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civil

Skills Shortages, Education and Research

Les pénuries de compétences, l'éducation et la recherche

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FROM THE EDITORS / MOT DES RÉDACTEURS

LOUISE NEWMAN LOUISE@CSCE.CA

GUEST EDITOR: DR. DAGMAR SVECOVA MCSCE, P.ENG., ASSOCIATE PROFESSOR, UNIVERSITY OF MANITOBA

This issue of CIVIL is on the theme of Education and Research and Skills Shortages and features four articles, each of them providing us with a different view on this subject. Our first article written by CSCE President Vic Perry and Richard Stephenson looks at the skills shortage problem in rural municipalities. CSCE will sponsor a pilot internship program that is discussed further in the article.

Tom Brown from the University of Calgary identifies research needs in all areas of civil engineering including structures, water resources and transportation. Research needs to focus on issues of sustainability, vulnerability and resiliency, says Brown.

"Research needs to focus on issues of sustainability, vulnerability and resiliency…"

Reg Andres offers reviews of statistical studies on skills shortage over the last 10 years. He identifies two key issues affecting this problem; one being the immigration policy and the other one is the number of graduating engineers. The article concludes by providing some solution to employers on how to overcome this problem in the future.

Juan Salinas from Carleton University gives us the academic perspective in his article "Back to School". This article shows us how an engineering professor prepares himself/herself for the school year, discusses various teaching models, and how they affect the learning style of the students. Dr. Salinas points out the unique role that engineering professors have shaping the mind of these young future engineers.

We extend our thanks to those who contributed to this issue. As always, we welcome your comments and feedback. ■

Ce numéro de L'ICC a pour thème l'éducation, la recherche et les compétences où il y a pénurie. Il comporte quatre articles présentant quatre opinions différentes sur ces sujets. Écrit par le président de la SCGC, Vic Perry, et Richard Stephenson, le premier article porte sur la pénurie de compétences dans les municipalités rurales. La SCGC commanditera un programme pilote de stages dont il est question dans l'article.

Tom Brown, de l'Université de Calgary, identifie les besoins en recherche dans tous les domaines du génie civil, dont les structures, l'eau et les transports. Les recherches doivent porter les problèmes de durabilité, de vulnérabilité et de résilience, selon Brown.

« Les recherches doivent porter les problèmes de durabilité, de vulnérabilité et de résilience… »

Reg Andres recense les études statistiques des 10 dernières années sur les pénuries de compétences. Il identifie deux aspects principaux du problème : la politique en matière d'immigration, et le nombre d'ingénieurs qui obtiennent leur diplôme. L'article propose enfin des solution aux employeurs sur la façon de régler ce problème pour l'avenir.

Juan Salinas, de l'Université Carleton, expose la thèse des universités sous le titre « Back to School (retour à l'école)». Cet article explique comment un professeur de génie prépare son année, décrit divers modèles pédagogiques et leur effet sur le mode d'apprentissage des élèves. Le professeur Salinas souligne le rôle absolument unique joué par le professeur de génie dans la formation de l'esprit de ces futurs jeunes ingénieurs civils.

Nous remercions toutes les personnes qui ont contribué à ce numéro. Comme d'habitude, vos commentaires sont toujours bien accueillis. ■

We are happy that a recent article, *The New Civil Engineer*, written by Alan Perks and Reg Andres and published in the Spring 2010 issue of the Canadian Civil Engineer (pp. 14–15) attracted a reader to respond. Below is a slightly abridged version of the reader's letter, together with the authors' reply.

Charles R. Neill, M.CSCE
5608 – 108 St NW, Edmonton AB, T6H 2Y9

I wish to comment on the article by Alan Perks and Reg Andres in Spring 2010, entitled *The New Civil Engineer,* in which they present their ideas for the required attributes of new graduates.

The authors quote from CSCE's Sustainable Development Guidelines of 2005, mentioning problems of infrastructure scale, environmental degradation, resource consumption, population growth and the need for holistic consideration of societal interactions. They also mention that urban settlements have increased far beyond the natural capacity of the earth. I would like to expand somewhat on those concerns.

I believe it is a defensible proposition that population growth is the main engine driving so many of our global problems, and that unless growth can be halted or reversed, there is little hope of reducing most of those problems. As engineers with a need to earn a living, most of us are just dragged along by societal, governmental and corporate demands for infrastructure, power, transport, housing, factories etc. resulting from this growth. Growth is the sacred cow of most economists, industrialists and politicians, but growth is killing the natural world on which we all depend.

Somehow we have to put up some kind of resistance to the demands of employers and clients for more and bigger projects. Technical and professional organizations could perhaps help by educating and supporting the profession towards a change of direction that would emphasize conservation and restraint rather than unending expansion of facilities. We also need to accept as a profession that when our projects assist rather than discourage continued population and economic growth, we may be condemning future generations to even worse disasters than those faced by our present world.

So I would suggest adding the following to Messrs. Perks and Andres' list of desirable attributes for new graduates:

- Awareness of historical and current trends (both national and international) in population and consumption, their effects on the natural world, and their implications for coming generations.
- Readiness to question projects and designs that appear to encourage or promote further attacks on the natural world and the long-term sustainability of human society.
- Personal restraint in consumption of resources and impact on the natural world.

With respect to CSCE's 2005 Guidelines, I suggest that while they point in the right direction, they are too timid because they are reluctant to admit that continued growth in the long term is a recipe for disaster. ■

"Mr. Neill's comments are very much in line with where we believe civil engineers must develop, and we appreciate his thoughts."
—Alan R. Perks, P.Eng., FCSCE and Reg Andres, P.Eng., FCSCE

V.H. (VIC) PERRY FEC, FCSCE, MASC., P.ENG. / FEC, FSCGC, MASC., ING.

Good bye summer, welcome to fall and back to the routine!

My term as President is already 1/3 over and there are many things yet to accomplish. Your Board of Directors and National Office team are busy preparing for the fall Board meeting, to be held on the last weekend in November, which will mark the halfway point in my term as President.

The CSCE's Vision2020 of ***"Leadership in Sustainable Infrastructure"*** is a top priority for the Board and the fall Board meeting. Under the chairmanship of our President Elect, Randy Pickle, the "Road Map" to achieving the vision is being developed. Randy has laid out a timeframe, assembled a team and is working to have a road map to roll out at the annual meeting in Ottawa in June 2011. Your support and comments are welcome.

In parallel with the road map being developed, the CSCE already is advancing many initiatives in support of our vision. The following is a short overview of these initiatives:

i) Contact has been made with the Canadian Minister of Transportation and Infrastructure to raise CSCE's profile and to establish an ongoing dialogue about sustainable infrastructure in Canada.

ii) An external communications strategy has been implemented, along with targets for regular communications about CSCE and civil engineering.

iii) A Canadian Infrastructure Report Card Working Group has been established and is drafting a protocol for rating Canada's infrastructure on an ongoing basis.

iv) Plans are under way for a winter 2011 series of cross Canada public "Town Hall" meetings to develop a clear national image of sustainable infrastructure and;

v) A "Young Professionals Group" is being explored to identify the needs and provide relevant programs for recent graduates, particularly in the area of "Soft Skills".

The majority of the programs being developed by CSCE are aimed directly at the "*Leadership*" aspect of our vision. When I meet with civil engineers, I am often reminded that it is necessary for civil engineers to become more involved in the public policy on infrastructure—the business of civil engineers. In order to show leadership it is essential to have a clear vision of the future and then be able to communicate the vision.

As a first step, prior to the November Board meetings, CSCE will also be holding a workshop for the Board members, Section Chairs and Committee Chairs. This half-day workshop will focus also on the leadership and communication aspect of our vision.

As you read through this edition of the *Canadian Civil Engineer*, you will also notice that the focus of the articles is consistent with the leadership aspect of our vision. These articles emphasize education, mentoring, soft skills and particularly the ones needed to effectively communicate and be successful.

In closing, I will put forth a challenge to our membership: "*Describe or list the measurable parameters that would define a piece of infrastructure as sustainable versus a non-sustainable piece of infrastructure*". I welcome your opinions and comments. Your ideas will be included in the data collection from the cross Canada Town Hall meetings.

While there is a lot to be done to put us on the road to our vision and it won't all necessarily be easy, the words of American author and publisher William Feather may summarize it best:

"Almost any idea is good if a man has ability and is willing to work hard. The best idea is worthless if the creator is a loafer and ineffective."

I am committed to working hard, with the ability that I have, and with your help will move the CSCE towards its vision of "Leadership in Sustainable Infrastructure". ■

L'été s'achève, l'automne arrive, et la routine recommence!

Le tiers de mon mandat est déjà passé, et il reste tant à faire. Votre c.a. et vos permanents préparent en ce moment la réunion d'automne du c.a., qui aura lieu la dernière fin de semaine de novembre, ce qui marquera aussi la fin de la première moitié de mon mandat.

Le document de la SCGC intitulé « ***Vision 2020 : leadership en matière d'infrastructures durables*** » est une priorité absolue pour la réunion d'automne du c.a. Sous la présidence de notre Président désigné, Randy Pickle, le programme devant nous mener à ces objectifs en 2020 est en voie d'élaboration. Randy a fixé un échéancier, réuni une équipe, et il devrait avoir un programme à soumettre lors de l'assemblée annuelle qui aura lieu à Ottawa, en juin 2011. Nous avons besoin de votre appui et de vos commentaires.

Parallèlement à l'élaboration de ce programme, la SCGC a déjà mis de l'avant nombre d'initiatives conformes à cette démarche. Voici un bref aperçu de ces initiatives :

i) Des relations ont été établies avec le ministre canadien des Transports et des Infrastructures pour affirmer la présence de la SCGC et amorcer un dialogue permanent sur les infrastructures durables au Canada.

ii) Une stratégie de communications externes a été mise en œuvre et des objectifs ont été fixés afin de maintenir des communications constantes avec la profession.

iii) Un groupe de travail chargé du bulletin sur les infrastructures canadiennes a été créé et est en train d'élaborer un protocole pour évaluer les infrastructures canadiennes de façon permanente.

iv) Des plans sont élaborés pour tenir une série d'assemblées publiques à travers le pays, pendant l'hiver 2011, pour avoir une bonne idée de la situation nationale en matière d'infrastructures durables et;

v) On songe à créer un « groupe des jeunes professionnels » pour identifier les besoins et fournir les programmes pertinents pour les nouveaux diplômés, surtout dans le domaine des compétences non-techniques.

