

CANADIAN CIVIL ENGINEER
L'INGÉNIEUR CIVIL CANADIEN

civil



**Engineering a Sustainable World
Solutions de génie pour un monde durable**

MAY / MAI
2010

27.2

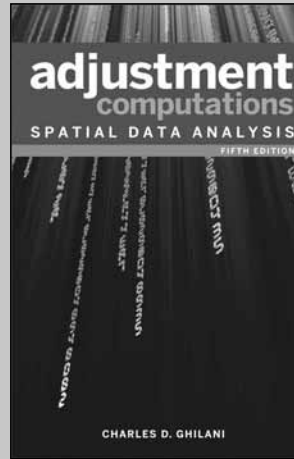
New and Bestselling Resources from Wiley for the Civil Engineer



Design Risk Management: Contribution to Health and Safety

Stuart Summerhayes

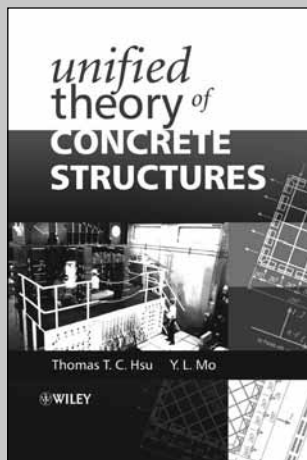
978-1-4051-3275-6 • Paper
176 pp. • April 2010 • \$91.99



Adjustment Computations: Spatial Data Analysis, 5th Edition

Charles D. Ghilani, Ph.D.,
Paul R. Wolf, Ph.D.

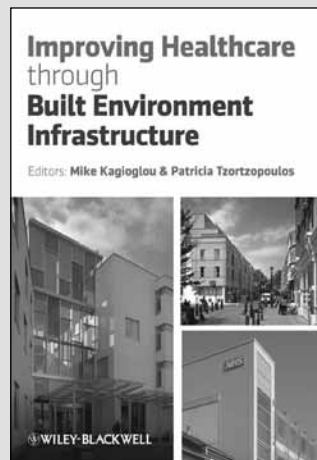
978-0-470-46491-5 • Cloth
672 pp. • March 2010 • \$198.00



Unified Theory of Concrete Structures

Thomas Hsu

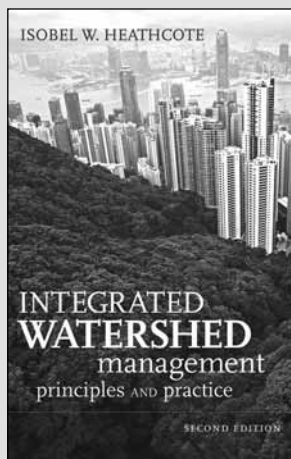
978-0-470-68874-8 • Cloth
520 pp. • June 2010 • \$192.00



Improving Healthcare through Built Environment Infrastructure

Michail Kagioglou,
Patricia Tzortzopoulos

978-1-4051-5865-7 • Cloth
296 pp. • April 2010 • \$142.99



Integrated Watershed Management: Principles and Practice, 2nd Edition

Isobel W. Heathcote

978-0-470-37625-6 • Cloth
464 pp. • January 2010 • \$162.00



Guide to Stability Design Criteria for Metal Structures, 6th Edition

Ronald D. Ziemian

978-0-470-08525-7 • Cloth
1120 pp. • January 2010 • \$210.00

Available in bookstores and online.

 **WILEY-BLACKWELL**

 **WILEY**
Now you know.

civil



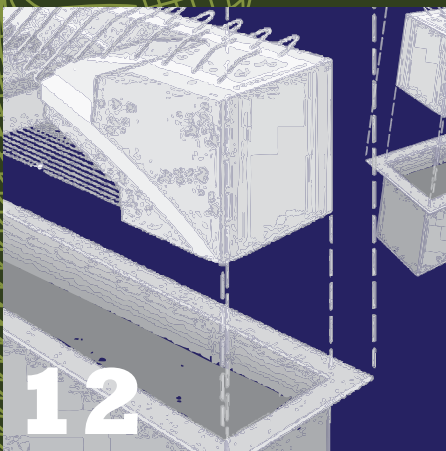
features

page 8

Evaluation of Biofilm as a Protective Barrier for the Inhibition of Microbially Influenced Deterioration in Treatment Structures and Sewer Pipelines

page 12

Hybrid-composite beams—a sustainable structural solution



columns

4 from the editor / mot de la rédactrice

5 history notes / notes historiques

6 presidential perspective / perspective présidentielle

15 engineering a sustainable world—winnipeg 2010—solutions de génie pour un monde durable

26 national historic civil engineering site / lieu historique national du génie civil

29 lifelong learning / l'éducation permanente

30 coming events / calendrier des activités



civil

27.2

The *Canadian Civil Engineer* (CCE) ISSN 9825-7515 is published bi-monthly by the Canadian Society for Civil Engineering (CSCE).

L'Ingénieur civil canadien (ICC) ISSN 9825-7515 est publié bi-mensuellement par la Société canadienne de génie civil (SCGC).



CSCE / SCGC

4920 de Maisonneuve W., Suite 201
Montréal, QC H3Z 1N1
Tel: 514-933-2634 Fax: 514-933-3504
E-mail: info@csce.ca
www.csce.ca

CSCE Office / Office de la SCGC

President / Présidente

Gordon Jin, P.Eng., FCSCE (St. Johns, NL)

Senior Vice-President / Vice-président senior

Vic Perry, P.Eng., FCSCE (Calgary, AB)

CCE Board / Conseil de l'ICC

CSCE Publications Committee Chair

Présidente, Comité des publications de la SCGC

Dagmar Svecova, MCSCE (Winnipeg, MB)

CCE Editor / Rédactrice de l'ICC

Louise Newman (Montréal, QC)

Editorial Committee Members / Membres du comité éditorial

David Lau, P.Eng., FCSCE (Ottawa, ON)

O. Burkan Isgor, Ph.D., P.Eng., MCSCE (Ottawa, ON)

Annual Subscription Rates / Abonnement annuel

Canada & U.S.A. \$35.00

other countries / autres pays \$45.00

single copy / au numéro \$7.50

agency discount / rabais aux distributeurs 10%

Design / Production

AN Design Communications (Ottawa, ON)

613-744-0444

www.an-design.ca

Advertising / Publicité

Dovetail Communications Inc.

T: 905-886-6640

F: 905-886-6615

Janet Jeffery 905-886-6641 ext. 329

E: jjeffery@dvetail.com

The opinions expressed in the papers are solely those of the authors and the Canadian Society for Civil Engineering is not responsible for the statements made in this publication.

Les opinions exprimées dans les articles sont la seule responsabilité de leurs auteurs et la Société canadienne de génie civil n'engage pas sa responsabilité dans les propos exprimés.

All commentaries and questions about this publication should be forwarded to the Editor:

Pour vos commentaires ou de plus amples informations, contactez la rédactrice :

Louise Newman, louise@csce.ca 514-933-2634 ext. 23

Return Address / Adresse de retour :

The Canadian Society for Civil Engineering

La Société canadienne de génie civil

4920 de Maisonneuve W., Suite 201

Montréal, QC H3Z 1N1

FROM THE EDITOR / MOT DE LA RÉDACTRICE

LOUISE NEWMAN LOUISE@CSCE.CA



This edition of the Canadian Civil Engineer highlights our 2010 Annual Conference, which will take place in Winnipeg, MB from June 9–12, 2010. Under the theme “Engineering a Sustainable World”, the conference will provide a forum for the presentation of recent developments in all areas of civil engineering. In addition to presentations from internationally renowned speakers, the technical program will feature keynote addresses, an industrial exhibition, and engineering tours to local sites of special interest.

The two feature articles in this issue are abridged versions of papers that will be presented during the technical program and were selected for their excellent quality by the technical program chair to provide a sampling of the nearly two hundred papers submitted.

The conference will also include a special dedication ceremony of the Red River Floodway and its expansion as a National Historic Civil Engineering Site.

The social evening will be held on Thursday, June 10th at Fort Gibraltar, situated on the banks of the Red River. The ‘Joie de Vivre’ Homecoming event will allow you to travel back in time and spend an unforgettable evening as a voyageur returning home after months on the trail. Not to be missed!

The Awards Banquet on Friday, June 11th will recognize and celebrate academic distinction, outstanding career achievements and excellence in technical writing.

I extend my thanks to all who contributed to this magazine and to all members of the Local Organizing Committee of the CSCE 2010 Annual Conference who have worked diligently to offer a program that is sure to please everyone. See you in Winnipeg! ■

Cette édition de L'ICC porte sur notre congrès annuel de 2010 qui aura lieu à Winnipeg, Manitoba du 9 au 12 juin prochains. Sous le thème « Solutions de génie pour un monde durable », le congrès sera un forum où seront exposés les derniers développements dans tous les domaines du génie civil. En plus des exposés de conférenciers de réputation internationale, le programme technique comportera des conférences, une exposition industrielle et des visites techniques à des lieux dignes d'intérêt.

Les deux articles publiés dans ce numéro sont des résumés de communications qui seront présentées dans le cadre du programme technique et ont été choisis pour leur qualité par le président du programme technique afin de donner une idée des centaines de communications programmées.

Le congrès comporte également une cérémonie de commémoration d'un lieu historique national du génie civil. On trouvera des détails sur cette activité dans la rubrique historique.

La réception en soirée aura lieu le jeudi 10 juin, au vieux fort Fort Gibraltar, situé sur les rives de la rivière Rouge. La « Joie de Vivre » des coureurs de bois vous transporte dans le temps et vous fait vivre une soirée inoubliable comme coureur de bois qui rentre à la maison après des mois d'expédition en forêt. À ne pas manquer!

Le banquet des lauréats du vendredi 11 juin, rendra hommage aux membres qui se sont distingués par leur carrière, leurs communications et leur excellence académique.

Je remercie toutes les personnes qui ont contribué à ce numéro et à tous les membres du comité organisateur local du congrès de 2010 qui ont réussi à nous offrir un programme qui plaira à tous. Nous comptons sur votre présence à Winnipeg! ■



SIR JOHN KENNEDY PLAQUE UNVEILING

On Friday March 5, 2010, the Historic Sites and Monuments Board of Canada unveiled a plaque at the Port of Montréal Building commemorating Sir John Kennedy as a "Person of National Historic Importance".

Born in Grenville County in 1838 of Scottish parents, Sir John Kennedy had a varied engineering career which started in 1854 as an apprentice in the office of T.C. Keefer. This was followed in 1863 by his appointment as an assistant land surveyor by the Montréal municipal government. Thereafter he became involved in a variety of engineering projects which included city infrastructure and railway construction. The most important part of his career, and that which earned him his outstanding reputation, was as Chief Engineer of the Montréal Harbour Commission from 1875 to 1907. His work in reconstructing the port, which included deepening the St. Lawrence River from

Québec City to Montréal, adding four wharves and rebuilding and modernizing the harbour, created a world class port facility which contributed significantly to the growth of Montréal and to the development of Canada.

Sir John Kennedy was also very involved in the development of the engineering profession in Canada and worked hard to enhance the prestige of the profession. He was a founding Vice President of the original Canadian Society of Civil Engineers and served as President of the Society in 1892. He was also a founding member of the Canadian Engineering Standards Association (now CSA) and was knighted in 1916.

At the ceremony the Government of Canada was represented by Senator David Angus on behalf of Environment Minister Jim Prentice. EIC Past President Rémy Dussault presented an overview of



PHOTO: Mr. Antonio Boemi, Vice-president, Growth & Development, Montreal Port Authority, The Honourable W. David Angus, Senator, representative of the Honourable Jim Prentice, Canada's Environment Minister and Minister responsible for Parks Canada, Mrs. Helen Fotopoulos, Member of the Executive Committee Responsible for Culture, Heritage, Design and the Status of Women, City of Montréal, Mr. Rémy Dussault, Representative, Engineering Institute of Canada. Photo Credit: Normand Rajotte/ Parks Canada

Kennedy's career. CSCE were represented by Past Presidents Peter Wright, Jules Houde and Alistair MacKenzie, Executive Director Doug Salloum and Communications Manager Louise Newman.



Sika protège les structures avec...

- ▲ Adjuvants pour béton
- ▲ Adhésifs structuraux et coulis
- ▲ Résines d'injections
- ▲ Ciments et mortiers modifiés aux polymères
- ▲ Scellants élastiques
- ▲ Systèmes de renforcement structural
- ▲ Enduits protecteurs pour béton

... et cent ans de savoir-faire.

Sika safeguards structures with...

- ▲ Concrete enhancing admixtures
- ▲ Structural adhesives and grouts
- ▲ Resin injection solutions
- ▲ Cement and polymer mortars
- ▲ Elastic joint sealants
- ▲ Structural strengthening systems
- ▲ Concrete protective coatings

... and a century of experience.



www.sika.ca
1-800-933-SIKA



Innovation & Continuité | depuis 1910
Innovation & Consistency | since 1910



The 2010 CSCE Annual Conference will once more provide an opportunity and a forum for engineers, academics, scientists, designers, researchers, owners and decision makers to network, and to share knowledge about new and innovative technologies and developments in the different areas of civil engineering. In this special conference issue of Canadian Civil Engineer (CCE), you will discover what CSCE 2010 Conference Chair—Dr. Peter Rasmussen—and his Local Organizing Committee have planned, to ensure that your stay in Winnipeg will be a fulfilling and memorable one.

The theme of this conference “*Engineering a Sustainable World*” addresses our aging Canadian infrastructure, and the increasing demand on Canadian civil engineers to come up with innovative and sustainable solutions, and the conference will provide a forum to disseminate that knowledge. Lifelong learning and knowledge sharing via gathering experts together are the primary mandates of our Society. This conference

will also be an opportunity again to network with existing colleagues and to make new friends and colleagues. I invite you to join me in Winnipeg to celebrate together the successes of our fellow engineers.

Canadian civil engineers have made many great accomplishments of which they should be proud. However, more often than not, our engineering feats go unnoticed in the daily lives of our neighbours, and in fact in the lives of all Canadians in all walks of life. Canadian civil engineers have developed innovative buildings, modern highway and transportation systems, an extensive network of underground services, infrastructure and appurtenances. Civil engineers are the builders of civilization, and as such, the profession needs to raise the profile of the important roles played by civil engineers.

This is my last column, and it only seems like yesterday that I started writing the first in the series of Presidential Perspectives for this magazine. It has been a very busy year, and I have had the opportunity to

meet many of our members far and wide, and have renewed our alliances with our sister engineering societies in China and our CSCE Hong Kong Branch. As I near the end of my presidential year, it is rewarding to see that despite the financial restraints imposed by the world’s economic recession, the Society has fared well under the circumstances.

It has been a great pleasure and honour to serve as the Society’s President for 2009–2010. The strength of our Society is in its members. I thank you for your continued participation and membership in our learned Society. Many of you are responsible for the continuing success of the Canadian Society for Civil Engineering. Our volunteers serve on Section, Region and National Committees. We all share in the efforts and success of our Society. I encourage you to read CSCE’s Annual Report, which provides a broader perspective on the many accomplishments of the Board of Directors this past year.

continued on page 7

Le congrès annuel de 2010 de la SCGC offre à nouveau une occasion de rencontres et d’échanges pour les ingénieurs, les universitaires, les scientifiques, les chercheurs, les propriétaires et les décideurs qui peuvent ainsi partager leurs connaissances sur les derniers développements et les dernières innovations dans les divers secteurs du génie civil. Dans ce numéro spécial de L’Ingénieur civil canadien consacré au congrès, vous découvrirez ce que le président du congrès de 2010, le professeur Peter Rasmussen, et son comité organisateur local, ont planifié pour que votre séjour à Winnipeg soit aussi enrichissant que mémorable.

Le thème de ce congrès, « *Solutions de génie pour un monde durable* », porte sur nos infrastructures canadiennes vieillissantes et sur la pression croissante exercée sur les ingénieurs civils pour produire des solutions novatrices et durables. Le congrès offre un forum pour la diffusion de ces connaissances. La formation permanente et le partage des connaissances au moyen de réunions d’experts sont les premiers man-

ats de notre Société. Ce congrès sera également une occasion de raffermir les relations avec les collègues et de se faire de nouveaux amis. Je vous invite à être des nôtres à Winnipeg pour fêter ensemble les succès de nos confrères.

