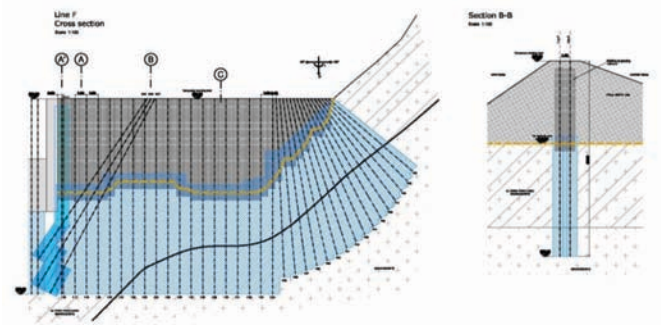


Figure 12: Cross sections of the treatment for the impervious curtain along the earth dam.

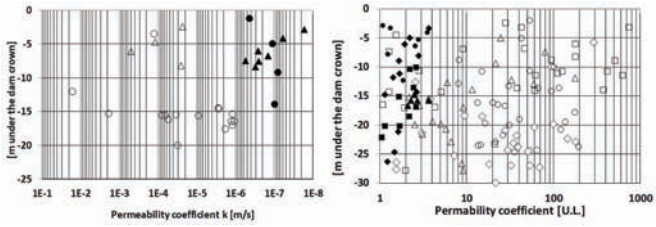


Figure 13: Final controls on the impervious curtain: Lefranc test in soil (on left), Lugeon test in rock (on right) white and black dots. before and after the grouting.

above the contact between rock and jet grouting, in order to treat this transition zone with higher care.

In correspondence of the structures founded directly on the bedrock, the holes were drilled using as guides some plastic tubes previously embedded in the cast concrete.

The upper obturator bag was placed about 1 m (3 ft) under the foundation level, in order to obtain a sealed contact between rock and concrete. In this area a third alignment of pipes was executed, inclined towards the reservoir, in order to guarantee a better treatment from the side of the hydraulic head.

Final controls on the impervious curtain

After the completion of the jet grouting and rock grouting treatments, on each site a final investigation campaign was carried out. Lugeon and Lefranc tests (rock and jet grouted soil) were carried out on inclined cored holes along the impervious curtain and at different depths.

The tests always showed the fulfilling of the prescribed permeability coefficient, as plotted in the following charts in fig. 13: the diagram on the left shows the permeability values before and after the jet grouting treatment in the soil, whereas on the right the permeability in Lugeon Units (UL) before and after the rock grouting.

Permeability values after the treatment are plotted with full symbols

Summary and Conclusions

The cascade HPP of Iskar River, in Bulgaria, is composed of nine plants. For each of them, the design required the execution of a cofferdam for protecting the power house excavation site from the river flow, and of an impervious curtain, along the earth dam and the structures section, against the water seepage in the ground, composed of rock basement underlying alluvial coarse soil. Until today, five plants are completed and regularly operating.

Jet grouting columns reinforced with steel pipes were executed along the provisional embankment in order to make it waterproofed and to work as a gravity structure able to withstand the hydraulic effort of the water even in case of floods. This solution allowed to avoid any seasonal interruption during the works in the riverbed, gaining between 4 and 6 month in the execution schedule of each plant.

The impervious curtains have been executed by combining the use of jet grouting for the treatment of the coarse soil layers, and the MPSP system for the grouting of the underlying bedrock. The adoption of the MPSP allowed to save time during the treatment of crushed rock and to obtain a highly homogenous watertight treatment, particularly sealing some critical zones such as: the contact between the rock and the jet grouted soil; the upper part of the rock mass, weakened from the excavations (usually made by blasting); the contact between the rock and the concrete foundation structures of the power house and the weir. Final permeability controls on site into the curtains confirmed the good outcome of the treatments.

Acknowledgments

A special acknowledgment to Plamen Dilkov, construction manager of Vez Svoghe OOD that owns and has built the plant, who directed the works with the support of Patrick Pauletto, to Achille Balossi Restelli and Elena Rovetto who have contributed to the development and the design of part of the project, to Injectosond S.r.l., specialized company executor of the treatments.

References

Balossi Restelli A., Rovetto E. and Fava A. R., 1993. La tratta Dinegro – Principe della Metropolitana di Genova. Atti del XVIII Convegno Nazionale di Geotecnica, Rimini (Italy), pp. 51-60.

