

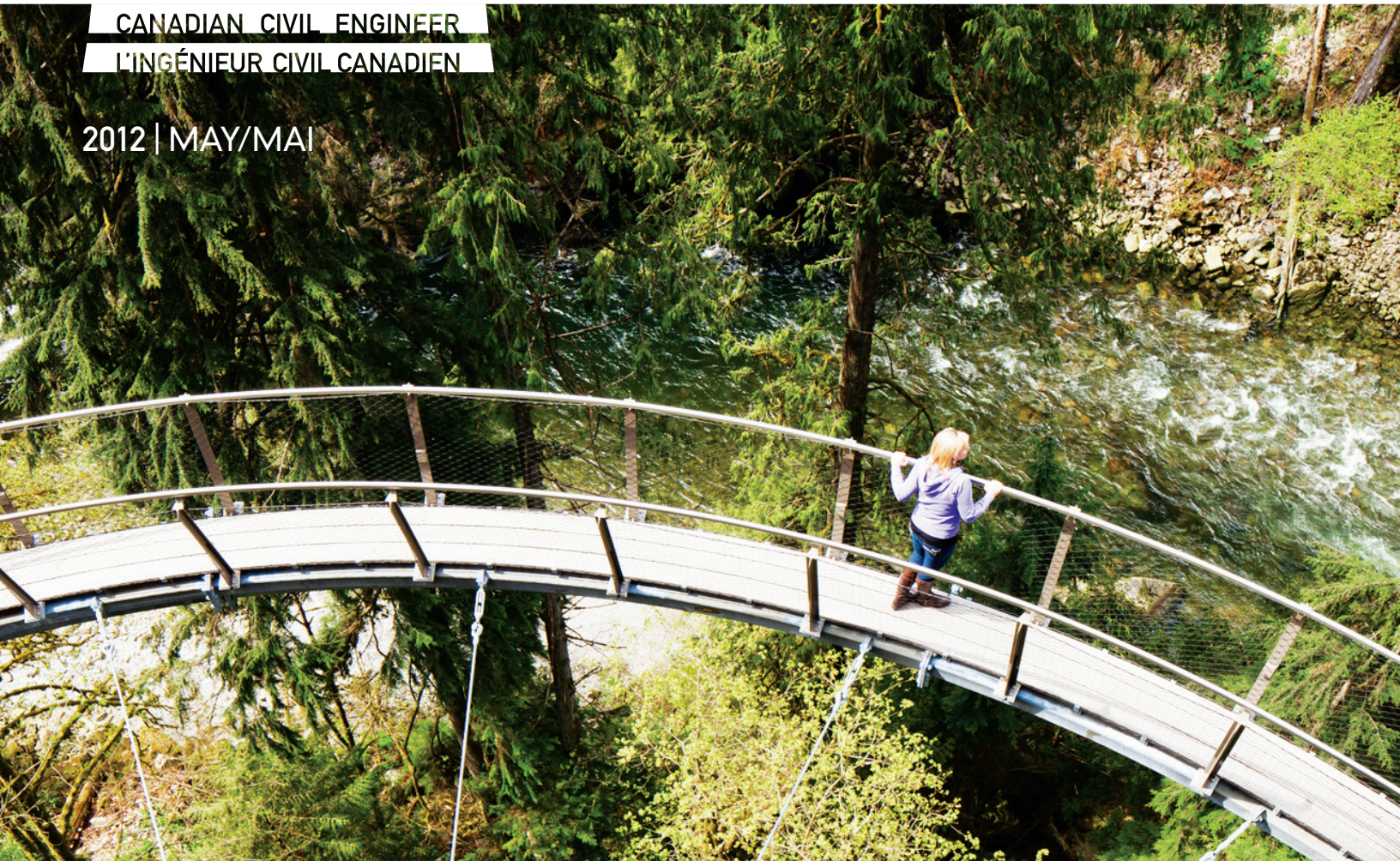


CANADIAN CIVIL ENGINEER

L'INGÉNIEUR CIVIL CANADIEN

2012 | MAY/MAI

- CSCE Conference | Congrès SCGC
| 2012 Edmonton
- Cliffwalk
- Strandherd-Armstrong Bridge
- Mackenzie River Twin Bridges



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Cover photograph: Cliffwalk, Vancouver. Courtesy Capilano Suspension Bridge Park.

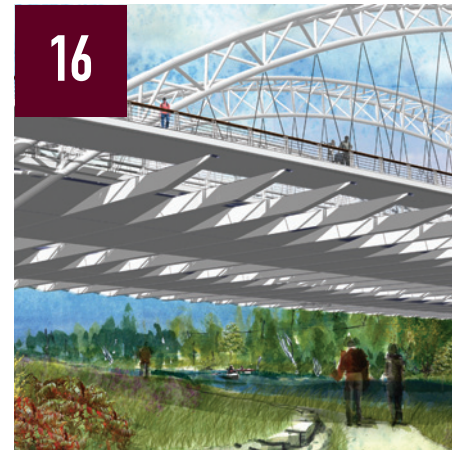


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**Randy Pickle, P.Eng., FCSCE,
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Sustainable infrastructure requires taking the long-term view

To go forward with successful sustainable infrastructure, we must look to where we have come from and what have been the causes of infrastructure failure. The planning and design of civil infrastructure must consider the long term aspects, not only in regards to life-cycle costing of the project, but also the potential future needs. This long-term approach is evident in the Tower Bridge in London, England and Victoria Bridge, in Montreal -- two examples of civil infrastructure that meet the needs of the 21st century but were planned, designed and constructed in the 19th century. Conversely, it could be argued that the 20th-century designers of the Champlain Bridge in Montreal were not forward thinking in anticipation of the potential growth of commuter vehicle crossings of the St. Lawrence River.

A study from a number of years ago that assessed the condition of the national civil infrastructure in Atlantic Canada and Western Canada not only confirmed the expectation that the infrastructure was deteriorating at an alarming rate, but also identified a number of external factors relevant to the ability of jurisdictions to maintain the infrastructure.

It was found from the study and from discussions with the civil engineers involved in managing the infrastructure that there were different priorities within the same management group. In Atlantic Canada, the infrastructure managers put their priority on the bridges, with the thinking that if the bridges were unusable then it did not matter that the approach roads were severely distressed, rutted and potholed. In Western Canada, efforts were put into ensuring that the roads were in good or better condition. Potholes and any other surface distress with the potential to cause vehicle damage were immediately addressed.

In Atlantic Canada, when it was necessary to deal with road rehabilitation the resources were not readily available. At the time of the study, the other road jurisdictions in the region were not spending on road improvements and consequently the availability of road constructors was limited, especially in areas of the provinces that are away from the major urban centres. In Western Canada, the provinces, in particular, were aggressive in undertaking road work projects and therefore the national road system had ready access to constructors to undertake roads rehabilitation even in remote areas of the provinces.

An accepted measure of the condition of a road is the Pavement Condition Index, which is a function of the riding quality and distress manifestations of the road section. As illustrated by the above noted study, an acceptable system PCI varies from road authority to road authority. In Atlantic Canada a low PCI was acceptable for the road users, whereas in Western Canada effort was made to ensure that the PCI of the road system was high. At a local level, municipalities tend to work at the project level to improve road sections rather than looking at improving their system PCI.

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CSCE National Office will be asking for articles from our Regions as a regular feature of CIVIL magazine. These contributions will be organized on a rotation, such that each Region has one issue per year in which to highlight local activities. The first of these Regional reports was submitted by Prairie Region. Harold Retzlaff, Prairie Region VP, asked Saskatoon Section to submit the following report.

— Doug Salloum, Executive Director

Le Bureau national de la SCGC demandera à nos Régions de fournir des articles qui paraîtront régulièrement dans le magazine CIVIL. Ces contributions seront publiées par rotation de telle manière que chaque Région aura un numéro par an dans lequel elle présentera ses activités locales. Le premier de ces comptes rendus régionaux sera soumis par la Région des Prairies. Le Vice-président de cette Région, Harold Retzlaff, a demandé à la Section de Saskatoon de soumettre le compte-rendu suivant.

— Doug Salloum, Directeur exécutif

Birth of the “Networker”

By Mike Hnatiuk

CHAIR, CSCE SASKATOON SECTION

Greetings from Saskatoon! The Saskatoon section of the CSCE has begun a new initiative that we’d like to tell you about. First, a bit of background. Luncheon events have been held in Saskatoon for many years, dating back to the mid-1970s. Each event features a presentation on a topic of local interest, generally related to civil engineering but occasionally on other topics that may appeal to a broader audience. These luncheon events have always had an informative component, but they also allow civil engineering professionals a chance to interact with other professionals in the area.

The events are held at the Faculty Club on the University of Saskatchewan campus, so we are able to offer an opportunity for our members to indulge in the best buffet lunch in the city.

However, as good as the luncheon events, or “Nooners” as they are known, have been, they were found to be somewhat lacking in the social component. In large measure, the timeframe over lunch is sufficiently short that attendees don’t have a lot of time for interaction except with the people at their



Saskatoon Section members get together for informal chats at a local pub.

own table. Although the lunch meeting is, and will continue to be, a great event, we thought we would try to come up with an event of an almost strictly social nature that allows for more interaction between the attendees. And with that, the “Networker” was born.

The Networker is intended to provide a time for local civil engineering professionals and students to get together in the same location and be able to chat without a formal program. Every Networker is held at a popular downtown pub, which provides for a relaxed atmosphere. Although the event is not in any way limited to our associate members, the idea for the event was to provide our

associate members another chance to mingle and get to know each other.

So far we’ve held three of these events: one in November, one in December, and the most recent one at the end of February. We are still experimenting with different ideas on potential discussion topics, but generally topics are generated through open discussion without an agenda.

Although the initiative is still in its infancy, we believe that it is off to a great start and will continue far into the future.

Next time you come to Saskatoon, check out our website, www.cscsaskatoon.ca to see our upcoming event schedule and join us for a Networker! ■

When did you start to feel like a "real" civil engineer?

By Lynn Cowe-Falls,
CHAIR, CSCE STUDENT CHAPTERS

Was it a prof? A teaching assistant? A classmate? The coffee lady? A crazy weekend at GNCTR, or the Troitsky Concordia Bridge competition? Was it a guest lecture, or an industry-student mixer? POETS?

When you look back on your four (or five, or six) years as an undergraduate student, what is the first memory that comes to mind? When did you begin to feel like a "real" civil engineer? Was it in the first lab where you got dirty handling concrete, the first time you donned steel toed boots, the first field trip, or the first conference where you actually understood what the "expert" at the podium was presenting?

These are all things that add up to the student experience and are a vital part of our educational journey. Engineers are generally known on campus as being cohesive, perhaps rowdy, but definitely a distinct group of students who work hard and play hard and generally make themselves known. They also have an educational experience that is unique.

Many universities use experiential learning as a teaching approach where professors build curricula around real-world examples and cases. This hands-on approach also is the basis for student competitions where students build toboggans, solar cars, solar homes, big beams or trebuchets with minimum input from faculty — where they apply their learning to tangible items and in some cases fail!

This column marks the beginning of regular reporting from our student chapters and from individual students who will share some of their experiences as they study, compete and travel abroad. Join us and perhaps rekindle some memories of your own student experiences!

To join a CSCE Student Chapter, e-mail Patricia Kerr at membership@csce.ca ■

À quel moment ai-je senti que j'étais vraiment un ingénieur ?

par Lynn Cowe-Falls,
PRÉSIDENTE DES SECTIONS
ÉTUDIANTES DE LA SCGC

Était-ce un prof ? Un assistant ? Un confrère ? La préposée au café ? Lors d'une fin de semaine échevelée au concours de pont Troitsky de l'Université Concordia ? Ou était-ce un conférencier invité, ou lors d'une rencontre industrie-étudiants ?