La majorité des programmes en voie d'élaboration par la SCGC sont axés directement sur l'aspect « *Leadership* » de notre plan. Lorsque je rencontre des ingénieurs civils, on me rappelle souvent que les ingénieurs civils doivent s'impliquer davantage dans l'élaboration des politiques publiques en matière d'infrastructure, ce qui constitue le cœur du travail des ingénieurs civils. Exercer un leadership, c'est d'abord avoir une idée de ce que sera l'avenir, et être en mesure de communiquer cette idée.

En guise de première étape, avant les réunions du c.a. de novembre, la SCGC organisera également un atelier à l'intention des membres du c.a., des présidents des sections et des présidents des comités. Cet atelier d'une demi-journée portera également sur les aspects leadership et communication.

En lisant ce numéro de *L'ingénieur Civil Canadien*, vous remarquerez que les thèmes abordés reflètent l'aspect leadership de notre programme. Ces articles portent notamment sur la formation, les compétences non-techniques, et surtout les compétences nécessaires pour communiquer efficacement et réussir.

En guise de conclusion, je lance un défi à nos membres : « *Décrivez ou énumérez les paramètres mesurables susceptibles de définir un élément d'infrastructure durable, comparativement à un élément d'infrastructure non-durable* ». J'attends vos commentaires et vos opinions. Vos idées seront intégrées aux données qui seront colligées lors des assemblées publiques qui seront tenues à travers le pays.

Même s'il y a encore beaucoup à faire pour placer la SCGC sur la bonne voie, même si ce ne sera pas nécessairement facile,
suite à la page 10

V.H. (Vic) Perry FCSCE, MASc., P.Eng.

Richard Stephenson MCSCE, P.Eng.

Pilot Internship Program to Address the Rural Municipal Engineering Skills Shortage

Rural municipalities across Canada and around the world are experiencing a shortage of engineers with municipal engineering skills. The CSCE and the Province of Nova Scotia are about to implement a Pilot Internship Program for Rural Municipal Engineers aimed at placing civil engineering students in rural municipalities during their co-operative work terms where they will be introduced to the many facets of the life of a rural municipal engineer.

THE SKILLS SHORTAGE CHALLENGE

The looming skills shortage facing civilization is not new! For more than 20 years, recognized authorities have been predicting changing demographics in society, which will lead to professional and technical skill shortages. The impact of changing demographics in the workforce is a problem not unique to civil engineering; however, it is important for civil engineers and municipal stakeholders to take the initiative now to address this important issue before the consequences negatively impact the level of services provided by municipalities and the quality of life expected by society.

Various studies have indicated that over the next 25 years there will be a shift towards an increasing percentage of our population with reduced levels of education, declining birth rates, declining marriage rates and increased mobility. All of these trends will create both challenges and opportunities for all levels of government, especially for rural municipalities.

While these changing demographic patterns are important to understand and can help to explain historical events or help to predict future challenges, it is not the intent of this article to interpret the impact on the municipal skills shortage analytically, but simply to recognize the impact of these changes on rural municipalities and to offer a program that will help to address this challenging trend.

The issue of a looming skills shortage to manage urban and rural municipal infrastructure is a major concern not only to civil engineers but also to society in general. Without well-designed and well-maintained municipal infrastructure (distribution networks for food, clean water, wastewater collection and treatment, etc.) civilization as we know it and continued development will be unsustainable. Without infrastructure that has been properly designed, constructed and maintained, modern society will not be able to deliver the services that our citizens have come to expect. This skills shortage is particularly acute in rural areas, which have seen their educated children migrate to the cities, but where highly skilled technical and engineering services are required in ever-increasing quantity to provide modern municipal services to the rural communities.

CSCE INITIATIVE

The Canadian Society for Civil Engineering (CSCE) has initiated a program to address this rural municipal engineering skills shortage. From October 2008 through May 2009, interviews were conducted with senior professionals who are directly or indirectly involved in the daily delivery of municipal services over a range of types of municipal infrastructure. The results of these interviews, augmented by a literature search and personal experience have helped to identify specific elements of the "Civil Engineering Skills Shortage" facing rural and urban municipal governments across Canada and to justify the implementation of our "Internship Program for Rural Municipal Engineers".

THE LIFE OF A MUNICIPAL ENGINEER

From the CSCE's interview process, it became evident that the civil engineering skills shortage within municipal governments must be considered in two distinct categories—"Rural Municipal Engineering" and "Urban Municipal Engineering"—each of which has its own special challenges.

Due to the higher population density in cities and the higher levels of funding available to urban municipalities, the job profile of an urban municipal engineer is more consistent with classical engineering profiles and skills requirements. In larger urban areas, municipal civil engineers are typically members of a larger team of professionals, within which technical and administrative support staff and career mentoring services are provided by more senior colleagues. The urban municipal engineer, whose workload is largely engineering activities working with support from other members of the team, is not required to be "everything to everybody". An urban municipal civil engineer is more likely to be a civil engineering specialist in the area of structural (bridges and buildings), water resources (water supply and treatment), wastewater (collection and treatment), transportation, or highways engineering. Most urban municipal engineers feel they are well trained and qualified in their area of responsibility and they are given plenty of opportunity to practice their discipline with opportunities for ongoing skills improvements.

Alternatively, a rural municipal engineer, who normally is employed by a small rural municipality, is often the only technical or engineering professional employed by the municipality and is, therefore, often required to be all things to all people in the organization. The rural municipal engineer may be responsible for management of all services delivered to the community—handling all aspects including the planning, design, and contracting of capital projects, along with management of ongoing operations, and maintenance. Typically, the rural municipal engineer is also tasked with reporting directly to the council and the administration, while also dealing directly with the citizens and other stakeholders on a daily basis. The common concern of rural municipal engineers is that there are many aspects of their job for which they were not given adequate academic training, so they must learn on the job.

With the gradual movement of people from the rural areas to the city, many young rural students tend to find student employment in the urban areas and full-time employment there after graduation. Since most civil engineering graduates have not been exposed to the complex and challenging life of a rural municipal engineer, they often do not even think to pursue employment in a rural municipality after graduation. A major challenge for rural municipal governments is their inability to attract graduate civil engineers to the life of a rural municipal engineer after graduation.

Without overlooking the opportunities available to graduate civil engineers within urban municipal governments and the private sector, the CSCE wishes to focus their efforts on addressing the skills shortage within rural municipal governments in Canada through the implementation of a Pilot Program in Nova Scotia for the new Internship Program for Rural Municipal Engineers.

RURAL MUNICIPAL ENGINEERING SKILLS DEFICIT

There are two related aspects to the challenge facing rural municipalities concerning the rural engineering skills deficit—*first*, the municipalities struggle to attract and retain civil municipal engineers in the rural area; and *second*, the need to expose young civil engineering students to the life of a rural municipal engineer through cooperative student employment. The CSCE believes that the first challenge can most effectively be met by addressing the second challenge. If students are exposed to the quality of life available to a rural municipal engineer, they are more likely to choose employment in the rural areas after graduation.

Attracting and Retaining Rural Municipal Engineers

The first challenge faced by rural municipalities in attracting graduate civil engineers to the rural area, is to make the individual aware of the opportunities and benefits that lie within the life of a rural municipal engineer. This can start at the rural high school by making local students aware of the great lifestyle available in their hometown.

Another challenge in attracting students to the rural area is the inability of the municipality to adequately compensate the civil engineer due to financial constraints. The municipality needs to be able to communicate to the civil engineering student the lifestyle benefits and value of choosing a career in rural municipal engineering and the benefits of raising a family in a rural environment. A lower income may be significantly offset by non-monetary benefits such as lower housing and transportation costs and improved healthful living.

A third challenge is to retain the rural municipal engineer so that he/she is not lured away once the skills have been developed. Initially, the young rural municipal engineer may be working under the guidance of the sole senior municipal engineer within the municipality. After a time, rather than waiting for the senior engineer to retire, the young engineer may relocate to another community where an opening is more readily available. In other cases, the young engineer may become bored waiting for additional responsibilities he/she believes are deserved, even though the young engineer may not yet have amassed the required skills. The young engineer may also believe that access to the training required for career advancement may not be available.

Skills Required for Rural Municipal Engineers:

(Complimentary to Current Civil Engineering Undergraduate Degree)

Based on interviews and literature, the following list of skills' deficiencies has been developed

- Project Management
- Asset Management and Operations
- Municipal Finance and Contract Management
- Communication Skills
- Negotiation Skills and Personnel Management
- Public Liaison and People Skills

The CSCE's Internship Program for Rural Municipal Engineers is intended to provide cooperative civil engineering students with an opportunity to experience the life of a rural municipal engineer through a student placement within a rural municipality under the mentorship of a practicing Rural Municipal Engineer.

Potential Options for Municipal Governments to Address the "Rural" Skills Shortage

The following, not exhaustive, list provides ideas for Municipal Governments to provide interim and longer-term solutions to the "Rural" Municipal Skills Shortage.

- Use of Part-time for Retired Civil Engineers
- Share Civil Engineers between multiple Municipalities
- Increase the % of women
- Increase the % of immigrants
- Increase the % of Aboriginals
- Increased utilization of CET's
- Promote Job Fairs at High Schools etc…
- Promote the advantages of "Small Town" lifestyle vs. Big City
  - > stress
  - > cost of living
  - > commute times
  - > family life
  - > responsibility vs. age or experience level
  - > diversity of work
- Promote the "Challenges" facing Municipal Governments
- Develop programs with Municipal Governments
- National Round Table on Sustainable Infrastructure NRTSI (Innovative Programs & Research Funding)

CSCE'S INTERNSHIP PROGRAM FOR RURAL MUNICIPAL ENGINEERS

The CSCE's Internship Program for Rural Municipal Engineers is based, in part, on the experience of the medical profession's Rural Residency Program, wherein it has been observed that physicians who do their residency in rural settings tend to set up their practice in rural settings. The CSCE has agreed to sponsor, in the rural setting, a similar Internship Program for Civil Engineering Students and Graduates, with the expectation that such a program will increase the number of graduate civil engineers who will choose a career in rural municipal engineering. This expectation is supported by interviews with current civil engineers working in positions within rural municipalities, who have emphasized the many benefits and qualities of their work, including a better life/work balance.

CSCE is well suited to administer a collaborative internship program for rural municipal engineering. In the past, the CSCE has successfully operated internship programs (HRDC Sustainability Development Youth Internship 2002–04). With support from Infrastructure Canada, The Province of Nova Scotia and rural municipal governments, CSCE is working to develop and administer a Pilot Internship Program for Rural Municipal Engineers to be implemented in 2011 in Nova Scotia.

