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Volume 36 • Number 1 • March 2018

GEOTECHNICAL news

Mosul Dam - an extraordinary year of rehabilitation

Wireless Data Collection | for Geotechnical Monitoring Instrumentation

2 Wireless Data Collection Systems to quickly get you connected to your data: **RSTAR** and **DT LINK**

+ MINIMUM PER CHANNEL COST + EXTRA LONG BATTERY LIFE + LONG DISTANCE TRANSMISSION

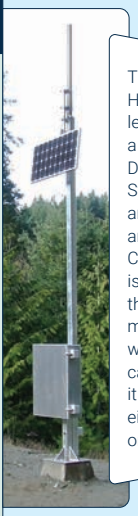
FULLY AUTOMATED COLLECTION (REMOTELY)

An RSTAR System uses data loggers (nodes) at the sensor level, deployed in a star topology from an active RSTAR Hub containing an RST flexDAQ Data Logger.

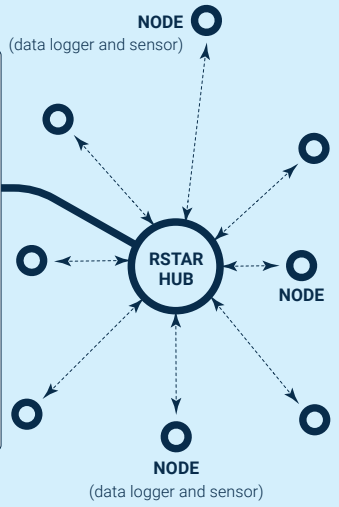
rstar ARRAY RADIO SERIES

FEATURES

- Up to 10 years of battery life from 1 lithium 'D' cell.
- Up to 14 km range from Hub to Node in open country. (depending on antenna type)
- Up to 255 nodes per RSTAR Hub.
- Based on 900 MHz , 868 MHz and 2.4 GHz spread spectrum band. (country dependent)



The RSTAR Hub shown left contains a flexDAQ Data Logger System with an antenna and battery. Collected data is saved to the flexDAQ memory where users can access it remotely, either on-site or off-site.



Watch the video for both systems at: www.rstinstruments.com/Wireless-Data-Collection.html

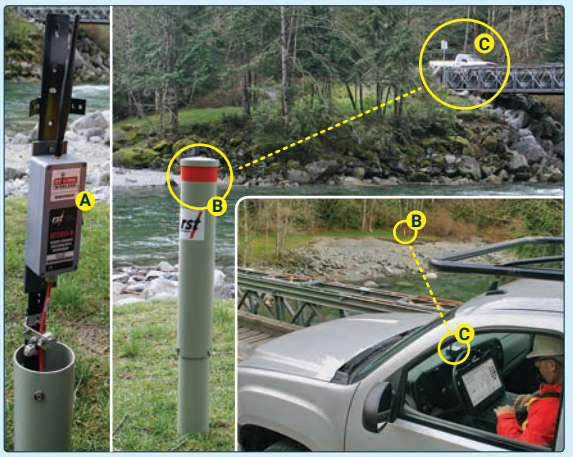
SEMI-AUTOMATED COLLECTION (ON-SITE)

DT LINK is an on-site wireless connection to RST data loggers for quick data collection. Ideal for hard to access areas where the data logger is within line of sight.

DT LINK WIRELESS

FEATURES

- Safely & easily collect data from data loggers that are in areas with poor access, trespass issues and hazardous obstacles.
- Years of battery life from 1 lithium 'D' cell.
- Range up to 800 m (900 MHz) and up to 500 m (2.4 GHz).
- Collect data in seconds with a laptop connected to DT LINK HUB.



Pictured: (A) DT LINK WIRELESS data logger, connected to a vibrating wire piezometer and housed in a (B) protective enclosure, has its data collected from a laptop connected to the (C) DT LINK HUB - all within seconds from the convenience of your vehicle.

DT SERIES DATA LOGGERS

RST's "DT Series" Data Loggers accommodate the RSTAR and DT LINK WIRELESS Systems. Compatible sensor types include: *Vibrating Wire, Potentiometers, MEMS Tilt Sensors, Strain Gauge (full bridge) Sensors, Digitally Bussed Sensors, 4-20 mA Sensors, and Thermistors.*

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Message from the President

Dharma Wijewickreme, President of Canadian Geotechnical Society

As we enter the spring of 2018, it is my pleasure to write this message and share some thoughts for your consideration, along with a number of Canadian Geotechnical Society updates.

As the learned Society for geotechnical engineering and related geosciences in Canada, our key focus has been, and is, to serve our membership through various avenues such as: advancing knowledge via research and innovation, dissemination of technical and scientific knowledge, and fostering opportunities for exchange of information amongst academia, industry, and government. We continually perform very well along these lines of focus and contribute to the recognition of well qualified geo-professionals, which enables us to provide high quality professional services and geotechnical products to the society-at-large.

The assurance of quality is one of the keys to the sustainability and reliability of what we do as professionals. With ever-increasing competition in the market place, balancing the quality with cost-efficiency has long been a key challenge and it is becoming a dominant driver. In this regard, I believe that it is timely and important for us to ask the question: "How can we help provide incentives and support to geo-professionals to deliver high quality products and services in geotechnique and justify fair and appropriate compensation in a highly competitive business environment?" It is sometimes considered that the latter "non-technical" issues should be addressed by professional licensing bodies and other similar entities, and they need not be in the purview of learned societies like the CGS. I personally believe that our Society can also contribute to this key aspect of our professional endeavours.

Our geo-profession has inherently unique attributes as we deal with earth-based materials that are highly complex, variable, and compounded with uncertainties. For example, our approaches to the design of "geotech-

nical products" are difficult to codify, thus leading to specific challenges in assuring quality in a uniform manner across our practice; in this regard, it would be quite a challenge for instance to try to codify approaches for geotechnical site investigations! I feel that it is timely to have a conversation amongst us on these non-technical, but significant, considerations related to quality-assurance. I invite you to take a moment to think about this and let us know your thoughts.

Now, let me present a few updates with regard to our CGS activities.

We have been making further improvements on the already updated CGS website. We have introduced a more personalized **myCGS** dashboard, now in place, with newly updated user-friendly navigation panes on the website. If you have not already done so, please log onto *https://www.cgs.ca* and take a quick look. Thanks are due to **Wayne Gibson** (Director of Administration and Finance) and our Website provider pro.Net for working hard to get this task accomplished.

By the time you read this message, you should have already received the updated *Errata for the 4th edition of the Canadian Foundation Engineering Manual (CFEM)*. Another major task underway is to establish a framework for the next (online) edition of the *CFEM*; this is not a straightforward task, and it is a taking a bit longer than we would have liked.

Our next Cross Canada Lecture Tour (CCLT) talks are well organized: **Dr. Tom O'Rourke** (Cornell University, Ithaca, NY) will be the spring 2018 speaker for the CCLT, and **Dr. Alex Sy** (Klohn Crippen Berger, Vancouver, BC) has kindly agreed to be the fall 2018 speaker.

Sincere thanks to **Suzanne Powell** (VP Technical) for the above *CFEM* and CCLT related organizational work. I also want express my gratitude to **Kent Bannister** (VP Finance) for his leadership on the Financial Advisory Task Force to examine the ways to best invest the CGS' funds, and **Jean Côté** (VP Communications and Member Services) for working towards a renewed Membership Committee and Communication Strategy.

Another important task that arises periodically is to appoint new chairs for our Technical Divisions and Committees, and new Section Directors to replace the outgoing Chairs and Directors who have completed their three-year terms. In this regard, let me first take the opportunity to thank all the volunteers who stepped down at the end of 2017 for their extensive contributions to the CGS. It is my pleasure to announce that the new representatives of the Technical Divisions and Regional Sections on the Executive Committee (EC) for 2018 are **Nicholas Vlachopoulos** and **Andrea Lougheed**, respectively. Furthermore, **Maraika DeGroot** will be serving as the new CGS Young Professionals Representative on the EC. I also would like to welcome several incoming Division Chairs: **Dipanjan Basu, Jasmin Raymond**, **René Laprade**, **Magdalena Krol** and **Mohsen Nicksiar**; Section Directors: **Dwayne Tannant**, **Renato Macciotta**, **Leanne McLaren**, **Billy Singh**, **Michael James** and **Christopher McQueen**; and Committee Chairs, **Sumi Siddiqua** and **Thomas Pabst**. The most up to date list of all the CGS members volunteering in 2018 is published elsewhere in this issue.

As mentioned in my previous President's message, **Mario Rue**l has been named the CGS President-elect for 2018; he will become the President of the Society for the 2019-2020 term. I would like to offer my congratulations and warm welcome to Mario, who will also sit on the 2018 Executive Committee as part of serving in this new role.

The extensive and mostly time-sensitive volume of work involved in the operation of the CGS cannot be accomplished without the commitment and dedication extended by the CGS National Office directors. I would like to express my gratitude to **Michel Aubertin** (Executive Director), **Wayne Gibson** (Director, Administration and Finance) and **Lisa McJunkin** (Director, Communications and Member Services) for their amazing contributions and support in this regard.

This is the time that the CGS requests nominations from the membership with respect to the annual awards and honours. Additional details on these nominations are presented elsewhere in this issue. Please consider nominating your deserving colleagues to be rewarded with these CGS accolades.

Our Society is well supported by generous donations from our Corporate Sponsors; I would like to take the opportunity to thank the following firms for their contributions for the Year 2018: **Advanced Construction**, **DownUnder Geotechnical**; **Geo-Slope International**; **GKM Consultants**; **Golder Associates**; **Insitu Contractors**; **Klohn Crippen Berger**; **Knight Piésold Consulting**; **Mobile Augers and Research**; **Naviq Consulting**; **Reinforced Earth**; **Rocscience**; **SoilVision**, **Stantec**; **Thurber Engineering**; and **Trek Geotechnical**.

I invite you to mark your calendars to attend the following CGS conferences: Geohazards 7, the 7th Canadian Geohazards Conference to be held June 3-6, 2018 in Canmore, Alberta and the 71st Annual CGS Conference GeoEdmonton to be held September 23 - 26, 2018 in Edmonton, Alberta (please visit the conference websites *http://www.geohazards7.ca* and *http://www.geoedmonton2018.ca* for more details).

I am pleased to end my March report by sharing the exciting news that **Kerry Rowe** (CGS Past President, 2001-2002) has been recognized as a new Officer in the Order of Canada. The Order of Canada is a Canadian national order that was established to pay tribute to those who exemplify

the highest qualities of citizenship and whose contributions enrich the lives of others. Specifically, for his "seminal contributions to the field of geoenvironmental engineering, notably for his pioneering research in waste barrier systems". Congratulations and best wishes from the CGS, Kerry!

As we all know, our membership is the key to the Society's success and strength. So, if you haven't already done so, please visit *http://www.cgs.ca*, or contact CGS National Office (*admin@cgs.ca*) to renew your CGS membership for 2018.

Provided by Dharma Wijewickreme
CGS President 2017 - 2018

Message du président

Alors que nous amorçons la saison printanière de 2018, j'ai le plaisir d'écrire ce message pour vous faire part de quelques réflexions et de nouvelles de la Société canadienne de géotechnique (SCG).

En tant que la société savante de la géotechnique et des géosciences au Canada, notre principal objectif a été, et est toujours, de servir nos membres par divers moyens, notamment : l'avancement des connaissances par la recherche et l'innovation, la diffusion des connaissances techniques et scientifiques et la création d'opportunités d'échange d'information entre les universités, l'industrie et le gouvernement. Nous faisons toujours bonne figure dans ces domaines et contribuons à la reconnaissance de géoprofessionnels qualifiés, ce qui nous permet d'offrir des services professionnels et des produits géotechniques de haute qualité à l'ensemble de la société.

L'assurance qualité est l'une des clés de la durabilité et de la fiabilité de ce que nous réalisons en tant que professionnels. Avec une concurrence de plus en plus vive sur le marché, l'équilibre entre la qualité et le rapport coût-efficacité est depuis longtemps un défi majeur et devient un facteur dominant. À cet égard, je crois qu'il est opportun et important pour nous de poser la question: « Comment pouvons-nous inciter et soutenir les géoprofessionnels pour qu'ils fournissent des produits et des services de haute qualité en géotechnique et justifier une rémunération juste et appropriée dans un environnement commercial hautement concurrentiel? » On considère parfois que ces questions « non techniques » devraient être traitées par des organismes de réglementation professionnelle et d'autres entités similaires, et qu'elles ne devraient pas être du ressort de sociétés savantes comme la SCG. Je crois personnellement que notre Société peut également contribuer à cet aspect important de nos efforts professionnels.

Notre géoprofession possède des attributs intrinsèquement uniques puisque nous gérons des matériaux à base de terre qui sont extrêmement complexes et variables et qui comportent des incertitudes. Par exemple, nos approches pour la conception de « produits géotechniques » sont difficiles à codifier, ce qui entraîne des défis particuliers pour assurer la qualité d'une manière uniforme dans notre pratique; à cet égard, ce serait tout un défi en revanche d'essayer de codifier des approches pour les études géotechniques! Je crois qu'il est opportun d'avoir une conversation entre nous sur ces considérations non techniques, mais importantes, liées à l'assurance qualité. Je vous invite à prendre un moment pour y réfléchir et à nous faire part de vos réflexions.

Permettez-moi maintenant de vous présenter quelques nouvelles sur les activités de la SCG.

Nous avons apporté d'autres améliorations au site Web de la SCG. En outre, nous avons personnalisé davantage le tableau de bord **maSCG**, qui comporte des volets de navigation conviviaux récemment mis à jour. Si vous ne l'avez pas encore fait, ouvrez une session sur le site *http://www.cgs.ca/index.php?lang=fr* et jetez-y un coup d'œil. Merci à Wayne Gibson (directeur, Administration et finances) et à notre fournisseur de site Web pro. Net d'avoir travaillé fort pour accomplir cette tâche.

Lorsque vous lirez ce message, vous devriez déjà avoir reçu la version mise à jour de l'erratum de la *4e édition du Manuel canadien d'ingénierie des fondations (MCIF)*. Une autre tâche importante en cours est d'établir un cadre pour la prochaine édition (en ligne) du *MCIF*; elle n'est pas simple et prend un peu plus de temps que nous l'aurions souhaité.

Nos prochaines Tournées de conférences transcanadiennes (TCT) sont organisées : le **Dr Tom O'Rourke** (Université Cornell, Ithaca, État de New York) sera le conférencier de la TCT du printemps 2018, et le **Dr Alex Sy** (Klohn Crippen Berger, Vancouver, C.-B.) a aimablement accepté d'être celui de l'automne 2018.

Sincères remerciements à **Suzanne Powell** (v.-p. technique) pour avoir organisé le travail relatif au *MCIF* et aux TCT susmentionnés. Je tiens également à exprimer ma gratitude à **Kent Bannister** (v.-p. aux finances) pour le leadership dont il a fait preuve au sein du Groupe de travail consultatif sur les finances pour examiner les meilleurs moyens d'investir les fonds de la SCG, et à **Jean Côté** (v.-p. aux communications et aux services aux membres) pour avoir travaillé à la mise en place d'un nouveau Comité des membres et d'une nouvelle stratégie de communication.

Une autre tâche importante qui se pose périodiquement est de nommer les nouveaux directeurs des comités et divisions techniques, ainsi que les nouveaux directeurs de section, pour remplacer ceux qui terminent leur mandat de trois ans. À cet égard, permettez-moi tout d'abord de profiter de l'occasion pour remercier tous les bénévoles qui se sont retirés à la fin de l'année 2017 pour leur importante contribution à la SCG. J'ai le plaisir d'annoncer que, pour l'année 2018, les nouveaux représentants des divisions et des sections régionales au Comité exécutif (CE) sont **Nicholas Vlachopoulos** et **Andrea Lougheed**, respectivement. De plus, **Maraika DeGroot** agira à titre de nouvelle représentante des jeunes professionnels au CE. Je souhaite également la bienvenue à plusieurs nouveaux présidents de division : **Dipanjan Basu**, **Jasmin Raymond**, **René Laprade**, **Magdalena Krol** et **Mohsen Nicksiar**; aux directeurs de section : **Dwayne Tannant**, **Renato Macciotta**, **Leanne McLaren**, **Billy Singh**, **Michael James** et **Christopher McQueen**; et aux présidents de comité : **Sumi Siddiqua** et **Thomas Pabst**. La liste la plus à jour de tous les bénévoles de la SCG en 2018 est publiée ailleurs dans ce numéro.

Comme je l'ai mentionné dans mon dernier message du président, **Mario Ruel** a été nommé président désigné de la SCG pour 2018; il deviendra président de la Société pour 2019-2020. Je tiens à féliciter et à accueillir chaleureusement M. Ruel, qui siégera également au Comité exécutif de 2018 dans le cadre de ce nouveau rôle.

Le volume de travail considérable et souvent assujetti à des contraintes de temps que comporte le fonctionnement de la SCG ne peut être accompli sans l'engagement et le dévouement des directeurs du Bureau national de la SCG. Je voudrais exprimer ma gratitude à **Michel Aubertin** (directeur général), **Wayne Gibson** (directeur, Administration et finances) et **Lisa McJunkin** (directrice, Communications et services aux membres) pour leurs remarquables contributions et leur soutien à cet égard.

C'est le moment où la SCG demande aux membres de soumettre des candidatures pour ses distinctions et prix annuels. Des renseignements supplémentaires sur ces mises en candidature sont présentés ailleurs dans ce

numéro. N'hésitez pas à proposer la candidature de vos collègues méritants pour qu'ils soient récompensés par ces distinctions de la SCG.

Notre Société est appuyée par les généreux dons de nos commanditaires. J'aimerais profiter de l'occasion pour remercier les sociétés suivantes pour leurs contributions pour l'année 2018 : **Advanced Construction**, **DownUnder Geotechnical**; **GeoSlope International**; **GKM Consultants**; **Golder Associates**; **Insitu Contractors**; **Klohn Crippen Berger**; **Knight Piésold Consulting**; **Mobile Augers and Research**; **Naviq Consulting**; **Reinforced Earth**; **Rocscience**; **SoilVision**, **Stantec**; **Thurber Engineering**; et **Trek Geotechnical**.

Je vous invite à inscrire les dates des conférences suivantes de la SCG à vos calendriers pour y participer: Geohazards 7, la 7e conférence canadienne sur les géorisques, qui aura lieu du 3 au 6 juin 2018, à Canmore, en Alberta, et la 71e conférence annuelle de la SCG, GéoEdmonton, qui se déroulera du 23 au 26 septembre, à Edmonton, en Alberta. Veuillez consulter les sites Web de ces conférences, *http://www.geohazards7.ca* et *http://www.geoedmonton2018.ca*, pour obtenir de plus amples renseignements.

Il me fait grand plaisir de terminer mon rapport de Mars en partageant l'excellente nouvelle que **Kerry Rowe** (ancien président de la SGG, 2001-2002) a été nommé Officier de l'Ordre du Canada. L'Ordre du Canada est un ordre national canadien qui a été établi pour rendre hommage à ceux et à celles qui incarnent les plus hautes qualités de la citoyenneté et dont les contributions enrichissent la vie des autres. Concrètement, pour ses « contributions déterminantes au domaine du génie géoenvironnemental, notamment pour ses recherches novatrices sur les systèmes de barrière de recouvrement des déchets ». Félicitations et meilleurs vœux de la part de la SCG, M. Rowe!

Comme nous le savons tous, nos membres sont la clé du succès et de la force de la Société. Donc, si vous ne l'avez pas encore fait, veuillez consulter le site *http://www.cgs.ca/index.php?lang=fr*, ou écrire au Bureau national de la SCG (*admin@cgs.ca*) pour renouveler votre adhésion à la SCG pour 2018.

Fourni par Dharma Wijewickreme
SCG Président 2017-2018

From the Society

Call for Nominations for CGS Awards

Look around. We all know at least one geotechnical professional deserving of recognition!