Lorsque vous considérez rétrospectivement vos quatre (ou cinq, ou six) années d'étude de premier cycle, quel est le premier souvenir qui vous revient en mémoire ? À quel moment avez-vous senti que vous étiez vraiment un ingénieur civil ? Est-ce lors de ce premier labo où vous vous êtes sali les mains avec du béton, la première fois que vous avez porté des bottes avec embouts d'acier, la première visite de chantier ou le premier congrès où vous avez compris pour la première fois ce dont les « experts » parlaient ?

Toutes ces choses font partie de l'expérience étudiante et constituent un élément essentiel de notre formation. Sur le campus, les ingénieurs sont généralement reconnus comme étant un groupe uni, parfois un peu rude, mais un groupe très particulier de personnes qui mettent autant d'ardeur au travail que dans les loisirs, et qui ne passent pas inaperçus. Leur expérience en matière de formation est également unique.

Nombre d'universités pratiquent un apprentissage au moyen d'exemples réels. Cette démarche directe est également le fondement des concours dans le cadre desquels les étudiants construisent des toboggans, des voitures fonctionnant à l'énergie solaire et des assemblages divers, avec une aide minime des professeurs, en s'efforçant d'appliquer leurs connaissances à des problèmes réels, qu'ils ne réussissent parfois pas à régler !

Cette rubrique marque le début d'une série portant sur les sections étudiantes et sur



Lynne Cowe Falls, Ph.D., P.Eng., FCSCE

des étudiants qui acceptent de partager avec vous leurs expériences de travail, de concours et de voyages. Participez à cette rubrique en racontant les histoires qui ont marqué votre vie d'étudiant !

Pour devenir membre d'une section étudiante, faites parvenir un courriel à Patricia Kerr, à l'adresse membership@csce.ca ■



38TH ANNUAL GREAT NORTHERN CONCRETE TOBOGGAN RACE

This year's GNCTR was hosted by the University of Calgary in early February. The overall winner was Ryerson University. The photograph shows the Red River College team arriving at the finish line. See www.gnctr2012.com

LA 38^E COURSE DE TOBOGGANS EN BÉTON

Cette année, ce concours était organisé par l'Université de Calgary, au début du mois de février. Les grands gagnants sont l'Université Ryerson. La photo montre l'équipe du collège de Red River franchissant la ligne d'arrivée. Voir le site web www.gnctr2012.com

CSCE Troitsky Bridge Building Competition 2012

By Micha Kindarji,

ENGINEERING & COMPUTER SCIENCE
ASSOCIATION, CONCORDIA UNIVERSITY

Skilled engineering students from all over North America gathered in Montreal this year for the 28th Annual CSCE Troitsky Bridge Building Competition. The rules of the competition require that using only popsicle sticks, white glue, dental floss and toothpicks, the teams build a bridge that can sustain the force of Concordia University's hydraulic presser. The catch? Each team had to finish constructing the bridge in two hours.

Early morning on March 2, the teams began their final assemblies. Music flowed in the auditorium as nerve-wracked students used the tools at their disposal, building towards one common goal: winning.

When the time was up, the building phase was over. Bubbling with pride and fatigued to the core, teams put on a brave face and chanted their school anthems as they carried their bridges from the assembly area to the testing site where the FERIQUE Crushing Ceremony awaited. It was finally time to make it or break it! Deflection and resistance were the two measures of bridge performance assessed during the crushing phase. The three front rows of seats in the auditorium were cordoned off and safety glasses were distributed. Bits of bridge flew as one after the other the bridges were crushed.

In the final analysis, McMaster's "League of Extraordinary Gentlemen" snagged first place. Their bridge supported the truly extraordinary weight of 2100 kilos, almost breaking Concordia's hydraulic presser!

Nobody left empty handed though. The participating students built friendships as well as bridges across universities throughout North America and even to England. The friendships and memories will last longer than the bridges — all of which, except for the McMaster bridge — were crushed to pieces.

CSCE and Concordia will do it all over again next year. We hope to see you there. ■

Le concours de construction de ponts Troitsky de la SCGC de 2012

par Micha Kindarji,

« ENGINEERING & COMPUTER SCIENCE
ASSOCIATION », UNIVERSITÉ CONCORDIA

Des étudiants en génie de l'Amérique du Nord se sont réunis à Montréal cette année pour participer au 28^e concours annuel de construction de ponts Troitsky. Les règles du concours exigent qu'on n'utilise que des bâtons de « popsicles », avec de la colle blanche, de la soie dentaire et des cure-dents. Les équipes doivent construire un pont capable de supporter une force appliquée par une presse hydraulique de l'Université Concordia. Le secret ? Chaque équipe n'a que deux heures pour construire son pont.

Le 2 mars au matin, les équipes font le montage final. La musique remplit l'auditorium, tandis que des étudiants nerveux utilisent les outils à leur disposition pour livrer leur pont gagnant et gagner.

À l'expiration du délai, la construction est terminée. Épuisées mais fières, les équipes entonnent l'hymne de leur alma mater et transportent leur œuvre jusqu'au lieu où se fera la cérémonie de mise sous pression et d'anéantissement ! Ça passe et ça casse ! La mise sous pression permet de calculer le fléchissement et la résistance des ouvrages. On isole au moyen de cordons les trois premières rangées de siège de l'auditorium et on distribue des lunettes de sécurité. Des éclats de ponts revolent au fur et à mesure que les œuvres sont écrasées.

En dernière analyse, c'est la « League of Extraordinary Gentlemen » de l'Université McMaster qui remporte le premier prix. Leur ouvrage aura supporté une charge extraordinaire de 2100 kilos, réussissant presque à détruire la presse hydraulique de Concordia !

Personne n'a cependant quitté les mains vides. En plus des ponts, tous les participants ont créé de précieux liens avec leurs d'Amérique du Nord et même d'Angleterre. Ces amitiés et ces souvenirs vont vivre plus longtemps que les ponts, qui ont tous été pulvérisés, à l'exception du pont des gens de McMaster.

La SCGC et l'Université Concordia referont l'opération l'an prochain, et nous espérons que vous y serez. ■

Université de Moncton to host 18th CSCE Canadian National Concrete Canoe Competition

By Jérémie Aubé,

LOGISTICS & EVENT COORDINATOR,
CNCCC 2012

From May 11-13, Université de Moncton will be hosting the 18th CSCE Canadian National Concrete Canoe Competition. The event is a national competition involving teams from many different Canadian universities, held each year at one of the participating universities.

This year, Université de Moncton, Moncton campus, will proudly host this event for 200 engineering students from more than 10 Canadian universities. During the course of one weekend each participating team will have to demonstrate to a panel of judges — experts in the fields of civil engineering and canoe racing — the quality of the work they have been committed to over the last year.

Concrete canoe competitions first started in the 1960s and grew over the years into a demanding trial for engineering students as they demonstrate and apply technical knowledge, creativity and teamwork, while following strict regulations. The competition calls for each team to demonstrate excellence in concrete design, project management, engineering reports, and physical fitness. The rules also incorporate sustainable design criteria.

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THE STUDENT VOICE | LA VOIX DES ÉTUDIANTS



Teams compete in a CSCE-SCGC Canadian National Concrete Canoe Competition. Les équipes participant au concours national canadien de canoë en béton.

has committed funding to the competition for the next five years.

Results of the CSCE Canadian National Concrete Canoe Competition will be announced on the CSCE website, Facebook page and CIVIL magazine. ■

L'Université de Moncton accueille le 18^e concours national canadien de canoë en béton

par Jérémie Aubé,

COORDONNATEUR DE LA LOGISTIQUE ET DE L'ACTIVITÉ POUR 2012

Du 11 au 13 mai, l'Université de Moncton accueillera le 18^e concours national de canoë en béton de la SCGC. Il s'agit d'un concours national annuel à l'intention d'équipes provenant de diverses universités canadiennes et se déroulant dans l'une de ces universités participantes.

Cette année, c'est le campus de Moncton de l'Université de Moncton qui accueillera les quelque 200 étudiants en génie d'une dizaine d'universités canadiennes. Pendant une fin de semaine, chaque équipe devra démontrer à un groupe de juges – experts en génie civil et en course de canots – la qualité du travail effectué au cours de l'année.

Les concours de canoës en béton ont débuté dans les années soixante et sont devenus au fil des ans un exercice exigeant pour les étudiants en génie qui doivent faire preuve de connaissances, de créativité et d'esprit d'équipe, tout en observant des règles strictes. Le concours exige que chaque équipe établisse la qualité de son plan, de sa gestion de projet, de ses rapports et de sa condition physique. Les règles comportent aussi des exigences en termes de durabilité.

La SCGC est fière de commanditer cette activité et s'est engagée à financer le concours pour les cinq prochaines années.

Les résultats du concours national canadien de canoë en béton seront annoncés sur le site web de la SCGC, sur le site Facebook et dans la revue CIVIL. ■

A Hangar, a Town, and a Goldfield Dredger

Three fascinating examples of engineering from Northwest Canada will be designated National Historic Civil Engineering Sites during the Edmonton 2012 CSCE-SCGC Conference.

By Bernard Trevor, MCSCE & Ken Johnson
CSCE 2012 HISTORY COMMITTEE

Edmonton is as far north as the annual CSCE conference circuit usually travels and holding the event in the city presents an opportunity to highlight civil engineering history in northern Alberta and points beyond. The civil engineering history of this region goes back more than 200 years to the construction of forts and trading posts.

For about 70 years, Edmonton has been formally recognized as the Gateway to the North, since it became an expediting hub for the Alaska Highway (dedicated as an International Historic Civil Engineering Landmark in 1996) and the Canol pipeline in 1942.

However, the gateway opportunity was first explored 20 years earlier with the first sub-arctic flight from Edmonton to Norman Wells as part of the oilfield development, and more than 20 years before that the city was the send-off point for the all-Canadian route to the Klondike goldfields.

This history gives Edmonton a natural link to the three sites nominated as CSCE National Historic Civil Engineering Sites for 2012. The sites represent a cross section of civil engineering achievements in the Canadian Northwest from a period of 50 to 100 years ago. Each of them was also associated with a major event in Canadian history — the Klondike Gold Rush (Dredge No. 4), World War II (Hangar #14), and the Roads to Resources program of John Diefenbaker (Town of Inuvik).

Hangar #14

The signing of the British Commonwealth Air Training Plan (BCATP) agreement in 1939 marked the start of a massive effort to train air and ground crews during the Second World War. It also prompted the construction of significant air transportation infrastructure across Canada. By the end of the war, more than 100 new airfields had been built, many more were expanded or improved, and 8,300 buildings were built — including 701 hangars — all with their attendant water, sewer and electrical infrastructure.

With the start of the war, Blatchford Field (now Edmonton City Centre Airport) was offered by the City of Edmonton to support the BCATP. Under the control of the Federal Department of Transport, the size of the airfield grew from 160 to 750 acres, and 16

Hangar #14 at the Edmonton City Centre Airport now houses the Alberta Aviation Museum. The hangar's Warren trusses form a backdrop to a restored World War II, De Havilland DH 98 Mosquito bomber aircraft.



Photo: Ken Johnson

NATIONAL HISTORIC CIVIL ENGINEERING SITES

Each year at the CSCE annual conference, the society's National History Committee selects a site or project from the region in which the conference is being held as a national Historic Civil Engineering Site.

Through this program the committee aims to make the general public and engineers themselves more aware of the rich history and heritage of civil engineering in Canada. A commemoration ceremony is held during the CSCE conference, and a plaque is placed on the chosen site, in a place where it is readily visible to the public.