The long-term goal of this program is the implementation of an Internship Program for Rural Municipal Engineers to be established by CSCE in collaboration with Civil Engineering Schools in each province. This program will have national scope, with funding from all three levels of government—federal, provincial and municipal.

As previously stated, initially the Internship Program will be launched as a provincially targeted Pilot Internship Program, in the province of Nova Scotia. Once running successfully in Nova Scotia, it is intended that the program will be expanded to other provinces across Canada. ■

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suite de la page 7

rappelons-nous les propos de l'écrivain et éditeur américain William Feather :

« *N'importe quelle idée est valable si un homme a la compétence nécessaire et s'il est prêt à travailler fort. La meilleure idée demeure stérile si son auteur est paresseux et inefficace.* »

Je me suis engagé à travailler fort, avec tous mes moyens et avec votre aide, pour réaliser les objectifs de la SCGC tel qu'énoncés dans « Vision 2020 : leadership en matière d'infrastructures durables ». ■

Research Needs in Civil Engineering

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ABSTRACT

As the original, non-military, form of engineering, Civil Engineering has evolved significantly over the last 200+ years, and continues to evolve as the expectations of society change. In response, the foci of our research needs have also changed and continue to change. In structural engineering, during my research career, the focus initially was on numerical methods (The Finite Element Method, now almost considered passé), behaviour of steel components and behaviour of reinforced concrete components, progressing to behaviour of Fibre Reinforced Plastics, new forms of composite systems, and, surprise, heritage structures. Other areas (seismic engineering, for example) have maintained their focus over this period.

What is the future for Civil Engineering research, and how do we continue to attract appropriate research monies because, despite being the oldest non-military form of engineering, what we do is as important today, if not more so, than it was 200 years ago?

CIVIL ENGINEERING TODAY

Although the systems that are the responsibility of Civil Engineers today, are not dissimilar to those that our forebears had responsibility for, the societal expectations have changed enormously. It has been argued[1] that today's civil engineers need to be equipped to deal with public discourse and the "vulgarization" of technical information. We hear more discussion of "sustainability" than practically any other topic, as it relates to civil infrastructure. So today, we are still responsible for the planning, design, construction, and operation of civil infrastructure, and the design and construction of much of the built environment. However, increasingly, we must do this in a climate of public scrutiny, of economic constraints, of environmental concerns and limitations, and of sustainability. Yet, while we continue to meet these expectations with innovation and professionalism, we do so in a political environment, where we do not "pull the strings". Typically, we are absent from the corridors of power, so have little political say in how civil infrastructure is priorised, implemented, and managed. As a consequence, we are often considered as providing a 'service' function, not as the experts who know what is required, and what is the best way of achieving what is required.

This was highlighted in a recent news report[2] that discussed the problems experienced by the City of Montreal and its "crumbling infrastructure". The article did not discuss the engineering problems associated with this crumbling infrastructure, and they are certainly manifest, but rather the political problems associated with getting the necessary work accomplished. I would hazard that there are few, if any, engineers serving on the relevant urban councils—the people who would be in a position to talk confidently of the importance of the required rehabilitation work.

This further highlights a growing trend in Civil Engineering—the focus on rehabilitation: of crumbling infrastructure, of heritage buildings, and of over-utilized systems. This stems from a number of sources: poor initial construction, poor material selection, systems being used beyond their design life and/or design capacity. The solutions can, and will, take many forms, but will require innovation and an understanding of the systems and materials that were originally used. One would like to think that we are better at construction and the selection of materials today than our

ABOVE: Exposed reinforcing steel in recent (< 15 years) concrete.

forebears were, but we all can find examples of recent construction that is already showing signs of deterioration.

There is another aspect that is receiving significant attention—the issue of sustainability. One of the most significant difficulties with sustainability is its definition, and there are numerous definitions currently being used both within the Civil Engineering profession and elsewhere. CSCE, in its Guidelines for Sustainable Development[3] uses a definition that combines social, environmental and economic principles. Sustainability is being introduced into undergraduate curricula, and, as a profession, we may have embraced sustainability, but society is a long way from accepting the associated costs and potential changes to the development of our built infrastructure.

As a further example, the City of Calgary recently[4] went through a long-range planning process, called Plan-It, to develop a plan for the future development of the city that would rein in the unfettered horizontal growth of the city. This was based on many principles related to quality of life (social), the transportation impacts (environmental) and the implications for extended water and sewage systems and the associated exponentially rising costs (economics). When initially published, the plan resulted in a fire-storm of protest, generally led by developers. The adopted plan, while maintaining many of the original principles, is not nearly as innovative as was originally envisaged—society was not ready for the consequences.

As society changes and develops, our profession is faced with new challenges in the design and planning of civil infrastructure. There is a growing recognition that civil infrastructure is becoming vulnerable to the impact of a changing climate. The United Nations Framework Convention on Climate Change (UNFCCC) has created an adaptation fund for use by developing countries to assist them to adapt their infrastructure (Social, Economic and Physical) to address vulnerabilities. In the developed world, there are examples of these considerations becoming more commonplace. Engineers Canada[5] has developed an infrastructure assessment tool for water, wastewater, transportation and building infrastructure that identifies vulnerabilities.

CIVIL ENGINEERING RESEARCH

Because of the changing pressures on our profession, there is an urgent need for our research foci to change so that we are better able to meet the expectations of society and ensure that the ~$70 billion that is spent annually on construction in this country, is wisely spent. While this is not to say that we should not pursue fundamental research in all areas of Civil Engineering, there is also a need for research that focuses on the immediate problems of today.

Many in structural engineering will argue that that is what is being done – that the excellent research in the use of Fibre Reinforced Plastics addresses much of the agenda of society as to sustainability; that eliminating steel in construction should be a major objective. I disagree. The issue of deteriorating reinforced concrete due to steel corrosion (Photograph 1) is often a result of poor concrete design and placement. The blame should not be directed to the steel. Our research in structural engineering needs to address the issue of sustainability in a holistic way so that new developments are fully assessed as to societal, environmental and economic implications, as well as the structural implications. Too often we see Doctoral Theses in which the candidate has no vision as to the potential applications of their work.

In material research, there is a growing need to understand the compatibility of different materials. This is particularly important when we are considering the rehabilitation of infrastructure and the preservation of heritage structures — In the latter, the use of mortars which, in themselves may not meet any sustainability criteria, but, through their application to a heritage structure, may provide a sustainable solution. Similarly, research into the use of materials in new construction methods may lead to long-term sustainable construction — Insulated Concrete Forms may be one example of this.

Civil Engineers need to engage seriously in research in Urban Planning and introduce the planning and design of transportation systems, water supply systems and sewage disposal systems to social aspects of urban planning. This should include research on the energy footprint of our urban areas, where we need to collaborate with Architecture and Urban Planning researchers to create sustainable solutions to urban growth. It should also include research on long-term, low-impact and resilient designs for urban infrastructure. To do this, we need to be able to quantify the differences in long-term cost and environmental impact for various forms of urban growth to be better able to inform decision makers. To some extent, this is already done with respect to transportation, but the other infrastructure components are often ignored.

"Because of the changing pressures on our profession, there is an urgent need for our research foci to change so that we are better able to meet the expectations of society and ensure that the ~$70 billion that is spent annually on construction in this country, is wisely spent. While this is not to say that we should not pursue fundamental research in all areas of Civil Engineering, there is also a need for research that focuses on the immediate problems of today."

In Transportation research, despite the focus for many years on Intelligent Transportation Systems, we see very few actual applications of ITS, and yet the potential savings in time and energy resources, and reduction in greenhouse gas emissions, that might accrue from the use of ITS are enormous. Is this yet another example of our failure to truly sell the benefits of the technology? Similarly, I have recently been in two jurisdictions that have invested in roundabouts instead of traffic lights—why are they not more widely used?

In water and wastewater engineering, the most critical requirement may be the presence of chemicals that were not previously present and for which our systems were not originally designed. New pressures are being placed on sewage treatment systems from the new chemicals that are finding their way into waste systems from toiletries, drugs and other products in everyday household use. Much research is ongoing in this area. However, another pressing issue is the losses within these systems, particularly in water supply systems. While it is generally accepted that cities lose 30% of their water from the distribution system, the loss can be as high as 40%—a staggering figure, when everybody agrees that water is the most valuable commodity on earth. Also related to water is research on how we can best use the water resources available to us. Very little water (~3%) is actually used for drinking water—the balance is used in household applications that may not require the same levels of purification. Why not have dual systems?

One issue that needs additional research is the issue of design-life, and life-cycle consideration for infrastructure systems. It is apparent that systems that may be designed for 50 years are often expected to function for 100 years, those that are designed for 100 years are expected to function for 200 years. Partly this is a consequence of the prohibitive cost of replacement and the associated disruption to society. Related to bridge deck replacement, would a less efficient design with greater concrete cover, or a design utilizing better designed concrete, have increased the time to rehabilitation and been a more resilient solution?

In construction, the issue of waste (estimated as 20% of all construction materials), needs to be addressed. It has been suggested[6] that the implementation of good Project Management practices could reduce this significantly.

The whole issue of infrastructure deficit needs more engineering input and what is missing is an ability or appreciation among engineers to do some long range financial planning and to present that information to decision makers. Our work has been too focused on building new stuff without regard for what should be reinvested in existing infrastructure.

In conclusion, Civil Engineering research is as important today as it was 200 years ago, but our research must address much broader issues than the narrow foci that we see in much of the research today. It must address economic and social issues as well as engineering issues. It must address issues of sustainability, vulnerability, and resiliency. We must work with practicing engineers, and municipalities to solve their (our) problems.

ACKNOWLEDGEMENT

The views expressed in this article are those of the author. The author acknowledges the excellent advice provided by colleagues through invited reviews. ■

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Skills Shortage—Fact or Fiction

Civil Engineering: Challenges for the 21st Century

Is there, or is there not a current skills shortage in civil engineering in Canada? This question has been raised as a concern in varying degrees for decades. The ebb and flow of the hype and debate of skills shortages over the past 30 to 40 years parallels specific economic trends and drivers occurring at the same time. By example, it is not too difficult to recognize the primary response in Canada to the most recent global economic crisis has been to invest in infrastructure projects designed to stimulate the Canadian economy. With the resulting boom in infrastructure spending is the spin off debate of the engineering and contracting capacity in Canada to implement all of the projects within the defined timelines.

