

CANADIAN CIVIL ENGINEER  
L'INGÉNIEUR CIVIL CANADIEN

# civil



**Engineers — Advocates  
for Future Policy**  
**L'ingénieur, garant d'une  
politique de l'avenir**

MAY / MAI  
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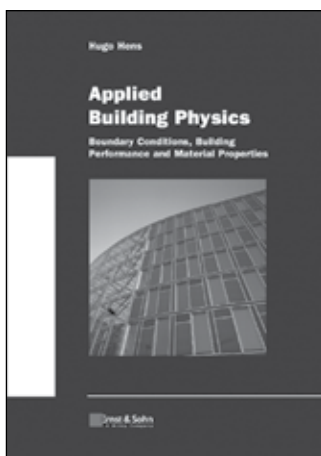
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## FROM THE EDITOR / MOT DE LA RÉDACTRICE

LOUISE NEWMAN LOUISE@CSCE.CA



This edition of the Canadian Civil Engineer highlights our 2011 Annual Conference, which will take place in Ottawa, ON from June 14–17, 2011. Under the theme “Engineers—Advocates for Future Policy”, 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 more than 350 papers submitted.

The conference will also include a special dedication ceremony of the City of Ottawa's Fleet Street Pumping Station as a National Historic Civil Engineering Site.

The optional social evening will be held on Wednesday, June 15th at the renowned Museum of Nature, home to brand-new exhibitions and galleries, a 100-year old stone ‘castle’, and Canada's natural history collection. Not to be missed!

The Awards Banquet on Thursday, June 16th 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 2011 Annual Conference who have worked diligently to offer a program that is sure to please everyone. See you in Ottawa! ■

Cette édition de L'ICC porte sur notre congrès annuel de 2011 qui aura lieu à Ottawa, Ontario du 14 au 17 juin prochains. Sous le thème « L'ingénieur, garant d'une politique de l'avenir », 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 techniques 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 mercredi 15 juin, au Musée canadien de la nature, où un « château » centenaire en pierre abrite des expositions et des galeries flambant neuves, sans oublier la collection d'histoire naturelle du Canada. À ne pas manquer!

Le banquet des lauréats du jeudi 16 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 2011 qui ont réussi à nous offrir un programme qui plaira à tous. Nous comptons sur votre présence à Ottawa! ■

# Ottawa 2011



## CSCE 2011 CONFERENCE CHAIR'S REMARKS

Linda Newton, CD, PhD, MCSCE, 2011 CSCE Conference Chair

On behalf of the Local Organizing Committee, I look forward to welcoming our delegates and guests from across Canada, North America and around the world to Ottawa from June 14–17, 2011 for the 2011 Canadian Society for Civil Engineering Annual Conference.

The 2011 CSCE Annual Conference will be held at the Westin Hotel in downtown Ottawa and will comprise the General Conference, a pre-conference professional development day, the 2nd International Engineering Mechanics and Materials Specialty Conference; the 3rd International/9th Construction Specialty Conference; and the 20th Canadian Hydrotechnical Conference. The Conference theme “*Engineers—Advocates for Future Policy*”, provides a unique opportunity for the presentation and discussion of the role of engineers in shaping national and international policy in all areas of civil engineering.

Situated at the heart of the National Capital Region, Ottawa is rich in culture, history and recreational opportunities. Over one million people live and work on both sides of the Ottawa River and the conference site is just steps from the Rideau Canal—a UNESCO World Heritage Site. In addition, the region is known for its many cycling and walking paths, hiking in the beautiful Gatineau Park and the vibrant Byward Market. Our Companions' Program will take full advantage of the many treasures to be found in the area.

We expect almost 500 delegates to attend the conference, along with papers submitted by authors from around the world. World-class keynote speakers have been confirmed for the General Conference. In addition to the technical program, we have two special sessions, an industry trade show, technical tours, and an outstanding Companions' Program. We will also be designating the Fleet Street Pumping Station as a National Civil Engineering Historic Site.

The optional social evening at the newly renovated Museum of Nature is a must as the museum was partially closed for over two years whilst it underwent an extensive retrofit and seismic upgrading; the result is spectacular. Cocktails and hors d'oeuvres in the Salon will be accompanied by a leisurely visit to two of the museum's newly renovated galleries, open exclusively for the attendees. Space is limited so be sure to sign up early.

The CSCE Annual General Meeting will be held on Thursday 16th June and the CSCE award winners and new Fellows will be honoured at the Banquet later that evening.

Please join CSCE President Vic Perry, P.Eng., FCSCE, our Honorary Chair Ms. Marie Lemay, P.Eng. and the Local Organizing Committee at this year's Annual Conference. We look forward to welcoming you! ■

## REMARQUES DE LA PRÉSIDENTE DU CONGRÈS

Linda Newton, CD, PhD, MSCGC, présidente du congrès 2011 de la SCGC

Au nom du comité organisateur local, j'espère bien accueillir en grand nombre nos délégués et nos invités du Canada, de l'Amérique du Nord et du monde entier, du 14 au 17 juin 2011, au congrès annuel de la Société canadienne de génie civil.

Le congrès annuel de 2011 de la SCGC aura lieu à l'hôtel Westin, au centre-ville d'Ottawa, et comportera le congrès général, une journée de perfectionnement pré-congrès, le 2<sup>e</sup> congrès international spécial du génie des matériaux et mécanique appliquée, le 3<sup>e</sup> congrès international/9<sup>e</sup> congrès spécial sur le génie de la construction, et le 20<sup>e</sup> congrès canadien d'hydrotechnique. Le thème du congrès « *L'ingénieur, garant d'une politique de l'avenir* », offre une occasion unique d'exposer et de discuter du rôle de l'ingénieur dans l'élaboration des politiques nationales et internationales dans tous les domaines du génie civil.

Située au cœur de la région de la capitale nationale, Ottawa est riche de culture, d'histoire et de loisirs. Plus d'un million de personnes vivent et travaillent des deux côtés de la rivière des Outaouais, et le lieu où se déroule le congrès est à quelques pas du canal Rideau, site du patrimoine mondial de l'UNESCO. En outre, la région est réputée pour ses sentiers de randonnée à pied ou en vélo, pour les excursions dans le parc de la Gatineau et pour son marché By. Notre programme des conjoints profitera pleinement de tout ce que la région peut offrir.

Nous attendons presque 500 délégués au congrès. Des communications y seront présentées par des auteurs du monde entier. Des conférenciers de réputation mondiale ont confirmé leur présence au congrès général. En plus du programme technique, nous aurons deux sessions spéciales, une exposition industrielle, des visites techniques et un programme exceptionnel pour les conjoints. Nous procéderons aussi à la commémoration du poste de pompage de la rue Fleet, qui deviendra ainsi un lieu historique national du génie civil.

La réception en soirée (facultative) au Musée de la nature (récemment rénové) est à ne pas manquer; le musée a été fermé pendant deux ans, au cours desquelles il a été modernisé de fond en comble et a fait l'objet de protections antisismiques. Le résultat est spectaculaire. Après les cocktails et les hors d'oeuvres au Salon, les délégués pourront visiter deux des galeries rénovées du musée, qui seront ouvertes expressément pour les délégués. Comme l'espace disponible est limité, inscrivez-vous dès maintenant.

L'assemblée générale annuelle de la SCGC aura lieu le jeudi 16 juin 2011, et le banquet des lauréats et des nouveaux « fellows » aura lieu plus tard, en soirée.

Le président de la SCGC, Vic Perry, ing., FSCGC, notre présidente honoraire, M<sup>me</sup> Marie Lemay, ing. et le comité organisateur local comptent sur votre présence au congrès annuel de cette année! ■

I would like to express my sincere, personal thanks to all the volunteers and the National Office staff who have given selflessly over the past year to advance the Society forward towards its vision of “Leadership in Sustainable Infrastructure”. It is through these untiring efforts that the CSCE is able to offer its varied programs and represent our profession. As well, it is through these untiring efforts that those who came before us made Civil Engineering a distinguished profession which enables us to have satisfying careers. Furthermore, it is through these untiring efforts that we, and those who follow in our footsteps, can continue to enjoy this career satisfaction and know that, as a profession, we have the skills and ability to keep moving our society in a more sustainable direction.

The Local Organizing Committee of the 2011 Annual General Meeting & Conference in Ottawa has selected the theme “Engineers—Advocates for Future Policy”, that presents a call to action by our profession. This action is “ADVOCACY”, which requires us to take a position and speak out in support of the cause. In this case, the cause is future policy concerning infrastructure—the business of Civil Engineers. As custodians of the infrastructure, Civil Engineers have the responsibility and duty to the public to ensure that our infrastructure is built in the most sustainable way. Designing and building infrastructure without adequate consideration to the public policies on infrastructure will not result in the most sustainable solutions.

As Civil Engineers, we are trained to understand problems and seek solutions; as well, we are the profession best trained to address the issue of “What is sustainable infrastructure?” We must advocate for the best public policies for sustainable infrastructure. *We must stand up, speak out and show leadership.* We won’t always get it right or perfect, but those before us have provided many examples where it wasn’t done perfectly either. Therefore maintaining the ‘status quo’ is unacceptable and being an advocate for future policy is the only responsible action.

As the CSCE rolls out its new vision and business plan to support its vision of

*“We make a living by what we get; we make a life by what we give.”*

—Winston Churchill

“Leadership in Sustainable Infrastructure”, it will become more obvious to the membership and the public that the CSCE does want to lead and be at the center of the debate on sustainable infrastructure. The recent letter ballot on the by-laws that will permit the president to speak out on behalf of its members is an example. The CSCE’s progress over the past year with respect to the establishment and development of a dialogue at the ministerial level of Infrastructure Canada is another example. Developing a “White Paper” on sustainable infrastructure provides a starting point for the debate. These are good examples of short-term initiatives, but they are not sufficient.

Under the continuing leadership of President-Elect Randy Pickle, the CSCE will begin to roll out very specific action plans that will put the organization at the center of the debate on sustainable infrastructure. I have confidence that the CSCE is on the right path to meeting this challenge and ask all members to provide their continued support and assistance to Randy, in order to accomplish this mission. As a Past-President, I will continue to support the CSCE and its future leaders in reaching its vision of “Leadership in Sustainable Infrastructure”.

I wish to thank the members of the CSCE for trusting in me and for giving me the opportunity serve as President over the past year. It is truly an honour and a privilege to have been the President of the CSCE and to have worked with so many great and giving people. Thank you to the CSCE team—you have made my term in office very rewarding.

*“We make a living by what we get; we make a life by what we give.”*—Winston Churchill ■

Je tiens à remercier tous les bénévoles et les permanents qui se sont dévoués au cours de l’année pour faire progresser la SCGC dans la voie du « leadership en matière d’infrastructures durables ». C’est grâce à leurs efforts que la SCGC est en mesure d’offrir ses programmes et de bien représenter la profession. En outre, c’est aussi grâce à ces efforts que nos prédécesseurs ont fait du génie civil une profession noble qui nous permet de connaître des carrières satisfaisantes. Et c’est grâce à ces mêmes efforts que nous et nos successeurs pouvons profiter de carrières en sachant que nous avons effectivement la compétence pour orienter notre société dans une voie plus durable.