Since the program began in 1983, 58 national, international and regional sites have been designated, and three more will be dedicated at the conference this year in Edmonton.

Sites selected over the years range from the Cape Spear Lighthouse in Newfoundland on the most easterly point of the North American continent, to the Esquimalt dry dock on Vancouver Island in the west, and from the St. Clair Tunnel at Sarnia in southern Ontario, to the Snare River Hydro Electric Scheme in the Northwest Territories.

Others include such Canadian icons as the elegant Victoria Bridge in Montreal, which was the longest bridge in the world at the time of its construction; the Quebec Bridge, scene of both tragedy and triumph in its construction history; and Pier 21 at the Port of Halifax, which was the entry point for tens of thousands of immigrants who helped to build this great country. Another is the historic site of the "Last Spike" on the transcontinental railway at Craigellachie in British Columbia.

This year, 2012, marks the 125th anniversary of the founding of the Canadian civil engineering profession in Canada. The original Canadian Society of Civil Engineers was established in 1887 and its first President was Thomas Coltrin Keefer, who designed two sites that have been historically designated: the Fleet Street Pumping Station in Ottawa — designated last year — and the Hamilton Pumping Station which was the first site to be designated, in 1983.

— adapted from a speech given in 2011 by Alistair Mackenzie, former chair of the CSCE National History Committee.

buildings were constructed, two of which were hangars.

Hangar #14, or Hangar M, as it was known during the war, was completed in 1942 and is an example of the standard BCATP hangar design. The design could be doubled in length and/or width, and Hangar #14 is the only surviving "double wide, double long" hangar in Canada.

The hangar is of wood construction. Douglas fir is used for the modified Warren trusses in the roof structure and the supporting

columns. A patented Canadian system of steel bolts and split ring connectors join the structural elements.

The hangar now houses the Alberta Aviation Museum and is designated as both a municipal and provincial historic resource.

Town of Inuvik

The town of Inuvik was built to replace the flood-prone community of Aklavik, which had served as a key centre for trade and transport

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Photo: Inuvik in Pictures: 1958-2008 by Dick Hill



Inuvik's above-ground "utilidor" prevents water and sewer pipes from warming the permafrost.

tation for the Mackenzie Delta since 1920. An extensive selection process in the 1950s throughout the Delta area ultimately identified the site for the new town, which is Canada's largest community north of the Arctic Circle.

Located 2,000 kilometres northwest of Edmonton, Inuvik was also the first completely "engineered" northern community above the Arctic Circle.

The permafrost conditions in Inuvik proved to be a significant challenge to engineers and contractors. The design and construction in the late 1950s and early 1960s pioneered cold region engineering practices such as pile construction, freeze protection of water and sewer systems, and construction techniques associated with isolated northern communities.

To prevent heat from warm buildings thawing the permafrost and causing them to sink, most structures, including those for water and sewers, were designed to sit on timber piles drilled five metres into the ground, with about one-half to one metre of space between the ground and the bottom of the building. Inuvik's above-ground "utilidor" is unique in the world. Over the past several decades work has begun to replace the wooden piles with steel piles, while still applying the same engineering concepts developed more than 50 years ago.

Dredge No. 4 in the Klondike goldfields

The large-scale mining era in the north that followed the Klondike Gold Rush pio-

neered techniques in northern planning, northern transportation, northern water resource development, northern mining, and the associated construction that is unique to the north because of the cold weather, permafrost, and isolation.

Associated with the mining was the application of bucket dredges for mining placer gold. Dredge No. 4 is the largest vessel of its kind in North America for picking up gravel from a creek bed, washing it with water to separate the gold, and discarding waste rock at the discharge end.

Floating on a pond of its own creation, the dredge lifted the gold-bearing gravel by means of a chain of buckets. The buckets emptied into a hopper which fed into an

inclined revolving circular screen (or trommel), where the gravel was washed by immense volumes of water. The fine material passed through the holes in the trommel into gold saving tables, where it was sluiced and the gold was collected in a series of riffles and mats.

Dredge No. 4 is two-thirds the size of a football field and eight stories high. It has a displacement weight of more than 2,700 tonnes, with a 0.45 m³ bucket capacity.

Dredge No. 4 was originally constructed in 1912 and was operational on the Klondike River in 1913. The dredge was completely reconstructed at a new operating site in 1941 using the original machinery but replacing all of the timber. It is now a Parks Canada National Historic Site in Bonanza Creek, Yukon. ■



The massive, eight-storey Dredge No. 4 searched for gold on the Klondike River in 1913.

Photo: Ken Johnson



Cliffwalk

High above a canyon in Vancouver's Capilano Park, a unique pathway structure has been cantilevered and suspended from the rock face.

By Elaine Laprairie, Morrison Hershfield

Cliffwalk is sustainable infrastructure unlike any other. This eco-adventure structure is located in a West Coast rain forest amidst streams, giant ferns and old growth trees thousands of years old. It is a unique 0.6-m (2-ft.) wide pathway starting at the lip of the 90-m high canyon above Vancouver's Capilano River and winds through previously unexplored sensitive areas. It is not for the faint of heart.

Engineers have leveraged innovative and sustainable techniques and technologies to design and construct Cliffwalk. Extending for over 210 metres, a series of cantilevered and suspended walkways, supported only by steel brackets screwed into the sheer cliff face, follow the contour of the canyon walls. In some spots a narrow glass floor is all that separates visitors from the canyon bed hundreds of feet below. The structure includes seven straight bridges, eight sets of stairs and six platforms.

Cliffwalk was opened in June 2011 by the Capilano Group of Companies. Kent LaRose, P.Eng., the project's engineer of record and the lead design engineer from Morrison Hershfield, says: "Cliffwalk is definitely a first-of-its-kind in the world. There has never been anything constructed like this in modern history that we are aware of."

No precedent to follow

Early in the project it became evident that the design, fabrication and construction techniques would have to be heavily interconnected. From start to completion a significant amount of collaboration occurred between the structural engineer, rock engineer, erector, owner and surveyor.

Because of the unique nature of the structure there was no independently applicable building code that could be followed. As a result, both the Canadian Highway Bridge Design Code and the 2005 National Building Code of Canada were considered in determining the design criteria. Additional guidance was taken from the Transportation Association of Canada and state-of-the-art technical literature.

It took four years and \$4.5 million for Cliffwalk to be realized. To protect the site every piece of Cliffwalk was custom designed and built through an intricate step-by-step process of surveying, engineering and fabricating.

With the rock being so variable, all the potential anchor points needed to be mapped, installed and tested before the structural design could be finalized. Throughout the design process survey personnel who were trained in fall protection and vertical lifeline techniques undertook much of their rock mapping while rappelling over the cliff. The reliance upon 3-D survey data, in conjunction with having to constantly update the model as foundation elements were tested and installed, were considered to be ground-breaking approaches by the Cliffwalk steel fabricator.

Rock dictated location of anchors

A number of structural forms were investigated during the design process, including suspension bridges, suspension supported staircases, pure cantilevers and others. The final arrangement was determined to offer the optimal fabrication and installation process, combined with the highest level of confidence and minimal environmental impact. The majority of Cliffwalk is constructed from steel, North America's top recycled material. Other major material groups used in the construction are concrete and glass, which are recyclable materials; and timber, a renewable resource.

As potential environmental impacts were identified on-site, some of the anchor points were adjusted, which also required a redesign of the structure. The continuous improvement process led to the adoption of a philosophy of letting the rock dictate where anchors should be placed.

The guard-rail and post system was made from stainless steel woven wire mesh that resembles chain-link mesh. It was designed to conform to the 3-D shapes and was woven onto the Cliffwalk cables. This application satisfied the safety and transparency needs, staying true to the original design concept.

To protect delicate flora and fauna, the builders handcrafted the



Photographs: Capilano Suspension Bridge Park

One of several platforms along the 210-m trail.

bridge and walkway sections off-site, assembling them on-site with minimally invasive construction equipment. The structures were lowered from the top of the cliff and attached to the rock face.

With an environmental footprint of just 11 m² (approximately 118 sq. ft.), the Cliffwalk route is unobtrusive as it winds its way alongside the cliff through rainforest vegetation. The habitat loss for the entire project, including trails, is 100 m². The footprint is so small, Cliffwalk barely touches the natural environment.

With visitors on walkways suspended among and high above the trees, the risk of soil erosion and damage to the undergrowth is reduced. Cliffwalk has also allowed the Capilano Suspension Bridge Park to reclaim and transform over two acres of land into usable park space. Hundreds of thousands of visitors per year are provided with eco-educational, interactive and interpretive signage.

The Cliffwalk structure is the culmination of several years of brainstorming innovative designs combined with environmentally friendly surveying techniques, construction methods and materials. The outcome is a visually appealing and unique “bridge” into a rarely seen eco-sensitive area. ■

Elaine Laprairie is Director of Communications at Morrison Hershfield, and is based in Toronto.

OWNER-CLIENT: Capilano Group of Companies

ENGINEER OF RECORD/LEAD DESIGN ENGINEER:

Morrison Hershfield (Kent LaRose, P.Eng.)

PROJECT MANAGEMENT: Marc Luc Lalumiere

SURVEY/DESIGN CONSULTANT:

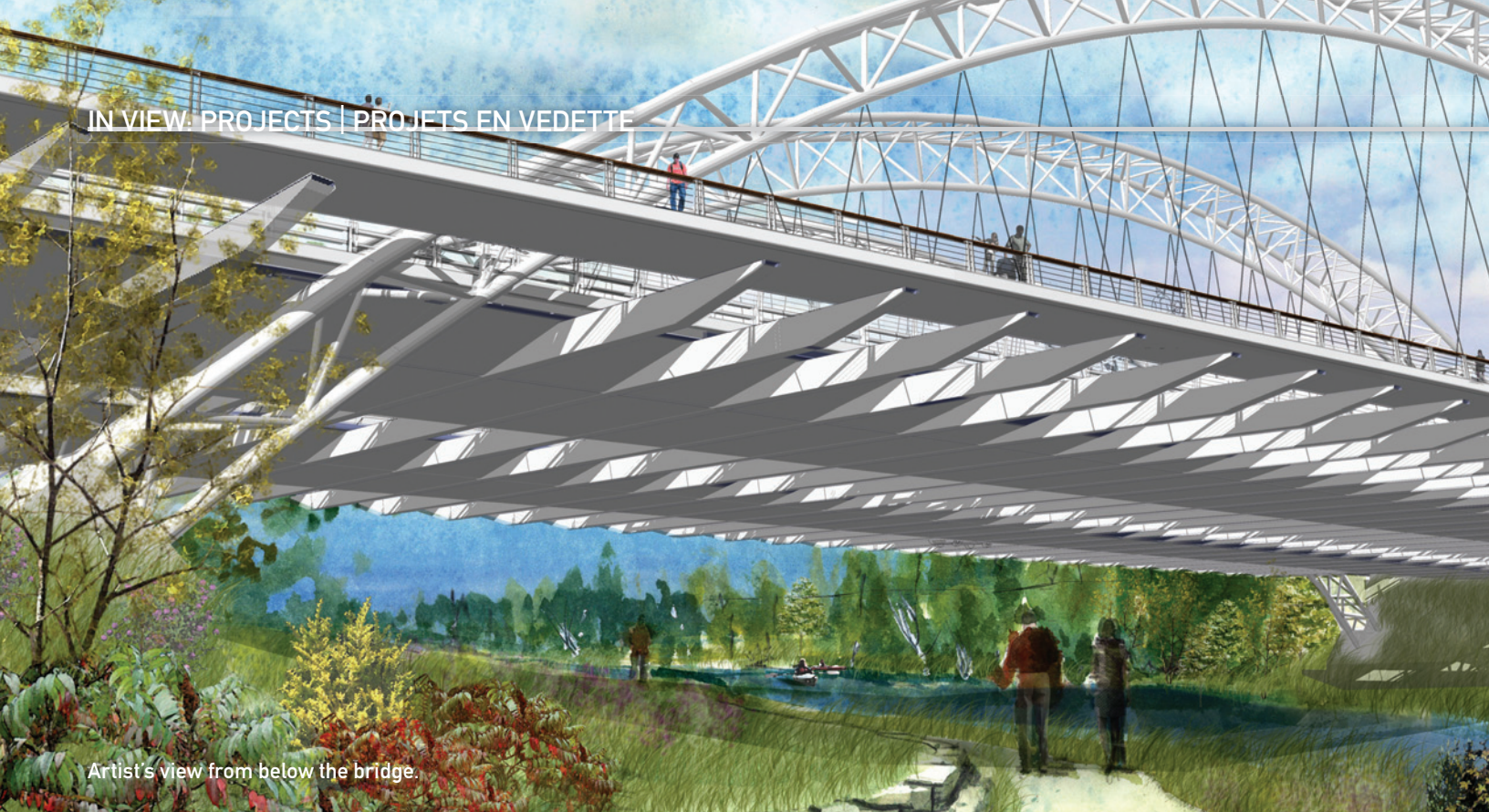
McElhanney Consulting Services

ROCK/GEOTECHNICAL ENGINEER:

Wyllie & Norrish Rock Engineers

ENVIRONMENTAL CONSULTANT: Phoenix Environmental

FABRICATOR: Solid Rock Steel Fabricating Company



Artist's view from below the bridge.