More often than not, two key issues are raised during periods of apparent skill shortages. They include the issue of national immigration policies allowing sufficient offshore skilled labour to enter the Canadian workforces to address predicted skill shortfalls and secondly, the ability of our educational institutions to generate sufficient graduate engineers to fill long-term needs. A review of different statistical studies and opinion reports over the past 10 years suggests there is no common agreement on the question of whether we have a national shortfall of skilled labour or not. The following examples of article and report headlines suggest there is a shortfall, or potential for a shortfall of skilled labour, but several

sources offer a different point of view and thus serve to confuse the issue.

2000 "***Shortage of trained engineers looms on horizon***"—article by Consulting Engineers of Ontario in Environmental Science & Engineering

2000 "***Missing Persons: Generation X and the shortage of young engineers***"—editorial in Canadian Consulting Engineer magazine describing the challenges of finding young engineers with 10 years of experience—those graduating in the early 1990's but not working in the engineering field

2007 "***Current and Future Labour Market Shortages in Canada***"—published background briefing report from Human Resources and Skills Development Canada (HRSDC) suggesting several occupations are facing labour shortages at the national level—civil engineering was not on this list

2009 "***National labour shortage will become part of Canadian economic life***"—editorial in Daily Commercial News referencing three opinions about engineering labour shortages including CanaData economist warning that a shortage of skilled workers was likely to blunt the effectiveness of infrastructure spending, ACEC president responding to CanaData opinion noting that engineering sector has a lot of available capacity should infrastructure projects materialize and a study paper by Atlantic Institute suggesting a general labour shortage will become a fact of Canadian economic life

2010 "***Occupations in Demand in Alberta, British Columbia and Ontario***"—website of "Workingin-Canada.com", international immigration and employment specialists offering a list of identified occupations in demand based on Provinces agreement with Canadian federal government. The current list includes civil engineers and civil engineering technologists and technicians

2010 "***Engineering Oversupply to Canada over the Past Decade***"—website of Engineers for Engineers with a report suggesting recent engineering graduates and recent immigrants have been suffering unprecedented problems in finding employment due to an oversupply of engineers in Canada citing numerous public reports including CCPE, Stats Canada, etc.

2010 "***Job opportunities in Canada expected to grow as skills shortage returns***"—opinion article in website "Expatforum.com" describing engineering as one of those opportunities

Many of the above references are opinion articles and papers. Nonetheless, they serve to demonstrate varying interpretations of statistical data. So, is there or is there not a skills shortage? This may depend on one's specific perspective—business area (i.e. construction, consulting, municipal, etc) and how capacity building has been managed.

As a practitioner/owner of a Canadian consulting engineering company working in the municipal infrastructure field, I would offer the following "opinion" about the issues of skills shortages and more importantly, about capacity building challenges for civil engineering.

Is there a skills shortage? On one level, the answer is yes. As far as I can remember, we have been seeking to hire new employees with 5 to 10 years of Canadian consulting experience in the design and construction of municipal infrastructure systems, exceptional communication skills and a strong sense of business in the consulting industry. We never seem to have enough of these types of employees, especially with the specific discipline experience required.

Our efforts to address this shortage are to look for the perfect available "free agent" in the market place with all of these attributes. It is idealistic, however, to think one can build the full capacity needs for a business with this approach.

In reality there are two key approaches or components in a business strategy to address the skill shortages in the industry—hire the best available "free agent" in the market place that will, in all likelihood, require some training time for the technical, cultural and business aspects of the organization and hire new graduates and build the employee with these attributes.

While I believe we have a current skills shortage, I do not believe we have a shortage of young graduating engineers—they simply need the time to mature and develop. The current skills shortage in our industry is a legacy of several significant economic downturns in the 80's and 90's where graduating engineers were not hired and followed by a period where budget constraints and project demands mitigated the ability to take the time to train young engineers. The free agent and immigrant engineers need to be part of the capacity building business plan; however, the long-term future rests with the ability to hire, train and retain graduating engineers.

The challenges that need to be overcome with some suggested activities if we are to have success in meeting the skills capacity requirements of the business in the 21st century include and are clearly not limited to some of the following:

1. Ensure the right number and type of young people select engineering as a preferred career choice

- Encourage high school graduates to enter engineering programs when making career choices—participate in career days at high schools and public schools
- Sell engineering as a rewarding career choice, demonstrating its importance to society and challenging young people with the opportunity to make a difference in the world

2. Ensure engineering education prepares and develops graduating engineers for the working world

- Continue to develop stronger relationships between academia and industry to "ground" the curriculum with industry needs and identifying research areas, etc.
- Develop problem solvers and social conscience responsibilities
- Re-think the business model for university programs and teaching staff whose success depends so much on publishing papers

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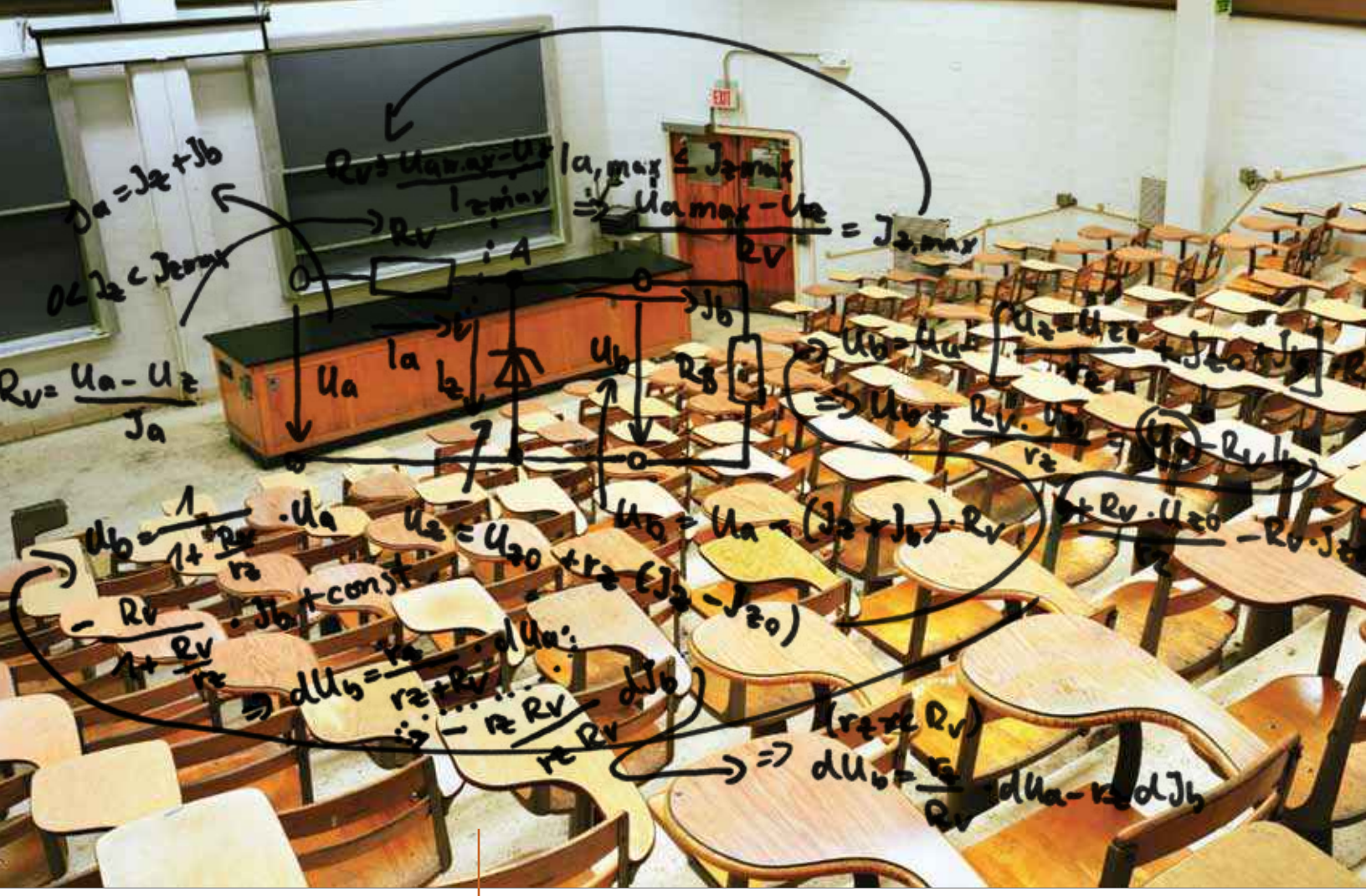

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Back to School

August marks the end of another Canadian summer, busy with so many activities and projects and, of course, holidays. For university academics the summer is a productive period of focused research and student supervision, often without immediate or pressing deadlines. In August, the end of summer, this situation experiences a change of pace, with more time constraints and a variety of other personal and academic commitments related to the upcoming term. August also marks the start of school preparations for students and teachers. Beginning mid-month, newspaper fliers and TV ads start reminding us that school start is fast approaching and we better start getting all those important supplies.

When the editors of Canadian Civil Engineer asked me if I would submit a contribution to this Fall 2010 issue, dealing with Engineering Education, I thought I'd share my checklist of activities, in preparation for September and the start of another academic year. I have been teaching since 1975 and learning since 1943, and over this time I have come across a few ideas and thoughts on teaching and learning, that I would like to share with engineers teaching engineers. The concepts presented here I learned from others, but I take full responsibility for their presentation. They are not necessarily espoused or supported by the institution where I teach.

TEACHING ENGINEERING STUDENTS

Have you noticed that any gathering of two or more engineering educators frequently results in comments regarding the current generation of students and their perceived commitment, engagement or performance in the courses we are teaching? A comment frequently heard would be related to the lack of background preparation, usually in mathematics or basic science concepts, from high school or from previous courses. I believe that students probably have parallel comments about their professors' seemingly "unreasonable" expectations and "toughness" in marking their work. Both groups are probably right. Perhaps what is needed is a more effective communication of academic and professional expectations early in the education process, with reinforcement of these expectations along the various courses in a given program.

TEACHING MODELS

Results from recent national engineering student surveys indicate that junior students seem to have an expectation of greater faculty involvement in the learning process, perhaps as an extension of their own high school studies. Some faculty members believe this to be some form of "spoon feeding". Maybe this is a reflection of the faculty preference for a teaching model that places the professor at the centre of the learning process, dispensing knowledge to be processed by students at a pace often dictated by academic and professional program requirements. Other learning models place the student at the centre of the process and appear to be more accepting of the various learning styles. Who is to say that the "sage on the stage" model is preferable to the "guide on the side" model? A combination of both approaches would make an excellent compromise worth considering. Junior basic science courses would probably benefit from a stronger student-centered component of the teaching approach. Senior engineering analysis and design courses would probably favor a professor-centered approach where the instructor's professional experience would "guide" the learning process.