Le comité organisateur local de l’assemblée générale et du congrès de 2011 à Ottawa a choisi le thème « l’ingénieur, garant d’une politique de l’avenir », qui exhorte notre profession à passer à l’action. Cette action, c’est la DÉFENSE et la PROMOTION de nos droits, qui exige que nous prenions position et que nous plaitions notre cause. Dans ce cas, la cause dont il s’agit est la politique de l’avenir en matière d’infrastructures, le domaine privilégié de l’ingénieur civil. En tant que grand gardien des infrastructures, l’ingénieur civil a la responsabilité et le devoir, face au public, de voir à ce que nos infrastructures soient construites de la façon la plus durable possible. Concevoir et construire des infrastructures sans égard pour les politiques publiques en matière d’infrastructures ne donnera jamais les solutions les plus durables.

Comme ingénieurs civils, nous sommes formés pour comprendre des problèmes et chercher des solutions. En outre, nous sommes les professionnels les mieux formés pour décider de ce qu’est « une infrastructure durable ». Nous devons exiger les meilleures politiques publiques pour assurer des infrastructures durables. *Nous devons nous tenir debout, faire valoir notre point de vue, et faire preuve de leadership.* Ce que nous faisons n’est pas toujours parfait ou même bien, mais nos prédécesseurs nous ont donné bien des exemples où les choses n’étaient pas parfaites. Voilà pourquoi le statu quo n’est pas acceptable et pourquoi le



souci des politiques de demain demeure le seul geste responsable.

À l'heure où la SCGC dévoile sa nouvelle stratégie et son plan d'affaires pour réaliser son objectif de « *leadership en matière d'infrastructures durables* », il deviendra de plus en plus évident pour les membres et pour le public que la SCGC tient à être au cœur du débat sur les infrastructures durables. Le dernier scrutin postal sur les règlements généraux en vue de permettre au président de prendre position au nom des membres en est un exemple. Les progrès de la SCGC au cours de l'année écoulée en ce qui a trait à l'établissement d'un dialogue au niveau d'Infrastructure Canada est un autre exemple. La préparation d'un « Livre blanc » sur les infrastructures durables constitue l'amorce du débat. Il y a beaucoup d'initiatives valables à court terme, mais ce n'est pas suffisant.

Sous le leadership du président désigné, Randy Pickle, la SCGC mettra en œuvre des plans précis qui placeront la SCGC au cœur du débat sur les infrastructures durables. Je sais que la SCGC est sur la bonne voie pour relever les défis et je demande à tous les membres de continuer à aider Randy Pickle à remplir sa mission. À titre de président sortant, je continue d'appuyer la SCGC et d'aider ses leaders à poursuivre leur programme en vue d'assurer « *le leadership en matière d'infrastructures durables* ».

Je remercie les membres de la SCGC qui m'ont fait confiance et m'ont donné l'occasion de servir à titre de président au cours de l'année. C'est un grand honneur et un grand privilège d'avoir été président de la SCGC et d'avoir pu ainsi travailler avec tant d'excellentes et généreuses personnes. Je remercie toute l'équipe de la SCGC. Vous avez fait en sorte que mon mandat soit une grande source d'enrichissement.

« *We make a living by what we get; we make a life by what we give.* »—Winston Churchill ■

## SECTION QUÉBEC

Pour une troisième année consécutive, le chapitre étudiant SCGC de l'Université Laval en collaboration avec la SCGC, section Québec a offert aux étudiants de 1er cycle un forum sur la profession d'ingénieurs.

Cette activité s'est tenue le 23 mars 2011. Quarante-cinq personnes ont assisté à la conférence.

Cette année, les conférenciers invités étaient M. Émile Langlois, ing. conseiller au développement des marchés chez Teknika-HBA et M. Paul Lefrançois, ing., M. Sc, Vice-Président opération LVM—Est du Québec.

Le but de cette conférence est de présenter aux futurs ingénieurs les différentes possibilités de cheminements de carrière, auxquels ils auront à faire face dans l'avenir, tant dans les domaines privés et publics. Les conférenciers ont parlé de leur expérience acquise sur des projets d'envergure ainsi que les défis qu'ils ont dû surmonter. Aussi, les conférenciers ont discuté de leur implication sociale et de réseautage dans leur profession.



**CHAPITRE ÉTUDIANT SCGC — UNIVERSITÉ LAVAL — DE GAUCHE À DROITE:** François Leprince, représentant 2<sup>e</sup> année, Francis-Olivier Biron, représentant 1<sup>ère</sup> année, Emmanuelle Soude, représentante 1<sup>ère</sup> année, Abdoulaye Ly, directeur des communications, Karianne Lavoie, trésorière, Maxime Noël, représentant 2<sup>e</sup> année, Sahar Ghorbani Liastani, représentant 2<sup>e</sup> année, Mamadou Badiane, représentant 1<sup>ère</sup> année, Charles Dubois, directeur du site web, Raphaël Morin-Gagnon, président du comité de la section étudiante.



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## Towards Sustainable Infrastructure

### INTRODUCTION

According to the United Nations Environment Programme Sustainable Buildings and Climate Initiative, buildings consume more than 40% of the global energy use and produce one-third of all greenhouse gases and 80% of the greenhouse gases produced in towns and cities. Pollutants are produced during construction, operation, occupation and demolition of buildings and infrastructure. Water (20% of the total) and natural materials (30% of the total) are consumed. Construction is responsible for 30% of all solid waste production. Economic aspects are traditionally considered with regards to infrastructure sustainability.

Environmental and social aspects must also be included to work towards sustainability goals.

Physical Infrastructure can be defined as buildings, structures, networks for communication and transport, plants and networks for water supply and wastewater treatment, plants for solid waste treatment and energy production, and networks for energy distribution. Over the entire life cycle, the building and construction sector throughout (construction, management, deconstruction and recycling) has a significant impact on the environment due to the use of resources (materials, energy, water, land) and the introduction of pollutants and production of greenhouse gas emissions. The impact



of climate change must also be considered on the various types of infrastructure in the future. The impacts will be felt on both existing infrastructure regarding maintenance and improvement, as well as for the new infrastructure regarding siting, design and material use.

## SUSTAINABLE INFRASTRUCTURE

### Definition of Sustainable Infrastructure

“The design, construction, planning and maintenance of infrastructure that meets the needs of the present without compromising the ability of future generations to meet their own needs. Environmental, economic and social dimensions of infrastructure must be incorporated in a systematic approach. Buildings are a major component of infrastructure according to NRC (2007), Regina-Sustainable Urban Infrastructure, NRC.

In the future, a balance is required between the environmental, social and economical aspects. Increasing CO<sub>2</sub> emissions from transport are an important issue that must be addressed. Unintended consequences and externalities (costs from air pollution, congestion, noise, accidents, lifestyle diseases, etc.) which economic calculations today are independent of. Tools are required to measure and improve sustainability of infrastructure systems. Frameworks are needed to assess decision making and investment planning, environmental factors (energy and material flows), enhancement of the quality of life.

Sahely et al. (2005) have reviewed approaches for measuring sustainability such as weighted multicriteria. Life cycle assessment (LCA) is a methodology using a systems approach. For considering infrastructure systems often aspects are conflicting, thus posing many challenges, Maintenance, repair and renewal options must be evaluated often balancing cost versus technical performance. A framework is needed to evaluate progress towards sustainability. Assessment of sustainable infrastructure is needed for planning, policy and decision making processes, and monitoring and measuring progress. A sustainable infrastructure ensures the smallest possible strain on resources and the environment, and contributes to a sustainable society as a whole. A well developed and maintained infrastructure is absolutely necessary for modern society.

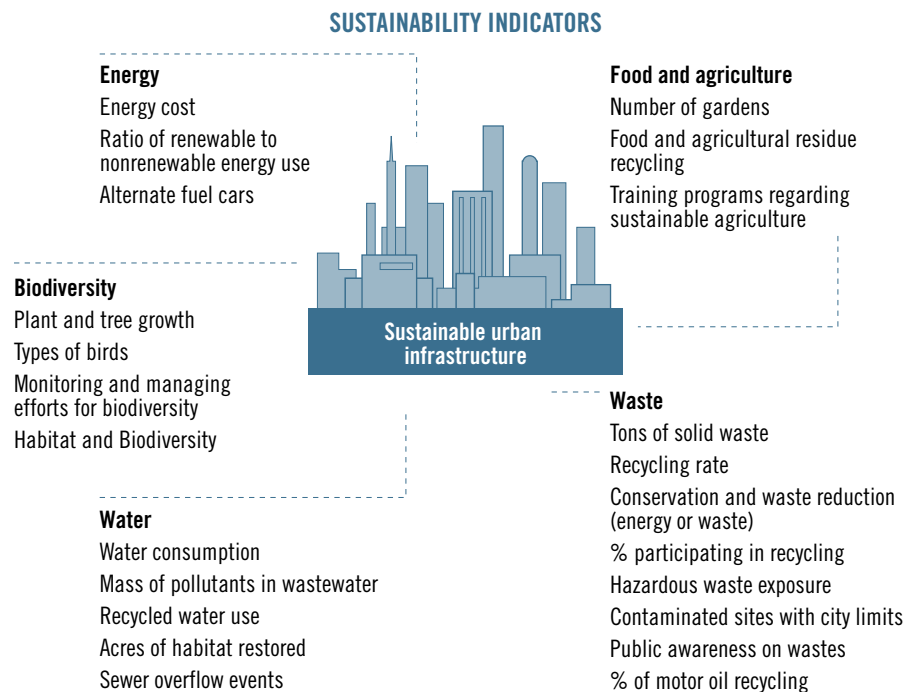


FIGURE 1: Indicators for Sustainable Infrastructure. (Yong et al., 2006)

### Challenges to Sustainable Infrastructure

Infrastructure must be safe, reliable and functional. The additional aspects of enhancing and preserving the environment must now be incorporated. Tools and methods for achieving and monitoring sustainable practices must be clear, easily understood and accepted by all stakeholders. Present inflexible codes, standards and regulations and practices for project selection, make it difficult to employ innovative technologies and solutions that work toward sustainability. Management often is not knowledgeable concerning these technologies and solutions.