Strandherd-Armstrong Bridge

A new bridge at the Rideau Canal in Ottawa is designed to enhance this UNESCO World Heritage Site.

By W. Victor Anderson, P.Eng., Delcan & Abdol Nouraeyan, P.Eng., City of Ottawa

The Strandherd-Armstrong Bridge over the Rideau River and the Rideau Canal is a unique bridge, now under construction in the City of Ottawa.

The main features of the bridge are three trichord steel arches spanning from bank-to-bank across the Rideau River. This bridge has no duplicate anywhere and can rightly claim to be a unique design.

The owner of the bridge is the City of Ottawa. It required a structure capable of carrying eight lanes of vehicular and transit traffic, two bicycle paths, and two sidewalks, for a total required basic deck width of 40.6 m.

The main span was defined at 125 m by a decision to span the waterway from bank-to-bank, hence keeping the bridge entirely out of the Rideau River and the Rideau Canal, which is contiguous with the Rideau River at this location. The bridge will be out of the water at all times, including high water events.

Many schemes were considered in developing the design for the

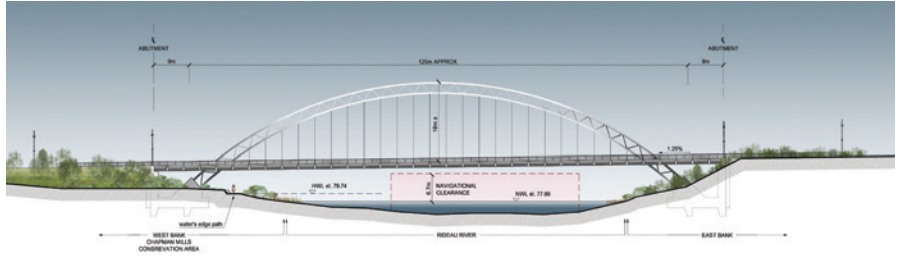
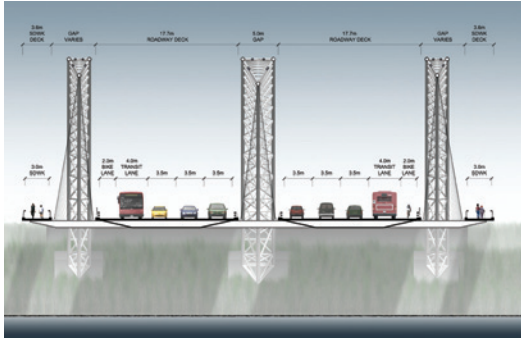
bridge. Factors taken into account included input from the City of Ottawa, the National Capital Commission, Parks Canada, Transport Canada, local ratepayers and interest groups, and many other agencies, authorities, groups and individuals.

A key factor in assessing the schemes was the fact that the Rideau Canal is a UNESCO World Heritage Site and so the design had to respect particular United Nations requirements. In addition, the Rideau Canal is a National Historic Site in Canada, which again required that the bridge design treat the context with particular respect.

It was clear that the new bridge should enhance the crossing and if possible have a net positive environmental effect rather than simply be a project that attempted to mitigate any negative environmental impacts. In addition, a key design parameter was that upon its completion the bridge would have the ability to inspire passers-by, whether it was viewed from vantage points on the bridge, on the riverbanks, on the road approaches, or on the waterway beneath the bridge. It is believed that the scheme ultimately chosen meets that criterion and the many dozens of other related technical and environmental criteria set down by the various parties to the project.

Trichord structural steel tube arch

In the context of a bridge that was very wide compared to its span, the designers elected to divide the bridge into four separate structures, all integrated by a structural steel box girder grillage system and supported by three arches. One arch is located centrally between the two vehicular travelled ways, and the other two arches are located between the vehicular travelled ways and the sidewalks. A gentle horizontally-curved alignment was introduced into the sidewalks to afford the bridge additional elegance and to complement the curvilinear nature of the arches.



Cross-section and elevation: being wide compared to its span, the bridge consists of four separate structures integrated by a box girder system and supported by three arches.

The bridge has a certain lineage and draws its inspiration principally from the Lusitania Bridge at La Merida in Spain, a bridge designed by Dr. Santiago Calatrava. It is from that bridge that the idea of the trichord structural steel tube arch is derived.

The bridge also finds context from arched and curvilinear structures on the Rideau Canal and the Rideau River, including the Cummings Bridge, the Bank Street Bridge, the Michael Sheflin Hunt Club Bridge, the Laurier Bridge, and the now-vanished St. Patrick Street Arch Bridge.

Hence, the new Strandherd-Armstrong Bridge is part of an historical family of structures crossing the Rideau Canal and the Rideau River, but it is clearly “of its time” and incorporates modern materials, technology, design techniques, and construction methods. In this and all other regards, it accords with the United Nations’ guidelines for bridges at World Heritage Sites.

Assembly on the riverbank

The contractor has developed a scheme for erecting the bridge that involves the initial construction of virtually the entire structural steel assembly, including the deck grillage and the arches, on land on the riverbank, and the subsequent rolling-out of the entire structural steel works in one assembled unit across the river to its final location. The erection method selected has many advantages, including having minimal effect on the environment and virtually no interference with navigation on the Rideau Canal.

In its final configuration, the bridge main span is flanked by two end spans of 9 m each, for a total bridge length of 143 m. Its overall

width, including the spaces through which the arches reach down to their foundations, is 58.7 m. The arches rise some 21 m above the deck. The bridge is supported on reinforced concrete abutments founded on large-diameter structural steel tubes socketed into bedrock. All the structural steel elements of the bridge are closed tube or box structures in order to offer minimum exposure to the weather and provide optimum durability. The deck is cast-in-place reinforced concrete, and reinforcing steel in the deck is galvanized for durability.

An illumination scheme provides functional lighting in concert with subdued architectural lighting of the arch and the main structural steel span.

Upon its completion, the bridge will take its place amongst the many historical and the more modern crossings of the Rideau River and the Rideau Canal. The bridge is a priority for the City of Ottawa and a partnership between the city, the province of Ontario and the Government of Canada. The budget is \$48 million.

Apart from being a unique bridge with a special lineage, the new Strandherd-Armstrong Bridge will provide a gateway to the National Capital Region for boaters on the Rideau Canal and an interesting new landmark in the City of Ottawa. ■

Vic Anderson, P.Eng. is Executive Vice President of Delcan.

Abdol Nouraeyan is a Program Manager at the City of Ottawa.

OWNER: City of Ottawa

PROJECT MANAGER: City of Ottawa

BRIDGE DESIGNER AND ENGINEER-OF-RECORD:
Delcan (Vic Anderson, P. Eng.)

ARCHITECT: DTAH

GEOTECHNICAL ENGINEER: Golder Associates

CONTRACTOR: ConCreate USL

STRUCTURAL STEEL FABRICATOR: Cherubini Group

Mackenzie River Twin Bridges

Photo courtesy of the Ministry of Transportation of Ontario

The Mackenzie River Twin Bridges with precast decks and UHPC joint fill connections

The joints between precast deck sections on a bridge near Thunder Bay, Ontario were filled with Ultra-High Performance Concrete to provide extreme durability.

By Vic Perry, FCSCE, M.A.Sc., P.Eng.
DUCTAL, LAFARGE NORTH AMERICA

Since 2005, several Canadian, provincial and U.S. state highway departments have used Ultra-High Performance Concrete (UHPC) joint fill with full precast bridge decks for the replacement of deteriorating highway bridges. The solution is to use a precast concrete deck with field-cast UHPC joints to develop continuity in the deck.

The Mackenzie River Twin Bridges project near Thunder Bay, Ontario, is to date the largest field-cast UHPC bridge project in North America. Part of the new TransCanada Highway realignment for the Ministry of Transportation of Ontario, it consists of twin, two-lane bridges, each with three spans, for a total length of 180 m each.

The bridges cross a deep gorge of the Mackenzie River (Canada's longest river), using variable depth continuous steel plate girders with full-depth precast deck panels that are lightly prestressed and run the full width of the bridge. There are 130 precast deck panels, 2.99 m wide x 14.5 m long x 225 mm thick. The transverse joints between the

panels are filled with UHPC, as are the shear pockets and haunches between the underside of the deck panels and the steel girders. Precast approach slabs with UHPC field-cast connections were also used.

To complete the work, Lafarge supplied all of the UHPC materials and twin 0.5-m³ Ryan mixers, producing over 20 m³ per day for a total of 175 m³. Casting of the joint fill material was completed with an 18-man crew in just 10 days.

Durable and locally available

The UHPC joint fill technology used for the joints is an ultra-high-strength, ductile material formulation made with the constituent ingredients: Portland cement, silica fume, quartz flour, fine silica sand, high-range water reducer, water, and steel fibres. The family of products used for this application is Lafarge's "Ductal JS1000," one of a range of UHPCs under the Ductal trademark.

Compressive strengths range from 120 to 200 MPa, and flexural strengths range from 15 to 40 MPa. Bond development lengths for 15 M bars are less than 75 mm, resulting in very narrow joints of approximately 150 mm width.

Concrete is one of the most durable building materials on the earth and in North America it is usually available locally. Durability means longevity, and local availability means a reduction in the transportation of resources. Furthermore, the cement, concrete and construction industries provide employment for people in local communities, also



Shear pockets and transverse joints

Pouring a UHPC joint

relating to reduced transportation impacts. Durable, long lasting, local products are fundamental elements in using a sustainability approach.

UHPC extends the sustainability and resiliency of our infrastructure. With a carbonation depth penetration of 0.5 mm, the material has almost no carbonation or penetration of chlorides or sulphides and it has high resistance to acid attack. The superior durability characteristics are due to its low porosity. It is made from a combination of fine powders, selected for their relative grain size (maximum 0.5 mm) and chemical reactivity. The net effect is a maximum compactness and a small, disconnected pore structure.