The CGS wishes to again recognize the considerable contributions and achievements by geotechnical professionals in Canada and abroad in a family of awards, many of which will be presented during the Awards Ceremony at the CGS Annual Conference in Edmonton, Alberta – GeoEdmonton 2018 (September 23 to 26, 2018). Funding for many of these awards is provided by the Canadian Foundation Geotechnique, so remember to also support your Foundation! The various awards are summarized below. You can also go to *www.cgs.ca/awards.php?lang=en* for more information and the list of past recipients, or contact CGS Headquarters.

If you know of someone deserving of any of the CGS Awards, nominate them and send your submissions by **May 15, 2018** to the CGS National Office at:

The Canadian Geotechnical Society
8828 Pigott Road
Richmond, BC
V7A 2C4, Canada,
Fax: (604) 277-7529
E-mail: *admin@cgs.ca*

Nominations should include the name and contact information of the nominator, a resume or curriculum vita of the nominee, and a letter highlighting the contributions and achievements that make the nominee a worthy candidate for that specific award. Letters of support from others, CGS members and non-members, are encouraged. If possible, nominations should include an appropriate head and shoulders photo of the nominee.

Submission details for Student Awards are available on the CGS website at *www.cgs.ca/student_comp.php?lang=en*, or contact **Ryley Beddoe**, Chair of the CGS Student Awards Selection Committee, at *ryley.beddoe@rmc.ca*

Appel de mise en candidatures pour les prix de la SCG

Regardez autour de vous. Nous connaissons tous au moins un professionnel en géotechnique méritant d'être reconnu!

L SCG souhaite de nouveau reconnaître les importantes contributions et réalisations des professionnels en géotechnique au Canada et à l'étranger, à l'aide d'un ensemble de prix, qui seront pour la plupart présentés durant la cérémonie de remise de prix lors de la conférence annuelle de la SCG à Edmonton, Alberta – GéoEdmonton 2018 (du 23 au 26 septembre 2018). La Fondation canadienne de géotechnique finance un grand nombre de ces prix, n'oubliez donc pas de soutenir également votre Fondation! Les différents prix sont résumés ci-dessous. Vous pouvez également consulter le site www.cgs.ca/awards.php?lang=fr pour obtenir de plus amples renseignements et la liste des précédents lauréats, ou communiquez avec le siège social de la SCG.

Si vous connaissez quelqu'un méritant l'un des prix de la SCG, posez sa candidature et envoyez votre soumission d'ici le **15 mai 2018** au bureau national de la SCG, à :

La Société canadienne de géotechnique
8828 Pigott Road
Richmond, C.-B.

V7A 2C4, Canada
Télécopieur : 604-277-7529
Courriel:*admin@cgs.ca*

Les candidatures doivent comprendre le nom et les coordonnées de la personne qui les soumettent, un curriculum vitæ du candidat et une lettre soulignant les contributions et les réalisations qui font en sorte que le candidat mérite ce prix. Des lettres de recommandation d'autres personnes, qu'elles soient membres ou non de la SCG, sont les bienvenues. Si possible, les candidatures doivent inclure une photo en buste du candidat.

Les détails pour la soumission d'une candidature pour les prix pour les étudiants sont disponibles sur le site Web de la SCG, à *http://www.cgs.ca/student_comp.php?lang=fr*, ou communiquez avec **Ryley Beddoe**, directrice du Comité de sélection des prix pour les étudiants, à *ryley.beddoe@rmc.ca*

Call for Nominations for 2019 Awards and Fellowships

Engineering Institute of Canada (EIC)

As a constituent Society of the Engineering Institute of Canada (EIC), CGS members are eligible for awards and fellowships of the EIC which are summarized below. CGS members are encouraged to submit EIC nominations of fellow members to CGS Headquarters by **July 15, 2018**.

Nominations must include:

1) a completed EIC Nomination Form which is available from *http://eic-ici.ca/honours_awards/)*
2) a nomination letter
3) supporting letters from colleagues, preferably Fellows of the EIC (FEIC).

Past CGS member recipients of EIC Awards and Fellowships can be found on the CGS website *www.cgs.ca/awards.php?lang=en*. It is recommended that nominators review the awards details and criteria prior to preparing nominations. For more information contact the CGS National Office at:

The Canadian Geotechnical Society
8828 Pigott Road
Richmond, BC
V7A 2C4, Canada,
Fax: (604) 277-7529
E-mail: admin@cgs.ca

Appel de candidatures pour les prix et médailles 2019 Institut canadien des ingénieurs (ICI)

À titre de société membre de l'Institut canadien des ingénieurs (ICI), les membres de la SCG sont admissibles aux prix et aux médailles de l'ICI décrits ci-dessous. Les membres de la SCG sont encouragés à soumettre des candidatures de collègues membres pour l'ICI au siège social de la SCG d'ici le 15 juillet 2018.

Les mises en candidature doivent inclure :

1) un formulaire de candidature de l'ICI dûment rempli qui est disponible sur le site *http://eic-ici.ca/honours_awards/*);
2) une lettre de mise en candidature;
3) des lettres de recommandation de collègues, préférablement des fellows de l'ICI.

Il est recommandé que les personnes qui soumettent des candidatures examinent les détails et les critères des prix avant de les préparer. Pour obtenir de plus amples renseignements, communiquez avec le bureau national de la SCG à :

La Société canadienne de géotechnique
8828 Pigott Road
Richmond, C.-B.
V7A 2C4, Canada
Télécopieur : 604-277-7529
Courriel : *admin@cgs.ca*

Les noms des membres de la SCG qui ont déjà reçu des prix et des bourses de recherche de l'ICI sont affichés sur le site Web de la SCG à *www.cgs.ca/awards.php?lang=fr*.

Canadian Foundation for Geotechnique

Canadian Foundation for Geotechnique's 4th Legacy Donor
Mr. Charles Kwok

The Canadian Foundation for Geotechnique's Legacy Donor Program was established in 2008 to honour individuals who have donated, or who donate, $25,000 or more to the Foundation. In 2009 the Foundation honoured its first two Legacy Donors, **Dr. Jack Mollard** and **Mr. Charles Ripley**. In 2010, **Dr. Ben Torchinsky** was honoured as the 3rd Legacy Donor. At the GeoOttawa Conference in 2017, the Foundation was very pleased to announce the 4th and newest Legacy Donor – **Mr. Charles C. K. Kwok**, a long standing and active member of the Canadian Geotechnical Society (CGS) from Calgary, Alberta.

Charles Kwok

Mr. Kwok graduated from the Civil Engineering program at the University of Manitoba with a B.Sc. in 1982 and a M.Sc. in geotechnical engineering in 1984. He is a registered professional engineer in Alberta, British Columbia and Saskatchewan.

Mr. Kwok is a Senior Geotechnical Engineer with 35 years of experience working on a wide variety of geotechnical engineering projects. His main areas of expertise include foundation geotechnique, slope stability assessments and stabilization, retaining structures, and linear corridor assessments for a wide range of municipal, industrial and commercial projects. He also has a special interest in providing expert opinion in forensic geotechnical reviews. Mr. Kwok started his geotechnical career with Fugro Consultants in Hong Kong before starting his M.Sc. program. Immediately after graduation, he worked with ID Engineering in Winnipeg before joining Jacques Whitford in 1988. He was employed 28 years with Jacques Whitford (acquired by Stantec in 2009), based in Halifax and Ottawa before relocating to Calgary in 1997 as a Senior Project Engineer and Principal. In 2016 he joined the Calgary office of Thurber Engineering, where he currently practices.

Mr. Kwok is well known and well respected in the geotechnical engineering community in Canada. He has given freely of his time to learned societies, in particular, the CGS. He is the recipient of the Calgary Geotechnical Society Award in 2008 and the A.G. Stermac Award from the CGS in 2012 for his outstanding service and excellent leadership as Chair of the 63rd CGS Conference in Calgary in 2010.

Mr. Kwok will be honoured by the Canadian Foundation for Geotechnique at the 71st Canadian Geotechnical Conference's Awards Banquet at GeoEdmonton in September 2018.

The following is some background to the Legacy Donor Program. Contributions can take the form of cash, stocks, securities or bequests. Contributions can be made by an individual or by a group of individuals to honour another's passing. Contributions can be targeted to one of the Foundation's existing initiatives or to the Foundation for unspecified purposes.

Legacy Donors will be honoured at a Canadian Geotechnical Conference Awards Banquet, in the Geotechnical News and on the Foundation's website. Each year, when the Foundation honours its new Legacy Donors, all previous Legacy Donors will be recounted. The amount of the contribution will never be disclosed.

Provided by Dennis Becker
Board Member - Canadian Foundation For Geotechnique

2018 Michael Bozozuk National Graduate Scholarship

Dr. Kevin Biggar, President of the Canadian Foundation for Geotechnique, is pleased to announce the call for nominations for its annual **Michael Bozozuk National Graduate Scholarship**.

The $5,000 scholarship was established by the Canadian Foundation for Geotechnique in 2007, on the occasion of the 60th Canadian Geotechnical Conference in Ottawa. The 2018 scholarship will be presented this fall at the Canadian Geotechnical Conference in Edmonton, Alberta.

Any graduate student entering or registered in a Canadian university Masters or PhD program that is directly related to an identified field of geotechnique, is eligible. Programs include geotechnical engineering, geological engineering, mining engineering, geoenvironmental engineering or geoenvironmental geoscience, engineering geology and hydrogeology. Nominees must have high academic standing and preference will be given to those who have some practical experience and are active, or show leadership, in the geotechnical community.

Nominations are limited to **one per academic department** and require a letter, accompanied by rationale, written **and signed** by the graduate supervisor. Rationale should include evidence of academic standing, research output, contributions to practice, and leadership/activity in the geotechnical community. A nomination package is limited to **five pages**. For award ceremony purposes, the nomination package should also include a digital image (300 dpi) of the nominee.

Nominations for the 2018 Scholarship will be accepted by the Selection Committee Chair, **Dr. Paul Simms** (c/o Carleton University, Department of Civil and Environmental Engineering, 1125 Colonel By Drive, Ottawa ON. K1S 5B6, telephone (613) 520 2600 ext. 2079, paul_simms@carleton.ca) up **until May 1, 2018**. If submitted by email, nominations **must be signed** by the supervisor and include the words "Canadian Foundation for Geotechnique National Graduate Scholarship" in the subject line.

For further information, refer to the Foundation's website *www.cfg-fcg.ca* or contact Dr. Kevin Biggar, *kbiggar@telus.net*

Provided by Kevin Biggar,
President of the Canadian Foundation for Geotechnique

Bourse nationale pour études supérieures Michael Bozozuk 2018 de la Fondation canadienne de géotechnique

Le **Dr Kevin Biggar,** président de la Fondation canadienne de géotechnique, est heureux de lancer un appel de candidatures pour la **Bourse nationale pour études supérieures Michael Bozozuk** qui est décernée annuellement.

D'une valeur de 5 000 $, la bourse a été établie par la Fondation Canadienne de géotechnique en 2007, lors de la 60e conférence canadienne de géotechnique qui a eu lieu à Ottawa. La bourse de 2018 sera décernée lors de la prochaine conférence canadienne de géotechnique, qui aura lieu dans la ville de Edmonton, AB cet automne.

Tout étudiant diplômé qui s'inscrira ou est inscrit dans un programme d'une université canadienne de maîtrise ou de doctorat directement lié à un domaine de la géotechnique est admissible. Au nombre de ces programmes, mentionnons le génie géotechnique (mécanique des sols ou des roches), les génies civil, géologique et des mines, le génie géoenvironnemental ou la science géoenvironnementale, la géologie de l'ingénieur et l'hydrogéologie. Les candidats doivent avoir des notes élevées. La préférence sera accordée à ceux qui ont de l'expérience pratique et qui sont actifs ou font preuve de leadership dans la communauté géotechnique.

Les candidatures sont limitées à **une par département**. Elles doivent être accompagnées d'une lettre et d'une justification, rédigées **et signées** par le directeur de thèse. La justification devrait démontrer le bon rendement académique du candidat, ainsi qu'une description de ses résultats de recherche, de ses contributions à la pratique et de son leadership ou de ses activités dans la communauté géotechnique. Un dossier de candidature est limité à **cinq pages**. Aux fins de la cérémonie de remise, le dossier de candidature devrait aussi comprendre une image numérique (300 ppp) du candidat.

Les candidatures présentées pour la bourse de 2018 seront acceptées par le président du Comité de sélection de la bourse de la Société canadienne de géotechnique, le Dr Paul Simms (a.s. de: Université Carleton, Département de génie civil et environnemental, 1125, chemin Colonel By, Ottawa, ON K1S 5B6, téléphone 613-520-2600, poste 2079, *paul_simms@carleton.ca*) **jusqu'au 1er mai 2018**. Les dossiers de candidature envoyés par courriel **doivent être signés** par le directeur de thèse et comprendre la mention « Bourse nationale pour études supérieures de la Fondation canadienne de géotechnique » dans la ligne objet.

Pour plus de renseignements, consultez le site Web de la Fondation, à *www.cfg-fcg.ca*, ou communiquez avec le Dr Kevin Biggar à *kbiggar@telus.net*

Fourni par Kevin Biggar,
Président de la Fondation canadienne de géotechnique

CGS Membership Registration for 2018

If you haven't already renewed your Canadian Geotechnical Society membership for 2018, or want to join, now's the time. There are no increases in membership fees for 2018. Please visit *www.cgs.ca* for more details.

Membership benefits include:

- online access to the monthly Canadian Geotechnical Journal, including all past issues, and special price for the printed Canadian Geotechnical Journal
- online and printed copies of the quarterly Geotechnical News, including CGS News
- the monthly electronic CGS Geotechnical Information Net
- online access to all past CGS Conference proceedings and some special lectures
- special price for all CGS conferences
- information on the spring and fall CGS Cross Country Lecture Tours
- membership in one or more of 7 CGS technical divisions and associated international societies
- involvement in one of 20 CGS local sections
- involvement in any of the 7 CGS standing committees
- involvement in THE society for all Canadian geotechnical professionals

We welcome all new and renewing members and look forward to your participation in 2018. And, we encourage you to recommend the CGS to a friend or colleague. Let's continue to improve the benefits that the CGS offers our profession.

Adhésion à la SCG pour 2018

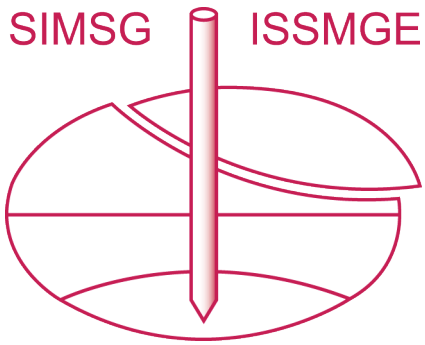
Si vous n'avez pas encore renouvelé votre adhésion à la Société canadienne de géotechnique pour 2018 ou désirez y adhérer pour la première fois... c'est le temps de le faire. Consultez la section <Devenir membre> du site *http://www.cgs.ca/index.php?lang=fr.* Il n'y a pas d'augmentation des cotisations pour 2018.

Les avantages de l'adhésion comprennent :

- 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;
- des versions en ligne et imprimée de la publication trimestrielle Geotechnical News, qui comprend CGS News;
- le bulletin électronique mensuel Réseau de l'information géotechnique de la SCG;
- un accès en ligne à tous les comptes-rendus des précédentes conférences de la SCG et à certaines conférences spéciales;
- des prix spéciaux pour toutes les conférences de la SCG;

- de l'information 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 sept comités techniques de la SCG;
- une participation dans LA Société pour tous les professionnels en géotechnique canadiens.

Nous souhaitons la bienvenue à tous les nouveaux membres ainsi qu'à ceux qui renouvellent leur adhésion et sommes impatients de vous voir participer en 2018. Nous vous encourageons également à recommander la SCG à un ami ou à un collègue. Nous continuons à améliorer les avantages que la SCG offre à notre profession.



Message from ISSMGE Vice-President For North America Timothy Newson

Whilst many of you may be aware of the **International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)**, you are probably less well acquainted with the day to day activities of the Society. The ISSMGE is a professional body that represents the interests and activities of global engineers, academics and contractors that actively participate in geotechnical engineering. The Society has its roots in the First International Conference on Soil Mechanics and Foundation Engineering that was held in Harvard in 1936. This organization now provides a focus for professional practice and leadership for 90 national societies and around 20,000 individual members around the world. I recently became the Vice-President for North America for the ISSMGE for a four-year period. My mandate is to support the activities of the three North American geotechnical organizations (**Canadian Geotechnical Society**, **Geo-Institute of the American Society of Civil Engineers** and **Sociedad Mexicana de Ingeniería Geotécnica)** and I am really looking forward to serving my region in this capacity. I would like to take this opportunity to tell you a little more about the society and my aims for the next four years.

I encourage you to visit the ISSMGE website (*www.issmge.org*), where many of the achievements of the society are showcased. This provides the membership with information on the activities related to global geotechnical practice, including webinars, lectures and articles. The Society is very actively involved in international conferences, running and supporting specialist and larger regional conferences, such as the upcoming XVI Pan-American ISSMGE conference in Cancun in 2019. Every four years the ISSMGE also organizes the pre-eminent International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE) that many of the world's geotechnical engineers attend. This was last held in Seoul in September 2017 and the next conference is in Sydney in 2021. A recent major initiative of the ISSMGE is the implementation of an open access policy and the online library has all of the ICSMGE proceedings archived from 1936 and includes more than 10,000 conference papers that are directly available to visitors of the website.

Over 1000 individual members are also directly involved in society activities through membership of one of the many international Technical Committees. Each technical committee is concerned with a specialist area of geotechnics, and this work leads to conferences, symposia and workshops. The society disseminates the output of these TCs through various publications and reports. A bimonthly electronic publication called the 'ISSMGE Bulletin' outlines ISSMGE news and events. The Society is also prominent on social media with a presence on Facebook, LinkedIn, Twitter and the Geoworld online platform. There is now even an ISSMGE app available for iOS devices.

During my four-year term, I would like to:

- Enhance the cooperation between our three North American societies (CGS, GI-ASCE and SMIG) and encourage regular exchange of technical information and views;
- Help the societies and committees organizing the next ISSMGE Pan-American Conference in Cancun (2019) and the speciality conferences within the region;
- Assist the functions of the technical committees in our region, with an emphasis on linking research and practice, and developing professional geotechnical resources;
- Support and foster cross-border initiatives that will lead to the improvement of technical competence and excellence of geotechnical engineers;
- Promote the attendance of young engineers and students at our regional ISSMGE events and develop other mechanisms to facilitate their interaction with their peers and mentors within academia and industry;
- Strengthen the relationships and cooperation of the ISSMGE North America region with the ISSMGE South America region for the mutual benefit of the Americas.

Please explore the ISSMGE website to get a feel for what the society offers to

our engineering community and contact me with your ideas on what the society might contribute to geotechnics in our region (*tnewson@eng.uwo.ca*).

Submitted by Timothy Newson
ISSMGE Vice President for North America

Upcoming Conferences and Seminars

High Level & LRT Bridges, Edmonton, Alberta.

71st Canadian Geotechnical Conference and the 13th Joint CGS/IAH-CNC Groundwater Conference September 23 to 26, 2018, Edmonton, Alberta, Canada

The **Geotechnical Society of Edmonton (GSE)** and the **Canadian Geotechnical Society (CGS)** in collaboration with the **Canadian National Chapter of the International Association of Hydrogeologists (IAH-CNC)**, invite you to **GeoEdmonton 2018**, the 71st Canadian Geotechnical Conference and the 13th Joint CGS/IAH-CNC Groundwater Conference. The conference will be held at the Shaw Conference Centre in Edmonton, Alberta, Canada from **Sunday, September 23 to Wednesday, September 26, 2018**. This spectacular facility is one of Canada's premier conference venues and is itself a geotechnical achievement, being constructed on the flank of an active landslide overlooking Edmonton's beautiful river valley in the heart of downtown.