Les ingénieurs civils canadiens comptent de nombreuses réussites dont ils peuvent être fiers. Toutefois, plus souvent qu’autrement, nos œuvres de génie passent inaperçues dans la vie quotidienne de nos voisins et même de tous les Canadiens. Les ingénieurs civils canadiens ont créé des édifices novateurs, des systèmes modernes d’autoroutes et de transport, un vaste réseau de services souterrains, d’infrastructures et d’installations diverses. Les ingénieurs civils sont les constructeurs de la civilisation, et à ce titre, la profession a besoin de proclamer bien haut le rôle important qu’elle joue.

Ceci est ma dernière chronique, et il me semble pourtant que je viens à peine de commencer à écrire mon premier message dans cette revue. L’année a été très occupée, et j’ai eu l’occasion de rencontrer nombre de nos membres un peu partout

et de renouveler nos alliances avec nos homologues en Chine et notre section à Hong-Kong. Au terme de ce mandat à la présidence, il est gratifiant de constater que, malgré les contraintes imposées par la récession mondiale, la SCGC a bien fait.

Ce fut à la fois un plaisir et un honneur de vous servir comme président en 2009–2010. La force de notre Société, ce sont nos membres. Je vous remercie de participer de façon constante à la vie de notre Société. Nombreux sont ceux d’entre vous qui êtes responsables des succès continus de la SCGC. Nos bénévoles œuvrent au sein des sections, des régions et des comités nationaux. Nous participons tous aux efforts et aux succès de la SCGC. Je vous encourage à lire le rapport annuel de la SCGC, qui vous donnera une idée des nombreuses réussites du c.a. au cours de l’année écoulée.

Je remercie en particulier notre ancien et notre nouveau directeur général, ainsi que les gens de la permanence pour leur travail et leur appui à la cause de la SCGC. Sans eux, nous n’aurions pas accompli autant.

suite à la page 7

SECTION NEWS – CALGARY

2010 APEGGA Summit Awards® Recipients
The L.C. Charlesworth Professional Service Award

Mr. Darrel J. Danyluk, P.Eng., FCSCE (Calgary) —
For diligent service to the profession and the association

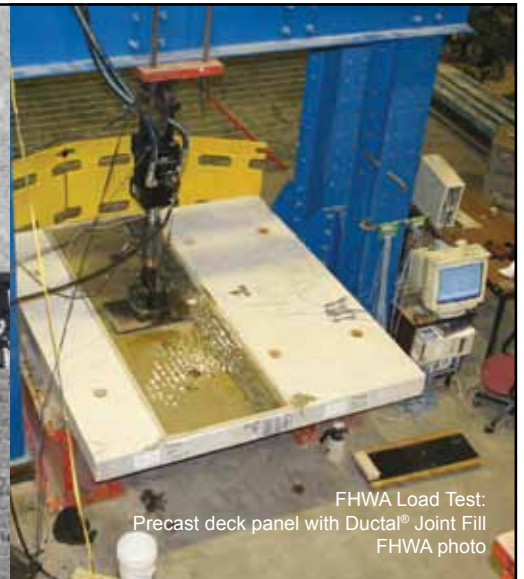
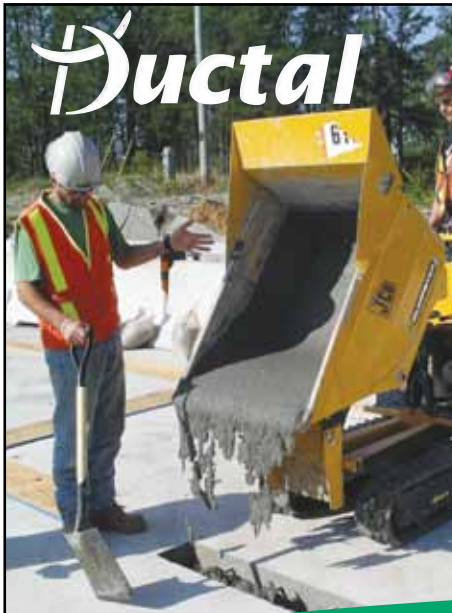
Mr. Darrel Danyluk, P.Eng., FCSCE, has been a strong and consistent voice of the engineering profession in Alberta, across Canada and internationally. He has served as president of Consulting Engineers of Alberta, APEGGA and the Canadian Council of Professional Engineers, and in 2007 he became a World Federation of Engineering Organizations Vice-President. In this capacity, he has been a driving force at the United Nations Commission on Sustainable Development and the UN Framework Convention on Climate Change. Through his ongoing leadership as project director, the University of Calgary/City of Calgary Urban Alliance initiative has become a model for universities to connect with local communities and to leverage expertise to the benefit of society.

I especially want to thank our former and new Executive Directors, and the rest of the CSCE National Office staff for all their hard work and continued support of our Society. We could not function without their diligent efforts. It is their support along with the contributions of the Board of Directors, the Regions and Sections and the many volunteers and members of our Society that has made my Presidential year a most satisfactory and enjoyable one.

Thank you all. I look forward to seeing you at the 2010 CSCE Annual Conference in Winnipeg. ■

C'est leur travail, combiné à la contribution des membres du c.a., des régions, des sections et des nombreux bénévoles qui ont permis de faire de mon mandat à la présidence une période agréable et enrichissante.

Merci à tous. Je compte vous voir au congrès annuel de 2010 de la SCGC, à Winnipeg. ■



Ultra-high performance field-cast joint fill for precast bridge systems

Strong. Ductile. Sustainable.

Ductal® Joint Fill offers strength, durability, fluidity and increased bond capacity. Its fiber matrix is significantly stronger than conventional concrete and performs better in terms of fatigue, abrasion and chemical resistance, freeze-thaw, carbonation and chloride ion penetration. When used with precast deck panels, precast box girders or bulb-tee girder joints, fabrication and installation processes are simplified, full deck continuity is achieved and the bridge deck joint is no longer the weakest link! After 10 million cycles of a truck wheel load, there is no leaking through the joint.

www.imagineductal.com

1-866-238-2825

LAFARGE
bringing materials to life™

Evaluation of Biofilm as a Protective Barrier for the Inhibition of Microbially Influenced Deterioration in Treatment Structures and Sewer Pipelines

S. Soleimani

Department of Civil and Environmental Engineering,
Carleton University, Ottawa

B. Ormeci

Department of Civil and Environmental Engineering,
Carleton University, Ottawa

O.B. Isgor

Department of Civil and Environmental Engineering,
Carleton University, Ottawa

S. Papavinasam

CANMET Materials Technology Laboratory,
Natural Resources Canada, Ottawa

INTRODUCTION

Microbially influenced corrosion (MIC) is an aggressive corrosion that is caused by microorganisms and their metabolic activities. MIC is a worldwide problem causing the deterioration of facilities and structures in wastewater treatment plants as well as sewer pipelines (Little and Lee 2007). Reduction and oxidation of sulphur is one of the major microbial activities which is responsible for MIC during wastewater treatment and transport. In this process, sulphate ion is biologically reduced to sulphide by sulphate reducing bacteria (SRB) and is converted to hydrogen sulphide in the presence of hydrogen. Sulphide or hydrogen sulphide is responsible for the microbial corrosion of metals (Booth 1964) and concrete deterioration (Vincke et al., 2001). Hence, measuring sulphide concentration is a reliable method for predicting the presence of SRB and monitoring MIC. To inhibit the microbiologically influenced deterioration of materials, such as concrete and metals, different approaches have been suggested:

- Chemical coating
- Biocide addition
- Adding oxidizing agents such as nitrate or nitrite
- Using the beneficial biofilm as a barrier

Among these alternatives, the use of biofilm as a protective layer on the surface of metals has shown promising results for corrosion reduction (Zua and Wood 2004; Ornek et al., 2002; Jayaraman et al., 1997 a,b). In this study, an enzyme electrode (biosensor) that measures the sulphide concentration was used to evaluate the effectiveness of a biofilm as a protective barrier for MIC inhibition. The enzyme electrode which was prepared using sulphide oxydase enzyme (Papavinasam et al., 2004), oxidizes sulphides and sulphur compounds to elemental sulphur resulting in an electric current. The electric current is proportional to the sulphide concentration in the solution; therefore, by amperometric measurement of electric current, one can investigate the sulphide concentration and subsequently the severity of microbial corrosion. An effective biofilm against MIC would reduce or prevent the passage of sulphide ions. If the tip of the enzyme electrode is covered with a biofilm, the decrease observed in the electric current density with the biofilm compared to the current density without the biofilm would be an indicator for the performance of the biofilm. This simple method would enable the comparison of several microbial biofilms in less than a day and selection of

the best performing one against MIC. The method would also eliminate the need for expensive, difficult and long-term testing of biofilms in microbial studies.

ENZYME ELECTRODE PREPARATION

A sulphide oxidase-producing bacterial strain which belongs to the *Arthrobacter* species, FR-3, was used for the production of sulphide oxidase (SO) enzyme (Mohapatra et al., 2006). The SO enzyme was extracted by sonification and purified using Minimate Tangential Flow Filtration Capsule and gel filtration. The purified enzyme was concentrated after each purification step by ultrafiltration using Macrosep Centrifugal Device (Pall Corporation, MWCO=10 kD). Detailed information on the preparation and purification of enzyme is reported in Mohapatra et al., (2006).

To improve the shelf life of SO, the purified enzyme is stabilized by adding 5% (w/v) lactitol and 1% (w/v) DEAE-dextran (Sooknah et al., 2008). The enzyme electrode (EE) was developed by immobilization of the stabilized SO in 1,1' dimethylferrocene and carbon/graphite paste. The immobilized enzyme paste was placed on a commercially available electrode body (Figure 1a) (BioAnalytical Systems Instruments Company, IN, US). The bottom of the electrode is perforated for a 3.0 mm inner diameter to house the enzyme paste (Figure 1a, b). A metal pin (0.75 cm) mounted in the plastic body of the electrode is used to connect the electrode to the potentiostat for current reading.

BIOFILM GROWTH

A tetracycline-resistant bacterium, *Escheria coli* DH5 α (pKMY319) was used based on its ability to form biofilm (Jayaraman et al., 1997 a, b). Due to the challenges faced growing the biofilm directly on the enzyme electrode, the biofilm was grown on a membrane and the membrane was used to cover the tip of the enzyme electrode. The biofilm was grown on a dialysis membrane with MWCO (molecular weight cut off) of 3,000 kD under static conditions with no agitation at 30°C. The membrane was placed on the bottom of a 60 mL glass bottle with a foam stopper. 10 mL of LB was used for the biofilm growth. The LB media was replaced every day with a fresh supply of LB, and addition of 0.1% (v/v) inoculum from an overnight grown culture.

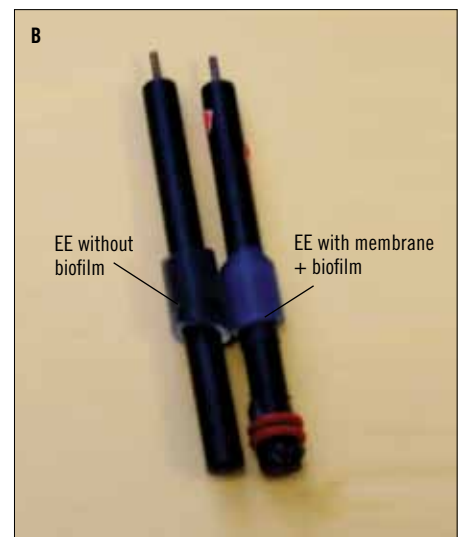
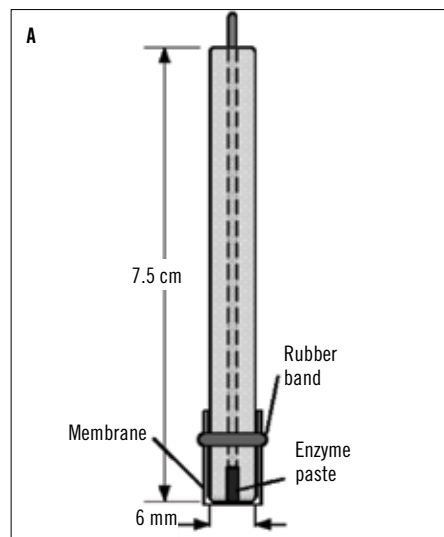


FIGURE 1: a) Schematic of the body of EE, b) EE filled with SO enzyme and covered with biofilm grown membrane.

The membrane was removed after 7 days and attached to the tip of enzyme electrode with a rubber band (Figure 1b).

AMPEROMETRIC MEASUREMENT OF SULPHIDE CONCENTRATION

All of the amperometric measurements were carried out at room temperature using 50 mM Tris-HCl buffer (pH = 7.5) as the electrolyte and sodium sulphide solution as the electroactive species. Since sodium sulphide is not stable in presence of air, a setup was designed to maintain anaerobic conditions (Figure 2a, b). This setup consist of a reservoir for holding the Tris-HCl buffer, a 100 mL mixing cell for mixing the buffer with the sulphide solution and a 50 mL testing cell. Test cell incorporates three electrodes, the EE as the working electrode, a SCE (Standard Calomel Electrode) Ag/AgCl reference electrode and a steel rod, as counter electrode (Figure 2a, b). A potential of +0.3 V versus the reference electrode was applied by the potentiostat, the Solartron SI 1287, to achieve the oxidation of sodium sulphide. A small amount of standardized sodium sulphide (1 to 5 mL) was injected in 100 mL deaerated Tris-HCl in the mixing reservoir to give a final concentration of 20–350 mg/L S²⁻. After mixing, the sulphide solution was transferred to the test cell by pressurizing the mixing cell by argon gas. The current was monitored as a function of time and the stabilized current was reported as the corresponding current to the sulphide concentration. The steady-state current response of EE with the membrane was compared to the response of EE covered

with the biofilm grown membrane in order to evaluate the performance of the biofilm against MIC. Amperometric measurements were also conducted for the EE with no membrane to provide a baseline reading.

BIOFILM EVALUATION

The calibration line representing the steady-state response of the EE was obtained from the difference of the steady-state current density reading corresponding to a particular sulphide concentration and the current density at zero sulphide concentration when the experiments were run with the Tris-HCl buffer only (Sooknah et al., 2008). The current was monitored as a function of time and the stabilized current density was reported as the corresponding current density to the sulphide concentration. The calibration lines of the EE with and without the membrane and with the biofilm grown membrane are provided in Figure 3. The data illustrates that the EE with the membrane had a lower sensitivity than the EE without the membrane. The sensitivity of the EE with the membrane, which is defined as the slope of the calibration line (Sooknah et al., 2008), was 55.1 $\mu\text{A}\cdot\text{mL}/\text{mg}$ compared to 186.7 $\mu\text{A}\cdot\text{mL}/\text{mg}$ for the EE without the membrane (Figure 3). Most importantly, the steady-state response of EE with the biofilm grown membrane stayed at and around zero, and no significant increase in current density was observed with increasing sulphide concentration. This indicates that the biofilm was very successful as a barrier against the sulphide ions and almost

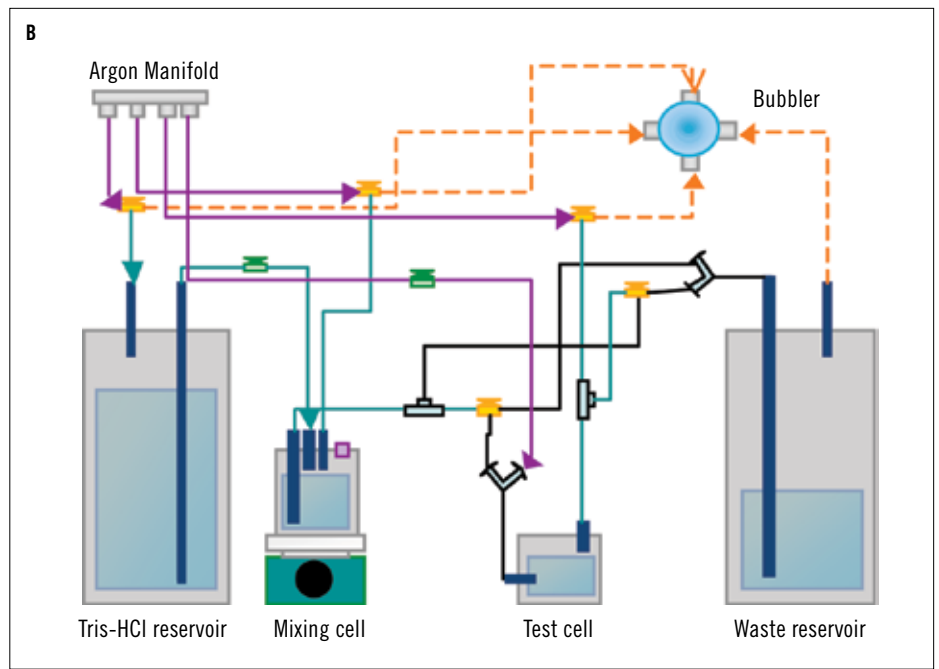
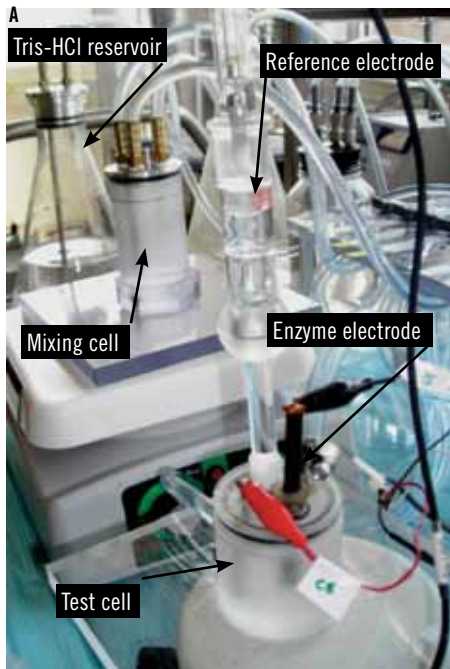


FIGURE 2: a) The setup for amperometric measurement of sulphide using EE, b) Schematic of setup showing the connections.

completely prevented the transport of the sulphide ions.