To better understand UHPC's long-term durability and life expectancy, a series of prisms (152 mm x 152 mm x 533 mm) were placed in 1996 and 2004 at the long-term exposure test site of the US Army Corp of Engineers in Treat Island, Maine. The prisms are situated on a wharf deck located at mean tide in the Bay of Fundy in Maine and are subjected to two daily tide cycles of wet/dry (sea water) and, during winter at low tide, are subjected to freeze/thaw. After 13 years of exposure, the samples were removed and measurements taken to determine the depth of chloride penetration.

After 13 years of similar exposure, High Performance Concrete (HPC) has more than 5 times the chloride content and 2.5 times the depth of penetration compared to UHPC.

Extrapolating the data suggests that UHPC requires 1000 years to have the same level of chloride penetration that HPC would have in

less than 100 years. After 13 years, the UHPC prisms at the exposure site have corners that are as clean and sharp as the original samples. Most other concrete samples, after one season, show rounding of the corners due to freeze/thaw durability.

UHPC technologies are not new, but rather a 20-year old technology. Nonetheless, relative to concrete, UHPC is still in its infancy, particularly in its deployment. Yet with its promising results for building better, longer-lasting infrastructure, UHPC offers the potential to address concerns with respect to sustainability and resiliency. ■

V.H. (Vic) Perry, FCSCE, M.A.Sc., P.Eng. is a former President (2010) of CSCE and currently Vice-President & General Manager of Ductal, Lafarge North America, based in Calgary. E-mail him at: ductal@lafarge-na.com, or visit www.ductal-lafarge.com

OWNER: Ministry of Transportation of Ontario
BRIDGE DESIGN ENGINEERS: McCormick Rankin Corp./MTO
CONTRACTOR: Teranorth Construction & Engineering
UHPC SUPPLIER, TECHNICAL ASSISTANCE & PRECASTER: Lafarge Canada

CONFERENCE CONGRÈS 2012 EDMONTON

LEADERSHIP IN SUSTAINABLE INFRASTRUCTURE LEADERSHIP EN INFRASTRUCTURES DURABLES



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Highlights:

- Grand opening reception at the Art Gallery of Alberta
- Annual General Conference
- 12th International Environmental Specialty Conference
- 3rd International Structural Specialty Conference
- 9th International Transportation Specialty Conference
- 1st International Conference on Sustaining Public Infrastructure
- 125th Anniversary CSCE/EIC Awards Gala and Banquet
- Trade show
- Historical site dedication ceremony at the Alberta Aviation Museum
- Technical tours (Edmonton Waste Management Centre, North LRT construction site, Mill Woods Double Barrel Tunnelling Project)
- Social event – Edmonton Queen riverboat cruise
- Companions' program

For more information or to register,
visit: www.csce2012.ca

WESTIN EDMONTON, EDMONTON DU 6 AU 9 JUIN 2012

Moments forts:

- Réception d'ouverture à la galerie d'art de l'Alberta
- Congrès annuel
- 12^{ème} Conférence internationale spécialisée sur l'environnement
- 3^{ème} Conférence internationale spécialisée sur les structures
- 9^{ème} Conférence internationale spécialisée sur les transports
- 1^{ère} Conférence internationale sur les infrastructures publiques durables
- Gala et Banquet des prix SCGC/ICI du 125^e anniversaire
- Salon commercial
- Cérémonie de consécration d'un site historique au Musée de l'aviation de l'Alberta
- Visites techniques (Centre de gestion des déchets d'Edmonton, site de construction de la ligne de train léger Nord, projet de tunnel à deux voies Mill Woods)
- Événement social – visite en bateau Edmonton Queen
- Programme des compagnons

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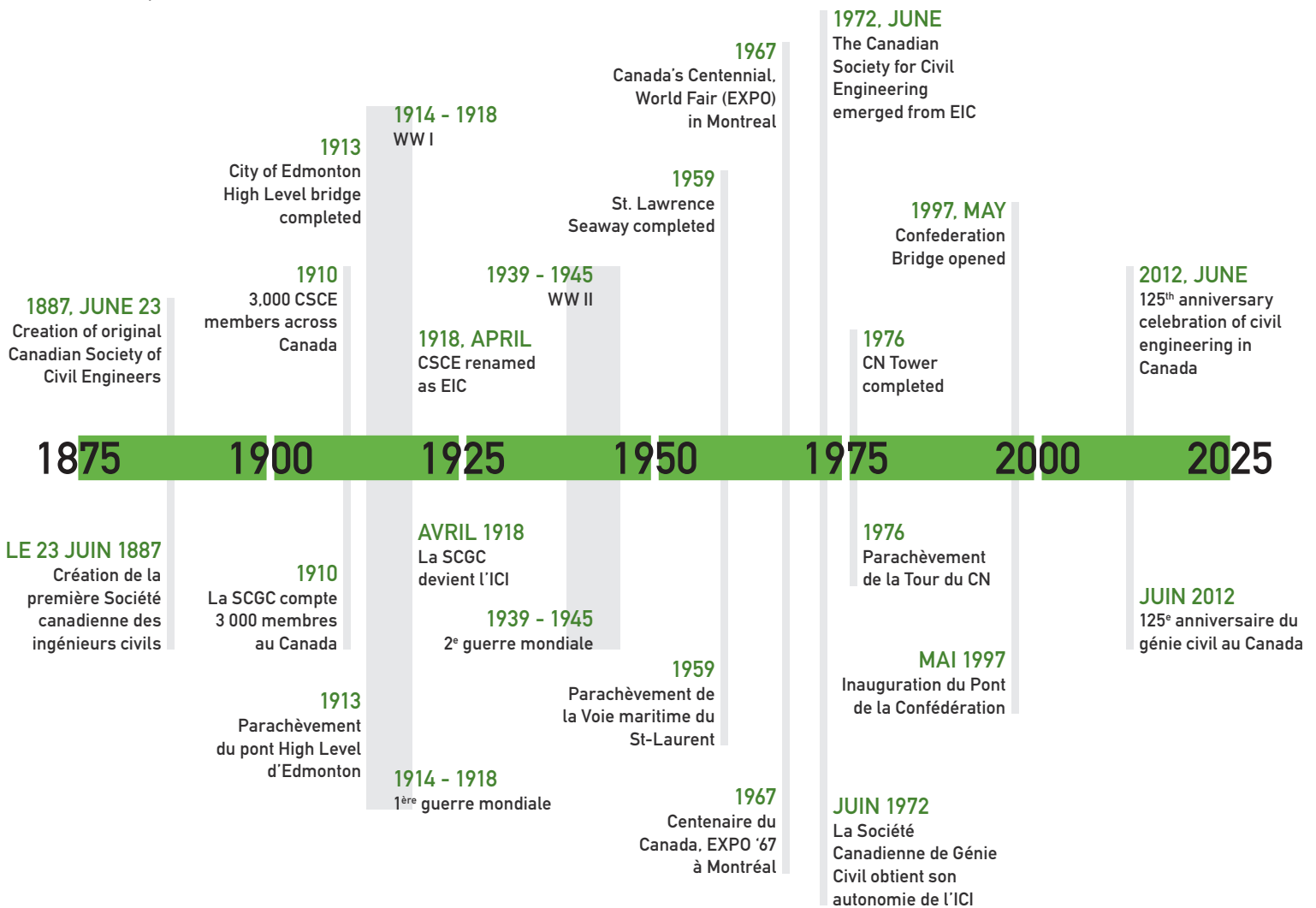
The original Canadian Society of Civil Engineers (CSCE) received royal assent for its charter 125 years ago on June 23, 1887. Since that time, Canadian civil engineers continue to apply their knowledge and curiosity to build, enhance and solve problems in society – achieving many great feats and establishing legacies in the process of building our nation.

This June, join CSCE and the Engineering Institute of Canada (EIC) in celebrating the 125th anniversary of our founding society. A week of conference events will be topped off by a special awards evening on June 7 to honour the achievements and accomplishments of our peers. A new Award for Governmental Leadership in Sustainable Infrastructure has been established to commemorate the 125th anniversary and CSCE's Vision 2020 initiative in recognizing the importance of sustainability in civil infrastructure.

La SCGC célèbre 125 ans d'ingénierie

La charte de la première Société canadienne des ingénieurs civils a reçu la sanction royale il y a 125 ans, le 23 juin 1887. Depuis, les ingénieurs civils canadiens s'emploient à construire des ouvrages et à régler les problèmes de la société, accumulant d'impressionnantes réussites et créant les bases d'un grand pays.

En juin prochain, la SCGC et l'Institut canadien des ingénieurs (ICI) célèbrent le 125^e anniversaire de la première société des ingénieurs. Cette semaine de congrès sera couronnée par une soirée spéciale des lauréats, le 7 juin, pour souligner les réussites de nos pairs. Un nouveau prix soulignant le leadership en matière d'infrastructures durables a été créé pour commémorer ce 125^e anniversaire et le projet Vision 2020 destiné à souligner l'importance de la durabilité des infrastructures civiles.



Edmonton Welcomes CSCE 2012

We are delighted to invite you to join us in June for CSCE 2012 *Leadership in Sustainable Infrastructure*, the annual conference of the Canadian Society for Civil Engineering (CSCE). Come to Edmonton and support the advancement of excellence in civil engineering and join the 125th anniversary celebration of the founding of the original Canadian Society of Civil Engineers in 1887 with our parent society, the Engineering Institute of Canada (EIC).

It is also our pleasure to announce the Honourable Ed Stelmach, former Premier of Alberta, as CSCE 2012 Conference Honorary Chair.

We are in the midst of an international rediscovery of the importance of civil infrastructure and the need to make wise, long-term investments. Current infrastructure needs must be met while simultaneously planning for the needs of future generations. This demand for enduring, financially prudent, and environmentally sound infrastructure presents huge challenges—and opportunities—for civil engineers and allied professions the world over. CSCE 2012 Edmonton will provide a forum to share ideas among civil engineers, planners, accountants, government officials and others who work together to deliver these vital infrastructure services.

Edmonton is the heart of Alberta's capital region. With a regional population in excess of one million, it is a hub of cultural and economic activity and is rapidly emerging as a leader in emphasizing sustainability in municipal infrastructure growth. Edmonton is the primary service centre to Alberta's energy sector, and therefore also a key research and development market. On the more creative and entertaining side, Edmonton is known as the Festival City with a thriving cultural and arts scene that is yours to discover during your visit. Consider extending your stay and taking in the breathtaking beauty of our national parks in Jasper and Banff, both just a few hours away.

We hope you'll join us at CSCE 2012 and the 125th anniversary celebration of the CSCE and EIC. In June in Edmonton, the days are warm and the evenings long. We can't wait to share a few of them with you.

CSCE 2012 CONFERENCE CO-CHAIRS

Dr. Robert Driver, Ph.D., P.Eng., MCSCE

Dr. Jeffrey DiBattista, Ph.D., P.Eng., MCSCE



Edmonton accueille le congrès de 2012 de la SCGC

Nous sommes ravis de vous inviter à être des nôtres et à participer au congrès annuel de 2012 de la SCGC, qui aura pour thème « Le leadership en matière d'infrastructures durables » et qui se déroulera en juin, à Edmonton. Venez donc à Edmonton pour appuyer les progrès de l'excellence en génie civil, et venez célébrer le 125^e anniversaire de la création de la première Société canadienne des ingénieurs civils (fondée en 1887), en compagnie de notre société mère, l'Institut canadien des ingénieurs (ICI).

Nous avons aussi le plaisir d'annoncer que l'Honorable Ed Stelmach, ancien Premier ministre de l'Alberta, est le président d'honneur du Congrès 2012 de la SCGC.