LEARNING STYLES

Just as professors have different teaching models, students have different learning styles. There are many ways of learning. One could say that individuals could develop their own particular learning style. For the sake of simplicity, learning styles could be grouped in two broad categories: *inductive* or *deductive*. Professors were likely *deductive* learners and probably tend to be *deductive* teachers. They like to teach from first principles. Students are mostly *inductive* learners; they like to learn "by example". Professors can always identify the *deductive* student learners; their solution to problems often matches that of the professor's. It is always a good idea to explain our engineering concepts in different ways and incorporate a variety of learning styles in our teaching. Having taught a first year Mechanics course for many years, we have found that students, by and large, prefer to learn "by example" and may have difficulties accepting or embracing a deductive teaching approach, especially in the early years.

RESEARCH IN ENGINEERING EDUCATION

Education research is well established in many areas outside engineering. While the results of this research have probably wide applications in all fields of learning, engineering educators still may have some concerns regarding the application of generalized education research to engineering teaching. Research in engineering education is alive and well in Canada although, perhaps it has not received very wide publicizing. It is time more engineering educators started getting more familiar with the findings of our colleagues in this field. We should also place more emphasis in conducting our own research on teaching/learning methods and styles for our own engineering fields. I do not think we will discover very different findings from those of our colleagues in other fields; but this is a worthwhile exercise. Very capable and proactive colleagues are currently reviving new special interest groups on engineering education. These groups need our individual and institutional support.

ENGINEERS TEACHING ENGINEERING STUDENTS

Engineering faculty members in university wear two hats, the mortarboard of academe and the hard hat of engineering. Engineering educators are responsible to the academy for making sure students meet academic regulations for promotion and graduation; and they are also responsible to the profession for making sure students and programs satisfy professional requirements for registration and accreditation. These two activities are both compatible and inclusive. They must be at the top of our minds when designing new programs or preparing lectures.

OUR UNIVERSITY WORK

Research and teaching are the two academic activities usually considered to be at the core of university life for all faculty members. The conventional wisdom is that knowledge is created through research and disseminated through teaching. There is a third academic activity which takes a considerable effort and which relies on faculty members' academic and professional training. This third activity is the grading and assessment of student course work to be used for promotion and graduation decisions. This third activity is also considered to be an important part of our academic commitment to the academy. Promotion of students in an engineering degree program relies on a well-established curriculum and student evaluation process leading to the granting of a diploma upon graduation.

This diploma is the first step in the professional registration process. The design and delivery of professional degree programs is over-seen by committees at the departmental, faculty and university-wide levels in the academy and, by the Canadian Engineering Accreditation Board in the profession.

Although research and teaching are usually associated with universities these two activities can, and often do, take place outside formal university environments. However, the granting of academic degrees is an exclusive function of universities and colleges. *Certification of knowledge*, leading to promotion, graduation and a university or college degree, is indeed a key function of engineering educators. This activity, leading to an institution's diploma-granting functions, is recognized and officially mandated by provincial legislation.

The authorities regulating the registration and accreditation processes have recently recognized the teaching of engineering as a professional activity. This opens an opportunity for engineering educators to count their teaching experience as credit towards professional registration and to conduct research in this field. Many engineering educators have strong interests in conducting research on teaching methods and outcomes. The current atmosphere will hopefully facilitate the acceptance of publications in engineering education research as important contributions, both to the academy and the profession, for the purpose of tenure and promotion decisions.

DO YOU KNOW YOUR ABCs?

Central to our "certification of knowledge" activities is the assessment of students' work through grading. Other than the pass/fail grades assigned to some courses, most programs use a combination of letter grades, percentages and grade points to quantify student work and to make decisions for promotion, graduation, letters of reference, scholarships and awards. We assess student work in assignments, tests and lab reports using percentages; final course grades as letter grades; and promotion and graduation decisions are made on the basis of grade points. To determine course performance, I believe most professors would be comfortable with assessment in terms of percentages. To make promotion and graduation decisions most administrators would prefer grade points or equivalent letter grades.

All these varieties of assessment require some form of rational, explicit, "conversion" from one system to another and this is where some discussion is needed in order to address some difficulties, especially at the high end of the scale. For example, it is possible to have two students with average A-level performance in a number of courses and yet, exhibit a discernible difference when percentages are used. This is important when making decisions about awards or admissions to graduate studies.

The first step is to have a clear understanding of, and agreement on, the specific meaning of the various letter grades, followed by their percent or grade point equivalency. This discussion should be led by the people with the chalk dust in their fingers. Otherwise it might be seen as university administration's interference with the academic or professional process.

There, that was the checklist in the back of my mind, as I sat down to prepare lecture plans for my courses which began in September.

Juan J. Salinas is a professor in the Department of Civil and Environmental Engineering at Carleton University in Ottawa, Ontario. He has been a professional engineer since 1965 and an educator since 1975. The comments presented reflect his own experience and views and are not necessarily those of the institution where he teaches. Discussion, criticism and comments from educators, students and professionals are welcome and encouraged. Please refer them to jsalinas@connect.carleton.ca

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3. Ensure selecting engineering as a career was a good choice by making sure there is an availability of challenging and interesting jobs upon graduation

- Continue to hire, regularly, new graduating engineers, in times when economic circumstances might suggest otherwise in any particular year
- Continue to develop stronger relationships between academia and industry to link young graduates with industry

4. Ensure financial viability of the philosophy of hiring and retaining graduate engineers on a regular basis

- Develop project/program budgets and schedules that allow for time to train new engineers on the job
- Develop new graduate pay scales and benefit packages that are competitive
- Develop formal in-house and on-the-job training programs for EIT's

5. Ensure retention of young engineers

- Provide challenges and opportunities for young engineers to demonstrate responsibility/capabilities
- Embrace and advance new technologies and business processes—these provide the opportunity for individuals to achieve higher production and thus mitigate high reliance on number of professionals required to complete tasks
- Provide training programs (formal and informal) that reinforce continuous learning
- Involve young engineers in the business development aspects of the organization—give them sense ownership
- Establish competitive, reward oriented remuneration and benefits packages
- Develop as much flexibility as is practical in terms of employment practices recognizing current needs, lifestyles and aspirations of young professionals

This list of challenges and suggested activities in terms of addressing skill shortages in civil engineering is based on the philosophy of hiring, training and retaining graduate engineers to fulfill long term skill shortage needs. It is not the definitive list. It is presented in the context of a consulting engineering practice responding to municipal infrastructure servicing needs. It is the opinion of the writer that these and other challenges like these can advance the ability to meet and mitigate skills shortages in the future.

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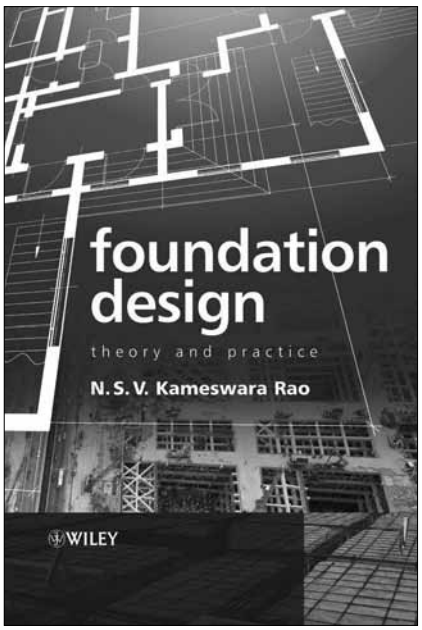

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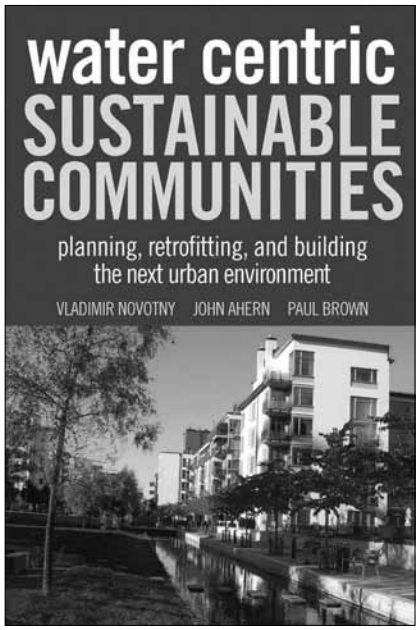

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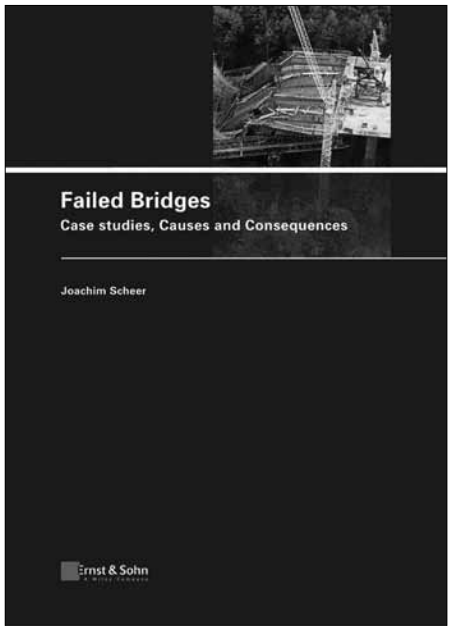

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THE CANADIAN SCIENCE AND ENGINEERING HALL OF FAME

An important section of the Canadian Science and Technology Museum in Ottawa is the Canadian Science and Engineering Hall of Fame, which honours "individuals whose outstanding scientific or technological achievements have had long term implications for Canadians".

There are at present forty two names of outstanding Canadians in the fields of science and engineering in the "Hall". However, only two of these, Sir Sandford Fleming and C.J. Mackenzie were Civil Engineers, surely not a true reflection of the significant influence that Civil Engineers have had on the growth of Canada as a nation.

Nominations are currently being sought for the "Hall" and so we have an opportunity to attempt to redress the balance.

As examples of potential inductees, four of our early pioneering Civil Engineers spring immediately to mind,—Thomas Coltrin Keefer, Sir Casimir Gzowski, Walter Shanly and Sir John Kennedy.

In addition to the extensive engineering works carried out by these outstanding engineers which contributed significantly to the development of the nation, all four were important players in the development of the Engineering profession in Canada. Keefer was the first President of the original Canadian Society of Civil Engineers and Gzowski, Kennedy and Shanly were the original three Vice Presidents.