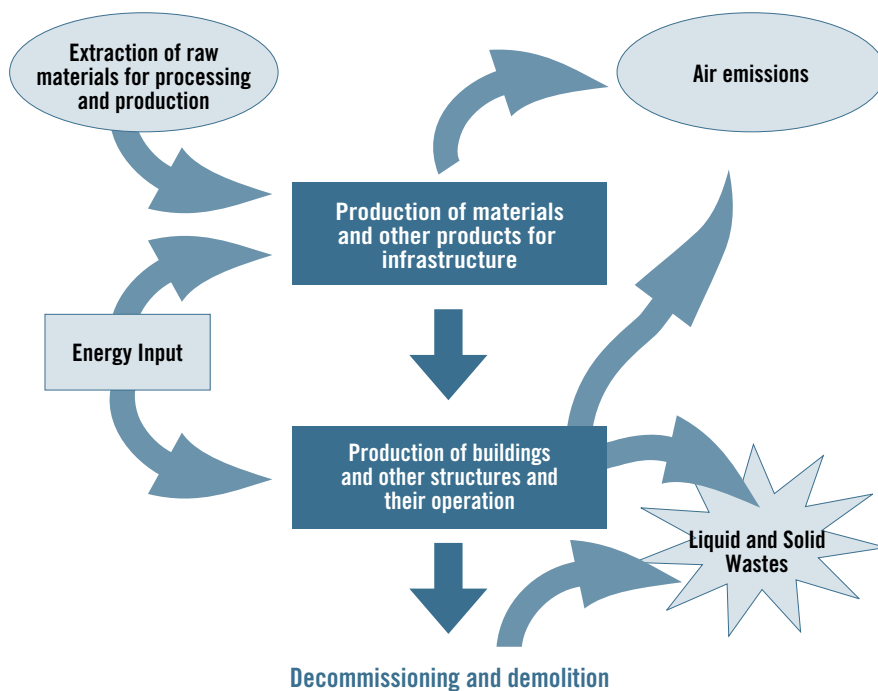
Direct costs and regulations are considered before waste and energy reduction, recyclability, renewability. These aspects must be incorporated. Engineers involved in the design of sustainable construction facilities face challenges by the attitudes of the public and other designers that lack of background and experience in sustainability. There is a lack of understanding related to sustainable design practices. A knowledge base would be beneficial to include political, social, economic and technical aspects. Working groups are needed to establish methods for defining, benchmarking, measuring, monitoring and disseminating results and information to all stakeholders.

### Sustainability Indicators for Urbanization

Implementation of indicators is highly important in decision making and for informing the public. Transparency and participation are facilitated. Quantitative representation can be difficult for some indicators and thus qualitative information is required. Data that is up to date and reliable is often difficult particularly for environmental data.

According to Dasgupta and Tam (2005), the indicators must be specific for the type of infrastructure, must determine if sustainability is being reached or not, can be used to evaluate alternatives, are preferably quantitative and are capable of evaluate all life stages of the infrastructure for environmental, economic and social aspects. They utilized a two tiered approach where some alternatives are eliminated by mandatory indicators (regulatory) and then others are compared based on judgement indicators (environmental and technical).

Most of the indicators for urban infrastructure presently available deal with easy-to-obtain data such as recycling information. Cities such as Seattle (Portney, 2003) use a wide range of indicators such as air quality, biodiversity, energy, climate change, ozone depletion, food and agriculture, hazardous materials, human health, parks and open space, economic



**FIGURE 2:** Life Cycle Assessment of Infrastructure Projects.

development, environmental justice, and education (Fig. 1).

Recently, the Consulting Engineers of Ontario participated in a consultation process with the Energy and Infrastructure Minister of the Province of Ontario for a 10-year Capital Infrastructure Plan (Steinberg and Martini-Wong, 2011), Key areas addressed in the plan included transportation, water conservation, treatment and reuses, power transmission and distribution and health facilities. Maintenance and rehabilitation are critical for these facilities. The plan indicated that economy must be stimulated while promoting social and environmental quality of life or in other words sustainable development.

#### Recent Initiatives Regarding Indicators

An index was developed for remediation projects named GoldSET® that evaluates various options in a web-based tool (Noël-de-Tilly and Lefrançois, 2010). Economic, societal and environmental indicators are selected after describing the site, selecting options. A three axis performance triangle is generated based on scoring and weighting schemes. Subsequent sensitivity analyses can be performed.

The Global Reporting Initiative (GRI) is a network-based organization that initiated the world's most widely used sustainability reporting framework (<http://www.globalreporting.org/>). This

Framework contains principles and performance indicators for measuring environmental, social and economic performance. However, no overall integration of the parameters is provided. The Sustainability Reporting Guidelines were published in 2006 and are freely available on their website (GRI, 2006). Specific industries are addressed through sector supplements. Currently the construction and real estate sector guidelines are under development and input is being solicited. Sector specific indicators have been identified.

The American Institute of Chemical Engineers (AIChE) has introduced a sustainability index by the Institute for Sustainability which was formed in 2004. Seven metrics are used including: Strategic commitment, environmental performance, safety performance, social responsibility, value chain management, product stewardship, sustainability innovation (Cobb et al., 2009). Companies can subscribe and obtain a report on their performance. Certified consultants can provide further services.

The American Society for Civil Engineering (ASCE) followed with their own Institute for Sustainable Infrastructure in partnership with American Council of Engineering Companies (ACEC), the American Public Works Association (APWA). In the summer of 2011, they will be launching a rating system that will be web based and will include environmen-

tal, economic and social aspects evaluating sustainability for owners, regulators and practitioners. The main aims are to promote community and policy acceptance of sustainable solutions, encourage collaboration and innovation through all stages of the life cycle from design to construction and maintenance of infrastructure (<http://www.asce.org/PressRelease.aspx?id=12884904365>).

#### Moving Forward to Sustainability

Education and training programs through universities, public education, practitioners and professional organizations are required to incorporate the multidimensions of design for sustainability. Construction methods and equipment must be improved to increase worker safety, hazardous site cleanups, productivity, and process quality of the constructed facility. Demonstration projects are needed to promote innovation in a sector that does not favorably to innovation.

Environmental impact is often not considered during life cycle analysis. Construction industry associations must cooperate with each other regarding eco-construction. The life cycle includes planning, design, manufacturing and procurement, construction, operation, maintenance, demolition, recycling, and waste treatment. Decision tool improvement is needed to enable appropriate life cycle benefit analysis (Fig. 2). New materials and systems must be developed to enhance facility durability, ease of construction, demolition and reuse to reduce life cycle impacts. Challenges exist including material availability at a local level. Tradeoffs currently exist between durability and performance and reusability and recyclability. Life cycle assessment is key to evaluating sustainable development practices. The chemical, electronic and communication industries are more advanced and must be consulted regarding life cycle assessment as seen by the efforts of the AIChE. Public and government policy is essential in affecting change to reach sustainability goals and promote innovation.

Professional organizations worldwide need to collaborate and share information to develop sustainable development methods and practices. In the US the AIChE and the ASCE have also made major efforts to determine methods for evaluating sustainability. As we have seen in Canada, the Infraguide was a useful database of knowledge in

infrastructure. Unfortunately this has ended and the current CSA Municipal Infrastructure Solutions Program (MISP) is now going ahead to validate knowledge from case studies and knowledge learned (Andres, 2011). The CSCE, with other organizations, is currently developing an Infrastructure Report Card similar to that of the ASCE in the USA. Developing methods for evaluating sustainable infrastructure was identified in 2003 and is part of the 2013 objectives for the Technology Road Map.

## CONCLUSIONS

Most indicators for evaluating sustainable infrastructure are based on costs, public safety, repairs, serviceability, and life time. The choice of the indicators is based on whether they are manageable, relevant meaningful, quantifiable, well-defined and aligned with the objectives. To be useable, the data should be stored in one place and accessible to municipal governments, easily weighted, easy to compare costs and other aspects, and able to be used over time. Indicators must be integrated over the life cycle of infrastructure. A useful measure such as an index or other visual aid should be obtained after the indicator analysis.

Currently, indicators (usually operational and technical) are used in early development and increasingly in the decision-making process. Often there is little communication between those with a technical understanding of the infrastructure and the municipal decision makers. There is also a lack of funding for managing assets. Technologies for reduction of energy, resource use and waste are required.

The Canadian Society of Civil Engineering has adapted sustainable practices for the future and will continue with the development of methods for evaluating infrastructure at the triple bottom line. Understanding of sustainable development requires multidisciplinary and broad thinking. Politics, law, financing, sociology, management, cultural, socio-economic and environment are some of the disciplines. Engineering and public works employees must see the value of the indicator development. The indicators should be tailored to the situation. Design must incorporate aspects of sustainable development. Research and education is highly needed in this area.

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# Tsunami Impact on Near-Shore Infrastructure: Challenges and Solutions

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## INTRODUCTION

Recent tsunami events have brought to light an often overlooked fact: that they represent one of the most destructive natural disasters. The past decade has been witness to four major earthquake-generated tsunamis: 2004 Indian Ocean Tsunami; 2007 Solomon Islands Tsunami; 2010 Chile Tsunami; and 2011 Japan Tsunami. These natural disasters have been responsible for widespread infrastructure damage, devastating economic consequences, and significant fatalities. The recovery for many of the coastal communities that have been hit by these tsunamis will take years. Those that have witnessed and survived such horrifying events will also deal with long lasting

psychosocial-related issues. While developed countries are apparently better prepared than many of the developing nations, the March 2011 Japan earthquake and subsequent tsunami demonstrated that the current state of the art in disaster prevention and mitigation, particularly for the case of tsunamis, is limited, in spite of the experience and prevention efforts of countries such as Japan.

## DESIGN STANDARDS AND BUILDING CODES

Although the impact from tsunamis has been severe, building codes and design standards that explicitly consider tsunami loading are rare and often inadequate.



FIGURE 1: Residential Structure in Pellhue, Chile.



FIGURE 2: Port Office in Talcahuano, Chile.

In Canada, the National Building Code (NBCC, 2005) does not address tsunami loading. Commentary J of the 2005 NBCC, “Design for seismic effects,” states that damage to buildings as a result of an earthquake can arise from ground shaking, soil failures, surface fault ruptures, or tsunamis. While ground shaking and the potential for soil liquefactions are explicitly considered, Commentary J states that other hazards can be addressed through proper site selection. Implementing tsunami design loads in design standards and building codes is slowly emerging. Knowledge of tsunami loading and effects on infrastructure is in its infancy relative to earthquake loading. Furthermore, tsunamis have been viewed as a very rare event. For these reasons, the structural engineering community has assumed that tsunamis are not critical and do not pose a significant loading event on structures. However, recent combined earthquake-tsunami events have demonstrated that although ample warning time is generally available for tsunami waves compared to earthquakes, an overwhelming proportion of damage and loss of life has been caused by the tsunamis and significantly less by the earthquakes. This reinforces the fact that current science and engineering knowledge towards understanding and mitigating the effects of tsunamis is acutely needed.

In reaction to recent tsunami events, interest in tsunami loading of near-shoreline infrastructure has emerged. From a survey of current design codes, design standards and design guidelines, four pioneering documents specifically account for tsunami-induced forces: the Federal Emergency Management Agency Coastal Construction Manual, FEMA 55 (FEMA, 2003), which provides recommendations

for tsunami-induced flood and wind wave loads; the City and County of Honolulu Building Code (CCH, 2000), which contains regulations that apply to districts located in flood and tsunami-risk areas; the Structural Design Method of Buildings for Tsunami Resistance (SMBTR) proposed by the Building Center of Japan (Okada et al., 2005), outlining structural design for tsunami refuge buildings; and the Guidelines for Structures that Serve as Tsunami Vertical Evacuation Sites, prepared by Yeh et al. (2005) for the Washington State Department of Natural Resources to estimate tsunami-induced forces on structures. Most recently, the Federal Emergency Management Agency published Guidelines for Design of Structures for Vertical Evacuation from Tsunamis, FEMA P646, (FEMA, 2008). This document focuses on high-risk tsunami-prone areas, and provides design guidance for vertical evacuation structures. The American Society of Civil Engineers (ASCE) 7, Minimum Design Loads of Buildings and Other Structures, which provides loads and load combinations that are suitable for inclusion in building codes, such as the International Building Code (IBC), recently established a Tsunami Loading and Effects (TLE) Subcommittee with the task to develop tsunami design provisions to be incorporated in the ASCE 7 Standard.