Nous sommes en pleine redécouverte internationale de l'importance des infrastructures et de la nécessité de procéder intelligemment à des investissements à long terme. Les besoins actuels en matière d'infrastructures doivent être comblés, tout en planifiant les besoins des générations à venir. Cette nécessité de créer des infrastructures durables, qui respectent l'environnement et le contexte financier, comporte d'énormes défis – qui sont autant d'occasions, pour les ingénieurs civils et les professions connexes du monde entier, de réaliser de grandes choses. Le congrès de 2012 de la SCGC, à Edmonton, sera un forum permettant aux ingénieurs, planificateurs, comptables, dirigeants gouvernementaux et autres de mettre en commun leurs idées pour fournir ces infrastructures essentielles à nos sociétés.

Edmonton est le cœur de la région de la capitale albertaine. Avec une population régionale de plus d'un million de personnes, c'est un centre économique culturel important, qui devient rapidement un leader en matière d'infrastructures municipales durables. Edmonton est le principal centre de service du secteur énergétique albertain, et, de ce fait, un important marché en matière de recherche et de développement. Dans un autre domaine, Edmonton est reconnue comme étant une ville de festivals. Vous y découvrirez une activité culturelle et artistique en pleine effervescence. Pendant que vous serez sur place, pourquoi ne pas prolonger votre séjour et faire un détour dans nos superbes parcs nationaux de Jasper et de Banff, à quelques heures de route !

Nous espérons que vous serez des nôtres au congrès de 2012 de la SCGC et pour le 125^e anniversaire de la SCGC et de l'ICI. En juin, à Edmonton, les journées sont chaudes et les soirées sont longues. Venez partager ces moments avec nous.

CO-PRÉSIDENTS DU CONGRÈS DE 2012 DE LA SCGC

Dr. Robert Driver, Ph.D., P.Eng., MCSCE

Dr. Jeffrey DiBattista, Ph.D., P.Eng., MCSCE

CONFERENCE PROGRAM HIGHLIGHTS

JUNE 6, 2012, WEDNESDAY

WORKSHOP I - INFRASTRUCTURE ASSET MANAGEMENT:
8 A.M. - 12 P.M.
Instructors: Guy Felio, ISR and Konrad Siu, City of Edmonton

WORKSHOP II - WINTER ROAD MAINTENANCE: 8 A.M. - 12 P.M.
Instructor: Dr. Liping (Li) Fu, University of Waterloo

YOUNG PROFESSIONALS (YP) SESSION WITH WORKSHOP:
8 A.M. - 12 P.M.

TECH TOUR I - MILLWOODS DOUBLE BARREL TUNNEL:
8 A.M. - 1 P.M.
Guide: Siri Fernando, City of Edmonton

TECH TOUR II - EDMONTON WASTE MANAGEMENT CENTRE:
8 A.M. - 1 P.M.
Guide: Bud Latta, City of Edmonton

TECHNICAL SESSIONS: 1 P.M. - 5:40 P.M.

COMPANIONS - CITY TOUR: 1 P.M. - 5 P.M.

CSCE COMMITTEE MEETINGS: 5 P.M. - 6:40 P.M.

YP MIXER: 6 P.M. - 7 P.M.

GRAND OPENING RECEPTION AT ART GALLERY OF ALBERTA:
7 P.M. - 9:30 P.M.

JUNE 7, 2012, THURSDAY

YP NATIONAL ROUND TABLE: 7 A.M. - 8 A.M.

TRADE SHOW: 8 A.M. - 6 P.M.
Trade Show Exhibition at Shaw Conference Centre. Play the Trade Show Passport game and you could win a fabulous prize!

OPENING PLENARY: 8 A.M. - 10 A.M.
Opening Keynote by Thomas Scarangelo

COMPANIONS - FORT EDMONTON: 9 A.M. - 1 P.M.
COMPANIONS - WEST EDMONTON MALL: 1 P.M. - 5 P.M.
The itinerary includes a guided tour of Fort Edmonton Park, a picnic lunch at the Selkirk, a shopping trip to West Edmonton Mall, then a wind-down afternoon tea and dessert at a local cafe.

TECHNICAL SESSIONS: 10 A.M. - 11:40 A.M.

LUNCHEON: Ed Stelmach, Honorary Chair; Keynote speaker, Dr. Michael Percy, former MLA & Acting Dean of Business and Economics, University of Winnipeg

TECHNICAL SESSIONS: 2 P.M. - 5:40 P.M.

CSCE-EIC AWARDS GALA: 5:40 P.M. - 10 P.M.
To celebrate the 125th anniversary of CSCE, the Awards Banquet will be held in conjunction with EIC. It will be a night to remember!

JUNE 8, 2012, FRIDAY

PRESIDENT'S BREAKFAST: 7 A.M. - 8 A.M.

TECHNICAL SESSIONS: 8 A.M. - 12 P.M.

COMPANIONS - TRAILS, RAILS, PYRAMIDS, AVENUES - OH MY!:
9 A.M. - 5 P.M.
Begin with a leisurely walk along the famous trails of Edmonton's river valley and end at the Muttart Conservatory. After lunch at Culina's you are off to Strathcona District for a historic tour and viewing of unique stores, galleries and cafes on Whyte Avenue.

LUNCHEON: CSCE / SCGC Annual General Meeting.

TECHNICAL SESSIONS: 2 P.M. - 5:40 P.M.

TECH TOUR III - NORTH LRT: 3 P.M. - 5 P.M.
Guide: Brad Smid, City of Edmonton

HISTORICAL DEDICATION: 3:30 P.M. - 5 P.M.
The Historical Landmark Dedication event will be held at the Alberta Aviation Museum to celebrate the 2012 inductees: Inuvik, Dredge No. 4, and Edmonton Municipal Airport Hangar #14.

SOCIAL - CRUISE ON EDMONTON QUEEN: 6:30 P.M. - 9:30 P.M.
The Edmonton Queen Riverboat is a unique attraction in the heart of downtown Edmonton, offering one of the most picturesque views of our beautiful river valley and city.

JUNE 9, 2012, SATURDAY

COMPANIONS - ITALIAN COOKING: 9 A.M. - 1 P.M.
Get ready to put on your apron and cook like an Italian! You will be treated to authentic cooking lessons comprising three courses: appetizer, entrée and dessert.

TECHNICAL SESSIONS: 10 A.M. - 12 P.M.

CLOSING LUNCHEON: 12 P.M. - 2 P.M.

CSCE COMMITTEE MEETINGS: 2 P.M. - 5 P.M.

CSCE FELLOWS DINNER: 6 P.M. - 9 P.M.

**FOR A DETAILED PROGRAM, VISIT
WWW.CSCE2012.CA**

Technical Program / Programme technique

Technical Program Has Global Input

At the heart of every great CSCE conference is a great technical program, and the 2012 conference is no different. More than 400 papers have been submitted to the 2012 conference from 27 countries. This research from around the world will be presented by some of the most distinguished engineers and practitioners connected to the civil engineering field.

The annual general conference will be held in conjunction with four specialty conferences—transportation, environmental, structural, and the first-ever specialty conference on sustaining public infrastructure. The conference will include exciting plenary and keynote presentations.

This year's general conference will cover a broad spectrum of civil engineering topics including construction, geotechnical, municipal and hydrological engineering, plus themed sessions of civil engineering history, emerging technologies and climate change mitigation strategies. Delegates will share ideas on exciting new technologies, research programs, software and award-winning projects. Visit www.csce2012.ca for a complete, up-to-date program.

An exciting plenary session on the rehabilitation of the Princess Margaret Bridge in Fredericton, N.B., will be presented. The useful life of the 1,100-m, 1950s-era bridge was extended using an innovative composite system of precast panels and steel trusses. This system rejuvenated the structure while reducing the construction schedule and accommodating the unique construction challenges.

The CSCE Conference presents an opportunity to share our civil engineering knowledge, strengthen our industry, meet with old friends and create new ones. I am truly excited about seeing everyone at this year's conference. ■

Cameron Franchuk, M.Sc., P.Eng., MCSCE
TECHNICAL PROGRAM CHAIR

Le programme technique provient du monde entier

Le programme technique est au cœur de tous les grands congrès de la SCGC, et celui de 2012 ne fait pas exception. Plus de 400 communications émanant de 27 pays ont été soumises pour



Art Gallery of Alberta

le congrès de 2012. Des travaux de recherche provenant du monde entier seront soumis par certains des ingénieurs les plus qualifiés du domaine du génie civil.

Le congrès général annuel se déroulera en même temps que quatre congrès spéciaux portant respectivement sur les transports, l'environnement, les charpentes, et le premier congrès sur les infrastructures publiques durables. Le congrès comportera de riches séances plénières ainsi que des présentations spéciales.

Le congrès général de cette année couvre une vaste gamme de sujets reliés au génie civil, dont la construction, la géotechnique, le génie municipal et le génie hydrologique, et comporte des séances thématiques sur l'histoire du génie civil, les technologies émergentes et les stratégies pour atténuer les changements climatiques. Les délégués pourront mettre en commun leurs idées sur les nouvelles technologies, les programmes de recherche, les logiciels et les projets primés. Vous trouverez le programme complet sur le site web www.csce2012.ca.

Une séance plénière sera consacrée à la restauration du pont Princess Margaret, à Fredericton, N.B. La durée de vie utile de cet ouvrage de 1 100 m., construit vers 1950, a été prolongée grâce à un système novateur de panneaux prémoulés et de fermes en acier. Ce système a permis de rajeunir la charpente, tout en écourtant l'échéancier de la construction et en réglant des problèmes de construction uniques.

Le congrès de la SCGC est une occasion exceptionnelle de mettre en commun nos connaissances en matière de génie civil, de renforcer notre industrie, de revoir de vieux amis et de s'en faire de nouveaux. Je compte sur votre présence au congrès de cette année. ■

Cameron Franchuk, M.Sc., P.Eng., MCSCE
PRÉSIDENT DU PROGRAMME TECHNIQUE

Specialty Conference – Sustaining Public Infrastructure

Conférence spécialisée – la viabilité des infrastructures publiques

Beyond Traditional Engineering

Owning, designing, constructing, operating and maintaining public infrastructure – such as roads, bridges, drainage systems, water treatment, transit and recreational facilities – has historically been the role of governments. While this responsibility continues to primarily rest with governments, recent global financial instability has put a greater onus on civil servants and elected officials to make sound financial decisions that will optimize infrastructure investment and ensure long-term sustainability.

INTERNATIONAL SUPER-SESSION / SUPER-SÉANCE INTERNATIONALE :

Dr. Ian Greenwood, New Zealand/ Australia
Dr. Bryan Adey, Switzerland
William Wallace, USA
Rhys Davis, United Kingdom
Dr. Gye Woon Choi, Korea
Councillor Dr. Guy Felio, Canada
Ravi Mital, India

TECHNICAL SESSIONS / SÉANCES TECHNIQUES :

30+ technical paper presentations relevant to sustaining public infrastructure

SMALL COMMUNITIES PANEL / PANEL SUR LES PETITES COLLECTIVITÉS :

Mark Hussey, City of St. Albert
Elmer Lickers, First Nation Communities
Brian Crist, City of Whitehorse
Jeanette Austin, Asset Management, B.C.

FINANCIAL SUSTAINABILITY PANEL / PANEL SUR LA VIABILITÉ FINANCIÈRE :

Tim Beauchamp, Chartered Accountants of Canada
Casey Vander Ploeg, Canada West Foundation
Bernie Kreiner, Government Finance Officers Association

Sustaining public infrastructure requires forward thinking and the careful weighing of physical, environmental, economic, political and social considerations. As stewards of the natural and built environment, civil engineers play a significant leadership role in achieving and managing this important balance.