CONCLUSIONS

Biofilm use as a protective barrier against corrosion inhibition was evaluated using a sulphide oxidase enzyme electrode. The simple method presented herein was shown to be valuable in rapidly determining the effectiveness of a biofilm as a corrosion barrier. Results from amperometric measurements showed that *E.coli* Dh5 α biofilm was successful in blocking the sulphide ions and provided an effective barrier against MIC. ■

ACKNOWLEDGMENT

The authors gratefully acknowledge Prof. T.K. Wood from Texas A&M University for providing the genetically engineered strain of *E.coli* Dh5 α .

REFERENCES

Booth GH. 1964. Sulphur bacteria in relation to corrosion. *J Appl Microbiol* 27(1):174–81.
 Jayaraman A, Earthman JC, Wood TK. 1997a. Corrosion inhibition by aerobic biofilms on SAE 1018 steel. *Appl Microbiol Biotechnol* 47(1):62–8.

Jayaraman A, Cheng ET, Earthman JC, Wood TK. 1997b. Axenic aerobic biofilms inhibit corrosion of SAE 1018 steel through oxygen depletion. *Appl Microbiol Biotechnol* 48(1):11–7.
 Little BJ, Lee JS. 2007. *Microbiologically influenced corrosion*. Wiley-Interscience.
 Örnek D, Wood TK, Hsu CH, Mansfeld F. 2002. Corrosion control using regenerative biofilms (CCURB) on brass in different media. *Corros Sci* 44(10):2291–302.
 Papavinasam S, Gould WD, Macleod A, Revie RW, Attard M. 2004. *Biosensor Development for Monitoring of Activity of Sulfate-reducing Bacteria in Oil and Natural Gas Pipelines*. US Patent No 6,673,222.
 Sooknah R, Papavinasam S, Attard M, Revie R, Gould W, Dinardo O. 2008. Performance of An Enzyme Electrode Designed for a Sulfide Monitoring Biosensor. *Journal of ASTM International* 5(6).
 Vincke E, Boon N, Verstraete W. 2001. Analysis of the microbial communities on corroded concrete sewer pipes—a case study. *Appl Microbiol Biotechnol* 57(5):776–85.
 Zuo RJ, Wood TK. 2004. Inhibiting mild steel corrosion from sulfate-reducing and iron-oxidizing bacteria using biofilms. *Applied Microbiol Biotechnol* 65(6):747–753.

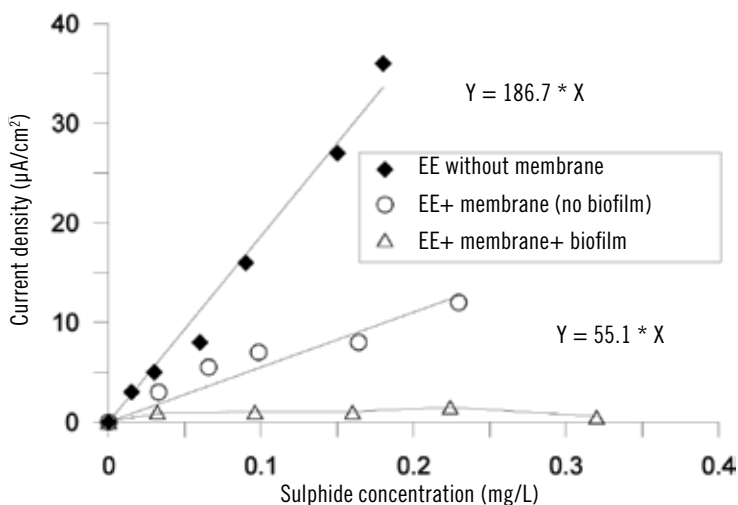


FIGURE 3: Calibration lines of EE with and without the membrane and steady-state current reading of EE with the biofilm grown membrane.



DÉVOILEMENT DE LA PLAQUE EN L'HONNEUR DE SIR JOHN KENNEDY

Le vendredi 5 mars 2010, la Commission des lieux et monuments historiques du Canada du Canada a dévoilé, dans l'édifice du port de Montréal, une plaque commémorative faisant de Sir John Kennedy une « personne d'importance historique nationale »

Né de parents écossais, dans Grenville County, en 1838, Sir John Kennedy connut une carrière diversifiée dans le domaine du génie, commençant à titre d'apprenti dans les bureaux de T.C. Keefer. En 1863, il était nommé arpenteur adjoint par le gouvernement municipal de Montréal. Par la suite, il participa à divers chantiers, et notamment aux infrastructures urbaines et à la construction des chemins de fer.

Les réalisations les plus importantes de carrière, qui lui valurent sa grande réputation, prirent place alors qu'il était chef ingénieur au port de Montréal, de 1875 à 1907. La reconstruction du port, qui comportait le dragage du St-Laurent entre Québec et Montréal, l'ajout de quatre quais et la reconstruction de et la modernisation du port, créa des installations portuaires de calibre international qui contribuèrent énormément à la croissance de Montréal et au développement du pays tout entier.

Sir John Kennedy participa également à l'essor du génie au Canada et s'employa à rehausser le prestige de la profession. Il fut vice-président fondateur de la première Société canadienne des ingénieurs

civils et en fut le président en 1892. Il fut aussi membre fondateur de la « Canadian Engineering Standards Association » (devenue l'Association canadienne de normalisation), et il fut fait chevalier en 1916.

À la cérémonie, le Gouvernement du Canada était représenté par le sénateur David Angus, qui représentait le ministre de l'Environnement, monsieur Jim Prentice. L'ancien président de l'ICI, Rémy Dussault, a exposé les grandes lignes de la carrière de Sir John Kennedy. La SCGC était représentée par les anciens présidents Peter Wright, Jules Houde et Alistair MacKenzie, le directeur exécutif Doug Salloum et la directrice des Communications, Louise Newman.

PHOTO : M. Antonio Boemi, vice-président, croissance et développement, Administration portuaire de Montréal, L'honorable W. David Angus, sénateur, représentant du ministre canadien de l'Environnement et ministre responsable de Parcs Canada, l'honorable Jim Prentice, Madame Helen Fotopoulos, Membre du comité exécutif responsable de la Culture, du Patrimoine, du Design et de la Condition féminine, Ville de Montréal, Monsieur Rémy Dussault, représentant, Institut canadien des ingénieurs. Photo Credit : Normand Rajotte/Parcs Canada

DADDY, WHY DIDNT YOU GALVANIZE THIS?

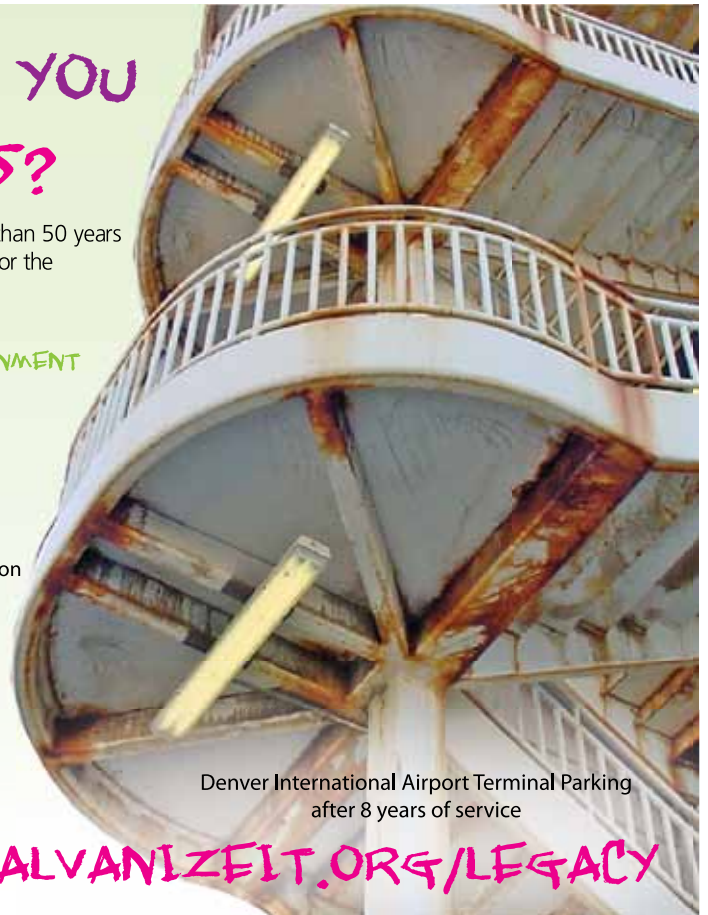
Don't leave a legacy of corrosion. Hot-dip galvanizing provides more than 50 years of corrosion protection and is 100% recyclable. Create a foundation for the future with a durable, sustainable coating for generations to enjoy.

AND THE ENVIRONMENT

Protecting Steel for Generations

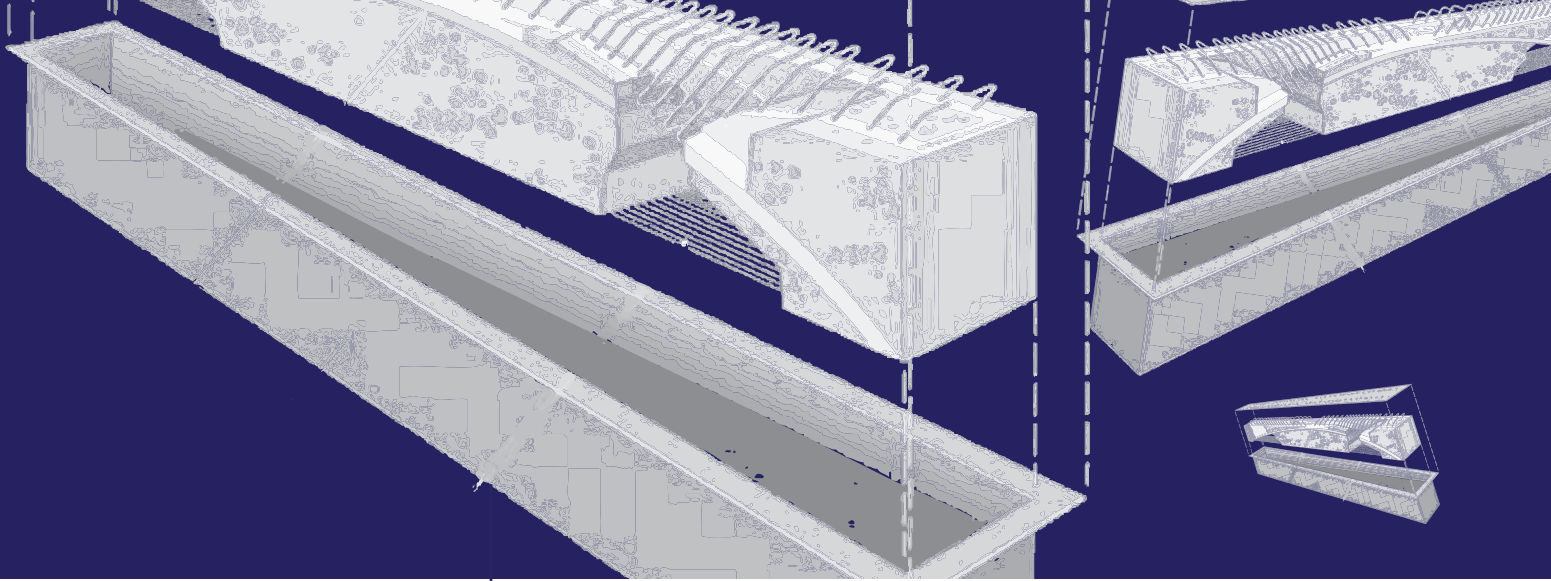


American Galvanizers Association



Denver International Airport Terminal Parking after 8 years of service

WWW.GALVANIZEIT.ORG/LEGACY



John R. Hillman PE, SE

President & Founder
HC Bridge Company, LLC, Wilmette, IL, USA

Hybrid-composite beams—a sustainable structural solution

ABSTRACT

The “Hybrid-Composite Beam” (HCB), is a new type of structural member developed for use in bridges and other structures. The HCB is comprised of three main sub-components that are a shell, compression reinforcement and tension reinforcement. The shell is comprised of a fiber reinforced plastic (FRP) box beam. The compression reinforcement consists of concrete which is pumped into a profiled conduit (generally an arch) within the beam shell. The tension reinforcement consists of carbon, glass or steel fibers anchored at the ends of the compression reinforcement. The HCB combines the strength and stiffness of conventional concrete and steel with the lightweight and corrosion advantages of advanced composite materials. What results is a new and cost effective alternative for major infrastructure projects using state-of-the-art sustainable structures that is safe, lightweight, corrosion resistant and with a greatly reduced carbon footprint. This paper will focus on the development of the HCB, with emphasis on successful deployment on major structures in North America.

THE CONCEPT

Throughout the evolution of structural engineering, the most significant advances have been founded on simple concepts. For example, by placing blocks of stone sequentially along a circular curve, the first arch structures were created. Centuries later, iron

and steel made it possible to span greater distances with much lighter structures. In 1879, Francois Hennebique developed concrete structures with steel tension reinforcement. In 1907, Eugene Freyssinet designed the first concrete bridges to employ pre-stressed steel reinforcement. Each of these advances in structural engineering sought to employ a more efficient use of building materials, generally through a combination of building materials. Further, these innovations have always been predicated on simple fundamental principals of structural behavior and willingness by the designer to deviate from traditional form in an effort to push the envelope of structural efficiency.

It is this same motivation that has led to the development of the Hybrid-Composite Beam or HCB. The HCB is comprised of three main sub-components as identified in Figure 1, that are a fiber reinforced polymer (FRP) shell, compression reinforcement and tension reinforcement. The compression reinforcement consists of self-consolidated concrete (SCC) which is pumped into a profiled conduit within the interior volume of the beam shell. The tension reinforcement consists of a high-strength, galvanized pre-stressing strands that run along the bottom flange of the beam and that are infused with the same vinyl ester resin during fabrication of the beam shell. In its most simplistic embodiment, the beams are simply supported and the profile of the compression reinforcement follows a parabolic curve,

emulating the funicular shape of the applied dead load. The vertical component of the thrust in the compression arch also results in a dramatic reduction in the amount of shear that has to be carried by the webs of the FRP shell. In this embodiment, the beam essentially functions like a tied-arch in a glass box. The same technology can be employed to manufacture beams with variable depths or widths. The beams can also be made continuous over several supports with simplistic splicing technology using the same materials.