Balossi Restelli A., Tornaghi R., Pettinaroli A: and Rovetto E., 2003. Reconstruction of La Fenice Theatre in Venice – Foundations problems. 13th European Conference on Soil Mechanics and Geotechnical Engineering, Prague, Vol.2, pp. 29-34

Bruce D. A., and Gallavresi F., 1988. The MPSP system: a new method of grouting difficult rock formations. ASCE Conference, Nashville, TN.

Manassero V., 1993. Different techniques for soil improvement and

underpinning. Cambridge programme for industry, Magdalene College, Cambridge, Department Of Engineering.

Tornaghi R. and Pettinaroli A., 2004. Design and control criteria of jet grouting treatments. ASEP-GI Paris, pp 295-319.

Andrea M. R. Pettinaroli
StAP - Studio Ing. Andrea Pettinaroli S.r.l., via Mauro Macchi, 58 - 20124 Milano, Italy, a.pettinaroli@stap-engineering.eu

Mario Ruggiero
Sireg Geotech S.r.l., via del Bruno 12, 20862 Arcore, MB Italy, m.ruggiero@sireg.it,
Gabriele Balconi, Sireg Geotech S.r.l., via del Bruno 12, 20862 Arcore, MB Italy, g.balconi@sireg.it

Massimo Poggio
Injectosond S.r.l., Arenzano, Italy, poggio@injectosond.it

Riccardo Castellanza
University of Milano Bicocca, Milan, Italy
riccardo.castellanza@unimib.it

Considering the time of the year, I would like to wish to everybody MERRY CHRISTMAS and A FANTASTIC 2020!

As usual I conclude with the same request, asking you to send me your grouting comments or grouting stories or case histories. My coordinates remain:

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

Ciao! Cheers!

Introduction

Canada's national election is over. Trudeau and his Liberals are in with a minority government and, one hopes, all parties are rolling up their sleeves and preparing to move Canada forward another few years. Central to the debates leading into the election was the role of pipelines in Canada. Pipelines come with real environmental and safety concerns, and moving liquids or gas from source to the user is more complicated than one would think.

Whether we *should* be reliant on fossil fuels or not, the evidence is unequivocal that we *are* reliant on oil and gas and will continue to be so well into the future. These products cloth us, house us, are integral to food production, transportation, heat, infrastructure, and to manufactured goods from anything that is made of plastic to high-tech carbon fiber toys. Sitting here and looking around my office, virtually everything is made or partially made from oil and gas: my mobile phone, my laptop, chairs, carpet, desk, writing pad (electronic) and post-it notes. Of course, there are components of metals, glass, wood, paper, and plaster, but at the end of the day these come with their own environmental challenges, and across the board humans have chosen petrochemicals to meet the demand for comfort, technology, and quality of life.

Geohazards can present a real threat to safe and environmentally sound pipeline operations. A pipeline is like a string across a landscape, inevitably intersecting hazards along its path. In Canada's Interior Plains, where the highest concentration of pipelines can be found, a geological history of weak horizontally bedded rock, pre-sheared and covered by similarly weak glaciolacustrine sediments primes the landscape for unusually low angled landslides that persist for thousands of years. Similarly, in lands adjacent to the St. Lawrence seaway, low angle landslides occur related to emplaced glaciomarine sediments. Watercourse crossings present challenges related to shifting banks, flood scour, and long-term bed lowering, all of which can expose pipelines to hydrodynamic forces. Melting permafrost threatens the north, and steep slopes threaten the west.

Despite challenges, and sometimes a shaky public image, the oil and gas industry seems determined to advance the state of knowledge in a manner that allows them to deliver their product safely to its destination. This presents a rare opportunity for Canadian geotechnical and hydrotechnical specialists to exercise their education, training and experience in a manner that is aligned both with industry and the national interest regardless of political or social position.

With respect to geohazards and pipelines, Canada is a world leader in understanding the problems and reducing threats. A few years back, a colleague of mine living in Vancouver remarked that Alberta spends more money on landslide research, investigation, and mitigation, than anywhere in the rest of Canada. This was shocking to a room full of landslide researchers who naturally thought of the west coast, or perhaps even Quebec, but I believe he's correct. The pipeline industry has never been more focused on reducing geohazards as they are today. The challenges to entry, however, remain high. The technical nature of geohazards problems, already complex, is amplified by an industry that is much more technical than the public generally knows.