Canadian civil engineers will need to broaden their scope and embrace the challenges, prospects and demands of today's changing society. The first International Specialty Conference on Sustaining Public Infrastructure provides a unique opportunity for practitioners to examine issues that are beyond the traditional discipline

Continues on page 26

Au-delà de la pratique traditionnelle du génie

Posséder, concevoir, exploiter et entretenir des infrastructures publiques comme des routes, des ponts, des réseaux de drainage, des usines de traitement des eaux, des équipements de transport et de loisirs a toujours été l'apanage des gouvernements. Bien que cette responsabilité demeure toujours le propre des gouvernements, l'instabilité financière qui sévit depuis peu a forcé élus et fonctionnaires à prendre des décisions financières plus éclairées qui résulteront en des investissements plus sains et une plus grande viabilité des infrastructures.

EDMONTON CASE STUDY PANEL / PANEL SUR L'ÉTUDE DU CAS D'EDMONTON :

Jim Andrais, Office of Environment
Heather McRae, Community Services
Gord Jackson, Sustainable Development
Rhonda Toohey, Transportation Planning

INTEGRAL CITIES PANEL / PANEL SUR LES VILLES :

Councillor Don Iveson, City of Edmonton
Bard Golightly, Development Industry
Eva Cairns, Civil Society
Antoine Palmer, Citizen's Voice

GOVERNMENT PANEL / PANEL GOUVERNEMENTAL :

Lorna Rosen, CFO – City of Edmonton
Neill McQuay, ADM – Alberta Treasury Board
Councillor Dr. Guy Felio, City of Clarence-Rockland

ENVIRONMENTAL SUSTAINABILITY PANEL / PANEL SUR LA DURABILITÉ DE L'ENVIRONNEMENT :

In conjunction with the 12th International Environmental Specialty Conference

La viabilité des infrastructures publiques exige une réflexion prospective et une évaluation serrée des considérations physiques, environnementales, économiques, politiques et sociales. À titre de gardiens de l'environnement naturel ou bâti, l'ingénieur civil joue un important rôle de leader dans le respect de cet important équilibre.

L'ingénieur civil canadien doit élargir ses horizons et relever les défis que présente la société contemporaine. Le premier congrès international spécial sur les infrastructures publiques durables représente pour les praticiens une occasion unique de se pencher sur des problèmes qui vont bien au-delà de la discipline traditionnelle du génie

Suite à la page 26

of engineering and consider how financial, political, social and environmental elements impact sustainability. Practitioners will explore recent advancements and innovative solutions to the global challenge of sustaining public infrastructure.

Themed panel discussions include infrastructure management and decision-making, financial sustainability, social sustainability, international practices on sustainable infrastructure, sustainable infrastructure in small municipalities, and environmental sustainability.

The first ever International Specialty Conference on Sustaining Public Infrastructure fits well with the Canadian Society of Civil Engineering's Vision 2020, Leadership in Sustainable Infrastructure, and breaks ground in developing a conversation in the field of sustainability by bringing together multiple disciplines that make and build our society. ■

pour étudier comment des éléments financiers, politiques, sociaux et environnementaux affectent la viabilité des équipements. Les praticiens étudieront les plus récents progrès en matière d'infrastructures publiques durables.

Des panels d'experts étudieront divers thèmes comme la gestion et la prise de décision en matière d'infrastructures, de viabilité financière, de viabilité sociale, de pratiques au niveau international et au niveau des petites municipalités.

Le premier congrès spécial international sur les infrastructures publiques durables reflète le document Vision 2020 de la SCGC en matière d'infrastructures durables et innove en favorisant le dialogue sur la durabilité et en réunissant les diverses disciplines qui créent et construisent notre société. ■

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Contact:
Carlos Lobo +1 647 923 7175

Specialty Conference – Transportation Conférence spécialisée – le génie des transports

International Flavour to Transportation Conference

The Ninth International Transportation Specialty Conference brings together practitioners from across Canada, the United States, China, the United Kingdom, India, Iran and other countries.

Featuring keynote presentations by:

- Dr. Laurence R. Rilett, University of Nebraska-Lincoln
- Mr. Ren Huixin, CCCC Road Maintenance Engineering Co.

This specialty conference will discuss multi-modal transportation with themed sessions on traffic operation, intelligent transportation systems, traffic safety analysis, transportation planning, pavement material, pavement asset management, sustainable transportation and public transportation.

To further promote the exchange of ideas and experiences, the CSCE Transportation Division and the China Highway and Transportation Society jointly organized the First China-Canada inter-transportation forum. This forum will take place in Edmonton prior to the conference. ■

Le congrès sur les transports prend une saveur internationale

Le neuvième congrès international spécial sur le génie des transports réunit des praticiens de tout le Canada, des États-Unis, de la Chine, du Royaume Uni, de l'Inde, de l'Iran et d'autres pays.

Présentations principales par :

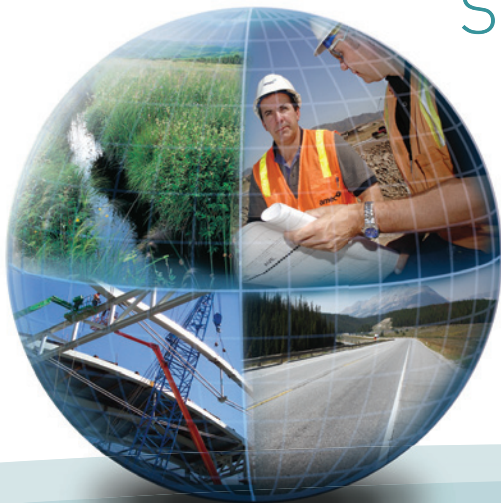
- Dr. Laurence R. Rilett, University of Nebraska-Lincoln
- Mr. Ren Huixin, CCCC Road Maintenance Engineering Co.

Ce congrès spécial portera sur le transport multimodal et comportera des séances thématiques consacrées aux opérations de trafic, aux systèmes de transport intelligents, à l'analyse de la sécurité routière, à la planification des transports, aux matériaux de revêtement des chaussées, à la gestion des chaussées, au transport durable et au transport collectif.

Pour favoriser l'échange d'idées et d'expériences, la division du génie des transports de la SCGC et la Société des transports et des autoroutes de Chine organisent conjointement le premier forum inter-transport Chine-Canada. Ce forum aura lieu à Edmonton, immédiatement avant le congrès. ■



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- Industrial Services
- Infrastructure
- Site Development/
Planning Services
- Transportation
- Mining



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Specialty Conference – Environment Conférence spécialisée – environnement

Focus on Water and Waste Management

The 12th International Environmental Specialty Conference will bring together environmental engineers and practitioners in academia, consulting, government and industry to present papers related to water quality and quantity, water treatment, municipal and industrial wastewater treatment, residuals management, solid waste management, contaminated site remediation and sustainability in environmental engineering.

Featuring keynote presentation by Daryl McCartney, executive manager of the Edmonton Waste Management Centre of Excellence. ■

Le congrès sur l'environnement porte sur l'eau et la gestion des déchets

Le 12^e congrès international spécial sur l'environnement réunira des praticiens, des universitaires, des consultants, des représentants des gouvernements et de l'industrie qui soumettront des communications sur la qualité et la quantité des eaux, le traitement des eaux, les usines municipales et industrielles de traitement des eaux usées, la gestion des déchets solides, l'assainissement des lieux contaminés et la durabilité dans le domaine du génie de l'environnement.

Intervention du conférencier principal: Daryl McCartney, directeur exécutif du « Edmonton Waste Management Centre of Excellence ». ■



Edmonton Waste Management Centre

Specialty Conference – Structural Conférence spécialisée – structures

Build Your Knowledge of Structural Issues

International academic, consulting and industry delegates will gather at the Third International Structural Specialty Conference to present over 150 papers related to a wide range of structures with themed sessions on analysis and design of structures, structural material and bio-mechanics, plus interesting case studies.

Featuring keynote presentation on the Princess Margaret Bridge Rehabilitation Project.

This conference is a great opportunity to network and enhance your knowledge on code development, innovative construction and fabrication techniques, advances in structural modelling, state-of-the-art research, deterioration models, rehabilitation and many more relevant topics. ■

Améliorez vos connaissances des problèmes de charpentes

Des délégués internationaux du monde universitaire, du secteur de la consultation et de l'industrie se réuniront à l'occasion du troisième congrès international spécial sur les charpentes pour présenter plus de 150 communications portant sur une vaste gamme de charpentes. Des séances thématiques porteront sur l'analyse et le design des charpentes, sur les matériaux et sur la bio-mécanique, sans oublier des études de cas.

Il y aura également des exposés spéciaux sur le sujet: Princess Margaret Bridge Rehabilitation Project.

Ce congrès est une occasion exceptionnelle de multiplier les contacts et d'améliorer vos connaissances en matière de développement de codes, de techniques novatrices de construction et de fabrication, de modélisation structurale, de recherches de pointe, de modèles de détérioration, de restauration, etc. ■

This standard is awarded to firms who have successfully been named a 50 Best Managed Company four consecutive years. This prestigious national award is sponsored by Deloitte, CIBC Commercial Banking, National Post, and Queen's School of Business.



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Opportunities for Young Professionals (YPs)

If you're interested in meeting new people and furthering your career, this year's CSCE 2012 conference is a must-do, packed with networking opportunities with industry leaders and fellow YPs. In addition, a dynamic interactive professional development workshop is offered exclusively for YPs to polish up their ability to work within a team environment towards a common goal. Young professional conference participants will be invited to dine with the CSCE president and executive board at the President's Breakfast and are encouraged to participate in round table discussions on professional and personal development and the roles that YPs play in industry.

Work Hard – Play Hard is our motto. After full day conference sessions, there will be plenty of opportunities to unwind. Nightly socials will be planned at local establishments for networking in a more casual and relaxed environment. ■

Stay Connected

Edmonton is very excited to host the annual CSCE conference and we want to spread our excitement both across the country and around the world. What better way than to send out one of our own, and who better to send out than our loveable mascot Eddie?

Eddie has been one busy beaver! He has travelled the world and visited famous landmarks including the Great Wall of China and the Great Barrier Reefs in Australia. In Canada, Eddie has made appearances at CSCE local sections from St. John's on the east coast all the way to Victoria in the west.

Eddie's adventures are not over yet. Be sure to visit the CSCE 2012 Facebook page or follow us on twitter (@CSCE2012) to track his adventures and stay up to date on all conference details!

Stay connected. We want to hear from you! ■



Working with Great Partners for Continued Success.

Congratulations to the City of Ottawa, Delcan Corporation and all members of the project team who contributed to the success of the Strandherd-Armstrong Bridge in Ottawa, Ontario.

Golder is honoured to have completed the geotechnical engineering for this innovative, infrastructure project.

Engineering Earth's Development, Preserving Earth's Integrity.

www.golder.com



Technical Tours: Solid Waste, Trains, Tunnels

Edmonton Waste Management Centre

The City of Edmonton's Waste Management Centre, situated on a 233-hectare site in the city's northeast, encompasses an integrated assembly of state-of-the-art facilities for solid waste management. This includes the largest composting facility of its type in North America, a materials recovery facility for sorting recyclables, an integrated processing and transfer facility, a leachate treatment facility, a recycled aggregate facility, an electronics waste recycling facility and a landfill gas plant that generates sufficient energy to power 4,600 homes. Canada's first waste-to-biofuels facility for municipal waste is also under construction at the site.