Throughout the course of development of the HCB, the goal has been to develop a bridge system that exploits the inherent benefits of FRP materials, but at the same time is compatible with the types of conventional structures. What results is a new alternative for rebuilding the world's infrastructure with structures having the following characteristics:

- **LIGHTWEIGHT**—1/10th the weight of concrete and 1/3rd the weight of steel.
- **SAFE**—Internal redundancy and serviceability design result in capacities that greatly exceed code requirements. Reduced mass and resilient, energy absorbing materials offer excellent resistance and elastic response to seismic forces.
- **REDUCED CARBON FOOTPRINT**—Beams use 80% less cement, one of the largest contributors to the carbon footprint. They also require 75 to 80% fewer trucks for shipping and smaller cranes for erection for reduced emissions.
- **CONGESTION RELIEF**—Lighter, modular bridge system allows for “Accelerated Bridge Construction”.
- **SUSTAINABILITY**—No painting, rusting, cracking or spalling provides for “100+ Year Service Life”.

DESIGN ASPECTS OF THE HCB

Although the HCB contains materials that are generally new to most practicing structural engineers, with a basic understanding of the mechanics of Bernoulli-Euler beam theory and a working knowledge of standard bridge design codes, it is not difficult to assess the load carrying capacity of the HCB. For the most part, the controlling limit state for the HCB typically tends to be live load deflections. Although the FRP shell laminates have reasonably high strengths, on the order of 414 MPa, they also

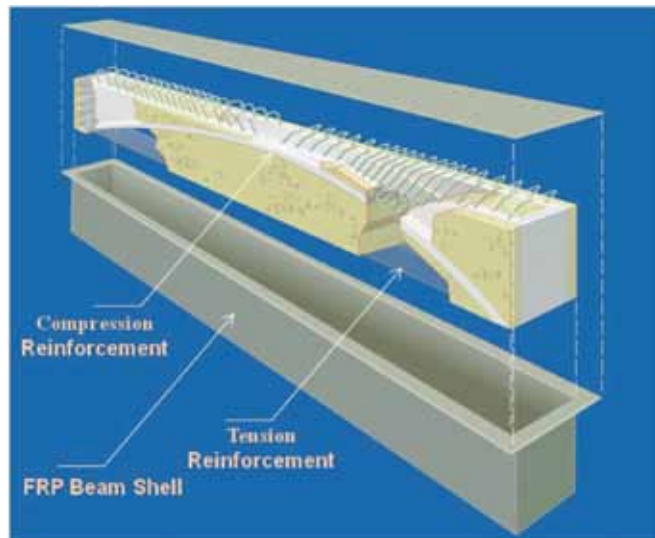


FIGURE 1: Fragmentary Perspective of HCB.

have a relatively low modulus of elasticity at 22,000 Mpa. The laminate thicknesses are also relatively thin at 5 mm. Subsequently most of the stiffness of the HCB is derived from the concrete arch and the tension steel in the bottom flange of the beam. The HCB Bridge also derives a great deal of its stiffness from the composite action between the HCB and the supported concrete deck. Once the deflection limit state has been met, there is usually more than adequate capacity to satisfy the factored demand for bending. Resistance to bending in the HCB can be calculated from strain compatibility and force equilibrium, similar to a reinforced concrete beam. The only major difference is that to get the exact solution, it is necessary to consider the contributions from the beam flanges and webs, in addition to the concrete and steel.

Shear behaviour of the HCB is equally as intriguing as bending and perhaps a bit more complex. In the HCB, shear resistance is facilitated by three mechanisms acting in concert. To start with, the primary reason for the arch shape of the compression reinforcing in the HCB is to carry a significant portion of the shear as direct compression forces down the thrust line and into the bearings. Another component of the shear mechanism is that the quad-weave fabrics in the HCB shell provide tremendous shear capacity due to the +/- 45 degree plies in the laminate. Finally, the third mechanism involves a thin concrete web (typically on the order of 75 mm) that extends vertically along the longitudinal centerline of the beam between the top of the arch and the bottom of the supported deck. This concrete

web is actually in fluid communication with the arch concrete when cast. Further, the diagonal shear connectors (galvanized reinforcing bars) extending from the arch to the deck provide for the most efficient reinforcing of this concrete web.

VALIDATION OF DESIGN BY FIELD LOAD TESTING

Railroad Test Bridge, Pueblo, CO.

The first HCB Bridge deployed under live loads was the railroad bridge constructed under the HSR-IDEA project shown in Figure 2. After more than ten years of research the long journey of HCB development culminated with the live load test of a 9.32 m span on the Association of American Railroad's (AAR) test track at the Transportation Technology Center, Inc. (TTCI) in Pueblo, CO on November 7, 2007.

The railroad bridge exemplifies the optimization of rapid installation as it relates to Accelerated Bridge Construction of ABC. Many railroad bridges are installed on active, revenue service tracks where traffic interruptions can often be limited to only 8 hours for a span replacement. For an HCB installation under these conditions, it is necessary to precast the arches as well as the deck and ballast curbs. Since its initial installation, the HCB Railroad Bridge has been subjected to over 150 Million Gross Tons (MGT) of heavy axle rail cars, each weighing approximately 1,422 kN. This is roughly equivalent to 750,000 cycles of fatigue. To date, there is no perceived change in the performance based on numerous strain gages and string pots to measure deflections and strains.



FIGURE 2: Live Load Test—Railroad Bridge.



FIGURE 3: Erecting HCB with 30 tonne Crane.



FIGURE 4: Picking 2 HCB's with Excavator.



FIGURE 5: HCB Planks Ready for Deck.

High Road Bridge

The first permanent HCB highway bridge was the High Road Bridge in Lockport Township, Illinois, opened in August of 2008. The framing plan for the High Road Bridge demonstrates a very conventional bridge system. The bridge itself is a 17.4 m single span bridge that carries two lanes of traffic over Long Run Creek. The superstructure is comprised of six 1,067 mm deep by 508 mm wide HCB's supporting a con-

ventional 200 mm reinforced concrete deck with an out-to-out dimension of 13.15 m and a curb-to-curb width of 12.2 m. The HCB's are spaced at 2.24 m centers. The erection advantages of the HCB can be seen in Figure 3.

Route 23 Bridge

Another example of an HCB Bridge with a slightly different framing configuration is the recently completed Route 23 Bridge

over Peckman Brook in Cedar Grove, New Jersey shown in Figures 4 and 5. In this bridge, the HCB's were still erected as empty shells, with the concrete arches and deck cast-in-place. The major difference in comparison to the High Road Bridge was that the HCB units for Route 23 were designed as a direct replacement for a hollow core, prestressed concrete plank bridge. Each HCB plank was 457 mm deep by 1,830 mm wide with a total span length of 9.45 m. The cross-section of the bridge included four lanes of traffic for a curb-to-curb width of 14.63 m and two 2.74 m sidewalks for a total bridge width of 20.12 m. The HCB units under each sidewalk included an 1,830 mm wide section and a 915 mm wide section. The units under the sidewalk were also 432 mm deep for a span-to-depth ratio of span/22.

Another unique feature of the units for the New Jersey Bridge had to do with the internal configuration of the planks. Each unit contained four vertical webs confining three internal cells. Only the outside two cells contained 100 mm arches. The center cell was only comprised of low density foam. It also became evident in design that both strength and serviceability limit states could be controlled simply by adding a couple of additional layers of glass in the bottom flanges in place of the high strength steel. Again, the performance was validated through laboratory testing prior to deployment.

CONCLUSIONS

It is human nature to offer recognition to projects of scale, yet the most significant impacts to technology often start with simple concepts. The HCB exemplifies this philosophy. Although the first deployments have been on small bridges, such as the High Road Bridge depicted in Figure 3, the technology serves as the catalyst for a quantum leap in bridge technology. The introduction of the HCB results in an innovative, cost effective and sustainable advancement in engineering with far reaching socioeconomic impacts. The HCB provides a revolutionary bridge technology that demonstrates a commitment by the civil engineering community to not only rectify the state of our decaying infrastructure, but also to provide a solution to this problem that will reduce the burden of decaying infrastructure for future generations. ■

R.V. Anderson Associates Limited
engineering · environment · infrastructure



water supply

wastewater

municipal infrastructure

transportation

structures + tunnels

urban development

architecture + building services

environmental management

electrical, SCADA and

telecommunications

toronto

niagara

ottawa

sudbury

london

moncton

fredericton

mumbai

tel 416 497 8600

www.rvanderson.com



CONFERENCE CHAIRS' REMARKS:

Peter Rasmussen, P.Eng., CSCE 2010 Conference Chair
Doug McNeil, P.Eng., CSCE 2010 Honorary Chair

On behalf of the Local Organizing Committee, we would like to extend a warm invitation to join us for the CSCE Annual General Meeting and Conference in Winnipeg, June 9–12. We trust that the conference will be a professionally rewarding experience for all delegates, as well as an opportunity to network with colleagues and friends.

The venue for the conference is the Fairmont Winnipeg, perhaps Winnipeg's finest hotel for a conference of this size. The hotel is located in the heart of the city, within easy walking distance to most of the major attractions including the Forks, the Legislative Building, the St. Boniface area, and the new Human Rights Museum currently under construction. A block of rooms have been reserved for delegates at a substantially reduced rate. Please book your room through the conference website.

The four-day program will include two technical workshops on the first day and technical sessions over the following two and a half days. In addition to the General Conference, there will be four specialty conferences: 11th International Environmental Specialty Conference; 2nd International Structural Specialty Conference; 8th International Transportation Specialty Conference; and 2nd Specialty Conference on Disaster Mitigation. A number of excellent speakers have been confirmed for the conference. The conference will also offer the option of some technical tours, including a visit to the Red River Floodway which has protected the City of Winnipeg from flooding since the late 60s, a visit to Winnipeg's brand new water treatment plant, as well as a tour of Manitoba Hydro's new office tower which is recognized as one of the most advanced and sustainable large office buildings in North America.

On the first full day of the conference (June 10), we invite you to join us for an optional off-site social event—an evening in the company of the voyageurs at the historic Fort Gibraltar. Space is limited, so register early if this is of interest to you. On the second full day of the conference (June 11), we will have the Annual General Meeting following the lunch, and the Awards Banquet in the evening, where we will honour new award recipients and induct new CSCE Fellows.

Once again, please join us for the CSCE 2010 Annual Conference in Winnipeg. We hope to count you among our delegates. ■

REMARQUES DES PRÉSIDENTS DU CONGRÈS :

Peter Rasmussen, ing., président du congrès de 2010 de la SCGC
Doug McNeil, ing., président honoraire du congrès de 2010 de la SCGC

Au nom du comité organisateur local, nous vous invitons à être des nôtres à l'occasion du congrès et de l'assemblée générale annuelle de la SCGC, à Winnipeg, du 9 au 12 juin. Nous espérons que le congrès sera une expérience professionnelle enrichissante pour tous les délégués, ainsi qu'une occasion de raffermir les liens avec les amis et les collègues.

Le congrès se déroulera à l'hôtel Fairmont Winnipeg, probablement le meilleur établissement de Winnipeg pour un congrès de cet envergure. L'hôtel est situé au cœur de la ville, à une distance de marche des principales attractions comme le confluent, le Palais législatif, le quartier de St-Boniface et le nouveau Musée des droits de la personne, présentement en construction. Un bloc de chambres a été réservé à l'intention des délégués à des prix très avantageux. Veuillez réserver en utilisant le site web du congrès.

Le programme de quatre jours comporte deux ateliers techniques dès le premier jour et des séances techniques étalées sur les deux journées et demie suivantes. En plus du congrès général, il y aura quatre conférences spécialisées : la 11^e conférence internationale spécialisée sur le génie de l'environnement, la 2^e conférence internationale spécialisée sur le génie des structures, la 8^e conférence internationale spécialisée sur le génie des transports et la 2^e conférence spécialisée sur l'allègement des désastres. Nombre d'excellents conférenciers ont confirmé leur présence au congrès. Le congrès comporte aussi des visites techniques, dont une au canal de dérivation de la rivière Rouge, qui protège la ville de Winnipeg des inondations depuis les années soixante, une visite à la nouvelle usine de traitement des eaux de Winnipeg et une visite du nouveau siège social de Manitoba Hydro, reconnu comme l'édifice à bureaux le plus avancé et le plus durable en Amérique du Nord.

Le premier jour du congrès (le 10 juin), nous vous invitons à une réception en soirée, chez les anciens coureurs de bois, au vieux fort Fort Gibraltar. Le nombre de places étant limité, inscrivez-vous au plus tôt. Le deuxième jour du congrès (le 11 juin), nous aurons l'assemblée générale annuelle, après le déjeuner, et le banquet des lauréats, en soirée, au cours duquel nous rendrons hommage aux gagnants des prix et aux nouveaux « Fellows » de la SCGC.

Soyez donc des nôtres au prochain congrès annuel de la SCGC! ■



Formerly **pcaSlab & ADOSS**

spSlab is highly efficient in helping engineers analyze, design and investigate reinforced concrete floor systems.

Like its predecessor ADOSS and pcaSlab, it analyzes both two-way slab systems as well as one-way slab and beam systems.

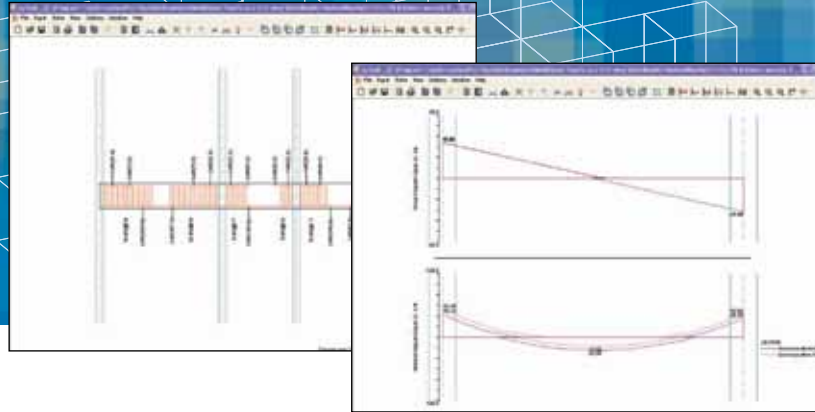
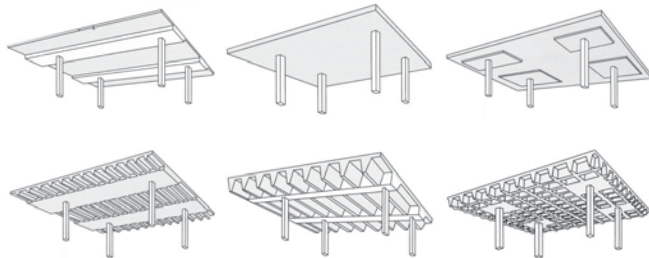
spSlab continues to support ACI 318 (American) and CSA.A 23.3 (Canadian) codes in both English and metric units, including the latest editions 318-08 and 23.3-04.

Analysis and design tools in spSlab are provided for the following systems:

- > Simple and continuous beams
- > One-way slabs
- > Two-way flat plates
- > Two-way flat slabs (with drop panels)
- > Two-way flat slab with slab bands
- > One-way pan joist systems (standard modules)
- > One-way skip joist systems (wide modules)
- > Two-way joist systems (waffle slabs)
- > Two-way slab band systems

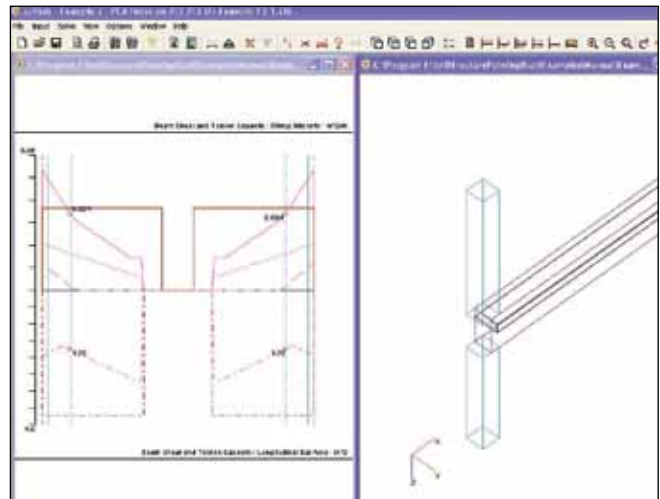
This program incorporates torsion into shear design and investigation of beam systems. Shear capacity including torsion is represented in terms of required and provided area of transverse and longitudinal reinforcement.