Fortunately, there are a few guidance documents for prospective engineers, hydrologists, and geoscientists who want to make a difference. One of the better ones, in my opinion, is the recent release of "Pipeline Geohazards: Planning, Design, Construction, and Operations", edited by Moness Rizkalla and Rodney Read. Despite the book being multi-authored, the editors have done an amazing job of ensuring consistent writing objectives and style across more than 800 pages of text. It reads as a cohesive, comprehensive reference. I think that this topic is so important to the discipline of geohazards in Canada, I asked them to provide a summary of the book in this issue of Geotechnical News. I hope you enjoy it.

Closing notes

Thank you for your letters! If you have a paper or project related to Geohazards that you think would be interesting to GN readers, please send me note at *Richard.guthrie@stantec.com.*

Pipeline geohazard assessment – reducing risk to linear infrastructure

M. Rizkalla, R.S. Read

Introduction

Pipelines and energy production are two topics that have dominated the news cycle in Canada. Geohazards - threats of a geological, geotechnical, hydrological, or seismic/tectonic nature – are particularly relevant to both topics.

Geohazards may negatively affect people, infrastructure and the environment. In a pipeline integrity management context, geohazards are considered under the threat category of Weather-related and Outside Force in the American standard ASME B31.8S. The Canadian standard CSA-Z662 addresses geotechnical failure of pipelines due to ground movement and related processes in several sections and annexes. Each of these standards allows flexibility in geohazard assessment as part of pipeline integrity management.

As a result of this flexibility, several systems to identify, characterize, analyze and manage geohazards have been developed by operators and geotechnical/geological engineering practitioners. The evolution of these systems, and general expectations regarding geohazard assessment, toward quantitative geohazard frequency assessment, is a trend in recent pipeline hearings and related regulatory filings in Canada.

While this trend is intended to frame geohazard assessment in an objective and repeatable manner, there remains an element of subjectivity in the assessment process at various project stages, requiring subject matter expertise and expert judgment to make informed and defensible evaluations of related observations and conditional probabilities.

In an attempt to frame the current state of geohazard assessment for pipelines, a new book "Pipeline Geohazards: Planning Design, Construction and Operations" (Rizkalla and Read, eds., 2019) has been published by the American Society of Mechanical Engineers (ASME). This article provides a brief synopsis of the book (Fig. 1).