### Tsunami Impact on Infrastructure

Recent tsunami events have provided a tremendous opportunity for the engineering community to survey the damage to infrastructure and determine the spatial extent of the coastal inundation depths. A recent example is the 2010 Chile Tsunami where, for the most part, non-engineered structures, particularly low-rise residential,

suffered extensive damage; while engineered structures performed well, experiencing non-structural damage. Note that in many cases the engineered structures were located a farther distance from the shoreline, thus were subjected to lower inundation levels. Figure 1 illustrates the damage experienced by a residential structure in the coastal town of Pellhue, Chile. Extensive damage to the roof tiles and information gathered from locals suggested a local tsunami inundation level of approximately 15 m. While the building did not collapse, brick masonry infill walls were breached and a number of load bearing elements were destroyed. Timber posts were then used at the lower level to support the structure temporarily. Figure 2 is a photo of the Port Office in the town of Talcahuano. This concrete structure, located approximately 100 m from the shoreline, was displaced approximately 10 m from its foundation. The first storey was inundated with water, which indicated a water level of approximately 5 m struck the building. Aside from failure of the glazing units, no other damage was evident.

### STATE-OF-THE-ART EXPERIMENTAL RESEARCH

Establishing tsunami loads for structural design requires a comprehensive understanding of the force- and water level-time histories of a tsunami event. Palermo and Nistor (2010) and Nistor et al. (2009) provided a summary of the force components that can be expected to arise as a tsunami hydraulic bore advances inland. The first type of forces can be grouped into lateral components, including: impulsive force, hydrodynamic force, hydrostatic force, and debris impact and damming forces. The second group consists of vertical components: buoyant and uplift forces,



FIGURE 3: Square Model.



FIGURE 4: Circular Model.

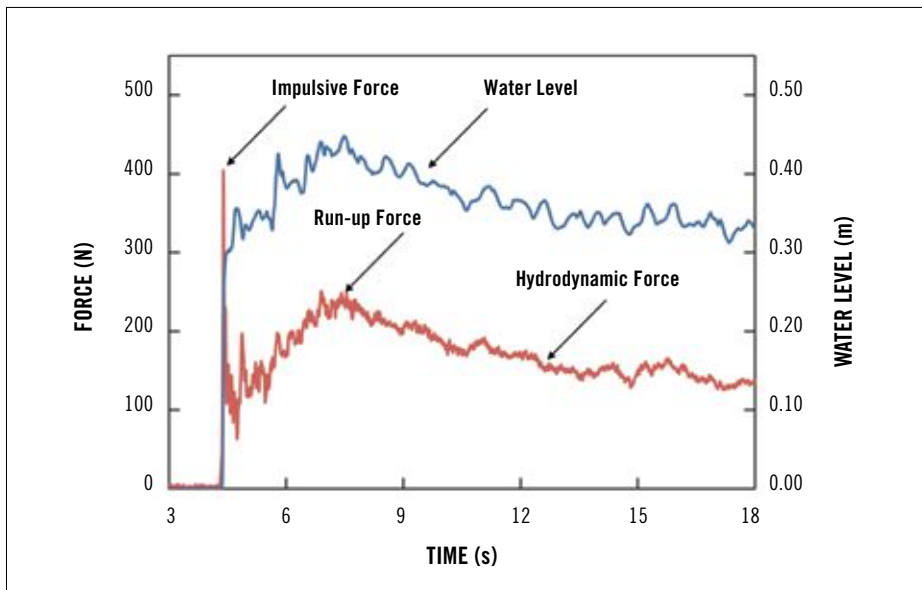


FIGURE 5: Force- and Water Level-Time Histories for Square Model.

and gravity forces due to drawdown of the water. Al-Faesly et al. (2011) have investigated the impact of simulated tsunami hydraulic bores on onshore structures. The focus of the study is to provide comprehensive knowledge of the force components and the magnitude of the components, and the velocity-time and water level-time histories of an advancing hydraulic bore. This experimental program is being conducted in the High Discharge Flume at the Canadian Hydraulics Centre (CHC), National Research Council, in Ottawa, Canada. The stainless steel flume was partitioned to create a 1.3 m wide by 7.3 m long

channel for testing. The height of the flume is 1.4 m. A hinged gate was designed and installed near the upstream end of the channel, where it can impound a specified height of water. The gate contains a swinging mechanism, which opens rapidly, releasing a turbulent hydraulic bore similar to a broken tsunami wave that advances downstream and impacts the structural models. Two structural models (Figures 3 and 4) are currently under investigation: square and circular. The models can represent either specific columns located at the base of a structure or the global shape of a building.

Figure 5 provides a typical force-time history experienced by the square model structure and the corresponding water level-time history at the location of the structure for a water impoundment depth of 550 mm. A short duration impulsive force arises at the instant the hydraulic bore impacts the structure. Immediately after the initial impact, the lateral force experienced by the model reduces due to a rebounding effect of the water. The force then gradually increases (run-up force) as the water level runs up the structural model. At a short time after, the water level converges to an approximate constant level, which results in a quasi-steady hydrodynamic force on the structure. Figure 5 illustrates that the impulsive force is the largest force component. This tends to be the situation for a dry bed condition, which replicates the surface conditions upon the arrival of the first tsunami wave. However, for a wet bed case, which characterizes the surface for subsequent tsunami waves advancing inland, the impulsive force does not generally exceed the hydrodynamic force. Under a dry bed case, the front of the advancing bore is steep and has the appearance of a wall of water. Conversely, on wet bed, the advancing bore travels with a shallower front. Figure 6 provides photos, taken during testing, corresponding to the individual force components labelled in Figure 5.

## SUMMARY AND FUTURE DIRECTIONS

This ongoing multi-disciplinary research project conducted in collaboration between the University of Ottawa and the Canadian Hydraulic Centre of the National Research Council in Ottawa is unique in Canada. Current experimental (Al-Faesly et al., 2011) and numerical modelling investigations (St-Germain et al., 2011), as well as future large-scale experimental research focusing on the impact of tsunami-type broken waves on structures will continue to elucidate the mechanisms of tsunami impact on infrastructure. The long-term goal of this comprehensive research program is the development of design guidelines for structures located in tsunami-prone coastal areas.

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FIGURE 6A: Impulsive Force.



FIGURE 6B: Run-up Force.



FIGURE 6C: Hydrodynamic Force.

*Canadian Society for Civil Engineering 20th Canadian Hydrotechnical Conference, Ottawa, Canada.*

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The candidate is expected to teach undergraduate and graduate courses in this area, and conduct research that develops preventive engineering in an area of Civil Engineering.

The Department of Civil Engineering at the University of Toronto is committed to excellence in teaching and interdisciplinary research and candidates must display evidence of excellence in teaching and research. The successful applicant is expected to have excellent communication skills, to be able to supervise graduate students, and to teach undergraduate courses in preventively oriented Civil Engineering.

Candidates should hold a doctoral degree and must be eligible for registration as a Professional Engineer in Ontario. Salary will be commensurate with qualifications and experience.

The Department is the home of two undergraduate programs: civil engineering and Lassonde mineral engineering. As a whole, the Department is committed to sustainability and resilience and recently ranked 9th in the World among other Civil departments according to the HEEACT Performance Ranking of Scientific Papers for Worlds Universities. To find out more about the Department and the programs, visit our homepage: [www.civil.engineering.utoronto.ca](http://www.civil.engineering.utoronto.ca)

All interested parties are encouraged to apply on-line at <http://www.jobs.utoronto.ca/faculty.htm>. If you are unable to apply online, please send your applications to Professor Brenda McCabe, Chair, Department of Civil Engineering, University of Toronto, 35 St. George Street, Room GB107, Toronto, Ontario, M5S 1A4. Applications should include detailed curriculum vitae (including publications and evidence of capacity and impact), a description of research, teaching and professional interests, and a list of at least four professional and character referees. The closing date for receipt of applications is May 31, 2011. The University of Toronto is strongly committed to diversity within its community. The University especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to further diversification of ideas. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

## FLEET STREET WATER PUMPING STATION

Rapid growth in Ottawa, in the mid- to late-19th century, created the desire for a modern water supply system, which became a contentious political issue. The Mayor's support generated violent protest in 1868 from the city's 31 licensed carters of water who did not favor a water system that would cost in excess of \$100,000.

The plan gained momentum in 1869 when Thomas Keefer submitted a report on "Water Supply for the City of Ottawa." His report described options, available technologies, and their strengths and weaknesses in existing North American systems and costing. His recommendation was to use the "economic and efficient" Holly pumping system with reciprocating piston pumps and hydrostatic pressure regulating equipment to provide domestic water supply and fire flows. Waterpower would be developed by routing water from Nepean Bay above the Chaudière falls to provide the required head. Keefer's recommended system was estimated to cost \$350,000.

A political driving force that generated support for Keefer's water works scheme was an enormous fire on August 17, 1870 that swept through several western townships and threatened the entire city. However, City Council further procrastinated and debated the issue. In March 1872, Keefer was appointed chief engineer (at a salary of \$3,000) to begin work in July on the 2,500-foot-long aqueduct and the Wheel House in the spring of 1873. The revised cost estimate for the project was now \$553,272. In the following year, the water pipe contracts were late and a significant escalation in prices occurred doubling the cost of iron causing expenses to mount: project costs were then estimated at \$890,652.

The Fleet Street Pumping Station (the name it is now know by) on Lebreton Flats was a one-storey limestone building with a mansard roof with individual and paired tall, segmental arch windows with voussoirs and keystones and prominent rusticated stone quoins. It started pumping water in November 1874 with work continuing on the piping system. The final expenditure amounted to \$930,693. With the successful



ABOVE: The Rideau Canal Fleet Street pumping station in Ottawa, Ontario. Courtesy of James R. Skinner (wikipedia).

completion of the work, Keefer's services were no longer required and the Water Commission provided high praise for his achievements as they would benefit the city for present and future generations. (Keefer might not get similar praise today with such high cost overruns).

Great-grandfather, Robert Surtees was appointed water works engineer in July 1887 and embarked on plans to increase the capacity of the Fleet Street Station pump house. In his November 1887 year-end report, Surtees, now Manager of the Ottawa Water Works, presented the case for expansion of the City's Water Works by enlarging the pump station's aqueduct fore bay and building to allow two sets of pumps; one set being immediately required and the second for future capacity when required. Another \$100,000 investment would be required.

In his 1888 Annual Report, Surtees addressed water quality: "Early in November last an epidemic of Malaria or Typhoid fever broke out in the City, and the general impression appears to be that the water supplied by the works was the primary cause, and in order to place this important matter intelligently before the public, I submit the following remarks..." He provided information on the water

testing, current information on germs and cysts, sewage pollution and water filtration. He did caution that before the water supply was blamed "a thorough and competent Biological examination should be made of the water..." He concluded with recommendations for improved sewage works at creeks upstream, enforcement of Ontario legislation governing the Ottawa Water Works prohibiting polluting activities for a distance of 3 miles upstream and the purchase of 5,000 household filters. (Surtees had concluded that filtration of the entire supply was impractical). He requested approval to commence with plans "without unnecessary waste of time."