Additional savings in both material and labor can be achieved using the moment redistribution feature. It allows up to 20% reduction of negative moments over supports reducing reinforcement congestions in these regions.



www.StructurePoint.org
847.966.4357

Many new features and options allow users maximum flexibility in achieving optimal and economical designs. spSlab can perform strength investigation for evaluation and/or modifications of existing structures saving users time crosschecking designs with design code provisions.



spBeam includes only beam and one-way slab system capabilities and is available as a limited version of spSlab.

Flexible licensing options include both hardware and software protection for standalone and network licensing. Commuter and corporate licensing along with maintenance subscription provides a wide spectrum of enhanced customer service, engineering services and technical support to help you keep your projects profitable and on schedule.

Designed with the engineer in mind, spSlab, combines beam and slab design tools to help you work more quickly, simply and accurately.

Work quickly.
Work simply.
Work accurately.

StructurePoint's Productivity Suite of powerful software tools for reinforced concrete analysis & design

sp wall

Finite element analysis & design of reinforced, precast ICF & tilt-up concrete walls

sp beam

Analysis, design & investigation of reinforced concrete beams & one-way slab systems

sp column

Design & investigation of rectangular, round & irregularly shaped concrete column sections

sp slab

Analysis, design & investigation of reinforced concrete beams & slab systems

sp mats

Finite element analysis & design of reinforced concrete foundations, combined footings or slabs on grade

StructurePoint's suite of productivity tools are so easy to learn and simple to use that you'll be able to start saving time and money almost immediately. And when you use StructurePoint software, you're also taking advantage of the Portland Cement Association's more than 90 years of experience, expertise, and technical support in concrete design and construction.

Visit StructurePoint.org to download your trial copy of our software products.

For more information on licensing and pricing options please call **847.966.4357** or e-mail info@StructurePoint.org.

CSCE 2010—TECHNICAL PROGRAM

Ehab El-Salakawy, Ph.D., P.Eng., CSCE 2010 Technical Program Chair,
Department of Civil Engineering, University of Manitoba

The theme of the 2010 CSCE Annual Conference to be held in Winnipeg from June 9–12 is “Engineering a Sustainable World”. Four Specialty Conferences will be held in conjunction with the General Conference: the 11th International Environmental Specialty Conference; the 2nd International Structural Specialty Conference; the 8th International Transportation Specialty Conference; and the 2nd Specialty Conference on Disaster Mitigation.

The conference is intended to provide a forum for the presentation of recent developments in all areas of civil engineering, as well as an opportunity for national and international delegates from industry, government and academia to share knowledge, to learn about new and innovative technologies in the different areas of civil engineering, and to discuss future directions. A total of approximately 210 technical papers from 11 countries have been accepted for presentation and publication in the conference proceedings.

The abridged versions of two papers, as a sample of the papers presented in the conference, are published in this issue of the *Canadian Civil Engineer*. In addition to the topics covered by the Specialty Conferences, the two and half day long Technical Program includes papers covering a wide range of topics including, but not limited to, hydrotechnical engineering, geotechnical engineering, construction management, sustainable infrastructure, innovation in civil engineering systems, codes and standards, case studies, structural health monitoring, engineering mechanics, civil engineering materials, civil engineering history and engineering education. There is definitely something for everyone.

Presentations by four distinguished guest speakers have been confirmed. Doug McNeil (Manitoba Infrastructure and Transportation), Randy Raban (Manitoba Hydro), Neb Erakovic (Halcrow Yolles) and Frank Albo (University of Cambridge) will give talks of general interest to all civil engineers.

The Technical Committee of the 2010 CSCE Annual Conference looks forward to welcoming all delegates to Winnipeg and promises to have interesting talks on “Engineering a Sustainable World”. ■

PROGRAMME TECHNIQUE—SCGC 2010

Ehab El-Salakawy, Ph.D., ing., président du programme technique—
SCGC 2010, Département de génie civil, Université du Manitoba

Le thème du congrès annuel de la SCGC qui aura lieu du 9 au 12 juin 2010 à Winnipeg est « Des solutions de génie pour un monde durable ». Quatre conférences spécialisées se tiendront en même temps que le congrès général : la 11^e conférence internationale spécialisée sur le génie de l’environnement; la 2^e conférence internationale spécialisée sur le génie des structures; la 8^e conférence internationale spécialisée sur le génie des transports; et la 2^e conférence spécialisée sur l’allègement des désastres.

Le congrès se veut un forum pour la présentation des derniers développements dans tous les domaines du génie civil, ainsi qu’une occasion pour les délégués nationaux et internationaux de l’industrie, du gouvernement et des universités de mettre en commun leurs connaissances, de se renseigner sur les technologies nouvelles et novatrices dans les différents secteurs du génie civil, et de discuter des orientations futures. Un total d’environ 210 communications techniques émanant de 11 pays ont été retenues pour présentation et publication dans les actes du congrès.

À titre d’exemples des communications soumises au congrès, L’ICC publie dans ce numéro les résumés de deux communications retenues. En plus des sujets couverts par les conférences spécialisées, le programme technique de deux journées et demie comporte des communications sur une vaste gamme de sujets comme le génie hydrotechnique, le génie géotechnique, la gestion de la construction, les infrastructures durables, l’innovation dans les systèmes en génie civil, les codes et les normes, les études de cas, la surveillance de la santé des structures, la mécanique, les matériaux, l’histoire du génie civil et la formation en génie civil. Il y a vraiment de tout pour tous!

Des exposés par quatre conférenciers de marque ont été confirmés : Doug McNeil (Manitoba Infrastructure and Transportation), Randy Raban (Manitoba Hydro), Neb Erakovic (Halcrow Yolles) et Frank Albo (Université de Cambridge) traiteront de sujets d’intérêt pour tous les ingénieurs civils.

Le comité technique du congrès annuel de la SCGC pour 2010 compte sur votre présence à Winnipeg et vous promet des débats intéressants sur le thème « des solutions de génie pour un monde durable ». ■

THANKS TO SPONSORS

Fariborz Hashemian, P.Eng.
Sponsorship coordinator

The Local Organizing Committee for the 2010 Annual General Meeting and Conference gratefully acknowledges the generous financial support provided by industry and government. This support will contribute significantly to the success of the conference and will allow students to attend at partly subsidized rates. The list of sponsors can be found at the conference web site (www.csce.ca/2010/annual).

MERCI AUX COMMANDITAIRES

Fariborz Hashemian, ing.
coordonnateur des commandites

Le comité organisateur local du congrès annuel et de l’assemblée générale de 2010 remercie les industries et les gouvernements qui ont fourni un appui financier. Cette aide constitue une importante contribution au succès du congrès et permettra à des étudiants d’y assister moyennant des frais modiques. La liste des commanditaires est accessible sur le site web du congrès, à l’adresse électronique www.csce.ca/2010/annual.



11TH INTERNATIONAL ENVIRONMENTAL SPECIALTY CONFERENCE (IESC-11)

Co-Chairs:

Professor J. Patrick Hettiaratchi,
University of Calgary

Jong Hyuk Hwang, University of Manitoba

Every other year, CSCE holds an environmental engineering specialty conference as part of the Annual General Meeting and Conference (AGMC). Reflecting the broad nature of environmental engineering/science practice in Canada, papers are usually presented on a wide variety of topics dealing with water, air and land pollution issues, contaminated sites, solid and hazardous waste issues, and specific air, water and land treatment technologies. In this year's environmental engineering conference (IESC 11), in line with the AGMC theme of *Engineering a Sustainable World*, a number of sessions related to sustainable development in addition to sessions on traditional topics are planned.

Approximately 40 papers have been reviewed and accepted for presentation at the conference. Although most papers deal with traditional environmental engineering and science topics, some deal with sustainability issues and subjects of current interest. IESC-11 will include presentations on contaminants of emerging concern (CEC), climate change and greenhouse gas emission control, leading-edge techniques for air, water and waste treatment, energy efficiency and resource conservation in civil engineering construction practice and sustainable communities. Presentations will cover almost all areas of vital interest to civil engineers engaged in environmental engineering/science practice and application of sustainable development principles in civil engineering practice.

We thank all those who assisted in the development of the technical program, including authors/presenters, reviewers of manuscripts and the international scientific advisory committee. ■

LA 11^E CONFÉRENCE INTERNATIONALE SPÉCIALISÉE SUR LE GÉNIE DE L'ENVIRONNEMENT (IESC-11)

Coprésidents :

Professeur J. Patrick Hettiaratchi,
Université de Calgary

Jong Hyuk Hwang, Université du Manitoba

Un an sur deux, la SCGC organise une conférence spécialisée sur le génie de l'environnement dans le cadre de son congrès annuel. Réflétant le caractère très vaste de la pratique du génie et de la science de l'environnement au Canada, les communications portent généralement sur une foule de sujets comme la pollution de l'eau, de l'air et du sol, les sites contaminés, les déchets solides et les déchets dangereux, les technologies pour le traitement de l'eau, de l'air et des sols. Lors de la conférence de cette année sur le génie de l'environnement, en parallèle avec le thème du congrès général « *Solutions de génie pour un monde durable* », il y aura plusieurs séances sur le développement durable, en plus des séances sur les sujets traditionnels.

Une quarantaine de communications ont été étudiées et acceptées pour présentation à la conférence. Bien que la plupart portent sur des sujets traditionnels en matière de science et de génie de l'environnement, certaines traitent des problèmes de durabilité et de sujets d'actualité. Cette conférence spécialisée comporte aussi des exposés sur les nouveaux contaminants, les changements climatiques et le contrôle des gaz à effets de serre, les techniques d'avant-garde pour le traitement de l'air, de l'eau et des déchets, l'efficacité énergétique et la conservation des ressources dans les pratiques en matière de construction, et les communautés durables. Les exposés traiteront de presque tous les domaines présentant un intérêt vital pour les ingénieurs civils engagés dans la pratique du génie/des sciences de l'environnement et dans l'élaboration de principes de développement durable pour la pratique du génie.

Nous remercions toutes les personnes qui ont contribué à l'élaboration du programme technique, et notamment les auteurs, présentateurs, examinateurs des manuscrits ainsi le comité scientifique consultatif international. ■

2ND INTERNATIONAL STRUCTURAL SPECIALTY CONFERENCE (ISSC-02)

Co-Chairs:

Rick Haldane-Wilson, P. Eng., MCSCE,
Wardrop Engineering Inc., Dr. Mamdouh

El-Badry, P. Eng., MCSCE, University of
Calgary, and Amr El-Ragaby, P. Eng., MCSCE,
University of Manitoba

The 2nd International Structural Specialty Conference (ISSC-02) will be part of the 2010 CSCE Annual Conference that will take place in Winnipeg, Manitoba, Canada between June 9 and June 12. The specialty conference, co-chaired by Rick Haldane-Wilson of Wardrop Engineering, Mamdouh El-Badry of the University of Calgary, and Amr El-Ragaby of the University of Manitoba, will provide a forum for sharing of knowledge and information on various structural engineering topics with a focus on engineering a sustainable world. The technical sessions will contain presentations, by distinguished researchers and practitioners that will address the needs of our ageing infrastructure from a structural perspective. We, the conference co-chairs, are pleased by the number and quality of the submissions that have been received and look forward to the opportunity to meet and share this knowledge with our colleagues and welcome you to Winnipeg in June 2010. ■

SECOND SPECIALTY CONFERENCE ON DISASTER MITIGATION (SCDM-2)

Chair:

Raafat El-Hacha, Ph.D., P.Eng, MCSCE,
University of Calgary, Alberta, Canada

On behalf of the organizing committee, it is my pleasure to invite you to the Second Specialty Conference on Disaster Mitigation, SCDM-2, to be held in conjunction with the 2010 CSCE Annual Conference in Winnipeg, Manitoba, June 9–12, 2010. In keeping with the conference theme, “*Engineering a Sustainable World*”, the aim is to bring together academics, researchers and practitioners from around the world in various fields of disaster mitigation, to present, review and debate recent achievements and innovative solutions as well as address and define the challenges.

It is estimated that disasters cause global economic losses of \$10 billion per week. More than 100,000 people die each year as a result of disasters. Around the world, natural disasters regularly threaten roads, bridges, railroads, airports, schools, water and wastewater systems, mass transit systems, dams, energy distribution facilities, ports, harbours, and river navigation facilities. Terrorism is merely one threat among the many regularly faced by our infrastructure. Blast protection, design to prevent progressive collapse, explosions and radiation, infrastructure security, design guidance for physical security and blast, and cost effective decision making for blast mitigation are all among the hot topics. Other research areas include disaster response, impacts of disasters on the economy and environment, disaster and environmental policies and education, disaster recovery and insurance systems, emergency response systems, materials and systems for structural fire protection, and vulnerability and response of structures to fire.

All papers were reviewed by experts in the subject area and accepted for publication and presentation at the conference. The conference will provide you with a global perspective through paper presentations from different countries. Four non-parallel sessions on Thursday and Friday will

2^E CONFÉRENCE SPÉCIALISÉE SUR L'ALLÈGEMENT DES DÉSASTRES

Présidents :

Raafat El-Hacha, Ph.D., ing, MSCGC,
Université de Calgary, Alberta, Canada

Au nom du comité organisateur, j'ai le plaisir de vous inviter à la 2^e conférence spécialisée sur l'allègement des désastres (SCDM-2), qui aura lieu en même temps que le congrès annuel de la SCGC de 2010, à Winnipeg, MB, du 9–12 juin 2010. Dans l'esprit du thème du congrès, « *Solutions de génie pour un monde durable* », le but est de réunir des universitaires, des chercheurs et des praticiens œuvrant dans le monde entier dans divers domaines reliés à l'allègement des désastres afin de présenter et de discuter des dernières réussites et des solutions novatrices dans le domaine, tout en traitant des défis présents et à venir.

On estime que les désastres entraînent des pertes économiques globales de 10 milliards de dollars à chaque semaine. Plus de 100 000 personnes meurent chaque année à la suite de désastres. À travers le monde, les catastrophes naturelles menacent périodiquement les routes, les ponts, les chemins de fer, aéroports, écoles, aqueducs, égouts, transports collectifs, barrages, réseaux de distribution d'énergie, ports, et la navigation fluviale. Le terrorisme n'est qu'une seule des multiples menaces que doivent constamment affronter nos infrastructures. La protection contre les explosions, la conception en vue de prévenir l'effondrement, les explosions et la radiation, la sécurité des infrastructures, les critères de conception assurant la sécurité physique, et la prise de décisions rentables pour l'atténuation des effets des explosions sont devenus autant de sujets brûlants d'actualité. D'autres sujets de recherche ont trait à la réaction en cas de désastre, aux impacts des désastres sur l'économie et l'environnement, les politiques et la formation en matière de désastres et d'environnement, la reprise après une catastrophe et les systèmes d'assurance, les systèmes de réaction en cas d'urgence, les matériaux et les systèmes pour la protection des charpentes contre le feu, la vulnérabilité et la réaction des charpentes dans les feux.

Toutes les communications ont été revues par des experts du secteur visé et acceptées

pour fins de présentation et de publication à la conférence. La conférence vous offrira une perspective globale grâce à des communications de différents pays. Quatre séances non en parallèle se dérouleront le jeudi et le vendredi, ce qui assurera la facilité de circulation entre les séances, vous permettant d'assister aux exposés qui vous intéressent. Chaque exposé se terminera par une courte période de questions-réponses afin de faciliter la participation de l'auditoire.