Edmonton was founded on the banks of the North Saskatchewan River and served as a Hudson's Bay Company trading outpost that grew to become Canada's Gateway to the North and is Alberta's Capital City. With a metro population of over 1.3 million people, Edmonton has an open and welcoming atmosphere. Also known as the Festival City, Edmonton showcases its local and international talent and diversity through various festivals like its annual Heritage Festival and the second largest Fringe Theatre Festival in the world. Boasting the longest stretch of connected urban parkland in North America and just steps from the conference venue, Edmonton is also a wonderful place to enjoy nature without leaving the city's limits.

The theme for GeoEdmonton 2018 is **Transportation Géotechnique - Moving Forward.** Much of Canada's prosperity is founded on its vast network of railways, pipelines, highways, and waterways. This conference intends to highlight recent achievements in transportation development and their associated geohazards. The technical program will cover a wide range of geotechnical and hydrogeological 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, five high calibre short courses, social events, and a technical tour. The official languages for the conference will be English and French.

For the latest information about the conference, please visit the conference website at *http://www.geoedmonton2018.ca*.

See you in Edmonton!

La 71e conférence canadienne de géotechnique et la 13e conférence conjointe SCG/AIH-SNC sur les eaux souterraines Du 23 au 26 septembre 2018, à Edmonton, en Alberta, au Canada

La Société géotechnique d'Edmonton (GSE) et **la Société canadienne de géotechnique (SCG)**, en collaboration avec **la section nationale canadienne de l'Association internationale des hydrogéologues (AIH-SNC),** vous invite à **GéoEdmonton 2018**, la 71e conférence canadienne de géotechnique et la 13e conférence conjointe SCG/AIH-SNC sur les eaux souterraines. La conférence aura lieu au Centre des congrès Shaw à Edmonton, en Alberta, au Canada, du **dimanche 23 septembre au mercredi 26 septembre 2018.** Cet établissement spectaculaire est l'un des principaux lieux de congrès du Canada et est aussi une

Shaw Convention Centre, Edmonton, Alberta.

réalisation géotechnique, puisqu'il est construit sur le flanc d'une zone de glissement de terrain active qui surplombe la magnifique vallée fluviale d'Edmonton, au cœur du centre-ville.

Edmonton a été fondée sur les rives de la rivière Saskatchewan Nord et a servi d'avant-poste commercial de la Compagnie de la Baie d'Hudson. Elle est devenue la porte d'entrée du Canada vers le Nord et la capitale de l'Alberta. Avec une population métropolitaine de plus de 1,3 million d'habitants, Edmonton a une atmosphère chaleureuse et accueillante. Également connue sous le nom de la ville des festivals, Edmonton met en valeur son talent local et international et sa diversité par l'entremise de divers festivals, comme son Festival du patrimoine annuel et le deuxième plus important festival de théâtre expérimental (Fringe Theatre Festival) au monde. Dotée de la plus longue étendue de forêt-parc urbaine en Amérique du Nord à seulement quelques pas du lieu de la conférence, Edmonton est aussi un endroit merveilleux pour profiter de la nature sans quitter les limites de la ville.

Le thème de GéoEdmonton 2018 est **La géotechnique des transports – Ouvrir la voie**. La prospérité du Canada repose en grande partie sur son vaste réseau de chemins de fer, de pipelines, de routes et de voies navigables. Cette conférence vise à mettre en lumière les récentes réalisations en matière de développement des transports et les géorisques qui y sont associés. Le programme technique couvrira un large éventail de sujets géotechniques et hydrogéologiques, y compris des séances spécialisées d'intérêt local et national. En plus du programme technique et des séances plénières, la conférence comprendra un éventail d'éminents conférenciers d'honneur et d'activités sociales, ainsi que cinq cours intensifs de haut calibre et une visite technique. Les langues officielles de la conférence seront le français et l'anglais.

Pour obtenir les derniers renseignements sur la conférence, veuillez consulter son site Web, à *http://www.geoedmonton2018.ca/index.php?lang=fr.*

Au plaisir de se voir à Edmonton!

2018 Geohazards 7 Conference
June 3 to 6, 2018
Canmore, Alberta

The CGS Geohazards Committee's specialty conference, **Geohazards 7**, will be held June 3 to 6, 2018 at the Coast Canmore Hotel & Conference Centre in Canmore, Alberta and the call for abstracts is well underway.

Geohazards 7 will touch on the full range of hazards and risks associated with floods, debris flows, landslides, snow avalanche, earthquakes, volcanic eruptions, degrading permafrost and more. The conference will be of interest to engineering and geoscience students and consultants, industry, and government agency representatives who are involved in planning, approval, construction and operation of infrastructure and residential development in areas prone to geohazards.

More information about the conference can be found by visiting the conference website at *http://www.geohazards7.ca/*

3rd Virtual GeoScience Conference
August 22 to 24, 2018
Kingston, Ontario, Canada

We are excited to announce that the **3rd Virtual Geoscience Conference (VGC)** will be held in the beautiful limestone city, **Kingston, Ontario, Canada, August 22 to 24, 2018.** The 3rd VGC will again provide a meeting place for researchers, government, and industry members at the forefront of innovative research and development in close range remote sensing and computer visualization applied to the geosciences. The conference will highlight technological advancements and the latest applications of geomat-

ics and visualization tools to a broad range of geoscience problems.

The conference theme is all about multidisciplinary collaboration at the intersection of geomatics, visualization, computer vision, graphics and gaming, as well as virtual and augmented reality with applications to a range of geoscience subfields, such as geological mapping, geomorphology, geohazards, glaciology, volcanology, tunnelling, and mining.

Virtual Geoscience tools have impacted geoscience research, practice, and education. Geoscientists are increasingly using 3D geological models in favor of 2D GIS maps to better understand and model the scale and scope of projects, to communicate complex geology and engineering designs to clients and to easily inform the public on the impact of infrastructure or mining activities on their community. Tools like augmented and virtual reality are allowing new modes of interaction and with geoscience that are **immersive** and intuitive to a wide range audiences. Recently, the use of powerful game engines has converged with geoscience research offering exciting geological process modelling opportunities. Additionally, an increasing number of close range remote sensing tools are being used to generate 3D geological models and to monitor geological processes. There are many close range techniques and a wide range of platforms allowing geology to be mapped and monitored at increasingly high spatial and temporal scales. With the increasing number of close range tools and the growth of computer visualization tools, it is of great benefit to meet and discuss the latest developments and applications.

The first two VGC conferences, held in Switzerland followed by Norway, focused on developments and applications of close range remote sensing techniques to a broad range of geoscience research including inputs to geological modelling and have brought together researchers and practitioners interested in a novel 3D technologies. The purpose of the third conference is to again offer a multidisciplinary forum for discussing the latest developments in geomatics tools and visualization in the geosciences.

For additional information, please visit our website at *http://virtualoutcrop.com/vgc2018* or contact us at *vgc2018@virtualoutcrop.com*.

Members in the News

Appointment to the Order of Canada
Kerry Rowe, O.C.

Her Excellency the **Right Honourable Julie Payette**, Governor General of Canada, recently announced **125 new appointments** to the Order of Canada. Included in the list was **R. Kerry Rowe**, **O.C.** Kerry was appointed for his seminal contributions to the field of geoenvironmental engineering, notably for his pioneering research in waste barrier systems.

The Order of Canada was created in 1967 and is one of our country's highest civilian honours, recognizing outstanding achievement, dedication to the community and service to the nation. Close to 7,000 people from all sectors of society have been invested into the Order. Their contributions are varied, yet they have all enriched the lives of others and have taken to heart the motto of the Order: DESIDERANTES MELIOREM PATRIAM ("They desire a better country"). Appointments are made by the governor general on the recommendation of the Advisory Council for the Order of Canada.

2018 EIC Medals and Fellowships
Seven CGS Members Recognized

The Engineering Institute of Canada has announced the recipients of the 2018 EIC Medals and Fellowships.

The CGS is very pleased to report that CGS members will receive two of the five EIC Medals, and five of the 20 EIC Fellowships.

CGS members receiving 2018 EIC Medals are:

- **Delwyn Fredlund**, CGS Legget Medal Recipient (1998) and Senior Geotechnical Engineering Specialist at Golder Associates in Saskatoon, who was awarded the **K.Y. Lo Medal** "for significant engineering contributions at the international level."
- **Catherine Mulligan**, CGS VP Communications (2013-2016), Professor in the Faculty of Engineering and Computer Science at Concordia University in Montreal and Director of the Concordia Institute for Water, Energy and Sustainable Systems, who was awarded the **John B. Stirling Medal** "for leadership and distinguished service at the national level within the Institute and/or its Member Societies."

CGS members who were awarded 2018 EIC Fellowships include:

- **Kevin Biggar**, K.W. Biggar Engineering Consulting Ltd, St. Albert, AB
- **Richard Brachman**, Queen's University, Kingston, ON
- **Michel Julien**, Agnico-Eagle Mines Ltd, Toronto, ON
- **Robert Kenyon**, KGS Group, Winnipeg, MB
- **Dharma Wijewickreme**, University of British Columbia, Vancouver, BC

Since 1965 when the EIC began awarding medals and fellowships, CGS members have been awarded 64 EIC medals and 152 EIC Fellowships. The CGS would like to thank the CGS members who prepared the nominations and those who wrote letters of support. Without nominations and letters of support there would be no recipients.

71ST CANADIAN GEOTECHNICAL CONFERENCE

71E CONFÉRENCE GÉOTECHNIQUE CANADIENNE

September 23-26 / 23-26 septembre
Edmonton, Alberta

Join us in Edmonton this September for the **Canadian Geotechnical Society's 71st annual conference** and the **13th Joint CGS/IAH-CNC Groundwater Conference.**

*The GeoEdmonton 2018 theme **Transportation Geotechnique - Moving Forward** will highlight recent achievements in transportation development and their associated geohazards. In addition to Transportation, the technical program will cover a wide range of geotechnical and hydrogeological topics.*

GeoEdmonton 2018 conference program highlights will include:

R.M. Hardy Address presented by Dr. C. Derek Martin (University of Alberta)
Darcy Lecture presented by Dr. Masaki Hayashi (University of Calgary)
Comprehensive Industry Trade Show with over 65 exhibitors
Over 600 delegates and more than 300 technical and special presentations over three days!

TENTATIVE TECHNICAL SESSIONS

PRIMARY GEOTECHNICAL
- Soil Mechanics and Foundations
- Rock Mechanics and Engineering Geology
- Landslides and Geohazards
- Mining Geotechnics and Hydrogeology
- Geoenvironmental Engineering
- Transportation Geotechnics
- Geosynthetics
- Cold Regions and Permafrost Geotechnics
- Sustainable Geotechnics
- Professional Practice

SPECIAL GEOTECHNICAL
- Peats and Soft Soils
- Light Rail Transit
- Tunnelling in Urban Environments
- Geohazards in Linear Infrastructure
- Remote Sensing and Monitoring
- In-situ Testing
- Trenchless Technology
- Risk Management in Geotechnical Projects
- Reliability Analysis for Geotechnical Design
- Dam Safety
- Shallow Geothermal Energy Exchange

HYDROGEOLOGICAL
- Mining, Energy Development and Groundwater
- Groundwater and Climate Change
- Watershed Resilience and Source Water Protection
- Groundwater Dependent Ecosystems
- Regional Characterization
- Hydrostratigraphy and Geological Modelling
- Hydrogeophysics
- Geostatistical Methods for Mapping and Modelling
- Isotopic and Geochemical Fingerprinting
- Approaches to Groundwater Management
- Transboundary Water Resources
- Outreach and Education
- General Hydrogeology
- Contaminant Hydrogeology

*The conference will be held at the **Shaw Conference Centre**, in itself a geotechnical achievement constructed on the flank of an active landslide overlooking Edmonton's beautiful river valley in the heart of downtown.*

Please see the conference web site at www.geoedmonton2018.ca for detailed conference information and to register online. Be sure to register before July 31, 2018 to take advantage of early pricing discounts!

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2017 CGS Awards - Thomas Roy Award
Dr. Erik Eberhardt

In this and future issues of *Geotechnical News*, the 2017 CGS award recipients are being featured. In this issue, **Dr. Erik Eberhardt**, winner of the **2017 Thomas Roy Award** of the CGS's Engineering Geology Division, is highlighted.

Established in 1982, this award recognizes an individual for their excellence in the field of engineering geology, or to a group of individuals for a paper that makes a significant contribution to the advancement of engineering geology in Canada.

Erik's citation reads: "The body of work for the University of British Columbia Director of Geological Engineering, **Erik Eberhardt**, hardly needs introduction. His work on the recognition, prediction and mitigation of complex rock engineering problems, unexpected rock mass responses and failures remains at the top of the Geological Engineering field. With a proven track record of academic and professional achievement with an emphasis on risk assessment, Dr Eberhardt remains one of the most important leaders in Geological Engineering in Canada and internationally.

His leadership in this field is also distinguished by his many contributions as a researcher, practitioner and teacher with respect to both surface and underground rock engineering problems. These topics include rock slope failures in the form of massive rockslides, as well as engineered rock slopes associated with open pit mine slopes. Other significant research areas of Dr. Eberhardt's includes tunnelling, underground mining, petroleum geomechanics and nuclear waste disposal.

Previously recognized as the 2013 recipient of the John A. Franklin Award, the Canadian Geotechnical Society is now doubly honoured to award **Professor Erik Eberhardt** with the **2017 Thomas Roy Award** for excellence in Geological Engineering."

Committee News

Sixth International Young Geotechnical Conference (iYGEC6)
Dr. Jeff Oke and Andrea Lougheed

The Canadian Geotechnical Society and the Canadian Foundation for Geotechnique sponsored two distinguished young geotechnical engineers to attend the Sixth International Young Geotechnical Engineering Conference (iYGEC6) from September 16 to 17, 2017. The conference was held at the Global Education Center for Engineers at Seoul National University in Seoul, Republic of Korea. Candidates were chosen for their leadership and activity in the Canadian geotechnical community and their contribution to practice. **Jeff Oke** and **Andrea Lougheed** were selected to represent the Canadian Geotechnical Society this event.

Dr. Jeffrey Oke completed his Ph.D. studies in 2016 on the numerical, empirical, and analytical analysis of umbrella arch support systems in underground excavations at Queen`s University. Since early 2015, he works as a geomechanic consultant at Mine Design Engineering Inc. Here is a short report from Jeff Oke summarizing his participation to the iYGEC6.

Report on iYGEC6

I would like to thank the Canadian Geological Society for providing me with opportunity to attend iYGEC6 in Seoul, South Korea. It was an excellent experience both personally and professionally. As I expected from such distinguished organizations, there was a strong focus was on developing relationships among participants. The social dinners and receptions were very well organized and the organizers made it a priority that during the gala, board executives would disperse among the iYGEC6 attendees to encourage communication and relationship building between the young and "less young" (I was instructed to not use the term "old") participants. I had the privilege to be seated with a fellow Canadian, Paul Mayne of Georgia Tech, as well as Moonkyung Chung, Vice-President for International Affairs of the Korean Geotechnical Society.

One negative about the conference was the rather relaxed adherence to the posted schedule. This made it difficult to jump between parallel sessions as the presentations were not always starting at the appointed time; However, I was able to catch many of the important lectures and to contribute to the discussions.

I was also able to discuss old research topics from my thesis, which allowed me to acquire a reference that I could not find at my university. Most importantly, I met a participant who indicated that he had in fact read my thesis, by his own choice! When I informed my spouse about this meeting, her response was a sarcastic "so he is the one". I'm almost sure that this joke was to ease the tension she was feeling over the political issues that were occurring during the conference.

Leading up to the conference, I was following the news to assure myself that North Korea and the United States were not about to break out into open hostilities. As a graduate from the Royal Military College of Canada, my many military friends tried to reassure us that they thought that both countries would continue to behave themselves and that nothing was going to happen. When discussing this issue with South Koreans we meet on the way to Seoul and during the conference, they all responded in the same way. They had all grown up with this type of rhetoric from North Korea and the constant threats, but no real action from the north. To them, it was just another day. This reassured both my spouse and

myself, as we were still quite apprehensive about our safety during the trip. It made me truly thankful for having grown up in such a stable country as Canada and its safe political environment. Even more was knowing that my kids will get probably get to enjoy the same security.

So once again, thank you CGS (Canadian Foundation for Geotechnique and the Education Committee) for providing me with this life changing experience.

Submitted by Dr. Jeff Oke
CGS iYGEC6 Participant

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The information on the following tables was current at the time of preparation, but individuals and their contact information may change over the course of the year. The most current contact information for the various positions shown below is located on the CGS website at *http://www.cgs.ca/index.php?lang=en&*. .

Les renseignements ci-dessous étaient à jour au moment où ils ont été préparés, mais les personnes et leurs coordonnées peuvent changer au cours de l'année. Vous trouvez les plus récentes coordonnées pour les différents postes présentés ci-dessous sur le site Web de la SCG, à *http://www.cgs.ca/index.php?lang=fr&*.

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Award of Honour	Brief Description/Comments
CGS Society Awards	
Legget Medal	For significant lifelong contribution to the geotechnical field in Canada. The most senior and prestigious CGS award.
RM Quigley Award	For the best paper published in Canadian Geotechnical Journal in the preceding year. Two runners-up are also recognized. CGS membership is not required.
Honorary Life Member	For longstanding exemplary service to the CGS, and/or exemplary technical contributions to the geotechnical field in Canada or abroad. Only awarded occasionally.
CGS Division Awards	
G. Geoffrey Meyerhof Award	Soil Mechanics & Foundation Division. For outstanding contribution to soil mechanics and foundation engineering.
Thomas Roy Award	Engineering Geology Division. For outstanding contribution (publication or otherwise) to engineering geology.
Roger JE Brown Award	Cold Regions Geotechnology Division. For outstanding contribution (publication or otherwise) to permafrost science or engineering. Awarded biannually.
John A Franklin Award	Rock Mechanics Division. For outstanding publication in rock mechanics and/or rock engineering. Awarded biannually. Not awarded in 2018.
Geosynthetics Award	Geosynthetics Division. For outstanding publication in the application of geosynthetics to civil, geotechnical or geoenvironmental engineering. Awarded biannually.
Geoenvironmental Award	Geoenvironmental Division. For outstanding contribution (publication or otherwise) in geoenvironmental engineering. Awarded biannually.
Joint Awards	
Robert N Farvolden Award	Joint award of the CGS Groundwater Division and the International Association of Hydrogeologists Canadian National Chapter. For outstanding contributions by an individual or group to the disciplines of earth science or engineering that emphasize the role or importance of groundwater.
Schuster Medal	Joint award of the CGS Geohazards Committee and Engineering Geology Division and the Association of Environmental and Engineering Geologists. For outstanding contribution to geohazards research in North America. Awarded biannually to a CGS member.
CGS Student Awards	
Graduate Presentation	For best 15-minute technical presentation on video submitted by a graduate student at a Canadian university. One runner-up is also recognized. CGS membership is not required.
Undergraduate Individual Report	For best undergraduate student report by an individual in Canada. One runner-up is also recognized. CGS membership is not required.
Undergraduate Group Report	For best undergraduate student report by a group in Canada. One runner-up is also recognized. CGS membership is not required.
CGS Service Awards	
AG Stermac Award	For outstanding service to the CGS by a member at the local, national or international level. More than one award can be presented each year.
Certificates of Appreciation	For deserving CGS members recognized by the President or others as having contributed noteworthy service to the CGS.