Over the next two decades, hindered by political interference, reaction to the knowledge of water borne pathogens was slow. Capacity and other improvements to the works were completed but unfortunately chlorination of the supply was implemented only after the 1911 typhoid outbreaks. In 1932, Ottawa's Lemieux Island Water Purification Plant was completed and coupled with the Fleet Street Pumping Station to distribute potable water through the growing city of Ottawa.

*continued on page 17*



## POSTE DE POMPAGE DE LA RUE FLEET

La croissance rapide d'Ottawa dans la deuxième moitié du 19<sup>e</sup> siècle fit naître le désir d'avoir un aqueduc moderne, ce qui donna lieu à un débat politique agité. L'appui du maire suscita des protestations violentes, en 1868, de la part des 31 porteurs d'eau licenciés, qui s'opposaient à un aqueduc susceptible de coûter au-delà de 100 000,00 \$.

Le projet progressa en 1869, lorsque Thomas Keefer soumit un rapport sur l'approvisionnement en eau de la ville d'Ottawa. Son rapport décrivait les choix possibles, les technologies disponibles, leurs forces et leurs faiblesses dans les réseaux existant en Amérique du Nord, et leurs coûts. Il recommandait d'utiliser le système de pompage Holly, « économique et efficace », avec des pompes à pistons alternatifs et un équipement de contrôle de la pression hydrostatique afin d'assurer l'approvisionnement en eau potable et en eau pour éteindre les incendies. Il s'agissait de créer une énergie hydraulique en prenant l'eau de la baie de Nepean, en amont des chutes Chaudière. Le système préconisé par Keefer devait coûter 350 000,00 \$.

Un gros appui politique vint relancer le projet de Keefer lorsqu'un grave incendie dévasta, le 17 août 1870, plusieurs quartiers de l'Ouest de la ville, menaçant la ville entière. Le conseil de ville éternisa cependant les discussions sur le sujet. En mars 1872, Keefer fut nommé ingénieur en chef (au salaire de 3 000,00 \$) pour lancer les travaux, en juillet, sur un aqueduc d'une longueur de 2 500 pieds et sur la « Wheel House », au printemps 1873. La révision des coûts du projet atteignait 553 272,00 \$. L'année suivante, les contrats pour la tuyauterie furent accordés en retard, et une importante hausse des prix fit doubler le prix du fer et augmenter les dépenses : le coût du projet s'établissait maintenant à 890 652,00 \$.

Le poste de pompage de la rue Fleet (l'ouvrage est maintenant connu sous ce nom), à Lebreton Flats, était un édifice d'un étage en pierre calcaire, avec toit mansardé, saillies individuelles et en paires, fenêtres avec voussoirs, et pierres d'angle rustiquées et bossagées. L'ouvrage commença à pomper l'eau en novembre 1874 tandis que

le travail se poursuivait sur la tuyauterie. Le coût total atteignit 930 693,00 \$. Avec le parachèvement des travaux, les services de Keefer n'étaient plus requis et la Commission des eaux fit l'éloge de son œuvre, qui allait desservir plusieurs générations. (Keefer n'aurait peut-être pas droit à un éloge analogue de nos jours, avec de tels dépassements de coûts!).

Déjà arrière-grand-père, Robert Surtees fut nommé ingénieur de l'aqueduc en juillet 1887 et se lança dans des projets en vue d'augmenter la capacité du poste de pompage de la rue Fleet. Dans son rapport de fin d'année de 1887, Surtees, devenu directeur de l'aqueduc d'Ottawa, fit valoir les mérites de l'aqueduc et agrandit la prise d'eau pour pouvoir installer deux séries de pompes, dont la première permettrait de satisfaire la demande existante, tandis que la deuxième était disponible pour l'avenir. Un autre investissement de 100 000,00 \$ serait alors nécessaire.

Dans son rapport annuel de 1888, Surtees traite de la qualité de l'eau : « Au début de novembre, une épidémie de malaria ou de typhoïde a frappé la ville, et l'impression générale des gens était que l'eau de l'aqueduc en était la principale cause. Afin d'exposer cette situation intelligemment au public, j'ai soumis les observations suivantes... » Il donnait ensuite des renseignements sur la pression de l'eau, les germes et les kystes, la pollution par les eaux usées et la filtration de l'eau. Il prévint les gens qu'avant d'incriminer l'alimentation en eau, il fallait procéder à un « examen biologique de l'eau exhaustif et qualifié... » Il concluait avec des recommandations pour l'amélioration du traitement des eaux usées en aval, le respect de la législation de l'Ontario sur l'aqueduc d'Ottawa interdisant les activités polluantes jusqu'à trois milles en amont, et l'achat de 5 000 filtres pour les résidences. (Surtees avait conclu que la filtration de tout l'approvisionnement en eau n'était pas pratique). Il demandait l'approbation pour commencer à mettre le plan en œuvre sans « perte de temps inutile ».

Au cours des deux décennies suivantes, gênée par l'ingérence politique, la réaction à la présence d'agents pathogènes dans l'eau fut lente. La capacité de la station a été

augmentée et d'autres améliorations ont été apportées, mais, malheureusement, la chloration de l'eau ne fut réalisée qu'après les épidémies de typhoïde de 1911. En 1932, l'usine d'épuration de l'eau de la ville d'Ottawa sur l'île Lemieux était parachevée et reliée au poste de pompage de la rue Fleet pour distribuer l'eau potable dans la ville d'Ottawa, alors en pleine croissance.

En 1983, la Fiducie du patrimoine ontarien a obtenu la permission de conserver le poste de pompage de Fleet Street. Depuis, des dizaines de millions de dollars ont été investis dans cet équipement pour qu'il continue à fonctionner, conservant ainsi ce superbe édifice patrimonial. Le poste de la rue Fleet épargne à la ville au moins 12 millions de kWh par année en énergie, soit environ 200 000,00 \$ par mois en frais d'Hydro. Ottawa a désigné le poste de pompage de la rue Fleet site patrimonial. Ce lieu demeure une attraction populaire à chaque journée porte ouverte qu'organise la ville à chaque année.

La SCGC a choisi de faire le poste de pompage de la rue Fleet un lieu historique national du génie civil en 2011. La ville d'Ottawa est fière de cet honneur et de l'importance accordée à cet ouvrage de génie qui est le sien. ■

*continued from page 16*

In 1983, the Ontario Heritage Trust secured a heritage easement to conserve the Fleet Street Station. Since then, tens of millions of dollars have been invested in the facility to ensure it continues to last another lifetime and to maintain the beauty of this heritage building. The Fleet Street Station saves the City as much as 12 million kWh per year in energy usage or about \$200,000 per month in Hydro costs. Ottawa designated the Fleet Street Water Pumping Station as a heritage site and it remains a popular attraction for the City's annual Open Doors event.

The Fleet Street Pumping Station has been selected as the Canadian Society for Civil Engineering historic designation in 2011. The City of Ottawa is honoured by this designation and the significant civil engineering accomplishment the facility represents. ■

# Ottawa 2011



## CSCE 2011 TECHNICAL TOURS

### National Research Council/Institute for Research in Construction Sound Lab and Fire Lab

Wednesday, June 15th from 1:30 p.m. to 3:30 p.m.

The tour will include the Main Lab which is the Dynamic Wall testing Facility (DWTF), the Fire Lab including the wall furnace and column furnace, the Roofing Lab, the Environmental Chambers and the Canadian Centre for Housing Technology, depending on space availability. A maximum of 40 participants can attend the tour. The group will be divided into two groups with the two tours occurring simultaneously.

### City of Ottawa's Fleet Street Pumping Station

Thursday, June 16th from 1:30 p.m. to 3:30 p.m. (with the heritage site designation ceremony to follow at 4:00 p.m.)

The City of Ottawa Fleet Street Pumping Station is designated a heritage site and will now receive this year's CSCE History dedication. The site, located on LeBreton Flats, is only minutes from downtown and it is also accessible from the National Capital Commission and City of Ottawa biking and walking pathway system.

The pumping station was designed and constructed by Thomas Keefer in 1874. The unique design used the hydraulic head of the nearby Chaudière Falls to drive the water turbines. These direct drive turbines powered the water pumps that distributed drinking water throughout the city's distribution system. The station was expanded by Robert Surtees in 1888, and many upgrades followed over the years to meet supply demands. Today this modernized pumping station's five turbine-driven pumps supply potable water from the Lemieux Island Water Treatment Plant into the city's distribution system.

The Fleet Street Pumping Station technical tour will include a guided discussion on the facility's historical context and its current operational role. CSCE's National History Committee will host the 2011 Historical Dedication of the Fleet Street Water Pumping Station at the end of the technical tour.

#### Logistics

Transportation to the facilities will be provided. Additional information will be available closer to the conference date, including what time a bus will be leaving the hotel to take participants to the facilities. Visit the registration desk at the conference to sign-up for the tours. There is no charge to attend the tours. ■

## SCGC 2011 — VISITES TECHNIQUES

### Conseil national de recherches/Institut de recherche en construction — laboratoire du son et laboratoire du feu

Le mercredi 15 juin, de 13 h 30 à 15 h 30

La visite inclut, selon l'espace disponible, le laboratoire principal, avec son installation pour les essais dynamiques sur les types de murs, le laboratoire du feu, la paroi et la colonne de fournaise, le laboratoire des toitures et recouvrements, les enceintes environnementales et le Centre canadien des technologies résidentielles. Le nombre de participants est limité à 40. Le groupe sera séparé en deux.

### Le poste de pompage de la rue Fleet

Le jeudi 16 juin, de 13 h 30 à 15 h 30 (la cérémonie de commémoration de ce lieu historique du génie civil suivra à 16 h)

Le poste de pompage de la rue Fleet, à Ottawa, a été désigné lieu historique du génie civil et la cérémonie de commémoration par la SCGC se déroulera cette année. Situé à LeBreton Flats, cet endroit n'est qu'à quelques minutes du centre-ville et est également accessible en vélo ou à pied par les divers sentiers et pistes de la Commission de la capitale nationale et de la ville d'Ottawa.

Le poste de pompage a été conçu et construit par Thomas Keefer en 1874. Cet ouvrage unique en son genre utilise le potentiel hydroélectrique des chutes Chaudière, tout près, pour actionner les turbines. Ces turbines à entraînement direct actionnaient les pompes à eau qui distribuaient l'eau potable dans l'aqueduc de la ville. La station a été agrandie par Robert Surtees en 1888, et de nombreuses améliorations furent apportées au fil des ans pour satisfaire la demande. Aujourd'hui, les cinq pompes à turbine modernes de la station fournissent de l'eau potable à l'aqueduc de la ville à partir de l'usine de traitement de l'île Lemieux.

La visite technique du poste de pompage de la rue Fleet comporte également une discussion du contexte historique de l'ouvrage et de son fonctionnement actuel. Le comité des affaires historiques de la SCGC tiendra la cérémonie officielle de commémoration du poste de pompage de la rue Fleet à la fin de la visite technique.