Gzowski become the third President of the Society and Kennedy the fourth (Keefer was President again in 1897). Although Shanly was never to become President, it was he, as a Member of Parliament, who introduced the private members' bill that established the CSCE. Royal Assent of the Society's Charter was received on June 23, 1887. The importance to the profession of these four engineers is remembered by both CSCE and EIC through Annual Awards presented in their names.

T.C. Keefer's most significant works were water supply systems, particularly those in Ottawa, Montréal and Hamilton. The provision of safe water supplies was a major factor in eliminating the typhoid and cholera outbreaks that had devastated many communities in the 1800's. Keefer was also a noted writer and two of his books, "The Philosophy of Railroads" and "The Canals of Canada", were critically acclaimed.

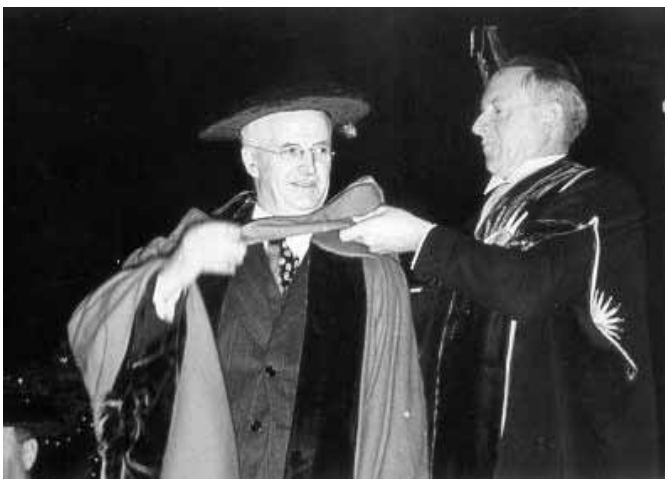
Casimir Gzowski was involved in the construction of canals, roads, harbours and bridges. He was responsible for the construction of the major part of the Grand Trunk Railway and of the International Peace Bridge between Fort Erie and Buffalo. He later became the first Chairman of the Niagara Parks Commission.

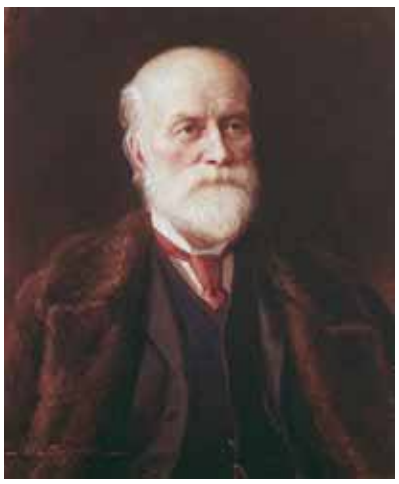
Walter Shanly was one of the most successful railway engineers in Canada in the mid 1800's. Amongst other appointments he was Chief Engineer of the Prescott and Bytown Railway and General Manager of the Grand Trunk Railway. With his brother Frank, he achieved international fame by completing the technically challenging Hoosac Tunnel in western Massachusetts.

John Kennedy was Chief Engineer of the Montréal Harbour Commission for the greater part of his career. His work in widening and deepening the shipping channel from Quebec City to Montréal and in reconstructing the facilities of the Port of Montréal resulted in the port becoming Canada's most important gateway for trade with foreign countries and the main access point for Upper Canada and the West.

Although these four founding members of the original CSCE are outstanding candidates, there are certainly many more Civil Engineers right up to the present day, who are deserving of a place in the "Hall". President Vic Perry is encouraging members to consider possible nominations and to contact him with suggestions.

It is long past time that more Civil Engineers were added to the Science and Engineering Hall of Fame. ■





LEFT: Jack Mackenzie
RIGHT: Sir Sandford Fleming

LE PANTHÉON CANADIEN DES SCIENCES ET DU GÉNIE

Une importante section du Musée canadien des sciences et de la technologie est consacrée au Panthéon canadien des sciences et du génie, qui rend hommage aux « personnes dont les réussites exceptionnelles en matière de science et de technologie ont eu des conséquences à long terme pour les Canadiens ».

Il y a en ce moment au Panthéon les noms de 42 Canadiens qui se sont distingués dans le domaine des sciences et du génie. Toutefois, seulement deux de ces personnes, Sir Sandford Fleming et C.J. Mackenzie étaient des ingénieurs civils, ce qui ne reflète certainement pas l'importante influence exercée par les ingénieurs civils sur la croissance du Canada.

On recherche en ce moment des candidatures au Panthéon, ce qui nous donne l'occasion de corriger la situation.

Voici quelques exemples de candidats possibles, dont quatre de nos premiers professionnels : Thomas Coltrin Keefer, Sir Casimir Gzowski, Walter Shanly et Sir John Kennedy.

En plus des travaux de génie complexes réalisés par ces grands ingénieurs qui ont apporté une importante contribution au développement du pays, ces quatre hommes ont joué un rôle important dans le développement de la profession au Canada. Keefer a été le premier président de la première Société canadienne des ingénieurs civils, tandis que Gzowski, Kennedy et Shanly en furent les trois premiers vice-présidents.

Gzowski devint le troisième président de la société et Kennedy en fut le quatrième (Keefer fut à nouveau président en 1897). Même si Shanly ne devait jamais devenir président, c'est quand même lui qui, en qualité de député, présenta le projet de loi créant la SCGC. La charte de la SCGC reçut la sanction royale le 23 juin 1887. L'importance du rôle de ces quatre ingénieurs dans l'histoire de la profession est soulignée tant par la SCGC que par l'ICI, au moyen de prix annuels portant leurs noms.

Les œuvres les plus importantes de T.C. Keefer furent réalisées dans le domaine des aqueducs, notamment à Ottawa, Montréal et Hamilton. L'approvisionnement sécuritaire en eau joua un rôle important dans l'élimination des épidémies de typhoïde et de choléra, qui ont dévasté plusieurs collectivités au cours du 19e siècle. Keefer fut également un écrivain réputé, et deux de ses œuvres, intitulées « The Philosophy of Railroads » et « The Canals of Canada », furent encensées par la critique.

Casimir Gzowski participa à la construction des canaux, des routes, des ports et des ponts. Il fut responsable de la construction de la plus importante partie du « Grand Trunk Railway » et du pont international de la Paix, entre Fort Erie et Buffalo. Par la suite, il devint président du conseil de la Commission des parcs de Niagara.

Walter Shanly fut l'un des meilleurs ingénieurs des chemins de fer au Canada vers le milieu du 19e siècle. Il fut entre autre ingénieur en chef du « Prescott and Bytown Railway » et directeur général du « Grand Trunk Railway ». Avec son frère Frank, il a acquis une réputation internationale en concevant le tunnel Hoosac, dans l'Ouest du Massachusetts.

John Kennedy était ingénieur en chef de la Commission du havre de Montréal pendant la majeure partie de sa carrière. Son travail pour creuser et élargir le chenal entre Québec et Montréal et pour la reconstruction des équipements du port de Montréal a fait de ce port la plus importante porte d'entrée pour le commerce international et le principal accès au Haut-Canada et à l'Ouest canadien.

Même si ces quatre membres fondateurs de la première SCGC sont des candidats exceptionnels, il y a certainement beaucoup plus d'ingénieurs civils, d'hier jusqu'à aujourd'hui, qui méritent une place au Panthéon. Le président Vic Perry encourage les membres à proposer d'éventuelles candidatures et à lui soumettre des suggestions.

Il est grand temps d'ajouter plus d'ingénieurs civils au Panthéon des sciences et du génie. ■

LAUREN QUAN CIVIL ENGINEERING STUDENT, SCHULICH SCHOOL OF ENGINEERING—UNIVERSITY OF CALGARY /
ÉTUDIANTE EN GÉNIE CIVIL, SCHULICH SCHOOL OF ENGINEERING—UNIVERSITÉ DE CALGARY

A Ghanaian Experience: Infrastructure Planning in Ghana

"... infrastructure issues aren't the only factors limiting opportunity but they are one component of the problem. In Ghana you have farmers who can't access markets to sell their produce because poor roads make transportation of goods prohibitively costly and time-consuming."

Jody Rechenmacher, P.Eng, a Water Engineer at CH2M Hill, recently spent four months working with Engineers Without Borders' Governance and Rural Infrastructure Team in Ghana. There, she noticed that the Engineers and Planners she worked with at the District Planning Office face similar issues to their Canadian counterparts.

In Ghana, information on existing community infrastructure and infrastructure needs are not centralized at the District Planning Office. Because of this in order for Planners to collect all the necessary data to make informed decisions and recommendations for the placement of new infrastructure they must travel throughout the District Capital to several Government Departments in different buildings. At each stop, they pour through reports and statistics—which are often in different formats and have various levels of accuracy. With this difficulty in finding accurate information the district's limited resources cannot be allocated to best serve the population.

With this in mind, Engineers Without Borders' Governance and Rural Infrastructure team works with the Government of Ghana at the district level to implement planning cycles based on the realities of rural communities. EWB volunteers work with local partners to create surveys, analyze trends, and aggregate data to allow planners to make evidence-based decisions which will improve standards of living in rural Ghana. With opportunities for infrastructure investment coming from within Ghana and internationally, affecting the government's ability to deliver public services to those in extreme poverty is an effective way to create lasting positive change in Ghana. Rechenmacher points out that the Canadian system also has flaws in the availability of information. "Think about trying to get information on underground utilities, there is often no centralized database and if there is the information is often not completely up-to-date," she notes. "Going through school I always assumed that you would have this information to base your decisions on but that's not always true."

In Ghana the importance of evidence-based decisions is compounded because governments operate under extremely tight financial constraints. Without available and accurate information the government cannot direct their own or outside funds to create or maintain infrastructure where it is most needed.

Engineers both in Canada and Ghana continue to work to improve the standard of living for people in their communities. With the access to accurate information engineers and planners can make strong recommendations so that universally beneficial decisions are taken.