Prix ou distinction	Courte description/Commentaires
Prix de la SCG	
Médaille Legget	Pour avoir contribué de manière importante au domaine de la géotechnique au Canada tout au long de sa vie. Le plus prestigieux prix de la SCG.
R.M. Quigley	Pour le meilleur article publié dans la Revue canadienne de géotechnique durant l'année précédente. Deux finalistes sont également reconnus. Il n'est pas nécessaire d'être membre de la SCG.
Membre honoraire à vie	Pour un service exemplaire de longue date à la SCG et/ou des contributions techniques incomparables au domaine de la géotechnique au Canada ou à l'étranger. Décerné occasionnellement seulement.
Prix des divisions de la SCG	
Prix G. Geoffrey Meyerhof	Division de la mécanique des sols et des fondations – Pour une contribution exceptionnelle au domaine de la mécanique des sols et de l'ingénierie des fondations.
Prix Thomas Roy	Division de la géologie de l'ingénieur – Pour une contribution exceptionnelle (dans une publication ou autrement) au domaine de la géologie de l'ingénieur.
Prix Roger J.E. Brown	Division de la géotechnique des régions froides – Pour une contribution exceptionnelle (dans une publication ou autrement) au domaine de l'ingénierie ou de la science du pergélisol. Décerné tous les deux ans.
Prix John A. Franklin	Division de la mécanique des roches – Pour une publication exceptionnelle sur la mécanique et/ou l'ingénierie des roches. Décerné tous les deux ans. **Pas de remise en 2018**
Prix de la géosynthétique	Division de la géosynthétique – Pour une publication exceptionnelle sur l'application de la géosynthétique en géotechnique, ou en génie civil ou géoenvironnemental. Décerné tous les deux ans.
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Prix communs	
Prix Robert N. Farvolden	Prix commun de la Division des eaux souterraines de la SCG et de l'International Association of Hydrogeologists – Canadian National Chapter. Pour une contribution exceptionnelle d'une personne ou d'un groupe dans les domaines des sciences de la terre et du génie qui met l'accent sur le rôle ou l'importance des eaux souterraines.
Médaille Schuster	Prix commun du Comité sur les géorisques et de la Division de la géologie de l'ingénieur de la SCG, ainsi que de l'Association of Environmental and Engineering Geologists. Pour une contribution remarquable à la recherche sur les géorisques en Amérique du Nord. Décernée tous les deux ans à un membre de la SCG.
Prix de la SCG pour les étudiants	
Présentation d'un étudiant gradué	Pour la meilleure présentation technique de 15 minutes sur vidéo soumise par un étudiant gradué d'une université canadienne. Un finaliste est également reconnu. Il n'est pas nécessaire d'être membre de la SCG.
Rapport d'un étudiant de premier cycle	Pour le meilleur rapport d'un étudiant de premier cycle au Canada. Un finaliste est également reconnu. Il n'est pa
Rapport d'un groupe d'étudiants de premier cycle	Pour le meilleur rapport d'un groupe d'étudiants de premier cycle au Canada. Un finaliste est également reconnu. Il n'est pas nécessaire d'être membre de la SCG.
Prix de service de la SCG	
Prix A.G. Stermac	Pour un service exceptionnel rendu à la SCG par un membre, au niveau local, national ou international. Plus d'un prix peut être présenté chaque année.
Certificats d'appréciation	Pour des membres méritants de la SCG reconnus par le président ou d'autres personnes pour avoir rendu un service digne de mention à la SCG.

Award of Honour	Brief Description/Comments
Sir John Kennedy Medal	For outstanding service to the profession or for noteworthy contributions to the science of engineering, or to the benefit of the EIC. EIC's most distinguished award (awarded every two years)
Julian Smith Medal	For achievement in the development of Canada; up to two medals can be awarded
John B. Stirling Medal	For leadership and distinguished service at the national level within the EIC and/or its member societies
CP Rail Engineering Medal	For leadership and service at the regional, branch and section levels by members of EIC member societies
K.Y. Lo Meda	For significant engineering contributions at the international level, such as promotion of Canadian expertise overseas; training of foreign engineers; significant service to international engineering organizations; and advancement of engineering technology recognized internationally
Fellowship of the EIC	For excellence in engineering and services to the profession and to society
Honorary Member	For non-members of the EIC and its member societies, and on occasion non-engineers, who have achieved outstanding distinction through service to engineering and the profession of engineering in Canada
Prix ou distinction	**Courte description/Commentaires**
Médaille Sir John Kennedy	En reconnaissance de services exceptionnels rendus à la profession d'ingénieur, ou des contributions remarquables à la science de l'ingénierie, ou au bénéfice de l'Institut. Plus prestigieux prix de l'ICI; décerné tous les deux ans.
Médaille Julian Smith	En reconnaissance des réalisations dans le développement du Canada; jusqu'à deux médailles remises chaque année.
Médaille John B. Stirling	En reconnaissance du leadership et des services rendus à l'échelle nationale à l'Institut ou à ses Sociétés Membres
Médaille CP Rail Engineering	En reconnaissance de nombreuses années de leadership et de service par les membres des sociétés au sein de l'Institut aux niveaux régional (Direction ou section); jusqu'à deux médailles remises chaque année.
Médaille K.Y. Lo	Pour des contributions remarquables au domaine de l'ingénierie au niveau international, comme la promotion de l'expertise canadienne à l'étranger, la formation d'ingénieurs étrangers, un service exceptionnel rendu à des organisations d'ingénierie internationales et l'‘avancement d'une technologie d'ingénierie reconnu sur la scène internationale.
Titre de Fellow	Pour l'excellence en ingénierie et des services rendus à la profession et à la société.
Membre honoraire	Pour les non-membres de l'ICI et de ses sociétés membres, et occasionnellement pour des personnes qui ne sont pas des ingénieurs, qui se méritent cette remarquable distinction en raison de services rendus au domaine de l'ingénierie et à la profession de l'ingénierie au Canada.

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Submit suitable digital images as jpgs at 300 dpi; image size 8.5" x 11" (portrait).

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Include photography credit and contact information.

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From the CGS Board

Amongst the new initiatives of CGS to better serve and inform its current and prospective members, it is my pleasure to introduce this new column called “From the CGS Board”. Divisions, committees and regional sections of the Society will be given the opportunity to feature technical work, describe some of their activities, and discuss issues of interest. Many thanks to BiTech for their collaboration and allowing the integration of this new column in Geotechnical News.

This first From the CGS Board edition features two articles. Nicholas Vlachopoulos, Chair of the Engineering Geology Division, and Bradley Forbes, Ph.D. candidate at Queen’s University, discuss the use of continuous strain sensing along ground support elements. The second article presents the first part (out of four) of the history of the Canadian Foundation Engineering Manual, as prepared for the Heritage Committee by Doug VanDine, Past President of CGS. It is noted that the complete story of the Manual will later be made available on the CGS website.

On behalf of CGS, I express the hope that you will find this column appealing and interesting and would be pleased to get your feedback.

En provenance du conseil de la SCG

Parmi les nouvelles initiatives de la SCG pour mieux servir et informer ses membres actuels et membres potentiels, il me fait plaisir d’introduire une nouvelle rubrique appelée « En provenance du conseil »de la SCG. Les divisions, comités et sections régionales de la Société auront l’opportunité de mettre de l’avant leur travail technique, de décrire certaines de leurs activités, et de discuter de sujets d’intérêt. Mille mercis à BiTech pour leur collaboration et de permettre l’intégration de cette nouvelle rubrique à l’intérieur de Geotechnical News.

La première édition d’En provenance du conseil met de l’avant deux articles. Nicholas Vlachopoulos, président de la division Géologie de l’ingénieur, et Bradley Forbes, candidat au doctorat à L’Université Queens, discutent de la mesure en continue des déformations tout au long d’éléments de support des sols. Le deuxième article présente la première partie (de quatre) de l’historique du Manuel canadien d’ingénierie des fondations, tel que préparé pour le comité sur le patrimoine par Doug VanDine, ancien président de la SCG. Il est à noter que l’historique complet du Manuel sera ultérieurement rendu disponible sur le site web de la SCG.

De la part de la SCG, j’espère que vous trouverez cette rubrique attrayante et intéressante, et serais heureux de recevoir vos commentaires.

Jean Côté, ing.
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Geological engineering - "Smart" ground support: Continuous strain monitoring using fiber optics

Nicholas Vlachopoulos and Bradley Forbes

The need for continuous strain sensing of ground support elements

A rising demand for underground transportation and resource management has led to the development of many more subterranean projects (deep foundations, tunnels, utility corridors etc.) which are constructed at larger scales, over greater distances, increased depths, and within proximity to sensitive urban environments (i.e. reduced tolerances with respect to adjacent infrastructure). For such projects, engineering design of support is primarily based on the stress and strain that are developing within the support structures as a result of the surrounding ground conditions. These ground loads are distributed continuously and spatially and as such, an improved understanding of the continuous strain profile would provide better insight into the true behaviour of such support elements. Research currently being conducted at the Royal Military College of Canada focuses on such micro-scale geomechanical mechanisms and interactions with a view to determining the overall design implications for full-scale (Figure 1) support design for tunnels (for example).

The use of fiber optics within the Geotechnical / Geological Engineering field is not a new concept. There are multiple projects that have utilized a particular type of fiber optic technology in the past, ranging from their use to monitor the construction and performance of embankments, tunnels, piles, mining operations and other geotechnical works. It is important to note that not all fiber optic technologies are similar as each type has their unique strengths and limitations. Historically, monitoring of such ground support members has been limited to electrical and mechanical techniques (e.g. foil-resistive strain gauges, inclinometers, linear variable displacement transducers). Such techniques provide discrete measurement points, implying that many sensors are required to obtain a full strain profile along the length of the support element.

These techniques provide a limited spatial resolution along the element, making such methods prone to misinterpretation, underestimation, and possibly omission of support response. For example, it not uncommon to observe a 'failed' rock bolt that has been subjected to both axial loads as well as bending (i.e. transverse loading(s))

Figure 1. Macroscale testing: fiber optics installed in an active mine within Northern Ontario.

Optical fiber technology, specimen preparation and methodology developed

An optical frequency domain reflectometry (OFDR) technology using low cost single mode optical fiber was investigated as a potential distributed strain monitoring technique for ground support members. What makes this OFDR technology particularly attractive for monitoring the aforementioned support elements is the capability to monitor strain with a spatial resolution of 0.65 mm along the length of the optical fiber sensor. As well, the operational accuracy is quite acceptable (better than +/- 10 microstrain).

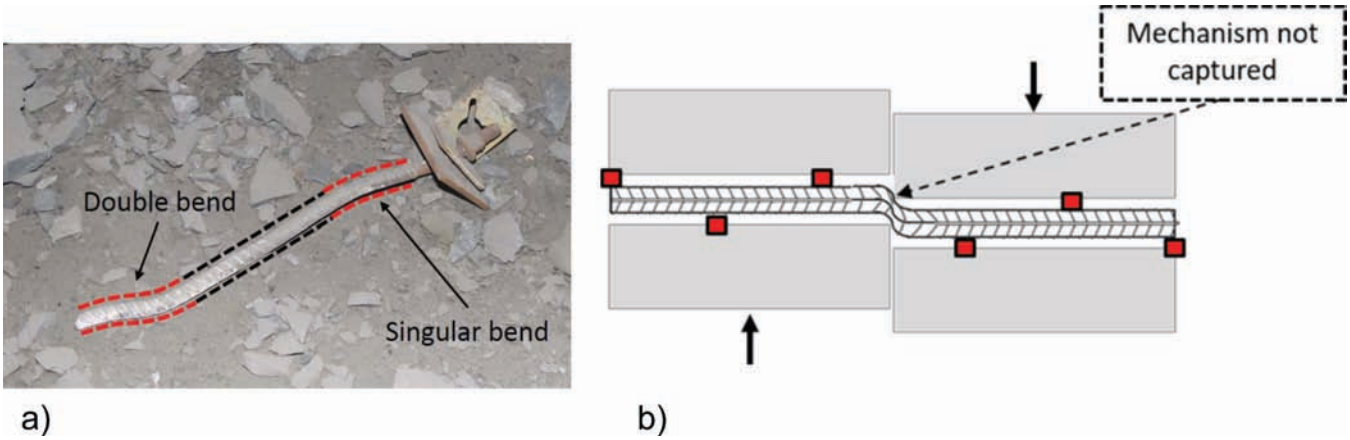

Figure 2. a) Permanently deformed bolt from an active mine site that indicates that the bolt has undergone lateral deformation and b) Deformed rebar element with sensors (red locations) that are too sparsely arranged in order to capture the local phenomenon.

In order to test the technology and methodology developed, No. 6 Grade 60 rebars were prepared by instrumenting them with a fiber optic. Steel bars were modified with 2.5 mm by 2.5 mm diametrically opposing grooves as shown in Figure 3.

Performance? Lessons learned?

Selected laboratory testing and results

To date, many configurations of testing that include axial, bending, and shear testing have been conducted utilizing multiple support elements. These support elements were tested as unique specimens as well as grouted within concrete (rock) samples. The support tested in the laboratory to date includes: Rebar (rock bolts), D-bolts, Cable bolts, Spiles and, Forepoles. Each sample preparation has its own unique challenges in terms of fitting the fiber optics in conjunction with a particular support element. In Figure 4 below, one can see selected results from the laboratory testing that has been conducted as part of this line of research. Figure 4a depicts results from an axial pullout test while Figure 4b depicts results from a 2-way shear test.

Field trials

As with any technology of this nature, it is encouraging to obtain excellent results within the controlled environment of the laboratory. The question now becomes how this technology can be employed in the harsh conditions associated with the field while limiting its impact on operations. To date, multiple successful field experiments have been conducted at 3 separate locations around the world. The authors are also in contact with other interested global parties who have shown an interest in employing such a technique within their operations.

Below (Figure 5) are relevant photos from the in-situ installation of the fiber optic technology within support elements that were designed by the authors. The data amassed in the field to date is of excellent quality, however, at the time of publication these results had not been authorized for release. None-the-less, it is extremely encouraging that the technology developed and tested at RMC is functioning as expected within the austere field site conditions with no real interruption to tunnelling or mining operations. It should also be noted that a unique fiber optic instrumentation solution must be determined for each type of ground support element; this is a non-trivial undertaking due to the unique requirements and installation procedures associated with each type of support and site.

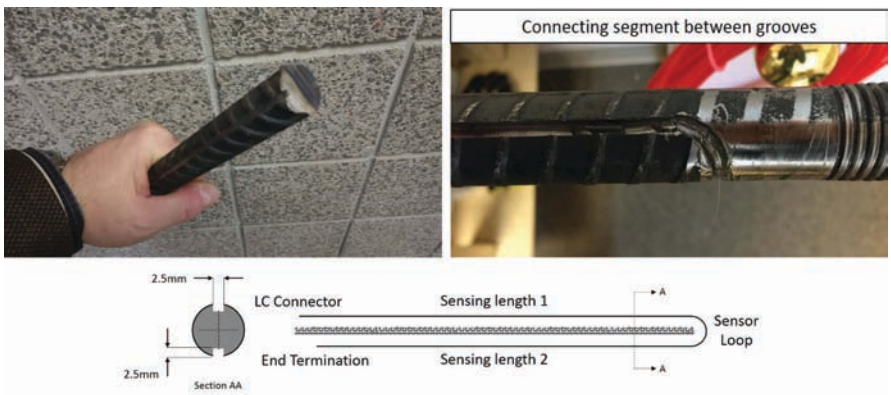

Figure 3. Photos and schematic depicting the grooves that were created during specimen peparation and the outfitting of the optical fiber with details of optical fiber groove; fiber was looped around one end of the rebar specimen providing continuous strain monitoring along two sides of the sample.

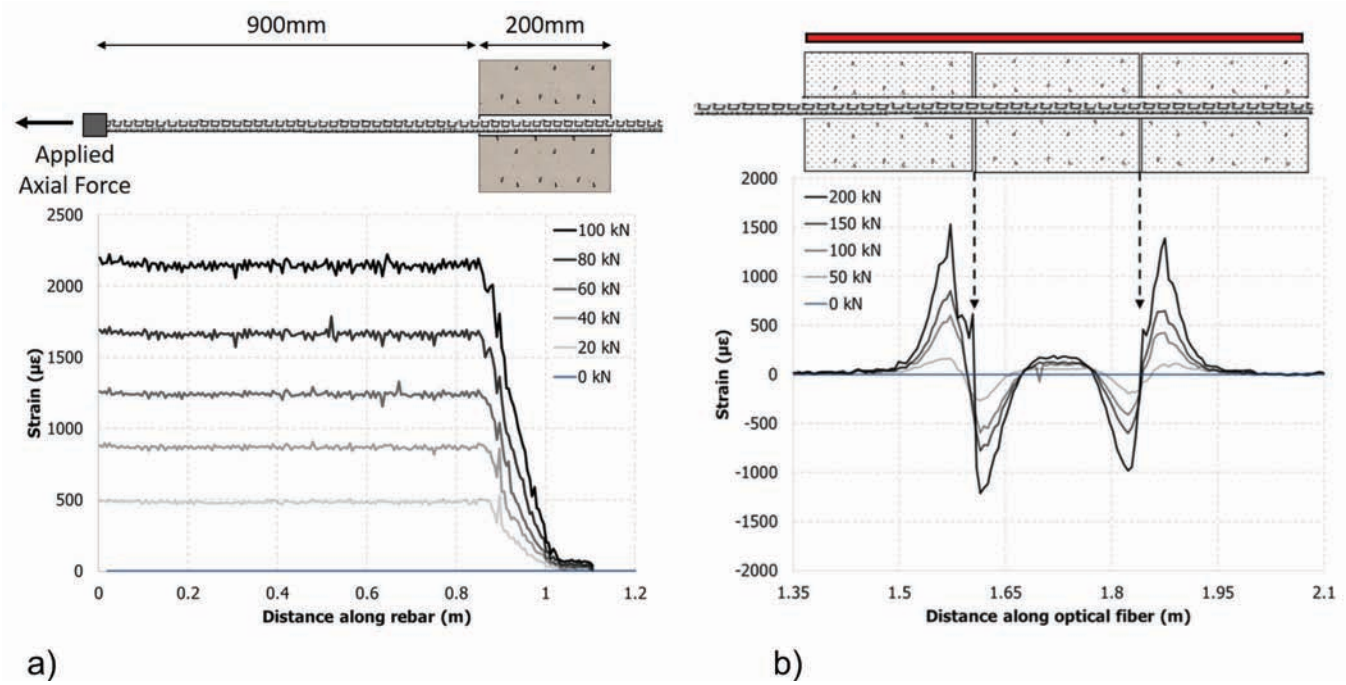

Figure 4. Selected results from a) pullout testing configuration and b) 2-way shear configuration.

Conclusions

The distributed optical strain sensing technique has been verified as a novel monitoring and geotechnical tool for capturing the performance of ground support members used in underground projects. The sensitive spatial resolution allows a continuous strain profile to be measured, overcoming the limitations of conventional, discrete strain measuring techniques, which in most cases will not fully capture the geomechanical behaviour of the support, especially when considering localized complexities. The results of using this instrumentation with ground support elements in the laboratory and the field have provided confidence for using and improving upon such a technique within the field. In addition, the optical technique can be realized as a novel tool with the capability to "see" and "sense" into the ground ahead of the working face, allowing the engineer to react and make adjustments to the support and excavation process in response to future ground conditions. As a monitoring solution, DOS provides unparalleled information concerning the behaviour and the interaction between the ground medium and the support elements which can be back-analyzed for predictive numerical model methods and ultimately support design optimization

The authors wish to acknowledge the support of the following industrial as well as governmental sponsors: Natural Sciences and Engineering Council of Canada (NSERC), the Canadian Department of National Defence, Yield Point Inc., The Royal Military College (RMC) Green Team as well as the very real contributions/roles of Dr. Mark Diederichs and Dr. Andrew Hyett.

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Professor Royal Military College of Canada (RMCC) within the Civil Engineering Department and Director of the RMC Green Team.

Bradley Forbes
PhD Candidate within the GeoMechanics group of the Geological Sciences and Geological Engineering Department at Queens University.