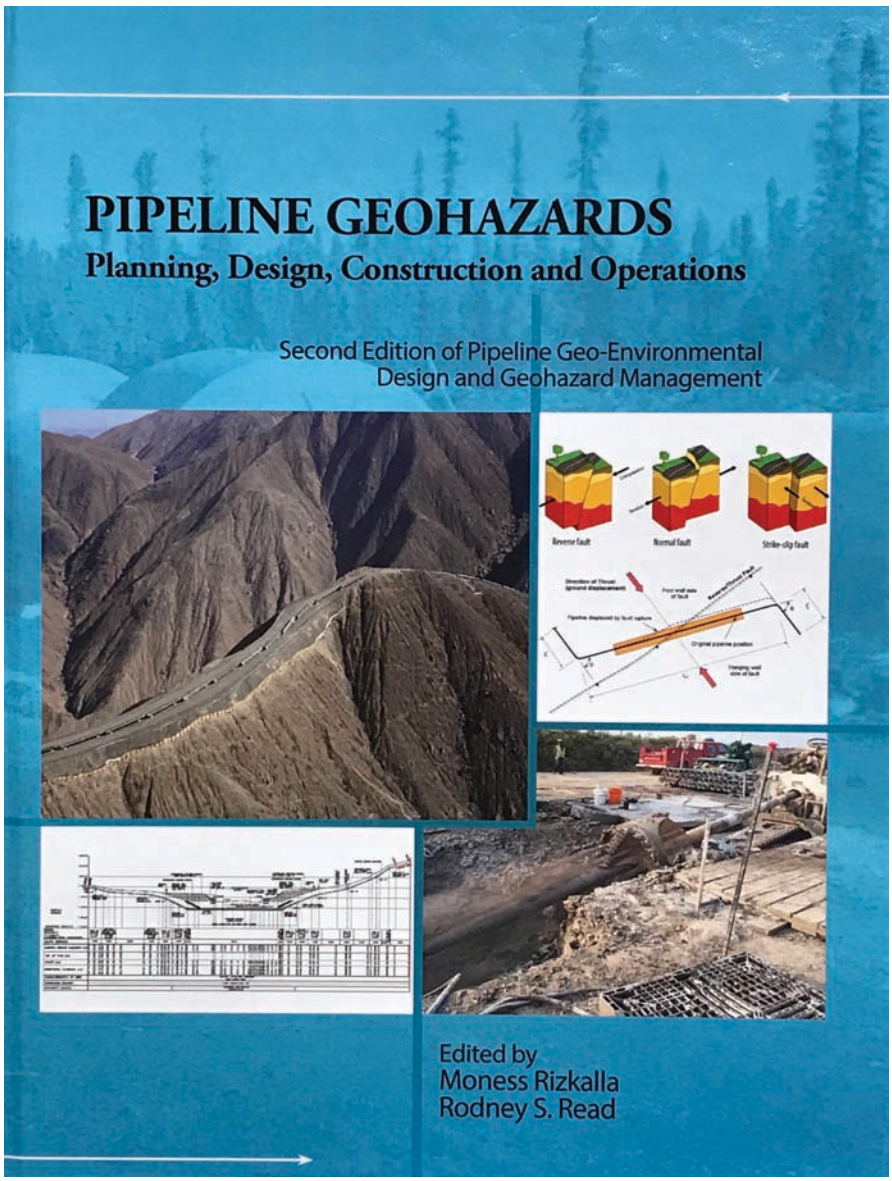


Figure 1: ASME book "Pipeline Geohazards: Planning, Design, Construction and Operations" (Rizkalla and Read, eds., 2019).

Pipeline Context

The book arrives at a time of increasing interest in the topic of pipeline geohazard management, particularly in the United States and Canada. This attention has been generated by a number of pipeline incidents caused by ground movement and other geological processes that have occurred in the United States in the last few years. A recent issue of the Federal Register included an advisory bulletin from the U.S. Federal Pipeline Safety Regulatory Agency that noted several of these incidents, including those that resulted in the release of more than 1,200 barrels of gasoline in Lycoming County, Pennsylvania, in October 2016; more than 12,600 barrels of crude oil in Billings County, North Dakota, in December 2016; more than 2,600 barrels of propane in Marshall County, West Virginia, in April 2018; and 165,000 MCF of natural gas near Moundsville, West Virginia, in June 2018.

In its 2017 transmission pipeline industry performance report, the Canadian Energy Pipeline Association (CEPA) estimates that geotechnical causes of pipeline incidents between 2012 and 2016 account for 7% of all reportable incidents (Fig. 2). A significant incident includes one or more of the following: caused a serious injury or fatality; caused a liquid release of greater than eight cubic metres (50 barrels); produced an unintentional ignition or fire; resulted in a rupture of a pipeline (CEPA, 2017).

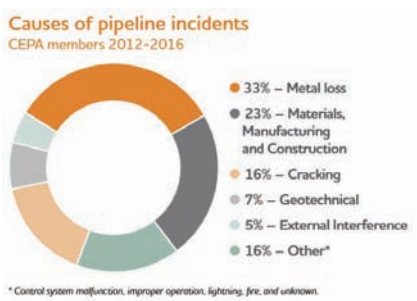


Figure 2: Causes of pipeline incidents for CEPA members between 2012 and 2016 (CEPA, 2017).

Significant incidents accounted for about 8% of all reported incidents in the CEPA statistics. Similarly, the National Energy Board (NEB) indicates that geohazards contributed to between 5 and 9% of incidents during the period 1991and 2009.

In addition to the heightened awareness of the subject in the United States and Canada, interest is also strong in other regions around the world. Many places like South America and parts of Europe have dense distributions of geohazards that cannot be avoided while developing linear infrastructure. Looking at pipeline systems performance outside the U.S. and Canada, one of the leading causes of rupture incidents is geohazards.

Since the publication of the first edition in 2008, many major pipeline projects have been proposed and advanced through various phases of project planning, design and regulatory reviews and approvals. Some of these projects have been constructed and have since been commissioned and are in operations. A subset of these projects has navigated through rugged and geohazard-intensive terrain, as well as steadily rising stakeholder scrutiny and expectations.