Je remercie toutes les personnes qui ont contribué à l'élaboration du programme technique, et notamment les auteurs et les présentateurs, qui ont accepté de consacrer du temps à la préparation et au partage de leur travail. Je remercie également les nombreuses personnes qui ont agi comme réviseurs ou membres du comité scientifique international. ■

provide the flexibility to move between sessions and see the presentations that most interest you. Each presentation will conclude with a short question and answer period to encourage audience participation.

I thank all those who assisted in the development of the technical program, especially the paper authors and presenters for the time they have taken to prepare and share their work. I also extend my appreciation to the many reviewers and members of the International Scientific Committee. ■



8TH INTERNATIONAL TRANSPORTATION SPECIALTY CONFERENCE

Co-Chairs:

L. Kavanagh, P.Eng., University of Manitoba

L. Fu, Ph.D, P.Eng., University of Waterloo

The 8th International Transportation Specialty Conference (ITSC) will be held in "The Heart of the Continent" Winnipeg, Manitoba from June 9–12, 2010. The ITSC is being hosted under the auspices of the CSCE Annual Conference and this year's gathering promises to be most enlightening. The ITSC will bring together academics, researchers, and practitioners from across Canada and the globe to engage and challenge each other through discussions and presentations in the fields of transportation and highway engineering. Thanks to the hard work of our author contributors, our international panel of experts was able to review and select over forty quality papers for presentation at the conference.

This year's transportation topics cover such diverse issues as the impact of climate change on transportation infrastructure, human factors in traffic collision, and a case study of full scale instrumented test roads. The on-going researches will no doubt address the challenges faced by practitioners and contribute to the body of knowledge in the transportation field. The ITSC papers that are presented at the conference will be published in the CSCE proceedings. In keeping with this year's theme of "Engineering a Sustainable World", two ITSC guest speakers will provide their insights on developing green highways and transportation partnerships with sustainable best practices. Don't miss this opportunity to attend the 8th International Transportation Specialty conference, interact with your colleagues, and renew old acquaintances. ■

LA 8^E CONFÉRENCE INTERNATIONALE SPÉCIALISÉE SUR LE GÉNIE DES TRANSPORTS

Coprésidents :

L. Kavanagh, ing., Université du Manitoba

L. Fu, Ph.D, ing., Université de Waterloo

La 8^e conférence internationale spécialisée sur le génie des transports aura lieu au « cœur du continent », à Winnipeg, au Manitoba, du 9 au 12 juin 2010. La conférence se déroule dans le cadre du congrès annuel de la SCGC, et promet d'être très intéressante. La conférence réunit des universitaires, des chercheurs et des praticiens de tout le pays et même du monde entier, qui échangent entre eux au moyen de discussions et d'exposés dans le domaine des transports et du génie des ponts et chaussées. Grâce aux efforts de nos auteurs, nos experts internationaux ont revu et choisi plus de quarante communications de qualité qui seront présentées à la conférence.

Les sujets abordés cette année vont de l'impact des changements climatiques sur les infrastructures de transport aux facteurs humains dans les collisions, en passant par une étude de cas sur une route expérimentale grandeur nature avec tous les instruments de contrôle. Les recherches en cours traiteront des défis que doivent relever les praticiens et contribueront à l'accumulation de connaissances dans le génie des transports. Les communications soumises à la conférence seront publiées dans les comptes rendus de la SCGC. Conformément au thème de cette année (Solutions de génie pour un monde durable), deux conférenciers invités à la conférence spécialisée parleront de leurs idées quant aux « autoroutes vertes » et des partenariats dans le transport avec les meilleures pratiques durables. Ne ratez pas cette occasion de rencontrer vos collègues et de renouer avec de vieilles connaissances! ■

2^E CONFÉRENCE INTERNATIONALE SPÉCIALISÉE SUR LE GÉNIE DES STRUCTURES

Coprésidents :

Rick Haldane-Wilson, ing., MSCGC, Wardrop Engineering Inc., le professeur Mamdouh El-Badry, ing., MSCGC, Université de Calgary et Amr El-Ragaby, ing., MSCGC, Université du Manitoba

La 2^e conférence internationale spécialisée sur le génie des structures se déroulera à Winnipeg, dans le cadre du congrès annuel de 2010 de la SCGC, du 9 au 12 juin. Coprésidé par Rick Haldane-Wilson, de Wardrop Engineering, Mamdouh El-Badry, de l'Université de Calgary et Amr El-Ragaby, de l'Université du Manitoba, la conférence offrira un forum pour la mise en commun des connaissances et des renseignements sur divers sujets reliés au génie des structures dans un univers durable. Les séances techniques comporteront des exposés par de distingués chercheurs et par des praticiens sur les besoins de nos structures vieillissantes. Les coprésidents de la conférence sont ravis de la quantité et de la qualité des communications reçues et espèrent vous accueillir à Winnipeg en juin 2010. ■

TECHNICAL TOURS

Eric Christiansen, P.Eng., Manitoba Department of Infrastructure and Transportation

Tour 1 Manitoba Hydro Place

Join us for a tour of Manitoba Hydro's new headquarters building in Winnipeg, the first of the next generation of sustainable buildings integrating time-tested environmental concepts in conjunction with advanced technologies to achieve a "living building" that dynamically responds to the local climate.

The tower design forms a capital 'A' composed of two 18-storey twin office towers that rest on a stepped, three-storey, street-scaled podium. The towers converge at the north and splay open to the south for maximum exposure to the abundant sunlight. Narrow floor plates and tall floor-to-ceiling glazing allow sunlight to penetrate into the core. Automated louvre shades control glare and heat gain while radiant slabs act as an internal heat exchange with the geothermal field, which is the largest closed loop geothermal system in the province. The system is composed of 280 boreholes penetrating 125 metres (400 ft.) underground, circulating glycol which is cooled in the summer and heated in the winter by the ground source heat exchanger. A 115 metre (377 foot) tall solar chimney is a key element in the passive ventilation system that relies on the natural stack effect. In contrast to conventional North American office buildings that use recirculated air, Manitoba Hydro Place is filled with 100% fresh air, 24 hours a day, year round, regardless of outside temperatures. The podium rooftops feature deep soil intensive green roofs and accessible terraces, creating a lush landscaped outdoor amenity for employees, while also reducing stormwater runoff and providing additional thermal insulation. A reflective coating on the tower rooftops reduces the summer season cooling load and the urban heat island effect. All of these features combine to help achieve an unprecedented 60% energy savings over a typical large office tower.



Tour 2 Winnipeg's Drinking Water Treatment Plant

This tour will take you to Winnipeg's brand new drinking water treatment plant. Construction on this state of the art facility began in early 2005 and was finished in late 2009. The facility cost about \$300 million to construct and can treat 400 million litres of water a day.

The complex automated control system monitors and controls 40 processors, 140 pumps, 2,300 valves, and 1,400 instruments. The treatment processes employed in this plant are: coagulation/flocculation; dissolved air floatation; ozonation; filtration; chlorine disinfection and ultraviolet disinfection.

The treated water from Winnipeg's new water treatment plant is of higher quality than guidelines set out by Health Canada. Taste and odour episodes experienced in the past due to the presence of algae have been eliminated or significantly reduced. Also, the ultraviolet disinfection will eliminate any concerns about the possible presence of harmful parasites such as cryptosporidium and giardia. Finally, the presence of chlorination by-products such as trihalomethanes has been reduced to well below guidelines set out by Health Canada.



Tour 3 Red River Floodway

Originally constructed in 1968, the Red River floodway is an artificial flood control waterway that consists of a 47 km channel that, during flood periods, diverts part of the Red River's flow around Winnipeg to the east and discharges back into the Red River near Lockport. The original floodway could carry floodwater at a rate of up to 1,700 cubic metres per second (m³/s) and provided a 1-in-90 year level of flood protection.

In 1997, Manitoba experienced a major flood—the "Flood of the Century", which forced the evacuations of communities in the Red River Valley and came close to reaching the floodway's capacity and threatening the protection of Winnipeg. The floodway was expanded between 2005 and 2010 to increase its flood protection to a 1:700 probability of occurrence at a cost of over \$600,000,000.

Join us on a tour of the floodway inlet structure and participate in the dedication of the Winnipeg Floodway as a National Historic Civil Engineering site. ■

VISITES TECHNIQUES

Eric Christiansen, ing., ministère des
Infrastructures et des Transports du Manitoba

1^{ère} visite Manitoba Hydro Place

Venez avec nous visiter le nouveau siècle social de Manitoba Hydro, le premier de la prochaine génération d'édifices durables intégrant des notions environnementales qui ont fait leurs preuves et les technologies les plus avancées afin de créer un édifice vivant qui réagit de façon dynamique au climat local.

L'édifice en forme de « A » majuscule comporte deux tours jumelles de 18 étages reposant sur un podium incliné de trois étages. Les tours convergent au nord et s'ouvrent vers le sud pour profiter au maximum des généreux rayons de soleil. D'étroits panneaux de plancher et des vitrages pleine hauteur laissent le soleil pénétrer jusqu'au cœur de l'édifice. Des persiennes automatisées contrôlent l'éblouissement et les gains de chaleur tandis que des dalles radiantes font office d'échangeurs de chaleur avec le champ géothermique, formant le plus gros système géothermique à boucle fermée dans la province. Le système est composé de 280 puits qui pénètrent à 125 mètres (400 pieds) sous le sol, de glycol en circulation qui est rafraîchi en été et réchauffé en hiver par l'échangeur de chaleur dans le sol. Une cheminée solaire de 115 mètres (377 pieds) de haut constitue un élément clé du système de ventilation passif basé sur l'effet cheminée naturel. Par contraste avec les édifices à bureaux conventionnels d'Amérique du Nord qui utilisent de l'air recyclé, Manitoba Hydro Place est rempli à 100 % d'air frais, 24 heures par jour, à l'année, peu importe la température extérieure. Les toits du podium présentent des épaisseurs de végétation et des terrasses accessibles, ce qui crée un paysage accueillant pour le personnel tout en diminuant le ruissellement des eaux de pluie et en assurant une isolation thermique additionnelle. Un revêtement réfléchissant sur les toits des tours diminue la charge de refroidissement en été ainsi que l'effet de la chaleur urbaine. Toutes ces caractéristiques de réaliser des économies d'énergie de 60 % comparativement à une tour à bureaux ordinaire.

2^e visite L'usine de traitement de l'eau potable de Winnipeg

Cette visite vous amènera à la nouvelle usine de traitement d'eau potable de Winnipeg. La construction de cette usine d'avant-garde a débuté en 2005 pour se terminer vers la fin de 2009. La construction a coûté environ 300 millions de dollars et l'usine peut traiter 100 millions de litres par jour.

Un système automatisé complexe contrôle 40 unités de traitement, 140 pompes, 2 300 valves et 1 400 instruments. Dans cette usine, la séquence de traitement est la suivante : coagulation/floculation, flottation par air dissous, ozonation; filtration, désinfection au chlore et désinfection par ultraviolet.

L'eau traitée par la nouvelle usine est d'une qualité supérieure aux normes de Santé Canada. Les épisodes de goût et d'odeur attribuables à la présence d'algues ont été éliminés ou très diminués. En outre, la désinfection par ultraviolet élimine tout souci relié à la présence de parasites nocifs comme le cryptosporidium et la giardia. Enfin, la présence de sous-produits de la chloration comme les trihalométhanes a été ramenée à des niveaux bien inférieurs aux normes de Santé Canada.



3^e visite le canal de dérivation de la rivière Rouge

Construite en 1968, le canal de dérivation de la rivière Rouge est un canal artificiel de contrôle qui consiste en un chenal de 47 km qui, pendant les périodes de crues, détourne vers l'est une partie des eaux de la rivière Rouge et les renvoie dans la rivière Rouge près de Lockport. Le premier canal pouvait détourner jusqu'à 1 700 mètres cubes par seconde (m³/s) et assurait une protection pour des événements susceptibles de se produire 1 fois en 90 ans.

En 1997, le Manitoba a connu une inondation exceptionnelle (« l'inondation du siècle »), ce qui a forcé l'évacuation des communautés de la rivière Rouge et a presque atteint la capacité nominale du canal de dérivation, menaçant directement Winnipeg. Le canal a été agrandi entre 2005 et 2010 pour faire passer la protection pour des événements susceptibles de se produire 1 fois en 700 ans. Les travaux ont coûté plus de 600 000 000,00 \$.

Soyez des nôtres pour cette visite de l'entrée du canal et participer à la commémoration du canal de dérivation, qui deviendra un lieu historique national du génie civil. ■



COMPANION AND SOCIAL PROGRAM

Dominika Celmer-Repin, EIT, City of Winnipeg
Ruth Eden, P.Eng., Manitoba Department of
Infrastructure and Transportation

The social program of the 2010 CSCE Annual Conference includes a number of events which will make your visit to Winnipeg an unforgettable experience!

The Welcome Reception, Awards Banquet, and Closing Luncheon are included in the basic registration. Additionally, a special program has been put together for delegates and companions. Visitors can choose to participate in two tours which will reveal the beauty and magic of Winnipeg. The social event at Fort Gibraltar will provide a once in a lifetime opportunity to become immersed in the life of the “voyageur”, the infamous fur traders of the Northwest Company.

Winnipeg City Sightseeing Tour (June 10, 2010)

Tour Winnipeg, the wonderful city of trees! This tour will include the Forks National Historic site, Winnipeg’s historical “meeting place”, with its unique outdoor historic site and indoor market of shops, cafes, and restaurants.

Across the new Esplanade Riel Bridge, you will see Winnipeg’s French Quarter (St. Boniface) and the beautiful St. Boniface Cathedral, the oldest cathedral in Western Canada. The Cathedral’s cemetery features the grave of Louis Riel, the famous Métis leader and founder of Manitoba.

The tour through the Exchange District will unveil its exceptional collection of terra cotta and cut stone architecture. This thriving and unique neighbourhood is home to an array of restaurants, nightclubs, art galleries and Winnipeg’s theatre district. Its cobblestone streets and friendly pedestrian environment also contribute to its popularity as a period backdrop for today’s movie industry. The tour includes the Manitoba Legislative Building as well as the beautiful homes of Wellington Crescent!

Lunch at Terrace Fifty-Five in Assiniboine Park will mirror the “greenness” of the park with a menu that is representative of regional cuisine, emphasizing local products and suppliers. After lunch, you will tour Winnipeg’s 393-acre Assiniboine

Park and walk through the unique Leo Mol Sculpture Garden, which features bronze sculptures, porcelains, paintings, and sketches by celebrated Winnipeg artist, Leo Mol.

Royal Winnipeg Ballet and *Hermetic Code* Tour (June 11, 2010)

This tour will start with a fascinating peek into the studios of the Royal Winnipeg Ballet School, where the students of the RWB learn the precise art of dance. You will take a look inside the Wardrobe and Shoe departments and, from the Observation Room, will get a glimpse of the world-renowned company rehearsal. Following lunch, Frank Albo, creator of the *Hermetic Code*, will reveal the famous symbols and architecture that make the Legislative Building truly unique. Frank Albo will uncover trails of occult clues concealed in the building’s architecture including: hidden hieroglyphic inscriptions, numerological codes, and Freemasonic symbols so intelligently masked they have escaped historians and visitors for nearly a hundred years! You will discover that the hidden face of the building is in fact a library of coded messages and secret techniques inscribed in a Masonic language. Is it possible that the Legislative Building is really a conduit of magical power? Is the building’s location in the centre of North America a site for numinous earth energies? See for yourself!



ABOVE: Esplanade Riel Bridge.

Voyageur “Joie de Vivre” Homecoming—Fort Gibraltar (June 10, 2010)

Fort Gibraltar, situated on the banks of the Red River, allows you to travel back in time and spend an unforgettable evening as a voyageur returning home after months on the trail. The fort comes alive as costumed interpreters interact with you: voyageurs, soldiers, clerks, blacksmiths, and first nations people. Enjoy appetizers and drinks in the home of your host, La Maison du Bourgeois, where traditional musicians play until the sun goes down. Stroll through the fort and visit the trading posts, the general store, a voyageur’s cabin, a native teepee, and the fur shop. Watch a black smith as he works his craft or a woman as she weaves wool onto a loom. Try your hand at hatchet throwing or making bannock over an open fire. Wander along the banks of the Red River, and talk with first nations people who have come to the fort to trade their furs for much-needed winter supplies.