#### Logistique

Le transport aller-retour au poste est fourni. Des renseignements additionnels seront disponibles à l'approche du congrès, dont l'heure à laquelle l'autobus quittera l'hôtel pour conduire les participants à la station. Vous pouvez vous inscrire pour les visites au kiosque des inscriptions. La participation aux visites est gratuite. ■

## CSCE 2011 — TECHNICAL PROGRAM

ROBERTO M. NARBAITZ, PhD, PE — Faculty of Engineering  
University of Ottawa

This year's CSCE Annual General Meeting and Conference will be held from June 14–17 in Ottawa, Ontario, the nation's capital, and its theme is *Engineers—Advocates for Future Policy*. Sustainable development can only be achieved through changes in government policies that incorporate a longer-term outlook with possibly higher initial investments. It is up to engineers to push for such policy changes so that more sustainable solutions become the norm. What a better place to discuss influencing policy than Ottawa?

The Annual General Conference will be held in conjunction with three specialty conferences and a special CSCE Forum on Professional Practice and Career Development. The International Specialty Conferences are the 20th Canadian Hydrotechnical Conference, the 2nd International Engineering Mechanics and Materials Specialty Conference, and the 3rd International/9th Construction Specialty Conference. In total, about 380 papers in diverse areas of civil engineering have been submitted from about 20 countries. The conference will also feature a graduate student paper competition, as well as an undergraduate capstone design/research poster competition. The abridged versions of two submitted papers are presented in this issue. Examples of other papers submitted to the General and Specialty Conferences include studies on modelling for tsunamis, evaluating progress towards sustainable infrastructure, high performance concrete, simulation tools in construction, structural health monitoring, hydraulic structures, blast vulnerability of buildings, seismic risk assessment of historical buildings, wood-concrete hybrid construction, asphalt pavement mixture using polymers and recycled materials, rehabilitation of old steel bridges, civil engineering history, settlement of footings in unsaturated soils, parallel computing in geomechanics, and novel water and wastewater treatment processes, to name a few. We are sure you will find many presentations that will interest you.

Confirmed keynote speakers for the Annual and Specialty Conferences include: Marie Lemay, CEO of the National Capital Commission; Dr. Slobodan Simonvic of the Institute for Catastrophic Loss Reduction at the University of Western Ontario and a leading researcher on climate change associated risks to infrastructure; Parker Mitchell/George Roter, co-founders of Engineers Without Borders; Major General Daniel Benjamin, Canadian Forces Chief Military Engineer; Reg Andres, Vice President, R.V. Anderson and Associates and a leading advocate for the role of engineers in policy; and Yong Li from China who will describe the engineering challenges of the South-to-North China water diversion megaproject.

The Technical Committee of the 2011 CSCE Annual Conference looks forward to welcoming all delegates who will be participating in this conference to deal with a variety of issues in civil engineering in Ottawa. ■

## SCGC 2011 — PROGRAMME TECHNIQUE

ROBERTO M. NARBAITZ, PhD, ing.—Faculté de génie, Université  
d'Ottawa

Le congrès et l'assemblée générale annuelle de cette année auront lieu à Ottawa, du 14 au 17 juin, sous le thème *L'ingénieur, garant d'une politique de l'avenir*. Le développement durable ne deviendra réalité qu'avec des modifications des politiques gouvernementales en vue d'incorporer une perspective à long terme et, probablement, des investissements initiaux plus substantiels. C'est aux ingénieurs de faire pression pour instaurer de tels changements dans les politiques afin que les solutions plus durables deviennent la norme. Y a-t-il une meilleure place qu'Ottawa pour parler des façons d'influencer les politiques?

Le congrès général annuel aura lieu en même temps que trois congrès spéciaux et qu'un forum spécial de la SCGC sur la pratique professionnelle et le développement de carrière. Les congrès spéciaux internationaux sont le 20<sup>e</sup> congrès canadien d'hydrotechnique, le 2<sup>e</sup> congrès international spécial sur le génie des matériaux et mécanique appliquée, et le 3<sup>e</sup> congrès international/9<sup>e</sup> congrès spécial sur le génie de la construction. Un total d'environ 380 communications dans divers domaines du génie civil ont été soumis par des auteurs venant d'une vingtaine de pays. Le congrès comporte également un concours de communications à l'intention des étudiants de 3<sup>e</sup> cycle ainsi qu'un concours d'affiche sur le design/la recherche à l'intention des étudiants de 1<sup>er</sup> cycle. À titre d'exemples des autres communications soumises aux congrès général et spéciaux, mentionnons des études sur la modélisation des tsunamis, l'évaluation des progrès réalisés en matière de durabilité des infrastructures, le béton à hautes performances, les outils de simulation en construction, la surveillance de la santé des structures, les structures hydrauliques, la vulnérabilité aux explosions des édifices, l'évaluation des risques encourus par les structures historiques en cas de séismes, les constructions hybrides bois-béton, les mélanges avec polymères et matériaux recyclés pour les revêtements de sol, la restauration des vieux ponts en acier, l'histoire du génie civil, le tassement des semelles dans les sols non saturés, l'informatique parallèle en géomécanique, et les nouveaux procédés pour le traitement des eaux et des eaux usées. Vous êtes assuré de trouver des exposés qui sauront vous intéresser.

Au nombre des conférenciers invités au congrès annuel et aux congrès spéciaux, mentionnons : Marie Lemay, PDG de la Commission de la capitale nationale; le professeur Slobodan Simonvic, de l'Institut de prévention des sinistres catastrophiques de l'Université Western Ontario et chercheur réputé sur les risques aux infrastructures associés aux changements climatiques; Parker Mitchell/George Roter, co-fondateurs d'Ingénieurs sans frontières; le major-général Daniel Benjamin, ingénieur-en-chef des forces armées canadiennes; Reg Andres, vice-président, R.V. Anderson and Associates et grand promoteur du rôle de l'ingénieur en matière de politique; et Yong Li, de Chine, qui décrira les défis qui se posent dans le méga-projet de diversion Sud-Nord des eaux en Chine.

Le comité technique du congrès annuel de la SCGC de 2011 sera heureux d'accueillir à Ottawa les délégués qui participeront à ce congrès et aborderont diverses questions qui intéressent la profession. ■

## 3RD INTERNATIONAL/9TH CONSTRUCTION SPECIALTY CONFERENCE

**CO-CHAIRS:** Dr. Mohamed Attalla, P.Eng., Senior Manager, Construction and Project Management, Toronto District School Board

**Dr. Ahmad Jrade, P.Eng., Assistant Professor, University of Ottawa**

The 9th Construction Specialty Conference/3rd International Conference will continue to provide researchers and practitioners of construction the most recent innovations and developments in the construction industry. For the first time, this conference is being held in partnership with the Construction Research Congress of the American Society of Civil Engineers which will enhance the level of collaboration among researchers and practitioners as well as improve the quality and quantity of submitted work.

This conference is considered to be the largest of this year's specialty conferences with over 150 submitted papers in a wide variety of topics including automated systems, modeling and simulation, computer applications, infrastructure, productivity, benchmarking, procurement, sustainability and others. The conference, once again, promises to be a wonderful forum for discussing practical applications that could be implemented immediately in the industry. Fourteen different countries are represented in this year's conference thereby providing a global outlook to the attendees. Four parallel sessions are planned in order to broaden the attendees' exposure and the freedom to choose their topic of interest.

The keynote address will be provided by MGen Daniel Benjamin, Canadian Forces Chief Military Engineer and Chief of Staff Infrastructure and Environment. He will talk about the evolution of military engineering as the forebear of modern civil engineering and the challenges faced by military engineers in the world today such as reconstruction in Afghanistan, Haiti, etc.

Conference participants will also explore different construction products with the strong industry presence through conference sponsorships and trade displays representing manufacturers, contractors, government and other construction buyers. We look forward to seeing all of you in Ottawa during the 9th Construction Specialty Conference/3rd International Conference. ■

## 3<sup>E</sup> CONGRÈS INTERNATIONAL/9<sup>E</sup> CONGRÈS SPÉCIAL SUR LE GÉNIE DE LA CONSTRUCTION

**CO-PRÉSIDENTS :** Mohamed Attalla, ing., gestionnaire principal, Construction et gestion de projets, Toronto District School Board

**Ahmad Jrade, ing., professeur adjoint, Université d'Ottawa**

Le 9<sup>e</sup> congrès spécial sur le génie de la construction/3<sup>e</sup> congrès international continuera de présenter aux chercheurs et aux praticiens les dernières innovations dans l'industrie de la construction. Pour la première fois, ce congrès a lieu en partenariat avec le congrès sur la recherche en construction de l' « American Society of Civil Engineers », ce qui améliorera le niveau de collaboration entre chercheurs et praticiens, en plus d'améliorer la qualité et la quantité de travaux soumis.

Ce congrès est considéré comme devant être le plus important congrès spécial de l'année, avec plus de 150 communications soumises sur une variété de sujets qui incluent les systèmes automatisés, la modélisation et la simulation, les applications de l'informatique, les infrastructures, la productivité, l'étalonnage, les achats, la durabilité, etc. Le congrès promet d'être un merveilleux forum pour discuter des applications pratiques susceptibles d'être mises en pratique immédiatement dans l'industrie. Quatorze pays seront représentés à ce congrès, assurant ainsi aux participants une perspective globale. On prévoit quatre séances en parallèle afin d'élargir les choix des participants et de choisir les sujets qui les intéressent.

Le conférencier invité sera le major général Daniel Benjamin, ingénieur militaire en chef de l'armée canadienne et chef d'état-major — Infrastructures et Environnement. Il parlera de l'évolution du génie militaire, ancêtre du génie civil moderne, et des défis que doivent relever les ingénieurs militaires à travers le monde aujourd'hui, comme la reconstruction en Afghanistan, à Haïti, etc.

Les participants au congrès étudieront également divers produits pour la construction, grâce à la forte présence de l'industrie par le biais des commandites et des expositions des fabricants, des entrepreneurs, des gouvernements et d'autres acheteurs du domaine de la construction. Nous comptons sur votre présence, en force, à ce 9<sup>e</sup> congrès spécial sur la construction/3<sup>e</sup> congrès international. ■



## 2ND INTERNATIONAL ENGINEERING MECHANICS AND MATERIALS SPECIALTY CONFERENCE

CO-CHAIRS: Professor Dan Palermo, University of Ottawa, Ph.D., P.Eng., MSCSE

Professor Medhat Shehata, Ryerson University, Ph.D., P.Eng., MSCSE

The 2nd International Engineering Mechanics and Materials Specialty Conference (IEMM), which has been organized under the auspices of the Engineering Materials and Mechanics Division of the CSCE, will be part of the 2011 CSCE Annual Conference that will take place in Ottawa between June 14 and June 17. The specialty conference will include technical sessions and a pre-conference workshop on the Role of Aggregate Quality on Durability of Concrete Structures. Over 80 papers were submitted by distinguished researchers and practitioners. The specialty conference will provide a forum to bring together academics, researchers and practitioners from around the world in the various fields of engineering mechanics and materials, and to present and discuss recent advancements and innovative solutions. The spectrum of topics to be presented include: properties of repair materials, alkali aggregate reaction, recycling and construction sustainability, performance of structures under extreme loads, high-performance concrete, response of structures under seismic loads, reinforcement corrosion, use of Fiber Reinforced Plastics (FRP) and fibers in concrete, service life of structures, and structural dynamics.

The co-chairs thank those that have contributed to the 2nd IEMM specialty conference including the local organizing committee, the 2nd IEMM sub-committee, authors/presenters, reviewers of the manuscripts, and speakers of the pre-conference workshop.