For more information on Engineers Without Borders and the Governance and Rural Infrastructure Team visit www.ewb.ca/africa. ■

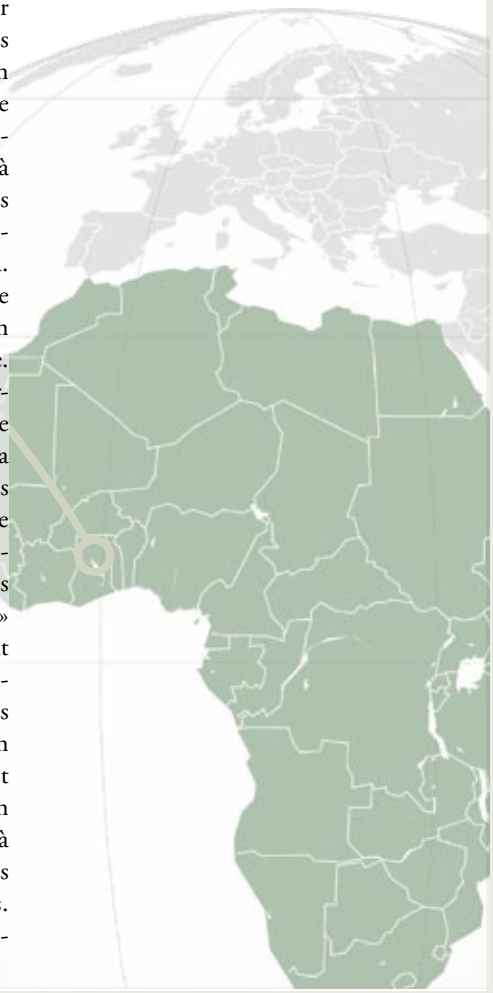
LEFT: Workers carrying sand to construct a Canadian International Development Agency (CIDA) funded teacher accommodation. / Travailleurs transportant du sable pour la construction d'un abri pour les enseignants, financé par l'Agence canadienne de développement international (ACDI).

Expérience au Ghana en matière de planification des infrastructures

« ... les problèmes d'infrastructure ne sont pas les seuls facteurs limitatifs, mais ils constituent l'une des composantes du problème. Au Ghana, il y a des cultivateurs qui n'ont pas accès au marché pour vendre leurs produits parce que le mauvais état des routes rend le transport prohibitif et exige trop de temps. »

Jody Rechenmacher, ing., spécialiste de l'eau chez CH2M Hill, a récemment passé quatre mois avec l'équipe d'Ingénieurs sans frontières responsable de la gouvernance et des infrastructures rurales au Ghana. Là-bas, elle a remarqué que les ingénieurs et les planificateurs avec qui elle travaillait au bureau de planification du district devaient régler des problèmes semblables à ceux de ses homologues au Canada. Au Ghana, les informations sur les infrastructures communautaires existantes et sur les besoins en infrastructures ne sont pas centralisées au bureau de planification du district. À cause de cela, et pour que les planificateurs puissent recueillir toutes les données nécessaires à une prise de décision éclairée et à la formulation de recommandations sur l'emplacement des nouvelles infrastructures, ils doivent se rendre dans plusieurs édifices de divers ministères, dans la capitale du district. À chaque endroit, ils consultent des rapports et des statistiques présentées dans des formats non uniformes, dont la précision varie souvent. À cause de cette difficulté reliée à la précision des informations, il devient difficile de procéder à une allocation des ressources de façon à offrir le meilleur service à la population. Dans cette situation, l'équipe pour la gouvernance et les infrastructures rurales d'Ingénieurs sans frontières travaille de concert avec le gouvernement du Ghana, au niveau du district, pour mettre en œuvre des cycles de planification reposant sur les réalités des collectivités rurales. Les bénévoles d'Ingénieurs sans frontières travaillent avec des partenaires locaux pour créer des enquêtes, analyser les tendances et réunir les données qui permettront aux planificateurs de prendre des décisions en fonction des réalités afin d'améliorer le niveau de vie dans les régions rurales du Ghana. Grâce aux investissements en infrastructures provenant du Ghana et de l'étranger, améliorer la capacité du gouvernement en matière de services publics à l'intention des zones extrêmement pauvres constitue une façon de créer des changements positifs à long terme au Ghana. Rechenmacher souligne que le système canadien comporte aussi des lacunes en ce qui a trait à l'information disponible. « Essayez de trouver des données sur les services souterrains… souvent, il n'y a pas de base de données centralisée, et lorsqu'il y a des informations, souvent, elles ne sont pas tout à fait à jour. À l'université, je croyais que l'on disposait toujours de ce genre de données pour prendre des décisions, mais je sais maintenant que ce n'est pas toujours le cas. » Au Ghana, il est encore plus important de prendre des décisions à partir des réalités parce que les gouvernements ont des ressources financières très limitées. En l'absence de renseignements précis, il est impossible de dépenser l'argent (le sien ou celui de l'aide étrangère) de façon à créer ou à entretenir les infrastructures là où les besoins sont les plus criants. Au Canada comme au Ghana, les ingénieurs s'emploient à améliorer le niveau de vie des gens dans leurs communautés. En disposant de données précises, ingénieurs et planificateurs sont en mesure de faire des recommandations bien étayées donnant lieu à des décisions qui aideront tout le monde. Pour obtenir plus de renseignements sur Ingénieurs sans frontières et sur l'équipe pour la gouvernance et les infrastructures rurales, consultez le site web www.ewb.ca/africa. ■

ABOVE: Government officers being trained to use data for planning. / Formation de fonctionnaires pour l'utilisation des données pour fins de planification.



CSCE National Honours and Awards Call For Nominations

Nominations are invited at any time for the awards listed below; those nominations received by November 15, 2010 will be considered for 2011 awards to be presented at the CSCE Annual Conference in Ottawa, ON in June 2011. Please submit nominations, clearly stating the award for which the nomination is made, by e-mail to louise@csce.ca, or mail to: Ms. Louise Newman, The Canadian Society for Civil Engineering, 4920 de Maisonneuve Blvd. W., Suite 201, Montreal, QC H3Z 1N1

A.B. SANDERSON AWARD

Recognizes outstanding contributions by a civil engineer to the development and practice of structural engineering in Canada.

ALBERT E. BERRY MEDAL

Recognizes significant contributions by a civil engineer to the field of environmental engineering in Canada.

CAMILLE A. DAGENAIS AWARD

Recognizes outstanding contributions by a civil engineer to the development and practice of hydrotechnical engineering in Canada.

E. WHITMAN WRIGHT AWARD

Recognizes significant contributions by a civil engineer to the development of computer applications in civil engineering in Canada.

EXCELLENCE IN INNOVATION IN CIVIL ENGINEERING AWARD

(deadline for nominations is Jan. 15, 2011)

Recognizes excellence in innovation in civil engineering by an individual or a group of individuals practicing civil engineering in Canada, or a Canadian engineering firm, or a Canadian research organization.

HORST LEIPHOLZ MEDAL

Recognizes outstanding contributions by a civil engineer to engineering mechanics research and/or practice in Canada.

JAMES A. VANCE AWARD

Recognizes a CSCE member whose dedicated service, other than as President, has furthered the advancement of the CSCE and who has completed or recently completed service in one or more sequential positions at the National level.

SANDFORD FLEMING AWARD

Recognizes outstanding contributions by a civil engineer to transportation engineering research and/or practice in Canada.

WALTER SHANLY AWARD

Recognizes outstanding contributions by a civil engineer to the development and practice of construction engineering in Canada.

W. GORDON PLEWES AWARD

Recognizes particularly noteworthy contributions by an individual to the study and understanding of the history of civil engineering in Canada, or civil engineering achievements by Canadian engineers elsewhere. Normally, the recipient will be an individual, not necessarily an engineer, but in special circumstances the award can be given to an organization.

Appel—Distinctions Honorifiques Nationales SCGC

Les membres sont invités à soumettre en tout temps, des candidatures pour les prix ci-dessous; les candidatures soumises d'ici le 15 novembre 2010 seront considérées pour les prix 2011 qui seront décernés au congrès annuel de la SCGC à Ottawa, ON en juin 2011. Veuillez soumettre les candidatures, en précisant le titre du prix, par courriel à louise@csce.ca, ou en vous adressant à : M^{me} Louise Newman, La Société canadienne de génie civil, 4920, boul. de Maisonneuve Ouest, bureau 201, Montréal, QC H3Z 1N1

LE PRIX A.B. SANDERSON

Est décerné aux ingénieurs civils qui se sont signalés par leur contribution exceptionnelle au développement et à la pratique du génie des structures au Canada.

LA MÉDAILLE ALBERT BERRY

Est décernée à un ingénieur civil qui s'est distingué par son importante contribution au génie de l'environnement au Canada.

LE PRIX CAMIILLE A. DAGENAIS

Est décerné aux ingénieurs civils qui se sont signalés par leur contribution exceptionnelle au développement et à la pratique de 1'hydrotechnique au Canada.

LE PRIX E. WHITMAN WRIGHT

Est décerné à un ingénieur civil qui s'est distingué par son importante contribution au développement des applications de 1'informatique au génie civil au Canada.

LE PRIX D'EXCELLENCE EN INNOVATION DANS LE DOMAINE DU GÉNIE CIVIL

(date limite est le 15 jan. 2011)

Souligne l'excellence dans le domaine du génie civil dont a fait preuve une personne ou un groupe de personnes pratiquant le génie civil au Canada, ou une société canadienne d'ingénierie ou un organisme canadien de recherche.

LA MÉDAILLE HORST LEIPHOLZ

Est décernée à un ingénieur civil qui s'est distingué par son importante contribution à la recherche et/ou a la pratique de la mécanique appliquée au Canada.

LE PRIX JAMES A. VANCE

Est décerné à un membre de la SCGC dont le dévouement a favorisé l'avancement de la Société et qui termine, ou achève, récemment un mandat au sein de la Société, sauf comme président.

LE PRIX SANDFORD FLEMING

Est décerné à un ingénieur civil qui s'est distingué par son importante contribution à la recherche et/ou à la pratique du génie du transport au Canada.

LE PRIX WALTER SHANLY

Est décerné à un ingénieur civil qui s'est distingué par son importante contribution au développement et/où à la pratique du génie de la construction au Canada.

LE PRIX W. GORDON PLEWES

Est décerné à une personne, pas nécessairement un ingénieur, qui s'est distinguée par sa contribution à l'étude de l'histoire du génie civil au Canada ou de l'histoire des réalisations canadiennes en matière de génie civil à travers le monde. Dans les circonstances exceptionnelles, le prix peut être décerné à une organisation.

MAHMOUD LARDJANE PROGRAMS MANAGER / DIRECTEUR DES PROGRAMMES

1. National Lecture Tour

Host City Olympic Transportation Plan: A Sustainable Legacy for Vancouver

October/November 2010

The 2010 Olympic Winter Games was Vancouver's largest special event and transportation planning for the event was a complex challenge. The City of Vancouver developed a wide range of innovative strategies to create its Host City Olympic Transportation Plan.