At sunset, you will be escorted into the Great Hall where a five-course buffet “festin” is being served in your honor. Traditional fiddlers, jiggers, and native hoop dancers will entertain you with lively songs and dances during dinner and for the remainder of this memorable evening. ■



PROGRAMME SOCIAL ET PROGRAMME DES CONJOINTS

Dominika Celmer-Repin, EIT, ville de Winnipeg
Ruth Eden, ing., ministère des Infrastructures et des Transports du Manitoba

Le congrès annuel de 2010 de la SCGC comporte un certain nombre d'activités sociales qui feront de votre visite à Winnipeg une expérience inoubliable!

La réception d'accueil, le banquet des lauréats et le déjeuner de clôture font partie de l'inscription de base. En outre, un programme spécial a été élaboré pour les délégués et les conjoint(e)s. Les visiteurs auront le choix entre deux visites qui leur révéleront la beauté et la magie de Winnipeg. La soirée à Fort Gibraltar sera l'occasion par excellence de goûter à la vie des coureurs de bois et des commerçants de fourrures de la Compagnie du Nord-Ouest.

Visite touristique de Winnipeg (le 10 juin 2010)

Visitez Winnipeg, la superbe ville des arbres! Cette visite comporte un arrêt au site historique national du confluent, point de rencontre historique de Winnipeg, avec son aire extérieure et son aire intérieure de boutiques, cafés et restaurants.

En face du nouveau pont de l'esplanade Riel, voyez le quartier français de Winnipeg (Saint-Boniface) et la superbe cathédrale de Saint-Boniface, la plus vieille cathédrale de l'Ouest du Canada. Le cimetière de la cathédrale renferme la tombe de Louis Riel, célèbre chef Métis et fondateur du Manitoba.

La visite du quartier de la Bourse vous fera voir une exceptionnelle collection d'architecture de terra cotta et de pierre de

taille. Ce quartier unique et prospère abrite un ensemble de restaurants, de clubs de nuit, de galeries d'art et de théâtres. La visite comporte un arrêt au Palais législatif ainsi qu'un coup d'œil sur les superbes demeures de Wellington Crescent!

Déjeuner à « Terrace Fifty-Five », dans « Assiniboine Park », pour admirer la verdure des lieux, avec un menu reflétant la cuisine régionale, suivi d'une visite de ce parc de 393 acres et d'une marche dans le jardin de sculptures Leo Mol, avec ses sculptures en bronze, ses porcelaines, ses peintures et ses esquisses de Leo Mol, célèbre artiste de Winnipeg.

Visite du « Royal Winnipeg Ballet » et du « Hermetic Code » (le 11 juin 2010)

Cette visite débute par une visite fascinante dans les studios de la « Royal Winnipeg Ballet School », où les élèves apprennent l'art de la danse. Voyez le département des chaussons et des décors, et, depuis la salle d'observation, assistez à une répétition. Après le repas, Frank Albo, créateur de « Hermetic Code », révélera les fameux symboles et l'architecture qui font du Palais législatif un édifice unique. Frank Albo dévoilera les indices cachés apparaissant sur l'édifice, comme des hiéroglyphes, des codes numérogiques, et des symboles maçonniques si brillamment dissimulés que visiteurs et historiens n'y ont rien vu pendant près d'un siècle! Vous découvrirez que la face cachée de l'édifice est en vérité un ensemble de messages codés et de secrets techniques inscrits en langage maçonnique. Ce Palais législatif pourrait-il être un long

message sur les pouvoirs magiques? Son emplacement au centre de l'Amérique du Nord est-il au cœur d'un nœud d'énergies terrestres? Venez constater en personne!

La « Joie de Vivre » des coureurs de bois— Fort Gibraltar (le 10 juin 2010)

Fort Gibraltar, situé sur les rives de la rivière Rouge, vous transporte dans le temps et vous fait vivre une soirée inoubliable comme coureur de bois qui rentre à la maison après des mois d'expédition en forêt. Apéros et consommations chez votre hôte, dans « La Maison du Bourgeois », où des musiciens de style traditionnel vous charmeront jusqu'à la nuit. Faites le tour du fort et voyez les postes de traite, le magasin général, une hutte de coureur de bois, un tipi autochtone et l'atelier des pelleteries. Voyez un forgeron exerçant son métier ou une femme qui travaille au métier à tisser. Tentez votre chance au lancer de la hache ou à la cuisson de la banique sur le feu. Flânez le long des rives de la rivière Rouge et parlez aux gens des Premières nations qui sont venus au fort pour échanger leurs fourrures contre de précieuses fournitures d'hiver.

Au coucher du soleil, vous passerez dans le grand hall où vous attendra un festin de cinq services. Violoneux, danseurs et autochtones vous raviront de leurs airs et de leurs danses pendant le repas et pendant le reste de cette soirée mémorable. ■

STUDENT PROGRAM

Dagmar Svecova, P.Eng., Ph.D.
Leonnie Kavanagh, P.Eng.

The CSCE 2010 Local Organizing Committee and the Student Affairs Committee of the Canadian Society for Civil Engineering (CSCE) is organizing a student paper competition as part of the Annual Conference. This year, more than a dozen students will be competing in this event.

New this year is a Popsicle Stick Bridge Building Competition that will take place in the evening of June 10, with the testing of the structures on June 11. Teams will be randomly composed, with the main goal of building friendships from coast to coast.

PROGRAMME ÉTUDIANT

Dagmar Svecova, ing., Ph.D.
Leonnie Kavanagh, ing.

Le comité organisateur local du congrès de 2010 de la SCGC et le comité des affaires étudiantes de la SCGC organisent un concours de communications à l'intention des étudiants dans le cadre du congrès. Cette année, plus d'une douzaine d'étudiants participeront à ce concours.

Du nouveau : un concours de construction de ponts à l'aide de bâtons de « popsicles » prendra place le 10 juin, et le jugement des œuvres sera fait le 11 juin. Les équipes seront créées au hasard, le but principal du concours étant de créer des amitiés à travers le pays.

THE RED RIVER FLOODWAY EXPANSION PROJECT

Commemoration as a National Historic Civil Engineering Site



Above: The Manitoba Legislature during the 1950 Flood—before the Red River Floodway was constructed. The 1950 flood resulted in the destruction of 10,000 homes, the evacuation of 100,000 residents, and would later be the impetus for the floodway project. / L'Assemblée législative du Manitoba pendant l'inondation de 1950, avant la construction du canal de dérivation de la rivière Rouge. L'inondation de 1950 a provoqué la destruction de 10 000 maisons, l'évacuation de 100 000 résidents, et devait justifier à toutes fins utiles la construction du canal de dérivation.



Above: At the official groundbreaking for the floodway on October 6, 1962, former Manitoba Premier Duff Roblin lifts his son onto an earth scraper used to turn the first sod to begin construction on the Red River Floodway. Also in the picture is S.V. Sigurdson, Head of Monarch Construction (Left), and Walter Dinsdale, Natural Resources Minister (Right). / Lors du début de la construction du canal de dérivation, le 6 octobre 1962, l'ancien Premier ministre du Manitoba, Duff Roblin, fait grimper son fils sur une machine qui va amorcer la construction. On reconnaît également sur la photo S.V. Sigurdson, patron de Monarch Construction (à gauche), et Walter Dinsdale, ministre des Richesses naturelles (à droite).

On June 11, 2010, the Canadian Society for Civil Engineering will recognize the Red River Floodway and its expansion as a National Historic Civil Engineering Site at a plaque unveiling in Winnipeg, Manitoba.

The Red River Floodway is considered to be one of the most important public infrastructure projects in Manitoba's history. Since its construction, it has protected the City of Winnipeg, Manitoba's capital city, on many occasions and prevented widespread social, economic and environmental devastation that accompanies a major flood.

Winnipeg is located in the Red River Basin making Winnipeg and its 700,000 residents vulnerable to flooding each and every spring. The floodway protects Winnipeg by diverting a portion of the Red River's flow around Winnipeg, through a 48 km long artificial flood control diversion channel north of Winnipeg at Lockport, Manitoba where it re-enters the Red River.

The original floodway was constructed between October 1962 and March 1968 at a cost of \$63 million. It was a major undertaking, resulting in the excavation

of approximately 76.5 million cubic metres of earth. At the time, the project was the second largest earthmoving project in the world—next only to the construction of the Panama Canal.

Since its construction and subsequent first use in 1969, the floodway has been operated over twenty times and has prevented over \$20 billion in flood damages. In recent years, the floodway has not only protected Winnipeg during spring floods but has also been used during summer months to protect against basement flooding during emergency summer flood periods.

Although the floodway was criticized by many at the time of its original construction, today it is affectionately known as "Duff's Ditch" after the Honorable Duff Roblin, the Premier of Manitoba who spearheaded its original construction.

In 1997, Manitoba experienced the "Flood of the Century" which stretched the floodway's capacity to its limit. In fact, the volume of flood water exceeded the floodway's design capacity for a 1-in-90 year flood and Winnipeg came within inches of major catastrophe.

In 2003, as a result of this close call, the Governments of Canada and Manitoba announced their intention to increase Winnipeg's flood protection from 1-in-90 to 1-in-700 year flood protection—significantly larger than the largest flood in Manitoba's recorded history. This level of flood protection would require the floodway's capacity to be increased from 60,000 cubic feet per second (cfs) (1,700 m³/s) to 140,000 cfs (4,000 m³/s). Once completed, the expansion will protect an additional 450,000 Winnipeg residents, 140,000 homes, 8,000 businesses and prevent over \$12 billion in flood damage during a major flood.

Construction on the expansion project began on September 23, 2005, and in the spring of 2009, the project achieved its objective of delivering 1-in-700 year flood protection for Winnipeg. Some of the main components of the project include channel widening, improvements to the Inlet Control Structure, expansion of the Outlet Control Structure, replacement of eight

continued on page 28

LE PROJET D'EXPANSION DU CANAL DE DÉRIVATION DE LA RIVIÈRE ROUGE

Commémoration d'un lieu historique national du génie civil

Le 11 juin 2010, la Société canadienne de génie civil fera du canal de dérivation de la rivière Rouge et de son projet d'expansion un lieu historique national du génie civil, à l'occasion du dévoilement d'une plaque commémorative, à Winnipeg, au Manitoba.

Le canal de dérivation de la rivière Rouge est considéré comme étant l'un des principaux chantiers publics d'infrastructure dans l'histoire du Manitoba. Depuis sa construction, il a protégé la ville de Winnipeg, capitale du Manitoba, à de nombreuses occasions, en plus de prévenir les dévastations sociales, économiques et environnementales qui accompagnent toute inondation majeure.

La ville de Winnipeg est située sur le bassin de la rivière Rouge, ce qui rend la ville et ses 700 000 habitants vulnérables à l'inondation à chaque printemps. Le canal de dérivation protège Winnipeg en déviant une partie des eaux de la rivière Rouge à l'extérieur de Winnipeg, grâce à un canal artificiel de 48 km de long situé au nord de Winnipeg, jusqu'à Lockport, Manitoba, où il rejoint la rivière Rouge.

Le canal original a été construit d'octobre 1962 à mars 1968, pour 63 millions de dollars. C'était un énorme chantier, qui a provoqué le déplacement d'environ 76,5 millions de pieds cubes de terre. À l'époque, c'était le deuxième plus important chantier au monde, dépassé uniquement par la construction du canal de Panama.

Depuis sa construction et sa première utilisation en 1969, le canal a fonctionné plus de 20 fois et empêché que les inondations ne causent des dommages de plus de 20 milliards de dollars. Au cours des dernières années, le canal a servi à protéger Winnipeg durant les crues printanières ainsi que pendant les mois d'été, alors que des inondations menacent les sous-sol des demeures.

Bien qu'il ait suscité nombre de critiques pendant sa construction, cet ouvrage est maintenant connu, bien amicalement, sous le nom de « Duff's Ditch (le fossé de Duff) », rappelant le nom de Duff Roblin, le Premier

ministre du Manitoba qui fut responsable de la construction de cet ouvrage.

En 1997, le Manitoba a vécu « l'inondation du siècle », qui a poussé le canal de dérivation à son extrême limite. En fait, le volume d'eau en surplus a dépassé la capacité théorique du canal, conçu pour une inondation susceptible de se produire une fois en 90 ans, et Winnipeg a frôlé la catastrophe de quelques pouces.

En 2003, suite à cette quasi-catastrophe, les Gouvernements du Canada et du Manitoba annoncèrent leur intention de faire passer la capacité du canal de dérivation à des événements susceptibles de se produire une fois en 700 ans plutôt qu'une fois en 90 ans, ce qui est supérieur à l'inondation la plus importante survenue au Manitoba. Ce niveau de protection exigeait que la capacité du canal passe de 60 000 pieds cubes à la seconde (1 700 m³/s) à 140 000 pieds cubes à la seconde (4 000 m³/s). Une fois terminé, le canal protégera 450 000 résidents de Winnipeg de plus, 140 000 maisons, 8 000 entreprises, en plus de prévenir des dommages de plus de 12 milliards de dollars que causerait une inondation importante.

La construction a débuté le 23 septembre 2005, et au printemps de 2009, l'ouvrage atteignait son objectif d'assurer la protection de Winnipeg pour un événement extrême susceptible de se produire une fois en 700 ans. Parmi les principaux volets du chantier, mentionnons l'élargissement du canal, les améliorations à la structure du contrôle de l'entrée, l'expansion de la structure de contrôle de la décharge et le remplacement de 8 ponts ferroviaires et autoroutiers, l'expansion de la digue ouest et le déplacement de certains services.

En plus d'assurer une meilleure protection contre les crues, l'expansion du canal de dérivation s'est traduit par d'importantes occasions d'affaires pour les travailleurs, l'industrie de la construction et toute l'économie provinciale. Plus de 2 900 personnes et plus de 150 entreprises

suite à la page 28



Above: Over the course of the floodway project, approximately 21 million cubic metres of earth were excavated from the floodway channel, which more than doubled the capacity of the floodway from 60,000 to 140,000 cfs. / Pendant l'exécution des travaux, environ 21 millions de mètres cubes de terre seront déplacés du lit du canal afin d'en doubler la capacité, qui passera de 60 000 à 140 000 pi³/s cfs.



Above: Over the course of the project, 8 highway and railway bridges will be replaced to ensure that they are above the 1-in-700 year flood level. / La réalisation du projet donnera lieu au remplacement de 8 ponts autoroutiers et ferroviaires afin qu'ils soient à un niveau supérieur à celui d'une crue susceptible de se produire une fois en 700 ans.



Above: At a cost of approximately \$35 million, the expansion of the Outlet Control Structure was the single largest component of the Red River Floodway Expansion Project. As a result of the expansion, the Outlet will now be able to accommodate 140,000 cfs of water that would be flowing through the channel during a 1-in-700 year flood. / D'un coût d'environ 35 millions de dollars, l'expansion de la structure de contrôle de la décharge était le volet le plus important du projet d'expansion du canal de dérivation de la rivière Rouge. Suite à l'expansion, la décharge pourra dégorger jusqu'à 140 000 pi³/s, un événement susceptible de se produire 1 fois en 700 ans.

continued from page 26

highway and railway bridges, expansion of the west dike and utility relocations.

In addition to providing greater flood protection, the expansion of the floodway has resulted in significant economic opportunities for workers, the construction industry and the provincial economy. Over 2,900 people and over 150 companies—including construction, engineering and supplier firms—have and continue to work on the project. One economist has suggested that the total economic spin-offs from the project over five years will be approximately \$2.5 billion to the provincial economy. Other aspects being examined as the project proceeds include recreational opportunities such as the New Duff Roblin Provincial Park in the vicinity of the Inlet Control Structure and a multi-use trail along the expanded floodway.

To date, the \$665 million expansion project is on schedule for completion during the winter of 2010/11. ■

suite de la page 27

(construction, génie, fournisseurs) ont travaillé et travaillent toujours sur le chantier. Un économiste suggère même que les retombées économiques totales sur 5 ans atteindront environ 2,5 milliards de dollars pour l'économie de la province. D'autres aspects sont à l'étude car le projet donne lieu à des possibilités en matière de loisirs, comme le nouveau Parc provincial Duff Roblin, près de l'édifice de contrôle, ainsi qu'un sentier polyvalent le long du canal.