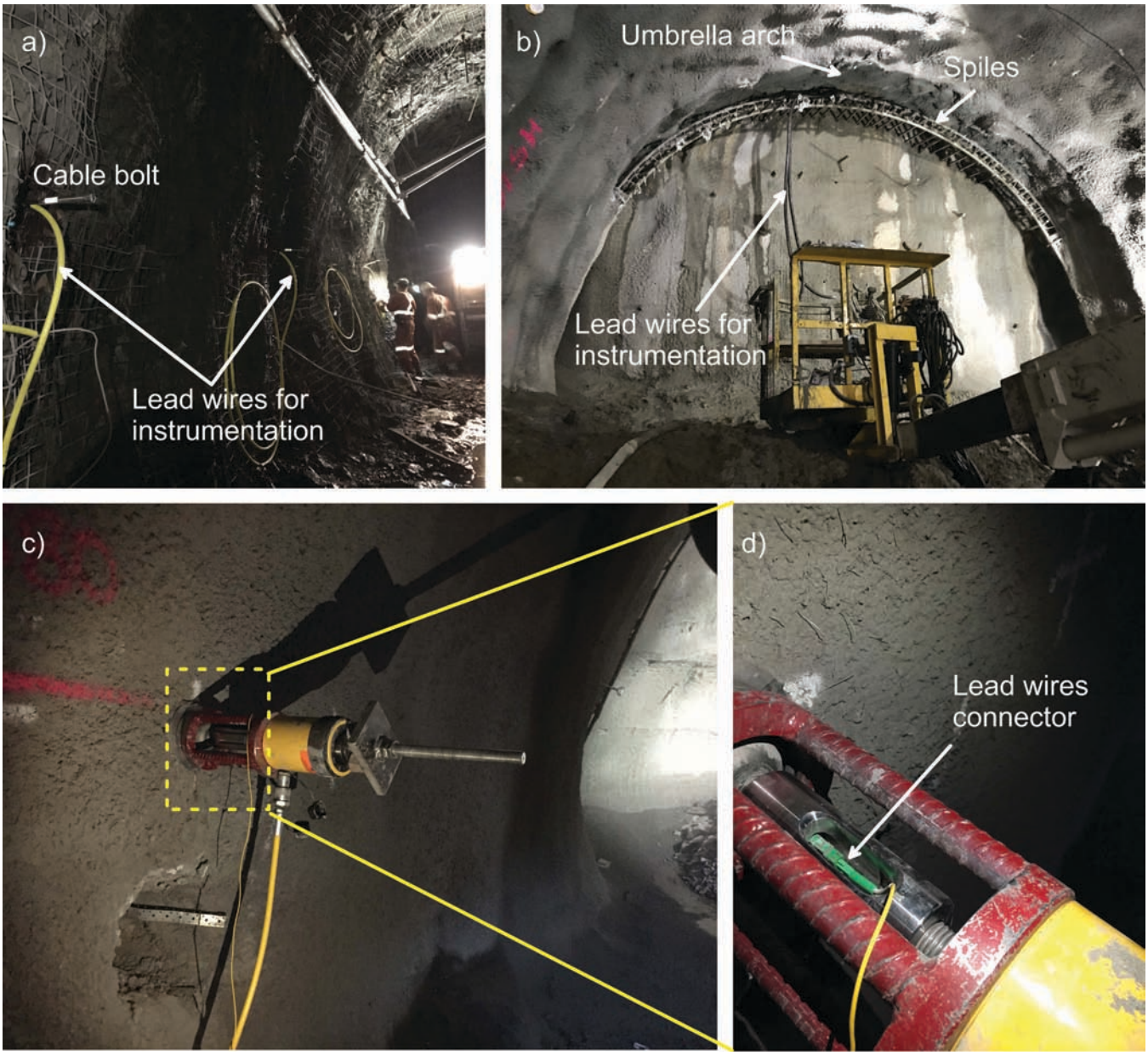

Figure 5. Field trials for support elements outfitted with optical fiber, a) Optical cable bolts installed in austere conditions, b) Installation of umbrella arch with spiles, lead wire extending from instrumented support member, c) In-situ pullout test of rock bolt instrumented within fiber optics and d) Lead wire connection detail for in situ pullout test of rock bolt instrumented with fiber optics.

History of the development of the Canadian Foundation Engineering Manual/ Manuel Canadien d'Ingénierie des Fondations Part 1 of 4

Doug VanDine

Introduction to Part 1 of the Series

In this, and the next three issues of *Geotechnical News*, the History of the development of the *Canadian Foundation Engineering Manual* (en français, le *Manuel Canadien d'Ingénierie des Fondations*) will be chronicled. The first draft of the manual was published in 1975, but as you will read in Part 1, its history began well before that. If you can't wait to read Parts 2, 3 and 4, the entire article is on the CGS website (see *http://www.cgs.ca/engineering_manual_overview.php?lang=en*).

Background

The British North America Act, which was passed by the British Parliament on July 1, 1867, not only created the country Canada, it also established the distribution of responsibilities and powers for each level of government in Canada. The responsibility for building regulations was given to the provinces and territories, and this responsibility was typically delegated to municipalities. Because each municipality tried to deal with its own needs and issues, these regulations often varied from one municipality to the next. This situation frequently made it very difficult for architects, designers, engineers, product manufacturers and contractors, as well as for national programs that supported construction.

In 1916, the National Research Council of Canada (NRC) was established as part of the war effort to advise the Canadian government on matters of science and industrial research.

In 1937, to help alleviate the difficulties associated with the multitude of municipal building regulations across the country, the federal Department of Finance asked the NRC to develop a building code that could be adopted by all municipalities in Canada. The result was the publication of the first edition of the *National Building Code of Canada (NBCC)* in 1941 (*NBCC, 1941)*.

The post-World War II construction boom required a revised NBCC and, in particular, one that did not require houses and small buildings to be designed by architects or engineers. In response, in 1947, the NRC established the Division of Building Research (DBR) and Robert Legget was appointed the first director[1].

One of DBR's original mandates was to provide research support for the NBCC. In 1948, the DBR established the Associate Committee on the National Building Code (ACNBC), and within that associate committee a Standing Committee on Structural Design was established. Under the leadership of the ACNBC, the NBCC was updated and revised in 1953, 1960, 1965 and 1970[2].

1975 Draft Edition of the Canadian Manual on Foundation Engineering

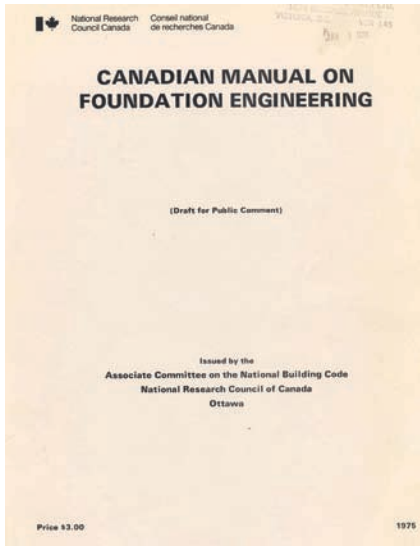

Figure 1. Cover of the 1975 Draft Edition.

In planning for the 1975 revision of the NBCC, the Standing Committee on Structural Design, established a Subcommittee on Foundations[3] that consisted of the following geotechnical engineers with their identified associations as of 1978:

A.G. (Tony) Stermac (Chair), Ontario Ministry of Transportation and Communications

D.J. (Don) Bazett, CBA Engineering

K.N. (Ken) Burn, NRC DBR

[1]The DBR has been renamed several times, but since 2012 it has been known as 'NRC Construction'.

[2]Subsequent to 1970, and continuing to the present, the NBCC has been updated and revised approximately every 5 years.

[3]It is unknown whether such a subcommittee existed before the early 1970s.

J.W. (John) Gadsby, Thurber Consultants

V. (Victor) Milligan, Golder Associates

L. (Laval) Samson, Terretach

F. (François) Tavenas, Université Laval, and

W.A. (Bill) Trow, Trow Group.

The Standing Committee on Structural Design asked the Subcommittee on Foundations to write the first draft of the Canadian Manual on Foundation Engineering. It was published as a 318-page document in 1975 as a "draft for public comment" by the NRC Associate Committee on the National Building Code (NRC, 1975, Figure 1).

The preface of the 1975 Draft Edition included the following paragraphs:

> *"It provides a "state of the art" report on foundation engineering containing recommended procedures for the design, installation and construction of foundations. It is intended to assist the enforcing official and the designer in satisfying the intent of Section 4.2 (Foundations) of the National Building Code of Canada 1975 [NBCC, 1975]. …*
>
> *Although the Manual was originally intended as a supplementary document …, no decision has yet been made on its final format and source of publication. The Associate Committee [of the National Building Code] has, therefore, agreed to release this material in its preliminary form in advance of this decision to obtain wide public review."*

The draft consisted of 8 chapters.

Chapter 1 provided an introduction, and noted that the draft did not present the subject matter in "strict specification form" as used in the NBCC because of the difference between "in-place geological materials and conditions compared with that of manufactured or preselected materials brought to the construction site…". The introduction went on to say that, largely because of the variety of materials and conditions, "foundation engineering" is less precise than structural design and "remains, to an important extent, an art based upon experience and judgement".

Chapter 1 also included a note on the limitations of use of the manual, and the need for experience and judgement:

> *"The methods presented … are applicable to most design problems. It should be understood, however, that strict use of these methods will not always yield the best technical or most economical solutions. Moreover, the design of unusual structures or the occurrence of unusual subsurface conditions may require the use of novel design approaches or methods of analysis beyond the scope of this Manual.*
>
> *…in the engineering application of the methods shown, neither this Manual nor the textbooks and papers to which it refers should be considered a substitute for the experience and judgement of a person familiar with the complexities of foundation practice."*

Chapters 2 and 3 included definitions, symbols and units of terms, and classification systems for soil and rock, respectively.

Chapter 4 summarized subsurface investigations and laboratory testing of soils, rock and groundwater, and included a synopsis of, and an appendix on, "Problem Soils, Rocks and Conditions".

Chapters 5, 6 and 7 covered the topics of excavation and retaining structures, shallow foundations and deep foundations, respectively: basic and alternative design methods; the "limits of validity" of each; references; and comments on specific construction problems.

Chapter 8 presented a number of commentaries on specific topics: the standard penetration test; relative density of cohesionless soils; foundations on swelling and shrinking clays; frost action; pile driving formulas; earthquake-resistant design; and the pressuremeter test.

This document, although published in draft, was quickly embraced by the geotechnical community in Canada and elsewhere. Comparisons were made to US "NAVFAC" (Naval Facility Engineering Command) DM [*Design Manual*] 7 *Soil Mechanics, Foundations and Earth Structures* (NAVFAC, 1971).

The 1975 Draft Edition sold for $3.00 (approximately $15.00 in 2017 dollars). It is not known how many copies were printed. A French version of this document was not translated or published.

Because the 1975 *Draft Edition* asked for "public comment", many Canadian geotechnical engineers provided written comments to the Associate Committee on the National Building Code.

Hugh Golder provided his comments in the form of a, self-described "subjective", 5-page detailed book review in the *Canadian Geotechnical Journal* (Golder, 1976). Golder, in his inimitable style, had insightful philosophical comments on the purpose, the title of the document and the order and arrangement of the chapters, and offered his suggestions on all these general topics. He then reviewed each chapter and offered suggestions where appropriate. After providing some relatively harsh comments on some aspects of the document, and some accolades on others, Golder concluded with "By and large, the Manual is good. It displays painstaking and conscientious work by experienced engineers". He indicated that his review was intended to "arouse interest in the draft of the Manual" to encourage geotechnical engineers to read it. "The greater the number of experienced engineers who

send in their comments to the editors, the better the final volume will be. It could be very good indeed!"

To be continued….

Part 2, the next part of this history, will cover the period from 1976 to 1988, and include the 1978 First and the 1985 Second editions of the manual.

Acknowledgements

Many individuals assisted the author in locating the older editions of the manual, providing valuable additional information, and providing excellent review comments on numerous drafts of the history. They will be appropriately acknowledged in Part 4. The author, however, accepts responsibility for any errors or misinterpretations of facts. If readers have additional information, or comments, on the history of the development of the *CFEM* and the *MCIF*, please send them to *vandine@islandnet.com*.

References for Part 1

Golder, H.Q, 1976, The Canadian manual on foundation engineering—a review, Canadian Geotechnical Journal, vol. 13, p. 499-504.

Naval Facilities Engineering Command (NAVFAC), 1971, DM [*Design Manual*] 7 *Soil Mechanics, Foundations and Earth Structures*, published by the NAVFAC, Alexandria, VA.

National Research Council (NBCC), 1941, *National Building Code of Canada*, published by the NRC, Ottawa, ON

National Research Council (NBCC), 1975, *National Building Code of Canada*, published by the NRC, Ottawa, ON

National Research Council (NRC), 1975, *Canadian Manual on Foundation Engineering*, published by the NRC Associate Committee on the National Building Code, Ottawa, ON, 318 p.

Introduction by John Dunnicliff, Editor

This is the 91st episode of GIN. Two articles this time.

Fully grouted piezometers again

The Groundwater section of September 2017 Geotechnical News consisted of an article by Marefat et al about fully grouted piezometers in a soft Champlain clay deposit. The article caused significant discussion among some of my colleagues. The same authors submitted "an improved paper" on the same subject to Geotechnical Testing Journal (GTJ), which is currently under review.

The authors have prepared the following update to the Geotechnical News article, indicating that "the GTJ reviewers raised some interesting questions about the paper that should be mentioned in Geotechnical News". I encourage you to read the GTJ paper. As indicated at the end of this article, the updated paper will be available on the Geotechnical Testing Journal website in the coming months (https://www.astm.org/DIGITAL_LIBRARY/JOURNALS/GEOTECH/). You can also email francois.duhaime@etsmtl.ca for a copy and an update on timing.

Extract / Transform / Load (ETL) processes for instrumentation data transfer.

Garrett Bayrd of Shannon and Wilson, Inc. explains that establishing communications with a datalogger does not move the data around. Extract / Transform / Load (ETL) processes move the data from an instrument or datalogger to a computer or server. ETL processes *extract* the data from the datalogger, *transform* it into a format that the storage system can input, then *load* the data into the specific file (database, text file) for long term storage, post-processing, or graphing.

Real-time performance monitoring as a risk management tool

In June 2017 Allen Marr, founder and CEO of Geocomp Corporation, Acton, MA, made a presentation in Cambridge, England on the above subject. The presentation covered:

- Why monitor?
- What we've learned in recent years
- How to achieve an effective instrumentation and monitoring program
- Importance of real-time monitoring

In my view this is an excellent presentation, appealing to me primarily because of its focus on what I've called "people issues" (others are using the term "human factors"), which are so vital to what we do. It's available online at www.youtube.com/watch?v=67gAXmxcokA. Here's an example of some pithy words about human factors:

Contractors talk every day about how to manage risk.

All the 'reasons for monitoring' help us identify and manage risk. Risk is something that not only we, but our clients and our construction contractors really understand. Contractors talk every day about how to manage risk. I want to suggest to you that that reason for doing instrumentation and monitoring is a far more powerful reason than simply saying "we're geotechnical engineers, we have uncertainties in our design, so we'd like to put some instruments in". That argument doesn't go over very well to owners. But if we talk about the fact that everything we do involves uncertainties and risk, we can then have an open discussion about methods of managing risks and the role and usefulness of instrumentation and monitoring.

10th International Symposium on Field Measurements in Geomechanics (FMGM)

The 10th FMGM will be held in Rio de Janeiro, Brazil during July 16-20, 2018. FMGM symposia have been held every four years since 1983, in Zurich, Kobe (1987), Oslo (1991), Bergamo (1985), Singapore (1999), Oslo (2003), Boston (2007), Berlin (2011) and Sydney (2015). I refer to these as "The once-every-four-years meeting of our club". Be there! Details are on http://fmgm2018.com/2018/

The program will include special lectures, technical presentations, a forum for young FMGM engineers, poster sessions, exhibitions, workshops and technical tours, as well as a parallel non-technical program. And a very important session about **Human Factors.**

Fifth International Course on Geotechnical and Structural Monitoring, May 22-24, 2018 in Rome, Italy.

The course schedule is now on **www.geotechnicalmonitoring.eu**. Registration for the course can be made on that site and also for the Master Classes that will be held on May 21, 2018. The total attendance for the four courses to date (2013-2017) has been 440 from 49 different countries.

Master Classes and leaders will be:

- Piezometers with Martin Clegg and Chris Spalton, Geosense Ltd, UK

- Inclinometers with Giorgio Pezzetti, SMAK s.a.s., Italy
- Extensometers with Daniel Naterop, DNGeo Switzerland
- Total stations with Werner Lienhart, Graz University of Technology, Austria.
- Vibration monitoring with Vincent Le Borgne, GKM Consultants, Canada
- Terrestrial Radar with Paolo Mazzanti, NHAZCA, Italy

Each class will cover the following main topics: installation, data acquisition, data processing, tricks and tips from everyday experience.

During the main course we will again have sessions on "New Monitoring Trends" and "Case Histories and Lessons Learned", with presentations given by registrants

Come and join us in magnificent Rome - a city of huge historical and cultural interest!

The care and feeding of individual consultants and their clients

About 15 years ago Harvey Parker (then and now an individual consultant who had previously worked for an engineering design company that contracted with individual consultants) and I published in this magazine an article with the above title. It included our views on:

- General expectations of the client and the consultant
- Issues before the client has the job
- Contractual issues
- Fees
- Miscellaneous day-to-day issues
- The client's professional issues
- The consultants personal and professional issues

The article generated significant interest among our fellow professionals, nineteen of whom submitted discussions. Many discussers supported the fact that these issues were "finally put into print", and made valuable suggestions for improvement of the article, which we summarized in our closure. Both Harvey and I have used the material to smooth our relationships with our clients over the years, and I've been wondering whether any of you (as *Stephen King says: "constant reader"*) might find it useful, particularly individual consultants and employees of companies who contract with individual consultants. If yes, please let me know by email (john@dunnicliff.eclipse.co.uk), and I'll send you pdfs of the material from four issues of Geotechnical News.

Closure

Please send an abstract of an article for GIN to john@dunnicliff.eclipse.co.uk—see the guidelines on www.geotechnicalnews.com/instrumentation_news.php

Gezondheid ("To your health"). Netherlands.

Fully grouted piezometers in a soft Champlain clay deposit. Update on the article in the Groundwater section of September 2017 issue of Geotechnical News

François Duhaime, Vahid Marefat, Robert P. Chapuis, Vincent Le Borgne

The Sainte-Marthe test site in southern Quebec was introduced in the Groundwater section of the September 2017 issue of Geotechnical News (GN, Marefat et al. 2017). This experimental test site was developed as part of the instrumented watershed project (BVE-Sainte-Marthe) at École de technologie supérieure for the teaching of hydrology and geotechnical engineering. As part of this project, a series of fully grouted and standpipe piezometers were installed in collaboration with GKM Consultants. Two grout recipes were used to obtain contrasting grout permeability values. The site also includes a bedrock well that will allow the vertical hydraulic gradient in the clay layer to be changed to look at the transient response of fully grouted piezometers.

An improved version of the GN article was submitted to the Geotechnical Testing Journal (GTJ) in September 2017 (Marefat et al. 2018). A revised version is currently under review. Compared to the GN article, the new paper puts more emphasis on numerical results. Parametric studies are presented regarding the response of fully grouted piezometers to seasonal water table fluctuations and an increase in total stress.

The GTJ reviewers raised some interesting questions about the paper that should be mentioned in Geotechnical News and, with John Dunnicliff's agreement we're doing so in GIN. First, the high-permeability grout that was used in one borehole led to significant segregation, as expected from the low Marsh funnel viscosity. As a result, the real grout permeability is difficult to estimate. The ratio between grout and soil permeability values could be well over 1100, the ratio stated by Marefat et al. (2017). Reviewers also wanted to stress the importance of adding bentonite to the grout to reach a proper viscosity and

stability. The Marsh funnel viscosity of a stable and pumpable grout should be around 50 s (Chapuis et al. 1984; Contreras et al. 2007; Marefat et al. 2018). Since bentonite properties and field conditions vary between projects, it is usually not possible to specify a definitive grout recipe with an exact bentonite proportion.