In undertaking these projects, the pipeline industry has responded with continuous improvements in the planning, design, construction and operations of pipelines. The period since the publication of the first edition of this book has witnessed a resetting of the state-of-practice in the area of pipeline geohazard management across the planning, design, construction and operations stages of a pipeline's life cycle. As part of the industry's overall continuous improvement, the experiences acquired in tackling challenging project environments as well as a wide range of advances in enabling technologies underpin the new state-of-practice that has emerged.

About the book...

The book is an updated edition of the book "Pipeline Geo-Environmental Design and Geohazard Management" (Rizkalla, ed., 2008) which was premised largely on the experience of the Mackenzie Gas Project in Canada. The new book clocks in at 824 pages, more than double the size of the original. It is intended as a state-of-the-art reference for practitioners in operating pipeline companies, as well as specialized pipeline engineering, and geotechnical consultants involved in either the design and construction of new pipelines or the integrity management of operating pipelines.

Subject matter experts were invited to contribute entire chapters, short Invited Technical Briefs or longer Invited Perspectives in their areas of specialization. Where suitable, certain chapters include many photographs and figures of practical applications from projects around the world. Additionally, some authors elected to include supplemental references both for completeness and as recognition of the considerable work by others.

Geohazard considerations at various pipeline project stages

During the corridor selection stage of pipeline development, a balance is required in addressing engineering, biophysical and socioeconomic factors. Boundaries for routing are established through the integration of multi-disciplinary datasets as a basis to address a pipeline proponent's range of responsibilities with respect to land owners, land users, the environment and wildlife. The extensive use of remote sensing products including maps, satellite imagery and aerial photography is a hallmark of this stage of a project's development.

Enabled with the now ubiquitous application of Geographic Information Systems (GIS) in synthesizing various data sets into geological models to support decision making and communication, the book provides an overview of the very dynamic space of data set generation, integration, management and visualization. The rapidly changing state-of-practice and emerg-

ing technologies are presented in what is intended to serve as a connection between geotechnical and pipeline engineers, and geomatics specialists.

The interpretation of the geotechnical and topographic setting, including surficial geology and geomorphology, for proposed or operating pipelines serves as the foundation of planning, design, construction and geohazard integrity management during operations. Accordingly, two chapters at the start of the book are titled:

- *Terrain Analysis for Pipeline Corridor Selection*
- *Data Generation, Integration, Management and Visualization*

A discussion is presented on the geotechnical aspects of pipeline construction (Fig. 3) titled:

- *Geotechnical Engineering and Pipeline Construction Interface Considerations.*

This chapter identifies key interface points between geotechnical engineering and construction specialists and highlights the areas where geological models and geotechnical principles can be leveraged to support construction execution planning and generate realistic estimates of geo-technical quantities.

The design and integrity management of water crossings is a critically important topic addressed in a chapter titled:

- *Trenched and Elevated River Crossings*

This chapter builds and expands on the recognized valuable reference on that topic presented in the first edition of the book. The chapter offers an overview of design considerations including design examples and lessons learned. Most importantly, guidance is provided in terms of what is critical and what is less critical in terms of design inputs. A discussion of water crossing construction methods is provided, differentiating between what needs 'hard' versus 'flexible' specifications. Practical recommendations are provided on monitoring practices during operations, mindful of what is suited and what is not suited for prediction.

The importance of the now prevalent trenchless techniques for pipeline construction is covered in two related chapters titled:

- *Trenchless Techniques for Pipeline Installation*
- *Horizontal Directional Drilling*

Figure 3: A large-diameter pipeline under construction (photo ©Tim Bossenberry, used by permission).

The two chapters offer an overview of the range of trenchless techniques for pipeline installation including common methods used for road and railway crossings (Fig. 3) and more involved methods such as the microtunneling class of technology as well as in-depth discussion of Horizontal Directional Drilling (HDD).