These facilities, combined with efficient waste collection systems and community engagement, enable the City of Edmonton to divert up to 60% of residential waste from landfill. The diversion rate will increase

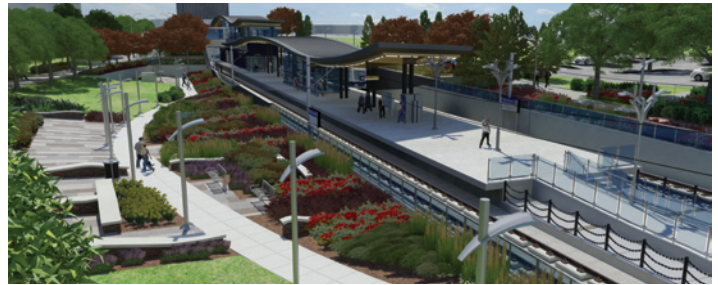
to 90% when the biofuels facility is fully operational in 2015. This full-scale municipal operation forms a dynamic "living laboratory" that makes it distinct as a centre for applied research and training.



North Light Rail Transit (LRT) Extension

The North LRT extension from downtown to the Northern Alberta Institute of Technology (NAIT) is part of Edmonton's plan to develop a comprehensive transit system and shift travel modes. This 3.3-km LRT extends from the existing LRT line at Churchill Station, through a 700-metre underground tunnel, before running along the surface from MacEwan University to NAIT. This extension will link major post-secondary institutions and health care centres to the LRT system and form the first section of a future extension to northwest Edmonton and St. Albert.

This project addressed unique challenges including the integration of the LRT tunnel into the construction of a high-rise office tower foundation, utility and traffic impacts in a high-density urban area,



and high-profile political and stakeholder demands. The North LRT project is a showcase for sustainable design initiatives including recycling of building materials, rainwater collection and irrigation, and a unique "tree canopy" that will preserve a row of mature elm trees in the heart of downtown Edmonton.

Mill Woods Double Barrel Replacement Tunnel

The Mill Woods Double Barrel Replacement Tunnel is a 4-m diameter tunnel with a length of 1700 m located 30 m below ground. It is part of a new network of storm tunnels that will allow the existing double-barrel sewers, which carry sanitary and storm flows in separate compartments within the same pipe, to be converted to sanitary sewers. This project will provide additional storm capacity in the new tunnel and additional sanitary capacity through the conversion of the existing double-barrel sewers to support future development and to reduce flooding frequency.

A soft ground tunnel boring machine (TBM) is used in the tunnel construction. The tunnel lining consists of more than 1,400 rings, each made up of four precast concrete segments which are expand-



ed against the soil. Each segment is 1.2 m long and 25 cm thick, reinforced with steel fibres. Construction of the tunnel started in mid-2009 and is scheduled to be completed by the spring of 2012.

Discover Edmonton

THINGS YOU MAY ALREADY KNOW ABOUT EDMONTON:

- It is Alberta's capital city.
- It is Canada's second-fastest growing city, and is the northernmost North American city with a metro population of more than one million.
- It is a major engineering and commercial hub that serves the resource development industries of the vast Canadian north.

THINGS YOU MAY NOT KNOW ABOUT EDMONTON:

- It has a vibrant arts and cultural scene.
- It offers many unique festivals and special events each year, including sports events, entertaining music and film festivals, and celebrations of food and culture from around the world.
- It is the gateway to the North and a short drive from the stunning Rocky Mountains.

The CSCE 2012 conference is a perfect opportunity to explore Edmonton.



Attractions

Your conference hotel and facilities are located in the heart of Edmonton's downtown Arts District. Take in a play at the Citadel theatre, browse the Art Gallery of Alberta, or enjoy one of our outdoor festivals in Churchill Square. A short ride on the LRT will take you to the Legislature precinct, with its walking trails and gardens, or to the University of Alberta for a relaxing stroll through campus. Ride the historic streetcar to Old Strathcona, and enjoy a wide variety of restaurants, lounges and cafes. A trip to Edmonton won't be complete without a visit to West Edmonton Mall, with its 800 shops, 100 eateries and nine world-class attractions.

Outdoor Activities

While attending the conference, we encourage you to enjoy Edmonton's river valley, North America's largest urban park. Walking trails and splendid vistas will greet you within our "ribbon of green." Edmonton is home to more than 70 golf courses, some within a short drive from downtown.

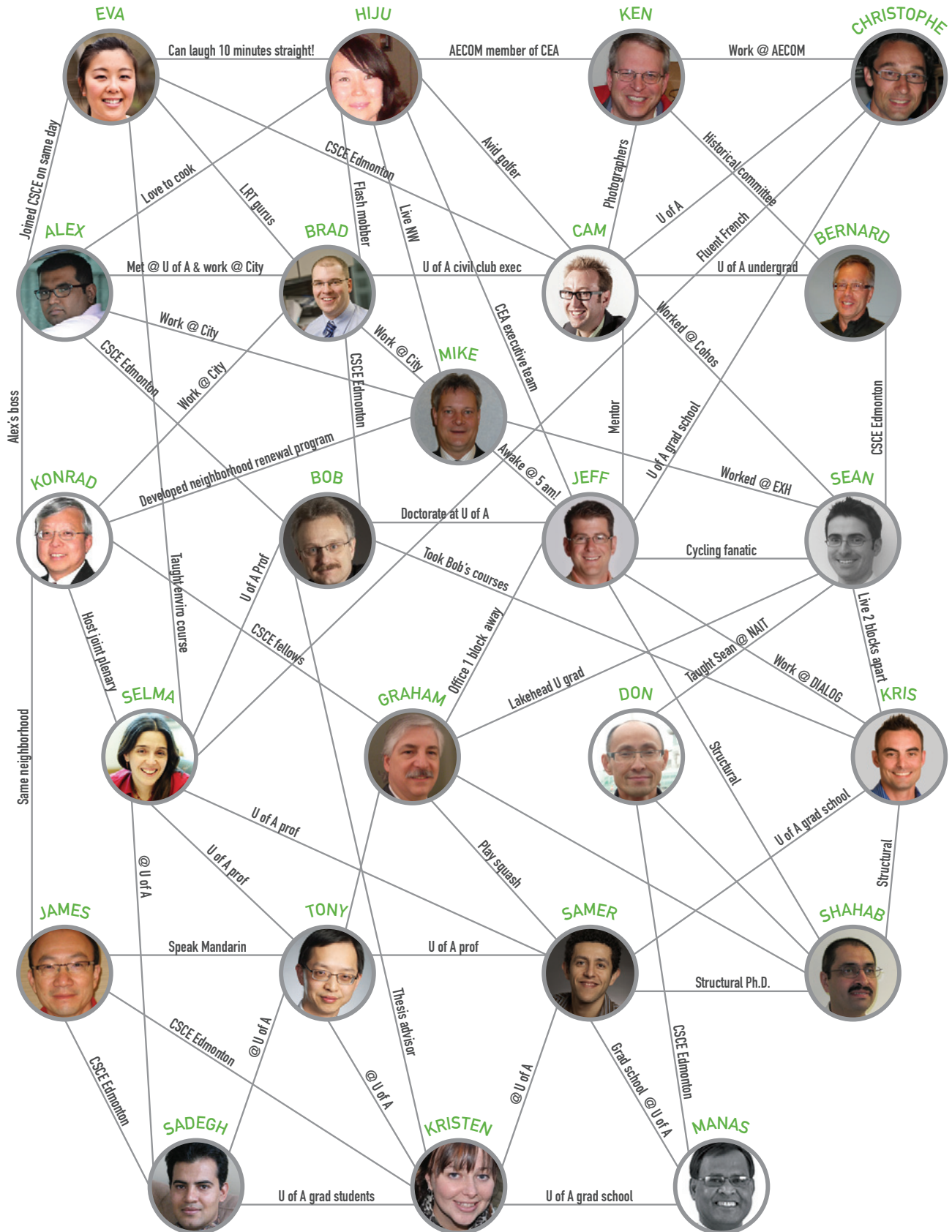
There are several day trips possible from Edmonton, including Elk Island National Park. This pristine oasis of aspen parkland, less than an hour from Edmonton, offers self-guided trails to view free-roaming herds of bison, moose, elk, and 250 species of birds.

Alberta's Natural Beauty

Further afield, we encourage you to extend your visit to Alberta and visit the spectacular Rocky Mountains. In addition to breathtaking views, Jasper National Park and Banff National Park offer many attractions, including the Banff Gondola, the Columbia Icefield Glacier and horseback riding. As the gateway to the north, Edmonton can also be a jumping off point for camping, fishing trips, and other outdoor pursuits.

We welcome you to experience all that Edmonton and Alberta have to offer!
Explore Edmonton at www.edmonton.com.

SIX DEGREES OF SEPARATION: 2012 Local Organizing Committee



Infrastructure Courses

CSCE has offered several very successful infrastructure-related courses that are in line with our Vision 2020: Leadership in Sustainable Infrastructure. This year the National Lecture Tour, which covered the impact of the Japan tsunami on infrastructure and the Guide to Bridge Hydraulics course, attracted over 800 participants. New courses are under preparation and will be scheduled in the coming months.

We have also developed the following two short courses to be presented at our 2012 annual conference:

- Winter Road Maintenance – Performance Measurement
- Evaluation and Infrastructure Asset Management.

For information, please go to: www.csce.ca

Soft Skills Training

Today's challenges demand that engineers not only are good at what they do, but also that they are proficient in getting the job done. While engineers are taught to build roads and bridges, the focus on the soft, human side of their work is often missing from their education.

CSCE is developing soft skills training aimed at emerging young professionals. The training will concentrate on "soft" factors not currently part of the engineering academic curriculum such as communication, writing and presentation skills, and leadership competencies. Our goal is to offer young engineers tools that would complement their technical training and make a difference to their performance, development and growth. ■



Mahmoud Lardjane

CSCE PROGRAMS MANAGER / DIRECTEUR DES PROGRAMMES
 MAHMOUD@CSCE.CA

Infrastructures

La SCGC a offert plusieurs formations en lien avec notre Vision 2020 : Leadership en matière d'infrastructures qui ont eu un très grand succès. Cette année, notre tournée nationale, qui a porté sur l'impact du tsunami du Japon sur les infrastructures et notre formation sur l'hydraulique des ponts ont attiré près de 800 participants. De nouvelles formations sont en préparation et seront présentées dans les prochains mois.

Nous avons aussi développé les deux cours suivants qui seront offerts à notre congrès annuel 2012 :

- Maintenance des routes en conditions hivernales – mesure et évaluation des performances
- Gestion des actifs en infrastructures.

Pour plus de détails, veuillez consulter www.csce.ca.

Compétences non techniques

Les défis d'aujourd'hui exigent des ingénieurs d'être efficaces non seulement dans l'accomplissement de leurs réalisations, mais aussi dans la manière dont ils les accomplissent. Les ingénieurs apprennent à construire des routes et des ponts, mais les aspects humains non techniques de leur formation sont souvent manquants.

La SCGC élabore actuellement des formations destinées aux jeunes professionnels. Ces formations portent essentiellement sur l'acquisition d'apprentissages ne faisant pas partie des programmes d'études académiques telles que les compétences en communication, en rédaction, en présentation et en leadership. Notre but est non seulement de proposer aux jeunes ingénieurs des outils leur permettant de compléter leur formation technique académique mais aussi de développer l'aspect humain de leur travail et leur croissance personnelle. ■

NOTICE OF 2012 ANNUAL GENERAL MEETING OF THE CSCE

The 2012 Annual General Meeting of the Canadian Society for Civil Engineering will be held during the Annual Conference of the Society on Friday, June 8, 2012 in the Ballroom of the Westin Hotel in Edmonton, Alberta. 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.

AVIS DE 2012 ANNUEL ASSEMBLÉE GÉNÉRALE DE LA SCGC

L'assemblée générale annuelle 2012 de la Société canadienne de génie civil aura lieu pendant le congrès annuel de la société, vendredi le 8 juin 2012 dans la salle de bal à l'hôtel Westin à Edmonton, Alberta. 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.

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PARTNERS / ASSOCIÉS



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