We look forward to welcoming our colleagues and guests to Ottawa in June. ■

## 2<sup>E</sup> CONGRÈS INTERNATIONAL SPÉCIAL SUR LE GÉNIE DES MATÉRIAUX ET MÉCANIQUE APPLIQUÉE

CO-PRÉSIDENTS : Dan Palermo, Université d'Ottawa, Ph.D., ing., MSCGC

Medhat Shehata, Université Ryerson, Ph.D., ing., MSCGC

Le 2<sup>e</sup> congrès international spécial sur le génie des matériaux et mécanique se déroulera dans le cadre du congrès annuel de la SCGC de 2011 CSCE, à Ottawa, du 14 au 17 juin 2011. Le congrès spécial comportera des séances techniques et un atelier pré-congrès sur le rôle de la qualité des agrégats dans la durabilité des structures en béton. Plus de 80 communications ont été soumises par d'éminents chercheurs et praticiens. Le congrès spécial sera une occasion de réunir universitaires, chercheurs et praticiens du monde entier dans les domaines du génie des matériaux et mécanique appliquée et d'exposer les dernières solutions novatrices dans ces domaines. Parmi les sujets qui seront abordés, mentionnons : les propriétés des matériaux utilisés pour les réparations, les réactions alcalines des agrégats, le recyclage et la durabilité en matière de construction, la performance des structures sous des charges extrêmes, le béton à haute performance, la réaction des structures sous les charges sismiques, les renforts contre la corrosion, l'utilisation des plastiques renforcés de fibres et de fibres dans le béton, la durée des structures, et la dynamique des structures.

Les co-présidents remercient toutes les personnes qui ont contribué à ce 2<sup>e</sup> congrès spécial, dont les membres du comité organisateur local, le sous-comité des auteurs/présentateurs, les réviseurs des manuscrits et les animateurs de l'atelier pré-congrès.

Nous comptons sur votre présence à Ottawa, en juin. ■



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## 20TH CANADIAN HYDROTECHNICAL CONFERENCE

CHAIR: Ioan Nistor, PhD, ing., University of Ottawa

The Hydrotechnical Division of the Canadian Society for Civil Engineering invites engineers, researchers, academics, decision makers and planners, and other water resources specialists to its Jubilee 20th Canadian Hydrotechnical Conference in the National Capital!

Our CSCE Conference theme—“Engineers—Advocates for Future Policy”—focuses on the central roles of hydrotechnical engineers in the broad field of water engineering for the development of sustainable policies in the management of water resources, and considers how these roles connect to broader aspects of societal and environmental sustainability of watersheds and coastal areas. The focus of the papers submitted covers a wide range of topics, from hydraulic structures to watershed management and from climate change impacts on water resources to natural hazards related to extreme hydrologic events and coastal disasters.

The 20th Canadian Hydrotechnical Conference will include technical sessions as well as a keynote lecture by Dr. Slobodan Simonovic, Professor of Civil and Environmental Engineering at the University of Western Ontario and Director of Engineering Studies with the Institute for Catastrophic Loss Reduction. His keynote lecture will focus on the role of science in policy development—experience from the impact of climate change on the municipal infrastructure (City of London).

We look forward to welcoming you in beautiful Ottawa! ■

## 20<sup>E</sup> CONGRÈS CANADIEN D'HYDROTECHNIQUE

PRÉSIDENT : Ioan Nistor, PhD, ing., Université d'Ottawa

La division d'hydrotechnique de la Société canadienne de génie civil invite ingénieurs, chercheurs, universitaires, décideurs et planificateurs ainsi que tous les autres spécialistes de l'eau à son 20<sup>e</sup> congrès canadien d'hydrotechnique, à Ottawa.

Le thème du congrès de la SCGC, « L'ingénieur—garant d'une politique de l'avenir », porte sur le rôle central des ingénieurs en hydrotechnique, dans le vaste domaine du génie de l'eau, pour l'élaboration de politiques durables en matière de gestion des eaux, et étudie comment ces rôles sont reliés aux vastes questions de durabilité sociétale et environnementale des bassins versants et des zones côtières. Les communications portent sur une vaste gamme de sujets allant des structures hydrauliques à la gestion des bassins versants et des impacts des changements climatiques sur les ressources en eau aux risques naturels reliés aux événements hydrologiques extrêmes et aux désastres côtiers.

Le 20<sup>e</sup> congrès canadien d'hydrotechnique comportera des séances techniques ainsi qu'une allocution du conférencier invité, le professeur Slobodan Simonovic, professeur de génie civil et de génie de l'environnement à l'Université de Western Ontario et directeur des études en génie à l'Institut de prévention des sinistres catastrophiques. Sa conférence portera sur le rôle de la science dans l'élaboration des politiques et l'expérience provenant de l'impact des changements climatiques sur les infrastructures municipales (ville de London).

Nous espérons bien vous accueillir dans la belle ville d'Ottawa! ■



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## COMPANIONS' PROGRAM

A unique program has been organized for companions, allowing them to immerse themselves in Canadian culture. Companions can register for the following activities put together in conjunction with an Ottawa professional tour guide:

### *Taking it day by day*

#### **WEDNESDAY, JUNE 15TH**

8:45 a.m. – 4:00 p.m.

The day will begin bright and early with a Motor Coach guided tour beginning at Parliament Hill with its striking architectural beauty and class. The tour will then guide companions through Sussex Drive with its breathtaking museums, churches, and embassies. The Royal Canadian Mint with its castle-like towers, the Prime Minister's home, and the Governor General's residence at Rideau Hall will be included in the tour.

A trip over to Hull—Chelsea, Québec will include a Wakefield Steam Train Guided tour of Wakefield. Lunch will then be served at Café Le Hibou.

Part two of the guided tour continues with driving along the Rideau Canal with a glance at its colourful history. Then companions will be visiting the Horse Stables of the "RCMP Musical Ride" with its beautiful thoroughbred horses. The tour draws to a magnificent close with the well-known and popular Byward Market.

#### **THURSDAY, JUNE 16TH**

8:45 a.m. – 4:00 p.m.

The day begins with a Motor Coach bus headed to Rideau Hall which has been both the residence and workplace of every governor general since 1867. Guides will be taking companions through this heritage site exploring its history and importance to Canada. After visiting Rideau Hall, the companions will be taken to the Mackenzie King Estate for a guided tour exploring the political career of Canada's 10th Prime Minister.

Lunch will then be served at L'Orée du Bois Restaurant, one of the best restaurants in Québec.

The day will end with a majestic Rideau Canal Boat Cruise. This man-made canal spans 7.5 Km, with many historical sites at its banks. This tour promises to educate participants with respect to Ottawa's rich history, and its world famous canal.

#### **FRIDAY, JUNE 17TH**

9:00 a.m. – 11:00 a.m.

To end the vast adventure through Canadian history, a guided walking tour to Parliament Hill has been arranged for companions. A knowledgeable guide has been specially chosen to take participants up to the grounds, and give a cultural tour of the center block of Parliament. This will conclude the companions' program for the C SCE 2011 Annual General Meeting and Conference.

## PROGRAMME DES CONJOINT(E)S

Un programme unique a été organisé pour les conjoint(e)s afin de leurs permettre d'apprécier la culture canadienne. Les conjoint(e)s peuvent s'inscrire aux activités suivantes qui auront lieu en collaboration avec un guide professionnel de la région d'Ottawa:

### *Prendre les choses au jour le jour*

#### **MERCREDI, LE 15 JUIN**

8 h 45 – 16 h

La journée débutera tôt le matin avec une visite guidée en autobus qui débutera sur la Colline du Parlement, à architecture unique. La visite se poursuivra sur la promenade Sussex avec ses musées, églises et ambassades pittoresques. La Monnaie royale canadienne avec ses tours à allure de châteaux, la demeure du Premier ministre, et la résidence du Gouverneur général au Rideau Hall seront aussi des destinations visées lors de la visite.

Un crochet à Hull—Chelsea, Québec inclura un tour guidé de Wakefield sur son train de vapeur. Un dîner sera ensuite servi au Café Le Hibou.

La visite guidée en autobus se poursuivra avec une promenade le long du canal Rideau avec un aperçu de son histoire haute en couleur. Les conjoint(e)s pourront aussi visiter les étables du « Carrousel de la GRC » avec ses magnifiques chevaux pur-sang. La visite mémorable se terminera au renommé et populaire marché By.

#### **JEUDI, LE 16 JUIN**

8 h 45 – 16 h

La journée débutera avec un tour d'autobus jusqu'au Rideau Hall qui est la résidence officielle et le lieu de travail de tous les gouverneurs généraux depuis 1867. Des guides touristiques accompagneront les conjoint(e)s pour découvrir le site patrimonial, son aspect historique et son importance au Canada. Après la visite du Rideau Hall, les conjoint(e)s seront conduits au domaine Mackenzie King pour une visite guidée qui permettra d'explorer la carrière politique du 10<sup>e</sup> Premier ministre du Canada.

Un dîner sera servi au restaurant L'Orée du Bois, un des meilleurs restaurants au Québec.

La journée se terminera avec une croisière en bateau sur le magnifique canal Rideau. Ce canal construit par l'homme s'étend sur 7.5 Km et on y retrouve plusieurs sites historiques le long de ses berges. Cette visite fournira aux participants des informations sur la riche histoire d'Ottawa, et sur son canal de renommé mondiale.

#### **VENDREDI, 17 JUIN**

9 h – 11 h

Une visite guidée pédestre sur la colline du Parlement a été organisée pour les conjoint(e)s afin de clore le survol de l'histoire canadienne. Un guide d'expérience accompagnera les participants sur le terrain pour offrir une visite culturelle de l'édifice du centre de la colline du Parlement. Ceci conclura le programme des conjoint(e)s de la Réunion générale annuelle et du Congrès de 2011 de la SCGC.

## NEW AT THE 2011 CONFERENCE CSCE YOUNG PROFESSIONALS GROUP ACTIVITIES


The CSCE is in the initial stages of setting up a Young Professionals Group and the Ottawa Conference will be the first forum for these events targeted specifically to Associate members. The President's breakfast will give you an opportunity to mingle with the incoming CSCE president and other key executives as well as your peers. There will also be various social activities that will complement the general conference schedule and provide informal networking opportunities with colleagues across the country. Associate members can also take advantage of a significantly reduced rate for the pre-conference writing workshop held at the conference venue. A lot of exciting things are in the works for Associate members both for Ottawa 2011 and for the future. These events and programs will be designed for and by young professionals. If you are interested in adding your voice to the group, please contact [associates@csce.ca](mailto:associates@csce.ca) and better yet, meet us and share your ideas in person in June in our Nation's Capital!