The updated paper will be available on the Geotechnical Testing Journal website in the coming months (https://www.astm.org/DIGITAL_LIBRARY/JOURNALS/GEOTECH/). You can also email us for a copy (francois.duhaime@etsmtl.ca). For an update on timing, please contact François.

References

Chapuis, R. P., Paré, J.-J., Loiselle, A. A. 1984. Laboratory tests results on self-hardening grouts for flexible cutoffs. Canadian Geotechnical Journal, 21:185-191.

Contreras, I. A., Grosser, A. T., VerStrate, R. H. 2007. The Use of the Fully-grouted Method for Piezometer Installation. Proceedings of the 7th International Symposium on Field Measurements in Geomechanics (FMGM), Boston.

Marefat V., Duhaime F., Chapuis R. P., Le Borgne, V. 2017. Fully grouted piezometers in a soft Champlain clay deposit – Part I: Piezometer installation. Geotechnical News, 35(3): 35-38.

Marefat, V., Duhaime, F., Chapuis, R. P., Le Borgne, V. 2018. Performance of fully grouted piezometers under transient flow conditions: field study and numerical results. Geotechnical Testing Journal, paper accepted with revision.

Francois Duhaime
francois.duhaime@etsmtl.ca

Extract / Transform / Load (ETL) processes for instrumentation data transfer

Garrett Bayrd

Introduction

Geotechnical instruments have changed slowly over the past few decades. With some notable exceptions, a geotechnical engineer practicing in 2001 would be familiar with the majority of instruments in 2018. For example, the manufacturing process used to make an inclinometer sensor may have changed, but the principle of the inclinometer is itself much the same.

Conversely, the way we are able to acquire and process data has dramatically changed over the past decade in several significant ways:

- Telemetry options are more plentiful, cheaper, and smaller.
- Dataloggers are less expensive, smaller, and many have built-in telemetry options.
- Less expensive processing and data storage tools allow for more data storage and more diverse ways of examining the data.
- Easier to use programming languages like Python process and display large quantities of data.

These changes, combined with a modern culture that emphasizes instant availability and access to information, have increased the number of monitoring projects that require near-real time data availability. Establishing this data availability can be more difficult than some realize when bidding on these projects, as it requires systems for data telemetry, Extract / Transform / Load (ETL) processes, data storage, data processing, and data visualization.

As a result, there have been more budgetary and conceptual mistakes in the design of these data acquisition systems – frequently with regard to ETL programs. It seems that many project managers, cost estimators, and engineers feel that if they establish a connection between a computer and a datalogger system, the data will easily flow back to them and be displayed in a timely manner. Instead, it takes careful planning and organization to create effective data acquisition systems. As is the case with any instrumentation project, designing data acquisition processes (and designing an applicable monitoring system) requires an understanding of the geotechnical setting that is to be monitored and the purpose of the system.

ETL processes move the data from an instrument or datalogger to a computer or server.

What is ETL?

Establishing communications with a datalogger does not move the data around. Extract / Transform / Load (ETL) processes move the data from an instrument or datalogger to a computer or server. ETL processes can be

purchased programs, specialty-written code, or open-source solutions.

ETL processes *extract* the data from the datalogger, *transform* it into a format that the storage system can input, then *load* the data into the specific file (database, text file) for long term storage, post-processing, or graphing. Depending on the ETL needs, commercially available programs that perform these tasks can add $1,000 to over $10,000 to the budget of a job. Configuration and programming of these programs requires labor, in addition to the cost. The type of ETL process will influence power-usage requirements, datalogger design, data storage design, and telemetry design. Manual data downloads / uploads, an admittedly low-tech variety of ETL, are outside the scope of this discussion.

The following questions should be answered when designing an ETL system:

1. How much data will the telemetry system handle?
    a. Are there increased costs for additional data transfer?
2. Is there a need for near-real time data from the system?
    a. If not, what frequency of readings and downloads are required?
3. What are the power requirements from the datalogger components?
    a. Will more frequent downloads deplete the battery?
    b. Will more frequent readings or continuous readings deplete the battery?
4. How should the data "look" once it has been transformed?
    a. What format does the data need to be in?
5. How is the data loaded into whatever storage system that is established?
    a. Is data appended to a text file?
    b. Is data loaded into an existing or new database?
6. What are the server storage space / processing power needs?
    a. Are more frequent readings going to fill the storage or require more processing time?
7. How frequently is the data being examined?
8. Are alarms established based on this data?

Answering these questions will prompt iterative reviews of the data transfer design. For example, a need for additional download frequency may change the plan for data telemetry, or a need for more frequent readings may prompt the installation of additional solar panels to meet power requirements.

Common methods of ETL

Commercially available programs

ETL is most commonly setup with commercially available programs, usually written by a vendor. Some examples include; LoggerNet from Campbell Scientific, Cloud and Enterprise from Sensemetrics, and DEX from dataTaker. These programs typically take care of the Extract and Transform part of the ETL process. They can be scheduled to communicate with the datalogger, *extract* the data, and *transform* the data to a format of your choice. Most of these programs can *load* the data into some storage format, whether it is a text file or proprietary database. These programs cannot load data into an internally developed database, as they would not "know" the database setup. These programs need to run on a computer, virtual machine, or cloud service.

Some advantages of using commercially available programs are:

1. They typically take care of the connections to the datalogger with relative ease.
2. They can handle difficult communications settings and networks, including configurations to download data at a specific time or repeat downloads if the downloads were unsuccessful.
3. Typically, they have some (but not full) functionality to control the format of the data.

Some disadvantages of using commercially available programs are:

1. You will need to configure your database uploading function to process the data as formatted by the program.
2. Only the manufacturer provides updates and support, as needed.

Purpose-written code

Code written specifically for the application is another commonly available ETL process. This purpose-written code can be more agile and flexible than a vendor program, and can automate any or all the required ETL processes. For example, when using a commercially available program like Loggernet to connect to the datalogger and save the data into a text file, a piece of code could be written to upload this data into a specific database. In this example, Loggernet would be performing the Extraction and Transforming parts of ETL, and the piece of code would be performing the Loading part. With more control of the process, the data can be saved in the format best suited for the project or application.

Advantages of using purpose-written code are:

1. Control of the format of the data.
2. Capability to automate the necessary data transfer steps, including loading into a database.
3. Not paying for functions of a system that aren't used.
4. Not beholden to any costly forced updates or lack of support for an older product.

Disadvantages of using purpose-written code are:

1. More time possibly spent in man-hours to develop the code than the cost of a commercially available project.

2. There may be difficulty in passing the project from one party to another using the proprietary code.

Open-source solutions

Open-source solutions are also available for some ETL options. The availability of this code is largely dependent on the size and culture of the group that is using the datalogger products. Essentially, there needs to be a large, dedicated group of technically savvy people to write, update, and maintain an open-source program to deal with data like this. Two examples of programs like this are the open-source HyperTerminal emulators (commonly used for basic communications and downloads from many dataloggers) and Earthworm (an open-source system used by regional seismic networks to monitor seismographs).

Advantages of using open-source solutions are:

1. It's free and some of the programming has already been done.
2. Not beholden to a specific company for software updates.

Disadvantages of using open-source solutions are:

1. They have a steep learning curve, and inconsistent documentation / manuals.
2. There is not a customer service department to call for help with problems.

Conclusions

When selecting among several bids on an instrumentation project, it's important to ensure that the firms bidding are aware of and capable of dealing with more than just the connections to the datalogger. Look for thorough bids that thoughtfully plan for ETL protocols and answer all the design questions presented here. Conversely, when bidding on a project, ensure that your bid and cost estimate take into account the needs and cost of ETL protocols.

There are five crucial elements of instrumentation data automation - Telemetry, ETL protocols, Storage, Processing, and Visualization – are all equally important to the proper setup of a near-real time instrumentation monitoring system.

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5th IcGSM

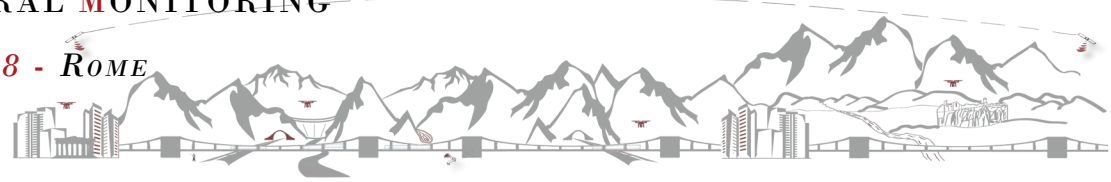
International Course on GEOTECHNICAL and STRUCTURAL MONITORING

organized by NHAZCA SRL
Natural Hazards Control and Assessments

in collaboration with Sapienza Università di Roma

22-25 May, 2018 - Rome

21 May, 2018
Master Classes



The IcGSM is growing year by year since its first edition in 2014 and, up to now, more than 450 attendees improved their technical knowledge with us!
40 international leaders have joined the courses as invited speakers and have presented their interesting projects from all around the world.
The course is a great opportunity to get in touch with important international companies in the field of monitoring who will show their products in the exhibition area.

Main topics:

- Basic concepts on monitoring
- Contact monitoring methods
- Remote monitoring methods
- Vibration monitoring
- Analysis and interpretation of data

Who should attend the course:

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

Schedule of the Course

21st May: Master Classes
22nd-24th May: Main Course
25th May: Field Trip

Master Classes
Inclinometers
Piezometers
Extensometers
Total Stations
Vibration Monitoring
Terrestrial RADAR

Field Trip
Learn more on monitoring systems at the Roman Forum archaeological area in Rome city center

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Paolo Gazzarrini

Overture

50th episode of the Grout Line. It is a significant number with approximately 12.5 years in, and what better opportunity to celebrate this anniversary with an article about one of the most important grouting projects ongoing in this moment? It is important not only technically but also logistically due to the well-known political situation. I am talking about Mosul Dam, Iraq.

I publish this article with some nostalgia, and many memories, considering that in 1982 (when I was still young and slim) it was my first international project that I had the possibility to work on, with ROKEM (Rodio-Keller Mosul JV).

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Mosul Dam – An extraordinary year of rehabilitaton to address dam safety issues

David Paul, Juan Vargas, Nagesh Malyala, Raffaella Granata

Background

Mosul Dam, a 3.4 km long, earth fill dam, located in Northern Iraq is one of the largest multi-purpose dams in the Middle-East. The dam is located on an extremely problematic karstic foundation which has the potential to erode due to the presence of dissolvable gypsum and carbonate layers. As the gypsum dissolves it can form interconnecting openings in the foundation that could compromise the stability of the dam. This issue has been addressed by maintenance grouting over the years; however, the deteriorating foundation of the dam poses a risk that if not fully addressed, could result in catastrophic loss of life, economic damage, and geopolitical instability. This paper discusses the technology, grout mixes, grouting methodology, equipment and computer-based monitoring systems used during 2016 and 2017 to address these foundation issues. The paper also discusses how technology is being used to address the aggressive schedules, production and intensity of the grouting effort and socio-political conditions.

Introduction

Mosul Dam is located on the Tigris River, approximately 40 km northwest of Mosul. The construction of Mosul Dam was completed in 1984. The majority of the flow into the reservoir comes from snow melt flow from Turkey. The dam is a multi-purpose dam providing flood control, irrigation, power generation, and water supply.

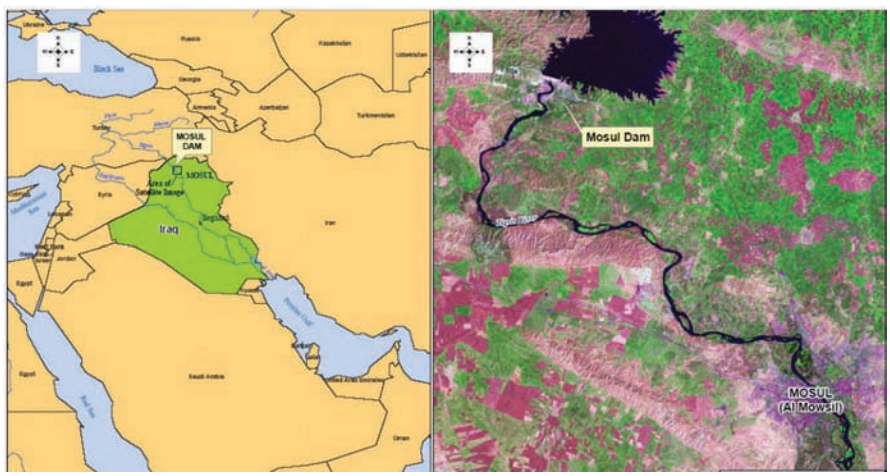


Figure 1. Project location map.

Geology

The foundation of the dam consists of Pleistocene to recent age alluvial deposits overlying rocks of the Lower to Middle Miocene age Lower Fars Group (the principal foundation rocks below the dam causing the major concerns) and the Oligocene to Lower Miocene age Jeribe Formation. The lower terraces along the river have sandy, clayey silt up to 20 m thick that was used for constructing the core of the dam.

The dam is founded on a layered sequence of rocks including marls, chalky limestone, gypsum, anhydrite, and limestone. A feature of the geology is the occurrence of karstic limestone and the development of solution cavities within the gypsum and anhydrite layers. Four significant gypsum units were identified during design and construction varying in thickness from 8 to 16 m and identified as GB0 (Gypsum Breccia 0), GB1, GB2, and GB3 in ascending order. The dissolution and erosion of gypsum by water seeping under the dam is believed to be the main cause of the development of voids requiring continuous grouting. The erosion and dissolution rates in gypsum are related to the seepage velocities and hydraulic gradient.

Dam design

Concern for underseepage and the associated risk of piping and dissolution of gypsum in the foundation was identified during the original design of the dam. To address the issue a wide, relatively shallow, grout blanket was installed beneath the dam core and a deep grout curtain was installed from a dedicated grouting gallery constructed at the base of the dam along the dam centerline. This 3.7 m tall and 3.0 m wide grouting gallery also provides access for continuous maintenance grouting of the deep grout curtain.

The presence of karstic terrain was confirmed during the site excavation for the core. Voids and large caverns were found under the river bed and in the surrounding area. There is evidence that the area may have high permeability conduits that carry river and ground water at varying velocities through the bedrock. The 113 m tall embankment dam core was constructed with locally borrowed, sandy, clayey silt material. The embankment design includes multiple filters, an internal chimney drain and transition zones. The embankment shoulders consist of rock fill. A typical cross section of the embankment is shown in Figure 2.

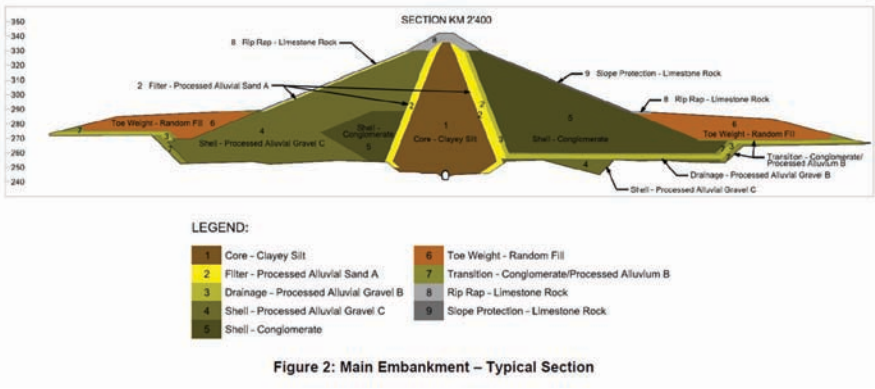


Figure 2. Typical cross section.

The Government of Iraq's (GoI) Ministry of Water Resources (MoWR) has been performing maintenance grouting since original dam construction. The geo-political instability in northern Iraq interrupted maintenance grouting between 2014 and 2015 and it was believed to have impacted the foundation conditions of the dam. This led to the emergency grouting initiative to stabilize the dam foundation beginning in 2016. The main objective of the emergency grouting program is to install a double grout line curtain along the full length of the grouting gallery and connecting curtains from the crest of the dam east of the spillway and west abutment.

Emergency grouting

Six highest risk failure modes identified from USACE Risk Analysis

- PFM N1 – Internal Erosion through the Shallow Main Valley Rock Foundation
- PFM N2/3 – Internal Erosion through a Deep Flaw in the Main Valley Foundation
- PFM N4 – Internal Erosion through the Right Abutment Rock Foundation
- PFM N5A – Internal Erosion (Stoping) through the Left Abutment Rock Foundation
- PFM N5B – Internal Erosion (Scour) through the Left Abutment Rock Foundation F-Bed
- PFM N10 – Internal Erosion through Rock Defects in the Vicinity of the Bottom Outlet Conduit

Figure 3.

Dam safety risk

Mosul Dam serves as a flood control structure protecting more than 1 million people residing in the flood plain from imminent threat. A risk-based study performed by the U.S. Army Corps of Engineers (USACE) in 2016 considered the likelihood of dam failure due to various Probable Failure Modes (PFMs) related to the foundation conditions combined with the predicted loss of life to determine a severe risk profile. If the failure modes (Figure 3) are not addressed, failure could result in catastrophic loss of life, economic damage, and geopolitical instability.

The conditions of the project present multiple challenges, the primary ones are as follows:

- Need to replace entire grouting infrastructure (mixing, batching,

distribution etc.) as well as dewatering and electrical systems

- Security situation in Northern Iraqi limits the movement of the grouting staff to the site and within the site. Increases difficulty to recruit technical staff for the engineer and contractor.
- Complicated logistics to move equipment, tools, consumables and supplies to project site.
- Procurement of materials, tools and equipment is difficult due to current made to order European approach.
- Change in the control of the area from the Kurdistan region to the central government of Iraq impacted the local work force with some workers not being able to cross the check points/border to reach the site

The need to upgrade the legacy grouting systems to meet the demanding production needs while concurrently drilling and grouting holes presented a significant amount of challenges at the beginning of the project. Approximately 1950 holes were planned to be drilled and grouted to establish a single line grout curtain across the entire 3.4 km of the dam. The 1950 holes account to approximately 250,000 m of drilling and grouting. Of the 1950 planned holes, about 500 were on the crest and the remaining were in the grouting gallery. The depths of the holes varied between 50m and 150m with an average depth of 100 m.
The magnitude of the grouting effort required special infrastructure including:

- Construction of 3 grout mixing plants
- Installation of grouting lines and electrical cables
- Procurement of nine new drill rigs
- Construction of new electrical, ventilation, communication/internet and water/wastewater systems
- Procurement and setup of 20 BGUs and ancillary equipment
- Construction of six new office buildings and a new repair-maintenance shop
- Construction of a secure base camp facility to provide living and working accommodations for the approximately 1000 people on site

To meet the schedule, drilling and grouting has been performed 24 hours per day six days per week. To direct, control and monitor this large round the clock operation the Owner specified state-of-art technology including advanced communication and computer-based monitoring systems, equipment, grout mixes, drilling and grouting methodologies.

Grouting gallery configuration

The configuration of grouting gallery cross section and profile across the length of the gallery varies and is shown in the schematic below (Figures 4 and 5).

The steep slopes (up to 41%) and configuration of the gallery cross section posed a significant challenge in terms of equipment configuration and maneuvering requirements. The grouting units (pumps and dispensing hoppers) were designed to fit within the limited space. Customized drill rigs that can fit within the gallery and with all terrain capabilities to travel up and down the slopes were designed for the job.