CSCE's 2010–2011 National Lecture Tour will present the Host City Olympic Transportation Plan and discuss how it was an unqualified success. The presentation will also include an overview of the City's Games-time transportation monitoring program where actual travel behaviour was observed using in-the-field data collection.

This tour will be presented by Dale Bracewell, M.A.Sc., P.Eng., of the City of Vancouver. Dale led the City of Vancouver's transportation planning and operations for the 2010 Olympic and Paralympic Winter Games.

Please visit www.csce.ca for venue and registration details.

La Tournée nationale 2010–2011 de la SCGC présentera en anglais le Plan de transport de la ville de Vancouver conçu et mis en place pour les Jeux olympiques d'hiver 2010.

Les détails de cette présentation sont disponibles à www.csce.ca.

2. CHBDC 2010

Fall 2010

This one-day course will cover the significant changes contained in the 2010 edition of the Canadian Highway Bridge Design Code. It will be presented throughout Canada by members of the CHBDC technical committees and authors of the code. Participants will be able to obtain a copy of the new code at a 20% discount. Please visit www.csce.ca for full details.

La SCGC offrira une formation sur les modifications apportées au Code canadien sur le calcul des ponts routiers 2010. Elle sera présentée par les auteurs du code dans tout le Canada. Vous trouverez les détails à www.csce.ca.

3. ASCE Webinars

CSCE members can attend ASCE webinars at ASCE member fees. ASCE offers over 200 webinars covering all areas of civil engineering. To review the list of available webinars, please visit www.asce.org. To register, please contact mahmoud@csce.ca

Les membres de la SCGC peuvent s'inscrire aux webinars de ASCE au tarif de membre ASCE. Plus de 200 webinars sont disponibles et présentés en anglais. Pour consulter la liste, veuillez visiter www.asce.org. Pour vous s'inscrire, veuillez contacter mahmoud@csce.ca

2011 CSCE ANNUAL GENERAL MEETING & CONFERENCE

ENGINEERS—ADVOCATES FOR FUTURE POLICY

OTTAWA
JUNE 14–17, 2011

CONFERENCE ANNOUNCEMENT AND CALL FOR PAPERS

Annual General Conference

2nd International Engineering Mechanics and Materials Specialty Conference

3rd International/9th Construction Specialty Conference

20th Canadian Hydrotechnical Conference

SUBMISSION DEADLINES

October 15th, 2010: Deadline for short abstracts (250 words max.)

November 15th, 2010: Notification of acceptance

January 14th, 2011: Draft of full paper

March 14th, 2011: Receipt of final paper

SUBMISSION FORMAT

Two paper formats are available:

- Full-length papers (up to 10 pages)
- Extended abstracts for case studies (4 pages only)

Authors should specify the appropriate conference (general, specialty or hydrotechnical) on their submission. Papers will be accepted in either English or French. Student presentations should be identified as such.

For more instructions on how and where to submit abstracts, visit:

WWW.CSCE.CA/2011/ANNUAL

Donald S. Mavinic, FCSCE Wins Manning Innovation Award for Waste to Fertilizer Technology

The University of British Columbia's Dr. Donald S. Mavinic, a world expert in wastewater treatment, is to receive one of Canada's most distinguished innovation awards, the Ernest C. Manning Awards Foundation has announced. Mavinic, a civil engineering professor and entrepreneur, received the $25,000 Dave Mitchell Award of Distinction for developing a unique technology to turn pipe-clogging and polluting phosphorus compounds in wastewater into environmentally friendly fertilizer.

Dr. Mavinic received his award in Ottawa on September 17th, in front of an audience of Canadian innovators, elected officials, educators and business leaders at a gala hosted by Senator Pamela Wallin, OC, Preston Manning, CC, and Bernard Lord.

"There is a critical need for more innovation in Canada—Canadians need to create and commercialize innovations to compete in the global economy," says Bruce Fenwick, Executive Director of the Ernest C. Manning Awards Foundation. The Foundation, which is named after the former Alberta Premier, has provided over $4.2 million in awards, celebrated 225 adult and youth award winners and has had over 2,500 nominations in its 29-year history. Adds Fenwick, "the Foundation's laureates are role models who inspire Canadians."

Dr. Mavinic's innovation turns a costly problem into a valuable product while addressing major environmental concerns of our time. The dead zone-inducing phosphorus pollution of natural waters is one of the most significant environmental challenges facing the planet. Yet phosphorus is also a dwindling resource that food crops can't grow without. Ostara's Pearl® Nutrient Recovery Process rescues phosphorus from sewage sludge, recycling the would-be pollutant as the environmentally friendly fertilizer, Crystal Green®.

Dr. Mavinic worked out the chemistry and engineering for the phosphorus recovery system with his research associate Frederic Koch and graduate students at the University of British Columbia. Mavinic also helped spin-off the technology to Ostara Nutrient Recovery Technologies, Inc., the company that markets the Pearl® Nutrient Recovery Process and Crystal Green® around the world.

A single Pearl® reactor can produce more than 500 kilograms of high quality fertilizer per day, while saving wastewater treatment plants about $100,000 a year in cleanup costs to get mineral buildup out of pipes and equipment. Removing the phosphorus from wastewater also keeps it out of rivers, lakes and oceans where it can wreak ecological havoc. In addition, there are significant carbon credits for every 1000 kilograms of Crystal Green® recovered.

Robert F. Kennedy Jr., Environmental Advocate and Attorney and Partner with VantagePoint Venture Partners, sits on Ostara's Board of Directors. Says Kennedy, "Ostara's technology not only helps to solve a major challenge faced by wastewater treatment facilities and communities around the world, but also serves an important role in protecting our natural waterways for future generations."

Kennedy goes on to say that "the technology, developed at UBC, and commercialized by Ostara, saves our waters from damaging pollution, and creates a slow-release fertilizer product that is not dependent on the mining of phosphorus—an energy intensive process, itself—from limited reserves. This technology provides an elegant solution that benefits the environment at all stages, and truly exhibits the new shift that we are seeing towards closed looped and sustainable technologies."

A demonstration scale Pearl® Nutrient Recovery Facility is operating in Edmonton, Alberta, and commercial scale Pearl® Nutrient Recovery Facilities are in operation at wastewater treatment facilities serving several cities near Portland, Oregon; as well as the region of Suffolk, Virginia and, soon, York, Pennsylvania, both near the ecologically-sensitive Chesapeake Bay Watershed. The technology has been successfully piloted in several locations across North America, and in Asia and Europe.

The Ernest C. Manning Awards Foundation (www.manningawards.ca) recognizes the importance of Canadian innovation in strengthening our nation's capacity to compete in the global economy. The Foundation annually supports and celebrates Canadians with the imagination to innovate and the stamina to succeed. ■

COMING EVENTS / CALENDRIER DES ACTIVITÉS

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—CDSCC 2011
Québec, QC
July 20–22, 2011
http://www.civil.usherbrooke.ca/cdcc2011

International Venues

2nd International Conference on Waste Engineering and Management (ICWEM 2010)
Shanghai, China
October 13–15, 2010
E-mail: icwem2010@163.com

Structural Engineers World Congress (SEWC)
Como, Italy
April 4–6, 2011
http://sewc-worldwide.org

6th International Structural Engineering and Construction Conference
Zurich, Switzerland
June 21–25, 2011
http://www.isec-society.org/ISEC_06/

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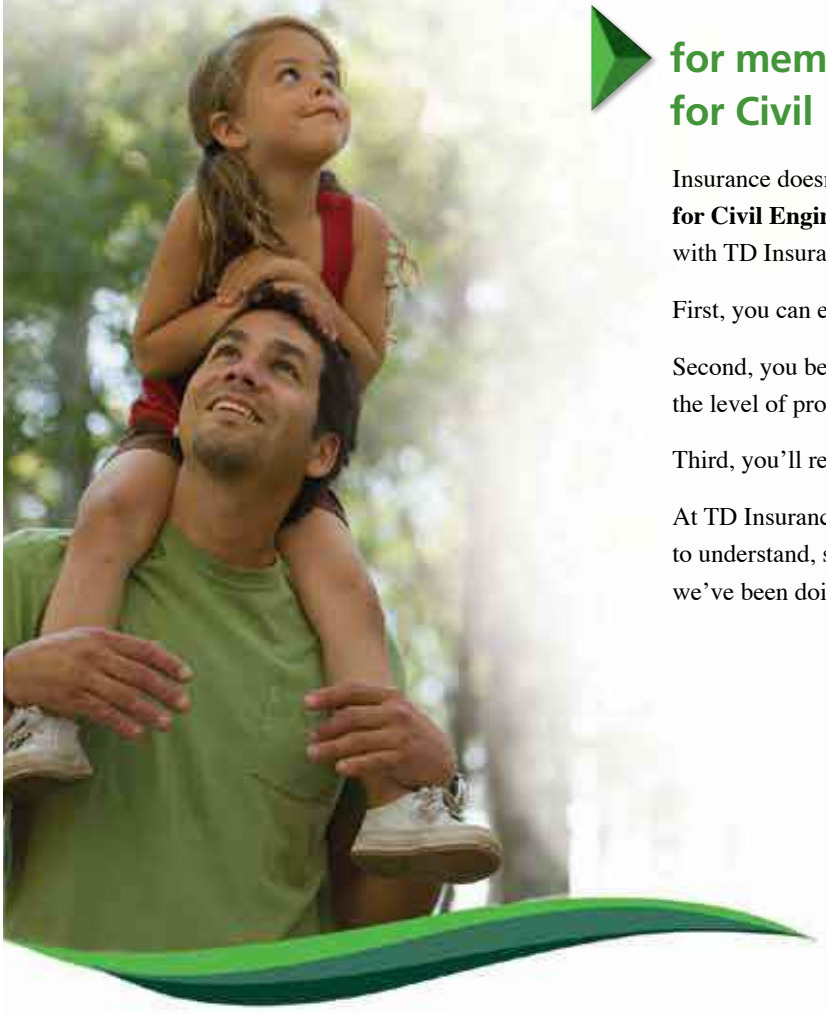

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Due to provincial legislation, our auto insurance program is not offered in British Columbia, Manitoba or Saskatchewan.

[1]Certain conditions and restrictions may apply.

*No purchase required. Contest ends on January 14, 2011. Total value of each prize is $30,000 which includes the Honda Insight EX and a $3,000 gas voucher. Odds of winning depend on the number of eligible entries received. Skill-testing question required. Contest organized jointly with Primmum Insurance Company and open to members, employees and other eligible people of all employer and professional and alumni groups entitled to group rates from the organizers. Complete contest rules and eligibility information available at www.melochemonnex.com. Actual prize may differ from picture shown.