Several key geohazard mechanisms that affect pipeline design, construction and integrity management during operations are presented in turn in four chapters titled:

- *Buoyancy Control at Water Crossings and Overland*
- *Erosion and Sediment Control of Pipeline Rights-of-Way*
- *Geotechnical Aspects of Pipelines in Permafrost*
- *Assessment and Mitigation of Seismic Geohazards for Pipelines*

Arguably the main focal point of the book in relation to pipeline geohazard assessment (Fig. 5), a set of four closely related chapters delve deeply into the broad area of pipeline geohazard assessment and management, expanding considerably on the treatment of the same topic presented in the first edition of the book. These chapters are titled:

- *Geohazards Assessment and Management: Overview*
- *Geohazard Assessment and Management: Geohazards, Weather and External Force Mechanisms*
- *Geohazard Assessment and Management: Assessment Principles and Techniques*
- *Geohazard Assessment and Management: Monitoring and Mitigation*

By necessity, an intentional filter is applied to refocus the description of geohazards from the classic geotechnical and geomorphological perspectives to the impact of these geohazards on pipelines. An emphasis on pipeline-centric fitness for service is advocated.

Figure 4: Cradle boring setup (Image ©Mike Wagner, used by permission).

Additionally, the benefit of capturing the wealth of peer-reviewed technical articles related to the book's scope has not been overlooked. Related articles have been compiled in a bibliography, with articles cross-referenced to individual chapters in the book.

Pipeline geohazard management

Increasingly, the practices of prudent pipeline owners include proactive management of this class of threats in response to business drivers. These best practices are due to at least two factors, namely:

1. There are heightened expectations of pipeline companies from the external stakeholders including regulators and the public at large. Ensuring public safety and accepting a role of environmental stewardship are now accepted as integral parts of business.
2. Financially, operators need to optimize internal expenditures associated with all aspects of pipeline integrity management. Prudent operators strive to move from reactive to proactive and predictive prevention for all hazards including geohazards. Increasingly, risk-based assessment and integrity management planning practices provide the basis of predictive prevention through a defendable methodology to support optimized expenditure profiles from year to year.

Several key philosophical points in developing the content of the pipeline geohazard management chapters of this book are as follows:

1. While mindful of corporate responsibilities to the environment in the pipeline's vicinity, decisions related to pipeline construction and integrity management with respect to geohazards should be managed from the pipeline out as opposed to a purely geotechnical treatment of the hazard. In other words, a pipe-centric fitness for purpose perspective should be adopted in

Figure 5a: Geohazards affected by seismic and precipitation triggers, landslide triggered by seismic activity on the Denali Fault, Alaska (photo ©Rod Read, used by permission).

Figure 5b: Debris flow associated with heavy, prolonged precipitation and snowmelt in western Canada (photo ©Rod Read, used by permission).

the assessment and mitigation of pipeline geohazards. This important philosophical point drives a key technical focus to incorporate the vulnerability or structural capacity of a pipeline in estimating the probability of failure.

2. So long as the geohazard assessment process workflow is transparent and yields repeatable results, there are many sound approaches to assess pipeline geohazards. In some cases, there are many commonalities and a high degree of concordance between different approaches used by various practitioners.
3. Results of pipeline system-wide screening level geohazard assessments may not be necessarily well suited for direct conversion into site-specific designs. Supplemental design approaches and associated levels of effort are typically required to develop detailed site-specific initial designs or operational mitigations for areas prioritized by the screening process.
4. Design stage pipeline geohazard assessments should be well suited to serve as the foundation of geohazard integrity management planning. In the case of new greenfield pipeline developments, the geohazard assessment may be well suited to support construction planning and an estimation of the project's footprint as indicated by the relationship presented in Fig. 6.
5. Target geohazard management risk levels or probabilities of failure developed for other contexts (e.g., urban planning, residential development, or other industries) may not be practically transferable to the pipeline geohazard risk context and should be adopted only with due diligence to demonstrate applicability in relation to pipelines.
6. In managing pipeline geohazards, it is prudent to monitor both the cause (the geohazard process) and the effect (i.e., the pipeline's response). Such approach corroborates the measured pipeline response and in certain cases supports forecasting the optimized timing of mitigation interventions.

Conclusions

Geohazard assessment is a vital part of new and existing pipeline projects to reduce the risk of potentially significant incidents. The state-of-the-art is evolving rapidly. The book described in this article is a snapshot of the current state-of-practice but provides guidance in rationalizing qualitative and quantitative information in assessing the risk posed by geohazards that is applicable for the foreseeable future.