Infrastructure upgrade

The infrastructure in the gallery that was in-place at the beginning of this task dated from the construction of the dam. The legacy infrastructure needed to be replaced in its entirety. The infrastructure upgrade included new electrical, water/wastewater, grout conveyance, grout mixing plants, communication/internet, lighting, ventilation, and concrete delivery installations (Figures 6 and 7). Details of the systems are as follows:

- Electrical: Upgrade included removal of over 3000 m of old cables and installation of new cables (170,000 m), cable trays, transformers and generators to supply power for the gallery and crest of the dam.
- Water/wastewater: Over 4500 m of new pipelines were installed (and 2000 m relocated) to carry fresh water/wastewater in and out of the gallery. New submersible pumps to circulate fresh water through the 3.4 km dam were installed. This upgrade also included installation of new sump pumps that carry the wastewater from the sumps to the siltation tanks outside the gallery.
- Grout mixing plants: Three permanent grout mixing plants that operate on weight-based batching, were constructed and positioned across the length of the dam to

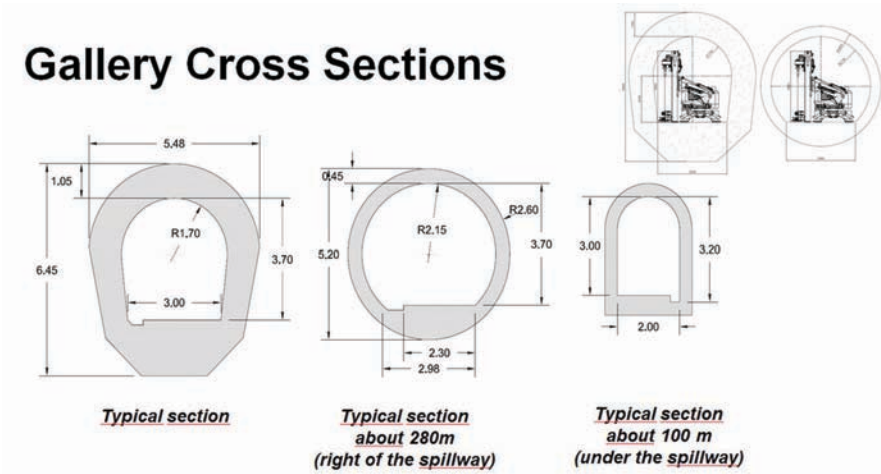


Figure 4. Grouting gallery cross Sections.

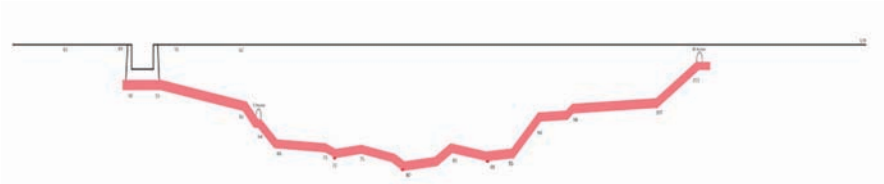


Figure 5. Grouting gallery profile.

assist in mass production of grout. The mixing plants have silos to store cement, dry bentonite, bentonite slurry and water. The grout batching units on the mixing plants can prepare 1500 liters of base grout mix per batch. Each plant is equipped with a group of grout pumps with a capacity to pump at 300 L/min. The pumps have a capacity to keep the grout in continuous circulation in the grout line circuit, 3000 m long.

- Grout conveyance systems: The grout mixed at the main mixing plants is conveyed to the gallery and crest through the grout delivery and distribution system. The system includes a series of pipes to keep grout and bentonite slurry in continuous circulation. The grouting units positioned at the injection holes draw the base mix, bentonite slurry, water from the conveyance systems and perform volumetric batching to produce the appropriate mix. The conveyance system initiates and ends at the grout mixer on the mixing plants. The conveyance system has been designed to be easily configured in multiple loops of varying length each. This facilitates grout delivery to where it is needed at the required volumes. Loops in excess of 2 Km in length are currently being used at the site.
- Communication/internet: To conduct a massive grouting operation of this magnitude, a robust communication network was critical. The entire gallery and crest were equipped with a Local Area Network (LAN) using the 2500 m of fiber optic cable newly installed. This has facilitated computerization of the operations. Wireless hotspots with internet connection were setup across the entire dam to enable communication among teams working simultaneously throughout the dam. The entire communication network is connected to a centralized operations center ("Control Room"), from where the entire drilling and grouting operations are supervised.
- Lighting: New lighting systems were provided in the gallery and crest for safer and more effective operations.
- Ventilation: A new ventilation system was designed and installed to draw fresh air in through the right access gallery, circulate it throughout the gallery and then out through the left access gallery.
- Concrete delivery system: The concrete delivery system was established through existing vertical shafts constructed in the dam to deliver concrete mix from the crest to the gallery.

Figure 6. Typical mixing plant setup.

Figure 7. Grouting gallery with legacy and updated infrastructure.

Equipment

Drill rigs needed for this project were expected to drill through different types of geology, fit in limited spaces, work on steep slopes, drill holes up to 150m deep, core holes and work through artesian conditions. To meet these needs, different types of customized rigs were used on the site and were equipped with drilling parameter recorders (DPR) that collect various parameters for analysis.

Two double-rotary SM-16 diesel rigs where purchased for outdoor drill-

Figure 8. Soilmec SM-16 drill rigs for outdoor operation.

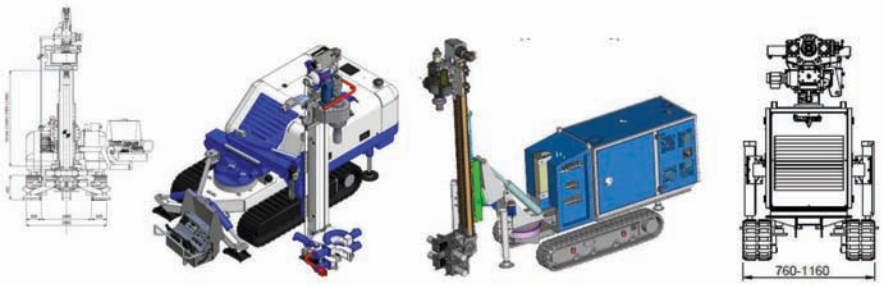


Figure 9. SoilMec SM-5 drill rig (left) and ripamonti birdie E250 (right) drill rig for gallery operation..

ing; and Six Soilmec SM-5 and one Ripamonti Birdie electrical rigs were purchased for drilling inside the gallery (Figures 8 and 9).

Aside its narrow width, the gallery presented other limitations to the mobility of the rigs including steep ramps, sharp turns at the intersection with the access galleries, new and old infrastructure that needed to be protected and multiple existing rows of stand pipes. Over 2200 stand pipes, one for each grout hole, are installed at the site. The stand pipes extended four to six inches above the gallery floor to facilitate the installation of clamps to secure blow off preventers and other tools when grouting. While the protruding stand pipes were necessary they presented a trip hazard and serious difficulties to the movement of equipment, tools and supplies. The Contractor submitted a proposal to cut the stand pipes flush with the gallery floor and install insert pipes with a flush threaded joint at its top end. The insert would work with a screwed in extension to connect to the required tools. The Owner expressed serious concerns and prior to approval requested multiple checks and tests to ensure the inserts and screw extension could withstand the backpressures expected and experienced at the site. Special grouts were designed and tested to ensure the correct bonding of the inserts to the existing standpipes, the inserts were modified with centralizers, a dedicated crew was trained to ensure proper installation and a testing apparatus was configured to test the pull-out resistance of all installed inserts. Figure 10 shows the protruding stand pipes and the completed inserts.

Figure 10. Gallery with legacy Iraqi standpipes (left) and with standpipes cut flush to surface (right).

Given the limited space constraints in the gallery, hauling the material and batching the grout mixes adjacent to the injection hole is not practical. The grouting system utilized was designed to prepare a base mix at the mixing plants outside the gallery and use the grout conveyance system to bring it into the gallery in a continuous loop. Additional conveyance lines convey bentonite slurry and fresh water through the gallery. The batching and grouting units located at the injection holes draw the base mix, bentonite slurry and water from the conveyance systems and use localized volumetric batching to prepare the desired mix (Figure 11).

The batching and grouting units are custom designed to operate in the gallery under high artesian conditions and with the ability to pump at high pressures and flow rates. The units are also automated to communicate with computer-based monitoring systems and to be remotely managed by grouting software (Figure 12).

Grouting

Grout Mixes

Grout mix design took into consideration the capacities of the grout pump, limitations of the grout monitoring systems, grouting software, conveyance systems and weather conditions.

Figure 11. Batching and grouting unit.

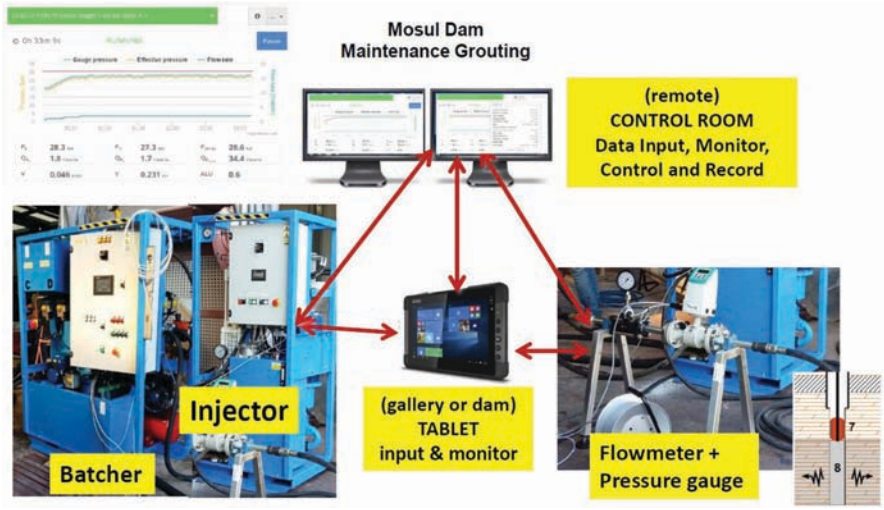


Figure 12. Computerized grouting control, monitoring and recording system.

Mix design was started in the Contractor offices in Italy prior to mobilization using cement and bentonite from sources being considered for the project. This effort continued at the site in a brand new laboratory set up for the project. MoWR laboratory personnel participated throughout the entire testing program and they are currently performing QA testing of the mixes as part of the integration program.

Mix Type		Mix A	Mix B	MIX C	Mix D
Cement/Water		0.3	0.5	1.0	1.0
Bentonite/Water		3%	3%	1%	1%
Fine Sand/Water		//	//	//	2.0
Density	g/cm3	1.20	1.30	1.51	1.90
Marsh	s/l	39	43	48	NA
Bleeding	%	< 1	< 1	< 1	< 1
7-day UCS	kPa	81	510	4612	4555
28-day UCS	kPa	156	1028	7654	8561

Table 1. Main types of grouted mixes. Average values, measured on 23011 samples of fresh grout and 3520 specimens (at each curing time).

A base mix is prepared at the mixing plants. The base mix is circulated through the grout conveyance system. The batching and grouting units at the injection hole draw the base mix from the conveyance system and modify it by adding bentonite slurry, admixtures and water in appropriate proportions to achieve the desired design mix.

Mortar mixes can be delivered through larger pipes installed throughout the gallery or vertical shafts from the crest of the dam.

Grouting methodology

Up to date, a total of over 30,000 m3 of grout have been injected, in almost 1,900 boreholes. The adopted grouting methodology has varied across the dam based on encountered geology and observed issues while drilling. Issues encountered during drilling like hole collapses, water loss were taken into consideration while designing the grouting methodology for each section. The upstage method was the most preferred grouting method to keep up with the aggressive production schedules. However, the downstage and downstage zone methods were also used based on field observations and geology. Each hole was pressure grouted in 5m intervals using a single packer lowered in the hole, at top of the stage to be grouted. The entire grouting operations have been automated using sophisticated grouting software.

Grout monitoring systems

All the grouting operation are controlled, monitored and managed by "T-Grout", a proprietary Automated Control System of the Grouting Process (Figure 12).

Automated data acquisition systems ("manifolds") are setup near the injection hole, directly connected with the

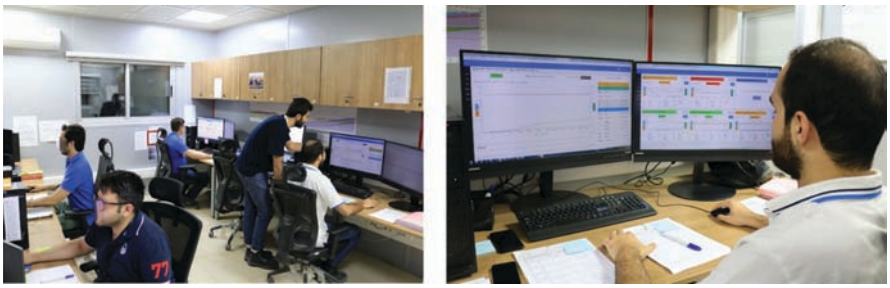


Figure 13. Activity in the "control room" (Computerized grouting control system).

in-hole packer and the grout pump, to gather pressure and flow data. All the collected data are transmitted to the grouting software, which in turn regulates the pump pressure and flow rate to maintain their values within the required limits. The software automatically computes the effective pressure, correcting the "raw value" (measured by the flowmeter) taking into consideration all the dynamic and static head losses. The grouting software triggers mix changes based on pre-set criteria for pressures or volumes within the bounds of the refusal criteria.

A centralized operations center ("control room") is setup to manage and monitor the grouting operations across the dam from a single location (Figure 13). At the grouting place, technical operators are allowed to check all the parameters and the grouting behavior through tablets, directly connected to the "manifolds" and the "control room". A vocal and writing messaging system (through the optical fibers) allowed the direct communication between the operators in the gallery and the "control room".

The gathered grouting data and process behavior are recorded, analyzed and archived by the software. The software produces "in-real-time" reports for each stage and summary of the main grouting data for each borehole, and updates the database for the whole site, including grout takes (volumes and solids) and grouted length (including number of stages and boreholes). Likewise, the software creates (and automatically updates) the drawings representing the position and detailed grout take of all the stages of all the holes, along the grout curtain profile.

Progress and challenges

Significant progress has been achieved since mobilization a year and a half ago and the start of grouting one year ago. The project has faced many challenges and the MoWR-USACE-Trevi team have worked closely to solve them. Successes and challenges are offered below as credit to the Iraqi-American-Italian team that continues to push this project to completion for the good of Iraq and its citizens.

- One-thousand-person housing complex practically completed. Completion was delayed due to contractual disputes between subcontractors. At the beginning of the project staff had to be mobilized in a staggering fashion according to the completion of the housing units.
- Completion of three mixing plants and six ancillary buildings. Completion of the plants was timed to the start of grouting on new gallery or crest grouting areas. Construction schedules were difficult to maintain due to the limitations of the local subcontractors.
- Installation of grout mix, bentonite and water piping systems; and electrical trays and lines from mixing plants 1 and 3 to the crest of the dam. The lines had to be installed on two to one (H:V) rip rap covered slopes and along the crest of the dam. Construction was complicated due to difficulties in getting needed materials to the site, space limitations, traffic and existing utilities.
- Drilling and grouting of over 1,835 grout holes along the crest (east and west abutments) and gallery. A continuous grout line along the length of the dam has been completed. This number of holes has been completed despite large grout takes, high back pressures, space limitations, difficult geology, work force new to drilling and grouting work, etc. The team has overcome these difficulties and more by focusing on the work and open communication. The difficulties of procuring and transporting equipment, tools and supplies to keep the drilling and grouting effort uninterrupted are magnified due to the complexities of the site being within a war zone.
- The equipment and grouting methods employed at the site are heavily dependent on electronic systems and grouting software for communication, data gathering, processing and reporting. Drilling rigs, mixing plants and BGUs incorporate electronic controls that are relatively new to MoWR staff. Under the Contract conditions the Contractor has trained over 100 MoWR staff on the operation, maintenance and repair of the equipment and mixing plants. However, MoWR-USACE-Trevi team has extended the training concept further to one of integrating MoWR personnel into the Contractor's crews with the objective of bringing MoWR work force to a level where they can take responsibility for directly executing the work on their own. Currently over 115 MoWR staff have been fully integrated into the project, the objective is to have approximately 250 workers integrated by the end of 2018.

Mosul Dam aerial view.

The socio-political conditions in Northern Iraq make it difficult for procurement of skilled labor, equipment, materials and modern technology at a fast pace. However, the use of modern day grouting practices and technology is essential to address the issues present at Mosul Dam in a time-sensitive fashion in order to reduce the risk to the safety and prosperity of Iraq. This is certainly an epoch in the making.

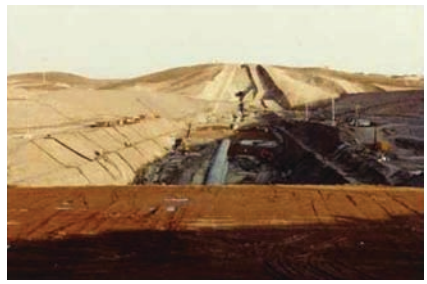
Acknowledgements

The Authors would like to sincerely thank the officials from Ministry of Water Resources, Government of Iraq.

And I finish not with my memories that can be quite tedious, but only adding a couple of pictures I took of the grouting gallery, several times mentioned in the article, during the time of construction.

Same request, as usual, 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!



Long-term performance of tailings dams in Alberta

Neeltje Slingerland, Haley Schafer, and Tim Eaton

A brief history of mining in Alberta

The mining industry in Alberta mainly consists of coal and oil sands extraction. Both types of mining have long histories in Alberta, and coal mining was crucial to the province's early development. Large-scale surface mining began in 1962, with much of this coal used to supply power-generating plants and a smaller amount used to process steel. The first large-scale oil sands surface mine was constructed in 1967. Over the next several decades, Alberta's coal and oil sands deposits were quickly expanded. Currently, eight oil sands mines are operating in northern Alberta, with lifespans ranging from 20 to 100 years at current production rates. Coal mining for power generation is currently being phased out of the province to reduce greenhouse gas emissions, with many coal mines scheduled to close by 2030.

Tailings and tailings dams in Alberta

Tailings are the waste material left over after the valuable resources—in Alberta, coal and bitumen—have been removed from the mined ore. If released in the environment in an uncontrolled fashion, tailings pose risks to the environment and human health.

Operators build tailings storage facilities (TSFs) to house the tailings until they can be stored in-pit and eventually reclaimed. Aboveground tailings dams, which hold tailings ponds, are the most common types of TSFs; these facilities are among the first features constructed at a mine and remain

Figure 1. A tailings pond at a coal mine in the Alberta Rockies. (Credit: Alberta Energy Regulator).

Figure 2. The first oil sands tailings storage facility ("Pond 1") in Alberta, located north of Fort McMurray along the Athabasca River. Closure and reclamation of this facility is ongoing. (Credit: Alberta Energy Regulator).

permanent features on the landscape. There are over 40 tailings dams in Alberta, many with extreme failure consequences. Figures 1 and 2 show examples of TSFs in Alberta, at a coal and oil sands mine, respectively.

Dam operators must comply with regulatory requirements to construct, operate, and monitor active tailings dams. As part of this, operators must make resources and personnel available to manage and monitor the facilities. Failure modes of active dams are well understood, and contingency plans are put in place in case the dam's performance deviates from what is expected.

In Alberta, the safe operation of coal and oil sands mines—and their tailings dams and ponds—is regulated by the Alberta Energy Regulator (AER). The AER ensures that operators construct, operate, monitor, and decommission their tailings dams and ponds responsibly; regulation and compliance are enforced through enactments, regulations, standards, and directives. For oil sands tailings dams in Alberta in particular, their design, construction, operation, and management systems are advanced and highly regarded internationally (Morgenstern 2010).

Decommissioning tailings dams

Many of Alberta's early tailings dams were designed with little consideration of their long-term behaviour (i.e., when the dam is no longer active), but we now recognize that the post-mining life of these structures is significantly longer than their active life. Some higher risk dams may prove difficult to re-integrate into the surrounding environment.