À ce jour, le projet d'expansion de 665 millions de dollars respecte l'échéancier et devrait être terminé à l'hiver 2010/2011. ■



SINCLAIR COCKBURN
FINANCIAL GROUP

3389 Steeles Ave. East
Suite 910
Toronto, Ontario M2H 3S8

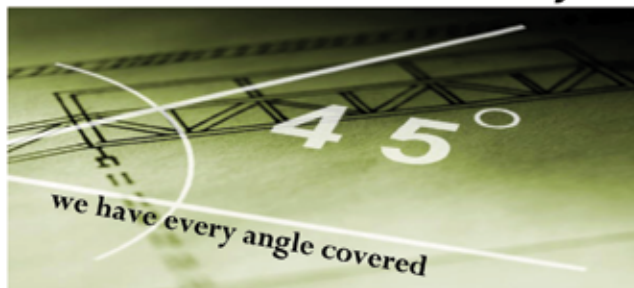
Visit us at: **scfg.ca**

Jamie Cardella

T. 416-494-7700 x 337
F. 416-494-5343
Tf. 1-800-328-7887

Email: jamie.cardella@scfg.ca

Professional Liability Solutions



An ENCON
Esteem Broker

Whether you are an Architect or an Engineer, mistakes can have a major impact on your firm not to mention your financial well being.

Errors & Omissions Insurance is the most important insurance available for design professionals. In today's business, you need proper protection and insightful advice that we know Sinclair Cockburn can deliver.

Call Today for your no-obligation customized risk management solutions and advice based on your field of work.



2009 Recipient of the Brokerage of the Year Award *

Ces formations sont offertes en anglais. CSCE offers the following courses at our annual conference. They will take place on June 9, 2010. For more details and registration, please visit www.csce.ca.

1. Introduction to Blast Load on Structures

This course will introduce participants to the basic characteristics of a blast wave and how to determine the fundamental blast parameters as it pertains to a target structure. Analysis and design of reinforced concrete and structural steel elements subjected to blast loads will be presented.

PRESENTER

Abass Braimah, Ph.D., Eng.
Assistant Professor of Civil Engineering, Department of Civil and Environmental Engineering,
Carleton University, Ottawa, ON

AGENDA

- Introduction to Explosives
- TNT Equivalence
- Air Blast Parameters
- Blast Loading of Structures
- Single-Degree-of-Freedom Model for Blast Load Analysis
- Design and Analysis of Reinforced Concrete and Structural Steel Elements for Blast Load
- PI Diagrams and Response Regimes for Blast Design

2. Seismic Design of Buildings

The course will provide an introduction to the seismicity of Canada and the new hazard maps produced by the Geological Survey of Canada. Basic concepts of structures dynamics relevant to earthquake resistant design of buildings will be introduced. The seismic design provisions of the 2005 National Building Code of Canada will be discussed with particular emphasis on local site effects, equivalent static load method of design, building irregularities, drifts and displacements, and the effect of torsion. The concepts will be illustrated with some sample designs. The forthcoming changes for the 2010 NBCC will be discussed in brief.

PRESENTER

Jag Mohan Humar, Ph.D., P.Eng., FCSCE, FEIC, FCAE
Distinguished Research Professor, Department of Civil and Environmental Engineering,
Carleton University, Ottawa, ON

AGENDA

- Seismic Hazard in Canada
- Fundamentals of Structural Dynamics and Seismic Analysis
- NBCC-2005 Seismic Design Provisions—Basic Concepts and Approaches
- Equivalent Static Load Approach as per NBCC-2005
- Introduction to Dynamic Analysis Procedure as per NBCC-2005
- Drift Requirements and Structural Irregularities as defined in NBCC-2005
- Forthcoming Changes for the 2010 NBCC

FOUR CSCE MEMBERS ELECTED AS FELLOWS OF THE ENGINEERING INSTITUTE OF CANADA

The Council of the Institute has, since 1963, elected annually to the grade of Fellow a number of engineers in recognition of their excellence in engineering and their services to the profession and to society. In the early years, the new Fellows were members of the Institute. Now they are members of the Member Societies of the Institute.

At its Honours & Awards Banquet held on February 27, in Ottawa, the EIC elected CSCE Fellows C. Michael Allen, Cathy Lynn Borbely, Said Easa, and A.F. (Bert) Lukey as Fellows of the EIC. We congratulate them on this recognition of excellence.



G. Jin, A.F. Lukey, S. Easa, C.M. Allen,
G. Akhras.

QUATRE MEMBRES DE LA SCGC SONT ÉLUS FELLOW DE L'INSTITUT CANADIEN DES INGÉNIEURS

Depuis 1963, le Conseil de l'Institut élit annuellement au titre de Fellow, un certain nombre d'ingénieurs en reconnaissance de leur excellence en ingénierie et des services rendus à la profession et à la société. Au début, les Fellows étaient choisis parmi les membres de l'Institut. Maintenant, ils sont choisis parmi les membres des Sociétés Membres de l'Institut.

À son banquet des lauréats qui a eu lieu le 27 février à Ottawa, l'ICI a élu deux Fellows de la SCGC, C. Michael Allen, Cathy Lynn Borbely, Said Easa et A.F. (Bert) Lukey à titre de Fellow de l'ICI. Nos félicitations pour cette reconnaissance d'excellence.



2010 CSCE Annual General Meeting and Conference

Winnipeg, June 9-12, 2010

Engineering a Sustainable World

- Annual General Conference
- 11th International Environmental Specialty Conference
- 2nd International Structural Specialty Conference
- 8th International Transportation Specialty Conference
- 2nd Specialty Conference on Disaster Mitigation



For registration information and technical program, visit us at:

www.csce.ca/2010/annual

COMING EVENTS / CALENDRIER DES ACTIVITÉS

Domestic Venues

CSCE 2010 Annual Conference

Winnipeg, MB
June 9–12, 2010
<http://www.csce.ca/2010/annual>

International Conference on Medium and Short Span Bridges (SMSB-8)

Niagara Falls, ON
August 3–6, 2010
<http://www.csce.ca/2010/smsb/>

4th International Conference on Durability & Sustainability of Fibre Reinforced Polymer (FRP) Composites for Construction—CDSGC 2011

Québec, QC
July 20–22, 2011
Web site: under construction

International Venues

2010 International Bridge Conference

Pittsburgh, Pa
June 6–9, 2010
<http://www.eswp.com/bridge>

6th International Conference on Concrete under Severe Conditions—CONSEC'10

Mérida, Yucatan, Mexico
June 7–10, 2010
<http://www.consec10.com/>

2nd International Conference on Sustainable Construction Materials and Technology—SCMT 2010

Ancona, Italy
June 28–30, 2010
<http://www.cbu.uwm.edu>

2nd International Conference on Waste Engineering and Management (ICWEM 2010)

Shanghai, China
October 13–15, 2010
E-mail: icwem2010@163.com

6th International Structural Engineering and Construction Conference

Zurich, Switzerland
June 21–25, 2011
Web site: http://www.isec-society.org/ISEC_06/

2010 ANNUAL GENERAL MEETING OF THE CSCE

The 2010 Annual General Meeting of the Canadian Society for Civil Engineering will be held during the Annual Conference of the Society on Friday, June 11, 2010 at the Fairmont Hotel in Winnipeg, MB. This meeting will receive the Annual Report of the Society including that of the President, the reports of the Technical Divisions, Regional Coordinating Committee, Administration Coordinating Committee, Programs Coordinating Committee, Official Auditors and will consider such other business as may come before the meeting.

ASSEMBLÉE GÉNÉRALE ANNUELLE 2010 DE LA SCGC

L'assemblée générale annuelle 2010 de la Société canadienne de génie civil aura lieu pendant le congrès annuel de la société, vendredi le 11 juin 2010 à l'hôtel Fairmont à Winnipeg, MB. Lors de cette assemblée seront soumis le bilan annuel de la société, incluant le rapport du président, les bilans des divisions techniques, des conseils régionaux, des comités de coordination de l'administration, des comités de coordination des programmes, du vérificateur et tout autre sujet soumis à l'assemblée.

MAJOR PARTNERS / ASSOCIÉS PRINCIPAUX



PARTNERS / ASSOCIÉS



AFFILIATES / AFFILIÉS



CSCE SECTIONS SCGC

Newfoundland

Contact: Gordon Jin, FCSCCE
T: 709-737-8816 F: 709-737-2537
E-mail: gjin@mun.ca

Nova Scotia

Contact: To be determined

East New Brunswick and P.E.I. (Moncton)

Contact: Gérard Poitras, MSCGC
T: 506-858-4759
E-mail: gerard.poitras@umoncton.ca

West New Brunswick

Contact: Andy Small, MSCGC
T: 506-458-1000 F: 506-450-0829
E-mail: andy.small@amec.com

Montréal

Contact: Stéphane Marcouiller, MSCGC
T: 450-967-1260, ext. 3636 F: 450-639-8737
E-mail: stephane.marcouiller@tecsult.com

Sherbrooke

Contact: To be determined

Québec

Contact: Stéphane Roy, MSCGC
T: 418-228-8031 F: 418-227-5424
Courriel: stephane.roy@canam.ws

Capital Section (Ottawa-Gatineau)

Contact: Gary Holowach, MCSCE
T: 613-745-2213, ext. 110
E-mail: gholowach@dillon.ca

Toronto

Contact: Peter Langan, FCSCCE
T: 416-497-8600, ext. 301 F: 416-497-0342
E-mail: plangan@rvanderson.com

Hamilton/Niagara

Contact: Mike Tait, MCSCE
T: 905-525-9140, ext. 26469 F: 905-525-9688
E-mail: taitm@mcmaster.ca

Northwestern Ontario

Contact: Gerry Buckrell, MCSCE
T: 807-623-3449 F: 807-623-5925
E-mail: gerry@enl-tbay.com

Durham/Northumberland

Contact: Amie Thérien, ASCSCE
T: 905-882-1100 ext. 3024
E-mail: therriena@mmm.ca

London and District

Contact: Ernest Yanful, MCSCE
T: 519-661-4069 F: 519-661-3492
E-mail: eyanful@eng.uwo.ca

Manitoba

Contact: Dagmar Svecova, MCSCE
T: 204-474-9180 F: 204-474-7513
E-mail: svecovad@cc.umanitoba.ca

South Saskatchewan

Contact: Harold Retzlaff, MCSCE
T: 306-787-5642 F: 306-787-4910
E-mail: hretzlaff@highways.gov.sk.ca

Saskatoon

Contact: Marc Bourassa, ASCSCE
T: 306-665-6223
E-mail: Marc.Bourassa@genivar.com

Calgary

Contact: Dan Dankewich, MCSCE
E-mail: ddanke2@telus.net

Edmonton

Contact: Eva Cheung, MCSCE
T: 780-944-7678
E-mail: eva.cheung@edmonton.ca

Vancouver

Contact: Shiva Tiwari, ASCSCE
T: 778-386-5740
E-mail: dambartiawari@gmail.com

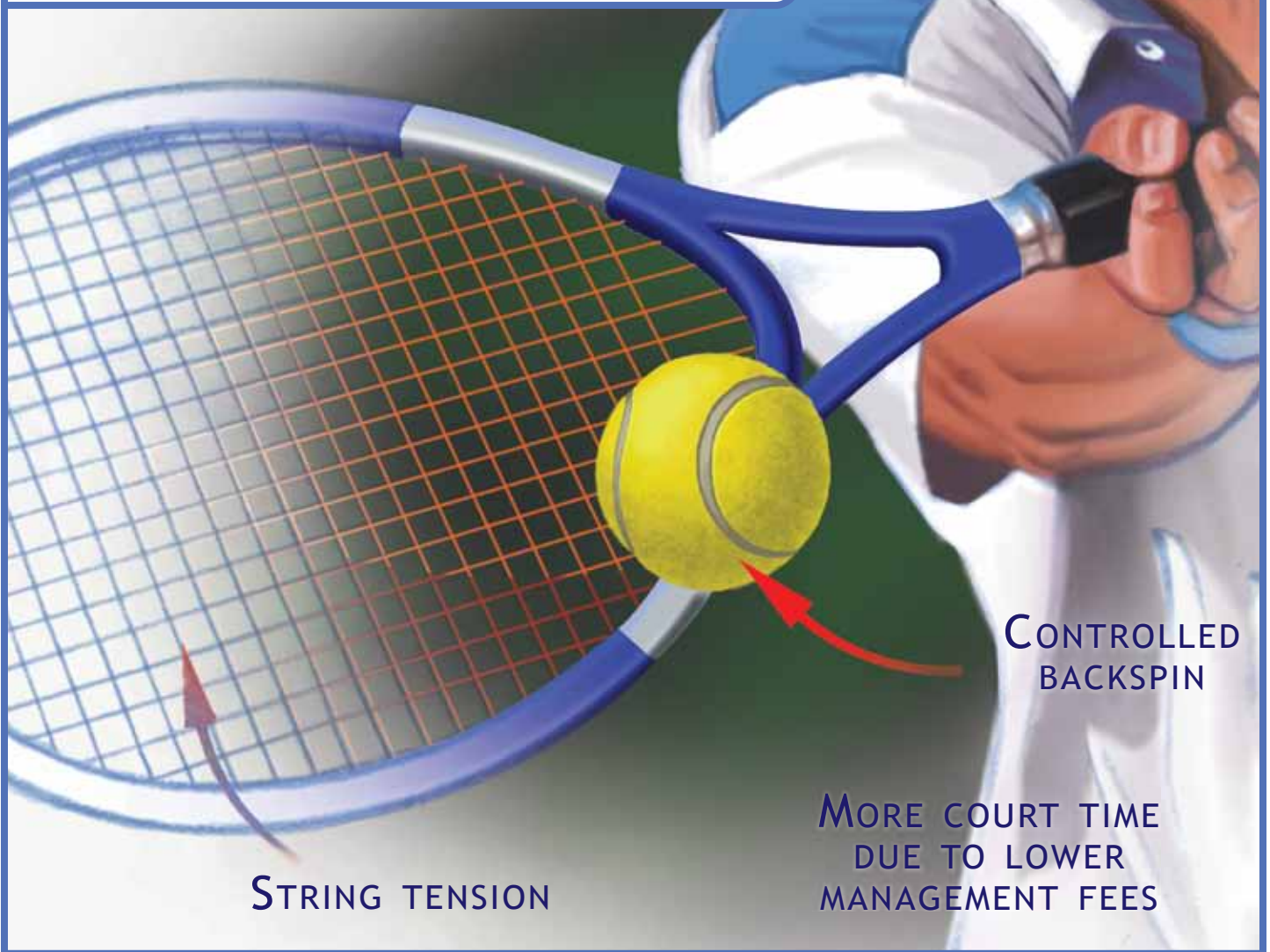
Vancouver Island

Contact: Kevin Baskin
E-mail: kevin.baskin@gov.bc.ca

CSCCE Hong Kong Branch

Contact: Moe M.S. Cheung, FCSCCE
T: (852) 2358-7152
E-mail: mscheung@ust.hk

ENGINEERS SEE THE WORLD
DIFFERENTLY.
INCLUDING THEIR RETIREMENT PLANS.



At Great-West Life, we know your standards extend well beyond your engineering career. And when it comes to your retirement, while you may be relaxing, you won't be relaxing those standards. That's why you should consider the only retirement plan officially sponsored by Engineers Canada. Our group retirement plan offers an impressive array of investment options combined with lower-than-market management fees and personalized assistance with investment selection. We understand that as an engineer you expect more and Great-West Life has the strength and stability to deliver.

For details, go to
www.engineerscanada.ca/e/pr_member_7.cfm
or call 1-800-724-3402.

Sponsored by



THE
Great-West Life
ASSURANCE  COMPANY

Engineers Canada is the business name of the Canadian Council of Professional Engineers.

Great-West Life and the key design are trademarks of The Great-West Life Assurance Company (Great-West), used under licence by its subsidiaries, London Life Insurance Company (London Life) and The Canada Life Assurance Company (Canada Life). Group retirement, savings and payout annuity products are issued by London Life and Canada Life respectively, and marketed and serviced by Great-West.