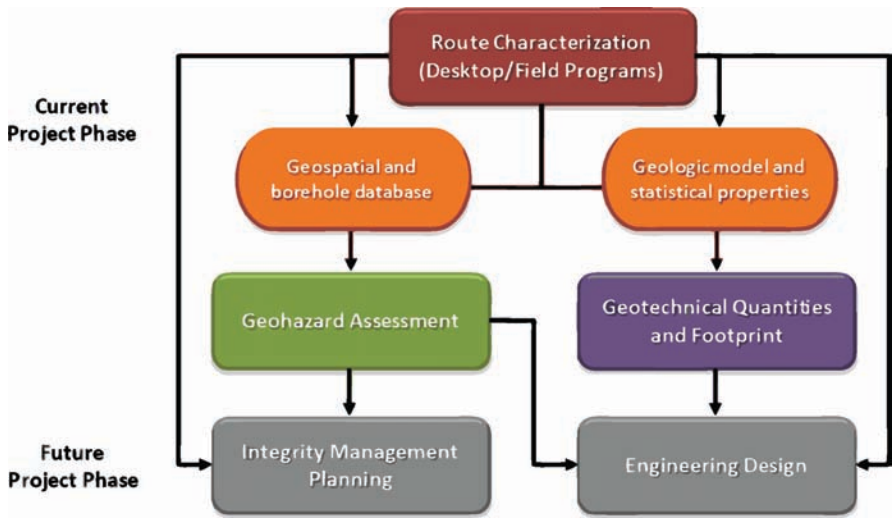


Figure 6: Role of geohazard assessment in an integrated project framework.

The book is available at *https://www.asme.org/shop/books order number 861790*

References

ASME B31.8S-2016 Managing System Integrity of Gas Pipelines, American Society of Mechanical Engineers, New York, NY

Canadian Standards Association CAN/CSA-Z662-15 Oil and Gas Pipeline Systems. Mississauga, Ontario.

CEPA. 2017. 2017 Transmission Pipeline Industry Performance report. Available at website https://pr17.cepa.com/cepa/ wp-content/uploads/2017/07/CEPA_ PerformanceData_E.pdf

National Energy Board. 2011. Focus on Safety, a Comparative Analysis of Pipeline Safety Performance.

Rizkalla, M. (ed.). 2008. Pipeline Geo-environmental Design and Geo-hazard Management, American Society of Mechanical Engineers (ASME). 353 p.

Rizkalla, M., and R.S. Read, eds. 2019. Pipeline Geohazards: Planning, Design, Construction and Operations. American Society of Mechanical Engineers (ASME). 824 p.

Moness Rizkalla, M.Eng., P.Eng.
Visitless Integrity Assessment Ltd.
Lacey Court, 344 12th Ave. SW
Calgary, Alberta, Canada T2R 0H2
+1.403.681.0842
rizkalla@via-plus.net

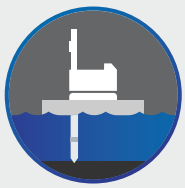
Rodney S. Read, Ph.D., P.Eng., P.Geo., P.Geol.
RSRead Consulting Inc.
117 Sheep River Bay
Okotoks, Alberta, Canada T1S 1R3
+1.403.850.5754
rsread@rsrci.com

ConeTec

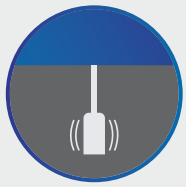
SAFETY. QUALITY. PEOPLE. EQUIPMENT.

Seismic Cone Penetration Testing (SCPTu)

Geophysical Testing



Over Water



In-Situ Testing (eVST, PMT, DMT)

Monitoring and Instrumentation

Drilling and Sampling

SECTORS

- MINING
- INFRASTRUCTURE
- ENERGY
- ENVIRONMENTAL
- COMMERCIAL DEVELOPMENT
- EARTHQUAKE ENGINEERING

BETTER INFORMATION
BETTER DECISIONS

CONETEC.COM

ConeTec

MUD BAY DRILLING

Becoming Keller

One company in each local market to serve all your geotechnical construction needs

- BENCOR A KELLER COMPANY
- CASE ATLANTIC A KELLER COMPANY
- CASE FOUNDATION A KELLER COMPANY
- HAYWARD BAKER A KELLER COMPANY
- HJ FOUNDATION A KELLER COMPANY
- KELLER CANADA
- MCKINNEY DRILLING A KELLER COMPANY
- MORETRENCH A HAYWARD BAKER COMPANY

KELLER

Keller's geotechnical construction businesses in North America are joining together as one unified company, and rebranding to Keller, effective January 1, 2020

Global strength and local focus

kellerfoundations.com/becoming-keller 800-943-5697