It is expected that a safely closed and reclaimed tailings dam will no longer function as a dam; that is, it will no longer retain fluids or liquefiable tailings, nor should there be unacceptable consequences if a failure occurs. It is also expected that the reclaimed structure will be compatible with natural landforms in the region and will be suitably resistant to processes of landscape evolution, including slope instabilities, surface erosion from wind and rain, erosion due to stream or river flow and floods, animal burrowing, and internal seepage. The operator must also identify and plan for foreseeable future climate conditions, land uses, and anthropogenic activities.

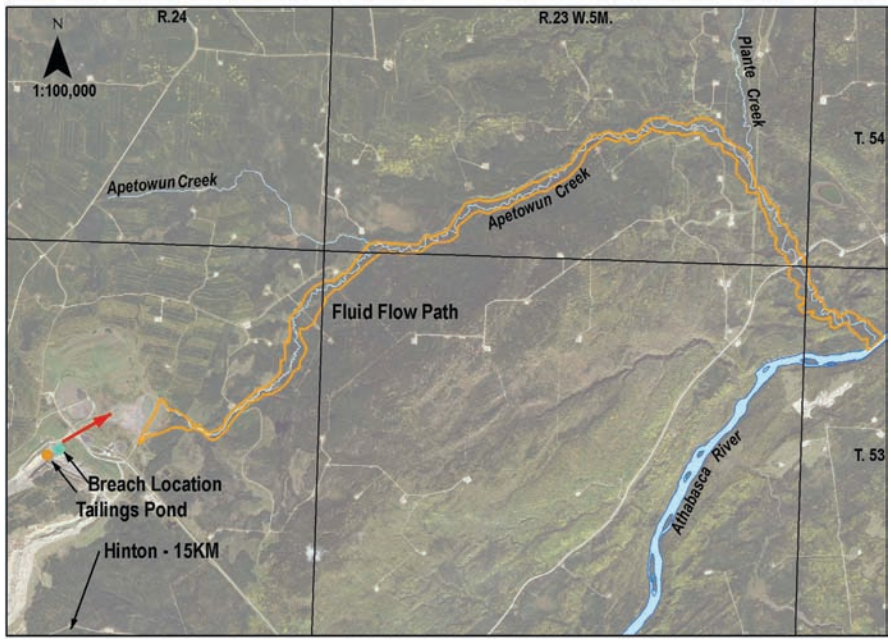


Figure 3. Plan view of the Obed Mountain coal mine showing the breach location and flow path of tailings fluids to the Athabasca River. (Source: Alberta Energy Regulator)

Many institutions, geotechnical conferences, and research facilities, as well as organizations and programs such as the Canadian Dam Association, the International Committee on Large Dams, and the United Nations Environment Programme, have advanced our knowledge about the decommissioning and delicensing process for tailings dams; however, we continue to know very little about the aging processes that tailings dams undergo in perpetuity. This information gap poses an unquantified long-term environmental risk, public safety risk, and financial liability to operators, the public, and the AER. Until we fully understand the conditions leading to post-operation risks, such as dam failures, diligence and prudence are required by the operator and regulator.

Kupper et al. (2013) proposed a risk-based approach to delicensing oil sands tailings dams that identified risk considerations, defined assessment criteria, and described how to apply a risk assessment process. Eaton (2016) reviewed a number of dam failures that occurred between 1972 and 2015, and related the failures to deficiencies in the dam safety management system, described elements of the AER Dam Safety Program and Tailings Management Framework, and discussed tailings dam safety and decommissioning.

The Obed Dam failure and creative sentence

An event in 2013 brought immediate attention to the need for long-term risk assessment and monitoring of tailings dams through the decommissioning and reclamation process. On October 31, 2013, a tailings dam failed at the Obed Mountain coal mine, about 15 km northeast of Hinton, Alberta (Figure 3). The failure occurred while the mine was being monitored and maintained after operations were suspended in 2012 due to poor economic conditions. About 670,000 m^3 of waste water and 90,000 tonnes of fine

mineral particles and flocculants were released into two tributaries of the Athabasca River (Provincial Court of Alberta 2017). Contaminants quickly reached the Athabasca River and were transported downstream.

In June 2017, an Alberta court gave a "creative sentence" to Prairie Mines & Royalty ULC, a subsidiary of Westmoreland Coal Company, for the environmental offence (Alberta Energy Regulator 2017). Creative sentencing has been one of the options used by Alberta courts since 1993 to penalize some companies found guilty of environmental offences. The concept is akin to restorative justice: it takes a criminal act against the environment and uses a penalty to benefit the environment.

Part of Prairie Mine & Royalty ULC's creative sentence included a fine to fund a dam safety research project to examine the long-term performance of tailings dams and ponds at coal and oil sands mines in Alberta. Currently underway, this research is expected to identify failure modes and degradation rates of tailings facilities, assess how reclaimed tailings facilities compare to surrounding natural systems, and assess whether these facilities pose long-term environmental and public safety risks. The research will classify failure risk and recommend methods to maintain and monitor these facilities over the long term.

With many of Alberta's coal mines scheduled to close by 2030, and with the closure of several oil sands tailings ponds already initiated, this research is timely. Its findings will increase our understanding of tailings dam closure and the associated risks, which may prevent similar events in Alberta and elsewhere.

The dam safety research project

The dam safety research project seeks to clarify the long-term risks associated with tailings facilities so these risks can be appropriately monitored and managed throughout reclamation and closure. This four-year investigation will be conducted by the University of Alberta Department of Civil and Environmental Engineering (DCEE) and led by Ph.D. student Haley Schafer. The research is complemented by an ongoing study at DCEE led by Ph.D. candidate Neeltje Slingerland, who is evaluating the long-term susceptibility to, and implications of, erosion on oil sands tailings "sand" dams, to guide their design for post-closure stability. Some of the investigative approaches developed and used for this oil sands tailings dam study are readily applied to the broader scope of the dam safety research project. Both studies are overseen by Dr. Nicholas Beier and Dr. Ward Wilson at the DCEE, who specialize in tailings management and design of mine waste structures, respectively.

The project aims to answer several questions that arise when considering the extended time frame between when a tailings dam concludes its active life and when it is considered a naturally behaving landform:

- What are the failure modes, how do they develop, and are there indicators prior to failure?
- How can we monitor for adverse conditions that lead to failure?
- How do we assess and determine the level of risk at various times throughout conversion?
- At what point is a tailings dam behaving sufficiently similar to its natural surroundings that it becomes a landform?
- What is a reasonable return period for maintenance and repairs? To what extent is maintenance likely required?
- How much financial security is required to address these uncertainties?

These questions directly impact public safety and the magnitude of long-term liability faced by the province. Their answers are also essential to inform our regulatory process and to permit delicensing.

General objectives for the project include

- identifying failure paths (and corresponding monitoring practices) throughout the post-closure progression from a dam to a landform,
- analyzing multiple failure pathways by quantifying the mechanism of failure and related susceptibility to failure over time,
- developing a risk-assessment tool based on failure consequence, similar to a failure modes and effects analysis (FMEA), and
- outlining an adaptive management framework for failure modes in post-mining tailings structures.

The investigation will include field observation and documentation, interviews with recognized experts in geotechnical engineering and mine waste design, laboratory materials testing, regional climate analysis for mining regions of Alberta, and computer modelling of failure modes. The results of the research will be applied in an adaptive management framework to continually improve processes for closing tailings dams in Alberta and for assessing failure risks over medium to long time frames (50 to 500 years). All findings will be reviewed by recognized experts in the fields of geotechnical design of tailings dams, mine reclamation, and regulation.

Applications of this research

As exemplified by the Obed dam failure, geotechnical failure of a tailings dam is potentially disastrous from social, environmental, and economic perspectives. While the AER is highly regarded globally for its high standard of regulation, many tailings dams in Alberta fall under the "extreme" failure consequence category, emphasizing the importance of providing operators with clear regulations of how to safely close and reclaim their dams.

The authors anticipate that the findings of the dam safety research project will help the regulator assess risk and manage tailings dams undergoing decommissioning and reclamation; provide clear regulatory requirements to operators of how to move tailings dams from active care to passive care to fully decommissioned structures; and establish dam (or non-dam) safety criteria for long time frames.

With many of Alberta's coal mines scheduled to close by 2030, the need for clarity regarding the corresponding risk and processes involved in closing and reclaiming tailings dams is immediate. The AER will be required to ensure that appropriate methods are being used and appropriate failure modes are being considered throughout the process of dam conversion into a landform. These methods and modes have not yet been fully assessed.

The research findings will also be essential to the province's understanding of the liability associated with TSFs, both in terms of time to delicensing (where possible) and in terms of the amount and type of maintenance to be expected for that same time frame.

Long-term performance of tailings dams is an international issue. It is hoped that the results of this project will help regulators and operators in Alberta and elsewhere prevent dam failure and poor dam performance post-closure. The Obed tailings dam breach cannot be reversed. However, the authors are optimistic that the creative sentence for this offence will advance understanding of the full scope of potential failure modes, maintenance, monitoring, and planning necessary to achieve successful closure of these structures.

References

Alberta Energy Regulator. (2017). ''Guilty plea leads to $925,000 penalty for Obed Mountain Coal Mine spill.'' http://www.aer.ca/about-aer/media-centre/news-releases/news-release - 2017-06-09.

Eaton T. (2016). "Tailings Dams, Safety and Decommissioning." Keynote presentation at the International Oil Sands Tailings Conference 2016 (unpublished).

Kupper AG. et al. (2013). "De-licensing Oil Sands Tailings Dams—When Is a Dam No Longer a Dam." Keynote address at Tailings & Mine Waste 2013, published by CRC Press.

Morgenstern NR. (2010). "Improving the Safety of Mine Waste Impoundments." Presentation at Tailings & Mine Waste 2010, published by CRC Press.

Provincial Court of Alberta. (2017). "Agreed Statement of Facts, Docket No. 151258456P1 & 160061354P1." http://www1.aer.ca/compliancedashboard/enforcement/201706-04_Agreed-StatementofFacts_PrairieMines_Obed_2013-006.pdf

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Introduction by Richard Guthrie, Editor

Winter 2018

Early into 2018, Mt. Mayon erupted in the Philippines and, almost at the same time, Kusatsu-Shirane erupted at a ski resort in Japan. The former caused the evacuation of almost 60,000, the latter physically injured several and killed one. Significant earthquakes hit Indonesia, Alaska (a 7.9 no less!), Japan, Taiwan, Peru, Mexico, South Africa, Chile and Honduras. California was inundated by debris flows, following on the heels of (and exacerbated by) the intense fires of December 2017.

Geohazards, as we continue to be reminded, take on increasingly important stature in modern societies. As professionals we are sought out for advice, explanation, understanding, and mitigation. How do we take care of our professional staff and colleagues when they are assessing hazards? What about during mitigation?

While we don't have all the answers, a relatively new group of like-minded professionals is trying to work out how to be safe while working on steep slopes.

The Association of Geohazards Professionals (AGHP) was formed in 2013 to establish standards and best practices around design and implementation of geohazard technologies such as rock fall fencing, debris flow nets, post-support systems, and monitoring systems. They are formally supported by the Canadian Geotechnical Society.

In this issue, John Duffy, Mark Fish and Colby Barrett, all from AGHP, discuss working safely on steep slopes that require rope systems to operate. I hope you find it thought provoking.

Call for project descriptions

Geohazards is interested in featuring projects that you've been researching, investigating, or implementing, around the world in 2017/2018. Specifically, we are looking to feature the breadth and depth of Canadian geotechnical expertise and input to Geohazard challenges elsewhere in the world. Please submit a good quality photograph and a project description to Richard.guthrie@stantec.com by June 21, 2018.

7th Canadian Geohazards Conference – Geohazards 7: Engineering Resiliency in a Changing Climate http://www.geohazards7.ca/

The Canadian Geotechnical Society (CGS) is pleased to announce the 7th Canadian Geohazards Conference – Geohazards 7 – to be held June 3-6, 2018 at the Coast Canmore Hotel & Conference Centre in Canmore, Alberta. The CGS's Geohazards conferences are the premiere forums in Canada for the sharing and dissemination of scientific and engineering knowledge related to geohazard assessment and risk management.

Canmore is ideally situated for hosting Geohazards 7. It is located within easy travel distance from the Calgary International Airport, and is less than a 30-minute drive from Banff National Park. Heavy rainfall in June 2013 resulted in the worst floods in Alberta's history. Landslides, debris floods and debris flows cut off highway and rail access to Banff and Canmore, and many homes constructed on alluvial fans were destroyed. Municipal governments, the Province and the engineering and geoscience community have since carried out aggressive programs to quantify geohazard risk, increase public awareness of hazards, and are constructing mitigation measures to reduce future risk. Canmore is a terrific venue to showcase the results of some of these initiatives, which will feature in the conference program and fieldtrip.

This conference will be of interest to engineering and geoscience students and consultants, industry, and government agency representatives who are involved in planning, approval, construction and operation of infrastructure and residential development in areas prone to geohazards. The conference will touch on the full gamut of hazards and risks associated with floods, debris flows, landslides, snow avalanche, earthquakes, volcanic eruptions, degrading permafrost and more. Arming participants with greater awareness of methods for quantifying geohazard magnitude and frequency for risk assessment and mitigation design, quantifying uncertainty in a changing climate, and communicating with the public about geohazard issues, are key objectives of the conference.

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*.

Until next time,

Rick

Safe work on dangerous slopes

John Duffy, Marc Fish, and Colby Barrett

Prologue

In 2013 a group of engineering, geologic and geotechnical consultants, contractors, manufacturers and stake holders came together to form the Association of Geohazard Professionals (AGHP). The concept was a diverse body that could promote material and application standards, best practices, safety practices, and knowledge transfer in North America. The association has grown steadily since, with much of its activity focused around committees dealing with various aspects of the industry such as debris flow mitigation, geohazard monitoring, anchor design and testing, material testing and dangerous slope access and safety.

The Rope Access Committee is one of the first committees to have formed. John Duffy (Yeh and Assoc., formerly California Department of Transportation) and Marc Fish (Washington State Department of Transportation) are the committee co-chairs, having a combined total of 50 years working on and around dangerous slopes. The committee consists of representatives from government, academics, consultants, contractors and geohazard system manufacturers.

(www.geohazardassociation.org/committees/rope-access-committee/).

Figure 1: Scaling operations along Highway SR 410 in Washington.

Introduction

The mitigation of many geohazards involves the movement of people and machinery on or within the affected areas of steep, unstable slopes (Figure 1). The very nature of the work means that lives are being put at risk at every stage of mitigation, whether it is in the course of preliminary site investigations, during construction, or carrying out inspection or maintenance of mitigation measures. Such activities are by no means a new phenomenon, but as the geohazard industry has progressed over the years, there has never been a widespread adoption of rope access protocols specific to the unique requirements of the industry. Instead, geohazard professionals have been left to draw on safety procedures and training originally developed for other applications such as recreational climbing, search and rescue, arborists, security, avalanche control, and man-made structures. Other than the fact that all these activities share the use of rope systems for mobility, they differ greatly in practice. The skills, techniques and equipment that make one activity safe cannot simply be transferred to another with an expectation of the same results. The Rope Access Committee is trying to establish rope access protocols and cultures that will fill make the industry safer, while at the same time allow professionals to work efficiently.

Rope access best-practice

Social acceptance of exposing employees to hazardous conditions on a worksite has reduced dramatically over the last century and employers are increasingly focused on protecting the worker from harm while carrying out their tasks. Safety standards are frequently set by State/Provincial or Federal public agencies, however, these policies can be absent, vague,

or inappropriate for the industry's specific needs.

Some of the largest stakeholders of hazardous slopes are Departments/ Ministries of Transportation found throughout North America. In general, their contract specifications require no specific rope access safety protocols or rely on safety procedures and training requirements from other disciplines.

A few agencies have identified the importance of safety protocols for working on hazardous slopes and

Figure 2: CalTrans staff participating in rope access training program (Photo credit Bill Gates).

established their own extensive training and certification programs (Figure 2). The California Department of Transportation (Caltrans), for example, created a training course used to train hundreds of employees since 1990 and developed the Caltrans Bank Scaling and Rock Climbing Manual (Caltrans 2014). Another available guideline is available from U.S. Bureau of Reclamation Guidelines for Rope Access (2004).

Geohazard specialty companies have further developed their own internal safety protocols and implemented comprehensive and on-going training programs. They often have workers certified by third party organizations such as SPRAT (Society of Professional Rope Access Technicians), IRATA (Industrial Rope Access Trade Association) or PCIA (Professional Climbing Instructors Association Slope Access Technician (SAT) program).

One common controversy is the selection of the appropriate climbing protocol and strategy for the task at hand. Each system has advantages, depending on site conditions and the characteristics of the work to be carried out. Important is that a choice be made by a competent and trained individual, based on careful consideration of decisive factors, such as available anchorage, geologic slope conditions, unstable rock blocks, entry and exit routes, need for mobility and other potential features that may affect the work.

In sum, while a safety and training program is vital for any geohazard professional engaging in work on dangerous slopes, there is currently no harmonized approach. Safety training and certification either done in-house or through third-party agencies will only help reduce risk to workers and demonstrate due diligence by their employer.

The Rope Access Committee is currently developing an AGHP safety best-practice guideline specific to the geohazards industry. Committee member Steve Wilcox, who previously authored a guideline for communication tower workers in the USA, is heading this effort. Steve is currently visiting multiple construction sites involving steep slopes in order to gather information and will work with the committee to prepare draft guidelines later this year.

Slope access and safety evaluation

While there are many jobsite safety programs, few are available for working on steep slopes. One of the key components missing is the recognition and evaluation of the slope characteristics as they relate to accessing the slope with ropes. Slope geometry, site access, geologic characteristics and potential hazards need to be identified. The process of identifying such features is part of the slope access and safety evaluation (SASE), which provides a critical first step to slope access safety.

The Rope Access Committee drafted a form for the purpose of standardizing the collection of information used for decision making regarding the proper slope access equipment and systems

Figure 3: Drilling operations on a steep slope.

required, site safety, work procedures, worker experience requirements and emergency response procedures. The form is available on the AGHP website.

A working group is currently designing a corollary guidance document on how the form should be used, whom should fill it out, and options for adjustment and modification. By implementing the use of SASEs as a best-practice, together with a job site assessment (JSA) a comprehensive job safety evaluation is possible when accessing steep slopes is required (Figure 3).

Safety culture and recognition

Best-practice guidelines and the SASE process are important tools, but are only of illusory benefit without a strong safety culture among industry participants. Increasingly, industrial firms have understood that working safe need not come at the expense of production. Workers that know that they are protected – by their firm's process, procedures, training, approaches, and equipment selection and maintenance – are able to achieve high levels of sustainable production (Figure 4). And as more owner agencies become aware of these best practices, they will inevitably require that anyone working on their slopes (including their own employees) do so with the highest safety standards and most appropriate certifications. This process takes time, but the trend in the North American geohazards mitigation industry is clear.

To help grow such a culture, the Rope Access Committee has initiated the AGHP Safety Recognition Program. The hope is that by recognizing industry members that are diligent in keeping their rope access workers safe, we will encourage others to follow. The public recognition will also help owners have confidence in those who carry out their work.

The Safety Recognition Program is an annual review of a company's safety program and performance metrics. The first identifies a commitment to management involvement and commitment to a firm's safety program, including specific questions about whether the firm has a written rope access safety procedure and adheres to other industry best practices. The latter identifies geohazards mitigation organizations that execute their work safer than industry averages based on Total Incident Rates and Lost Time/Modified Duty Rates statistics.

Figure 4: Scalers working off of a two-rope system.

More information about this program can be found on the committee's webpage.

Summary

The AGHP's Rope Access Committee is a group of volunteer individuals from the geohazards industry with a passion about making a safe work environment for those who literally put their lives on the line while making the world a safer place for others. This diverse group of experts is working towards establishing best-practice guidelines, standardizing safety procedures and instilling an industry wide culture of safety. If the saying "it takes a village to raise a child" is true, then it takes an association of volunteers to keep that child safe! Please share the culture.

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