Amie Therrien, P.Eng.  
Water Resources Engineer  
Sernas Associates  
[atherrien@sernas.com](mailto:atherrien@sernas.com)

## DU NOUVEAU AU CONGRÈS DE 2011 LES ACTIVITÉS DES GROUPES DE JEUNES PROFESSIONNELS

La SCGC est en train de créer un Groupe des jeunes professionnels, et le congrès d'Ottawa offrira le premier forum pour ces activités qui visent précisément les membres associés. Le petit déjeuner du président vous donnera une occasion de rencontrer le nouveau président de la SCGC, d'autres administrateurs, ainsi que vos pairs. Il y aura également diverses activités sociales qui compléteront le programme du congrès général et fourniront des occasions de tisser des liens avec des collègues de tout le pays. Les membres associés peuvent aussi profiter d'un rabais substantiel pour l'atelier de rédaction offert avant le congrès sur les lieux mêmes du congrès. Nombre d'initiatives attendent les membres associés au congrès d'Ottawa ainsi que dans les mois à venir. Ces activités et ces programmes sont conçus par et pour de jeunes professionnels. Si vous désirez ajouter votre voix au groupe, adressez-vous à [associates@csce.ca](mailto:associates@csce.ca) ou venez nous rencontrer en personne dans la capitale nationale.

Amie Therrien, ing.  
Ingénieure en ressources hydrauliques  
Sernas Associates  
[atherrien@sernas.com](mailto:atherrien@sernas.com)



<p><b>GEOTECHNICAL SERVICES</b></p> <ul style="list-style-type: none"> <li>Ground Investigation &amp; Engineering</li> <li>Field &amp; Laboratory Testing</li> <li>Foundation Engineering</li> <li>Blasting Services</li> <li>Ground Improvement</li> <li>Hydrogeology</li> <li>Geotechnical Instrumentation</li> <li>Geo-Contracting</li> <li>Pavement Engineering</li> </ul> <hr/> <p><b>ENVIRONMENTAL SERVICES</b></p> <ul style="list-style-type: none"> <li>Environmental Site Assessments</li> <li>Site Remediation</li> <li>Contaminant &amp; Waste Management</li> <li>Landfill Monitoring &amp; Approvals</li> <li>Certificates of Approval</li> <li>Fuel Tank Removals</li> </ul> <hr/> <p><b><a href="http://www.dstgroup.com">www.dstgroup.com</a></b></p>	
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Engineers — Advocates for Future Policy  
Solutions de génie pour un monde durable

Ottawa 2011



### THANKS TO SPONSORS AND EXHIBITORS MERCİ AUX COMMANDITAIRES ET EXPOSANTS

The 2011 CSCE Annual Conference Local Organizing Committee would like to thank our sponsors and trade show exhibitors for their support and contribution to the success of this event.

On behalf of all members of the local organizing committee, please accept our most sincere gratitude.

Le comité organisateur local du Congrès Annuel de la SCGC de 2011 voudrait remercier nos commanditaires et les exposants pour leur appui et leur contribution au succès de cet événement.

Au nom de tous les membres du comité organisateur local, veuillez accepter nos remerciements les plus sincères.



The CSCE will offer the following one-day courses at our Annual Conference in Ottawa on June 14, 2011. For full details and to register, please visit [www.csce.ca](http://www.csce.ca) or [www.csce.ca/2011/Annual](http://www.csce.ca/2011/Annual) (Technical Program).

La SCGC offrira les formations suivantes qui seront présentées en anglais. Pour plus de détails, veuillez visiter [www.csce.ca](http://www.csce.ca) ou [www.csce.ca/2011/Annual](http://www.csce.ca/2011/Annual) (Technical Program).

### 1. BASICS OF PROTECTIVE DESIGN AGAINST BLAST

This course will introduce participants to the basics of protective design against blast. Four topics will be covered: explosives and blast threats, blast loads, structural analysis and design of reinforced concrete and steel structures.

#### PRESENTERS

**Manuel Campidelli**, PhD  
Post-Doctoral Fellow, McMaster University  
Toronto, ON

**Murat Saatcioglu**, Ph.D., P.Eng.  
University of Ottawa, Ottawa, ON

**Michael Seica**, Ph.D.  
Halcrow Yolles, University of Toronto  
Toronto, ON

### 2. THE ROLE OF AGGREGATE QUALITY ON DURABILITY OF CONCRETE STRUCTURES

The quality of aggregates plays a major role in the deterioration process of concrete structures. This course provides civil engineers with knowledge pertaining to mechanisms of major aggregate-related deterioration modes in concrete including alkali-aggregate reaction and oxidation of sulphide-bearing phases.

#### PRESENTERS

**Benoit Fournier**, Ph.D.  
Laval University, Québec, QC

**Chris Rogers**, M.Sc.  
Consultant, Toronto, ON

**Medhat Shehata**, Ph.D, P.Eng.  
Ryerson University, Toronto, ON

### 3. WRITING THAT GETS RESULTS

Do you write for different audiences? Not sure how much information to include in a report? Learn the surprising truth about effective writing. Hint: it's not about including impressive words and every possible detail. Find ways you can trim your 1,000 long-winded words into a short, focused package that gives your readers the information they need.

#### PRESENTER

**Patricia Davies**  
Patricia Davies Communications  
Toronto, ON

### CHBDC 2010

A total of 514 engineers and students attended the CSCE-CSA CHBDC 2010 seminar held in 11 cities. The seminar was very well received. CSCE would like to thank the participants and the 19 speakers who took part in this event and Fibrwrap, Corporation Corbec Inc. and Pultrall Inc. who sponsored it.

Un total de 514 ingénieurs et étudiants ont assisté au séminaire CHBDC 2010 que nous avons offert dans 11 villes et où il fut très bien reçu. La SCGC remercie vivement les participants et les 19 conférenciers qui y ont pris part ainsi que Fibrwrap, Corporation Corbec Inc. et Pultrall Inc. qui l'ont commandité.

### 2011 ANNUAL GENERAL MEETING OF THE CSCE

The 2011 Annual General Meeting of the Canadian Society for Civil Engineering will be held during the Annual Conference of the Society on Thursday, June 16, 2011 at the Westin Hotel in Ottawa, ON. 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 2011 DE LA SCGC

L'assemblée générale annuelle 2011 de la Société canadienne de génie civil aura lieu pendant le congrès annuel de la société, jeudi le 16 juin 2011 à l'hôtel Westin à Ottawa, ON. 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.

## GREAT NORTHERN CONCRETE TOBOGGAN RACE

The Great Northern Concrete Toboggan Race was held at the University of Alberta from January 26–30, 2011. GNCTR started in 1972 as a competition between the Universities of Alberta and Calgary, and NAIT and SAIT. Today, teams from all across Canada design and build their own sled which they race down ski hills on concrete toboggans. To compete with a concrete toboggan, the sled must have a running surface of at least 50 per cent Portland Cement, room for five riders, steering, braking, and a functional roll bar, all weighing in at under 300 lbs.

Nineteen teams participated in this year's competition. The overall first-place winner was the University of Calgary; Queen's University took second place and third place went to Ryerson University. University of Saskatchewan was awarded The Best New Team. For a complete list of award winners and results summary visit [www.csce.ca/Current-News](http://www.csce.ca/Current-News)

We congratulate all the winners and participants!

## TROITSKY BRIDGE COMPETITION

On March 4, during National Engineering Month, Concordia University hosted the 27th Annual Troitsky Bridge Building Competition. This inter-university academic competition brings together Engineering students from across Canada and the United States to test their knowledge and skills in designing, building and presenting model bridges.

Each team must design and build a bridge with an open span of 1 metre, composed solely of Popsicle sticks, white glue, dental floss and toothpicks. This year's winning team was 'The League of Extraordinary Gentlemen' from McMaster University. Second place went to the team from the Université du Québec à Chicoutimi—The Aces, and Les ponts d'Érables, the team from Cégep de Chicoutimi took third place. A video of the competition is available at: <http://www.youtube.com/user/TroitskyBridge>

This competition is hosted during Engineering Week, a festival that serves to raise public awareness of the importance of engineering and technology, as well as to encourage young people to consider a career in this field.

## LA COURSE DE TOBOGGAN EN CIMENT DU GRAND NORD

La course de toboggan en ciment du Grand Nord a eu lieu à l'Université de l'Alberta, du 26 au 30 janvier 2011. Créé en 1972, ce concours était initialement une joute entre les Universités de l'Alberta et de Calgary, et les instituts de technologie NAIT et SAIT. Aujourd'hui, des équipes de tout le pays créent et construisent leurs propres toboggans en ciment pour dévaler les pentes. Chaque toboggan doit avoir une surface de glissement comportant au moins 50 % de ciment Portland, de l'espace pour cinq équipiers, un système de direction, un système de freinage, un arceau de sécurité, le tout ne devant pas dépasser 300 livres.

Dix-neuf équipes ont participé au concours de 2011. La première place est allée à l'Université de Calgary, tandis que Queen's a pris la deuxième place et Ryerson University prenait la troisième. L'Université de la Saskatchewan a reçu le prix décerné à la meilleure des nouvelles équipes. La liste des gagnants apparaît sur le site [www.csce.ca/Current-News](http://www.csce.ca/Current-News)

Félicitations aux gagnants et à tous les participants!

## LE CONCOURS DE PONTS TROITSKY

Le 4 mars, pendant le mois national du génie, l'Université Concordia a accueilli le 27<sup>e</sup> concours annuel de ponts Troitsky. Ce concours inter-universitaire réunit des étudiants du Canada et des États-Unis qui viennent concevoir et construire des modèles réduits de ponts.

Chaque équipe doit concevoir et construire un pont doté d'une travée d'au moins 1 mètre à l'aide de bâtons de « Popsicle », de colle blanche, de soie dentaire et de cure-dents. Les gagnants de cette année sont « The League of Extraordinary Gentlemen », de l'Université McMaster. La deuxième place est allée à l'équipe de l'Université du Québec à Chicoutimi—« The Aces », tandis que « Les ponts d'Érables », du Cégep de Chicoutimi, ont pris la troisième place. Un vidéo du concours est disponible à l'adresse <http://www.youtube.com/user/TroitskyBridge>

Ce concours se déroule dans le cadre de la Semaine du génie, un festival destiné à sensibiliser le public à l'importance du génie et de la technologie et à encourager les jeunes qui songent à une carrière dans ce domaine.

## Domestic Venues

### 2011 CSCE Annual General Meeting and Conference

Ottawa, ON

June 14–17, 2011

<http://www.csce.ca/2011/annual>

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

Québec, QC

July 20–22, 2011

<http://www.civil.usherbrooke.ca/cdcc2011>

## International Venues

### International Bridge Conference

Pittsburgh, PA

June 5–8, 2011

<http://www.eswp.com/bridge>

### 6th International Structural Engineering and Construction Conference

Zurich, Switzerland

June 21–25, 2011

[http://www.isec-society.org/ISEC\\_06/](http://www.isec-society.org/ISEC_06/)

### Third International Workshop on Performance, Protection & Strengthening of Structures under Extreme Loading (PROTECT2011)

Lugano, Switzerland

August 30–September 1, 2011

<http://www.protect2011.supsi.ch/>

### International Conference on Drinking Water, Safety, Security and Sustainability

October 9–11, 2011

Hangzhou, China

<http://drinkingwater.zju.edu.ca>

### Seismic Protection of Cultural Heritage

October 31–November 1, 2011

Ankara, Turkey

<http://e-imo.imo.org.tr/portal/web/Organizasyon/Default.aspx?id=4>

### Coastal Management 2011: Innovative Coastal Zone Management: Sustainable Engineering for a Dynamic Coast

November 15–16, 2011

Belfast, UK

[www.ice-coastalmanagement.com](http://www.ice-coastalmanagement.com)

## MAJOR PARTNERS / ASSOCIÉS PRINCIPAUX



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